IRIS Precursor Security, Safety and Performance Analysis

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Abstract

Iris is the European Space Agency's (ESA) program to develop a comprehensive satellite ATM system for SESAR based on a global communication standard.
As part of incrementally working towards the long-term Iris goals, the Iris Precursor service will provide air–ground communications for initial 4D flight path control by 2018.
This document presents an analysis of security, safety and performances requirements which could be applicable to the Iris Precursor system as an enabler for ATC Datalink services.

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Executive summary

The exchange of communication between aircraft and ground or in-between aircraft will evolve to develop the SESAR capability levels. These exchanges will require more advanced functionalities, different categories of quality of service and will be area dependent (e.g. the volume of exchange in an airport will be significantly different than in en-route).

The future SESAR amendments will require an implementation of the new communication systems on board the aircraft. However, current communication systems will or may still be needed, at least during the transition phases, to operate legacy exchanges.

This document specifies the high level safety and performance requirements relating to the aircraft systems, ground systems, air-ground communication service provisions, flight crew and controller. These aircraft systems high level requirement are allocated to aircraft subsystems, namely end system, routing system and communication system of the aircraft.

This document is based on safety and performance analysis provided by the Eurocae/RTCA.

The derived requirements (safety and performance) are relevant to the different airspaces as airport domain, approach domain, continental en-route domain and oceanic en-route domain for the datalink.

1 Introduction

1.1 Purpose of the document

This document presents an analysis of security, safety and performances requirements which could be applicable to the Iris Precursor system as an enabler for ATC Datalink services.

The security analysis has been performed by Inmarsat under ESA Iris Precursor project. The project SESAR 15.2.5 members was involved for review.

The safety and performances analysis is done in the frame of the SESAR project 15.2.5 which aims at developing and validating the Iris Precursor system. The analysis will be on all data link services even if the project 15.2.5 is limited to the 4D TRAD services.

This document is based on a detailed analysis of Safety and Performance Requirements documentation developed by the Eurocae/RTCA. The ED228 document is used to provide the capability for users and providers to support validation activities associated with the data communications needs of future Air Traffic Management concepts e.g., Next Generation Air Transportation System (NextGen) and Single European Sky Air Traffic Management Research (SESAR) initiatives. As such, issues such as multilink and volume requirement (capacity) are considered to be out-of-scope of the performed safety analysis.

The requirements identified are then further apportioned to the different boxes taking part to the Iris Precursor system.

1.2 Intended readership

This document can be used by manufacturers developing Iris Precursor systems and service providers who could operate such system.

Since Iris Precursor can be used for ATC DATALINK services, manufacturers shall pay attention to the Safety and Regularity of flight objectives which are related to such type of services.

In this document, manufacturers and service providers will get a list of ATC DATALINK services which could be supported by the Iris Precursor systems and allow deriving Safety and Performance recommendations.

1.3 Background

The used methodology is the same as those used in the SESAR 9.44 document [2] relating to the Means of communication systems. In comparison with the work performed in SESAR 9.44, this document extends the initial analysis to cover DATALINK services in all A/C phases. The scope of this document concerns the Iris Precursor service which will provide air-ground communications for initial 4D flight path control by 2018, used in all airspaces (APT, TMA, ENR-1 and ENR-2).

1.4 Structure of the document

This document is structured as follows:

- Chapter 1: introductory chapter.
- Chapter 2: definition of the considered environment (DATALINK) and DATALINK services for the FHA.
- Chapter 3: description of the methodology.
- Chapter 4: DATALINK communication FHA.
- Chapter 5: Safety and performance requirements applicable to the communication airborne system
- Chapter 6: Safety and performance requirements applicable to the communication ground system

- Chapter 7: Assumptions taken during the analysis.
- Chapter 8: Security Analysis
- Chapter 9: Reference documents.

1.5 Acronyms and Terminology

Term	Definition
AAA	Authentication Authorization Accounting
AC	Aircraft
ACR	Avionics Communication Router
ACSP	Air Ground Communication System Provision
ADS	Automatic Dependent Surveillance
AE	Abnormal Event
AOC	Aeronautical Operational Control[1]
APT	Airport
ASN	Access Service Network
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Service
ATSP	Air Traffic Service Provider
ATSU	Air Traffic Service Unit
CDA	Current Data Authority
CNS	Communication, Navigation, Surveillance
CPDLC	Controller – Pilot Data Link Communication
CR	Component Requirement
CU	Context of Use
DM	Downlink Message
EMM	External Mitigation Means
ENR	En-route
FH	Flight Hour
FHA	Functional Hazard Analysis
FMS	Flight Management System
ID	IDentifier
IPr	Iris Precursor
OH	Operational Hazard

[1] The AOC services are mainly dedicated to the airlines operation. AOC offers applications such as Out Off On It (OOOI), dispatch, weather updates, maintenance report,…

Term	Definition
OSA	Operational Safety Assessment
PR	Performance Requirement
SESAR	Single European Sky ATM Research Programme
SR	Safety Requirement
TMA	Terminal Control Area
UM	Uplink Message
UTC	Universal Time Coordinated

Terminology used within this document:

- The term '**Iris Precursor system**' covers all current and future systems of communication contributing to Iris Precursor service.
- The term **ACSP** includes all systems handle data between ATC ground systems and aircraft antenna: SBB Space Segment, SBB Ground Segment, ATN Gateway …;

2 Considered environments

2.1 Datalink communications environment

The Iris Precursor system should be able to support the following types of services:

- ATC communication between Aircraft and ATC centers
- AOC communication between Aircraft and Airlines operation centers

2.1.1 DATALINK system in its environment

The following figure presents the CNS/ATM system as it is defined in ED228 document. It includes the following elements:

- Flight Crew;
- Aircraft System;
- Air Ground Communication Service Provision (ACSP): ATN Gateway + SBB Ground Segment + SBB Space Segment,
- Air Traffic Service Unit (ATSU);
- Controller.

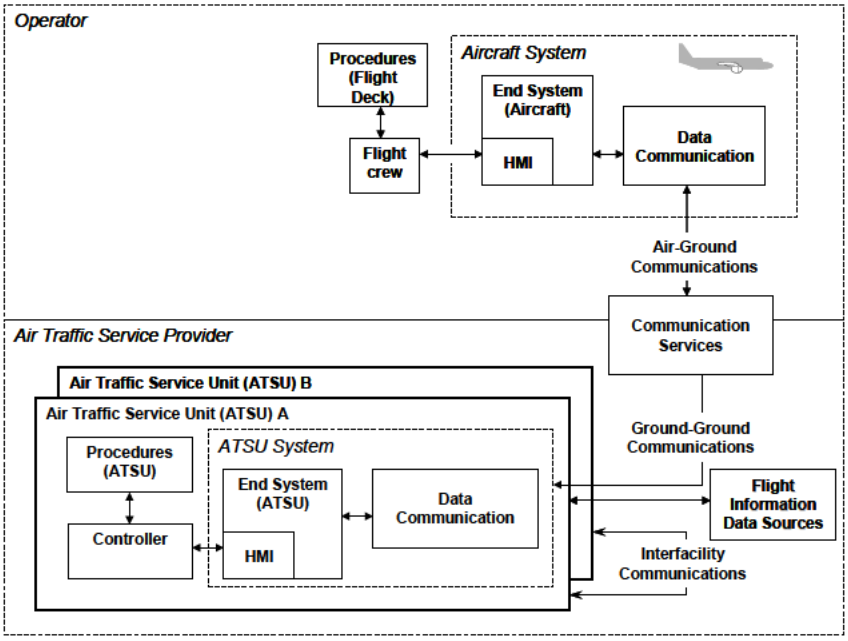

Figure 1 : Overview of CNS/ATM System

The Iris Precursor system comprises:

- on the airborne side of the data communication domain : Antenna + Data Communication systems + End systems;
- on the ground side (ATSP):
  - The Air Ground Communication Service Provision (ACSP) systems: ATN Gateway + SBB Ground Segment + SBB Space Segment,
  - The ATSUs systems: data communication systems + end systems.

2.1.2 Description of the considered environments by the Eurocae/RTCA

As presented in chapter 3, this document is based on the safety and performance analysis performed by the joint group Eurocae/RTCA.

The reference document that is used for this analysis is the document [3].

"ED228 environment" for different domains is described in ED228 document. The main characteristics of this environment are described below:

	APT domain	TMA domain	ENR-1 domain	ENR-2 domain
Data communication equipage	75% of aircraft are equipped with data communications	75% of aircraft are equipped with data communications	75% of aircraft are equipped with data communications	75% of aircraft are equipped with data communications
Aircraft flight duration per sector	20.5 minutes	5.5 minutes	11.25 minutes	Up to 6 hours
Average aircraft count per sector (during busy hour)	61 (19 Ramp, 31 Ground, and 11 Tower)	16	26	45
Peak instantaneous aircraft count per sector	96 (30 Ramp, 48 Ground, and 18 Tower)	27	41	80
Aircraft handled per sector hour	179	175	139	Up to 120

Table 1: Characteristics of ED228 environment

From a safety point of view, it is important to note that this environment considers the existence of **sophisticated automation tools for problem detection, resolution advisories and prioritization** to assist the controller.

2.1.3 Datalink services considered for the analysis

The following assumption is related to application/services considered in safety analysis:

- **ASSUMP_IPr_12**: Aeronautical Operational Control (AOC) services are not considered in the present safety and performance analyses.

  Justification:

  - AOC services are mainly used to exchange information between the aircraft and the airlines (for example to prepare / optimize the maintenance of the aircraft). They are not considered in ED228 document.

  - From a safety point of view, AOC services are less critical than ATS services. So safety requirements defined by considering the ATS services should be more stringent than safety requirements that could be defined by considering AOC services.

  - From a performance point of view, it is considered that performance requirements defined in ED228 document (i.e. availability and transaction times) for ATS services are sufficient to use AOC services efficiently.

  Note: other performance requirements such as volume requirement (capacity) are considered to be out-of-scope of this safety analysis.

ED228 document define the following Air Traffic Services (ATS) services:

- **DLIC** (DataLink Initiation)
  - Definition: This service exchanges information between an aircraft and an ATSU to identify the DATALINK services that are supported. The DLIC service is also used to establish a unique identity address for each aircraft initiating the connection process. It provides version and address information for all DATALINK services including itself.

- o Utilization: The DLIC service is executed prior to any other addressed DATALINK service.
- o Application: This service uses CM application.

- **ACM** (ATC Communication Management)
  - o Definition: This service provides automated assistance to the flight crew and current and next controllers for conducting the transfer of ATC communications.
  - o Utilization: The ACM service is intended to be used in all phases of flight and surface operations
  - o Application: This service uses CPDLC application.
- **CRD** (Clearance Request and Delivery)
  - o Definition: This service supports operational ATC data communication (clearance request, delivery and response) between the flight crew and the ground system/controller of the current data authority ATSU.
  - o Utilization: This service is intended to be used in all phases of flight.
  - o Application: This service uses CPDLC application.
- **IER** (Information Exchange and Reporting)
  - o Definition: This service provides the capability for the ATSU system/controller and airborne system/flight crew to exchange information (reports/confirmation messages, automatic report provided by aircraft, request for information on expected clearances...).
  - o Utilization: This service can be used in all phases of flight.
  - o Application: This service uses CPDLC and ADS-C application.

- **AMC** (ATC Microphone Check)
  - o Definition: This service provides controllers with the capability to uplink an instruction to an aircraft in order for the flight crew to check that the aircraft is not blocking a given voice channel.
  - o Utilization: The AMC service is intended to be used in all phases of flight.
  - o Application: This service uses CPDLC application.
- **PR** (Position Reporting)
  - o Definition: This service provides the controller with the capability to obtain position information from the aircraft.

    Additionally, the position report includes complementary information such as current speed information (*air and ground speeds*), the current meteorological information (*aircraft's wind, temperature, turbulence, and humidity information*) and the projected route (*next and next + 1 waypoints*).
  - o Utilization: This service is performed only during ENR-2 operations.
  - o Application: This service uses ADS-C application.
- **DCL** (Departure Clearance)
  - o Definition: This service provides automated assistance for requesting and delivering departure clearances.
  - o Utilization: This service is intended for use during the surface departure phase of operation.
  - o Application: This service uses CPDLC application.
- **D-TAXI** (DataLink Taxi)
  - o Definition: The D-TAXI service supports operational ATC data communication between the flight crew and the ground system/controller of the Current Air Traffic Service Unit (C-ATSU).The D-TAXI service uses CPDLC messages for requesting D-TAXI clearance and information delivery, request, and response.
  - o Utilization: The D-TAXI service is intended for use during ground operations, and while the aircraft is approaching the airport.
  - o Application: This service uses CPDLC application.
- **4D-TRAD** (4-Dimensional Trajectory Data Link)
  - o Definition: The 4DTRAD service enables the negotiation and synchronization of trajectory data between ground and air systems. This includes the exchange of 4-dimensional clearances and intent information such as lateral, longitudinal, vertical and time or speed (including uplinked constraints specified as cleared speed / time constraints which can be issued as a part of a route clearance).
  - o Utilization: During the pre-departure, the 4D-TRAD trajectory is loaded in the Flight Management System automatically. The proposed 4-D trajectory portion will be used later in the flight to facilitate negotiation of the aircraft's final 4-D trajectory
  - o Application: The 4DTRAD service uses CPDLC for exchange of 4D clearances; and ADS-C for acquiring trajectory data from the aircraft by the 4DTRAD service provider.
- **ITP** (In Trail Procedure)
  - o Definition: This service allows a controller to approve an altitude change request that would climb or descend through the altitude of an aircraft separated 15NM or greater along the same track during the procedure.
  - o Utilization: This service is performed only during ENR-2 operations.
  - o Application: This service uses CPDLC application.
- **OCL** (Oceanic Clearance)
  - o Definition: This service provides flight crews the capability to request and obtain oceanic clearances from ATSUs that are not yet in control of the aircraft.
  - o Utilization: This service can be used in all phases of flight.

o Application: This service uses CPDLC application.

- **IM** (Interval Management)
  - Definition: IM is an operation that enables an improved means for managing traffic flows and aircraft spacing. IM has a range of operations whose goal is precise inter-aircraft spacing. IM includes the use of ground and airborne tools.
  - Utilization: This service is performed only during Approach and ENR-1 operations.
  - Application: This service uses CPDLC application.

In consistence with ED228 document, the safety analysis is performed at application level: consequences of Iris Precursor failures are linked to hazards at application level instead of hazards at services level.

The following assumptions are related to application/services considered in safety analysis:

- **ASSUMP_IPr_01**: Context Management (CM) application is not considered during the identification of Operational Hazards.

  Justification: Consistent with Eurocae/RTCA approach: a failure during DATALINK initiation doesn't have direct operational effects. However it can have effects during the use of the others applications (CPDLC and ADS-C). So the safety requirements concerning CM messages are determined by studying all the others applications.

Based on these considerations, following table presents the applications that are taken into account in the present document and the related services.

Application		Services considered in safety analysis		Used in APT domain	Used in TMA domain	Used in ENR-1 domain	Used in ENR-2 domain	Covered by ED228	Adressed in present document
CM	Context Management	DLIC	DataLink Initiation	X	X	X	X	X	X
CPDLC	Controller Pilot DataLink Communication	ACM	ATC Communication Management	X	X	X	X	X	X
		CRD	Clearance Request and Delivery	X	X	X	X	X	X
		AMC	ATC Microphone Check	X	X	X	X	X	X
		DCL	Departure Clearance	X				X	X
		D-TAXI	DataLink Taxi	X				X	X
		4DTRAD	4-Dimensional Trajectory Data Link	X	X	X	X	X	X
		IER	Information Exchange and Reporting	X	X	X	X	X	X
		PR	Position Reporting				X	X	X
		IM	Interval Management		X	X		X	X
		OCL	Oceanic Clearance	X	X	X	X	X	X
		ITP	In Trail Procedure				X	X	X
ADS-C	Automatic Dependent Surveillance	4DTRAD	4-Dimensional Trajectory Data Link	X	X	X	X	X	X
		IER	Information Exchange and Reporting	X	X	X	X	X	X
		PR	Position Reporting				X	X	X

Table 2: Application considered for the safety analysis in ED228 environment

3 Methodology

The methodology to derive Safety and Performance requirements applicable to the Iris Precursor system is described below:

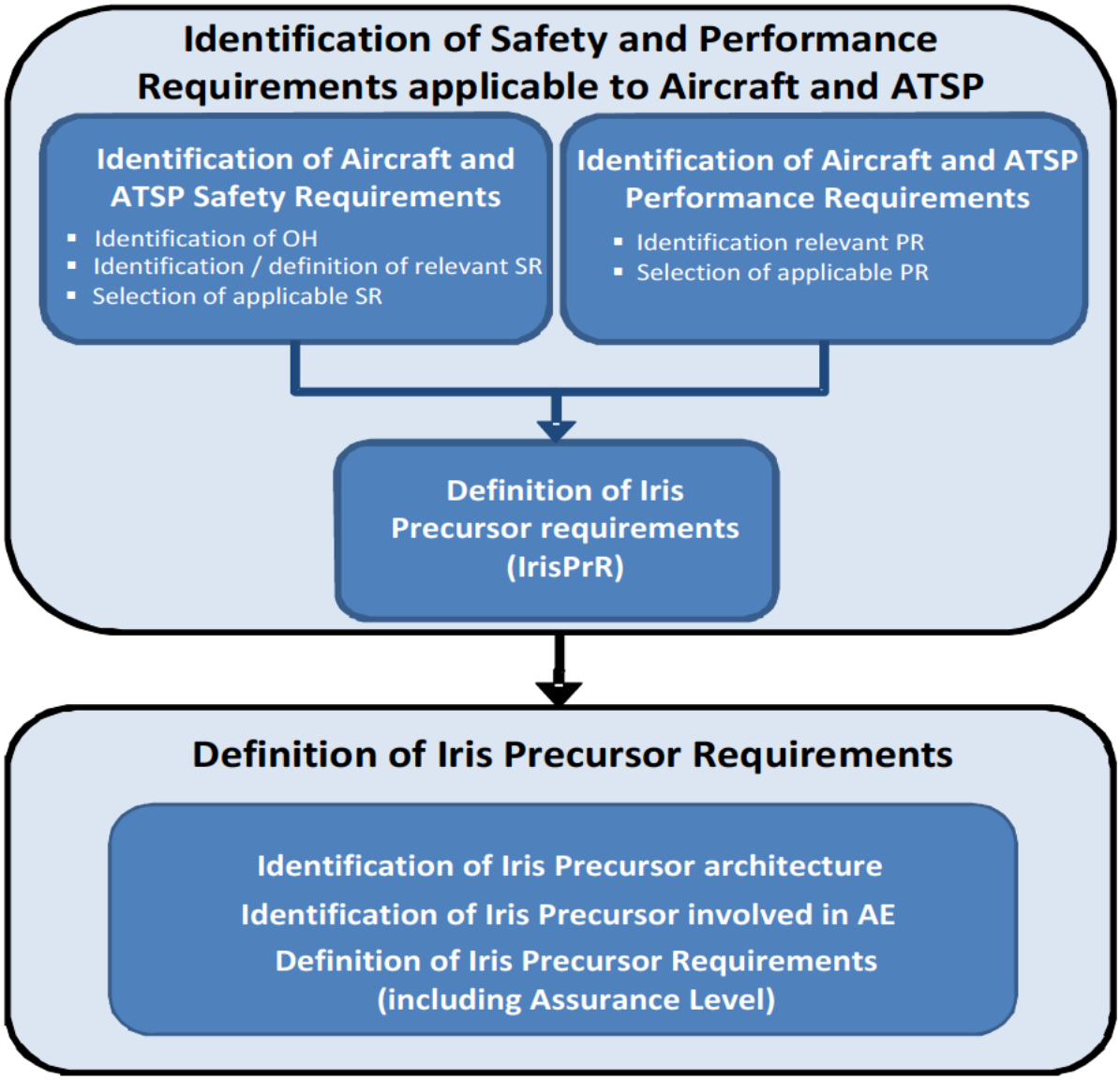

Figure 2 : Methodology for Safety and Performance analysis

As it appears on this figure, this analysis includes two main tasks:

- The Identification of requirements applicable at Aircraft and ATSP level (since these domains contain parts of the Iris Precursor). This task consists in a safety and performance analysis, based on Eurocae/RTCA documentation, aiming at determining the suitable list of requirements for the Iris Precursor. The detailed methodology of this task is presented in §3.1.
- The apportionment of requirements applicable to the Aircraft and ATSP domain to the Iris Precursor system. This task aims at deriving hardware, software and operation requirements applicable at Iris Precursor level and at sub function level. The detailed methodology of this task is presented in §3.2.

3.1 Definition of Safety and Performance Requirements applicable to Aircraft and ATSP

As presented on figure 3, two analyses are performed in order to determine Aircraft and ATSP Requirements: safety analysis and performance analysis. These two analyses are carried out independently to determine Safety Requirements and Performance Requirements. Then the most stringent of these two requirements is selected as being the applicable requirement for Iris Precursor.

The following chapters presents the methodology for the definition of Safety Requirements (§3.1.1) and Performance Requirements (§3.1.2).

3.1.1 Definition of Safety Requirements

The safety analysis includes two sub-tasks:

- Identification of Operational Hazards,
- Definition of relevant Safety Requirements

The principle of these two sub-tasks is presented in the following chapters.

3.1.1.1 Identification of Operational Hazards

This task is a qualitative bottom up analysis whose purpose is to identify all the Operational Hazards associated to the Iris Precursor. Operational Hazards are consequences, on the global ATM system, of the Iris Precursor failures (Abnormal Events). Abnormal Events can have different consequences depending on the Context of Use (CU) and on the success or failure of external mitigations means (in others systems).

The principle of this task is presented on the following figure.

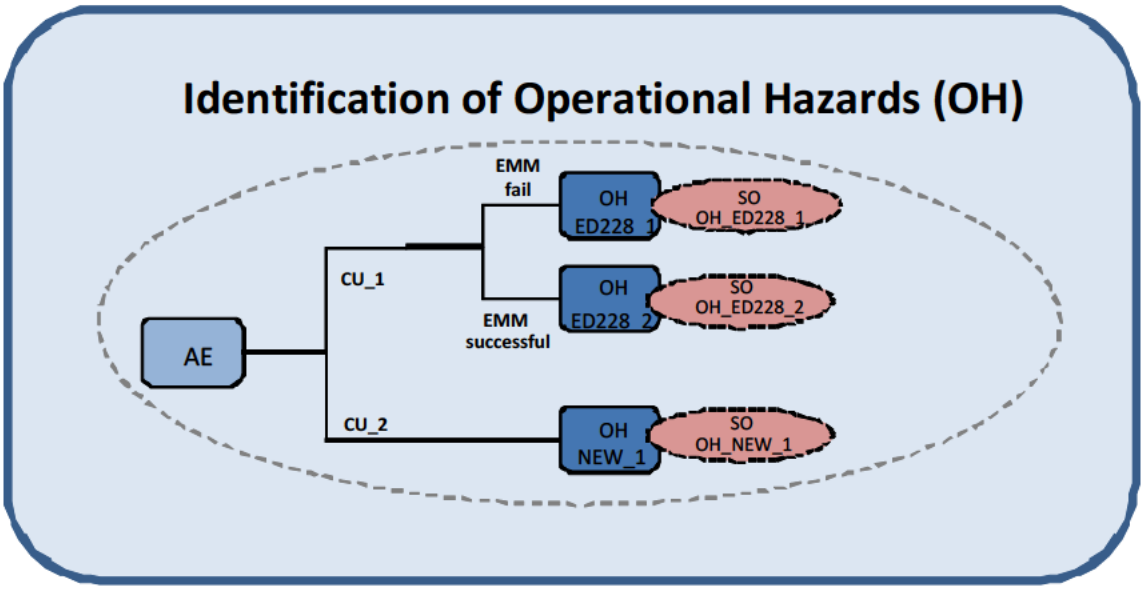

Figure 3 : Methodology for the identification of Operational Hazards

This identification is composed of five main sub-tasks:

- Identification of Abnormal Events at Iris Precursor Level;
- Identification of all Contexts of Use and External Mitigation Means associated to each Abnormal Event;
- Identification of all Operational Hazards associated to each Abnormal Event;
- Evaluation of severities associated to new Operational Hazards;

- Definition of safety objectives associated to new Operational Hazards;

A new operational hazard (NEW OH) is created either when it is missed in the ED228 document or when it corresponds to a combination of several operational hazards existing in the ED228 document.

The detailed methodology and the results associated to these different sub tasks are presented in §4.1.1.

3.1.1.2 Definition / Identification of relevant Aircraft and ATSP Safety Requirements

Safety Requirements can be defined on the different components of the ATM system (Controller, Flight Crew, Aircraft System, Air Ground Communication System or Ground System) from the Operational Hazards / Safety Objectives identified during the previous task.

As presented in paragraph 2.1, Iris Precursor is split between Aircraft System and ATSP. So, only the requirements applicable to the Aircraft system (AC) and to ATSP are considered as relevant for Iris Precursor.

The definition of the relevant Aircraft or ATSP Safety Requirements is different depending on the kind of Operational Hazard:

- For "ED228 OH", an allocation has already been performed by ED228. So Aircraft and ATSP safety requirements are directly extracted from ED228 document.
- For "NEW OH", the complete allocation must be performed from the Operational Hazard to the different causes including Aircraft or ATSP.

Then, for a given failure mode (eg: Loss of message or corruption of message), only the most stringent safety requirements are selected as being the applicable safety requirements.

The principle of this task is presented on the following figure.

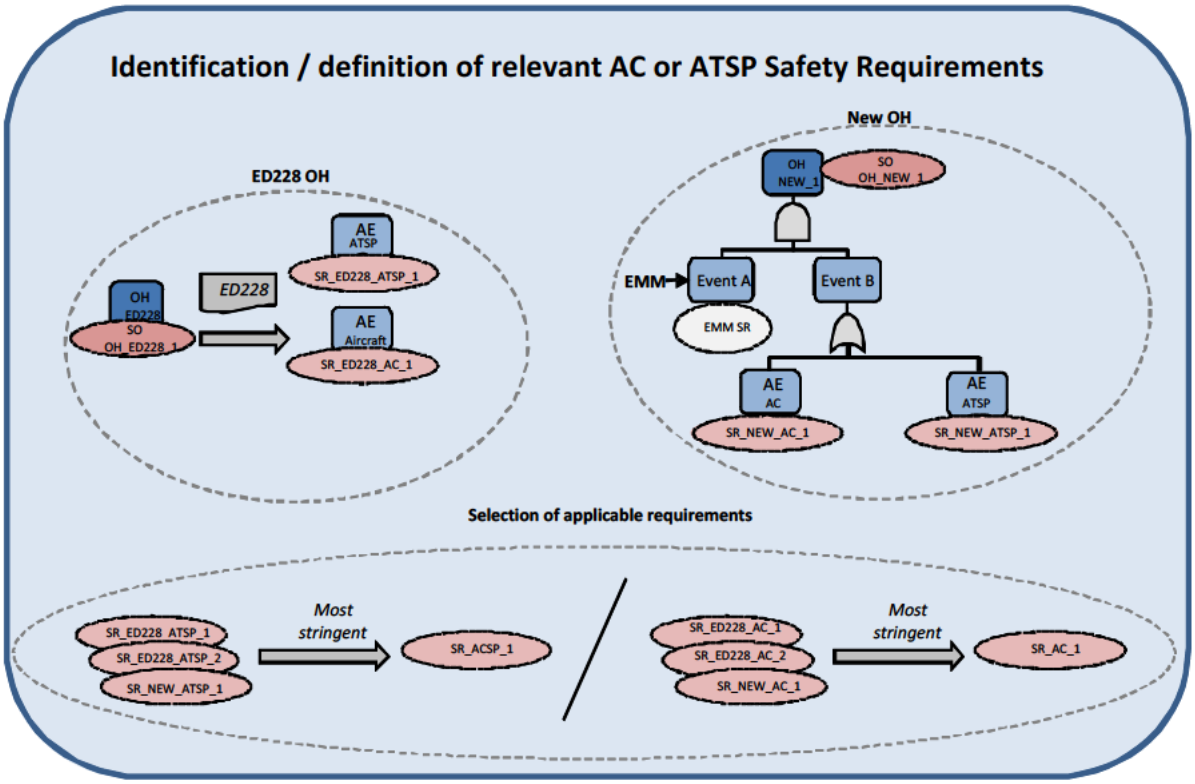

Figure 4 : Methodology for the definition / Identification of relevant AC or ATSP safety requirements

The detailed methodology and the results of this task are presented in §4.1.2.

3.1.2 Definition of Performance Requirements

The performance analysis includes two sub-tasks:

- Identification of relevant Performance Requirements,
- Selection of applicable Performance Requirements.

The principle of these two sub-tasks is presented on the following figure. More details are given in the following chapters.

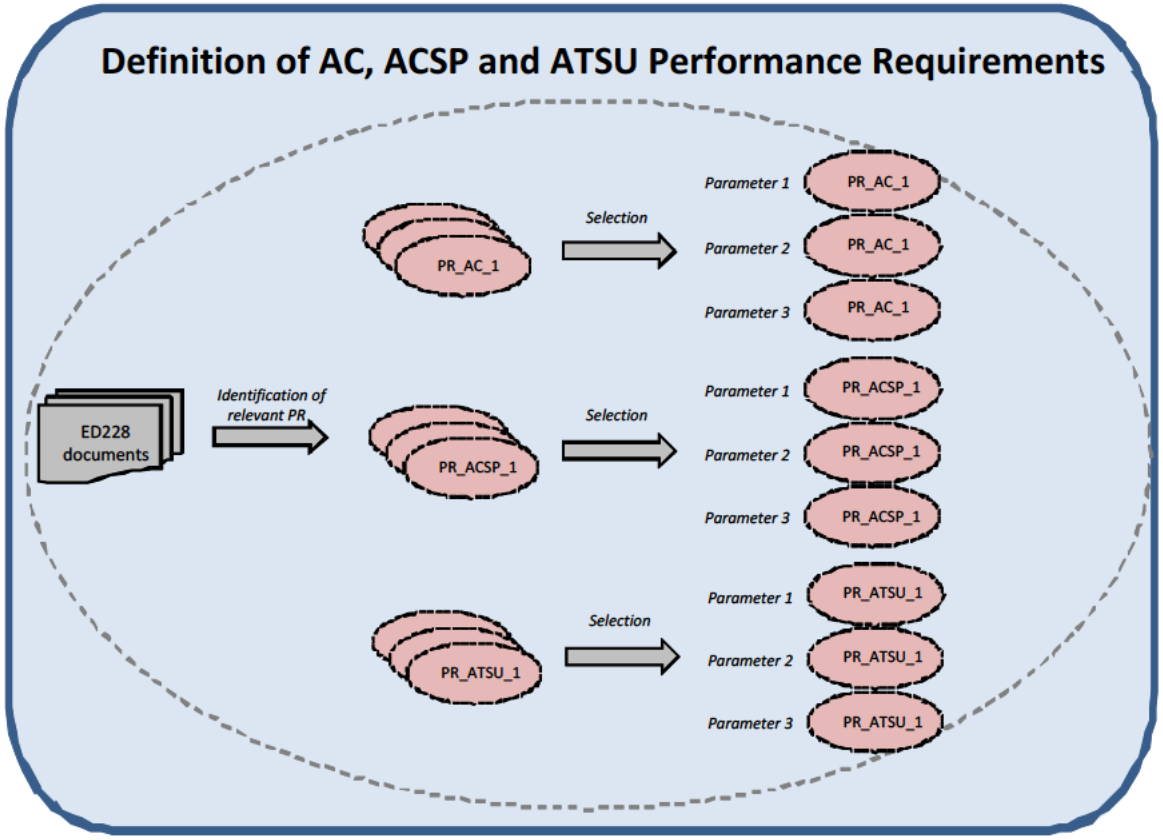

Figure 5 : Methodology for the definition of AC, ACSP and ATSU Performance Requirements

3.1.2.1 Identification of relevant Performance Requirements in ED228 document

ED228 has defined Performance requirements for the different components of the ATM system: Controller, Flight Crew, Aircraft System and Ground System.

As presented in paragraph 2.1, Iris Precursor is split between Aircraft System and ATSP. So, only the requirements applicable to the Aircraft system (AC) and to ATSP are considered as relevant for Iris Precursor.

This task consists in identifying, in the ED228 document, all the performance requirements allocated to the Aircraft system or to the ATSP and concerning the transmission of message between ground and aircraft.

The results of this task are presented in §4.2.1.

3.1.2.2 Selection of applicable AC and ATSP performance requirements

Different performance requirements can be defined, in the ED228 document, for a same performance parameter (for example continuity of service) and identified in the previous task. Consequently, this task consists in selecting, for each parameter, the most stringent performance requirement, that is the applicable performance requirement for this parameter.

The results of this task are presented in §4.2.2.

3.1.3 Selection of AC and ATSP Requirements

When a safety requirement (SR) and a performance requirement (PR) have been defined for a same parameter (e.g. availability) a comparison is performed between these two requirements and the most stringent is selected as being the applicable Requirement for this parameter. This principle is presented on the following figure:

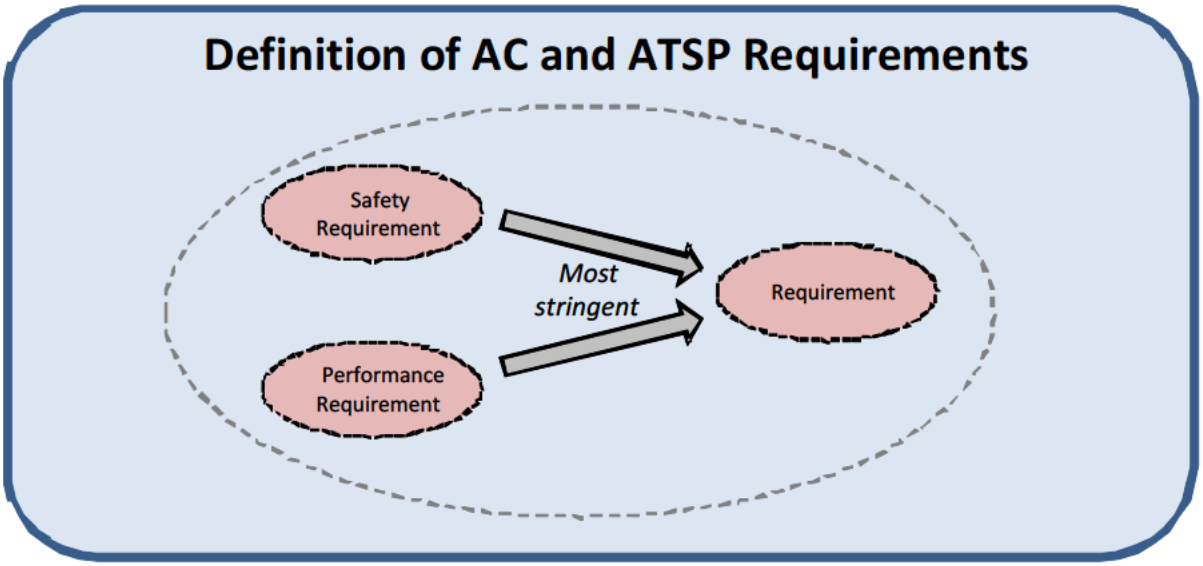

Figure 6 : Methodology for the selection of AC and ATSP Requirements

In this analysis, there was no SR / PR defined for the same parameter and this step of the process has been skipped.

3.1.4 Allocation of AC, ACSP and ATSU Safety Requirements on Iris precursor

The requirements, identified in the previous task, concern a perimeter larger than the Iris Precursor. So this task consists in re-allocating these requirements on the Iris Precursor.

For this purpose, a model of the AC, ACSP and ATSU systems will be established and assumptions will be taken concerning the percentage of failure that is attributable to Iris Precursor. The principle of this task is presented on the following figure.

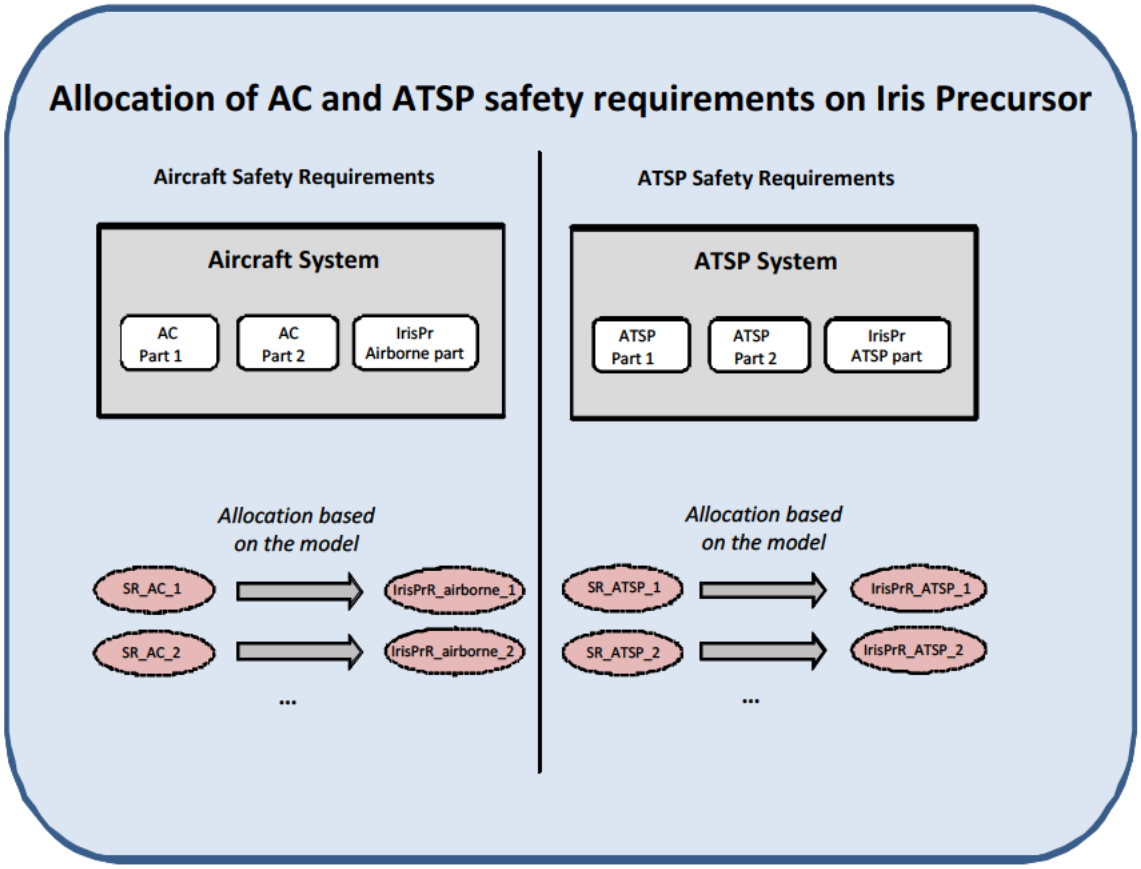

Figure 7 : Methodology for the allocation of AC and ATSP safety requirements on Iris Precursor

The results of this task are presented in the §4.3.

3.2 Definition of Components Requirements

The definition of Components Requirements (CR) for the Iris Precursor includes three sub-tasks:

- Definition of Iris Precursor Architecture
- Identification of components involved in Abnormal Events
- Allocation of Components Requirements

The principle of these three sub-tasks is presented on the following figure. More details are given in the following chapters.

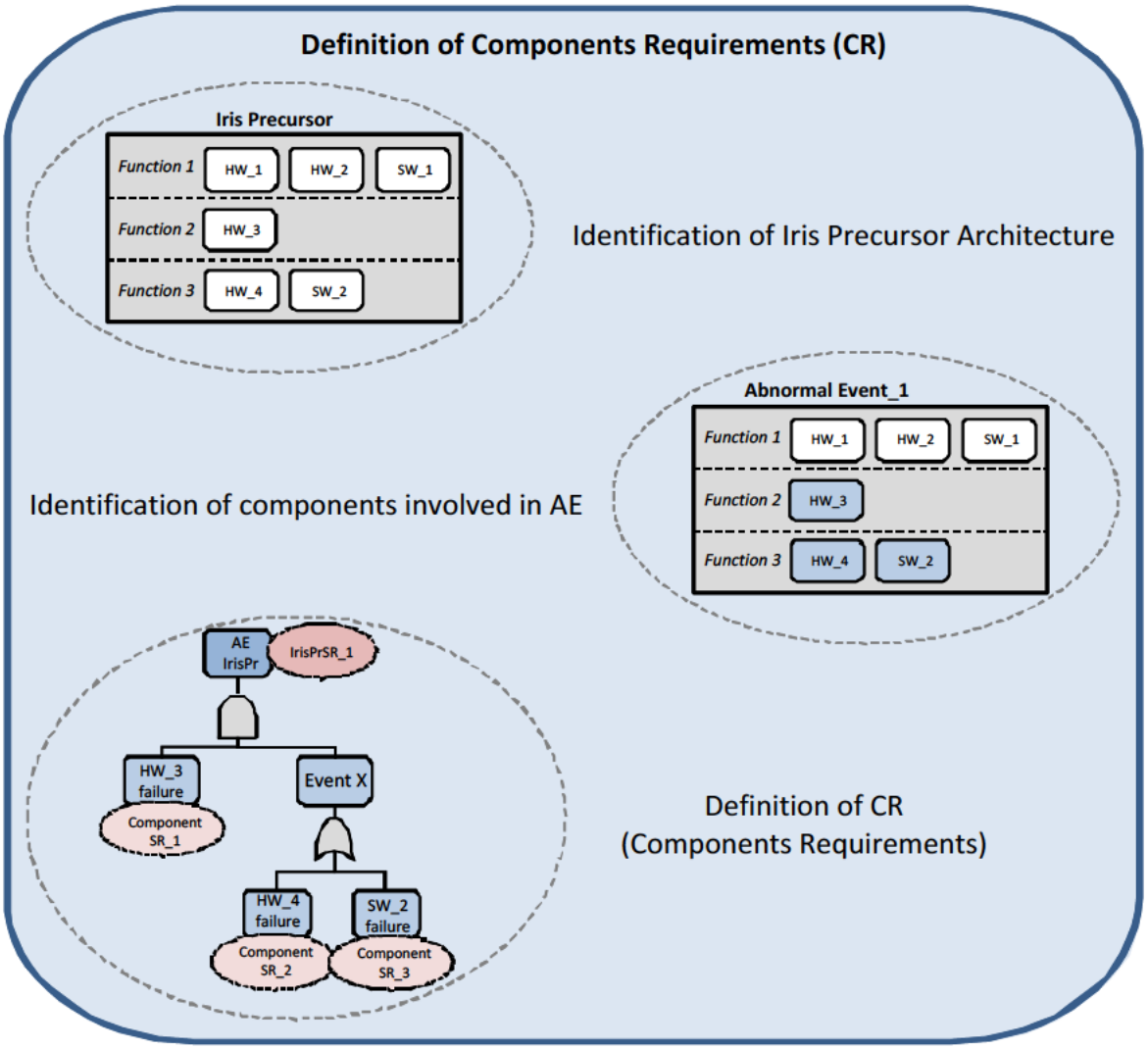

Figure 8 : Methodology for the definition of Components Requirements in ED228 Context

3.2.1 Definition of Iris Precursor Architecture

As presented on the previous figure, this task consists in identifying the Iris Precursor architecture systems (based on document [1]).

This identification should include:

- Presentation of airborne and ground parts of the Iris Precursor system
- Presentation of the different airborne and ground black boxes (hardware and software) in the Iris Precursor
- Presentation of the function of each black box
- Presentation of potential COTS in these black boxes

This task will be a basis for the identification of components involved in the different Abnormal Events. The detail level of this architecture must be commensurate with the desired detail-level of the Components Requirements.

3.2.2 Identification of components involved in Abnormal Events

As presented on Figure 4, this task consists in identifying for each Abnormal Event:

- the different failures that could lead to this Abnormal Event
- the combination of failures that must occurs to lead to this Abnormal Event

The failures are identified on the black boxes defined previously.

3.2.3 Allocation of Components Requirements

This task consists in performing the allocation of Components Requirements on the different black boxes identified previously.

In order to perform this allocation, a fault tree is constructed, for each Abnormal Event, presenting all potential contributors for this Abnormal Event (potential contributors have been identified during the previous task). Then, components requirements are allocated to each contributor. These components requirements can be:

- Quantitative requirements on hardware components. These requirements are derived from the Iris Precursor Safety Requirements. If these quantitative requirements seem impossible to reach, design requirements could be defined (redundancies…)
- Assurance Level on software components. These requirements are derived from the severity of the Operational Hazard to which the Abnormal Events contributes. The methodology for the allocation of Assurance Level will be detailed later.
- Qualitative requirements corresponding to the environment assumptions (monitoring, surveillance).

The results of this task are presented in §5.

4 Datalink communication FHA

4.1 Definition of Aircraft and ATSP Safety Requirements

In this section, first are identified the different failure cases which can be encountered by the Iris Precursor level.

Then, mainly based on ED228, the Operational Hazards to which each Abnormal Event leads are identified, depending on the Context of Use and on the External Mitigations Means success or failure.

4.1.1 Identification of Operational Hazards

4.1.1.1 Identification of Abnormal Events

This sub-task consists in identifying all the failures (Abnormal Events) that can occur at the Iris Precursor level. Abnormal Events are directly linked to the main function of the Iris Precursor ("Transmit messages between ground and airborne systems in order to perform data link services").

The Iris Precursor Abnormal Events are referenced as follow: "AE_XX: xxxx"

- XX: reference number of the AE;
- xxxx: title of the AE.

The identification of Abnormal Events is based on classical failures modes that can occur in a network. These failures modes are:

- Loss of message;
- Corruption of message;
- Misdirection of message;
- Delay of message;
- Generation of spurious message.

These classical failures modes can apply to:

- One message;
- All messages associated to one aircraft;
- All messages associated to more than one aircraft.

The following assumptions are related to abnormal events considered in safety analysis:

- **ASSUMP_IPr_10**: Failure concerning the "messages associated to one aircraft" can occur in case of failure in the airborne part of the Iris Precursor.

  Justification: a failure of ground part of the Iris Precursor cannot concern only one aircraft.

- **ASSUMP_IPr_11**: Failures affecting several messages are not considered.

  Justification: these failures are considered as equivalent to a succession of failure concerning one message.

The application of this systematic methodology leads to the following preliminary list of Abnormal Events which can be encountered at Iris Precursor level:

Ref	Failure mode	Number of messages concerned	Abnormal Events
AE_temp_01	Loss	One message	Loss of one message

Ref	Failure mode	Number of messages concerned	Abnormal Events
AE_temp_02	Loss	Messages associated to one aircraft	Loss of messages associated to one aircraft
AE_temp_03	Loss	Messages associated to more than one aircraft	Loss of messages associated to more than one aircraft
AE_temp_04	Corruption	One message	Corruption of one message
AE_temp_05	Corruption	Messages associated to one aircraft	Corruption of messages associated to one aircraft
AE_temp_06	Corruption	Messages associated to more than one aircraft	Corruption of messages associated to more than one aircraft
AE_temp_07	Misdirection	One message	Misdirection of one message
AE_temp_08	Misdirection	Messages associated to one aircraft	Misdirection of messages associated to one aircraft
AE_temp_09	Misdirection	Messages associated to more than one aircraft	Misdirection of messages associated to more than one aircraft
AE_temp_10	Delay	One message	Delay of one message
AE_temp_11	Delay	Messages associated to one aircraft	Delay of messages associated to one aircraft
AE_temp_12	Delay	Messages associated to more than one aircraft	Delay of messages associated to more than one aircraft
AE_temp_13	Spurious	One message	Generation of one spurious message
AE_temp_14	Spurious	Messages associated to one aircraft	Transmission of spurious messages to one aircraft
AE_temp_15	Spurious	Messages associated to more than one aircraft	Transmission of spurious messages to more than one aircraft

Table 3: Preliminary list of abnormal events

Some Abnormal Events of this list leads to the same Operational Hazards. So, the following assumptions were made in order to reduce the number of Abnormal Events to consider for the identification of operational hazards.

- **ASSUMP_IPr_04**: Abnormal Events concerning all the messages at Iris Precursor level associated to one aircraft are grouped as single event: “permanent failure to communicate with one aircraft" (Availability of aircraft).

  Justification: A failure on a message at Iris Precursor level (corruption, loss…), is detected thanks to the external mitigation means such as time stamps, checksum… at upper layers. The detection of this failure induces a clarification between controllers and flight crew. Then, following messages will be carefully watched; controllers will detect that there is a permanent failure on Datalink communication chain with the aircraft.

  ➔ AE_temp_02, AE_temp_05, AE_temp_08, AE_temp_11 and AE_temp_14 are grouped together: AE_06 “Permanent failure to communicate with one aircraft”

- **ASSUMP_IPr_05**: Abnormal Events concerning all messages at Iris Precursor level associated to more than one aircraft are grouped as single event: ”permanent failure to communicate with more than one aircraft” (Availability of provision).

  Justification: A failure on an Iris Precursor message (corruption, loss…), is detected thanks to the external mitigation means such as time stamps, checksum… at upper layers. The detection of this failure induces a clarification between controllers and flight crew. Then, following messages will be carefully watched; controllers will detect that there is a permanent failure on Datalink communication chain.

  ➔ AE_temp_03, AE_temp_06, AE_temp_09, AE_temp_12 and AE_temp_15 are grouped together: AE_07 “Permanent failure to communicate with more than one aircraft”

So the final list of Abnormal Events that will be considered for the identification of Operational hazards is:

Ref	Abnormal Events
AE_01	Loss of one message at Iris Precursor level
AE_02	Corruption of one message at Iris Precursor level
AE_03	Misdirection of one message at Iris Precursor level
AE_04	Delay of one message at Iris Precursor level
AE_05	Generation of a one spurious message at Iris Precursor level
AE_06	Permanent failure to communicate with one aircraft (availability of aircraft)
AE_07	Permanent failure to communicate with more than one aircraft (availability of provision)

Table 4: List of Abnormal Events considered for the identification of Operational Hazards

4.1.1.2 Identification of all Contexts of Use and External Mitigation Means associated to each Abnormal Event

4.1.1.2.1 Identification of "Context of Use"

This subtask consists in identifying all the "Contexts of Use" associated to each Abnormal Event. "Context of Use" reflects the operational environment in which the system can be used.

The Contexts of Use are referenced as follow: "CU_XX: xxxx"

- XX: reference number of the CU;
- xxxx: title of the CU.

The identification of "Context of Use" is based on the context of utilization of the Iris Precursor which includes:

- Application related to the message transmitted via Iris Precursor;
- Kind of message (uplink or downlink message);
- Kind of failure (corruption of a message into another existing message or corruption into an un-existing message).

The following table presents all the Contexts of Use identified for the Iris Precursor

Ref	Context of Use
CU_01_a	Message is related to CPDLC application
CU_01_b	Message is related to ADS-C application
CU_02_a	Message is an uplink message
CU_02_b	Message is a downlink message
CU_03_a	Downlink message is corrupted into an existing other downlink message
CU_03_b	Downlink message is corrupted into an unexisting downlink message
CU_04_a	Uplink message is corrupted into an existing other uplink message
CU_04_b	Uplink message is corrupted into an unexisting uplink message

Table 5: List of Contexts of Use considered for the identification of Operational Hazards

4.1.1.2.2 Identification of External Mitigation Means

This subtask consists in identifying all the External Mitigation Means associated to each Abnormal Event. Mitigation means are means that may help to reduce the effects of an Abnormal Event once it has occurred. External Mitigation Means are mitigations means outside the scope of the system under assessment, in our case it is thus outside Iris Precursor system.

The External Mitigation Means are referenced as follow: “EMM_XX: xxxx”

- XX: reference number of the EMM;
- xxxx: title of the EMM.

This identification of External Mitigation Means is based on the ED228 document: External Mitigation Means appear in Allocation of Safety Objectives and Requirements (ASOR) part of the OSAs. The mitigation means applicable to this safety analysis are mainly those related to the ground systems failures.

The result of this identification is that there exists an external mitigation means for all the classical failures of a network:

- Loss of message (AE_01);
- Corruption of message (AE_02);
- Misdirection of message (AE_03);
- Delay of message (AE_04);
- Generation of a one spurious message at Iris Precursor level (AE_05).

The following table presents all the External Mitigation Means that could apply and the failures that they mitigate:

Ref	External Mitigation Means	Concerned AE
EMM_01	Flight Crew detects uplink message is inappropriate	Corruption: AE_02 Misdirection: AE_03 Delay: AE_04
EMM_02	Aircraft system detects and rejects corrupted uplink messages	Corruption: AE_02
EMM_03	Ground system detects and rejects corrupted downlink messages.	Corruption: AE_02
EMM_04	Ground system detects that a message has not been responded to within the expected time	Loss: AE_01 Misdirection: AE_03 Delay: AE_04
EMM_05	Aircraft system time stamps downlink messages Ground system checks the time stamp of a delayed downlink message and rejects it	Delay: AE_04
EMM_06	Ground system time stamps uplink messages Aircraft system checks the time stamp of a delayed uplink message and rejects it	Delay: AE_04
EMM_07	Aircraft system detects and rejects misdirected uplink messages	Misdirection: AE_03
EMM_08	Ground system detects and rejects misdirected downlink messages	Misdirection: AE_03
EMM_09	Controller detects downlink message is inappropriate	Corruption: AE_02 Misdirection: AE_03 Delay: AE_04
EMM_10	Aircraft system checks UM/DM association and rejects spurious uplink messages	Spurious: AE_05
EMM_11	Ground system checks UM/DM association and rejects spurious downlink messages	Spurious: AE_05

Table 6: List of External Mitigation Means considered for the identification of Operational Hazards

4.1.1.3 Identification of all Operational Hazards associated to each Abnormal Event

This sub-task consists in identifying all the Operational Hazards to which each Abnormal Event leads, depending on the Context of Use and on the External Mitigations Means success or failure. Operational Hazards are identified by systematically applying the different Contexts of Use to the Abnormal Events and evaluating the associated consequences depending on External Mitigation Means success or failure.

A list of Operational effects has been established by the ED228 for the different data link application (CPDLC and ADS). This list was established through expert consensus.

An Abnormal Event can lead to some of these ED228 Operational Hazards and eventually to new Operational Hazards that were not identified by ED228.

The list of Operational Effects will be referenced as follow: “OH_XX_YY_ZZ: xxxx”

- XX identify the kind of OH “ED228” for the OH already identified in ED228 and “NEW” for the new OH;
- YY identify the application concerned by the OH: “CPDLC”, “ADSC”, or “ALL” if all the applications are involved simultaneously in an OH;
- ZZ: reference number of the OH. For the ED228 OH, the same number than in ED228 document is used;
- xxxx title of the OH.

The table associated to this systematic methodology is presented in Appendix B.

The results of this methodology are:

- Iris Precursor failures can lead to 16 “**ED228 Operational Hazards**”:
    - 8 **CPDLC** Operational Hazards:
        - OH_ED228_CPDLC_01: Loss of CPDLC capability [single aircraft];
        - OH_ED228_CPDLC_02d: Detected loss of CPDLC capability [multiple aircraft];
        - OH_ED228_CPDLC_02u: Undetected loss of CPDLC capability [multiple aircraft];
        - OH_ED228_CPDLC_03d: Detected reception of a corrupted CPDLC message [single aircraft];
        - OH_ED228_CPDLC_03u: Undetected reception of a corrupted CPDLC message [single aircraft];
        - OH_ED228_CPDLC_05d: Detected reception of an unintended CPDLC message [single aircraft];
        - OH_ED228_CPDLC_05u: Undetected reception of an unintended CPDLC message [single aircraft];
        - OH_ED228_CPDLC_07: Unexpected interruption of a CPDLC transaction [single aircraft];
    - 8 **ADS-C** Operational Hazards:
        - OH_ED228_ADSC_01d: Detected loss of ADS-C capability [single aircraft];
        - OH_ED228_ADSC_01u: Undetected loss of ADS-C capability [single aircraft];
        - OH_ED228_ADSC_02d: Detected loss of ADS-C capability [multiple aircraft];
        - OH_ED228_ADSC_02u: Undetected loss of ADS-C capability [multiple aircraft];

- OH_ED228_ADSC_03d: Detected reception of a corrupted ADS-C message [single aircraft];
- OH_ED228_ADSC_03u: Undetected reception of a corrupted ADS-C message [single aircraft];
- OH_ED228_ADSC_05: Reception of an unintended ADS-C message [single aircraft];
- OH_ED228_ADSC_07: Unexpected interruption of an ADS-C transaction [single aircraft];

- Iris Precursor failure can lead to 3 "**New Operational Hazards**":
  - o OH_NEW_ALL_01: Failure to exchange any message with a single aircraft (detected);
  - o OH_NEW_ALL_02d: Failure to exchange any message with more than one aircraft (detected);
  - o OH_NEW_ALL_02u: Failure to exchange any message with more than one aircraft (undetected);

For the ED228 Operational Hazards, definition of associated Safety Objective has already been performed by ED228. For the new Operational Hazards, the evaluation of the severity and the definition of associated safety objective are performed in the two following paragraphs.

4.1.1.4 Evaluation of severity associated to new Operational Hazards

This sub-task consists in evaluating the effects associated to new Operational Hazards and in proposing a severity for these Operational Hazards. Consistent with ED228 analysis, the ED-78 Hazards Classification Matrix (see Appendix A) is used to evaluate the severities.

This sub-task is carried out in comparison with the severities that have been attributed by ED228. If a "new OH" has the same effects than a "ED228 OH" and the same mitigation means, the same severity is attributed to this OH. If a "new OH" has the same effect than a "ED228 OH" and if it hasn't the same mitigation means, a more severe classification might be allocated on this "new OH".

Four new hazards have been identified during the previous task:

- OH_NEW_ALL_01: Failure to exchange any message with a single aircraft (detected).
- OH_NEW_ALL_02d: Failure to exchange any message with more than one aircraft (detected).
- OH_NEW_ALL_02u: Failure to exchange any message with more than one aircraft (undetected).

- **ASSUMP_IPr_06**: Simultaneous loss of all applications (CPDLC and ADS-C) for one aircraft is not more critical that independent failure of each application for one aircraft.

  Justification: This assumption seems coherent because Datalink application has never been considered as a reduction mean to mitigate the loss of another application. For example, OH_ED228_CPDLC_01 (failure to exchange CPDLC messages with a single aircraft) is not mitigated by the utilization of ADS-C.

- **OH_NEW_ALL_01: Failure to exchange any message with a single aircraft (detected)**

This Operational Hazard is a combination of Operational Hazards:

- OH_ED228_ADSC_01d: Detected loss of ADS-C capability [single aircraft] (SC4);
- OH_ED228_ADSC_01u: Undetected loss of ADS-C capability [single aircraft] (SC3)
- OH_ED228_CPDLC_01: Loss of CPDLC capability [single aircraft] (SC4);

Severities of all these Operational Hazards have been determined by evaluating their effects on the overall ATM system.

For **CPDLC** messages, in case of unavailability of longer duration, when initiating a message, the initiator **detects** the system fails to send the message. At the time of detection, the initiator reverts to voice communication in order to settle the open dialogue. All subsequent dialogues will be initiated by voice.

This leads to a slight increase in controller and flight crew workload and to a slight reduction in aircraft functional capabilities: **SC4**.

For **ADS** messages, when initiating an ADS-C contract request, the controller **detects** that the ground system fails to send the message. In case of a demand or periodic contract, if the aircraft system fails to send ADS-C report(s), the controller will detect it. For an event contract, the controller may detect the loss of ADS-C capability depending on the type of event.

The detected loss of ADS-C capability leads to a slight reduction in safety margins and separation: **SC4**.

The undetected loss of ADS-C capability leads to a significant reduction in safety margins and separation: **SC3**.

➔ This new operational hazard has a severity class 3 (**SC3**).

- **OH_NEW_ALL_02d: Failure to exchange any message with more than one aircraft (detected)**

This Operational Hazard is a combination of Operational Hazards:

- OH_ED228_ADSC_02d: Detected loss of ADS-C capability [multiple aircraft] (SC4);
- OH_ED228_ADSC_02u: Undetected loss of ADS-C capability [multiple aircraft] (SC3);
- OH_ED228_CPDLC_02d: Detected loss of CPDLC capability [multiple aircraft] (SC4);
- OH_ED228_CPDLC_02u: Undetected loss of CPDLC capability [multiple aircraft] (SC3);

- **ASSUMP_IPr_03**: This event includes the combination between one system detected loss of capability and the other system undetected loss of capability.

  Justification: the undetected loss of one system can occur after the detected loss of the other system and leading to a undetected failure to exchange any message with more than one aircraft until the more or less longer detection by the controller.

For **CPDLC** messages, in case of unavailability of longer duration, when initiating a message, the initiator **detects** the system fails to send the message. At the time of detection, the initiator reverts to voice communication in order to settle the open dialogue. In the worst case of non-employment of a Standby System, all subsequent dialogues with the effected aircraft are exchanged using voice.

This may lead to a significant increase in controller workload due to reversion to voice communication and number of impacted aircraft and a slight increase in flight crew workload. It may have a significant reduction in safety margins and separation: **SC3**.

For **ADS** messages, when initiating an ADS-C contract request, the controller **detects** that the ground system fails to send the message. In case of a demand or periodic contract, if two or more aircraft systems fail to send ADS-C reports, the controller will detect it. For event contracts, the controller may detect the loss of ADS-C capability depending on the type of event.

From the ground viewpoint, the IER service cannot be used with two or more aircraft. Less predictability, using EPP, is causing for several aircraft an extra burden for the controller because in normal circumstances he relies on the EPP to obtain better predictability crosschecking or route conformance checking.

This may lead to a significant reduction in safety margins and separation: **SC3**.

➔ This new operational hazard has a severity class 3 (**SC3**).

- **OH_NEW_ALL_02u: Failure to exchange any message with more than one aircraft (undetected)**

This Operational Hazard is a combination of two Operational Hazards:

- OH_ED228_ADSC_02u: Undetected loss of ADS-C capability [multiple aircraft] (SC3);
- OH_ED228_CPDLC_02u: Undetected loss of CPDLC capability [multiple aircraft] (SC3);

For **CPDLC** messages, the undetected capability loss leads to a significant reduction in safety margins and separation: **SC3**.

For **ADS** messages, the undetected capability loss leads to a significant reduction in safety margins and separation: **SC3**.

➔ This new operational hazard has a severity class 3 (**SC3**).

4.1.1.5 Definition of Safety Objectives associated to new Operational Hazards

This sub-task consists in defining the safety objectives associated to "new OH". In order to perform the allocation of Iris Precursor Safety Requirements (cf. § 3.1.1.2), it is necessary to determine the safety objectives associated to all Operational Hazards, even those not identified by ED228.

The same methodology than in ED228 is applied for this definition: the Safety Objective is linked to the severity attributed to the Operational Hazard.

- **OH_NEW_ALL_01: Failure to exchange any message with a single aircraft (detected)**

This new Operational Hazard is classified with a severity 3 (SC3).

As described previously, this severity is mainly driven because this hazard can lead to a "detected loss of CPDLC and ADS-C capability for one aircraft" (OH_ED228_CPDLC_01 and OH_ED228_ADSC_01).

The following safety objectives are allocated in WG78 Safety Analysis:

- OH_ED2288_ADSC_01d – Safety Objective: 1.0 10^{-3} /FH;
- OH_ED228_ADSC_01u – Safety Objective: 1.0 10^{-5} /FH;
- OH_ED228_CPDLC_01 – Safety Objective: 1.0 10^{-3} /FH.

Consequently, the most stringent of these two safety objectives is used for a failure to use any application.

➔ **Safety Objective for OH_NEW_ALL_01 is 1.0 10^{-5} /FH**

- **OH_NEW_ALL_02d: Failure to exchange any message with more than one aircraft (detected)**

This new Operational Hazard is classified with a severity 3 (SC3).

As described previously, this severity is mainly driven because this hazard can lead to a "loss of CPDLC and ADS-C capability for more than one aircraft" (OH_ED228_CPDLC_02 and OH_ED228_ADSC_02).

The following safety objectives are allocated in WG78 Safety Analysis:

- OH_ED228_ADSC_02d – Safety Objective: 1.0 10^{-3} /H;

- OH_ED228_ADSC_02u – Safety Objective: 1.0 10^{-5} /H;
- OH_ED228_CPDLC_02d – Safety Objective: 1.0 10^{-3} /H;
- OH_ED228_CPDLC_02u – Safety Objective: 1.0 10^{-5} /H.

Consequently, the most stringent of these two safety objectives is used for a failure to use any application.

➔ **Safety Objective for OH_NEW_ALL_02d is 1.0 10^{-5} /H**

- **OH_NEW_ALL_02u: Failure to exchange any message with more than one aircraft (undetected)**

This new Operational Hazard is classified with a severity 3 (SC3).

As described previously, this severity is mainly driven because this hazard can lead to a “loss of CPDLC and ADS-C capability for more than one aircraft” (OH_ED228_CPDLC_02u and OH_ED228_ADSC_02u).

The following safety objectives are allocated in WG78 Safety Analysis:

- OH_ED228_ADSC_02u – Safety Objective: 1.0 10^{-5} /H;
- OH_ED228_CPDLC_02u – Safety Objective: 1.0 10^{-5} /H.

Consequently, the most stringent of these two safety objectives is used for a failure to use any application.

➔ **Safety Objective for OH_NEW_ALL_02u is 1.0 10^{-5} /H**

4.1.2 Identification / definition of relevant AC and ATSU Safety Requirements

4.1.2.1 Identification of relevant AC and ATSP Safety Requirement from ED228 Operational Hazards

As mentioned previously, for all Operational Hazards identified by the ED228, an allocation of safety requirements has already been performed on the different components of the ATM system: Flight Crew, Aircraft System and Air Traffic Service Provider (ATSP). Consequently, this task consists in identifying, in the allocation fault tree of the ED228, all the safety requirements that are relevant for Iris Precursor.

Iris Precursor is split between Aircraft System and ATSP. So, the relevant Safety Requirements are the requirements allocated to Aircraft system or ATSP and that concerns the exchange of message between ground and aircraft.

The tables of this paragraph have been built as follow:

- OH columns:
    - o OH Ref: identify the OH issued from the ED228 document;
    - o Severity: identify the severity associated of the studied OH (issued from ED228 document);
    - o SO: identify the safety objective associated of the studied OH;
- Cause columns:
    - o Cause Ref: identify the high level safety requirement identified in the ED228 document (tables B-7 and C-7 (ADS-C and CPDLC OSA));
    - o Part: identify the ATM system component associated to the cause ref;
    - o Failure: identify the type of failure associated to the cause ref (unavailable, corruption, misdirection, generation of spurious, …);
- SR columns: The list of relevant ED228 Safety Requirements will be referenced as follow: “SR-XX-YY-ZZ: xxxx”
    - o XX-YY-ZZ constitutes the reference of the cause in the ED228 fault tree:
        - ▪ XX: identify the part on which the safety requirement is allocated : “*FC*” for Flight Crew, “*AC*” for Aircraft System or “GD” for ATSP;
        - ▪ YY: identify the application associated to the fault tree : “*ADSC*” or “*CPDLC*”;
        - ▪ *ZZ* : is a reference number of safety requirement;
    - o xxxx: title of the ED228 Safety Requirement.

The following chapters present the relevant safety requirements defined from each ED228 OH identified in § 4.1.1.3.

4.1.2.1.1 OH_ED228_ADSC_01d

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			*SR*	
OH Ref	**Severity**	**SO (/FH)**	**Cause Ref**	**Part**	**Failure**	**SR Ref**	**Title**
OH_ED228_ADSC_01d	4	1.00E-03	ED228_CASR_ADSC_01	ATSP	Unavailable	*SR-GD-ADSC-01*	*The ATSU shall provide an indication to the controller when an ADS-C contract is established.*
						SR-GD-ADSC-02	*The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.*
			ED228_CASR_ADSC_02	AC	Unavailable	*SR-AC-ADSC-01*	*The aircraft system shall indicate to the flight crew a detected loss of ADS-C service.*
				ATSP	Unavailable	*SR-GD-ADSC-03*	*The ATSU shall indicate to the controller a detected loss of ADS-C service.*
			ED228_CASR_ADSC_03	ATSP	Unavailable	*SR-GD-ADSC-04*	*ADS-C service shall be established in sufficient time to be available for operational use.*
			ED228_CASR_ADSC_04	ATSP	Unavailable	*SR-GD-ADSC-05*	*ATSU shall be notified of planned outage of ADS-C service sufficiently ahead of time.*
			ED228_CASR_ADSC_05	ATSP	Unavailable	*SR-GD-ADSC-06*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
			ED228_CASR_ADSC_14	ATSP	EMM_04 - Unavailable	*SR-GD-ADSC-13*	*The ATSU shall indicate to the controller when demand or periodic report for a request sent by the ATSU is not received within the required time (OT).*
			ED228_CASR_ADSC_29	AC	EMM_10 - Unavailable	*SR-AC-ADSC-16*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_11 - Unavailable	*SR-GD-ADSC-34*	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*
						SR-GD-ADSC-35	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 7: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_01d

4.1.2.1.2 OH_ED228_ADSC_01u

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-5} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_ADSC_01u	3	1.00E-05	ED228_CASR_ADSC_14	ATSP	EMM_04 - Unavailable	*SR-GD-ADSC-13*	*The ATSU shall indicate to the controller when demand or periodic report for a request sent by the ATSU is not received within the required time (OT).*
			ED228_CASR_ADSC_29	AC	EMM_10 - Unavailable	*SR-AC-ADSC-16*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_11 - Unavailable	*SR-GD-ADSC-34*	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*
						SR-GD-ADSC-35	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 8: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_01u

4.1.2.1.3 OH_ED228_ADSC_02d

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_ADSC_02d	4	1.00E-03	ED228_CASR_ADSC_01	ATSP	Unavailable	*SR-GD-ADSC-01*	*The ATSU shall provide an indication to the controller when an ADS-C contract is established.*
						SR-GD-ADSC-02	*The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.*
			ED228_CASR_ADSC_02	AC	Unavailable	*SR-AC-ADSC-01*	*The aircraft system shall indicate to the flight crew a detected loss of ADS-C service.*
				ATSP	Unavailable	*SR-GD-ADSC-03*	*The ATSU shall indicate to the controller a detected loss of ADS-C service.*
			ED228_CASR_ADSC_03	ATSP	Unavailable	*SR-GD-ADSC-04*	*ADS-C service shall be established in sufficient time to be available for operational use.*
			ED228_CASR_ADSC_04	ATSP	Unavailable	*SR-GD-ADSC-05*	*ATSU shall be notified of planned outage of ADS-C service sufficiently ahead of time.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
			ED228_CASR_ADSC_05	ATSP	Unavailable	*SR-GD-ADSC-06*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
OH_ED228_ADSC_02d	4	1.00E-03	ED228_CASR_ADSC_14	ATSP	EMM_04 - Unavailable	*SR-GD-ADSC-13*	*The ATSU shall indicate to the controller when demand or periodic report for a request sent by the ATSU is not received within the required time (OT).*
			ED228_CASR_ADSC_29	AC	EMM_10 - Unavailable	*SR-AC-ADSC-16*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_11 - Unavailable	*SR-GD-ADSC-34*	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*
						SR-GD-ADSC-35	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 9: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_02d

4.1.2.1.4 OH_ED228_ADSC_02u

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-5} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_ADSC_02u	3	1.00E-05	ED228_CASR_ADSC_04	ATSP	Unavailable	*SR-GD-ADSC-05*	*ATSU shall be notified of planned outage of ADS-C service sufficiently ahead of time.*
			ED228_CASR_ADSC_14	ATSP	EMM_04 - Unavailable	*SR-GD-ADSC-13*	*The ATSU shall indicate to the controller when demand or periodic report for a request sent by the ATSU is not received within the required time (OT).*
			ED228_CASR_ADSC_29	AC	EMM_10 - Unavailable	*SR-AC-ADSC-16*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_11 - Unavailable	*SR-GD-ADSC-34*	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*
						SR-GD-ADSC-35	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 10: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_02u

4.1.2.1.5 OH_ED228_ADSC_03d

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			*SR*	
OH Ref	**Severity**	**SO (/FH)**	**Cause Ref**	**Part**	**Failure**	**SR Ref**	**Title**
OH_ED228_ADSC_03d	4	1.00E-03	ED228_CASR_ADSC_06	AC	Corruption	*SR-AC-ADSC-02*	*The aircraft system shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
				ATSP	Corruption	*SR-GD-ADSC-07*	*The ATSU shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
			ED228_CASR_ADSC_11	AC	Corruption	*SR-AC-ADSC-05*	*The aircraft system shall process the message without affecting the intent of the message.*
				ATSP	Corruption	*SR-GD-ADSC-09*	*The ATSU system shall process the message without affecting the intent of the message.*
						SR-GD-ADSC-10	*The controller shall check the correctness and the appropriateness of every ADS-C report received.*
			ED228_CASR_ADSC_17	AC	EMM_02 - Corruption	*SR-AC-ADSC-08*	*The aircraft system shall discard any corrupted message.*
						SR-AC-ADSC-09	*The aircraft system shall send an indication to the ground system whenever a message is discarded by the aircraft system.*
				ATSP	EMM_03 - Corruption	*SR-GD-ADSC-17*	*The ATSU shall discard a detected corrupted message.*
					EMM_03 - Corruption	*SR-GD-ADSC-18*	*When the ATSU receives a report that has been corrupted, the ATSU shall request similar information with a demand report.*
			ED228_CASR_ADSC_20	ATSP	Corruption	*SR-GD-ADSC-22*	*ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in datalink initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*
						SR-GD-ADSC-23	*When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.*
						SR-GD-ADSC-24	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address).*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
						SR-GD-ADSC-25	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*
OH_ED228_ADSC_03d	4	1.00E-03	ED228_CASR_ADSC_23	ATSP	Corruption	*SR-GD-ADSC-27*	*An ATSU shall not permit ADS-C services when there are non-compatible version numbers.*
					Corruption	*SR-GD-ADSC-28*	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*
			ED228_CASR_ADSC_24	AC	Corruption	*SR-AC-ADSC-12*	*The aircraft system shall respond to each part of the request received.*
				ATSP	Corruption	*SR-GD-ADSC-29*	*The ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report.*
						SR-GD-ADSC-30	*The ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract.*
			ED228_CASR_ADSC_26	AC	Corruption	*SR-AC-ADSC-14*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*
				ATSP	Corruption	*SR-GD-ADSC-32*	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*
			ED228_CASR_ADSC_27	AC	Corruption	*SR-AC-ADSC-15*	*The aircraft system shall be capable to ensure the correct transfer out of the aircraft avionics route data sent via data link.*
			ED228_CASR_ADSC_28	ATSP	Corruption	*SR-GD-ADSC-33*	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).*
			ED228_CASR_ADSC_31	AC	Corruption	*SR-AC-ADSC-17*	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*
				ATSP	Corruption	*SR-GD-ADSC-36*	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*
			ED228_CASR_ADSC_32	AC	Corruption	*SR-AC-ADSC-18*	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established*
				ATSP	Corruption	*SR-GD-ADSC-37*	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*
						SR-GD-ADSC-38	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*

Table 11: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_03d

4.1.2.1.6 OH_ED228_ADSC_03u

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-5} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_ADSC_03u	3	1.00E-05	ED228_CASR_ADSC_06	AC	Corruption	*SR-AC-ADSC-02*	*The aircraft system shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
				ATSP	Corruption	*SR-GD-ADSC-07*	*The ATSU shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
			ED228_CASR_ADSC_11	AC	Corruption	*SR-AC-ADSC-05*	*The aircraft system shall process the message without affecting the intent of the message.*
				ATSP	Corruption	*SR-GD-ADSC-09*	*The ATSU system shall process the message without affecting the intent of the message.*
						SR-GD-ADSC-10	*The controller shall check the correctness and the appropriateness of every ADS-C report received.*
			ED228_CASR_ADSC_20	ATSP	Corruption	*SR-GD-ADSC-22*	*ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in datalink initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*
						SR-GD-ADSC-23	*When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.*
						SR-GD-ADSC-24	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address).*
						SR-GD-ADSC-25	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*
			ED228_CASR_ADSC_23	ATSP	Corruption	*SR-GD-ADSC-27*	*An ATSU shall not permit ADS-C services when there are non-compatible version numbers.*
					Corruption	*SR-GD-ADSC-28*	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*
			ED228_CASR_ADSC_24	AC	Corruption	*SR-AC-ADSC-12*	*The aircraft system shall respond to each part of the request received.*
				ATSP	Corruption	*SR-GD-ADSC-29*	*The ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report.*
						SR-GD-ADSC-30	*The ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract.*
			ED228_CASR_ADSC_26	AC	Corruption	*SR-AC-ADSC-14*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*
				ATSP	Corruption	*SR-GD-ADSC-32*	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*
			ED228_CASR_ADSC_27	AC	Corruption	*SR-AC-ADSC-15*	*The aircraft system shall be capable to ensure the correct transfer out of the aircraft avionics route data sent via data link.*
			ED228_CASR_ADSC_28	ATSP	Corruption	*SR-GD-ADSC-33*	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
							associated condition being met).
OH_ED228_ADSC_03u	3	1.00E-05	ED228_CASR_ADSC_31	AC	Corruption	*SR-AC-ADSC-17*	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*
				ATSP	Corruption	*SR-GD-ADSC-36*	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*
			ED228_CASR_ADSC_32	AC	Corruption	*SR-AC-ADSC-18*	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established*
				ATSP	Corruption	*SR-GD-ADSC-37*	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*
						SR-GD-ADSC-38	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*

Table 12: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_03u

4.1.2.1.7 OH_ED228_ADSC_05

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_ADSC_05	4	1,00E-03	ED228_CASR_ADSC_06	AC	Misdirec ion	*SR-AC-ADSC-02*	*The aircraft system shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
				ATSP	Misdirec ion	*SR-GD-ADSC-07*	*The ATSU shall provide unambiguous and unique identification (e g. ICAO recognized ID) of the origin and destination with each message it transmits.*
			ED228_CASR_ADSC_09	AC	EMM_05 - Delay	*SR-AC-ADSC-03*	*The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.*
				ATSP	EMM_06 - Delay	*SR-GD-ADSC-08*	*The ATSU system shall time stamp to within one second UTC each message when it is released for onward transmission.*
			ED228_CASR_ADSC_10	AC	Spurious	*SR-AC-ADSC-04*	*The aircraft system shall include in each ADS report the time at position to within ± one second of the UTC time the aircraft was actually at the position provided in the report.*
			ED228_CASR_ADSC_11	AC	Spurious	*SR-AC-ADSC-05*	*The aircraft system shall process the message without affecting the intent of the message.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
				ATSP	Spurious	SR-GD-ADSC-09	The ATSU system shall process the message without affecting the intent of the message.
						SR-GD-ADSC-10	The controller shall check the correctness and the appropriateness of every ADS-C report received.
OH_ED228_ADSC_05	4	1,00E-03	ED228_CASR_ADSC_12	AC	EMM_07 - Misdirec ion	SR-AC-ADSC-06	The aircraft system shall reject messages not addressed to itself.
				ATSP	EMM_08 - Misdirec ion	SR-GD-ADSC-11	The ATSU shall reject messages not addressed to itself.
			ED228_CASR_ADSC_13	AC	Misdirec ion	SR-AC-ADSC-07	The aircraft system shall transmit reports to the end system designated in the ADS-C contract.
				ATSP	Misdirec ion	SR-GD-ADSC-12	The ATSU shall transmit messages to the designated aircraft system.
			ED228_CASR_ADSC_14	ATSP	EMM_04 - Delay	SR-GD-ADSC-13	The ATSU shall indicate to the controller when demand or periodic report for a request sent by the ATSU is not received within the required time (OT).
			ED228_CASR_ADSC_15	ATSP	EMM_05 - Delay	SR-GD-ADSC-14	When the ATSU system receives a message whose time stamp is older than the current time minus OT, the ATSU shall reject the message.
						SR-GD-ADSC-15	When the ATSU system receives a periodic or event report whose time stamp is older than the current time minus OT, the ATSU shall request similar information from the message rejected with a demand report.
					EMM_06 - Delay	SR-GD-ADSC-16	The controller shall take appropriate action when indicated the aircraft system rejected a message whose time stamp exceeds the OT.
			ED228_CASR_ADSC_18	AC	Spurious	SR-AC-ADSC-10	The aircraft system shall be able to determine the message initiator.
				ATSP	Spurious	SR-GD-ADSC-19	The ATSU shall be able to determine the message initiator.
			ED228_CASR_ADSC_19	ATSP	EMM_08 - Misdirec ion	SR-GD-ADSC-20	The ATSU system shall prohibit to the controller operational processing of messages not addressed to the ATSU.
						SR-GD-ADSC-21	The ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft.
			ED228_CASR_ADSC_20	ATSP	Spurious	SR-GD-ADSC-22	ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in datalink initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.
						SR-GD-ADSC-23	When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.
						SR-GD-ADSC-24	The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address).

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
						SR-GD-ADSC-25	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*
OH_ED228_ADSC_05	4	1,00E-03	ED228_CASR_ADSC_21	AC	Spurious	*SR-AC-ADSC-11*	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*
				ATSP	Spurious	*SR-GD-ADSC-26*	*The aircraft identifiers used for data link initiation correlation by the ATSU system shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*
			ED228_CASR_ADSC_22	FC	EMM_01 - Spurious	*SR-FC-ADSC-01*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Delay	*SR-FC-ADSC-01*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Misdirec ion	*SR-FC-ADSC-01*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
			ED228_CASR_ADSC_25	AC	Misdirec ion	*SR-AC-ADSC-13*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*
				ATSP	Misdirec ion	*SR-GD-ADSC-31*	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*
			ED228_CASR_ADSC_28	ATSP	Delay	*SR-GD-ADSC-33*	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).*
			ED228_CASR_ADSC_29	AC	EMM_10 - Spurious	*SR-AC-ADSC-16*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_11 - Spurious	*SR-GD-ADSC-34*	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*
						SR-GD-ADSC-35	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*
			ED228_CASR_ADSC_31	AC	EMM_02 - Spurious	*SR-AC-ADSC-17*	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*
				ATSP	EMM_03 - Spurious	*SR-GD-ADSC-36*	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*
			ED228_CASR_ADSC_32	AC	Spurious	*SR-AC-ADSC-18*	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established*
				ATSP	Spurious	*SR-GD-ADSC-37*	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
						SR-GD-ADSC-38	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*

Table 13: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_05

4.1.2.1.8 OH_ED228_ADSC_07

The safety objective to be met for this Operational Hazard is extracted from ED228 ADS-C Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant ATSP and AC requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_ADSC_07	4	1.00E-03	ED228_CASR_ADSC_01	ATSP	Unavailable	*SR-GD-ADSC-01*	*The ATSU shall provide an indication to the controller when an ADS-C contract is established.*
						SR-GD-ADSC-02	*The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.*
			ED228_CASR_ADSC_02	AC	Unavailable	*SR-AC-ADSC-01*	*The aircraft system shall indicate to the flight crew a detected loss of ADS-C service.*
				ATSP	Unavailable	*SR-GD-ADSC-03*	*The ATSU shall indicate to the controller a detected loss of ADS-C service.*
			ED228_CASR_ADSC_04	ATSP	Unavailable	*SR-GD-ADSC-05*	*ATSU shall be notified of planned outage of ADS-C service sufficiently ahead of time.*
			ED228_CASR_ADSC_05	ATSP	Unavailable	*SR-GD-ADSC-06*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
			ED228_CASR_ADSC_06	AC	Unavailable	*SR-AC-ADSC-02*	*The aircraft system shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
				ATSP	Unavailable	*SR-GD-ADSC-07*	*The ATSU shall provide unambiguous and unique identification (e.g. ICAO recognized ID) of the origin and destination with each message it transmits.*
			ED228_CASR_ADSC_14	ATSP	EMM_04 - Unavailable	*SR-GD-ADSC-13*	*The ATSU shall indicate to the controller when demand or periodic report for a request sent by the ATSU is not received within the required time (OT).*
			ED228_CASR_ADSC_22	FC	EMM_01 - Unavailable	*SR-FC-ADSC-01*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
			ED228_CASR_ADSC_29	AC	EMM_10 - Unavailable	*SR-AC-ADSC-16*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*

				ATSP	EMM_11 - Unavailable	*SR-GD-ADSC-34*	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*
						SR-GD-ADSC-35	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*
			ED228_CASR_ADSC_32	AC	Unavailable	*SR-AC-ADSC-18*	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established*
				ATSP	Unavailable	*SR-GD-ADSC-37*	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*
						SR-GD-ADSC-38	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*

Table 14: Relevant AC and ATSP safety requirements allocated from OH_ED228_ADSC_07

4.1.2.1.9 OH_ED228_CPDLC_01

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			*SR*	
OH Ref	**Severity**	**SO (/FH)**	**Cause Ref**	**Part**	**Failure**	**SR Ref**	**Title**
OH_ED228_CPDLC_01	4	1,00E-03	ED228_CASR_CPDLC_01	AC	Unavailable	*SR-AC-CPDLC-01*	*The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.*
						SR-AC-CPDLC-02	*The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.*
						SR-AC-CPDLC-03	*The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.*
				ATSP	Unavailable	*SR-GD-CPDLC-01*	*The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.*
						SR-GD-CPDLC-02	*The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.*
						SR-GD-CPDLC-03	*The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.*
			ED228_CASR_CPDLC_02	AC	Unavailable	*SR-AC-CPDLC-04*	*The aircraft system shall indicate to the flight crew a detected loss of CPDLC.*
						SR-AC-CPDLC-05	*After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.*
				ATSP	Unavailable	*SR-GD-CPDLC-04*	*The ATSU shall indicate to the controller a detected loss of CPDLC.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
			ED228_CASR_CPDLC_03	ATSP	Unavailable	*SR-GD-CPDLC-05*	*CPDLC service shall be established in sufficient time to be available for operational use.*
			ED228_CASR_CPDLC_04	ATSP	Unavailable	*SR-GD-CPDLC-06*	*ATSU shall be notified of planned outage of CPDLC service sufficiently ahead of time.*
			ED228_CASR_CPDLC_05	AC	Loss	*SR-AC-CPDLC-06*	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*
					Delay	*SR-AC-CPDLC-06*	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*
				ATSP	Loss	*SR-GD-CPDLC-07*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
					Delay	*SR-GD-CPDLC-07*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
			ED228_CASR_CPDLC_14	ATSP	EMM_04 - Delay	*SR-GD-CPDLC-19*	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*
OH_ED228_CPDLC_01	4	1,00E-03	ED228_CASR_CPDLC_23	ATSP	Unavailable	*SR-GD-CPDLC-34*	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*
						SR-GD-CPDLC-35	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*
			ED228_CASR_CPDLC_29	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-26*	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*
					EMM_01 - Delay	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Misdirection	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Corruption	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_10 - Unavailable	*SR-AC-CPDLC-28*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-39*	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*
					EMM_11 - Unavailable	*SR-GD-CPDLC-40*	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 15: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_01

4.1.2.1.10OH_ED228_CPDLC_02d

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_02d	4	1,00E-03	ED228_CASR_CPDLC_01	AC	Unavailable	*SR-AC-CPDLC-01*	*The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.*
						SR-AC-CPDLC-02	*The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.*
						SR-AC-CPDLC-03	*The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.*
				ATSP	Unavailable	*SR-GD-CPDLC-01*	*The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.*
						SR-GD-CPDLC-02	*The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.*
						SR-GD-CPDLC-03	*The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.*
			ED228_CASR_CPDLC_02	AC	Unavailable	*SR-AC-CPDLC-04*	*The aircraft system shall indicate to the flight crew a detected loss of CPDLC.*
						SR-AC-CPDLC-05	*After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.*
				ATSP	Unavailable	*SR-GD-CPDLC-04*	*The ATSU shall indicate to the controller a detected loss of CPDLC.*
			ED228_CASR_CPDLC_03	ATSP	Unavailable	*SR-GD-CPDLC-05*	*CPDLC service shall be established in sufficient time to be available for operational use.*
			ED228_CASR_CPDLC_04	ATSP	Unavailable	*SR-GD-CPDLC-06*	*ATSU shall be notified of planned outage of CPDLC service sufficiently ahead of time.*
			ED228_CASR_CPDLC_05	AC	Loss	*SR-AC-CPDLC-06*	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*
					Delay	*SR-AC-CPDLC-06*	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*
				ATSP	Loss	*SR-GD-CPDLC-07*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
					Delay	*SR-GD-CPDLC-07*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
			ED228_CASR_CPDLC_14	ATSP	EMM_04 - Delay	*SR-GD-CPDLC-19*	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*
			ED228_CASR_CPDLC_23	ATSP	Unavailable	*SR-GD-CPDLC-34*	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*
						SR-GD-CPDLC-35	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_02d	4	1,00E-03	ED228_CASR_CPDLC_29	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-26*	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*
					EMM_01 - Delay	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Misdirection	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Corruption	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_10 - Unavailable	*SR-AC-CPDLC-28*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-39*	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*
					EMM_11 - Unavailable	*SR-GD-CPDLC-40*	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 16: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_02d

4.1.2.1.11OH_ED228_CPDLC_02u

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-5} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_WG78_CPDLC_02u	3	1,00E-05	ED228_CASR_CPDLC_04	ATSP	Unavailable	*SR-GD-CPDLC-06*	*ATSU shall be notified of planned outage of CPDLC service sufficiently ahead of time.*
			ED228_CASR_CPDLC_14	ATSP	EMM_04 - Delay	*SR-GD-CPDLC-19*	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_WG78_CPDLC_02u	3	1,00E-05	ED228_CASR_CPDLC_23	ATSP	Unavailable	*SR-GD-CPDLC-34*	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*
						SR-GD-CPDLC-35	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*
			ED228_CASR_CPDLC_29	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-26*	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*
					EMM_01 - Delay	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Misdirection	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Corruption	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_10 - Unavailable	*SR-AC-CPDLC-28*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-39*	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*
					EMM_11 - Unavailable	*SR-GD-CPDLC-40*	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 17: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_02u

4.1.2.1.12OH_ED228_CPDLC_03d

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_03d	4	1,00E-03	ED228_CASR_CPDLC_06	AC	Corruption	*SR-AC-CPDLC-07*	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
				ATSP	Corruption	*SR-GD-CPDLC-08*	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
			ED228_CASR_CPDLC_07	AC	EMM_10 - Spurious	*SR-AC-CPDLC-08*	*The aircraft system shall indicate in each response to which messages it refers.*
				ATSP	EMM_11 - Spurious	*SR-GD-CPDLC-09*	*The ATSU shall indicate in each response to which messages it refers.*
			ED228_CASR_CPDLC_08	AC	Corruption	*SR-AC-CPDLC-09*	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*
				ATSP	Corruption	*SR-GD-CPDLC-10*	*The ATSU shall send the route information with the route clearance uplink message.*
			ED228_CASR_CPDLC_11	AC	Corruption	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Delay	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Misdirection	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
				ATSP	Corruption	*SR-GD-CPDLC-13*	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*
						SR-GD-CPDLC-12	*The ATSU shall process the message without affecting the intent of the message.*
					Misdirection	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
					Delay	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
						SR-GD-CPDLC-14	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*
						SR-GD-CPDLC-15	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
					Loss	*SR-GD-CPDLC-15*	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
				FC	Corruption	*SR-FC-CPDLC-01*	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*
					Delay	*SR-FC-CPDLC-02*	*The flight crew shall respond or act in timely manner without unnecessary delay.*
					Corruption	*SR-FC-CPDLC-03*	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*

OH			Cause			*SR*	
OH Ref	**Severity**	**SO (/FH)**	**Cause Ref**	**Part**	**Failure**	**SR Ref**	**Title**
OH_ED228_CPDLC_03d	4	1,00E-03	ED228_CASR_CPDLC_16	AC	Corruption	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Misdirection	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Spurious	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
				ATSP	Corruption	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Misdirection	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Spurious	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
			ED228_CASR_CPDLC_17	AC	EMM_02 - Corruption	*SR-AC-CPDLC-16*	*The aircraft system shall prohibit operational processing by flight crew of corrupted messages.*
						SR-AC-CPDLC-17	*The aircraft system shall discard any corrupted message.*
				ATSP	EMM_03 - Corruption	*SR-GD-CPDLC-23*	*The ATSU shall prohibit operational processing by the controller of a corrupted report.*
						SR-GD-CPDLC-24	*The ATSU shall discard any corrupted message.*
			ED228_CASR_CPDLC_20	ATSP	Corruption	*SR-GD-CPDLC-28*	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*
						SR-GD-CPDLC-29	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*
						SR-GD-CPDLC-30	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*
						SR-GD-CPDLC-31	*The ground system shall provide an indication to the controller, when the ATSU system rejects a DLIC Logon or is notified of a DLIC contact failure.*
						SR-GD-CPDLC-32	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier.*
			ED228_CASR_CPDLC_23	ATSP	Corruption	*SR-GD-CPDLC-34*	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*
						SR-GD-CPDLC-35	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*
			ED228_CASR_CPDLC_24	AC	Corruption	*SR-AC-CPDLC-21*	*The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.*
				ATSP	Corruption	*SR-GD-CPDLC-36*	*The ATSU shall respond to messages in their entirety.*
				FC	Corruption	*SR-FC-CPDLC-05*	*The flight crew shall respond to a message in its entirety when not responded by the aircraft system.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_03d	4	1,00E-03	ED228_CASR_CPDLC_26	AC	EMM_02 - Corruption	*SR-AC-CPDLC-23*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*
				ATSP	EMM_03 - Corruption	*SR-GD-CPDLC-38*	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*
			ED228_CASR_CPDLC_27	AC	Corruption	*SR-AC-CPDLC-24*	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*
					Misdirection	*SR-AC-CPDLC-24*	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*
			ED228_CASR_CPDLC_28	AC	Corruption	*SR-AC-CPDLC-25*	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*
				FC	EMM_01 - Corruption	*SR-FC-CPDLC-06*	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*
			WG78_CASR_CPDLC_30	AC	EMM_02 - Corruption	*SR-AC-CPDLC-29*	*The aircraft system shall be capable to send an indication to the ground system whenever a message is rejected by the aircraft system.*
						SR-AC-CPDLC-30	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*
					EMM_07 - Misdirection	*SR-AC-CPDLC-29*	*The aircraft system shall be capable to send an indication to the ground system whenever a message is rejected by the aircraft system.*
						SR-AC-CPDLC-30	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*
					EMM_10 - Spurious	*SR-AC-CPDLC-29*	*The aircraft system shall be capable to send an indication to the ground system whenever a message is rejected by the aircraft system.*
						SR-AC-CPDLC-30	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_WG78_CPDLC_03d	4	1,00E-03	WG78_CASR_CPDLC_30	ATSP	EMM_02 - Corrup ion	*SR-GD-CPDLC-41*	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*
						SR-GD-CPDLC-42	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*
					EMM_07 - Misdirection	*SR-GD-CPDLC-41*	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*
						SR-GD-CPDLC-42	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*
					EMM_10 - Spurious	*SR-GD-CPDLC-41*	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*
						SR-GD-CPDLC-42	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*

Table 18: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_03d

4.1.2.1.13OH_ED228_CPDLC_03u

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-5} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_03u	3	1,00E-05	ED228_CASR_CPDLC_06	AC	Corruption	*SR-AC-CPDLC-07*	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
				ATSP	Corruption	*SR-GD-CPDLC-08*	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
			ED228_CASR_CPDLC_07	AC	EMM_10 - Spurious	*SR-AC-CPDLC-08*	*The aircraft system shall indicate in each response to which messages it refers.*
				ATSP	EMM_11 - Spurious	*SR-GD-CPDLC-09*	*The ATSU shall indicate in each response to which messages it refers.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_03u	3	1,00E-05	ED228_CASR_CPDLC_08	AC	Corruption	*SR-AC-CPDLC-09*	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*
				ATSP	Corruption	*SR-GD-CPDLC-10*	*The ATSU shall send the route information with the route clearance uplink message.*
			ED228_CASR_CPDLC_11	AC	Corruption	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Delay	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Misdirection	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
				ATSP	Corruption	*SR-GD-CPDLC-13*	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*
						SR-GD-CPDLC-12	*The ATSU shall process the message without affecting the intent of the message.*
					Misdirection	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
					Delay	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
						SR-GD-CPDLC-14	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*
						SR-GD-CPDLC-15	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
					Loss	*SR-GD-CPDLC-15*	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
				FC	Corruption	*SR-FC-CPDLC-01*	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*
					Delay	*SR-FC-CPDLC-02*	*The flight crew shall respond or act in timely manner without unnecessary delay.*
					Corruption	*SR-FC-CPDLC-03*	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*
			ED228_CASR_CPDLC_16	AC	Corruption	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Misdirection	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Spurious	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
				ATSP	Corruption	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Misdirection	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Spurious	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_WG78_CPDLC_03u	3	1,00E-05	ED228_CASR_CPDLC_20	ATSP	Corruption	*SR-GD-CPDLC-28*	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*
						SR-GD-CPDLC-29	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*
						SR-GD-CPDLC-30	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*
						SR-GD-CPDLC-31	*The ground system shall provide an indication to the controller, when the ATSU system rejects a DLIC Logon or is notified of a DLIC contact failure.*
						SR-GD-CPDLC-32	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier.*
			ED228_CASR_CPDLC_23	ATSP	Corruption	*SR-GD-CPDLC-34*	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*
						SR-GD-CPDLC-35	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*
			ED228_CASR_CPDLC_24	AC	Corruption	*SR-AC-CPDLC-21*	*The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.*
				ATSP	Corruption	*SR-GD-CPDLC-36*	*The ATSU shall respond to messages in their entirety.*
				FC	Corruption	*SR-FC-CPDLC-05*	*The flight crew shall respond to a message in its entirety when not responded by the aircraft system.*
			ED228_CASR_CPDLC_26	AC	EMM_02 - Corruption	*SR-AC-CPDLC-23*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*
				ATSP	EMM_03 - Corruption	*SR-GD-CPDLC-38*	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*
			ED228_CASR_CPDLC_27	AC	Corruption	*SR-AC-CPDLC-24*	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*
					Misdirection	*SR-AC-CPDLC-24*	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*
			ED228_CASR_CPDLC_28	AC	Corruption	*SR-AC-CPDLC-25*	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*
				FC	EMM_01 - Corruption	*SR-FC-CPDLC-06*	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*

Table 19: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_03u

4.1.2.1.14OH_ED228_CPDLC_05d

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05d	4	1,00E-03	ED228_CASR_CPDLC_06	AC	Misdirection	*SR-AC-CPDLC-07*	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
				ATSP	Misdirection	*SR-GD-CPDLC-08*	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
			ED228_CASR_CPDLC_07	AC	EMM_10 - Spurious	*SR-AC-CPDLC-08*	*The aircraft system shall indicate in each response to which messages it refers.*
				ATSP	EMM_11 - Spurious	*SR-GD-CPDLC-09*	*The ATSU shall indicate in each response to which messages it refers.*
			ED228_CASR_CPDLC_08	AC	Corruption	*SR-AC-CPDLC-09*	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*
				ATSP	Corruption	*SR-GD-CPDLC-10*	*The ATSU shall send the route information with the route clearance uplink message.*
			ED228_CASR_CPDLC_09	AC	EMM_05 - Delay	*SR-AC-CPDLC-10*	*The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.*
				ATSP	EMM_06 - Delay	*SR-GD-CPDLC-11*	*The ATSU shall time stamp to within one second UTC each message when it is released for onward transmission.*
			ED228_CASR_CPDLC_11	AC	Corruption	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Delay	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Misdirection	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05d	4	1,00E-03	ED228_CASR_CPDLC_11	ATSP	Corruption	*SR-GD-CPDLC-13*	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*
						SR-GD-CPDLC-12	*The ATSU shall process the message without affecting the intent of the message.*
					Misdirection	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
					Delay	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
						SR-GD-CPDLC-14	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*
						SR-GD-CPDLC-15	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
					Loss	*SR-GD-CPDLC-15*	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
				FC	Corruption	*SR-FC-CPDLC-01*	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*
					Delay	*SR-FC-CPDLC-02*	*The flight crew shall respond or act in timely manner without unnecessary delay.*
					Corruption	*SR-FC-CPDLC-03*	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*
			ED228_CASR_CPDLC_12	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-12*	*The aircraft system shall reject messages not addressed to itself.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-16*	*The ATSU shall reject messages not addressed to itself.*
			ED228_CASR_CPDLC_13	AC	Misdirection	*SR-AC-CPDLC-13*	*The aircraft system shall transmit messages to the designated ATSU.*
				ATSP	Misdirection	*SR-GD-CPDLC-17*	*The ATSU shall transmit messages to the designated aircraft system.*
						SR-GD-CPDLC-18	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft.*
			ED228_CASR_CPDLC_14	ATSP	EMM_04 - Delay	*SR-GD-CPDLC-19*	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*
			ED228_CASR_CPDLC_15	AC	EMM_06 - Delay	*SR-AC-CPDLC-14*	*When the aircraft system receives a message whose time stamp is older than the current time minus ET_{TRN}, the aircraft system shall reject the message and send an indication to the ATSU.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05d	4	1,00E-03	ED228_CASR_CPDLC_15	ATSP	EMM_05 - Delay	*SR-GD-CPDLC-20*	*When the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall display the emergency message to the controller.*
					EMM_09 - Corruption	*SR-GD-CPDLC-21*	*The controller shall take appropriate action when indicated the system aircraft rejected a message whose time stamp exceeds the ET_{TRN}.*
					EMM_09 - Misdirection	*SR-GD-CPDLC-21*	*The controller shall take appropriate action when indicated the system aircraft rejected a message whose time stamp exceeds the ET_{TRN}.*
					EMM_09 - Delay	*SR-GD-CPDLC-21*	*The controller shall take appropriate action when indicated the system aircraft rejected a message whose time stamp exceeds the ET_{TRN}.*
			ED228_CASR_CPDLC_16	AC	Corruption	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Misdirection	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Spurious	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
				ATSP	Corruption	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Misdirection	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Spurious	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
			ED228_CASR_CPDLC_18	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-18*	*The aircraft system shall be able to determine the message initiator.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-25*	*The ATSU shall be able to determine the message initiator.*
			ED228_CASR_CPDLC_19	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-19*	*The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-26*	*The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.*
						SR-GD-CPDLC-27	*The ATSU shall send operational messages to an aircraft when provision of the service has been established with the aircraft.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05d	4	1,00E-03	ED228_CASR_CPDLC_20	ATSP	Corruption	*SR-GD-CPDLC-28*	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*
						SR-GD-CPDLC-29	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*
						SR-GD-CPDLC-30	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*
						SR-GD-CPDLC-31	*The ground system shall provide an indication to the controller, when the ATSU system rejects a DLIC Logon or is notified of a DLIC contact failure.*
						SR-GD-CPDLC-32	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier.*
			ED228_CASR_CPDLC_21	AC	Corruption	*SR-AC-CPDLC-20*	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*
				ATSP	Corruption	*SR-GD-CPDLC-33*	*The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*
			ED228_CASR_CPDLC_22	FC	EMM_01 - Corruption	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Misdirection	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Delay	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
			ED228_CASR_CPDLC_25	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-22*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-37*	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*
			ED228_CASR_CPDLC_28	AC	Corruption	*SR-AC-CPDLC-25*	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*
				FC	EMM_01 - Corruption	*SR-FC-CPDLC-06*	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05d	4	1,00E-03	ED228_CASR_CPDLC_29	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-26*	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*
					EMM_01 - Delay	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Misdirection	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Corruption	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_10 - Unavailable	*SR-AC-CPDLC-28*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-39*	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*
					EMM_11 - Unavailable	*SR-GD-CPDLC-40*	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*
			WG78_CASR_CPDLC_30	AC	EMM_02 - Corruption	*SR-AC-CPDLC-29*	*The aircraft system shall be capable to send an indication to the ground system whenever a message is rejected by the aircraft system.*
						SR-AC-CPDLC-30	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*
					EMM_07 - Misdirection	*SR-AC-CPDLC-29*	*The aircraft system shall be capable to send an indication to the ground system whenever a message is rejected by the aircraft system.*
						SR-AC-CPDLC-30	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*
					EMM_10 - Spurious	*SR-AC-CPDLC-29*	*The aircraft system shall be capable to send an indication to the ground system whenever a message is rejected by the aircraft system.*
						SR-AC-CPDLC-30	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05d	4	1,00E-03	WG78_CASR_CPDLC_30	ATSP	EMM_02 - Corruption	*SR-GD-CPDLC-41*	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*
						SR-GD-CPDLC-42	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*
					EMM_07 - Misdirection	*SR-GD-CPDLC-41*	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*
						SR-GD-CPDLC-42	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*
					EMM_10 - Spurious	*SR-GD-CPDLC-41*	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*
						SR-GD-CPDLC-42	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*

Table 20: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_05d

4.1.2.1.15OH_ED228_CPDLC_05u

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-5} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05u	3	1,00E-05	ED228_CASR_CPDLC_06	AC	Misdirection	*SR-AC-CPDLC-07*	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
				ATSP	Misdirection	*SR-GD-CPDLC-08*	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
			ED228_CASR_CPDLC_07	AC	EMM_10 - Spurious	*SR-AC-CPDLC-08*	*The aircraft system shall indicate in each response to which messages it refers.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
				ATSP	EMM_11 - Spurious	*SR-GD-CPDLC-09*	*The ATSU shall indicate in each response to which messages it refers.*
OH_ED228_CPDLC_05u	3	1,00E-05	ED228_CASR_CPDLC_08	AC	Corruption	*SR-AC-CPDLC-09*	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*
				ATSP	Corruption	*SR-GD-CPDLC-10*	*The ATSU shall send the route information with the route clearance uplink message.*
			ED228_CASR_CPDLC_09	AC	EMM_05 - Delay	*SR-AC-CPDLC-10*	*The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.*
				ATSP	EMM_06 - Delay	*SR-GD-CPDLC-11*	*The ATSU shall time stamp to within one second UTC each message when it is released for onward transmission.*
			ED228_CASR_CPDLC_11	AC	Corruption	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Delay	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
					Misdirection	*SR-AC-CPDLC-11*	*The aircraft system shall process the message without affecting the intent of the message.*
			ED228_CASR_CPDLC_11	ATSP	Corruption	*SR-GD-CPDLC-13*	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*
						SR-GD-CPDLC-12	*The ATSU shall process the message without affecting the intent of the message.*
					Misdirection	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
					Delay	*SR-GD-CPDLC-12*	*The ATSU shall process the message without affecting the intent of the message.*
						SR-GD-CPDLC-14	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*
						SR-GD-CPDLC-15	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
					Loss	*SR-GD-CPDLC-15*	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*
				FC	Corruption	*SR-FC-CPDLC-01*	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*
					Delay	*SR-FC-CPDLC-02*	*The flight crew shall respond or act in timely manner without unnecessary delay.*
					Corruption	*SR-FC-CPDLC-03*	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*
			ED228_CASR_CPDLC_14	ATSP	EMM_04 - Delay	*SR-GD-CPDLC-19*	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05u	3	1,00E-05	ED228_CASR_CPDLC_15	AC	EMM_06 - Delay	*SR-AC-CPDLC-14*	*When the aircraft system receives a message whose time stamp is older than the current time minus ET_{TRN}, the aircraft system shall reject the message and send an indication to the ATSU.*
				ATSU	EMM_05 - Delay	*SR-GD-CPDLC-20*	*When the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall display the emergency message to the controller.*
					EMM_09 - Corruption	*SR-GD-CPDLC-21*	*The controller shall take appropriate action when indicated the system aircraft rejected a message whose time stamp exceeds the ET_{TRN}.*
					EMM_09 - Misdirection	*SR-GD-CPDLC-21*	*The controller shall take appropriate action when indicated the system aircraft rejected a message whose time stamp exceeds the ET_{TRN}.*
					EMM_09 - Delay	*SR-GD-CPDLC-21*	*The controller shall take appropriate action when indicated the system aircraft rejected a message whose time stamp exceeds the ET_{TRN}.*
			ED228_CASR_CPDLC_16	AC	Corruption	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Misdirection	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
					Spurious	*SR-AC-CPDLC-15*	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*
			ED228_CASR_CPDLC_16	ATSP	Corruption	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Misdirection	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
					Spurious	*SR-GD-CPDLC-22*	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*
			ED228_CASR_CPDLC_18	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-18*	*The aircraft system shall be able to determine the message initiator.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-25*	*The ATSU shall be able to determine the message initiator.*
			ED228_CASR_CPDLC_20	ATSP	Corruption	*SR-GD-CPDLC-28*	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*
						SR-GD-CPDLC-29	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*
						SR-GD-CPDLC-30	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*
						SR-GD-CPDLC-31	*The ground system shall provide an indication to the controller, when the ATSU system rejects a DLIC Logon or is notified of a DLIC contact failure.*
						SR-GD-CPDLC-32	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
							aircraft ID and different unique flight plan identifier.
OH_ED228_CPDLC_05u	3	1,00E-05	ED228_CASR_CPDLC_21	AC	Corruption	*SR-AC-CPDLC-20*	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*
				ATSP	Corruption	*SR-GD-CPDLC-33*	*The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*
			ED228_CASR_CPDLC_22	FC	EMM_01 - Corruption	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Misdirection	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Delay	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
			ED228_CASR_CPDLC_25	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-22*	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-37*	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*
			ED228_CASR_CPDLC_28	AC	Corruption	*SR-AC-CPDLC-25*	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*
				FC	EMM_01 - Corruption	*SR-FC-CPDLC-06*	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*
			ED228_CASR_CPDLC_29	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-26*	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*
					EMM_01 - Delay	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Misdirection	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Corruption	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_10 - Unavailable	*SR-AC-CPDLC-28*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_05u	3	1,00E-05	ED228_CASR_CPDLC_29	ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-39*	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*
					EMM_11 - Unavailable	*SR-GD-CPDLC-40*	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 21: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_05u

4.1.2.1.16OH_ED228_CPDLC_07

The safety objective to be met for this Operational Hazard is extracted from ED228 CPDLC Operational Safety Assessment: the probability of occurrence of this hazard shall be no greater than 1 10^{-3} per flight hour.

The following table presents the relevant AC and ATSP requirements identified in ED228 Safety Analysis for this Operational Hazard.

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
OH_ED228_CPDLC_07	4	1,00E-03	ED228_CASR_CPDLC_01	AC	Unavailable	*SR-AC-CPDLC-01*	*The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.*
						SR-AC-CPDLC-02	*The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.*
						SR-AC-CPDLC-03	*The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.*
				ATSP	Unavailable	*SR-GD-CPDLC-01*	*The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.*
						SR-GD-CPDLC-02	*The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.*
						SR-GD-CPDLC-03	*The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.*
			ED228_CASR_CPDLC_02	AC	Unavailable	*SR-AC-CPDLC-04*	*The aircraft system shall indicate to the flight crew a detected loss of CPDLC.*
						SR-AC-CPDLC-05	*After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.*
				ATSP	Unavailable	*SR-GD-CPDLC-04*	*The ATSU shall indicate to the controller a detected loss of CPDLC.*

OH			Cause			SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	SR Ref	Title
			ED228_CASR_CPDLC_04	ATSP	Unavailable	*SR-GD-CPDLC-06*	*ATSU shall be notified of planned outage of CPDLC service sufficiently ahead of time.*
OH_ED228_CPDLC_07	4	1,00E-03	ED228_CASR_CPDLC_05	AC	Loss	*SR-AC-CPDLC-06*	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*
					Delay	*SR-AC-CPDLC-06*	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*
				ATSP	Loss	*SR-GD-CPDLC-07*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
					Delay	*SR-GD-CPDLC-07*	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*
			ED228_CASR_CPDLC_06	AC	Misdirection	*SR-AC-CPDLC-07*	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
				ATSP	Misdirection	*SR-GD-CPDLC-08*	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*
			ED228_CASR_CPDLC_14	ATSP	EMM_04 - Delay	*SR-GD-CPDLC-19*	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*
			ED228_CASR_CPDLC_22	FC	EMM_01 - Corruption	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Misdirection	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
					EMM_01 - Delay	*SR-FC-CPDLC-04*	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*
			ED228_CASR_CPDLC_29	AC	EMM_07 - Misdirection	*SR-AC-CPDLC-26*	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*
					EMM_01 - Delay	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Misdirection	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_01 - Corruption	*SR-AC-CPDLC-27*	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*
					EMM_10 - Spurious	*SR-AC-CPDLC-28*	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*
				ATSP	EMM_08 - Misdirection	*SR-GD-CPDLC-39*	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*
					EMM_11 - Spurious	*SR-GD-CPDLC-40*	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*

Table 22: Relevant AC and ATSP safety requirements allocated from OH_ED228_CPDLC_07

4.1.2.2 Definition AC and ATSP Safety Requirement from Operational Hazards

This sub-task consists in performing the allocation of the Safety Objectives associated to Operational Hazards on the different contributors.

This allocation includes two steps:

- For each Operational Hazard, a fault tree is constructed identifying all potential contributors for this Operational Hazard (including AC and ATSP failures). Safety Requirements are defined by allocating the Safety Objective on the different contributors. ED228 document is used as references to determine the values that can reasonably be allocated on the different contributors.
- For each Operational Hazard, relevant Safety Requirements are identified amongst all the safety requirements Iris Precursor System is split between Aircraft System and Ground System. So, the relevant Safety Requirements are the requirements allocated to Aircraft system or Ground system and that concerns the exchange of message between ground and aircraft.

The tables of this paragraph have been built as follow:

- OH columns:
    - o OH Ref: identify the OH issued from the ED228 document;
    - o Severity: identify the severity associated of the studied OH (issued from ED228 document);
    - o SO: identify the safety objective associated of the studied OH;
- Cause columns:
    - o Cause Ref: identify the safety requirement identified in the associated fault tree;
    - o Part: identify the ATM system component associated to the cause ref;
    - o Failure: identify the type of failure associated to the cause ref (unavailable, corruption, misdirection, generation of spurious, …);
- SR columns: The list of new relevant Safety Requirements is referenced as follow: “SR-WWWW-XX-YY-ZZ: xxxx”:
    - o WWWW: identify the origin of the safety requirement: “E228” for ED228 OH and “NEW” for the new OH;
    - o XX: identify the part on which the safety requirement is allocated: “AC” for Aircraft System, and “GD” for Ground System;
    - o YY: identify the application associated to the fault tree : “ADSC” or “CPDLC” or “ALL”;
    - o ZZ: is a reference number of the safety requirement;
    - oxxxx: title of the New Safety Requirement.

The following chapters present the relevant safety requirements defined from each OH identified in § 4.1.1.3.

4.1.2.2.1 OH_ED228_ADSC_01d

This operational hazard consists of a detected loss of ADS-C capability [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3} /H.
In order for this hazard to occur:

a) All the ADS-C aircraft system are unavailable,
b) All the ADS-C ground systems are unavailable.

The allocations are based on an equipartition between all contributors.

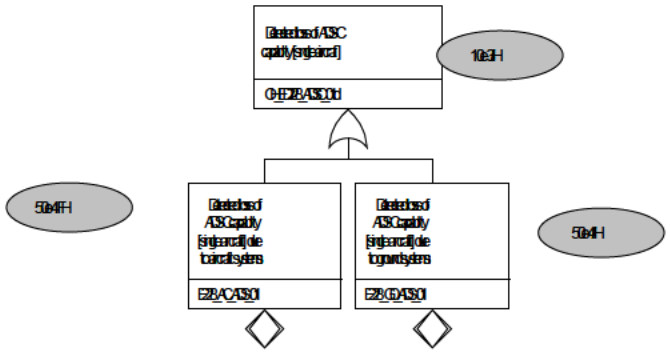

Figure 9 : OH_ED228_ADSC_01d – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_01d	4	1.00E-03	E228_AC_ADS_01	AC	Unavailable	5.00E-04	SR-E228-AC-ADS-01	The likelihood of the detected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.
			E228_GD_ADS_01	ATSP	Unavailable	5.00E-04	SR-E228-GD-ADS-01	The likelihood of the detected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.

Table 23: AC and ATSP safety requirements allocated from OH_ED228_ADSC_01d

4.1.2.2.2 OH_ED228_ADSC_01u

This operational hazard consists of an undetected loss of ADS-C capability [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-5} /H.

In order for this hazard to occur:

a) All the ADS-C aircraft system are unavailable,

b) All the ADS-C ground systems are unavailable.

The allocations are based on an equipartition between all contributors.

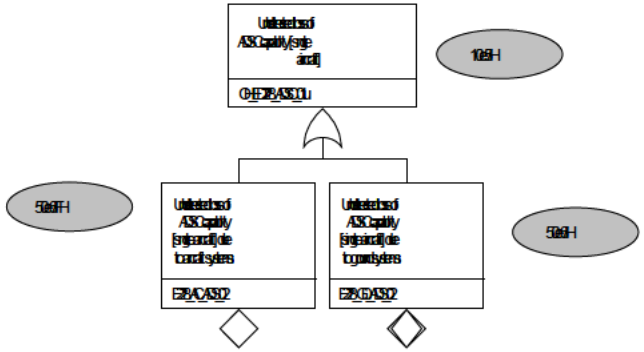

Figure 10 : OH_ED228_ADSC_01u – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_01u	3	1.00E-05	E228_AC_ADS_02	AC	Unavailable	5.00E-06	SR-E228-AC-ADS-02	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-06/FH.
			E228_GD_ADS_02	ATSP	Unavailable	5.00E-06	SR-E228-GD-ADS-02	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-06/H.

Table 24: AC and ATSP safety requirements allocated from OH_ED228_ADSC_01u

4.1.2.2.3 OH_ED228_ADSC_02d

This operational hazard consists of a detected loss of ADS-C capability [multiple aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3}/H.

In order for this hazard to occur:

a) More than one ADS-C aircraft system is unavailable,

b) All the ADS-C ground systems are unavailable.

The allocations are based on the OH_ED228_ADSC_01d allocations.

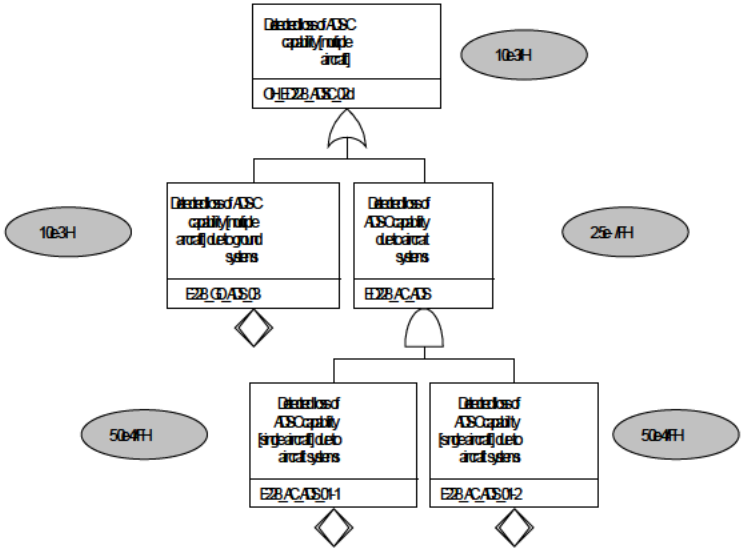

Figure 11 : OH_ED228_ADSC_02d – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_02d	4	1.00E-03	E228_GD_ADS_03	ATSP	Unavailable	1.00E-03	SR-E228-GD-ADS-03	The likelihood of the detected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.

Table 25: AC and ATSP safety requirements allocated from OH_ED228_ADSC_02d

4.1.2.2.4 OH_ED228_ADSC_02u

This operational hazard consists of an undetected loss of ADS-C capability [multiple aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-5} /H.

In order for this hazard to occur:

a) More than one ADS-C aircraft system is unavailable,

b) All the ADS-C ground systems are unavailable.

The allocations are based on the OH_ED228_ADSC_01u allocations.

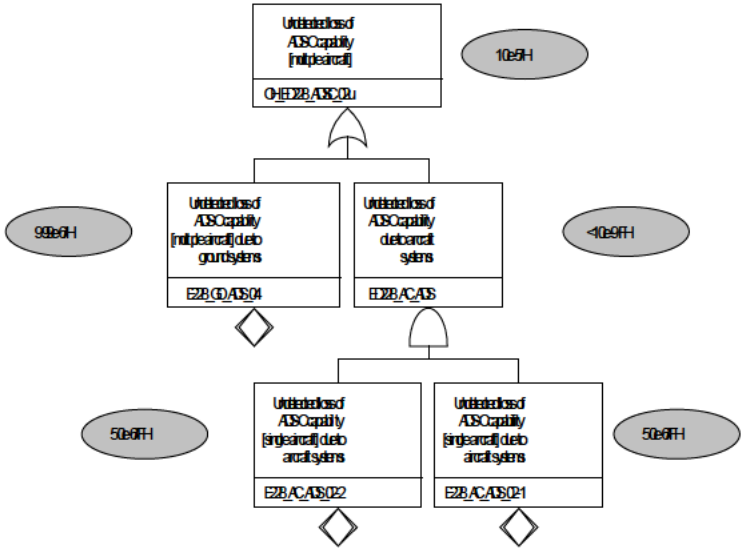

Figure 12 : OH_ED228_ADSC_02u – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH	Cause				SR

OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_02u	3	1.00E-05	E228_GD_ADS_04	ATSP	Unavailable	9.99E-06	SR-E228-GD-ADS-04	The likelihood of the undetected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 9.99E-06/H.

Table 26: AC and ATSP safety requirements allocated from OH_ED228_ADSC_02u

4.1.2.2.5 OH_ED228_ADSC_03d

This operational hazard consists of a detected reception of a corrupted ADS-C message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3}/H.

In order for this hazard to occur:

a) Messages are corrupted by aircraft or ground systems,

b) Data provided are corrupted.

The allocations are based on an equipartition between aircraft and ground components.

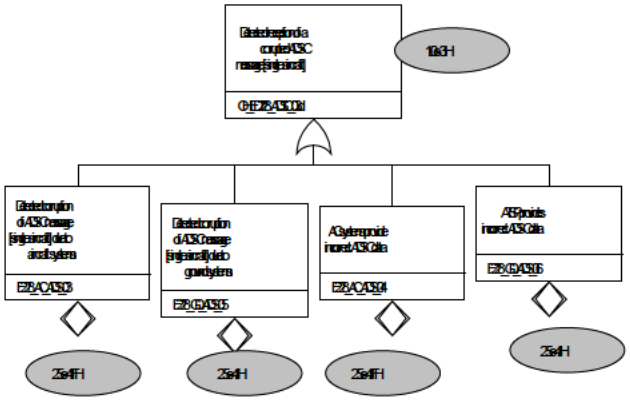

Figure 13 : OH_ED228_ADSC_03d – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH	Cause				SR

OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_03d	4	1.00E-03	E228_GD_ADS_05	ATSP	Corruption	2.50E-04	SR-E228-GD-ADS-05	The likelihood of the detected corruption of ADS-C message [single aircraft] due to ground systems shall be less than 2.5E-04/H.
			E228_AC_ADS_03	AC	Corruption	2.50E-04	SR-E228-AC-ADS-03	The likelihood of the detected corruption of ADS-C message [single aircraft] due to aircraft systems shall be less than 2.5E-04/FH.
			E228_GD_ADS_06	ATSP	Corruption	2.50E-04	SR-E228-GD-ADS-06	The likelihood that the ATSP provides incorrect ADS-C data [single aircraft] shall be less than 2.5E-04/H.
			E228_AC_ADS_04	AC	Corruption	2.50E-04	SR-E228-AC-ADS-04	The likelihood that the AC systems provide incorrect ADS-C data [single aircraft] shall be less than 2.5E-04/FH.

Table 27: AC and ATSP safety requirements allocated from OH_ED228_ADSC_03d

4.1.2.2.6 OH_ED228_ADSC_03u

This operational hazard consists of an undetected reception of a corrupted ADS-C message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-5} /H.

In order for this hazard to occur:

a) Messages are corrupted by aircraft or ground systems,

b) Data provided are corrupted.

The allocations are based on an equipartition between aircraft and ground components.

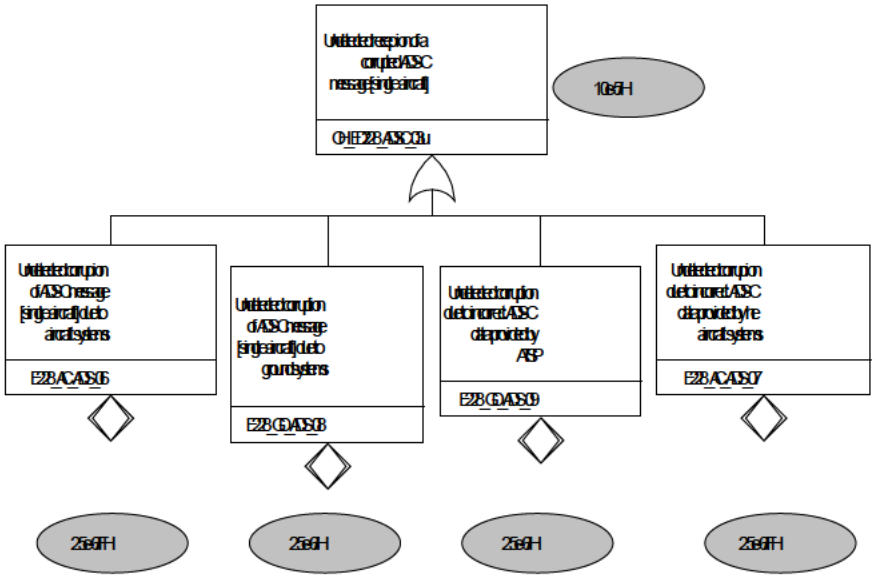

Figure 14 : OH_ED228_ADSC_03u – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_03u	3	1.00E-05	E228_GD_ADS_08	ATSP	Corruption	2.50E-06	SR-E228-GD-ADS-08	The l kelihood of the undetected corruption of ADS-C message [single aircraft] due to ground systems shall be less than 2.5E-06/H.
			E228_AC_ADS_06	AC	Corruption	2.50E-06	SR-E228-AC-ADS-06	The l kelihood of the undetected corruption of ADS-C message [single aircraft] due to aircraft systems shall be less than 2.5E-06/FH.
			E228_GD_ADS_09	ATSP	Corruption	2.50E-06	SR-E228-GD-ADS-09	The likelihood of the undetected corruption due to incorrect ADS-C data [single aircraft] provided by ATSP shall be less than 2.5E-06/H.
			E228_AC_ADS_07	AC	Corruption	2.50E-06	SR-E228-AC-ADS-07	The likelihood of the undetected corruption due to incorrect ADS-C data [single aircraft] provided by the aircraft systems shall be less than 2.5E-06/FH.

Table 28: AC and ATSP safety requirements allocated from OH_ED228_ADSC_03u

4.1.2.2.7 OH_ED228_ADSC_05

This operational hazard consists of a reception of an unintended ADS-C message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3} /H.

In order for this hazard to occur:

a) Messages are delayed by aircraft or ground systems,

b) Messages are misdirected by aircraft or ground systems,

c) Aircraft or ground systems generate spurious messages.

The allocations are based on an equipartition between aircraft and ground components. The chosen repartition is 28% for delay, 58% for misdirection and 14% for generation of a spurious message.

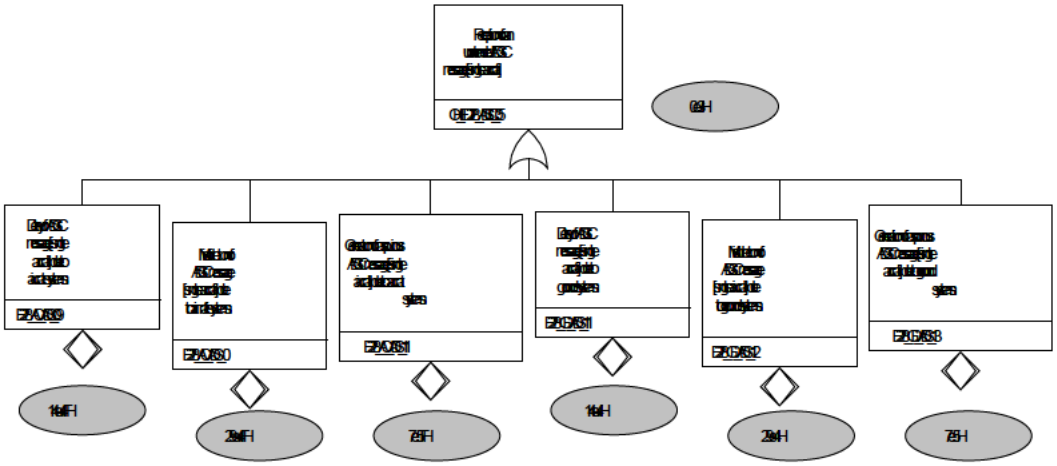

Figure 15 : OH_ED228_ADSC_05 – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_05	4	1.00E-03	E228_AC_ADS_09	AC	Delay	1.40E-04	SR-E228-AC-ADS-09	The likelihood of the detected delay of ADS-C message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.
			E228_AC_ADS_10	AC	Misdirection	2.90E-04	SR-E228-AC-ADS-10	The l kelihood of the detected misdirection of ADS-C message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.
			E2288_AC_ADS_11	AC	Spurious	7.00E-05	SR-E228-AC-ADS-11	The l kelihood of the detected generation of a spurious ADS-C message [single aircraft] due to aircraft systems shall be less than 7E-05/FH.
			E2288_GD_ADS_11	ATSP	Delay	1.40E-04	SR-E228-GD-ADS-11	The likelihood of the detected delay of ADS-C message [single aircraft] due to ground systems shall be less than 1.4E-04/H.
			E2288_GD_ADS_12	ATSP	Misdirection	2.90E-04	SR-E228-GD-ADS-12	The l kelihood of the detected misdirection of ADS-C message [single aircraft] due to ground systems shall be less than 2.9E-04/H.
			E2288_GD_ADS_13	ATSP	Spurious	7.00E-05	SR-E228-GD-ADS-13	The l kelihood of the detected generation of a spurious ADS-C message [single aircraft] due to ground systems shall be less than 7E-05/H.

Table 29: AC and ATSP safety requirements allocated from OH_ED228_ADSC_05

4.1.2.2.8 OH_ED228_ADSC_07

This operational hazard consists of an unexpected interruption of an ADS-C transaction [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3}/H.

In order for this hazard to occur:

a) Messages are delayed by aircraft or ground systems,

b) Messages are misdirected by aircraft or ground systems,

c) Messages are lost by aircraft or ground systems.

d)The allocations are based on an equipartition between aircraft and ground components. The chosen repartition is 28% for delay, 58% for misdirection and 14% for loss.

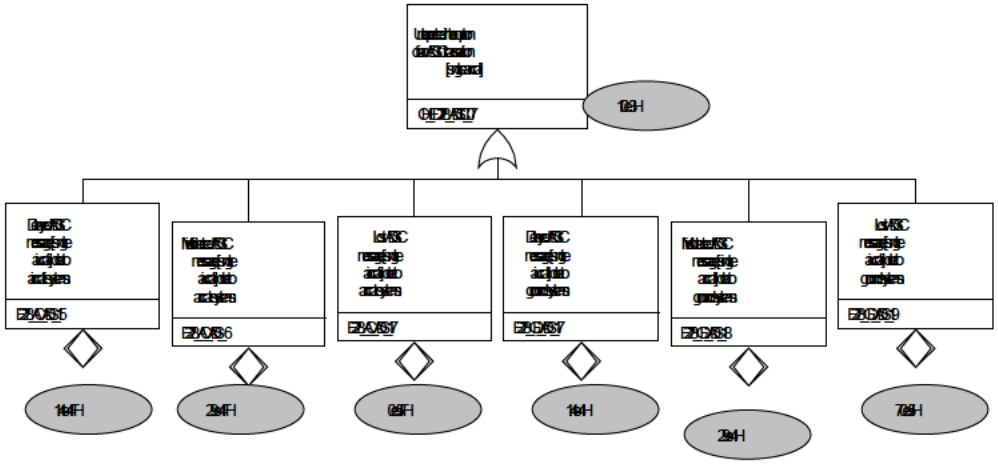

Figure 16 : OH_ED228_ADSC_07 – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_ADSC_07	4	1.00E-03	E228_AC_ADS_15	AC	Delay	1.40E-04	SR-E228-AC-ADS-15	The likelihood of the delayed ADS-C message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.
			E228_AC_ADS_16	AC	Misdirection	2.90E-04	SR-E228-AC-ADS-16	The l kelihood of the misdirected ADS-C message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.
			E228_AC_ADS_17	AC	Loss	7.00E-05	SR-E228-AC-ADS-17	The likelihood of the lost ADS-C message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.
			E228_GD_ADS_17	ATSP	Delay	1.40E-04	SR-E228-GD-ADS-17	The likelihood of the delayed ADS-C message [single aircraft] due to ground systems shall be less than 1.4E-04/H.
			E228_GD_ADS_18	ATSP	Misdirection	2.90E-04	SR-E228-GD-ADS-18	The likelihood of the misdirected ADS-C message [single aircraft] due to ground systems shall be less than 2.9E-04/H.
			E228_GD_ADS_19	ATSP	Loss	7.00E-05	SR-E228-GD-ADS-19	The likelihood of the lost ADS-C message [single aircraft] due to ground systems shall be less than 7.0E-05/H.

Table 30: AC and ATSP safety requirements allocated from OH_ED228_ADSC_07

4.1.2.2.9 OH_ED228_CPDLC_01

This operational hazard consists of a loss of CPDLC capability [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3} /H.

In order for this hazard to occur:

a) All the CPDLC aircraft system are unavailable,

b) All the CPDLC ground systems are unavailable.

The allocations are based on an equipartition between all contributors.

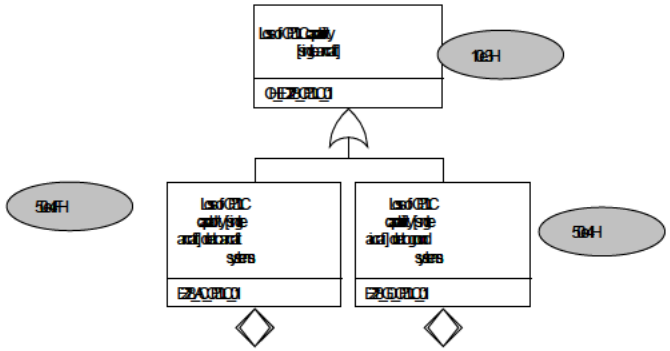

Figure 17 : OH_ED228_CPDLC_01 – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_01	4	1.00E-03	E228_AC_CPDLC_01	AC	Unavailable	5.00E-04	SR-E228-AC-CPDLC-01	The l kelihood of the loss of CPDLC capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.
			E228_GD_CPDLC_01	ATSP	Unavailable	5.00E-04	SR-E228-GD-CPDLC-01	The likelihood of the loss of CPDLC capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.

Table 31: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_01

4.1.2.2.10OH_ED228_CPDLC_02d

This operational hazard consists of a detected loss of CPDLC capability [multiple aircraft]. The Safety Objective to be met shall be no greater than $1.0\ 10^{-3}$/H.

In order for this hazard to occur:

a) More than one CPDLC aircraft system is unavailable,

b) All the CPDLC ground systems are unavailable.

The allocations are based on the OH_ED228_CPDLC_01 allocations.

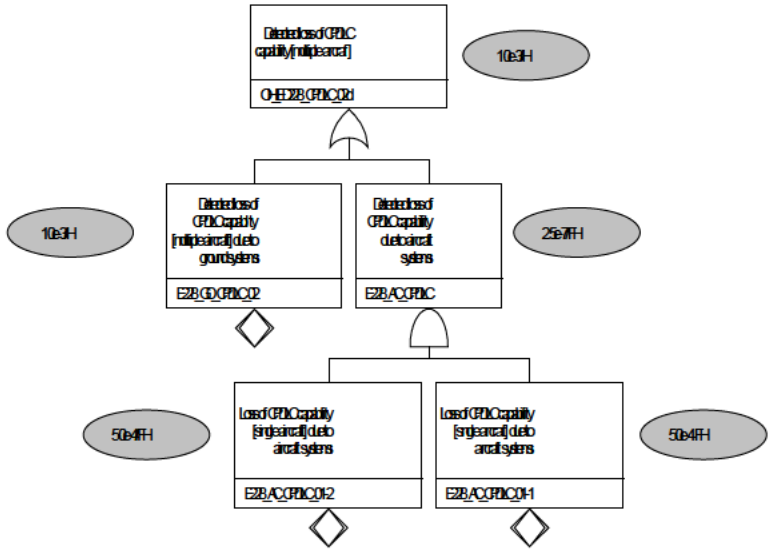

Figure 18 : OH_ED228_CPDLC_02d – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_02d	4	1.00E-03	E228_GD_CPDLC_02	ATSP	Unavailable	1.00E-03	SR-E228-GD-CPDLC-02	The likelihood of the detected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.

Table 32: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_02d

4.1.2.2.11OH_ED228_CPDLC_02u

This operational hazard consists of an undetected loss of CPDLC capability [multiple aircraft]. The Safety Objective to be met shall be no greater than $1.0\ 10^{-5}$ /H.

In order for this hazard to occur:

a) More than one CPDLC aircraft system is unavailable,

b) All the ADS-C ground systems are unavailable.

The allocations are based on the OH_ED228_CPDLC_01 allocations.

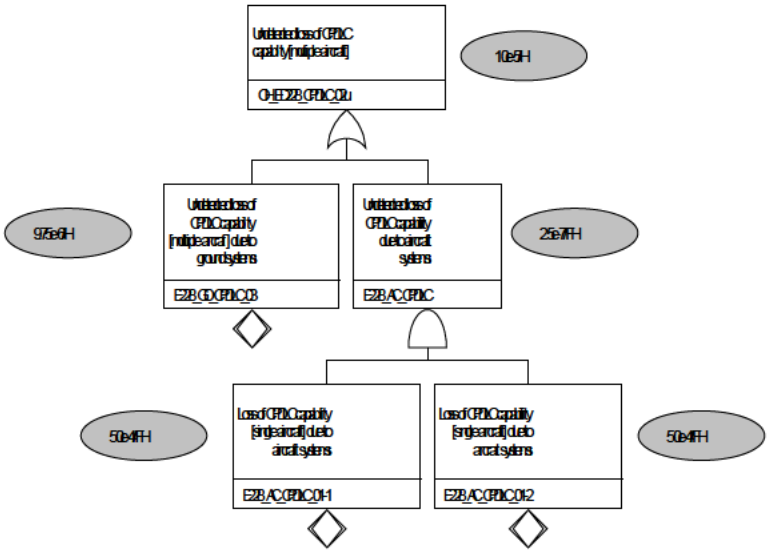

Figure 19 : OH_ED228_CPDLC_02u – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_02u	3	1.00E-05	E228_GD_CPDLC_03	ATSP	Unavailable	9.75E-06	SR-E228-GD-CPDLC-03	The l kelihood of the undetected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 9.75E-06/H.

Table 33: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_02u

4.1.2.2.12OH_ED228_CPDLC_03d

This operational hazard consists of a detected reception of a corrupted ADS-C message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3}/H.

In order for this hazard to occur:

a) Messages are corrupted by aircraft or ground systems,

b) Data provided are corrupted.

The allocations are based on an equipartition between aircraft and ground components.

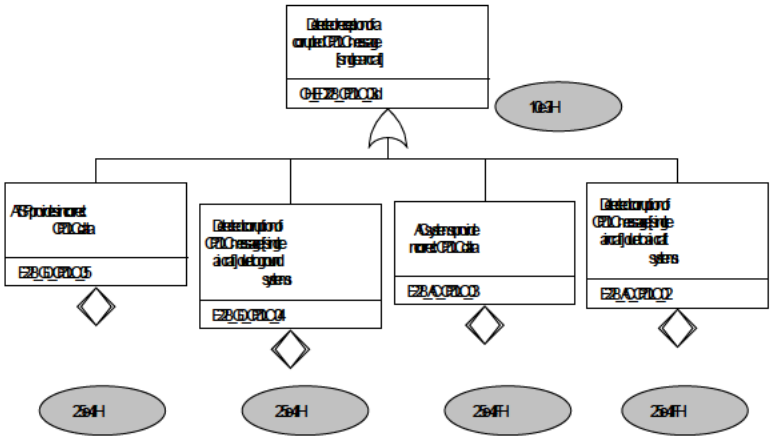

Figure 20 : OH_ED228_CPDLC_03d – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_03d	4	1.00E-03	E228_GD_CPDLC_04	ATSP	Corruption	2.50E-04	SR-E228-GD-CPDLC-05	The likelihood of the detected corruption of CPDLC message [single aircraft] due to ground systems shall be less than 2.5E-04/H.
			E228_AC_CPDLC_02	AC	Corruption	2.50E-04	SR-E228-AC-CPDLC-03	The likelihood of the detected corruption of CPDLC message [single aircraft] due to aircraft systems shall be less than 2.5E-04/FH.
			E228_GD_CPDLC_05	ATSP	Corruption	2.50E-04	SR-E228-GD-CPDLC-06	The l kelihood that the ATSP provides incorrect CPDLC data [single aircraft] shall be less than 2.5E-04/H.
			E228_AC_CPDLC_03	AC	Corruption	2.50E-04	SR-E228-AC-CPDLC-04	The l kelihood that the AC systems provide incorrect CPDLC data [single aircraft] shall be less than 2.5E-04/FH.

Table 34: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_03d

4.1.2.2.13OH_ED228_CPDLC_03u

This operational hazard consists of an undetected reception of a corrupted CPDLC message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-5} /H.

In order for this hazard to occur:

a) Messages are corrupted by aircraft or ground systems,

b) Data provided are corrupted.

The allocations are based on an equipartition between aircraft and ground components.

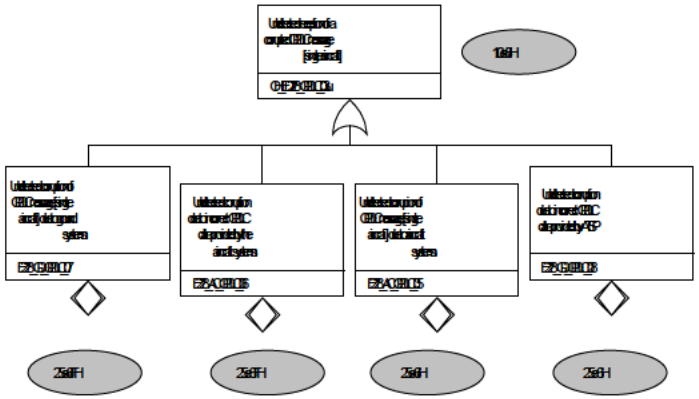

Figure 21 : OH_ED228_CPDLC_03u – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_03u	3	1.00E-05	E228_GD_CPDLC_07	ATSP	Corruption	2.50E-06	SR-E228-GD-CPDLC-07	The likelihood of the undetected corruption of CPDLC message [single aircraft] due to ground systems shall be less than 2.5E-06/H.
			E228_AC_CPDLC_05	AC	Corruption	2.50E-06	SR-E228-AC-CPDLC-05	The likelihood of the undetected corruption of CPDLC message [single aircraft] due to aircraft systems shall be less than 2.5E-06/FH.

			E228_GD_CPDLC_08	ATSP	Corruption	2.50E-06	SR-E228-GD-CPDLC-08	The likelihood of the undetected corruption due to incorrect CPDLC data [single aircraft] provided by ATSP shall be less than 2.5E-06/H.
			E228_AC_CPDLC_06	AC	Corruption	2.50E-06	SR-E228-AC-CPDLC-06	The likelihood of the undetected corruption due to incorrect CPDLC data [single aircraft] provided by the aircraft systems shall be less than 2.5E-06/FH.

Table 35: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_03u

4.1.2.2.14OH_ED228_CPDLC_05d

This operational hazard consists of a detected reception of an unintended CPDLC message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3} /H.

In order for this hazard to occur:

a) Messages are delayed by aircraft or ground systems,

b) Messages are misdirected by aircraft or ground systems,

c) Aircraft or ground systems generate spurious messages.

The allocations are based on an equipartition between aircraft and ground components. The chosen repartition is 28% for delay, 58% for misdirection and 14% for generation of a spurious message.

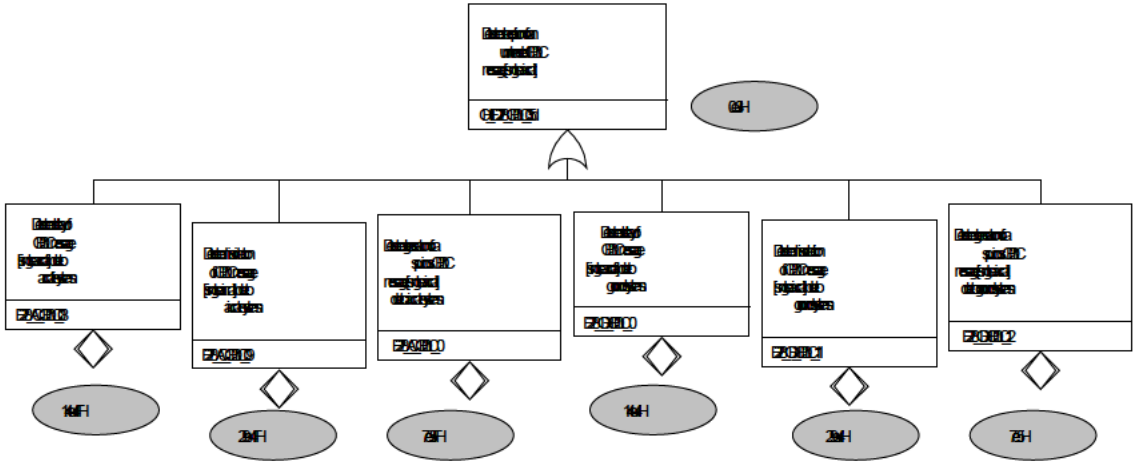

Figure 22 : OH_ED228_CPDLC_05d – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_05d	4	1.00E-03	E228_AC_CPDLC_08	AC	Delay	1.40E-04	SR-E228-AC-CPDLC-08	The likelihood of the detected delay of CPDLC message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.
			E228_AC_CPDLC_09	AC	Misdirection	2.90E-04	SR-E228-AC-CPDLC-09	The l kelihood of the detected misdirection of CPDLC message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.
			E228_AC_CPDLC_10	AC	Spurious	7.00E-05	SR-E228-AC-CPDLC-10	The l kelihood of the detected generation of a spurious CPDLC message [single aircraft] due to aircraft systems shall be less than 7E-05/FH.
			E228_GD_CPDLC_10	ATSP	Delay	1.40E-04	SR-E228-GD-CPDLC-10	The likelihood of the detected delay of CPDLC message [single aircraft] due to ground systems shall be less than 1.4E-04/H.
			E228_GD_CPDLC_11	ATSP	Misdirection	2.90E-04	SR-E228-GD-CPDLC-11	The l kelihood of the detected misdirection of CPDLC message [single aircraft] due to ground systems shall be less than 2.9E-04/H.
			E228_GD_CPDLC_12	ATSP	Spurious	7.00E-05	SR-E228-GD-CPDLC-12	The l kelihood of the detected generation of a spurious CPDLC message [single aircraft] due to ground systems shall be less than 7E-05/H.

Table 36: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_05d

4.1.2.2.15OH_ED228_CPDLC_05u

This operational hazard consists of an undetected reception of an unintended CPDLC message [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-5} /H.

In order for this hazard to occur:

a) Messages are delayed by aircraft or ground systems,

b) Messages are misdirected by aircraft or ground systems,

c) Aircraft or ground systems generate spurious messages.

The allocations are based on an equipartition between aircraft and ground components. The chosen repartition is 28% for delay, 58% for misdirection and 14% for generation of a spurious message.

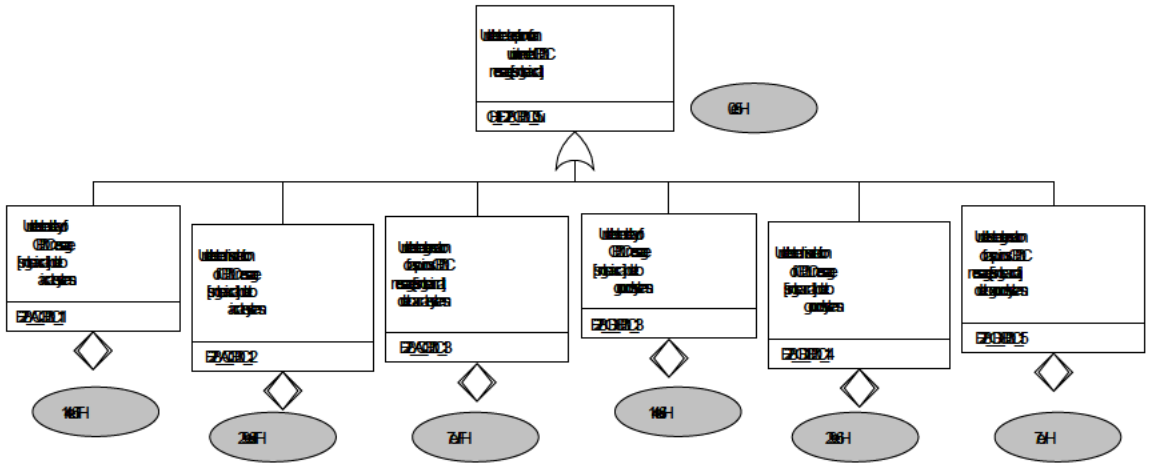

Figure 23 : OH_ED228_CPDLC_05u – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_ED228_CPDLC_05u	3	1.00E-05	E228_AC_CPDLC_11	AC	Delay	1.40E-06	SR-E228-AC-CPDLC-11	The likelihood of the undetected delay of CPDLC message [single aircraft] due to aircraft systems shall be less than 1.4E-06/FH.
			E228_AC_CPDLC_12	AC	Misdirection	2.90E-06	SR-E228-AC-CPDLC-12	The likelihood of the undetected misdirection of CPDLC message [single aircraft] due to aircraft systems shall be less than 2.9E-06/FH.
			E228_AC_CPDLC_13	AC	Spurious	7.00E-07	SR-E228-AC-CPDLC-13	The likelihood of the undetected generation of a spurious CPDLC message [single aircraft] due to aircraft systems shall be less than 7E-07/FH.
			E228_GD_CPDLC_13	ATSP	Delay	1.40E-06	SR-E228-GD-CPDLC-13	The likelihood of the undetected delay of CPDLC message [single aircraft] due to ground systems shall be less than 1.4E-06/H.
			E228_GD_CPDLC_14	ATSP	Misdirection	2.90E-06	SR-E228-GD-CPDLC-14	The likelihood of the undetected misdirection of CPDLC message [single aircraft] due to ground systems shall be less than 2.9E-06/H.
			E228_GD_CPDLC_15	ATSP	Spurious	7.00E-07	SR-E228-GD-CPDLC-15	The likelihood of the undetected generation of a spurious CPDLC message [single aircraft] due to ground systems shall be less than 7E-07/H.

Table 37: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_05u

4.1.2.2.16OH_ED228_CPDLC_07

This operational hazard consists of an unexpected interruption of a CPDLC transaction [single aircraft]. The Safety Objective to be met shall be no greater than 1.0 10^{-3}/H.

In order for this hazard to occur:

a) Messages are delayed by aircraft or ground systems,

b) Messages are misdirected by aircraft or ground systems,

c) Messages are lost by aircraft or ground systems.

The allocations are based on an equipartition between aircraft and ground components. The chosen repartition is 28% for delay, 58% for misdirection and 14% for loss.

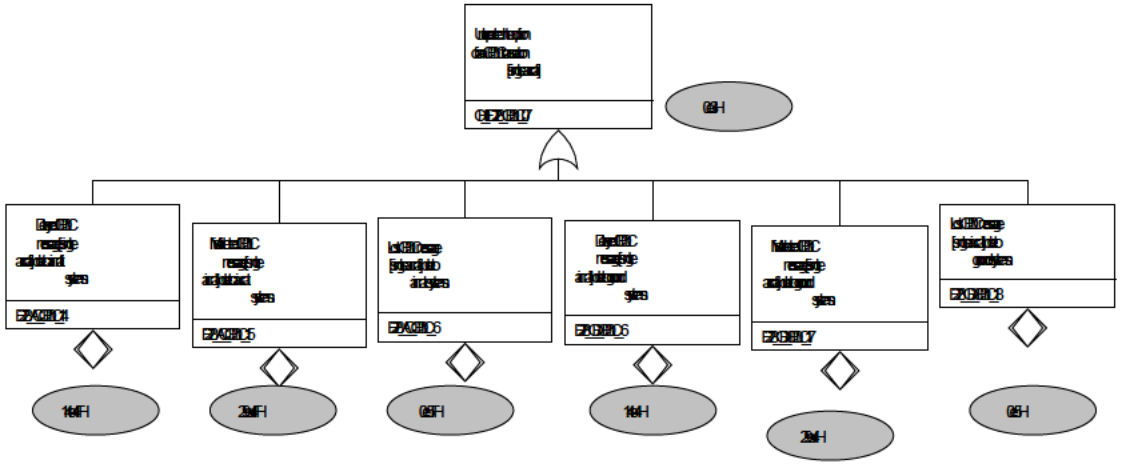

Figure 24 : OH_WG78_CPDLC_07 – Fault tree

The following table presents the causes identified on AC and ATSP for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value)	SR Ref	Title
OH_ED228_CPDLC_07	4	1.00E-03	E228_AC_CPDLC_14	AC	Delay	1.40E-04	SR-E228-AC-CPDLC-14	The likelihood of the delayed CPDLC message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.
			E228_AC_CPDLC_15	AC	Misdirection	2.90E-04	SR-E228-AC-CPDLC-15	The likelihood of the misdirected CPDLC message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.
			E228_AC_CPDLC_16	AC	Loss	7.00E-05	SR-E228-AC-CPDLC-16	The l kelihood of the lost CPDLC message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.
			E228_GD_CPDLC_16	ATSP	Delay	1.40E-04	SR-E228-GD-CPDLC-16	The l kelihood of the delayed CPDLC message [single aircraft] due to ground systems shall be less than 1.4E-04/H.
			E228_GD_CPDLC_17	ATSP	Misdirection	2.90E-04	SR-E228-GD-CPDLC-17	The likelihood of the misdirected CPDLC message [single aircraft] due to ground systems shall be less than 2.9E-04/H.
			E228_GD_CPDLC_18	ATSP	Loss	7.00E-05	SR-E228-GD-CPDLC-18	The l kelihood of the lost CPDLC message [single aircraft] due to ground systems shall be less than 7.0E-05/H.

Table 38: AC and ATSP safety requirements allocated from OH_ED228_CPDLC_07

4.1.2.2.17OH_NEW_ALL_01

This new operational hazard consists of an impossibility to exchange any data link message with a single aircraft (detected). The Safety Objective to be met shall be no greater than 1.0 10^{-5} /FH.

In order for this hazard to occur:

c) All the aircraft system are unavailable,

d) Common failure modes between the aircraft systems.

The following assumption is made for the unavailability of the aircraft systems

- **ASSUMP_IPr_09**: The probability that all the aircraft systems (except common mode failures) are unavailable is assumed to be less than 1.0 10^{-6} per flight hour.

  Justification: The probability that all the aircraft systems (except common mode failures) are unavailable is less than the product between the probability of the loss of CPDLC capability [single aircraft] and the probability of the loss of ADS-C capability [single aircraft].

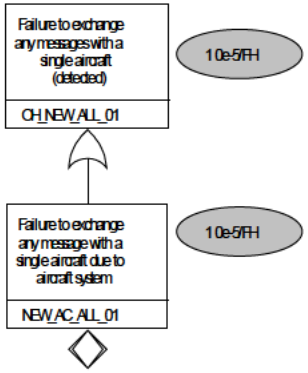

Figure 25 : OH_NEW_ALL_01 – Fault tree

The following table presents the causes identified on AC for this OH, the values allocated on these causes and the associated Safety Requirements

OH			Cause				SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	Value (/FH)	SR Ref	Title
OH_NEW_ALL_01	3	1.00E-05	NEW_AC_ALL_01	AC	Unavailable	1.00E-05	SR-NEW-AC-ALL-01	The likelihood that all aircraft systems are unavailable shall be less than 1.0E-05/FH.

Table 39: AC and ATSP safety requirements allocated from OH_NEW_ALL_01

4.1.2.2.18OH_NEW_ALL_02d

This new operational hazard consists of an impossibility to exchange any data link message with more than one aircraft. The Safety Objective to be met shall be no greater than 1.0 10^{-5}/H.

In order for this hazard to occur:

a) All the ground system are unavailable;

b) Common failure modes between the ground systems;

c) More than one aircraft system is unavailable.

The allocations are based on the OH_NEW_ALL_01 allocations.

The following assumption is made for the unavailability of the ground systems

- **ASSUMP_IPr_08**: The probability that all the ground systems (except common mode failures) are unavailable is assumed to be less than 1.0 10^{-6} per hour.

-Justification: The probability that all the ground systems (except common mode failures) are unavailable is less than the product between the probability of the loss of CPDLC capability [single aircraft] and the probability of the loss of ADS-C capability [single aircraft].

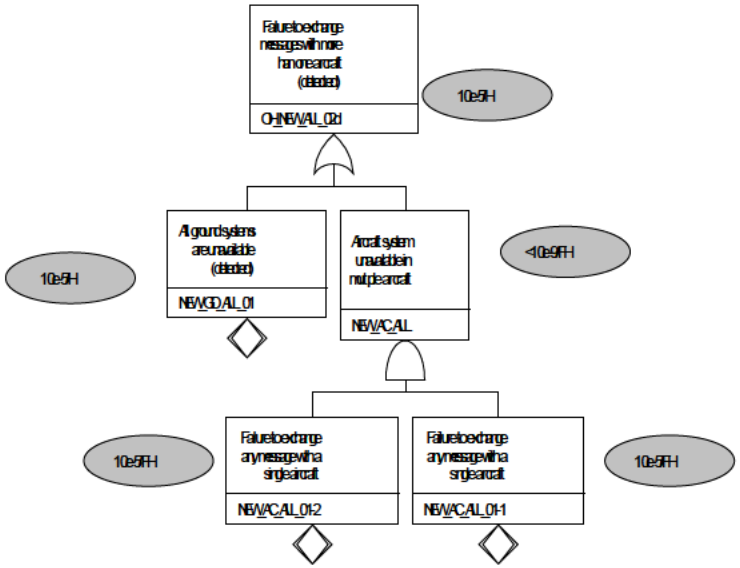

Figure 26 : OH_NEW_ALL_02d – Fault tree

The following table presents the causes identified on ATSP for this OH, the values allocated on these causes and the associated Safety Requirements.

OH			Cause				SR	
OH Ref	Severity	SO (/H)	Cause Ref	Part	Failure	Value	SR Ref	Title
OH_NEW_ALL_02d	3	1.00E-05	NEW_GD_ALL_01	ATSP	Unavailable	1.00E-05	SR-NEW-GD-ALL-01	The likelihood that all ground systems are unavailable (detected) shall be less than 1.0E-05/H.

Table 40: AC and ATSP safety requirements allocated from OH_NEW_ALL_02d

4.1.2.2.19OH_NEW_ALL_02u

This new operational hazard consists of an impossibility to exchange any data link message with more than one aircraft. The Safety Objective to be met shall be no greater than 1.0 10^{-5} /H.

In order for this hazard to occur:

a) All the ground system are unavailable;

b) Common failure modes between the ground systems;

The following assumption is made for the unavailability of the ground systems

- **ASSUMP_IPr_08**: The probability that all the ground systems (except common mode failures) are unavailable is assumed to be less than 1.0 10^{-6} per hour.

-Justification: The probability that all the ground systems (except common mode failures) are unavailable is less than the product between the probability of the loss of CPDLC capability [single aircraft] and the probability of the loss of ADS-C capability [single aircraft].

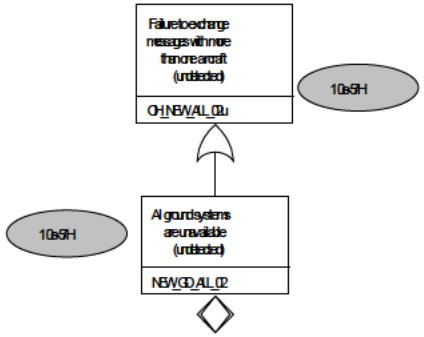

Figure 27 : OH_NEW_ALL_02u – Fault tree

The following table presents the causes identified on ATSP for this OH, the values allocated on these causes and the associated Safety Requirements.

OH			Cause				SR	
OH Ref	Severity	SO (/FH)	Cause Ref	Part	Failure	Value (/FH)	SR Ref	Title

OH_NEW_ALL_02u	3	1.00E-05	NEW_GD_ALL_02	ATSP	Unavailable	1.00E-05	SR-NEW-GD-ALL-02	The likelihood that all ground systems are unavailable (undetected) shall be less than 1.0E-05/FH.

Table 41: AC and ATSP safety requirements allocated from OH_NEW_ALL_02u

4.1.2.3 Selection of applicable AC and ATSP Safety Requirements

Several Safety Requirements have been defined in the previous chapters on ATSP and AC systems. Different Safety Requirements could have been defined for same abnormal events (loss of message, corruption of message...).

Consequently this task consists in listing all the Safety Requirements that have been determined for each failure mode. Then the most stringent Safety Requirements is selected has being the applicable requirement for this failure mode.

Some Safety Requirements have been grouped and to avoid a discontinuity in the listing, a new referencing for the applicable Safety Requirements have been created.

The list of applicable Safety Requirements will be referenced as follow: “SR_XX_YY: xxxx”:

- XX: identify the part on which the safety requirement is allocated: “AC” for Aircraft System, “GD” for Ground System (including the controller) and “FC” for Flight Crew;
- YY: is a reference number of the applicable safety requirement;
- xxxx: title of the applicable safety requirement.

The safety requirements concern all domains (APT, TMA, ENR-1 and ENR-2).

Following table presents for each abnormal event, all the Safety Requirements that have been identified or defined in the previous chapters (in red: quantitative requirement).

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
AE_01	Loss of message	SR-GD-03	ATSP	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-14	AC	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-23	ATSP	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4 4 4 4
		SR-AC-39	AC	The l kelihood of a lost message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-GD-62	ATSP	The likelihood of a lost message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-GD-01	ATSP	*A service shall be established in sufficient time to be available for operational use.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u	4 4 4 4 3
		SR-AC-01	AC	*After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-05	ATSP	*ATSU shall be notified of planned outage of a service sufficiently ahead of time.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_CPDLC_02u OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_07	4 4 3 4 4 4 3 4

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
		SR-AC-05	AC	*The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
AE_01	Loss of message	SR-AC-13	AC	*The aircraft system shall indicate to the flight crew a detected loss of any service.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4 4 4 4
		SR-AC-19	AC	*The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-AC-21	AC	*The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-10	ATSP	*The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-11	ATSP	*The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-19	ATSP	*The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07	4 4 4
		SR-GD-21	ATSP	*The ATSU shall indicate to the controller a detected loss of any service.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4 4 4 4
		SR-GD-31	ATSP	*The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-32	ATSP	*The ATSU shall provide an indication to the controller when an ADS-C contract is established.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07	4 4 4

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
		SR-AC-51	AC	The l kelihood of the detected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	OH_ED228_ADSC_01d	4
		SR-GD-56	ATSP	The l kelihood of the detected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	OH_ED228_ADSC_01d	4
		SR-GD-57	ATSP	The likelihood of the detected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	OH_ED228_ADSC_02d	4
AE_01	Loss of message	SR-GD-58	ATSP	The likelihood of the detected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	OH_ED228_CPDLC_02d	4
		SR-AC-38	AC	The likelihood of the loss of CPDLC capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	OH_ED228_CPDLC_01	4
		SR-GD-61	ATSP	The likelihood of the loss of CPDLC capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	OH_ED228_CPDLC_01	4
		SR-AC-45	AC	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-06/FH.	OH_ED228_ADSC_01u	3
		SR-GD-69	ATSP	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-06/H.	OH_ED228_ADSC_01u	3
		SR-GD-70	ATSP	The l kelihood of the undetected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 9.99E-06/H.	OH_ED228_ADSC_02u	3
		SR-GD-71	ATSP	The l kelihood of the undetected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 9.75E-06/H.	OH_ED228_CPDLC_02u	3
		SR-AC-23	AC	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-AC-32	AC	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established.*	OH_ED228_ADSC_07	4
		SR-GD-02	ATSP	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u	4 4 3
		SR-GD-15	ATSP	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*	OH_ED228_ADSC_07	4
		SR-GD-17	ATSP	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*	OH_ED228_ADSC_07	4
		SR-GD-34	ATSP	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-GD-37	ATSP	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u	4 4 3
AE_02	Corruption of message	SR-GD-02	ATSP	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
		SR-AC-02	AC	*The aircraft system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3 4 3
AE_02	Corruption of message	SR-GD-04	ATSP	*The ATSU system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3 4 3
		SR-GD-06	ATSP	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-04	AC	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
		SR-GD-09	ATSP	*The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
		SR-AC-07	AC	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-AC-08	AC	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
		SR-AC-15	AC	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-16	AC	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-23	AC	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
		SR-AC-26	AC	*The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3
		SR-AC-30	AC	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
AE_02	Corruption of message	SR-AC-31	AC	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-14	ATSP	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-16	ATSP	*The ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-22	ATSP	*The ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-25	ATSP	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-28	ATSP	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3 4 3
		SR-GD-37	ATSP	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*	OH_ ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3
		SR-GD-38	ATSP	*The ATSU shall respond to messages in their entirety.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
		SR-GD-40	ATSP	*The ATSU shall send the route information with the route clearance uplink message.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d	4 3 4

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
					OH_ED228_CPDLC_05u	3
		SR-GD-43	ATSP	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-45	ATSP	*The controller shall check the correctness and the appropriateness of every ADS-C report received.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
AE_02	Corruption of message	SR-GD-46	ATSP	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-FC-01	FC	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-FC-02	FC	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-FC-06	FC	*The flight crew shall respond to a message in its entirety when not responded by the aircraft system.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
		SR-GD-50	ATSP	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-51	ATSP	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 4 3 4 3
		SR-AC-34	AC	The I kelihood of the detected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-04/FH.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
		SR-GD-53	ATSP	The likelihood of the detected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-04/H.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
		SR-AC-41	AC	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by the aircraft systems shall be less than 2.5E-06/FH.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
		SR-GD-64	ATSP	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by ATSP shall be less than 2.5E-06/H.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
		SR-AC-42	AC	The likelihood of the undetected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-06/FH.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
AE_02	Corruption of message	SR-GD-66	ATSP	The likelihood of the undetected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-06/H.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
		SR-AC-48	AC	The likelihood that the AC systems provide incorrect data [single aircraft] shall be less than 2.5E-04/FH.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
		SR-GD-74	ATSP	The likelihood that the ATSP provides incorrect data [single aircraft] shall be less than 2.5E-04/H.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
		SR-GD-76	ATSP	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-81	ATSP	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-20	AC	*The aircraft system shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-AC-32	AC	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-15	ATSP	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-17	ATSP	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
		SR-GD-26	ATSP	*The ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
		SR-GD-34	ATSP	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3
		SR-GD-77	ATSP	*When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
AE_03	Misdirection of message	SR-AC-02	AC	*The aircraft system shall process the message without affecting the intent of the message.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-04	ATSP	*The ATSU system shall process the message without affecting the intent of the message.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-08	AC	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
		SR-AC-15	AC	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-23	AC	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
		SR-AC-28	AC	*The aircraft system shall transmit messages to the designated ATSU.*	OH_ED228_CPDLC_05d	4
		SR-AC-29	AC	*The aircraft system shall transmit reports to the end system designated in the ADS-C contract.*	OH_ED228_ADSC_05	4
		SR-GD-25	ATSP	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-34	ATSP	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
		SR-GD-42	ATSP	*The ATSU shall transmit messages to the designated aircraft system.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-AC-37	AC	The likelihood of the detected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-GD-59	ATSP	The likelihood of the detected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
AE_03	Misdirection of message	SR-AC-40	AC	The likelihood of a misdirected message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-GD-63	ATSP	The l kelihood of a misdirected message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-AC-46	AC	The l kelihood of the undetected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-06/FH.	OH_ED228_CPDLC_05u	3
		SR-GD-72	ATSP	The l kelihood of the undetected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-06/H.	OH_ED228_CPDLC_05u	3
		SR-AC-52	AC	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05	4
		SR-GD-33	ATSP	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05	4
		SR-GD-39	ATSP	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft.*	OH_ED228_CPDLC_05d	4
AE_04	Delay of message	SR-GD-03	ATSP	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-02	AC	*The aircraft system shall process the message without affecting the intent of the message.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-04	ATSP	*The ATSU system shall process the message without affecting the intent of the message.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
		SR-AC-14	AC	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
		SR-GD-23	ATSP	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
AE_04	Delay of message	SR-GD-47	ATSP	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-FC-05	FC	*The flight crew shall respond or act in timely manner without unnecessary delay.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-AC-33	AC	The likelihood of a delayed message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-GD-52	ATSP	The likelihood of a delayed message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
		SR-AC-35	AC	The l kelihood of the detected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-GD-54	ATSP	The likelihood of the detected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-AC-43	AC	The likelihood of the undetected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-06/FH.	OH_ED228_CPDLC_05u	3
		SR-GD-67	ATSP	The l kelihood of the undetected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-06/H.	OH_ED228_CPDLC_05u	3
		SR-GD-76	ATSP	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).*	OH_ED228_ADSC_05	4
AE_05	Spurious message	SR-AC-02	AC	*The aircraft system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_05	4
		SR-GD-04	ATSP	*The ATSU system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_05	4
		SR-AC-04	AC	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_ADSC_05	4

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
		SR-GD-09	ATSP	*The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*	OH_ED228_ADSC_05	4
		SR-AC-06	AC	*The aircraft system shall be able to determine the message initiator.*	OH_ED228_ADSC_05	4
		SR-AC-11	AC	*The aircraft system shall include in each ADS report the time at position to within ± one second of the UTC time the aircraft was actually at the position provided in the report.*	OH_ED228_ADSC_05	4
AE_05	Spurious message	SR-AC-15	AC	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-12	ATSP	*The ATSU shall be able to determine the message initiator.*	OH_ED228_ADSC_05	4
		SR-GD-25	ATSP	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
		SR-GD-26	ATSP	*The ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.*	OH_ED228_ADSC_05	4
		SR-GD-28	ATSP	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*	OH_ED228_ADSC_05	4
		SR-GD-45	ATSP	*The controller shall check the correctness and the appropriateness of every ADS-C report received.*	OH_ED228_ADSC_05	4
		SR-GD-51	ATSP	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*	OH_ED228_ADSC_05	4
		SR-AC-36	AC	The likelihood of the detected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-GD-55	ATSP	The l kelihood of the detected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-AC-44	AC	The likelihood of the undetected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-07/FH.	OH_ED228_CPDLC_05u	3
		SR-GD-68	ATSP	The likelihood of the undetected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-07/H.	OH_ED228_CPDLC_05u	3

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
		SR-GD-77	ATSP	*When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.*	OH_ED228_ADSC_05	4
		SR-AC-32	AC	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established.*	OH_ED228_ADSC_05	4
		SR-GD-15	ATSP	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*	OH_ED228_ADSC_05	4
		SR-GD-17	ATSP	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*	OH_ED228_ADSC_05	4
AE_06	Availability of aircraft	SR-AC-47	AC	The likelihood that all aircraft systems are unavailable shall be less than 1.0E-05/FH.	OH_NEW_ALL_01	3
AE_07	Availability of provision	SR-GD-73	ATSP	The likelihood that all ground systems are unavailable (detected) shall be less than 1.0E-05/H.	OH_NEW_ALL_02d	3
		SR-GD-60	ATSP	The likelihood that all ground systems are unavailable (undetected) shall be less than 1.0E-05/H.	OH_NEW_ALL_02u	3

Table 42: List of Safety Requirements defined from ED228 and NEW Operational Hazards for Abnormal Events

Following table presents for each external mitigation means, all the Safety Requirements that have been identified or defined in the previous chapters (in red: quantitative requirement).

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
EMM_01	Detection of inappropriate messages by the crew	SR-AC-22	AC	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 3 4 3 4
		SR-FC-03	FC	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 4 3 4

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
		SR-FC-04	FC	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
EMM_02	Detection of corrupted messages by the aircraft systems	SR-AC-07	AC	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
EMM_02	Detection of corrupted messages by the aircraft systems	SR-AC-09	AC	*The aircraft system shall be capable to send an indication to the ground system whenever a message is discarded by the aircraft system.*	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d OH_ED228_CPDLC_5d	4 4 4
		SR-AC-10	AC	*The aircraft system shall discard any corrupted message.*	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
		SR-AC-17	AC	*The aircraft system shall prohibit operational processing by flight crew of corrupted messages.*	OH_ED228_CPDLC_03d	4
		SR-AC-50	AC	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
		SR-GD-80	ATSP	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
		SR-AC-30	AC	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*	OH_ED228_ADSC_05	4
		SR-GD-35	ATSP	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
EMM_03	Detection of corrupted messages by the ground systems	SR-GD-14	ATSP	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
		SR-GD-18	ATSP	*The ATSU shall discard any corrupted message.*	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
		SR-GD-29	ATSP	*The ATSU shall prohibit operational processing by the controller of a corrupted report.*	OH_ED228_CPDLC_03d	4
		SR-GD-13	ATSP	*When the ATSU receives a report that has been corrupted, the ATSU shall request similar information with a demand report.*	OH_ED228_ADSC_03d	4
		SR-GD-43	ATSP	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*	OH_ED228_ADSC_05	4

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
EMM_04	Detection of unexpected time of response	SR-GD-24	ATSP	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 3 4 4 4 4 3 4 3 4
EMM_05	Detection of delayed downlink messages	SR-AC-27	AC	*The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
		SR-GD-49	ATSP	*When the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall display the emergency message to the controller.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
		SR-GD-78	ATSP	*When the ATSU receives a message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall reject the message.*	OH_ED228_ADSC_05	4
		SR-GD-79	ATSP	*When the ATSU receives a periodic or event report whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall request similar information from the message rejected with a demand report.*	OH_ED228_ADSC_05	4
EMM_06	Detection of delayed uplink messages	SR-GD-41	ATSP	*The ATSU shall time stamp to within one second UTC each message when it is released for onward transmission.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
		SR-GD-48	ATSP	*The controller shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN}.*	OH_ED228_ADSC_05	4
		SR-AC-49	AC	*When the aircraft system receives a message whose time stamp is older than the current time minus ET_{TRN}, the aircraft system shall discard the message and send an indication to the ATSU.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
EMM_07	Detection of misdirected uplink messages	SR-AC-06	AC	*The aircraft system shall be able to determine the message initiator.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
		SR-AC-09	AC	*The aircraft system shall be capable to send an indication to the ground system whenever a message is discarded by the aircraft system.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_5d	4 4
		SR-AC-18	AC	*The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.*	OH_ED228_CPDLC_05d	4

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
		SR-AC-24	AC	*The aircraft system shall reject messages not addressed to itself.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-AC-25	AC	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 3 4 3 4
		SR-AC-50	AC	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
		SR-GD-35	ATSP	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
EMM_07	Detection of misdirected uplink messages	SR-GD-80	ATSP	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
		SR-AC-52	AC	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
EMM_08	Detection of misdirected downlink messages	SR-GD-08	ATSP	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 3 4 3 4
		SR-GD-30	ATSP	*The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-GD-36	ATSP	*The ATSU shall reject messages not addressed to itself.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-GD-12	ATSP	*The ATSU shall be able to determine the message initiator.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
		SR-GD-27	ATSP	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
		SR-GD-33	ATSP	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3

AE		Selected SR				
Ref	**Failure Mode**	**Reference**	**Part**	**Title**	**Source**	**Severity**
EMM_09	Detection of inapropriate messages by the controller	SR-GD-48	ATSP	*The controller shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN}.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
EMM_10	Detection of spurious uplink messages	SR-AC-09	AC	*The aircraft system shall be capable to send an indication to the ground system whenever a message is discarded by the aircraft system.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_5d	4 4
		SR-AC-12	AC	*The aircraft system shall indicate in each response to which messages it refers.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
EMM_10	Detection of spurious uplink messages	SR-AC-03	AC	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 0H_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 3 4 4 4 4 3 4 3 4
		SR-AC-50	AC	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
		SR-GD-35	ATSP	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
		SR-GD-80	ATSP	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
EMM_11	Detection of spurious downlink messages	SR-GD-07	ATSP	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d	4 3 4 3 4 4 4 4

AE		Selected SR				
Ref	Failure Mode	Reference	Part	Title	Source	Severity
					OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	3 4 3 4
		SR-GD-20	ATSP	*The ATSU shall indicate in each response to which messages it refers.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
EMM_11	Detection of spurious downlink messages	SR-GD-44	ATSP	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 OH_ED228_ADSC_07	4 3 4 3 4 4

Table 43: List of Safety Requirements defined from ED228 and NEW Operational Hazards for External Mitigation Means

Based on these tables, the applicable Safety Requirements for this study are (this table also presents the Operational Hazard that drives the Safety Requirements and its severity):

Selected SR				
Reference	Part	Title	Source	Severity
SR-AC-01	AC	*After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-AC-02	AC	*The aircraft system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 4 3 4 3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-AC-03	AC	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 0H_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 3 4 4 4 4 3 4 3 4
SR-AC-04	AC	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-AC-05	AC	*The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-AC-06	AC	*The aircraft system shall be able to determine the message initiator.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-AC-07	AC	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3
SR-AC-08	AC	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
SR-AC-09	AC	*The aircraft system shall be capable to send an indication to the ground system whenever a message is discarded by the aircraft system.*	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d OH_ED228_CPDLC_5d	4 4 4
SR-AC-10	AC	*The aircraft system shall discard any corrupted message.*	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
SR-AC-11	AC	*The aircraft system shall include in each ADS report the time at position to within ± one second of the UTC time the aircraft was actually at the position provided in the report.*	OH_ED228_ADSC_05	4
SR-AC-12	AC	*The aircraft system shall indicate in each response to which messages it refers.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d	4 3 4

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
			OH_ED228_CPDLC_05u	3
SR-AC-13	AC	*The aircraft system shall indicate to the flight crew a detected loss of any service.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4 4 4 4
SR-AC-14	AC	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-AC-15	AC	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-AC-16	AC	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-AC-17	AC	*The aircraft system shall prohibit operational processing by flight crew of corrupted messages.*	OH_ED228_CPDLC_03d	4
SR-AC-18	AC	*The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.*	OH_ED228_CPDLC_05d	4
SR-AC-19	AC	*The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-AC-20	AC	*The aircraft system shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
SR-AC-21	AC	*The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-AC-22	AC	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 3 4 3 4

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-AC-23	AC	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 4 4 3 4 3 4
SR-AC-24	AC	*The aircraft system shall reject messages not addressed to itself.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-AC-25	AC	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 3 4 3 4
SR-AC-26	AC	*The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3
SR-AC-27	AC	*The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-AC-28	AC	*The aircraft system shall transmit messages to the designated ATSU.*	OH_ED228_CPDLC_05d	4
SR-AC-29	AC	*The aircraft system shall transmit reports to the end system designated in the ADS-C contract.*	OH_ED228_ADSC_05	4
SR-AC-30	AC	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05	4 3 4
SR-AC-31	AC	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-AC-32	AC	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_ADSC_07	4 3 4 4

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-AC-33	AC	The likelihood of a delayed message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
SR-AC-34	AC	The likelihood of the detected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-04/FH.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
SR-AC-35	AC	The likelihood of the detected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-AC-36	AC	The likelihood of the detected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-AC-51	AC	The likelihood of the detected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	OH_ED228_ADSC_01d	4
SR-AC-37	AC	The likelihood of the detected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-AC-38	AC	The likelihood of the loss of CPDLC capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	OH_ED228_CPDLC_01	4
SR-AC-39	AC	The likelihood of a lost message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
SR-AC-40	AC	The l kelihood of a misdirected message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
SR-AC-41	AC	The l kelihood of the undetected corruption due to incorrect data [single aircraft] provided by the aircraft systems shall be less than 2.5E-06/FH.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
SR-AC-42	AC	The likelihood of the undetected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-06/FH.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
SR-AC-43	AC	The l kelihood of the undetected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-06/FH.	OH_ED228_CPDLC_05u	3
SR-AC-44	AC	The likelihood of the undetected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-07/FH.	OH_ED228_CPDLC_05u	3
SR-AC-45	AC	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-06/FH.	OH_ED228_ADSC_01u	3
SR-AC-46	AC	The likelihood of the undetected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-06/FH.	OH_ED228_CPDLC_05u	3
SR-AC-47	AC	The l kelihood that all aircraft systems are unavailable shall be less than 1.0E-05/FH.	OH_NEW_ALL_01	3
SR-AC-48	AC	The likelihood that the AC systems provide incorrect data [single aircraft] shall be less than 2.5E-04/FH.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
SR-AC-49	AC	*When the aircraft system receives a message whose time stamp is older than the current time minus ET_{TRN}, the aircraft system shall discard the message and send an indication to the ATSU.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-AC-50	AC	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
SR-AC-52	AC	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-FC-01	FC	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-FC-02	FC	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-FC-03	FC	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 4 3 4
SR-FC-04	FC	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-FC-05	FC	*The flight crew shall respond or act in timely manner without unnecessary delay.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-FC-06	FC	*The flight crew shall respond to a message in its entirety when not responded by the aircraft system.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
SR-GD-01	ATSP	*A service shall be established in sufficient time to be available for operational use.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u	4 4 4 4 3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-02	ATSP	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 4 3 4 3
SR-GD-03	ATSP	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-04	ATSP	*The ATSU system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 4 3 4 3
SR-GD-05	ATSP	*ATSU shall be notified of planned outage of a service sufficiently ahead of time.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_CPDLC_02u OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_07	4 4 3 4 4 4 3 4
SR-GD-06	ATSP	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-07	ATSP	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 3 4 4 4 4 3 4 3 4
SR-GD-08	ATSP	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 4 3 4 3 4
SR-GD-09	ATSP	*The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-GD-10	ATSP	*The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-GD-11	ATSP	*The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-GD-12	ATSP	*The ATSU shall be able to determine the message initiator.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-GD-13	ATSP	*When the ATSU receives a report that has been corrupted, the ATSU shall request similar information with a demand report.*	OH_ED228_ADSC_03d	4
SR-GD-14	ATSP	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-15	ATSP	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_ADSC_07	4 3 4 4
SR-GD-16	ATSP	*The ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
SR-GD-17	ATSP	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_ADSC_07	4 3 4 4
SR-GD-18	ATSP	*The ATSU shall discard any corrupted message.*	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
SR-GD-19	ATSP	*The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07	4 4 4
SR-GD-20	ATSP	*The ATSU shall indicate in each response to which messages it refers.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-21	ATSP	*The ATSU shall indicate to the controller a detected loss of any service.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4 4 4 4
SR-GD-22	ATSP	*The ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u	4 3
SR-GD-23	ATSP	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4 4 4 4

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-24	ATSP	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 3 4 4 4 4 3 4 3 4
SR-GD-25	ATSP	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-26	ATSP	*The ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05	4 3 4
SR-GD-27	ATSP	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-GD-28	ATSP	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 4 3 4 3
SR-GD-29	ATSP	*The ATSU shall prohibit operational processing by the controller of a corrupted report.*	OH_ED228_CPDLC_03d	4
SR-GD-30	ATSP	*The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-GD-31	ATSP	*The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.*	OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_07	4 4 4
SR-GD-32	ATSP	*The ATSU shall provide an indication to the controller when an ADS-C contract is established.*	OH_ED228_ADSC_01d OH_ED228_ADSC_02d OH_ED228_ADSC_07	4 4 4

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-33	ATSP	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-GD-34	ATSP	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_ADSC_07 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u OH_ED228_CPDLC_07	4 3 4 4 4 3 4 3 4
SR-GD-35	ATSP	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
SR-GD-36	ATSP	*The ATSU shall reject messages not addressed to itself.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-GD-37	ATSP	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*	OH_ ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_CPDLC_01 OH_ED228_CPDLC_02d OH_ED228_CPDLC_02u OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3 4 4 3 4 3
SR-GD-38	ATSP	*The ATSU shall respond to messages in their entirety.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u	4 3
SR-GD-39	ATSP	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft.*	OH_ED228_CPDLC_05d	4
SR-GD-40	ATSP	*The ATSU shall send the route information with the route clearance uplink message.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-41	ATSP	*The ATSU shall time stamp to within one second UTC each message when it is released for onward transmission.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-GD-42	ATSP	*The ATSU shall transmit messages to the designated aircraft system.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-43	ATSP	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05	4 3 4
SR-GD-44	ATSP	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*	OH_ED228_ADSC_01d OH_ED228_ADSC_01u OH_ED228_ADSC_02d OH_ED228_ADSC_02u OH_ED228_ADSC_05 OH_ED228_ADSC_07	4 3 4 3 4 4
SR-GD-45	ATSP	*The controller shall check the correctness and the appropriateness of every ADS-C report received.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05	4 3 4
SR-GD-46	ATSP	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-47	ATSP	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-48	ATSP	*The controller shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN}.*	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 4 3
SR-GD-49	ATSP	*When the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall display the emergency message to the controller.*	OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3
SR-GD-50	ATSP	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3
SR-GD-51	ATSP	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05 OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 4 3 4 3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-52	ATSP	The likelihood of a delayed message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
SR-GD-53	ATSP	The likelihood of the detected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-04/H.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
SR-GD-54	ATSP	The likelihood of the detected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-GD-55	ATSP	The l kelihood of the detected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-GD-56	ATSP	The likelihood of the detected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	OH_ED228_ADSC_01d	4
SR-GD-57	ATSP	The l kelihood of the detected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	OH_ED228_ADSC_02d	4
SR-GD-58	ATSP	The l kelihood of the detected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	OH_ED228_CPDLC_02d	4
SR-GD-59	ATSP	The l kelihood of the detected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	OH_ED228_ADSC_05 OH_ED228_CPDLC_05d	4 4
SR-GD-60	ATSP	The likelihood that all ground systems are unavailable (undetected) shall be less than 1.0E-05/H.	OH_NEW_ALL_02u	3
SR-GD-61	ATSP	The likelihood of the loss of CPDLC capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	OH_ED228_CPDLC_01	4
SR-GD-62	ATSP	The likelihood of a lost message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
SR-GD-63	ATSP	The likelihood of a misdirected message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	OH_ED228_ADSC_07 OH_ED228_CPDLC_07	4 4
SR-GD-64	ATSP	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by ATSP shall be less than 2.5E-06/H.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
SR-GD-66	ATSP	The l kelihood of the undetected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-06/H.	OH_ED228_ADSC_03u OH_ED228_CPDLC_03u	3 3
SR-GD-67	ATSP	The likelihood of the undetected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-06/H.	OH_ED228_CPDLC_05u	3
SR-GD-68	ATSP	The likelihood of the undetected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-07/H.	OH_ED228_CPDLC_05u	3
SR-GD-69	ATSP	The l kelihood of the undetected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-06/H.	OH_ED228_ADSC_01u	3
SR-GD-70	ATSP	The likelihood of the undetected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 9.99E-06/H.	OH_ED228_ADSC_02u	3
SR-GD-71	ATSP	The likelihood of the undetected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 9.75E-06/H.	OH_ED228_CPDLC_02u	3
SR-GD-72	ATSP	The likelihood of the undetected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-06/H.	OH_ED228_CPDLC_05u	3

Selected SR				
Reference	**Part**	**Title**	**Source**	**Severity**
SR-GD-73	ATSP	The l kelihood that all ground systems are unavailable (detected) shall be less than 1.0E-05/H.	OH_NEW_ALL_02d	3
SR-GD-74	ATSP	The l kelihood that the ATSP provides incorrect data [single aircraft] shall be less than 2.5E-04/H.	OH_ED228_ADSC_03d OH_ED228_CPDLC_03d	4 4
SR-GD-76	ATSP	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05	4 3 4
SR-GD-77	ATSP	*When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.*	OH_ED228_ADSC_03d OH_ED228_ADSC_03u OH_ED228_ADSC_05	4 3 4
SR-GD-78	ATSP	*When the ATSU receives a message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall reject the message.*	OH_ED228_ADSC_05	4
SR-GD-79	ATSP	*When the ATSU receives a periodic or event report whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall request similar information from the message rejected with a demand report.*	OH_ED228_ADSC_05	4
SR-GD-80	ATSP	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_05d	4 4
SR-GD-81	ATSP	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier.*	OH_ED228_CPDLC_03d OH_ED228_CPDLC_03u OH_ED228_CPDLC_05d OH_ED228_CPDLC_05u	4 3 4 3

Table 44: List of applicable AC and ATSP Safety Requirements

4.2 Definition of Aircraft, ACSP and ATSU Performance Requirements

4.2.1 Identification of relevant Performance Requirements in ED228 document

This task consists in identifying, in the ED228 Performance Analysis, the performances requirements, that could be relevant for Iris Precursor (that means requirements allocated to Aircraft, ACSP or ATSU and that concerns the exchange of message between ground and aircraft).

ED228 identify performances requirements in terms of:

- Integrity: ED228 Performance Analysis defines end-to-end integrity requirements, for each data link application. These requirements are directly extracted from ED228 Safety Analysis. There is no specific integrity requirement from a purely performance point of view.

  Consequently, these integrity requirements have already been considered during the safety analysis (cf. § 4.1) and it is not necessary to consider them again.

- Availability. ED228 Performance Analysis defines end-to-end availability requirements, for each DATALINK application. These availability requirements are expressed in terms of “overall availability” and “availability of provision”.

  ED228 Performance Analysis then derives these end-to-end availability requirements on the different CNS/ATM components (Aircraft, ACSP and ATSU) using the following formula:

$$A_{ACSP} = A_{ATSU} = \sqrt{A_{PROVISION}} \text{ And } A_{AIRCRAFT} = \frac{A}{A_{ACSP} * A_{ATSU}}$$

  Availability is defined for each ATM component as the following ratio $A = \frac{MTBF}{MTBF + \sum MTTR}$ $A = \frac{MTSO}{MTSO+MTSR}$, expressed in percentage.

- Transaction Time (TT). ED228 Performance Analysis defines end-to-end timing requirements, for each data link application. These timing requirements are expressed in terms of:
  - Nominal Transaction Time (TT_{95}): it defines the time at which 95 percent of all transactions, that are initiated, are completed;
  - Maximum Transaction Time (TT_{MAX}): it defines the maximum acceptable transaction time after which the initiator is required to revert to an alternative procedure. This duration is associated with the probability, corresponding to the continuity target (cf. below). In the case, an expiration time is used; this time is referred to as expiration time (TT_{ET}).

  Timing requirement are defined for each function of each application: a RxP specification (Required Communication or Surveillance Performance) is defined for each function with a specific end-to-end timing requirement, expressed in seconds.

  ED228 Performance Analysis then derives these end-to-end timing requirements on the different CNS/ATM components (Composition by the pilot, recognition by the controller, Aircraft, ACSP and ATSU), using statistical allocation. This allocation methodology leads to larger duration on the different components than the classical arithmetic allocation.

- Continuity: ED228 Performance Analysis defines end-to-end continuity requirements, for each data link application. Continuity is associated with the required level of efficiency or usability of the data communications system. It is defined as the probability that a transaction

completes within the expiration time. Consequently, continuity is closely linked to transaction time.

ED228 Performance Analysis then derives these end to end continuity requirements on the different CNS/ATM components (Aircraft, ACSP and ATSU). In this allocation, continuity remains fixed over all ATM components: the allocation is made purely by the transaction time, allocated to each component.

The following table presents the availability, continuity and transaction time requirements allocated by ED228, on AC, ACSP and ATSU, for each application kind of message:

List of Performance Requirements							
Application	**RxP specification**	**Function**	**Part**	**TT_{ET} (in seconds)**	**TT_{95} (in seconds)**	**Continuity**	**Availability (in percent)**
CPDLC	RCP 130	*Taxi Clearance; ATC Comm; IM-S; 4DTBO*	ATSU	14	6	0.999	99.95%
			ACSP	18	10	0.999	99.95%
			AC	23	10	0.999	99.00%
	RCP 240	*SA2 ; ITP*	ATSU	15	10	0.999	99.90%
			ACSP	120	100	0.999	99.90%
			AC	15	10	0.999	99.00%
	RCP 400/A1	*ATC Comm; SA1*	ATSU	15	10	0.999	99.90%
			ACSP	280	240	0.999	99.90%
			AC	15	10	0.999	99.00%
	RCP-400/A2	*Departure Clearance*	ATSU	14	6	0.999	99.95%
			ACSP	18	10	0.999	99.95%
			AC	23	10	0.999	99.00%
ADS-C	RSP160	*4DTBO; ATC Comm*	ATSU	7	3	0.999	99.95%
			ACSP	12	5	0.999	99.95%
			AC	159	86	0.999	99.00%
	RSP 180	*SA2*	ATSU	5	3	0.999	99.90%
			ACSP	170	84	0.999	99.90%
			AC	5	3	0.999	99.00%
	RSP 400	*ATC Comm; SA1*	ATSU	30	15	0.999	99.90%
			ACSP	340	270	0.999	99.90%
			AC	30	15	0.999	99.00%

Table 45: Relevant AC, ACSP and ATSU performance requirements (Availability, Continuity, and Transaction times)

4.2.2 Selection of applicable AC, ACSP and ATSU performance requirements

Several relevant Performance Requirements have been identified in the previous chapters on ACSP and AC systems. This task now consists in identifying, for each parameter (availability, continuity and transaction time), the most stringent requirement (that is the applicable requirement):

- Availability: selection of the highest percentage among all values of Table 45.
- Nominal Transaction Time (TT_{95}): selection of the lowest TT_{95} value in Table 45.

  In facts this selection might be not totally exact if we considered different categories of messages, with different priority classes that could affect the transaction time. However, this is the requirement for transactions with the highest level of priority.

- Continuity / Maximum Transaction Time (TT_{ET}): The same continuity requirement is defined on all ATM components for all applications (cf. Table 45). This requirement defines the probability that the transaction completes within the expiration time. Consequently a common continuity / TT_{ET} requirement is defined specifying the delay that all transactions shall respect. This requirement is the lowest TT_{ET} value in Table 45.

The selected Performance Requirements are referenced as follow: "PR_XX_YY: xxxx"

- XX: identify the part on which the performance requirement is allocated: "SP" for ACSP, "AC" for Aircraft System and "SU" for ATSU;
- YY: is a reference number of the selected performance requirement;
- xxxx: value of the performance requirement (expressed in percent for availability, and in seconds for transaction times).

The following table presents the selected AC, ACSP and ATSU performance requirements (in red: quantitative requirement, in green: qualitative requirements):

Selected Performance Requirement					
Ref	**Part**	**Parameter**	**Value**	**Title**	**Source**
PR_SP_01	ACSP	Maximum Transaction Time (in seconds)	12	The maximum transaction time in ACSP system shall be less than 12 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 160
PR_SP_02	ACSP	Maximum Transaction Time (in seconds)	120	The maximum transaction time in ACSP system shall be less than 120 seconds for any messages in ENR-2 domain	Performance analysis CPDLC – RCP 240
PR_SP_03	ACSP	Nominal Transaction Time (in seconds)	5	The nominal transaction time in ACSP system shall be less than 5 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 120
PR_SP_04	ACSP	Nominal Transaction Time (in seconds)	100	The nominal transaction time in ACSP system shall be less than 100 seconds for any messages in ENR-2 domain	Performance analysis CPDLC – RCP 240
PR_SP_05	ACSP	Availability (in percent)	99.95%	The availability of the ACSP system shall be more than 99.95%	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2 ADS-C – RSP 160
PR_SP_06	ACSP	Availability	-	The ACSP system shall be capable of detecting ACSP failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function.	Performance analysis
PR_SP_07	ACSP	Availability	-	When the ACSP communication capability no longer meets the requirements for the intended function, the ACSP system shall provide indication to the ground system.	Performance analysis
PR_SP_08	ACSP	Continuity	0.999	The continuity of the ACSP system shall be more than 0.999	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
PR_AC_01	AC	Maximum Transaction Time (in seconds)	23	The maximum transaction time in Aircraft shall be less than 23 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2
PR_AC_02	AC	Maximum Transaction Time (in seconds)	5	The maximum transaction time in Aircraft shall be less than 5 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_AC_03	AC	Nominal Transaction Time (in seconds)	10	The nominal transaction time in Aircraft shall be less than 10 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2
PR_AC_04	AC	Nominal Transaction Time (in seconds)	3	The nominal transaction time in Aircraft shall be less than 3 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_AC_05	AC	Availability (in percent)	99.00%	The availability of the aircraft system shall be more than 99.00%	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2

Selected Performance Requirement					
Ref	**Part**	**Parameter**	**Value**	**Title**	**Source**
					ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
PR_AC_06	AC	Availability	-	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft communication capability to no longer meet the requirements for the intended function.	Performance analysis
PR_AC_07	AC	Availability	-	When the aircraft communication capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	Performance analysis
PR_AC_08	AC	Continuity	0.999	The continuity of the AC system shall be more than 0.999	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
PR_SU_01	ATSU	Maximum Transaction Time (in seconds)	7	The maximum transaction time in ATSU system shall be less than 7 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 160
PR_SU_02	ATSU	Maximum Transaction Time (in seconds)	5	The maximum transaction time in ATSU system shall be less than 5 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_SU_03	ATSU	Nominal Transaction Time (in seconds)	3	The nominal transaction time in ATSU system shall be less than 3 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 160
PR_SU_04	ATSU	Nominal Transaction Time (in seconds)	3	The nominal transaction time in ATSU system shall be less than 3 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_SU_05	ATSU	Availability (in percent)	99.95%	The availability of the ATSU system shall be more than 99.95%	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2 ADS-C – RSP 160
PR_SU_06	ATSU	Availability	-	The ATSU system shall be capable of detecting ATSU failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function.	Performance analysis
PR_SU_07	ATSU	Availability	-	When the ATSU communication service no longer meets the requirements for the intended function, the ATSU system shall provide indication to the controller.	Performance analysis
PR_SU_08	ATSU	Continuity	0.999	The continuity of the ATSU system shall be more than 0.999	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
PR_CT_01	CT	Availability	-	When the controller receives an indication that the communication service no longer meets the requirements for the intended function, the controller shall take action to resolve the situation	Performance analysis
PR_CT_02	CT	Availability	-	When the communication service can no longer meet the RCP/RSP specification for the intended function, the controller shall take appropriate action	Performance analysis
PR_FC_01	FC	Availability	-	When the flight crew determines that the aircraft communication capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned	Performance analysis
PR_FC_02	FC	Availability	-	When the communication service can no longer meet the RCP specification for the intended function, the flight crew shall take appropriate action	Performance analysis

Table 46: Selected AC, ACSP and ATSU performance requirements

4.3 Summary of Safety and Performance requirements applicable to Aircraft, ATSP, ACSP and ATSU

The following table is the detailed AC, ATSP, ACSP and ATSU requirement list:

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
PR_AC_01	AC	23	The maximum transaction time in Aircraft shall be less than 23 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2
PR_AC_02	AC	5	The maximum transaction time in Aircraft shall be less than 5 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_AC_03	AC	10	The nominal transaction time in Aircraft shall be less than 10 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2
PR_AC_04	AC	3	The nominal transaction time in Aircraft shall be less than 3 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_AC_05	AC	99.00%	The availability of the aircraft system shall be more than 99.00%	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
PR_AC_06	AC	-	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft communication capability to no longer meet the requirements for the intended function.	Performance analysis
PR_AC_07	AC	-	When the aircraft communication capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.	Performance analysis
PR_AC_08	AC	0.999	The continuity of the AC system shall be more than 0.999	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
SR-AC-01	AC	-	*After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-AC-02	AC	-	*The aircraft system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-03	AC	-	*Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_01u (SC3) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_02u (SC3) OH_ED228_ADSC_05 (SC4) 0H_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-AC-04	AC	-	*The aircraft identifiers sent by the aircraft system and used for data link initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u(SC3)
SR-AC-05	AC	-	*The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-06	AC	-	*The aircraft system shall be able to determine the message initiator.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-07	AC	-	*The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-AC-08	AC	-	*The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link that is used to define the aircraft's active flight plan.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-AC-09	AC	-	*The aircraft system shall be capable to send an indication to the ground system whenever a message is discarded by the aircraft system.*	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_5d (SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-AC-10	AC	-	*The aircraft system shall discard any corrupted message.*	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4)
SR-AC-11	AC	-	*The aircraft system shall include in each ADS report the time at position to within ± one second of the UTC time the aircraft was actually at the position provided in the report.*	OH_ED228_ADSC_05 (SC4)
SR-AC-12	AC	-	*The aircraft system shall indicate in each response to which messages it refers.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4 OH_ED228_CPDLC_05u (SC3)
SR-AC-13	AC	-	*The aircraft system shall indicate to the flight crew a detected loss of any service.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-14	AC	-	*The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-15	AC	-	*The aircraft system shall prevent the release of responses to clearances without flight crew action.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-16	AC	-	*The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-17	AC	-	*The aircraft system shall prohibit operational processing by flight crew of corrupted messages.*	OH_ED228_CPDLC_03d (SC4)
SR-AC-18	AC	-	*The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.*	OH_ED228_CPDLC_05d (SC4)
SR-AC-19	AC	-	*The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-20	AC	-	*The aircraft system shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3)
SR-AC-21	AC	-	*The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07(SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-AC-22	AC	-	*The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-AC-23	AC	-	*The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-AC-24	AC	-	*The aircraft system shall reject messages not addressed to itself.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-AC-25	AC	-	*The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-AC-26	AC	-	*The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-AC-27	AC	-	*The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-28	AC	-	*The aircraft system shall transmit messages to the designated ATSU.*	OH_ED228_CPDLC_05d (SC4)
SR-AC-29	AC	-	*The aircraft system shall transmit reports to the end system designated in the ADS-C contract.*	OH_ED228_ADSC_05 (SC4)
SR-AC-30	AC	-	*The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-AC-31	AC	-	*The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-32	AC	-	*The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4)
SR-AC-33	AC	1.40 E-04	The l kelihood of a delayed message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-34	AC	1.00 E-05	The likelihood of the detected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-04/FH.	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4)
SR-AC-35	AC	1.40 E-04	The l kelihood of the detected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-AC-36	AC	7.10 E-05	The likelihood of the detected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-AC-37	AC	2.90 E-04	The likelihood of the detected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-AC-38	AC	5.00 E-04	The l kelihood of the loss of CPDLC capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	OH_ED228_CPDLC_01 (SC4)
SR-AC-39	AC	7.00 E-05	The likelihood of a lost message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-40	AC	2.90 E-04	The likelihood of a misdirected message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_07 (SC4)
SR-AC-41	AC	1.00 E-07	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by the aircraft systems shall be less than 2.5E-06/FH.	OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03u (SC3)
SR-AC-42	AC	1.00 E-07	The likelihood of the undetected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-06/FH.	OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03u (SC3)
SR-AC-43	AC	1.40 E-06	The likelihood of the undetected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-06/FH.	OH_ED228_CPDLC_05u (SC3)
SR-AC-44	AC	7.00 E-07	The l kelihood of the undetected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-07/FH.	OH_ED228_CPDLC_05u (SC3)
SR-AC-45	AC	5.00 E-06	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-06/FH.	OH_ED228_ADSC_01u (SC3)
SR-AC-46	AC	2.90 E-06	The likelihood of the undetected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-06/FH.	OH_ED228_CPDLC_05u (SC3)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-AC-47	AC	1.00 E-05	The likelihood that all aircraft systems are unavailable shall be less than 1.0E-05/FH.	OH_NEW_ALL_01 (SC3)
SR-AC-48	AC	1.00 E-05	The likelihood that the AC systems provide incorrect data [single aircraft] shall be less than 2.5E-04/FH.	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4)
SR-AC-49	AC	-	*When the aircraft system receives a message whose time stamp is older than the current time minus ET_{TRN}, the aircraft system shall discard the message and send an indication to the ATSU.*	OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-AC-50	AC	-	*When the aircraft system receives an indication from the ATSU indicating a message has been rejected, the aircraft system shall notify the flight crew.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_05d (SC4)
SR-AC-51	AC	5.00 E-04	The likelihood of the detected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	OH_ED228_ADSC_01d (SC4)
SR-AC-52	AC	-	*The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d(SC4) OH_ED228_CPDLC_05u (SC3)
PR-CT-01	CT	-	When the controller receives an indication that the communication service no longer meets the requirements for the intended function, the controller shall take action to resolve the situation	Performance analysis
PR-CT-02	CT	-	When the communication service can no longer meet the RCP/RSP specification for the intended function, the controller shall take appropriate action	Performance analysis
PR-FC-01	FC	-	When the flight crew determines that the aircraft communication capability no longer meets the requirements for the intended function, the flight crew shall advise the ATC unit concerned	Performance analysis
PR-FC-02	FC	-	When the communication service can no longer meet the RCP specification for the intended function, the flight crew shall take appropriate action	Performance analysis
SR-FC-01	FC	-	*The flight crew shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the controller.*	OH ED228 CPDLC 03d (SC4) OH ED228 CPDLC 03u (SC3) OH ED228 CPDLC 05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-FC-02	FC	-	*The flight crew shall execute clearances, received in a concatenated message, in the same order as displayed to the flight crew.*	OH ED228 CPDLC 03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-FC-03	FC	-	*The flight crew shall perform the initiation data link procedure again with any change of the Flight Identification or Aircraft Identification (either the Registration Marking or the 24-bit Aircraft Address).*	OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4) OH ED228 CPDLC 05d (SC4) OH ED228 CPDLC 05u (SC3) OH_ED228_CPDLC_07 (SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-FC-04	FC	-	*The flight crew shall recognize the conditional nature of the clearance and execute the clearance only when the associated condition is met.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-FC-05	FC	-	*The flight crew shall respond or act in timely manner without unnecessary delay.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-FC-06	FC	-	*The flight crew shall respond to a message in its entirety when not responded by the aircraft system.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-GD-01	ATSP	-	*A service shall be established in sufficient time to be available for operational use.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3)
SR-GD-02	ATSP	-	*An ATSU shall permit CPDLC services only when there are compatible version numbers.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-GD-03	ATSP	-	*An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-04	ATSP	-	*The ATSU system shall process the message without affecting the intent of the message.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-05	ATSP	-	*ATSU shall be notified of planned outage of a service sufficiently ahead of time.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-GD-06	ATSP	-	*ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-07	ATSP	-	*Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_01u (SC3) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_02u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-GD-08	ATSP	-	*Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-GD-09	ATSP	-	*The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-10	ATSP	-	*The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-11	ATSP	-	*The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-12	ATSP	-	*The ATSU shall be able to determine the message initiator.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-13	ATSP	-	*When the ATSU receives a report that has been corrupted, the ATSU shall request similar information with a demand report.*	OH_ED228_ADSC_03d (SC4)
SR-GD-14	ATSP	-	*The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-GD-15	ATSP	-	*The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4)
SR-GD-16	ATSP	-	*The ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3)
SR-GD-17	ATSP	-	*The ATSU shall correlate each ADS-C report with the contract that prescribed the report.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4)
SR-GD-18	ATSP	-	*The ATSU shall discard any corrupted message.*	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4)
SR-GD-19	ATSP	-	*The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_07 (SC4)
SR-GD-20	ATSP	-	*The ATSU shall indicate in each response to which messages it refers.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-21	ATSP	-	*The ATSU shall indicate to the controller a detected loss of any service.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-22	ATSP	-	*The ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-23	ATSP	-	*The ATSU shall indicate to the controller when a message cannot be successfully transmitted.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-24	ATSP	-	*The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_01u (SC3) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_02u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-GD-25	ATSP	-	*The ATSU shall make the controller aware of any operational message being automatically or manually released.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-26	ATSP	-	*The ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4)
SR-GD-27	ATSP	-	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-28	ATSP	-	*The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-29	ATSP	-	*The ATSU shall prohibit operational processing by the controller of a corrupted report.*	OH_ED228_CPDLC_03d (SC4)
SR-GD-30	ATSP	-	*The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-31	ATSP	-	*The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.*	OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-32	ATSP	-	*The ATSU shall provide an indication to the controller when an ADS-C contract is established.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_07 (SC4)
SR-GD-33	ATSP	-	*The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-34	ATSP	-	*The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3) OH_ED228_CPDLC_07 (SC4)
SR-GD-35	ATSP	-	*The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-36	ATSP	-	*The ATSU shall reject messages not addressed to itself.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-37	ATSP	-	*The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.*	OH_ ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_01 (SC4) OH_ED228_CPDLC_02d (SC4) OH_ED228_CPDLC_02u (SC3) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-GD-38	ATSP	-	*The ATSU shall respond to messages in their entirety.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3)
SR-GD-39	ATSP	-	*The ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft.*	OH_ED228_CPDLC_05d (SC4)
SR-GD-40	ATSP	-	*The ATSU shall send the route information with the route clearance uplink message.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-41	ATSP	-	*The ATSU shall time stamp to within one second UTC each message when it is released for onward transmission.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-42	ATSP	-	*The ATSU shall transmit messages to the designated aircraft system.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-43	ATSP	-	*The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4)
SR-GD-44	ATSP	-	*The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.*	OH_ED228_ADSC_01d (SC4) OH_ED228_ADSC_01u (SC3) OH_ED228_ADSC_02d (SC4) OH_ED228_ADSC_02u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_ADSC_07 (SC4)
SR-GD-45	ATSP	-	*The controller shall check the correctness and the appropriateness of every ADS-C report received.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4)
SR-GD-46	ATSP	-	*The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)à
SR-GD-47	ATSP	-	*The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-48	ATSP	-	*The controller shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN}.*	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-49	ATSP	-	*When the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall display the emergency message to the controller.*	OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-50	ATSP	-	*The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-51	ATSP	-	*The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
SR-GD-52	ATSP	1.40 E-04	The likelihood of a delayed message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-53	ATSP	1.00 E-05	The l kelihood of the detected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-04/H.	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4)
SR-GD-54	ATSP	1.40 E-04	The l kelihood of the detected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-55	ATSP	7.00 E-05	The likelihood of the detected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-56	ATSP	5.00 E-04	The l kelihood of the detected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	OH_ED228_ADSC_01d (SC4)
SR-GD-57	ATSP	1.00 E-03	The likelihood of the detected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	OH_ED228_ADSC_02d (SC4)
SR-GD-58	ATSP	1.00 E-03	The likelihood of the detected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	OH_ED228_CPDLC_02d (SC4)
SR-GD-59	ATSP	2.90 E-04	The likelihood of the detected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	OH_ED228_ADSC_05 (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-60	ATSP	1.00 E-05	The likelihood that all ground systems are unavailable (undetected) shall be less than 1.0E-05/H.	OH_NEW_ALL_02u (SC3)
SR-GD-61	ATSP	5.00 E-04	The likelihood of the loss of CPDLC capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	OH_ED228_CPDLC_01 (SC4)
SR-GD-62	ATSP	7.00 E-05	The l kelihood of a lost message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-63	ATSP	2.90 E-04	The likelihood of a misdirected message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	OH_ED228_ADSC_07 (SC4) OH_ED228_CPDLC_07 (SC4)
SR-GD-64	ATSP	1.00 E-07	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by ATSP shall be less than 2.5E-06/H.	OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03u (SC3)
SR-GD-66	ATSP	1.00 E-07	The likelihood of the undetected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-06/H.	OH_ED228_ADSC_03u (SC3) OH_ED228_CPDLC_03u (SC3)
SR-GD-67	ATSP	1.40 E-06	The likelihood of the undetected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-06/H.	OH_ED228_CPDLC_05u (SC3)

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
SR-GD-68	ATSP	7.00 E-07	The l kelihood of the undetected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-07/H.	OH_ED228_CPDLC_05u (SC3)
SR-GD-69	ATSP	5.00 E-06	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-06/H.	OH_ED228_ADSC_01u (SC3)
SR-GD-70	ATSP	1.00 E-05	The l kelihood of the undetected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 9.99E-06/H.	OH_ED228_ADSC_02u (SC3)
SR-GD-71	ATSP	1.00 E-05	The likelihood of the undetected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 9.75E-06/H.	OH_ED228_CPDLC_02u (SC3)
SR-GD-72	ATSP	2.90 E06	The l kelihood of the undetected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-06/H.	OH_ED228_CPDLC_05u (SC3)
SR-GD-73	ATSP	1.00 E-05	The likelihood that all ground systems are unavailable (detected) shall be less than 1.0E-05/H.	OH_NEW_ALL_02d (SC4)
SR-GD-74	ATSP	1.00 E-05	The likelihood that the ATSP provides incorrect data [single aircraft] shall be less than 2.5E-04/H.	OH_ED228_ADSC_03d (SC4) OH_ED228_CPDLC_03d (SC4)
SR-GD-76	ATSP	-	*When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4)
SR-GD-77	ATSP	-	*When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.*	OH_ED228_ADSC_03d (SC4) OH_ED228_ADSC_03u (SC3) OH_ED228_ADSC_05 (SC4)
SR-GD-78	ATSP	-	*When the ATSU receives a message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall reject the message.*	OH_ED228_ADSC_05 (SC4)
SR-GD-79	ATSP	-	*When the ATSU receives a periodic or event report whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall request similar information from the message rejected with a demand report.*	OH_ED228_ADSC_05 (SC4)
SR-GD-80	ATSP	-	*When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_05d (SC4)
SR-GD-81	ATSP	-	*When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier.*	OH_ED228_CPDLC_03d (SC4) OH_ED228_CPDLC_03u (SC3) OH_ED228_CPDLC_05d (SC4) OH_ED228_CPDLC_05u (SC3)
PR_SP_01	ACSP	12	The maximum transaction time in ACSP system shall be less than 12 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 160
PR_SP_02	ACSP	120	The maximum transaction time in ACSP system shall be less than 120 seconds for any messages in ENR-2 domain	Performance analysis CPDLC – RCP 240
PR_SP_03	ACSP	5	The nominal transaction time in ACSP system shall be less than 5 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 120
PR_SP_04	ACSP	100	The nominal transaction time in ACSP system shall be less than 100 seconds for any messages in ENR-2 domain	Performance analysis CPDLC – RCP 240

Requirement List				
Réf	**Part**	**Value**	**Title**	**Source**
PR_SP_05	ACSP	99.95%	The availability of the ACSP system shall be more than 99.95%	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2 ADS-C – RSP 160
PR_SP_06	ACSP	-	The ACSP system shall be capable of detecting ACSP failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function.	Performance analysis
PR_SP_07	ACSP	-	When the ACSP communication capability no longer meets the requirements for the intended function, the ACSP system shall provide indication to the ATSU system.	Performance analysis
PR_SP_08	ACSP	0.999	The continuity of the ACSP system shall be more than 0.999	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400
PR_SU_01	ATSU	7	The maximum transaction time in ATSU system shall be less than 7 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 160
PR_SU_02	ATSU	5	The maximum transaction time in ATSU system shall be less than 5 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_SU_03	ATSU	3	The nominal transaction time in ATSU system shall be less than 3 seconds for any messages in APT, TMA and ENR-1 domains	Performance analysis ADS-C – RSP 160
PR_SU_04	ATSU	3	The nominal transaction time in ATSU system shall be less than 3 seconds for any messages in ENR-2 domain	Performance analysis ADS-C – RSP 180
PR_SU_05	ATSU	99.95%	The availability of the ATSU system shall be more than 99.95%	Performance analysis CPDLC – RCP 130 CPDLC – RCP 400/A2 ADS-C – RSP 160
PR_SU_06	ATSU	-	The ATSU system shall be capable of detecting ATSU failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function.	Performance analysis
PR_SU_07	ATSU	-	When the ATSU communication capability no longer meets the requirements for the intended function, the ATSU system shall provide indication to the controller.	Performance analysis
PR_SU_08	ATSU	0.999	The continuity of the ATSU system shall be more than 0.999	Performance analysis CPDLC – RCP 130 CPDLC – RCP 240 CPDLC – RCP 400/A1 CPDLC – RCP 400/A2 ADS-C – RSP 160 ADS-C – RSP 180 ADS-C – RSP 400

Table 47: Selected AC, ATSP, ACSP and ATSU Requirements

5 Definition of safety and performance requirements applicable to the communication airborne system

5.1 Functional description of the aircraft system

The aircraft system as referred to in this document includes all sub-systems associated data communications on an aircraft.

For the purpose of this analysis, it will be considered that the aircraft is made up of:

- End System, including HMI;
- Avionics Communication Routing System;
- Communication System (data).

The End System part of the aircraft system considered for the purpose of this section includes:

- ATS applications (e.g. CPDLC) that support ATS functions (e.g. Departure Clearance) using DATALINK services;

This set of components is called “End System” thereafter.

The Avionics Communication Routing System part of the aircraft system considered for the purpose of this section includes:

- ATN/OSI bidirectional communication services (implemented in ACR);

The Communication System part of the aircraft system considered for the purpose of this section includes:

- Data Communication Systems (SATCOM).
- Antennas associated to the Communication Systems.

This set of components is called “Communication Means” hereafter.

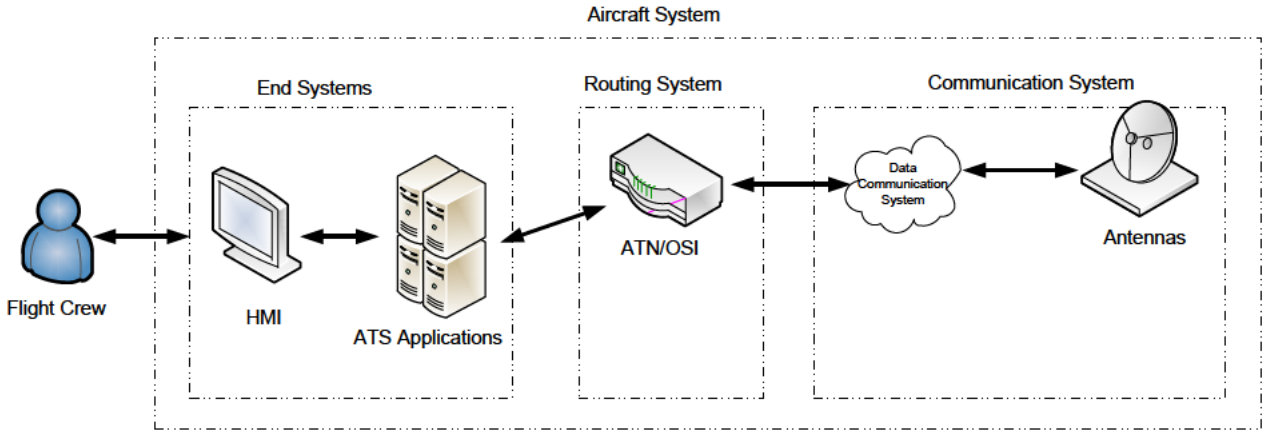

Figure 28 : Aircraft System Components.

5.2 Allocation of Safety and Performance Requirements to the aircraft system components

5.2.1 Introduction and assumptions

This section identifies the components which could be involved in the degradation of the performance and safety level with regards to the requirements identified previously.

Then, the safety and performance requirements are apportioned to the different parts of the aircraft system, including Communication Means. Furthermore, recommendations are derived on the Communication Means components in order to reach these requirements.

For the purpose of the analysis the following assumption related to aircraft system architecture is defined:

- **ASSUMP_AC_01**: The end-to-end integrity checks are performed by the ATS application within the End System.

Note: the term “integrity” deals with the hazards assessed in the OSA (Operational Safety Analysis), leading to amongst other things:

- Undetected corruption;
- Undetected misdirection;
- Undetected spurious;
- Undetected delivery of a delayed message after expiration time;
- Undetected loss of communication and user attempts to initiate a transaction.

This analysis will also make use of the following assumption, defined in the ED228 document [3]:

-**ASSUMP_IPr_02**: Future Datalink implementation within aircraft systems are expected to be developed at least ED12C/DO178C [7] based Development Assurance Level consistent with its failure condition categorization.

5.2.2 Quantitative safety requirements

5.2.2.1 Introduction

The quantitative safety requirements applicable to the aircraft system are reminded hereafter.

Note: the following table provides also cross-reference with European Aviation Safety Agency (EASA) Acceptable Means of Compliance (AMC) 25.1309, System Design and Analysis (of airplane systems and associated components). This AMC is available on the internet at http://easa.europa.eu/agency-measures/certification-specifications.php.

Requirement list				
Ref.	**Parameter**	**Value (per FH)**	**Title**	**Classification (as per AMC 25.1309)**
SR-AC-33	Delay of message	1.40 E-04	The likelihood of a delayed message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	Minor (MIN)
SR-AC-34	Detection of corrupted message	2.50 E-04	The likelihood of the detected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-04/FH.	Minor (MIN)
SR-AC-35	Detection of delayed message	1.40 E-04	The likelihood of the detected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-04/FH.	Minor (MIN)
SR-AC-36	Detection of spurious message	7.10 E-05	The l kelihood of the detected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	Minor (MIN)

Requirement list				
Ref.	**Parameter**	**Value (per FH)**	**Title**	**Classification (as per AMC 25.1309)**
SR-AC-37	Detection of misdirected message	2.90 E-04	The l kelihood of the detected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	Minor (MIN)
SR-AC-38	Availability	5.00 E-04	The likelihood of the loss of CPDLC capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	Minor (MIN)
SR-AC-39	Loss of message	7.00 E-05	The likelihood of a lost message [single aircraft] due to aircraft systems shall be less than 7.0E-05/FH.	Minor (MIN)
SR-AC-40	Misdirection of message	2.90 E-04	The l kelihood of a misdirected message [single aircraft] due to aircraft systems shall be less than 2.9E-04/FH.	Minor (MIN)
SR-AC-41	Detection of corrupted message	2.50 E-06	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by the aircraft systems shall be less than 2.5E-06/FH.	Major (MAJ)
SR-AC-42	Detection of corrupted message	2.50 E-06	The likelihood of the undetected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.5E-06/FH.	Major (MAJ)
SR-AC-43	Detection of delayed message	1.40 E-06	The likelihood of the undetected delay of a message [single aircraft] due to aircraft systems shall be less than 1.4E-06/FH.	Major (MAJ)
SR-AC-44	Detection of spurious message	7.00 E-07	The likelihood of the undetected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.0E-07/FH.	Major (MAJ)
SR-AC-45	Availability	5.00 E-06	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-06/FH.	Major (MAJ)
SR-AC-46	Detection of misdirected message	2.90 E-06	The l kelihood of the undetected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.9E-06/FH.	Major (MAJ)
SR-AC-47	Availability	1.00 E-05	The likelihood that all aircraft systems are unavailable shall be less than 1.0E-05/FH.	Major (MAJ)
SR-AC-48	Corruption of message	2.50 E-04	The likelihood that the AC systems provide incorrect data [single aircraft] shall be less than 2.5E-04/FH.	Minor (MIN)
SR-AC-51	Availability	5.00 E-04	The likelihood of the detected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.0E-04/FH.	Minor (MIN)

Table 48: AC Quantitative safety requirements

5.2.2.2 Loss of DATALINK capability

The safety requirements regarding availability of DATALINK aircraft system are:

- SR-AC-51: the likelihood that the detected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.00 E-04/FH,
- SR-AC-38: the likelihood that the loss of CPDLC capability [single aircraft] due to aircraft system shall be less than 5.00 E-04/FH,
- SR-AC-45: the likelihood that the undetected loss of ADS-C capability [single aircraft] due to aircraft systems shall be less than 5.00 E-06/FH,
- SR-AC-47: the likelihood that all aircraft systems are unavailable shall be less than 1.00 E-05/FH.

The potential causes for this failure condition to occur are:

- The End System is unable to provide ATS functions,
- The Routing System is inoperative,
- The Communication System is itself is unable to provide datalink services,

The figure below provides the fault tree for this failure condition and allocation to the system components (equipartition):

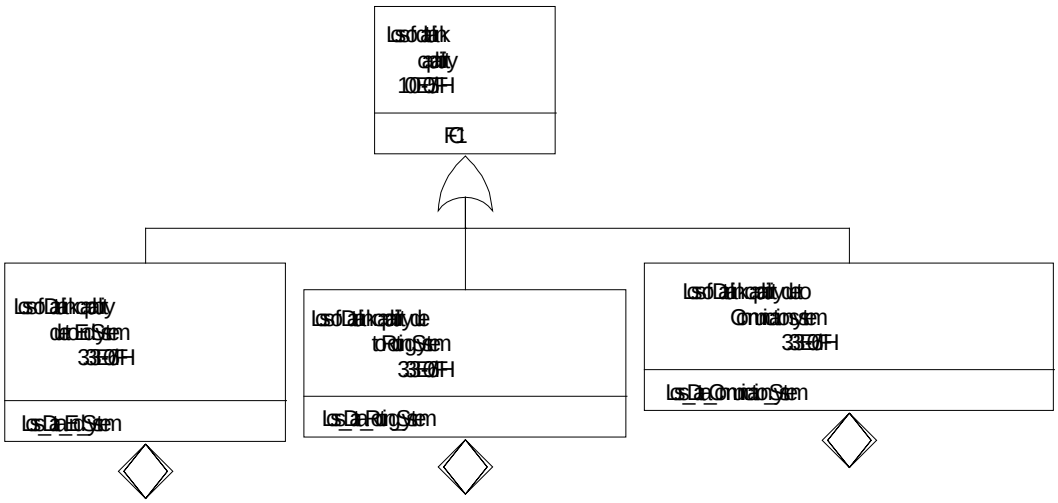

Figure 29 : Loss of AC datalink capability fault tree.

The following Safety Requirements have been identified to be applicable to the End System:

- SR-ES-01: the likelihood that the datalink End System is unavailable shall be less than 3.33 E-06/FH,
- SR-ES-02: the likelihood that the loss of ADS-C aircraft systems is detected shall be less than 5.00 E-04/FH,
- SR-ES-03: the likelihood that the loss of ADS-C aircraft systems is undetected shall be less than 5.00 E-06/FH,
- SR-ES-04: the likelihood that the CPDLC aircraft system is unavailable shall be less than 5.00 E-04/FH.

The following Safety Requirement has been identified to be applicable to the Routing System:

- SR-RS-01: the likelihood that the Datalink Routing System is unavailable shall be less than 3.33 E-06/FH,

The following Safety Requirements have been identified to be applicable to the Communication System:

- SR-CS-01: the likelihood that the Datalink Communication System is unavailable shall be less than 3.33 E-06/FH,

5.2.2.3 Erroneous datalink message

The safety requirements regarding availability of aircraft communication systems are:

- SR-AC-34: the likelihood of the detected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.50E-04/FH.
- SR-AC-41: the likelihood of the undetected corruption due to incorrect data [single aircraft] provided by the aircraft systems shall be less than 2.50E-06/FH.
- SR-AC-42: the likelihood of the undetected corruption of a message [single aircraft] due to aircraft systems shall be less than 2.50E-06/FH.
- SR-AC-48: the likelihood that the AC systems provide incorrect data [single aircraft] shall be less than 2.50E-04/FH.

The potential causes for this failure condition to occur are:

- The End System is unable to detect a corrupted message.
- The End System corrupts the message, after having checked the end to end integrity, when processing it.
- The Routing System corrupts a message.
- The Communication System corrupts a message.

The figure below provides the fault tree for this failure condition and allocation to the system components (the chosen repartition is 1% undetected and 99% detected, equipartition between Aircraft System and incorrect data provided by aircraft system and 59.6% for end system, 20.2%for routing system and 20.2% for communication system):

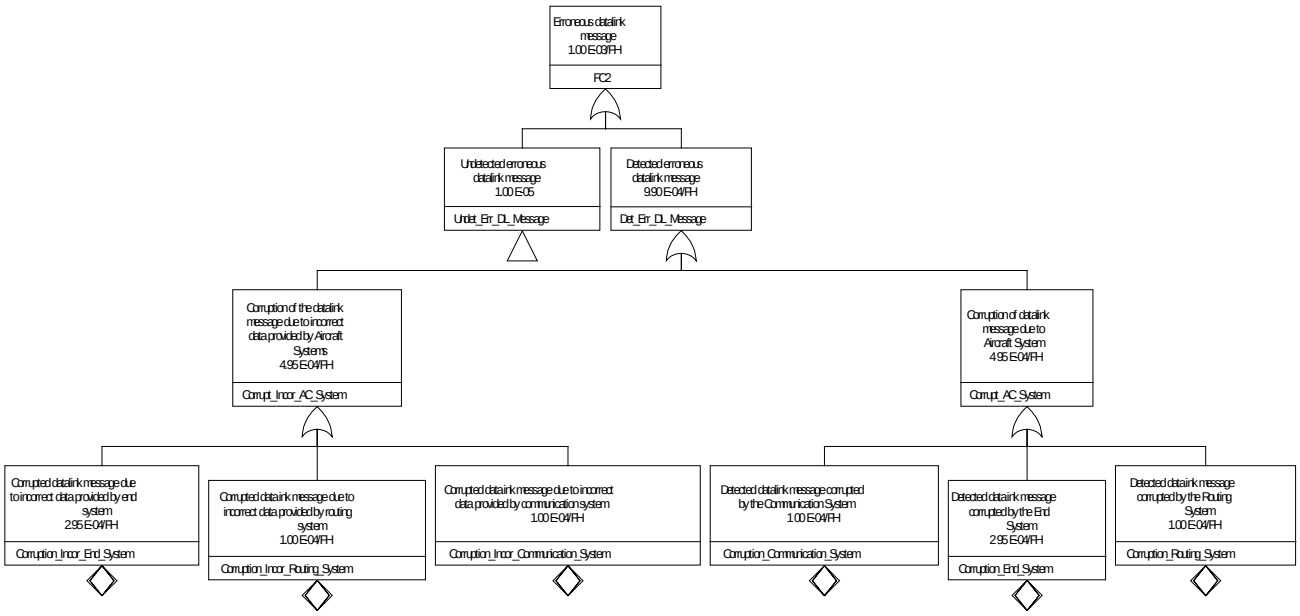

Figure 30 : AC Erroneous DATALINK message fault tree (1/2).

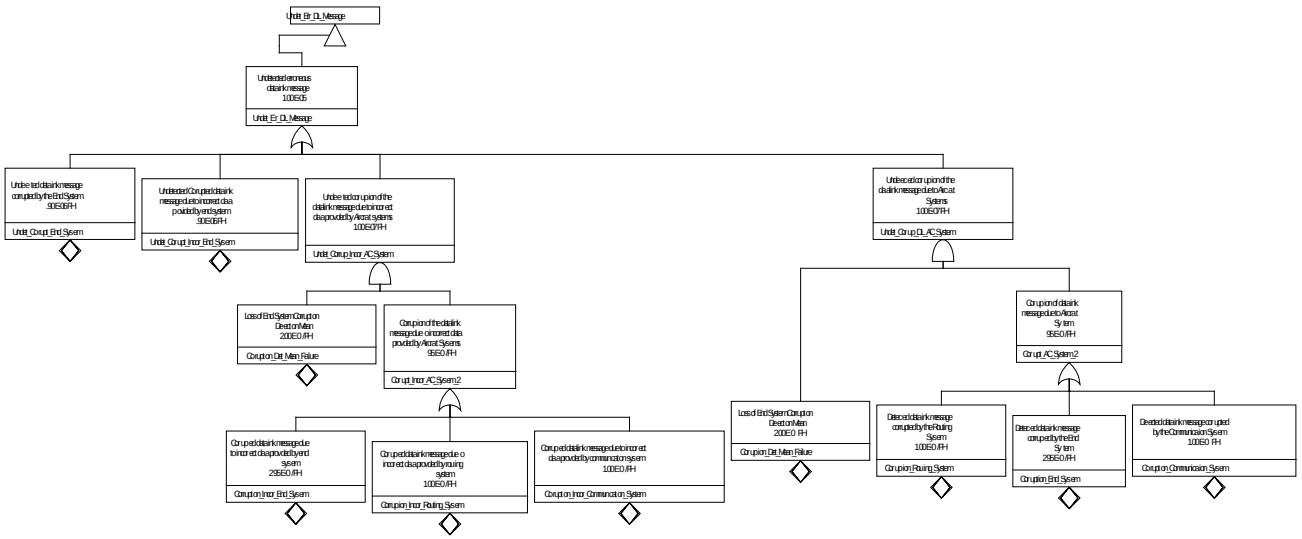

Figure 31 : AC Erroneous DATALINK message fault tree (2/2).

The following Safety Requirements have been identified to be applicable to the End System:

- SR-ES-05: the likelihood that the DATALINK End System corrupts DATALINK message (downlink or uplink) shall be less than 2.95 E-04/FH,
- SR-ES-06: the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the End System shall be less than 2.95 E-04/FH,
- SR-ES-07: the likelihood that the DATALINK End System fails to detect a corrupted message (downlink or uplink) shall be less than 2.00 E-04/FH,
- SR-ES-08: the likelihood of an undetected corrupted datalink message (downlink or uplink) due to the End System shall be less than 4.90 E-06/FH.
- SR-ES-09: the likelihood of an undetected corrupted datalink message (downlink or uplink) due to incorrect data provided by the End System shall be less than 4.90 E-06/FH,

The following Safety Requirements have been identified to be applicable to the Routing System:

- SR-RS-02: the likelihood that the Routing System corrupts datalink message (downlink or uplink) shall be less than 1.00 E-04/FH.
- SR-RS-03: the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the Routing System shall be less than 1.00 E-04/FH,

The following Safety Requirements have been identified to be applicable to the Communication System:

- SR-CS-02: the likelihood that the Communication System corrupts datalink message (downlink or uplink) shall be less than 1.00 E-04/FH,
- SR-CS-03: the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the Communication System shall be less than 1.00 E-04/FH.

5.2.2.4 Unexpected datalink message

The safety requirements regarding availability of aircraft communication systems are:

- SR-AC-33: the likelihood of a delayed message [single aircraft] due to aircraft systems shall be less than 1.40 E-04/FH,
- SR-AC-35: the likelihood of the detected delay of a message [single aircraft] due to aircraft systems shall be less than 1.40 E-04/FH,
- SR-AC-36: the likelihood of the detected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.00 E-05/FH,
- SR-AC-37: the likelihood of the detected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.90 E-04/FH,
- SR-AC-39: the likelihood of a lost message [single aircraft] due to aircraft systems shall be less than 7.00 E-05/FH,
- SR-AC-40: the likelihood of a misdirected message [single aircraft] due to aircraft systems shall be less than 2.90 E-04/FH,
- SR-AC-43: the likelihood of the undetected delay of a message [single aircraft] due to aircraft systems shall be less than 1.40 E-06/FH,
- SR-AC-44: the likelihood of the undetected generation of a spurious message [single aircraft] due to aircraft systems shall be less than 7.00 E-07/FH,
- SR-AC-46: the likelihood of the detected misdirection of a message [single aircraft] due to aircraft systems shall be less than 2.90 E-06/FH.

The potential causes for this failure condition to occur are:

- The End System misbehaves, after having checked the end to end integrity, when processing it,

- The End System is unable to detect an unexpected message,
- The Routing System misbehaves,
- The Communication System misbehaves.

The figure below provides the fault tree for this failure condition and allocation to the system components (the chosen repartition is 1% undetected and 99% detected and 59.6% for end system, 20.2%for routing system and 20.2% for communication system):

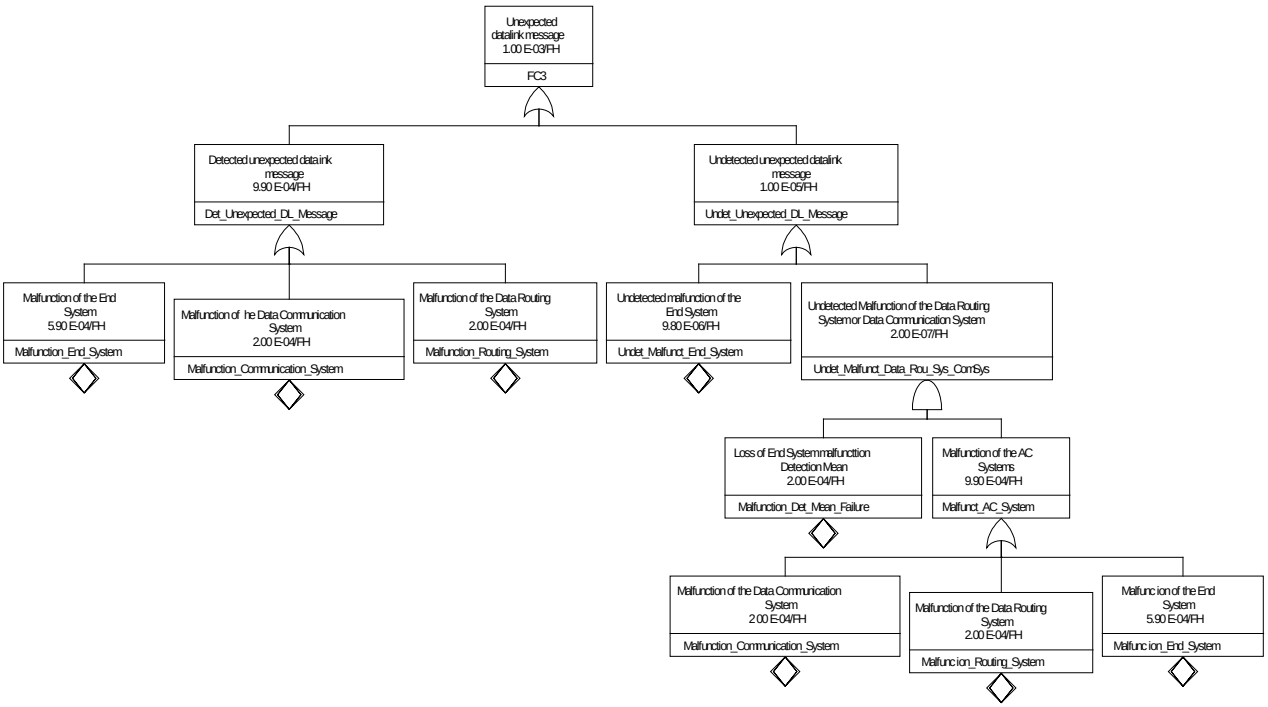

Figure 32 : AC Unexpected datalink message fault tree.

The following Safety Requirements have been identified to be applicable to the End System:

- SR-ES-10: the likelihood that the datalink End System spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 5.90 E-04/FH,
- SR-ES-11: the likelihood that the datalink End System fails to detect an unexpected message (downlink or uplink) shall be less than 2.00 E-04/FH,
- SR-ES-12: the likelihood of an undetected unexpected datalink message (downlink or uplink) due to the End System shall be less than 9.80 E-06/FH.

The following Safety Requirements have been identified to be applicable to the Routing System:

- SR-RS-04: the likelihood that the Routing System spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 2.00 E-04/FH.

The following Safety Requirements have been identified to be applicable to the Communication System:

- SR-CS-04: the likelihood that the Communication System spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 2.00 E-04/FH.

5.2.2.5 Development Assurance Level (DAL)

In the fault tree related to "Loss of datalink capability", taking into account:

- The failure condition is classified MINOR, as per AMC 25.1309,
- A single failure of any component can lead to the abnormal event,

the Development Assurance Levels of Data End System and of Data Routing and Communication Systems shall be at least "D" as per ED12C/DO178C [7].

In the fault trees related to "Erroneous datalink message" and "Unexpected datalink message", taking into account:

- The erroneous, spurious, delay, loss or misdirection of datalink message is classified MAJOR, as per AMC 25.1309,
- The assumption ASSUMP_AC_01,

the Development Assurance Level of Data End System should be "C" and DAL of Data Routing and Communication Systems should be at least "D", as per ED12C/DO178C [7].

The following Safety Requirements have been identified to be applicable to the End System:

- SR-ES-13: the Development Assurance Level of the DATALINK End System shall be at least "C", as per ED12C/DO178C,

The following Safety Requirements have been identified to be applicable to the Routing System:

- SR-RS-05: the Development Assurance Level of the DATALINK Routing System shall be at least "D", as per ED12C/DO178C.

The following Safety Requirements have been identified to be applicable to the Communication System:

- SR-CS-05: the Development Assurance Level of the DATALINK Communication System shall be at least "D", as per ED12C/DO178C,

5.2.3 Qualitative safety requirements

The qualitative safety requirements applicable to the aircraft system are reminded hereafter.

The lines in **bold** indicate the requirements allocated to the Communication System, provided that all requirements are applicable to the End System and Routing System part of the aircraft system.

The lines in underlined indicate the requirements allocated to the Routing System, provided that all requirements are applicable to the End System part of the aircraft system.

Requirement list			
Ref.	**Parameter**	**Title**	**Classification (as per AMC 25.1309)**
SR-AC-01	Spurious message	After the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the aircraft system shall prohibit use of any CPDLC service prior to initiation of a new logon.	Minor (MIN)
SR-AC-02	**Detection of inappropriate message**	**The aircraft system shall process the message without affecting the intent of the message.**	**Major (MAJ)**
SR-AC-03	Detection of spurious message	Each downlink message shall be uniquely identified for a given aircraft-ATSU pair.	Major (MAJ)
SR-AC-04	Corruption of	The aircraft identifiers sent by the aircraft system and used for data link	Major (MAJ)

Requirement list			
Ref.	**Parameter**	**Title**	**Classification (as per AMC 25.1309)**
	message	initiation correlation shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address).	
SR-AC-05	Availability	The aircraft system shall display the indication provided by the ATSU when a data link initiation request (logon) initiated by the flight crew is rejected.	Minor (MIN)
SR-AC-06	Detection of misdirected message	The aircraft system shall be able to determine the message initiator.	Major (MAJ)
SR-AC-07	**Corruption of message**	**The aircraft system shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service.**	**Major (MAJ)**
SR-AC-08	Corruption of message	The aircraft system shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link, that is used to define the aircraft's active flight plan.	Major (MAJ)
SR-AC-09	Detection of corrupted message	The aircraft system shall be capable to send an indication to the ground system whenever a message is discarded by the aircraft system.	Minor (MIN)
SR-AC-10	**Corruption of message**	**The aircraft system shall discard any corrupted message.**	**Minor (MIN)**
SR-AC-11	Misdirection of message	The aircraft system shall include in each ADS report the time at position within ± one second of the UTC time the aircraft was actually at the position provided in the report.	Minor (MIN)
SR-AC-12	Detection of spurious message	The aircraft system shall indicate in each response to which message it refers	Major (MAJ)
SR-AC-13	**Availability**	**The aircraft system shall indicate to the flight crew a detected loss of any service.**	**Minor (MIN)**
SR-AC-14	**Loss of message**	**The aircraft system shall indicate to the flight crew when a message cannot be successfully transmitted.**	**Minor (MIN)**
SR-AC-15	**Spurious message**	**The aircraft system shall prevent the release of responses to clearances without flight crew action.**	**Major (MAJ)**
SR-AC-16	Corruption of message	The aircraft system shall process the route information contained with the route clearance uplink message received from the ATSU.	Major (MAJ)
SR-AC-17	**Corruption of message**	**The aircraft system shall prohibit operational processing by flight crew of corrupted messages.**	**Minor (MIN)**
SR-AC-18	**Spurious message**	**The aircraft system shall prohibit to the flight crew operational processing of messages not addressed to the aircraft.**	**Minor (MIN)**
SR-AC-19	Detection of inappropriate message	The aircraft system shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established.	Minor (MIN)
SR-AC-20	Corruption of message	The aircraft system shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link.	Major (MAJ)
SR-AC-21	Availability	The aircraft system shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU.	Minor (MAJ)
SR-AC-22	Detection of inappropriate message	The aircraft system shall provide to the flight crew an indication of the ATSU that has established CPDLC service.	Major (MAJ)
SR-AC-23	Misdirection of message	The aircraft system shall provide unambiguous and unique identification of the origin and destination of each message it transmits.	Major (MAJ)
SR-AC-24	**Misdirection of message**	**The aircraft system shall reject messages not addressed for itself.**	**Minor (MIN)**
SR-AC-25	Detection of inappropriate message	The aircraft system shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA).	Major (MAJ)
SR-AC-26	**Corruption of message**	**The aircraft system shall respond to messages in their entirety or allow the flight crew to do it.**	**Major (MAJ)**
SR-AC-27	Detection of delayed message	The aircraft system shall time stamp to within one second UTC each message when it is released for onward transmission.	Major (MAJ)
SR-AC-28	Misdirection of message	The aircraft system shall transmit messages to the designated ATSU.	Minor (MIN)
SR-AC-29	Misdirection of message	The aircraft system shall transmit reports to the end system designated in the ADS-C contract.	Minor (MIN)
SR-AC-30	Corruption of message	The aircraft system shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU.	Major (MAJ)
SR-AC-31	**Corruption of message**	**The aircraft system shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position).**	**Major (MAJ)**
SR-AC-32	Detection of spurious message	The aircraft system shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established.	Major (MAJ)
SR-AC-49	Detection of delayed	When the aircraft system receives a message whose time stamp in order than	Major (MAJ)

Requirement list			
Ref.	**Parameter**	**Title**	**Classification (as per AMC 25.1309)**
	message	the current time minus ET_{TRN}, the aircraft system shall discard the message and send an indication to the ATSU.	
SR-AC-50	Detection of corrupted message	When the aircraft system receives an indication from the ATSU indicating a message has been discarded, the aircraft system shall notify the flight crew.	Minor (MIN)
SR-AC-52	Detection of misdirected message	The aircraft system shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.	Major (MAJ)

Table 49: AC Qualitative safety requirements

The following Safety Requirements have been identified to be applicable to the End System:

- SR-ES-14: the DATALINK End System shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service,
- SR-ES-15: the DATALINK End System shall discard any corrupted message,
- SR-ES-16: the DATALINK End System shall indicate to the flight crew a detected loss of any service,
- SR-ES-17: the DATALINK End System shall indicate to the flight crew when a message cannot be successfully transmitted,
- SR-ES-18: the DATALINK End System shall prevent the release of responses to clearances without flight crew action,
- SR-ES-19: the DATALINK End System shall prohibit operational processing by flight crew of corrupted messages,
- SR-ES-20: the DATALINK End System shall prohibit to the flight crew operational processing of messages not addressed to the aircraft,
- SR-ES-21: the DATALINK End System shall reject messages not intended for itself,
- SR-ES-22: the DATALINK End System shall respond to messages in their entirety or allow the flight crew to do it,
- SR-ES-23: the DATALINK End System shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position),
- SR-ES-24: the DATALINK End System shall process the message without affecting the intent of the message,
- SR-ES-25: the DATALINK End System shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link,
- SR-ES-26: the DATALINK End System shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link, that is used to define the aircraft's active flight plan,
- SR-ES-27: the DATALINK End System shall transmit messages to the designated ATSU,
- SR-ES-28: the DATALINK End System shall transmit reports to the end system designated in the ADS-C contract,
- SR-ES-29: the DATALINK End System shall prohibit after the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the use of any CPDLC service prior to initiation of a new logon,
- SR-ES-30: the DATALINK End System shall identify each downlink message uniquely for a given aircraft-ATSU pair,
- SR-ES-31: the DATALINK End System shall send for the data link initiation correlation unique and unambiguous aircraft identifiers (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address),
- SR-ES-32: the DATALINK End System shall display the indication provided by the ATSU when a data link initiation request (logon) by the flight crew is rejected,
- SR-ES-33: the DATALINK End System shall be able to determine the message initiator,

- SR-ES-34: the DATALINK End System shall be capable to send an indication to ground system whenever a message is discarded,
- SR-ES-35: the DATALINK End System shall include in each ADS report the time at position within one ± second of the UTC time the aircraft was actually at the position provided in the report,
- SR-ES-36: the DATALINK End System shall indicate in each response to which message it refers,
- SR-ES-37: the DATALINK End System shall process the route information contained with the route clearance uplink message received from the ATSU,
- SR-ES-38: the DATALINK End System shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established,
- SR-ES-39: the DATALINK End System shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU,
- SR-ES-40: the DATALINK End System shall provide to the flight crew an indication of the ATSU that has established CPDLC service,
- SR-ES-41: the DATALINK End System shall provide unambiguous and unique identification of the origin and destination of each message it transmits,
- SR-ES-42: the DATALINK End System shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA),
- SR-ES-43: the DATALINK End System shall time stamp to within one second UTC each message when it is released for onward transmission,
- SR-ES-44: the DATALINK End System shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU,
- SR-ES-45: the DATALINK End System shall discard the message and send an indication to the ATSU when a received message contains a time stamp in order than the current time minus ET_{TRN},
- SR-ES-46: the DATALINK End System shall notify the flight crew when an indication from the ATSU indicating that a message has been discarded, has been received,
- SR-ES-47: the DATALINK End System shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established,
- SR-ES-48: the DATALINK End System shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service.

The following Safety Requirements have been identified to be applicable to the Routing System:

- SR-RS-06: the DATALINK Routing System shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service,
- SR-RS-07: the DATALINK Routing System shall discard any corrupted message,
- SR-RS-08: the DATALINK Routing System shall indicate to the flight crew a detected loss of any service,
- SR-RS-09: the DATALINK Routing System shall indicate to the flight crew when a message cannot be successfully transmitted,
- SR-RS-10: the DATALINK Routing System shall prevent the release of responses to clearances without flight crew action,
- SR-RS-11: the DATALINK Routing System shall prohibit operational processing by flight crew of corrupted messages,
- SR-RS-12: the DATALINK Routing System shall prohibit to the flight crew operational processing of messages not addressed to the aircraft,
- SR-RS-13: the DATALINK Routing System shall reject messages not intended for itself,
- SR-RS-14: the DATALINK Routing System shall respond to messages in their entirety or allow the flight crew to do it,
- SR-RS-15: the DATALINK Routing System shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position),

- SR-RS-16: the DATALINK Routing System shall process the message without affecting the intent of the message,
- SR-RS-17: the DATALINK Routing System shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link,
- SR-RS-18: the DATALINK Routing System shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link, that is used to define the aircraft's active flight plan,
- SR-RS-19: the DATALINK Routing System shall transmit messages to the designated ATSU,
- SR-RS-20: the DATALINK Routing System shall transmit reports to the end system designated in the ADS-C contract.

The following Safety Requirements have been identified to be applicable to the Communication System:

- SR-CS-06: the DATALINK Communication System shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service,
- SR-CS-07: the DATALINK Communication System shall discard any corrupted message,
- SR-CS-08: the DATALINK Communication System shall indicate to the flight crew a detected loss of any service,
- SR-CS-09: the DATALINK Communication System shall indicate to the flight crew when a message cannot be successfully transmitted,
- SR-CS-10: the DATALINK Communication System shall prevent the release of responses to clearances without flight crew action,
- SR-CS-11: the DATALINK Communication System shall prohibit operational processing by flight crew of corrupted messages,
- SR-CS-12: the DATALINK Communication System shall prohibit to the flight crew operational processing of messages not addressed to the aircraft,
- SR-CS-13: the DATALINK Communication System shall reject messages not intended for itself,
- SR-CS-14: the DATALINK Communication System shall respond to messages in their entirety or allow the flight crew to do it,
- SR-CS-15: the DATALINK Communication System shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position),
- SR-CS-16: the DATALINK Communication System shall process the message without affecting the intent of the message.

5.2.4 Quantitative performance requirements

The quantitative performance requirements applicable to the aircraft system are reminded hereafter.

Requirement list			
Ref.	**Parameter**	**Value**	**Title**
PR_AC_01	Transaction Time	23 seconds	The maximum transaction time in Aircraft shall be less than 23 seconds for any messages in APT, TMA and ENR-1 domains
PR_AC_02	Transaction Time	5 seconds	The maximum transaction time in Aircraft shall be less than 5 seconds for any messages in ENR-2 domain
PR_AC_03	Transaction Time	10 seconds	The nominal transaction time in Aircraft shall be less than 10 seconds for any messages in APT, TMA and ENR-1 domains
PR_AC_04	Transaction Time	3 seconds	The nominal transaction time in Aircraft shall be less than 3 seconds for any messages in ENR-2 domain
PR_AC_05	Availability	99.00%	The availability of the aircraft system shall be more than 99.00%
PR_AC_08	Continuity	0.999	The continuity of the AC system shall be more than 0.999

Table 50: AC Quantitative performance requirements

5.2.4.1 Transaction Time (Continuity)

The performance requirements regarding transaction time of message by aircraft system are:

- The maximum transaction time (one way) in aircraft shall be less than 5 seconds for any messages (PR_AC_02);
- The nominal transaction time (one way) in aircraft shall be less than 3 seconds for any messages (PR_AC_04);
- The continuity of the AC system shall be more than 0.999.

Transaction time is allocated on the different components using arithmetic distribution. The following table presents the result of this allocation.

Objective (one way transmission) (downlink or uplink)	End System	Interface between End and Routing Systems	Routing System	Interface between Routing and Communication Systems	Communication System
Nominal: 3 sec	1.5 sec	0.25 sec	0.5 sec	0.25 sec	0.5 sec
Maximum: 5 sec	2.25 sec	0.5 sec	0.75 sec	0.5 sec	1 sec

The following Performance Requirements have been identified to be applicable to the End System:

- PR-ES-01: The nominal delay introduced by the End System for a one way transmission (downlink or uplink) shall be less than 1.5 second,
- PR-ES-02: The maximum delay introduced by the End System for a one way transmission (downlink or uplink) shall be less than 2.25 seconds,
- PR-ES-05: the continuity of the End System shall be more than 0.999

The following Performance Requirements have been identified to be applicable to the Routing System:

- PR-RS-01: The nominal delay introduced by the Routing System including interface delays for a one way transmission (downlink or uplink) shall be less than 1 second,
- PR-RS-02: The maximum delay introduced by the Routing System including interface delay for a one way transmission (downlink or uplink) shall be less than 1.75 seconds,
- PR-RS-05: the continuity of the Routing System shall be more than 0.999

The following Performance Requirements have been identified to be applicable to the Communication System:

- PR-CS-01: The nominal delay introduced by the Communication System for a one way transmission (downlink or uplink) shall be less than 0.5 second,
- PR-CS-02: The maximum delay introduced by the Communication System for a one way transmission (downlink or uplink) shall be less than 1 seconds,
- PR-CS-05: the continuity of the Communication System shall be more than 0.999

5.2.4.2 Availability

The performance requirements regarding availability of aircraft system is:

- PR_AC_05: The availability of the aircraft system shall be more than 99.00%

In order to fulfill this availability requirement, the likelihood that the aircraft system is unavailable has to be less than 1.0 E-02/FH.

The requirements SR-ES-01, SR-RS-01 and SR-CS-01 lead to a probability of loss less that 1.0 E-03/FH which is deemed acceptable.

Thus there is no need to define a more stringent quantitative availability requirement, and Safety requirements SR-ES-01, SR-RS-01 and SR-CS-01 still applicable for Performance.

5.2.5 Qualitative performance requirements

The qualitative performance requirements applicable to the aircraft system are reminded hereafter:

Requirement list		
Ref.	**Parameter**	**Title**
PR_AC_06	Availability	The aircraft system shall be capable of detecting aircraft system failures or loss of air/ground communication that would cause the aircraft communication capability to no longer meet the requirements for the intended function.
PR_AC_07	Availability	When the aircraft communication capability no longer meets the requirements for the intended function, the aircraft system shall provide indication to the flight crew.

Table 51: AC Qualitative performance requirements

The following Performance Requirements have been identified to be applicable to the End System:

- PR-ES-03: The End System shall indicate a detected loss of DATALINK services,
- PR-ES-04: The End System shall indicate when a message cannot be successfully transmitted

The following Performance Requirements have been identified to be applicable to the Routing System:

- PR-RS-03: The Routing System shall indicate a detected loss of DATALINK services,
- PR-RS-04: The Routing System shall indicate when a message cannot be successfully transmitted

The following Performance Requirements have been identified to be applicable to the Communication System:

- PR-CS-03: The Communication System shall indicate a detected loss of DATALINK services,
- PR-CS-04: The Communication System shall indicate when a message cannot be successfully transmitted

5.3 Summary of Safety and Performance requirements applicable to airborne End System, Routing System and Communication System

5.3.1 Summary of Safety and Performance requirements applicable to airborne End System

Requirement list		
Ref.	**Title**	**Source**
SR-ES-01	the likelihood that the datalink End System is unavailable shall be less than 3.33 E-06/FH	SR-AC-47

Requirement list		
Ref.	**Title**	**Source**
SR-ES-02	the likelihood that the loss of ADS-C aircraft systems is detected shall be less than 5.00 E-04/FH	SR-AC-51
SR-ES-03	the likelihood that the loss of ADS-C aircraft systems is undetected shall be less than 5.00 E-06/FH	SR-AC-45
SR-ES-04	the likelihood that the CPDLC aircraft system is unavailable shall be less than 5.00 E-04/FH	SR-AC-38
SR-ES-05	the likelihood that the DATALINK End System corrupts DATALINK message (downlink or uplink) shall be less than 2.95 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-ES-06	the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the End System shall be less than 2.95 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-ES-07	the likelihood that the DATALINK End System fails to detect a corrupted message (downlink or uplink) shall be less than 2.00 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-ES-08	the likelihood of an undetected corrupted datalink message (downlink or uplink) due to the End System shall be less than 4.90 E-06/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-ES-09	the likelihood of an undetected corrupted datalink message (downlink or uplink) due to incorrect data provided by the End System shall be less than 4.90 E-06/FH	SR-AC-41, SR-AC-42
SR-ES-10	the likelihood that the datalink End System spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 5.90 E-04/FH	SR-AC-33, SR-AC-35 SR-AC-36, SR-AC-37 SR-AC-39, SR-AC-40 SR-AC-46
SR-ES-11	the likelihood that the datalink End System fails to detect an unexpected message (downlink or uplink) shall be less than 2.00 E-04/FH	SR-AC-33, SR-AC-35 SR-AC-36, SR-AC-37 SR-AC-39, SR-AC-40 SR-AC-46
SR-ES-12	the likelihood of an undetected unexpected datalink message (downlink or uplink) due to the End System shall be less than 9.80 E-06/FH	SR-AC-43, SR-AC-44
SR-ES-13	the Development Assurance Level of the DATALINK End System shall be at least “C”, as per ED12C/DO178C	
SR-ES-14	the DATALINK End System shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service	SR-AC-07
SR-ES-15	the DATALINK End System shall discard any corrupted message	SR-AC-10
SR-ES-16	the DATALINK End System shall indicate to the flight crew a detected loss of any service	SR-AC-13
SR-ES-17	the DATALINK End System shall indicate to the flight crew when a message cannot be successfully transmitted	SR-AC-14
SR-ES-18	the DATALINK End System shall prevent the release of responses to clearances without flight crew action	SR-AC-15
SR-ES-19	the DATALINK End System shall prohibit operational processing by flight crew of corrupted messages	SR-AC-17
SR-ES-20	the DATALINK End System shall prohibit to the flight crew operational processing of messages not addressed to the aircraft	SR-AC-18
SR-ES-21	the DATALINK End System shall reject messages not intended for itself	SR-AC-24
SR-ES-22	the DATALINK End System shall respond to messages in their entirety or allow the flight crew to do it	SR-AC-26
SR-ES-23	the DATALINK End System shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position)	SR-AC-31
SR-ES-24	the DATALINK End System shall process the message without affecting the intent of the message	SR-AC-02
SR-ES-25	the DATALINK End System shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link	SR-AC-20
SR-ES-26	the DATALINK End System shall be capable to ensure the correct transfer into or out of the aircraft’s FMS of route data received and sent via data link, that is used to define the aircraft’s active flight plan	SR-AC-08
SR-ES-27	the DATALINK End System shall transmit messages to the designated ATSU	SR-AC-28
SR-ES-28	the DATALINK End System shall transmit reports to the end system designated in the ADS-C contract	SR-AC-29

Requirement list		
Ref.	**Title**	**Source**
SR-ES-29	the DATALINK End System shall prohibit after the end of a flight or after a power cycle resulting in a cold start or when CPDLC is turned off by aircraft systems, the use of any CPDLC service prior to initiation of a new logon	SR-AC-01
SR-ES-30	the DATALINK End System shall identify each downlink message uniquely for a given aircraft-ATSU pair	SR-AC-03
SR-ES-31	the DATALINK End System shall send for the data link initiation correlation unique and unambiguous aircraft identifiers (e.g. the Aircraft Identification and either the Registration Marking or the 24-bit Aircraft Address)	SR-AC-04
SR-ES-32	the DATALINK End System shall display the indication provided by the ATSU when a data link initiation request (logon) by the flight crew is rejected	SR-AC-05
SR-ES-33	the DATALINK End System shall be able to determine the message initiator	SR-AC-06
SR-ES-34	the DATALINK End System shall be capable to send an indication to ground system whenever a message is discarded	SR-AC-09
SR-ES-35	the DATALINK End System shall include in each ADS report the time at position within one ± second of the UTC time the aircraft was actually at the position provided in the report	SR-AC-11
SR-ES-36	the DATALINK End System shall indicate in each response to which message it refers	SR-AC-12
SR-ES-37	the DATALINK End System shall process the route information contained with the route clearance uplink message received from the ATSU	SR-AC-16
SR-ES-38	the DATALINK End System shall provide an indication to the flight crew when a CPDLC connection for a given aircraft-ATSU pair is established	SR-AC-19
SR-ES-39	the DATALINK End System shall provide to the ATSU an indication when the aircraft system rejects a CPDLC connection request initiated by the ATSU	SR-AC-21
SR-ES-40	the DATALINK End System shall provide to the flight crew an indication of the ATSU that has established CPDLC service	SR-AC-22
SR-ES-41	the DATALINK End System shall provide unambiguous and unique identification of the origin and destination of each message it transmits	SR-AC-23
SR-ES-42	the DATALINK End System shall reject operational CPDLC messages from an ATSU that is not the current ATC Data Authority (CDA)	SR-AC-25
SR-ES-43	the DATALINK End System shall time stamp to within one second UTC each message when it is released for onward transmission	SR-AC-27
SR-ES-44	the DATALINK End System shall use the actual route of flight computed by the aircraft system for ADS-C reports sent to the ATSU	SR-AC-30
SR-ES-45	the DATALINK End System shall discard the message and send an indication to the ATSU when a received message contains a time stamp in order than the current time minus ET_{TRN}	SR-AC-49
SR-ES-46	the DATALINK End System shall notify the flight crew when an indication from the ATSU indicating that a message has been discarded, has been received	SR-AC-50
SR-ES-47	the DATALINK End System shall indicate in each ADS-C report the unique reference identifier provided by the ATSU when the contract was established	SR-AC-32
SR-ES-48	the DATALINK End System shall be capable of detecting errors in uplink messages that would result in mis-delivery introduced by the communication service	SR-AC-42
PR-ES-01	The nominal delay introduced by the End System for a one way transmission (downlink or uplink) shall be less than 1.5 second	PR-AC-02
PR-ES-02	The maximum delay introduced by the End System for a one way transmission (downlink or uplink) shall be less than 2.25 seconds	PR-AC-04
PR-ES-03	The End System shall indicate a detected loss of DATALINK services	PR-AC-06
PR-ES-04	The End System shall indicate when a message cannot be successfully transmitted	PR-AC-07
PR-ES-05	the continuity of the End System shall be more than 0.999	PR-AC-08

5.3.2 Summary of Safety and Performance requirements applicable to airborne Routing System

Requirement list		
Ref.	**Title**	**Source**
SR-RS-01	the likelihood that the Datalink Routing System is unavailable shall be less than 3.33 E-06/FH	SR-AC-47
SR-RS-02	the likelihood that the Routing System corrupts datalink message (downlink or uplink) shall be less than 1.00 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-RS-03	the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the Routing System shall be less than 1.00 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-RS-04	the likelihood that the Routing System spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 2.00 E-04/FH	SR-AC-33, SR-AC-35 SR-AC-36, SR-AC-37 SR-AC-39, SR-AC-40 SR-AC-46
SR-RS-05	the Development Assurance Level of the DATALINK Routing System shall be at least "D", as per ED12C/DO178C	
SR-RS-06	the DATALINK Routing System shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service	SR-AC-07
SR-RS-07	the DATALINK Routing System shall discard any corrupted message	SR-AC-10
SR-RS-08	the DATALINK Routing System shall indicate to the flight crew a detected loss of any service	SR-AC-13
SR-RS-09	: the DATALINK Routing System shall indicate to the flight crew when a message cannot be successfully transmitted	SR-AC-14
SR-RS-10	the DATALINK Routing System shall prevent the release of responses to clearances without flight crew action	SR-AC-15
SR-RS-11	the DATALINK Routing System shall prohibit operational processing by flight crew of corrupted messages	SR-AC-17
SR-RS-12	the DATALINK Routing System shall prohibit to the flight crew operational processing of messages not addressed to the aircraft	SR-AC-18
SR-RS-13	the DATALINK Routing System shall reject messages not intended for itself	SR-AC-24
SR-RS-14	the DATALINK Routing System shall respond to messages in their entirety or allow the flight crew to do it	SR-AC-26
SR-RS-15	the DATALINK Routing System shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position)	SR-AC-31
SR-RS-16	the DATALINK Routing System shall process the message without affecting the intent of the message	SR-AC-02
SR-RS-17	the DATALINK Routing System shall be capable to ensure the correct transfer out the aircraft avionics route data sent via data link	SR-AC-20
SR-RS-18	the DATALINK Routing System shall be capable to ensure the correct transfer into or out of the aircraft's FMS of route data received and sent via data link, that is used to define the aircraft's active flight plan	SR-AC-08
SR-RS-19	the DATALINK Routing System shall transmit messages to the designated ATSU	SR-AC-28
SR-RS-20	the DATALINK Routing System shall transmit reports to the end system designated in the ADS-C contract	SR-AC-29
PR-RS-01	The nominal delay introduced by the Routing System including interface delays for a one way transmission (downlink or uplink) shall be less than 1 second	PR-AC-02
PR-RS-02	The maximum delay introduced by the Routing System including interface delay for a one way transmission (downlink or uplink) shall be less than 1.75 seconds	PR-AC-04
PR-RS-03	The Routing System shall indicate a detected loss of DATALINK services	PR-AC-06
PR-RS-04	The Routing System shall indicate when a message cannot be successfully transmitted	PR-AC-07
PR-RS-05	the continuity of the Routing System shall be more than 0.999	PR-AC-08

5.3.3 Summary of Safety and Performance requirements applicable to airborne Communication System

Requirement list		
Ref.	**Title**	**Source**
SR-CS-01	the likelihood that the Datalink Communication System is unavailable shall be less than 3.33 E-06/FH	SR-AC-47
SR-CS-02	the likelihood that the Communication System corrupts datalink message (downlink or uplink) shall be less than 1.00 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-CS-03	the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the Communication System shall be less than 1.00 E-04/FH	SR-AC-34, SR-AC-41 SR-AC-42, SR-AC-48
SR-CS-04	the likelihood that the Communication System spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 2.00 E-04/FH	SR-AC-33, SR-AC-35 SR-AC-36, SR-AC-37 SR-AC-39, SR-AC-40 SR-AC-46
SR-CS-05	the Development Assurance Level of the DATALINK Communication System shall be at least “D”, as per ED12C/DO178C	
SR-CS-06	the DATALINK Communication System shall be capable of detecting errors in uplink messages that would result in corruption introduced by the communication service	SR-AC-07
SR-CS-07	the DATALINK Communication System shall discard any corrupted message	SR-AC-10
SR-CS-08	the DATALINK Communication System shall indicate to the flight crew a detected loss of any service	SR-AC-13
SR-CS-09	the DATALINK Communication System shall indicate to the flight crew when a message cannot be successfully transmitted	SR-AC-14
SR-CS-10	the DATALINK Communication System shall prevent the release of responses to clearances without flight crew action	SR-AC-15
SR-CS-11	the DATALINK Communication System shall prohibit operational processing by flight crew of corrupted messages	SR-AC-17
SR-CS-12	the DATALINK Communication System shall prohibit to the flight crew operational processing of messages not addressed to the aircraft	SR-AC-18
SR-CS-13	the DATALINK Communication System shall reject messages not intended for itself	SR-AC-24
SR-CS-14	the DATALINK Communication System shall respond to messages in their entirety or allow the flight crew to do it	SR-AC-26
SR-CS-15	the DATALINK Communication System shall provide a means of enhancing flight crew awareness for when to execute a clearance containing a deferred action when the associated condition is met (i.e. based on a level, time or position)	SR-AC-31
SR-CS-16	the DATALINK Communication System shall process the message without affecting the intent of the message	SR-AC-02
PR-CS-01	The nominal delay introduced by the Communication System for a one way transmission (downlink or uplink) shall be less than 0.5 second	PR-AC-02
PR-CS-02	The maximum delay introduced by the Communication System for a one way transmission (downlink or uplink) shall be less than 1 second	PR-AC-04
PR-CS-03	The Communication System shall indicate a detected loss of DATALINK services	PR-AC-06
PR-CS-04	The Communication System shall indicate when a message cannot be successfully transmitted	PR-AC-07
PR-CS-05	the continuity of the Communication System shall be more than 0.999	PR-AC-08

6 Definition of safety and performance requirements applicable to the communication ground system

This chapter is based on the document [4].

Note, however, that despite acknowledging the applicability of (EC) No 482/2008, document [4] does not take it into account when assigning Assurance Levels. Where AL5 was allocated, AL4 should be used. Assurance Level AL4 provides more evidence than Software Level D in the airborne environment, but less that Software Level C, which is equivalent to Assurance Level AL3.

AL5 does not require requirements to be verifiable; neither does it require checks that algorithms are accurate, nor test procedures are correct. It does not require test results to be checked, nor discrepancies in them to be explained. So, given that, it is not feasible to provide an assurance argument, to the satisfaction of a National Supervisory Authority, that, for example, 'safety requirements are adequately satisfied and they are traceable to the level at which satisfaction is demonstrated'. The evidence set of AL4 does allow this argument to be made.

6.1 Functional description of the ground system

The ATSP system as referred to in this document includes all sub-systems associated data communications on ground.

For the purpose of this analysis, it will be considered that the ATSP is made up of:

- Air Ground Communications System Provision (ACSP);
- Air Traffic Service Unit (ATSU).

The Air Ground Communications System Provision part of the ATSP system considered for the purpose of this section includes:

- SBB Space Segment;
- SBB Ground Segment;
- ATN Gateway;

This set of components is called “ACSP” thereafter.

The Air Traffic Service Unit part of the ATSP system considered for the purpose of this section includes:

- Multiple ATSU systems.

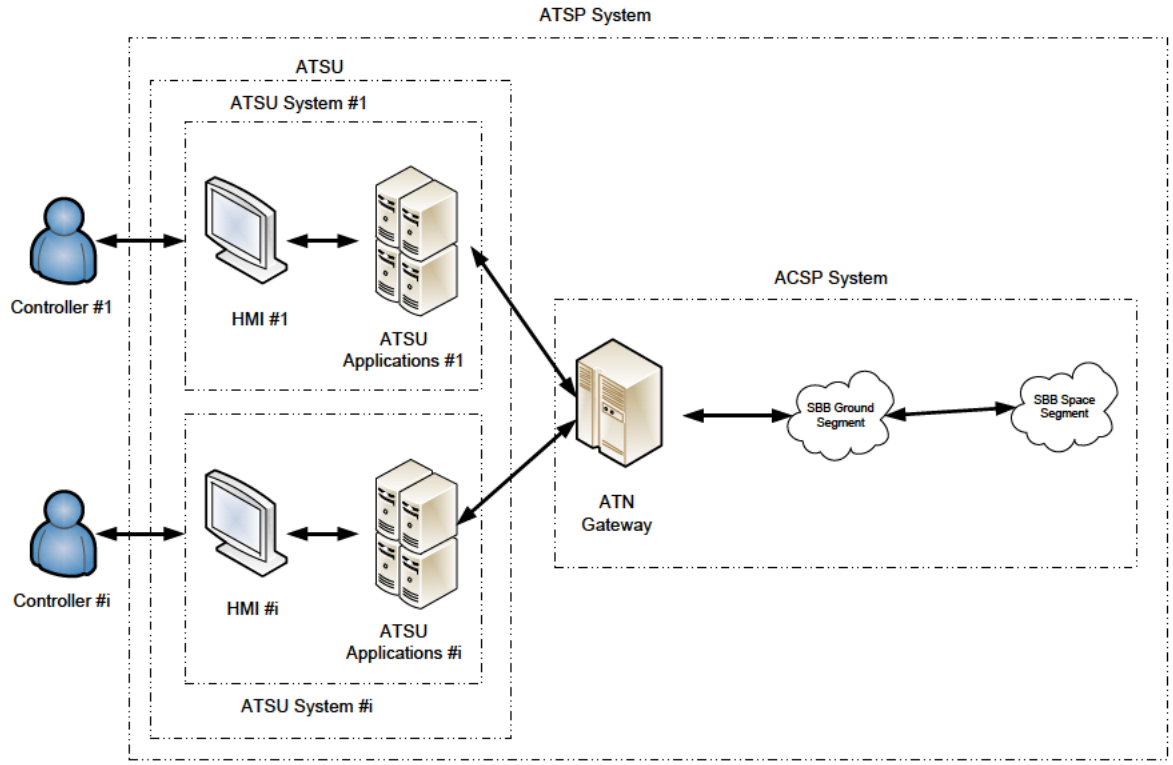

Figure 33 : ATSP System Components.

6.2 Allocation of Safety and Performance Requirements to the ATSP system components

6.2.1 Introduction and assumptions

This section identifies the components which could be involved in the degradation of the performance and safety level with regards to the requirements identified previously.

Then, the safety and performance requirements are apportioned to the different parts of the ATSP system. Furthermore, recommendations are derived on the ACSP and ATSU components in order to reach these requirements.

For the purpose of the analysis the following assumption related to ATSP system architecture is defined:

- **ASSUMP_GD_01**: The end-to-end integrity checks are performed by the ATSU.

Note: the term “integrity” deals with the hazards assessed in the OSA (Operational Safety Analysis), leading to amongst other things:

- Undetected corruption;
- Undetected misdirection;
- Undetected spurious;
- Undetected delivery of a delayed message after expiration time;
- Undetected loss of communication and user attempts to initiate a transaction.

This analysis will also make use of the following assumption, defined in the ED228 document [3]:

-**ASSUMP_IPr_13**: Future Datalink implementation within aircraft systems are expected to be developed at least ED109A/DO278A [6] based Assurance Level consistent with its failure condition categorization.

6.2.2 Quantitative safety requirements

6.2.2.1 Introduction

The quantitative safety requirements applicable to the ground system are reminded hereafter.

Requirement list				
Ref.	**Parameter**	**Value (per H)**	**Title**	**Classification**
SR-GD-52	Delay of message	1.40 E-04	The likelihood of a delayed message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	SC4 (Minor (MIN))
SR-GD-53	Detection of corrupted message	1.00 E-05	The likelihood of the detected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-04/H.	SC4 (Minor (MIN))
SR-GD-54	Detection of delayed message	1.40 E-04	The likelihood of the detected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-04/H.	SC4 (Minor (MIN))
SR-GD-55	Detection of spurious message	7.00 E-05	The l kelihood of the detected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	SC4 (Minor (MIN))
SR-GD-56	Availability	5.00 E-04	The likelihood of the detected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	SC4 (Minor (MIN))
SR-GD-57	Availability	1.00 E-03	The l kelihood of the detected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	SC4 (Minor (MIN))
SR-GD-58	Availability	1.00 E-03	The likelihood of the detected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H.	SC4 (Minor (MIN))
SR-GD-59	Detection of misdirected message	2.90 E-04	The l kelihood of the detected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	SC4 (Minor (MIN))
SR-GD-60	Availability	1.00 E-05	The likelihood that all ground systems are unavailable (undetected) shall be less than 1.0E-05/H.	SC3 (Major (MAJ))
SR-GD-61	Availability	5.00 E-04	The likelihood of the loss of CPDLC capability [single aircraft] due to ground systems shall be less than 5.0E-04/H.	SC4 (Minor (MIN))
SR-GD-62	Loss of message	7.00 E-05	The l kelihood of a lost message [single aircraft] due to ground systems shall be less than 7.0E-05/H.	SC4 (Minor (MIN))
SR-GD-63	Misdirection of message	2.90 E-04	The l kelihood of a misdirected message [single aircraft] due to ground systems shall be less than 2.9E-04/H.	SC4 (Minor (MIN))
SR-GD-64	Detection of corrupted message	1.00 E-07	The likelihood of the undetected corruption due to incorrect data [single aircraft] provided by ATSP shall be less than 2.5E-06/H.	SC3 (Major (MAJ))
SR-GD-66	Detection of corrupted message	1.00 E-07	The likelihood of the undetected corruption of a message [single aircraft] due to ground systems shall be less than 2.5E-06/H.	SC3 (Major (MAJ))
SR-GD-67	Detection of delayed message	1.40 E-06	The likelihood of the undetected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-06/H.	SC3 (Major (MAJ))
SR-GD-68	Detection of spurious message	7.00 E-07	The likelihood of the undetected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-07/H.	SC3 (Major (MAJ))
SR-GD-69	Availability	5.00 E-06	The likelihood of the undetected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-06/H.	SC3 (Major (MAJ))
SR-GD-70	Availability	9.90 E-06	The l kelihood of the undetected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 9.99E-06/H.	SC3 (Major (MAJ))
SR-GD-71	Availability	9.75 E-06	The l kelihood of the undetected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 9.75E-06/H.	SC3 (Major (MAJ))
SR-GD-72	Detection of misdirected	2.90 E-06	The l kelihood of the undetected misdirection of a message [single aircraft] due	SC3 (Major (MAJ))

Requirement list				
Ref.	**Parameter**	**Value (per H)**	**Title**	**Classification**
	message		to ground systems shall be less than 2.9E-06/H.	
SR-GD-73	Availability	1.00 E-05	The likelihood that all ground systems are unavailable (detected) shall be less than 1.0E-05/H.	SC3 (Major (MAJ))
SR-GD-74	Detection of corrupted message	1.00 E-05	The likelihood that the ATSP provides incorrect data [single aircraft] shall be less than 2.5E-04/H.	SC4 (Minor (MIN))

Table 52: ATSP Quantitative safety requirements

6.2.2.2 Loss of DATALINK capability

The safety requirements regarding availability of DATALINK ground system are:

- SR-GD-56: the likelihood of the detected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-04/H,
- SR-GD-57: the likelihood of the detected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H,
- SR-GD-58: the likelihood of the detected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 1.0E-03/H,
- SR-GD-60: the likelihood that all ground systems are unavailable (undetected) shall be less than 1.0E-05/H,
- SR-GD-61: the likelihood of the loss of CPDLC capability [single aircraft] due to ground systems shall be less than 5.0E-04/H,
- SR-GD-69: the likelihood of the undetected loss of ADS-C capability [single aircraft] due to ground systems shall be less than 5.0E-06/H,
- SR-GD-70: the likelihood of the undetected loss of ADS-C capability [multiple aircraft] due to ground systems shall be less than 9.99E-06/H,
- SR-GD-71: the likelihood of the undetected loss of CPDLC capability [multiple aircraft] due to ground systems shall be less than 9.75E-06/H,
- SR-GD-73: likelihood that all ground systems are unavailable (detected) shall be less than 1.0E-05/H.

The potential causes for this failure condition to occur are:

- The ATSU is unable to provide ATS functions,
- The ACSP System is inoperative,

The figure below provides the fault tree for this failure condition and allocation to the system components (equipartition):

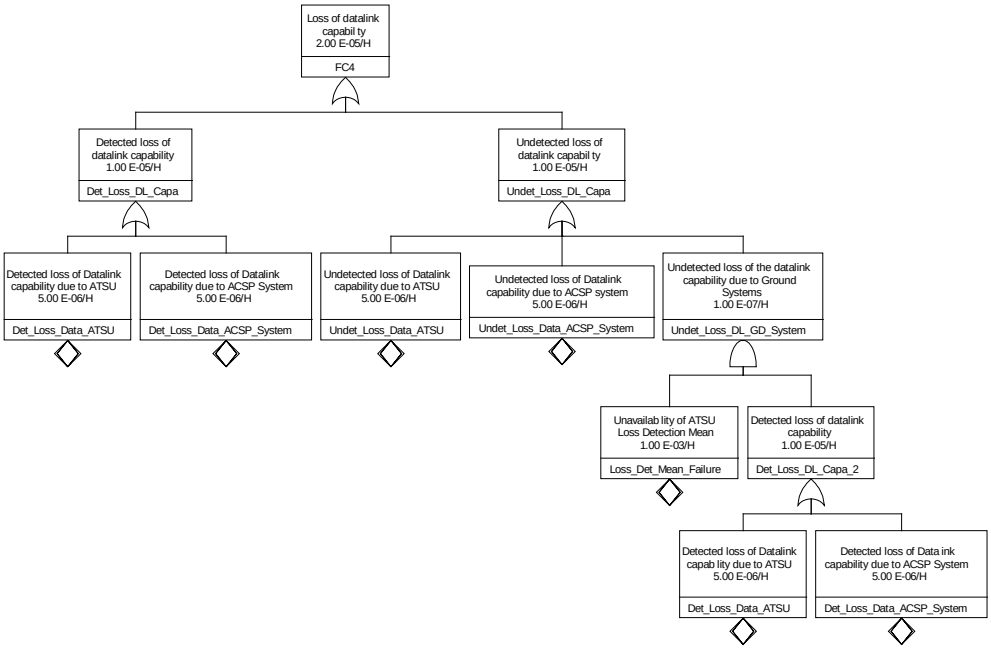

Figure 34 : Loss of ATSP datalink capability fault tree.

The following Safety Requirements have been identified to be applicable to the ACSP System:

- SR-SP-01: the likelihood that the datalink ACSP System is unavailable (detected) shall be less than 5.00 E-06/H,
- SR-SP-02: the likelihood that the datalink ACSP System is unavailable (undetected) shall be less than 5.00 E-06/H,

The following Safety Requirements have been identified to be applicable to the ATSU:

- SR-SU-01: the likelihood that the Datalink ATSU is unavailable (detected) shall be less than 5.00 E-06/H,
- SR-SU-02: the likelihood that the Datalink ATSU is unavailable (undetected) shall be less than 5.00 E-06/H,
- SR-SU-03: the likelihood that the loss of ADS-C ground systems is detected shall be less than 5.00 E-04/H,
- SR-SU-04: the likelihood that the loss of ADS-C ground systems is undetected shall be less than 5.00 E-06/H,
- SR-SU-05: the likelihood that the CPDLC ground system is unavailable shall be less than 5.00 E-04/H.

6.2.2.3 Erroneous datalink message

The safety requirements regarding corruption of datalink ground system are:

- SR-GD-53: the likelihood of the detected corruption of a message [single aircraft] due to ground systems shall be less than 1.0E-05/H.
- SR-GD-64: the likelihood of the undetected corruption due to incorrect data [single aircraft] provided by ATSP shall be less than 1.0E-07/H.
- SR-GD-66: the likelihood of the undetected corruption of a message [single aircraft] due to ground systems shall be less than 1.0E-07/H.
- SR-GD-74: the likelihood that the ATSP provides incorrect data [single aircraft] shall be less than 1.0E-05/H.

The potential causes for this failure condition to occur are:

- The ATSU is unable to detect a corrupted message.
- The ATSU corrupts the message, after having checked the end to end integrity, when processing it.

The figure below provides the fault tree for this failure condition and allocation to the system components (the chosen repartition is 1% undetected and 99% detected, equipartition between ATSU and incorrect data provided by ATSU):

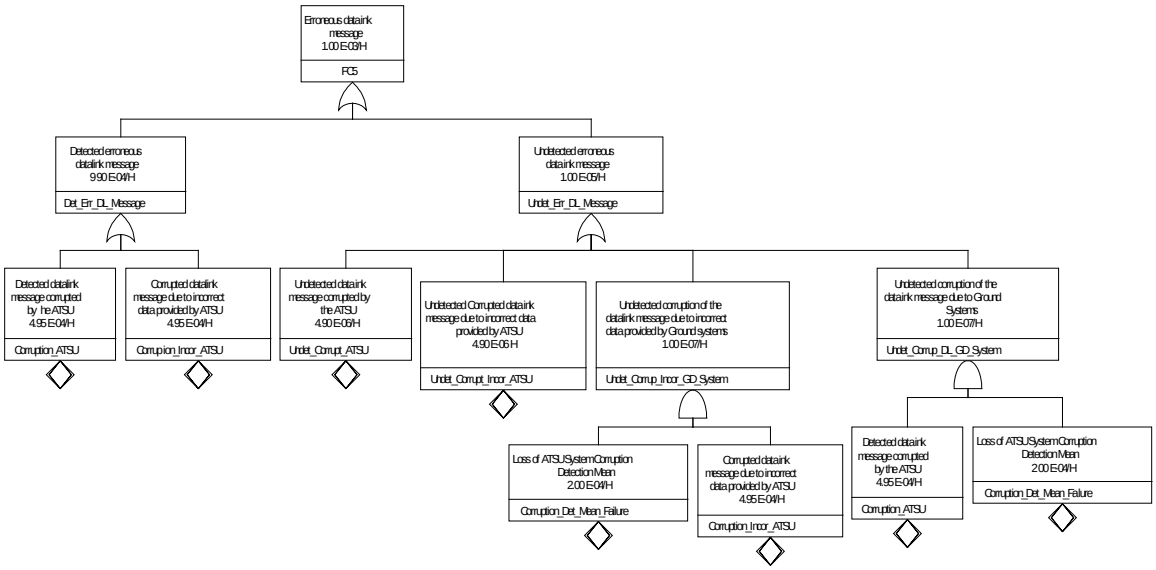

Figure 35 : ATSP Erroneous DATALINK message fault tree.

The following Safety Requirements have been identified to be applicable to the ATSU:

- SR-SU-06: the likelihood that the DATALINK ATSU corrupts DATALINK message (downlink or uplink) shall be less than 4.95 E-04/H,
- SR-SU-07: the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the ATSU shall be less than 4.95 E-04/H,
- SR-SU-08: the likelihood that the DATALINK ATSU fails to detect a corrupted message (downlink or uplink) shall be less than 2.00 E-04/H,
- SR-SU-09: the likelihood of an undetected corrupted datalink message (downlink or uplink) due to the ATSU shall be less than 4.90 E-06/H.
- SR-SU-10: the likelihood of an undetected corrupted datalink message (downlink or uplink) due to incorrect data provided by the ATSU shall be less than 4.90 E-06/H,

6.2.2.4 Unexpected datalink message

The safety requirements regarding availability of aircraft communication systems are:

- SR-GD-52: the likelihood of a delayed message [single aircraft] due to ground systems shall be less than 1.4E-04/H,
- SR-GD-54: the likelihood of the detected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-04/H,

- SR-GD-55: the likelihood of the detected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-05/H,
- SR-GD-59: the likelihood of the detected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-04/H,
- SR-GD-62: the likelihood of a lost message [single aircraft] due to ground systems shall be less than 7.0E-05/H,
- SR-GD-63: the likelihood of a misdirected message [single aircraft] due to ground systems shall be less than 2.9E-04/H,
- SR-GD-67: the likelihood of the undetected delay of a message [single aircraft] due to ground systems shall be less than 1.4E-06/H,
- SR-GD-68: the likelihood of the undetected generation of a spurious message [single aircraft] due to ground systems shall be less than 7.0E-07/H,
- SR-GD-72: the likelihood of the undetected misdirection of a message [single aircraft] due to ground systems shall be less than 2.9E-06/H.

The potential causes for this failure condition to occur are:

- The ATSU misbehaves, after having checked the end to end integrity, when processing it,
- The ATSU is unable to detect an unexpected message,

The figure below provides the fault tree for this failure condition and allocation to the system components (the chosen repartition is 1% undetected and 99% detected):

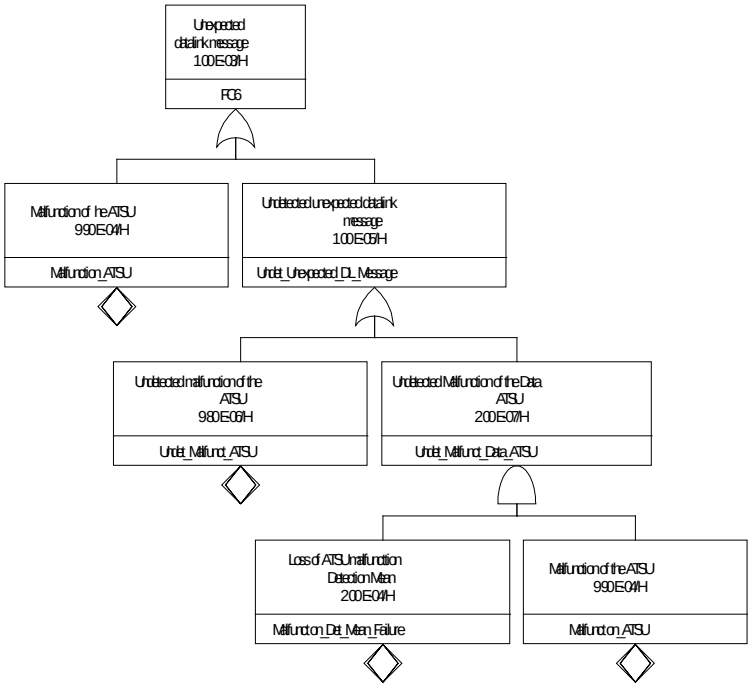

Figure 36 : ATSP Unexpected datalink message fault tree.

The following Safety Requirements have been identified to be applicable to the ATSU:

- SR-SU-11: the likelihood that the datalink ATSU spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 9.90 E-04/H,
- SR-SU-12: the likelihood that the datalink ATSU fails to detect an unexpected message (downlink or uplink) shall be less than 2.00 E-04/H,

- SR-SU-13: the likelihood of an undetected unexpected datalink message (downlink or uplink) due to the ATSU shall be less than 9.80 E-06/H.

6.2.2.5 Assurance Level (AL)

In the fault tree related to "Loss of datalink capability", taking into account:

- The failure condition is classified MAJOR,
- A single failure of any component can lead to the abnormal event,

the Assurance Levels of Data ATSU and of Data ACSP System shall be at least "AL3" as per ED109A/DO278A [6].

In the fault trees related to "Erroneous datalink message" and "Unexpected datalink message", taking into account:

- The erroneous, spurious, delay, loss or misdirection of datalink message is classified MAJOR,
- The assumption ASSUMP_GD_01,

the Assurance Level of Data ATSU should be "AL3" and Assurance Level of ACSP Systems should be at least "AL4", as per ED109A/DO278A [6].

The following Safety Requirements have been identified to be applicable to the ATSU:

- SR-SU-14: the Assurance Level of the DATALINK ATSU System shall be at least "AL3", as per ED109A/DO278A,

The following Safety Requirements have been identified to be applicable to the ACSP System:

- SR-SP-03: the Assurance Level of the DATALINK ACSP System shall be at least "AL3", as per ED109A/DO278A.

6.2.3 Qualitative safety requirements

The qualitative safety requirements applicable to the ground system are reminded hereafter.

The lines in **bold** indicate the requirements allocated to the ACSP System, provided that all requirements are applicable to the ATSU part of the ground system.

Requirement list			
Ref.	**Parameter**	**Title**	**Classification**
SR-GD-01	**Availability**	**A service shall be established in sufficient time to be available for operational use.**	**SC3 (Major (MAJ))**
SR-GD-02	Availability	An ATSU shall permit services only when there are compatible version numbers.	SC3 (Major (MAJ))
SR-GD-03	Availability	An indication shall be provided to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$).	SC3 (Major (MAJ))
SR-GD-04	Detection of inappropriate message	The ATSU system shall process the message without affecting the intent of the message.	SC3 (Major (MAJ))
SR-GD-05	**Availability**	**ATSU shall be notified of planned outage of a service sufficiently ahead of time.**	**SC3 (Major (MAJ))**
SR-GD-06	Corruption of message	ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan.	SC3 (Major (MAJ))
SR-GD-07	Detection of spurious	Each uplink message shall be uniquely identified for a given aircraft-ATSU pair.	SC3 (Major (MAJ))

Requirement list			
Ref.	**Parameter**	**Title**	**Classification**
	message		
SR-GD-08	Detection of misdirected message	Only the ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft.	SC3 (Major (MAJ))
SR-GD-09	Corruption of message	The aircraft identifiers used for data link initiation correlation by the ATSU shall be unique and unambiguous (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address).	SC3 (Major (MAJ))
SR-GD-10	Availability	The ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected.	SC4 (Minor (MIN))
SR-GD-11	Availability	The ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew.	SC4 (Minor (MIN))
SR-GD-12	Detection of misdirected message	The ATSU shall be able to determine the message initiator.	SC3 (Major (MAJ))
SR-GD-13	Detection of corrupted message	When the ATSU receives a report that has been corrupted, the ATSU shall request similar information with a demand report.	SC4 (Minor (MIN))
SR-GD-14	Detection of corrupted message	The ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service.	SC3 (Major (MAJ))
SR-GD-15	Detection of spurious message	The ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft.	SC3 (Major (MAJ))
SR-GD-16	Detection of inappropriate message	The ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report.	SC3 (Major (MAJ))
SR-GD-17	Detection of misdirected message	The ATSU shall correlate each ADS-C report with the contract that prescribed the report.	SC3 (Major (MAJ))
SR-GD-18	Corruption of message	The ATSU shall discard any corrupted message.	SC4 (Minor (MIN))
SR-GD-19	Availability	The ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected.	SC4 (Minor (MIN))
SR-GD-20	Detection of spurious message	The ATSU shall indicate in each response to which messages it refers.	SC3 (Major (MAJ))
SR-GD-21	Availability	The ATSU shall indicate to the controller a detected loss of any service.	SC4 (Minor (MIN))
SR-GD-22	Detection of inappropriate message	The ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract.	SC3 (Major (MAJ))
SR-GD-23	Loss of message	The ATSU shall indicate to the controller when a message cannot be successfully transmitted.	SC4 (Minor (MIN))
SR-GD-24	Detection of delayed message	The ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}).	SC3 (Major (MAJ))
SR-GD-25	Detection of misdirected message	The ATSU shall make the controller aware of any operational message being automatically or manually released.	SC3 (Major (MAJ))
SR-GD-26	Corruption of message	The ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan.	SC3 (Major (MAJ))
SR-GD-27	Detection of spurious message	The ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft.	SC4 (Minor (MIN))
SR-GD-28	Corruption of message	The ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)	SC3 (Major (MAJ))
SR-GD-29	Corruption of message	The ATSU shall prohibit operational processing by the controller of a corrupted report.	SC4 (Minor (MIN))
SR-GD-30	Misdirection of message	The ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU.	SC4 (Minor (MIN))
SR-GD-31	Availability	The ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established.	SC4 (Minor (MIN))
SR-GD-32	Availability	The ATSU shall provide an indication to the controller when an ADS-C contract is established.	SC4 (Minor (MIN))
SR-GD-33	Detection of misdirected message	The ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service.	SC3 (Major (MAJ))

Requirement list			
Ref.	**Parameter**	**Title**	**Classification**
SR-GD-34	Misdirection of message	The ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.	SC3 (Major (MAJ))
SR-GD-35	Misdirection of message	The ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU.	SC4 (Minor (MIN))
SR-GD-36	Detection of misdirected message	The ATSU shall reject messages not addressed to itself.	SC4 (Minor (MIN))
SR-GD-37	Corruption of message	The ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function.	SC3 (Major (MAJ))
SR-GD-38	Corruption of message	The ATSU shall respond to messages in their entirety.	SC3 (Major (MAJ))
SR-GD-39	Detection of spurious message	The ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft.	SC4 (Minor (MIN))
SR-GD-40	Corruption of message	The ATSU shall send the route information with the route clearance uplink message.	SC3 (Major (MAJ))
SR-GD-41	Detection of delayed message	The ATSU shall time stamp to within one second UTC each message when it is released for onward transmission.	SC3 (Major (MAJ))
SR-GD-42	Misdirection of message	The ATSU shall transmit messages to the designated aircraft system.	SC4 (Minor (MIN))
SR-GD-43	Corruption of message	The ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan.	SC3 (Major (MAJ))
SR-GD-44	Misdirection of message	The ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft.	SC3 (Major (MAJ))
SR-GD-45	Corruption of message	The controller shall check the correctness and the appropriateness of every ADS-C report received.	SC3 (Major (MAJ))
SR-GD-46	Corruption of message	The controller shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew.	SC3 (Major (MAJ))
SR-GD-47	Delay of message	The controller shall respond or act in timely manner to meet the RCP specification for the concerned ATS function.	SC3 (Major (MAJ))
SR-GD-48	Detection of delayed message	The controller shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN}.	SC3 (Major (MAJ))
SR-GD-49	Detection of delayed message	When the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall display the emergency message to the controller.	SC3 (Major (MAJ))
SR-GD-50	Corruption of message	The ground system shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services.	SC3 (Major (MAJ))
SR-GD-51	Availability	The ground system shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure.	SC3 (Major (MAJ))
SR-GD-76	Delay of message	When a conditional clearance is sent to an aircraft, the ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met).	SC3 (Major (MAJ))
SR-GD-77	Corruption of message	When flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C), the ATSU system shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan.	SC3 (Major (MAJ))
SR-GD-78	Delay of message	When the ATSU receives a message whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall reject the message.	SC4 (Minor (MIN))
SR-GD-79	Detection of delayed message	When the ATSU receives a periodic or event report whose time stamp is older than the current time minus ET_{TRN}, the ATSU shall request similar information from the message rejected with a demand report.	SC4 (Minor (MIN))
SR-GD-80	Detection of inappropriate message	When the ATSU receives an indication from the aircraft system indicating a message has been rejected, the ATSU shall notify the controller.	SC4 (Minor (MIN))
SR-GD-81	Corruption of message	When there are multiple non-active flight plans and the SYSTEM is in AUTOMODE, the SYSTEM shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan	SC3 (Major (MAJ))

Requirement list			
Ref.	Parameter	Title	Classification
		identifier.	

Table 53: ATSP Qualitative safety requirements

The following Safety Requirements have been identified to be applicable to the ACSP System:

- SR-SP-04: the DATALINK ACSP System contribution to the establishment of a service shall permit that this service will be established in a sufficient time to be available for operational use,
- SR-SP-05: the DATALINK ACSP System shall be notified of planned outage of a service sufficiently ahead of time.

The following Safety Requirements have been identified to be applicable to ATSU:

- SR-SU-15: the DATALINK ATSU contribution to the establishment of a service shall permit that this service will be established in a sufficient time to be available for operational use,
- SR-SU-16: the DATALINK ATSU shall permit services only when there are compatible version numbers,
- SR-SU-17: the DATALINK ATSU shall provide an indication to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$),
- SR-SU-18: the DATALINK ATSU shall process the message without affecting the intent of the message,
- SR-SU-19: the DATALINK ATSU shall be notified of planned outage of a service sufficiently ahead of time,
- SR-SU-20: the DATALINK ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identification in the current flight plan,
- SR-SU-21: the DATALINK ATSU shall uniquely identify each uplink message for a given aircraft-ATSU pair,
- SR-SU-22: only the DATALINK ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft,
- SR-SU-23: the DATALINK ATSU shall use unique and unambiguous aircraft identifiers for data link initiation correlation (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address),
- SR-SU-24: the DATALINK ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system or the controller is rejected,
- SR-SU-25: the DATALINK ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew,
- SR-SU-26: the DATALINK ATSU shall be able to determine the message initiator,
- SR-SU-27: the DATALINK ATSU shall request similar information with a demand report, when the ATSU receives a report that has been corrupted,
- SR-SU-28: the DATALINK ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service,
- SR-SU-29: the DATALINK ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft,
- SR-SU-30: the DATALINK ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report,
- SR-SU-31: the DATALINK ATSU shall correlate each ADS-C report with the contract that prescribed the report,
- SR-SU-32: the DATALINK ATSU shall discard any corrupted message,
- SR-SU-33: the DATALINK ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected,
- SR-SU-34: the DATALINK ATSU shall indicate in each response to which messages it refers,
- SR-SU-35: the DATALINK ATSU shall indicate to the controller a detected loss of any service,
- SR-SU-36: the DATALINK ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract,
- SR-SU-37: the DATALINK ATSU shall indicate to the controller when a message cannot be successfully transmitted,

- SR-SU-38: the DATALINK ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN}),
- SR-SU-39: the DATALINK ATSU shall make the controller aware of any operational message being automatically or manually released,
- SR-SU-40: the DATALINK ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan,
- SR-SU-41: the DATALINK ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft,
- SR-SU-42: the DATALINK ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address),
- SR-SU-43: the DATALINK ATSU shall prohibit operational processing by the controller of a corrupted report,
- SR-SU-44: the DATALINK ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU,
- SR-SU-45: the DATALINK ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established,
- SR-SU-46: the DATALINK ATSU shall provide an indication to the controller when an ADS-C contract is established,
- SR-SU-47: the DATALINK ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service,
- SR-SU-48: the DATALINK ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits.
- SR-SU-49: the DATALINK ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU,
- SR-SU-50: the DATALINK ATSU shall reject messages not addressed to itself,
- SR-SU-51: the DATALINK ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function,
- SR-SU-52: the DATALINK ATSU shall respond to messages in their entirety,
- SR-SU-53: the DATALINK ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft,
- SR-SU-54: the DATALINK ATSU shall send the route information with the route clearance uplink message,
- SR-SU-55: the DATALINK ATSU shall time stamp to within one second UTC each message when it is released for onward transmission,
- SR-SU-56: the DATALINK ATSU shall transmit messages to the designated aircraft system,
- SR-SU-57: the DATALINK ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan,
- SR-SU-58: the DATALINK ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft,
- SR-SU-59: the DATALINK ATSU shall check the correctness and the appropriateness of every ADS-C report received,
- SR-SU-60: the DATALINK ATSU shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew,
- SR-SU-61: the DATALINK ATSU shall respond or act in timely manner to meet the RCP specification for the concerned ATS function,
- SR-SU-62: the DATALINK ATSU shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN},
- SR-SU-63: the DATALINK ATSU shall display the emergency message to the controller, when the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN},

- SR-SU-64: the DATALINK ATSU shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services,
- SR-SU-65: the DATALINK ATSU shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure,
- SR-SU-66: the DATALINK ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met), when a conditional clearance is sent to an aircraft,
- SR-SU-67: the DATALINK ATSU shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan, when flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C),
- SR-SU-68: the DATALINK ATSU shall reject the message, when the ATSU receives a message whose time stamp is older than the current time minus ET_{TRN},
- SR-SU-69: the DATALINK ATSU shall request similar information from the message rejected with a demand report, when the ATSU receives a periodic or event report whose time stamp is older than the current time minus ET_{TRN},
- SR-SU-70: the DATALINK ATSU shall notify the controller, when the ATSU receives an indication from the aircraft system indicating a message has been rejected,
- SR-SU-71: the DATALINK ATSU shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier, when there are multiple non-active flight plans and the SYSTEM is in AUTOMODE.

6.2.4 Quantitative performance requirements

The quantitative performance requirements applicable to the ATSP system are reminded hereafter.

Requirement list			
Ref.	**Parameter**	**Value**	**Title**
PR_SP_01	Transaction Time	12 seconds	The maximum transaction time in ACSP system shall be less than 12 seconds for any messages in APT, TMA and ENR-1 domains
PR_SP_02	Transaction Time	120 seconds	The maximum transaction time in ACSP system shall be less than 120 seconds for any messages in ENR-2 domain
PR_SP_03	Transaction Time	5 seconds	The nominal transaction time in ACSP system shall be less than 5 seconds for any messages in APT, TMA and ENR-1 domains
PR_SP_04	Transaction Time	100 seconds	The nominal transaction time in ACSP system shall be less than 100 seconds for any messages in ENR-2 domain
PR_SP_05	Availability	99.00%	The availability of the ACSP system shall be more than 99.00%
PR_SP_08	Continuity	0.999	the continuity of the ACSP system shall be more than 0.999
PR_SU_01	Transaction Time	7 seconds	The maximum transaction time in ATSU system shall be less than 7 seconds for any messages in APT, TMA and ENR-1 domains
PR_SU_02	Transaction Time	5 seconds	The maximum transaction time in ATSU system shall be less than 5 seconds for any messages in ENR-2 domain
PR_SU_03	Transaction Time	3 seconds	The nominal transaction time in ATSU system shall be less than 3 seconds for any messages in APT, TMA and ENR-1 domains
PR_SU_04	Transaction Time	3 seconds	The nominal transaction time in ATSU system shall be less than 3 seconds for any messages in ENR-2 domain
PR_SU_05	Availability	99.95%	The availability of the ATSU system shall be more than 99.95%
PR_SU_08	Continuity	0.999	the continuity of the ATSU system shall be more than 0.999

Table 54: ATSP Quantitative performance requirements

6.2.4.1 Transaction Time (Continuity)

The performance requirements regarding transaction time of message by ACSP system are:

- The maximum transaction time (one way) in ACSP system shall be less than 12 seconds for any messages (PR_SP_01);

- The nominal transaction time (one way) in ACSP system shall be less than 5 seconds for any messages (PR_SP_03);
- The continuity of the ACSP system shall be more than 0.999 (PR_SP_08).

The performance requirements regarding transaction time of message by ATSU are:

- The maximum transaction time (one way) in ATSU shall be less than 5 seconds for any messages (PR_SU_02);
- The nominal transaction time (one way) in ATSU shall be less than 3 seconds for any messages (PR_SU_03 & PR_SU_04);
- The continuity of the ATSU shall be more than 0.999 (PR_SP_08).

There is no decomposition of the ACSP system and ATSU into sub-systems. As such:

The following Performance Requirements have been identified to be applicable to the ACSP System:

- PR-SP-01: The nominal delay introduced by the ACSP System for a one way transmission (downlink or uplink) shall be less than 5 seconds,
- PR-SP-02: The maximum delay introduced by the ACSP System for a one way transmission (downlink or uplink) shall be less than 12 seconds,
- PR-SP-05: The continuity of the ACSP system shall be more than 0.999.

The following Performance Requirements have been identified to be applicable to the ATSU:

- PR-SU-01: The nominal delay introduced by the ATSU including interface delays for a one way transmission (downlink or uplink) shall be less than 3 seconds,
- PR-SU-02: The maximum delay introduced by the ATSU including interface delay for a one way transmission (downlink or uplink) shall be less than 5 seconds,
- PR-SU-05: The continuity of the ATSU shall be more than 0.999.

6.2.4.2 Availability

The performance requirements regarding availability of ATSP system is:

- PR_SP_05: The availability of the ACSP system shall be more than 99.95%,
- PR_SU_05: The availability of the ATSU shall be more than 99.95%.

In order to fulfill this availability requirement, the likelihood that the aircraft system is unavailable has to be less than 5.0 E-04/FH.

The requirements SR-SP-01 and SR-SU-01 lead to a probability of loss less that 1.0 E-05/H which is deemed acceptable.

Thus there is no need to define a more stringent quantitative availability requirement, and Safety requirements SR-SP-01 and SR-SU-01 still applicable for Performance.

6.2.5 Qualitative performance requirements

The qualitative performance requirements applicable to the ATSP system are reminded hereafter:

Requirement list		
Ref.	**Parameter**	**Title**

Requirement list		
Ref.	**Parameter**	**Title**
PR_SP_06	Availability	The ACSP system shall be capable of detecting ACSP failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function.
PR_SP_07	Availability	When the ACSP communication capability no longer meets the requirements for the intended function, the ACSP system shall provide indication to the ATSU system.
PR_SU_06	Availability	The ATSU system shall be capable of detecting ATSU failures and configuration changes that would cause the communication service to no longer meet the requirements for the intended function.
PR_SU_07	Availability	When the ATSU communication capability no longer meets the requirements for the intended function, the ATSU system shall provide indication to the controller.

Table 55: ATSP Qualitative performance requirements

The following Performance Requirements have been identified to be applicable to the ACSP System:

- PR-SP-03: The ACSP System shall indicate a detected loss of DATALINK services,
- PR-SP-04: The ACSP System shall indicate when a message cannot be successfully transmitted

The following Performance Requirements have been identified to be applicable to the ATSU System:

- PR-SU-03: The ATSU System shall indicate a detected loss of DATALINK services,
- PR-SU-04: The ATSU System shall indicate when a message cannot be successfully transmitted

6.3 Summary of Safety and Performance requirements applicable to ACSP System and ATSU

6.3.1 Summary of Safety and Performance requirements applicable to ACSP System

Requirement list		
Ref.	**Title**	**Source**
SR-SP-01	the likelihood that the datalink ACSP System is unavailable (detected) shall be less than 5.00 E-06/H	SR-GD-73
SR-SP-02	the likelihood that the datalink ACSP System is unavailable (undetected) shall be less than 5.00 E-06/H	SR-GD-60
SR-SP-03	the Assurance Level of the DATALINK ACSP System shall be at least “AL3”, as per ED109A/DO278A	
SR-SP-04	the DATALINK ACSP System contribution to the establishment of a service shall permit that this service will be established in a sufficient time to be available for operational use	SR-GD-01
SR-SP-05	the DATALINK ACSP System shall be notified of planned outage of a service sufficiently ahead of time	SR-GD-05
PR-SP-01	The nominal delay introduced by the ACSP System for a one way transmission (downlink or uplink) shall be less than 5 seconds	PR_SP_01
PR-SP-02	The maximum delay introduced by the ACSP System for a one way transmission (downlink or uplink) shall be less than 12 seconds	PR_SP_03
PR-SP-03	The ACSP System shall indicate a detected loss of DATALINK services	PR SP 06
PR-SP-04	The ACSP System shall indicate when a message cannot be successfully transmitted	PR_SP_07
PR-SP-05	The continuity of the ACSP system shall be more than 0.999	PR SP 08

6.3.2 Summary of Safety and Performance requirements applicable to ATSU

Requirement list		
Ref.	**Title**	**Source**
SR-SU-01	the likelihood that the Datalink ATSU is unavailable (detected) shall be less than 5.00 E-06/H	SR-GD-73
SR-SU-02	the likelihood that the Datalink ATSU is unavailable (undetected) shall be less than 5.00 E-06/H	SR-GD-60
SR-SU-03	the likelihood that the loss of ADS-C ground systems is detected shall be less than 5.00 E-04/H	SR-GD-56
SR-SU-04	the likelihood that the loss of ADS-C ground systems is undetected shall be less than 5.00 E-06/H	SR-GD-69
SR-SU-05	the likelihood that the CPDLC ground system is unavailable shall be less than 5.00 E-04/H	SR-GD-61
SR-SU-06	the likelihood that the DATALINK ATSU corrupts DATALINK message (downlink or uplink) shall be less than 4.95 E-04/H	SR-GD-53, SR-GD-64, SR-GD-66, SR-GD-74
SR-SU-07	the likelihood that the corruption of a datalink message (downlink or uplink) due to incorrect data provided by the ATSU shall be less than 4.95 E-04/H	SR-GD-53, SR-GD-64, SR-GD-66, SR-GD-74
SR-SU-08	the likelihood that the DATALINK ATSU fails to detect a corrupted message (downlink or uplink) shall be less than 2.00 E-04/H	SR-GD-53, SR-GD-74
SR-SU-09	the likelihood of an undetected corrupted datalink message (downlink or uplink) due to the ATSU shall be less than 4.90 E-06/H	SR-GD-66, SR-GD-74
SR-SU-10	the likelihood of an undetected corrupted datalink message (downlink or uplink) due to incorrect data provided by the ATSU shall be less than 4.90 E-06/H	SR-GD-64, SR-GD-74
SR-SU-11	the likelihood that the datalink ATSU spontaneously generates, delays, losses or misdirects a message (downlink or uplink) shall be less than 9.90 E-04/H	SR-GD-52, SR-GD-54, SR-GD-55, SR-GD-59, SR-GD-62, SR-GD-63
SR-SU-12	the likelihood that the datalink ATSU fails to detect an unexpected message (downlink or uplink) shall be less than 2.00 E-04/H	SR-GD-52, SR-GD-54, SR-GD-55, SR-GD-59, SR-GD-62, SR-GD-63
SR-SU-13	the likelihood of an undetected unexpected datalink message (downlink or uplink) due to the ATSU shall be less than 9.80 E-06/H	SR-GD-52, SR-GD-62, SR-GD-63, SR-GD-67, SR-GD-68, SR-GD-72
SR-SU-14	the Assurance Level of the DATALINK ATSU shall be at least “AL3”, as per ED109A/DO278A	
SR-SU-15	the DATALINK ATSU contribution to the establishment of a service shall permit that this service will be established in a sufficient time to be available for operational use	SR-GD-01
SR-SU-16	the DATALINK ATSU shall permit services only when there are compatible version numbers	SR-GD-02
SR-SU-17	the DATALINK ATSU shall provide an indication to the controller when a downlink message, requiring a response, is rejected because no response is sent by the controller within the required time ($ET_{RESPONDER}$)	SR-GD-03
SR-SU-18	the DATALINK ATSU shall process the message without affecting the intent of the message	SR-GD-04
SR-SU-19	the DATALINK ATSU shall be notified of planned outage of a service sufficiently ahead of time	SR-GD-05
SR-SU-20	the DATALINK ATSU shall only establish and maintain CPDLC services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU’s corresponding aircraft identification in the current flight plan	SR-GD-06
SR-SU-21	the DATALINK ATSU shall uniquely identify each uplink message for a given aircraft-ATSU pair	SR-GD-07
SR-SU-22	only the DATALINK ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall be permitted to send a Next Data Authority (NDA) message to the aircraft	SR-GD-08
SR-SU-23	the DATALINK ATSU shall use unique and unambiguous aircraft identifiers for data link initiation correlation (e.g. the Aircraft Identification and either the Registration Marking or the Aircraft Address)	SR-GD-09
SR-SU-24	the DATALINK ATSU shall display the indication provided by the aircraft system when a CPDLC connection request initiated by the ground system	SR-GD-10

Requirement list		
Ref.	**Title**	**Source**
	or the controller is rejected	
SR-SU-25	the DATALINK ATSU shall provide to the aircraft system an indication when the ATSU rejects a data link initiation request (logon) initiated by the flight crew	SR-GD-11
SR-SU-26	the DATALINK ATSU shall be able to determine the message initiator	SR-GD-12
SR-SU-27	the DATALINK ATSU shall request similar information with a demand report, when the ATSU receives a report that has been corrupted	SR-GD-13
SR-SU-28	the DATALINK ATSU shall be capable of detecting errors in downlink messages that would result in corruption introduced by the communication service	SR-GD-14
SR-SU-29	the DATALINK ATSU shall provide unambiguous and unique reference identifier in each ADS contract it sends to the aircraft	SR-GD-15
SR-SU-30	the DATALINK ATSU shall detect the absence of a periodic report per the established ADS-C contract then request similar information with a demand report	SR-GD-16
SR-SU-31	the DATALINK ATSU shall correlate each ADS-C report with the contract that prescribed the report	SR-GD-17
SR-SU-32	the DATALINK ATSU shall discard any corrupted message	SR-GD-18
SR-SU-33	the DATALINK ATSU shall display the indication provided by the aircraft system when an ADS-C contract request initiated by the ground system or the controller is rejected	SR-GD-19
SR-SU-34	the DATALINK ATSU shall indicate in each response to which messages it refers	SR-GD-20
SR-SU-35	the DATALINK ATSU shall indicate to the controller a detected loss of any service	SR-GD-21
SR-SU-36	the DATALINK ATSU shall indicate to the controller the absence of a periodic report per the established ADS-C contract	SR-GD-22
SR-SU-37	the DATALINK ATSU shall indicate to the controller when a message cannot be successfully transmitted	SR-GD-23
SR-SU-38	the DATALINK ATSU shall indicate to the controller when a required response for a message sent by the ATSU is not received within the required time (ET_{TRN})	SR-GD-24
SR-SU-39	the DATALINK ATSU shall make the controller aware of any operational message being automatically or manually released	SR-GD-25
SR-SU-40	the DATALINK ATSU shall only establish and maintain ADS-C services when the aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) in data link initiation correlates with the ATSU's corresponding aircraft identifiers in the current flight plan	SR-GD-26
SR-SU-41	the DATALINK ATSU shall only send operational messages to an aircraft when provision of the service has been established with that aircraft	SR-GD-27
SR-SU-42	the DATALINK ATSU shall perform the correlation function again with any change of the flight identification or aircraft identification (either the registration marking or the 24-bit aircraft address)	SR-GD-28
SR-SU-43	the DATALINK ATSU shall prohibit operational processing by the controller of a corrupted report	SR-GD-29
SR-SU-44	the DATALINK ATSU shall prohibit to the controller operational processing of messages not addressed to the ATSU	SR-GD-30
SR-SU-45	the DATALINK ATSU shall provide an indication to the controller when a CPDLC connection for a given aircraft-ATSU pair is established	SR-GD-31
SR-SU-46	the DATALINK ATSU shall provide an indication to the controller when an ADS-C contract is established	SR-GD-32
SR-SU-47	the DATALINK ATSU shall be capable of detecting errors in downlink messages that would result in mis-delivery introduced by the communication service	SR-GD-33
SR-SU-48	the DATALINK ATSU shall provide unambiguous and unique identification of the origin and destination of each message it transmits	SR-GD-34
SR-SU-49	the DATALINK ATSU shall be capable to send an indication to the aircraft system whenever a message is rejected by the ATSU	SR-GD-35
SR-SU-50	the DATALINK ATSU shall reject messages not addressed to itself	SR-GD-36
SR-SU-51	the DATALINK ATSU shall replace any previously held application data relating to an aircraft after a successful DLIC initiation function	SR-GD-37
SR-SU-52	the DATALINK ATSU shall respond to messages in their entirety	SR-GD-38

Requirement list		
Ref.	**Title**	**Source**
SR-SU-53	the DATALINK ATSU shall only send operational messages to an aircraft when provision of the service has been established with the aircraft	SR-GD-39
SR-SU-54	the DATALINK ATSU shall send the route information with the route clearance uplink message	SR-GD-40
SR-SU-55	the DATALINK ATSU shall time stamp to within one second UTC each message when it is released for onward transmission	SR-GD-41
SR-SU-56	the DATALINK ATSU shall transmit messages to the designated aircraft system	SR-GD-42
SR-SU-57	the DATALINK ATSU shall use ADS-C reports to conform the route of flight to the ATSU current flight plan	SR-GD-43
SR-SU-58	the DATALINK ATSU that has control of the aircraft, i.e. Current Data Authority (CDA), shall establish an ADS-C contract with the aircraft	SR-GD-44
SR-SU-59	the DATALINK ATSU shall check the correctness and the appropriateness of every ADS-C report received	SR-GD-45
SR-SU-60	the DATALINK ATSU shall check the correctness and the appropriateness of every ATC message received and of every message before sending to the flight crew	SR-GD-46
SR-SU-61	the DATALINK ATSU shall respond or act in timely manner to meet the RCP specification for the concerned ATS function	SR-GD-47
SR-SU-62	the DATALINK ATSU shall take appropriate action when indicated the aircraft system discarded a message whose time stamp exceeds the ET_{TRN}	SR-GD-48
SR-SU-63	the DATALINK ATSU shall display the emergency message to the controller, when the ATSU receives an emergency message whose time stamp is older than the current time minus ET_{TRN}	SR-GD-49
SR-SU-64	the DATALINK ATSU shall correlate the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) with the ground system's corresponding identifiers in the current flight plan prior to establishing and maintaining data link services	SR-GD-50
SR-SU-65	the DATALINK ATSU shall provide an indication to the controller, when the ground system rejects a DLIC Logon or is notified of a DLIC contact failure	SR-GD-51
SR-SU-66	the DATALINK ATSU shall establish an ADS-C contract with the aircraft to ensure the aircraft does not execute the clearance too early or too late (i.e. ATSU be aware aircraft movement occurs without the associated condition being met), when a conditional clearance is sent to an aircraft	SR-GD-76
SR-SU-67	the DATALINK ATSU shall only establish and maintain data link services when as a minimum the flight identification and aircraft identification (either the Registration Marking or the 24-bit Aircraft Address) correlates with the ground system's corresponding identifiers in the current flight plan, when flight plan correlation is performed, either as part of CM or a given application (e.g. ADS-C)	SR-GD-77
SR-SU-68	the DATALINK ATSU shall reject the message, when the ATSU receives a message whose time stamp is older than the current time minus ET_{TRN}	SR-GD-78
SR-SU-69	the DATALINK ATSU shall request similar information from the message rejected with a demand report, when the ATSU receives a periodic or event report whose time stamp is older than the current time minus ET_{TRN}	SR-GD-79
SR-SU-70	the DATALINK ATSU shall notify the controller, when the ATSU receives an indication from the aircraft system indicating a message has been rejected	SR-GD-80
SR-SU-71	the DATALINK ATSU shall prevent the automatic processing of all subsequent departure clearances received after the first for a flight with the same aircraft ID and different unique flight plan identifier, when there are multiple non-active flight plans and the SYSTEM is in AUTOMODE	SR-GD-81
PR-SU-01	The nominal delay introduced by the ATSU including interface delays for a one way transmission (downlink or uplink) shall be less than 3 seconds	PR_SU_03, PR_SU_04
PR-SR-02	The maximum delay introduced by the ATSU including interface delay for a one way transmission (downlink or uplink) shall be less than 5 seconds	PR_SU_02
PR-SU-03	The ATSU shall indicate a detected loss of DATALINK services	PR_SU_06
PR-SU-04	The ATSU shall indicate when a message cannot be successfully transmitted	PR_SU_07
PR-SU-05	The continuity of the ATSU shall be more than 0.999	PR_SU_08

7 List of assumptions

List of Assumptions			
Ref	**Phase**	**Assumption**	**Justification**
ASSUMP_IPr_01	Services / Application	Context Management (CM) application is not considered during the identification of Operational Hazards.	Consistent with Eurocae/RTCA approach: a failure during DATALINK initiation doesn't have direct operational effects. However it can have effects during the use of the others applications (CPDLC and ADS-C). So the safety requirements concerning CM messages are determined by studying all the others applications.
ASSUMP_IPr_02	Software Assurance Allocation	Future DATALINK implementation within aircraft systems are expected to be developed at least ED12C/DO178C [7] based Development Assurance Level consistent with its failure condition categorization.	Additional guidance on acceptable risk and software considerations defined in the ED228 document.
ASSUMP_IPr_03	Definition of new operational hazard	This event includes the combination between one system detected loss of capability and the other system undetected loss of capability.	The undetected loss of one system can occur after the detected loss of the other system and leading to an undetected failure to exchange any message with more than one aircraft until the more or less longer detection by the controller.
ASSUMP_IPr_04	Definition of AE	Abnormal Events concerning all the messages at Means of Communication level associated to one aircraft are grouped as single event: "permanent failure to communicate with one aircraft" (Availability of aircraft).	A failure on a message at Means of Communication level (corruption, loss…), is detected thanks to the external mitigation means such as time stamps, checksum… at upper layers. The detection of this failure induces a clarification between controllers and flight crew. Then, following messages will be carefully watched; controllers will detect that there is a permanent failure on DATALINK communication chain with the aircraft.
ASSUMP_IPr_05	Definition of AE	Abnormal Events concerning all messages at Iris Precursor level associated to more than one aircraft are grouped as single event: "permanent failure to communicate with more than one aircraft" (Availability of provision).	A failure on a Means of Communication message (corruption, loss…), is detected thanks to the external mitigation means such as time stamps, checksum… at upper layers. The detection of this failure induces a clarification between controllers and flight crew. Then, following messages will be carefully watched; controllers will detect that there is a permanent failure on DATALINK communication chain.
ASSUMP_IPr_06	Evaluation of severity	Simultaneous loss of all applications (CPDLC and ADS-C) for one aircraft is not more critical that independent failure of each application for one aircraft.	This assumption seems coherent because DATALINK application has never been considered as a reduction mean to mitigate the loss of another application. For example, OH_ED228_CPDLC_01 (failure to exchange CPDLC messages with a single aircraft) is not mitigated by the utilization of ADS-C.
ASSUMP_IPr_07	Evaluation of severity	Simultaneous loss of all applications (CPDLC and ADS-C) for one aircraft is not more critical than independent failure of each application for one aircraft.	This assumption must be validated by working group 78. However, this assumption seems coherent because DATALINK application has never been considered as a reduction mean to mitigate the loss of another application.
ASSUMP_IPr_08	Allocation of SR	The probability that all the ground systems (except common mode failures) are unavailable is assumed to be less than $1.0\ 10^{-6}$ per flight hour	The probability that all the ground systems (except common mode failures) are unavailable is less than the product between the probability of the loss of CPDLC capability [single aircraft] and the probability of the loss of ADS-C capability [single aircraft]

List of Assumptions			
Ref	**Phase**	**Assumption**	**Justification**
ASSUMP_IPr_09	Allocation of SR	The probability that all the aircraft systems (except common mode failures) are unavailable is assumed to be less than 1.0 10^{-6} per flight hour	The probability that all the aircraft systems (except common mode failures) are unavailable is less than the product between the probability of the loss of CPDLC capability [single aircraft] and the probability of the loss of ADS-C capability [single aircraft]
ASSUMP_IPr_10	Definition of AE	Failure concerning the "messages associated to one aircraft" can occur in case of failure in the airborne part of the Means of Communication.	A failure of ground part of the Means of Communication cannot concern only one aircraft.
ASSUMP_IPr_11	Definition of AE	Failures affecting some messages are not considered.	These failures are considered as equivalent to a succession of failure concerning one message.
ASSUMP_IPr_12	Services / Application	Aeronautical Operational Control (AOC) services are not considered in the present safety and performance analyses.	- AOC services are mainly used to exchange information between the aircraft and the airlines (for example to prepare / optimize the maintenance of the aircraft). They are not considered in Working Group 78 documents. - From a safety point of view, AOC services are less critical than ATS services. So safety requirements defined by considering the ATS services should be more stringent than safety requirements that could be defined by considering AOC services. - From a performance point of view, it is considered that performance requirements defined in ED228 document (i.e. availability and transaction times) for ATS services are sufficient to use AOC services efficiently. Note: other performance requirements such as volume requirement (capacity) are considered to be out-of-scope of this safety analysis.
ASSUMP_IPr_13	Software Assurance Allocation	Future DATALINK implementation within aircraft systems are expected to be developed at least ED109A/DO278A [6] based Assurance Level consistent with its failure condition categorization.	Additional guidance on acceptable risk and software considerations defined in the ED228 document.
ASSUMP_AC_01	Communication System Allocation	The end-to-end integrity checks are performed by the ATS application within the End System.	Consistent with the current architecture.
ASSUMP_GD_01	ATSP System Allocation	The end-to-end integrity checks are performed by the ATSU System.	Consistent with the current architecture.

Table 56: List of Assumptions

8 Security Analysis

The security analysis was performed and led by Inmarsat under ESA Iris Precursor project. SESAR 15.02.05 project was involved in the security activity as reviewer.

The security analysis and the conclusion are compiled in the referenced document below:

- **[8] Iris Precursor – System Security Technical Note** – IrisPre-C-GS-TN-0019-INM V1.1 July 23, 2015

This document will only be available upon request to SESAR JU directly and sharing is limited by contractual agreement between ESA and SESAR.

9 References

[1] **Iris Precursor Verification and Validation Strategy Plan –** SESAR WP 15.2.5 D02 Edition 1.0, April 15, 2014

[2] **Means of Communications Safety and Performance Analysis –** SESAR WP 9.44 V3R0, December 18, 2014

[3] **Safety and Performance Standard for Baseline 2 ATS Data Communications** – ED228, March 2014

[4] **Iris Precursor – Technical Note on the Iris Precursor Safety, Performance and Security Requirements** – IrisPre-C-OS-TN-0008-INM V1.2 February 18, 2015

[5] **Guidelines for approval of the provision and use of ATS supported by data communications –** ED78A, December 2000

[6] **Software Integrity Assurance Considerations for Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM) systems** – ED109A/DO278A, January 2012

[7] **Software Considerations in airborne systems and equipment certification** – ED12C/DO178C, May 2012

[8] **Iris Precursor – System Security Technical Note** – IrisPre-C-GS-TN-0019-INM V1.1 July 23, 2015

Appendix A : Hazard Classification Matrix (ED78A [5])

Hazard Class	1 (most severe)	2	3	4	5 (least severe)
Effect on Operations	Normally with hull loss. Total loss of flight control, mid-air collision, flight into terrain or high speed surface movement collision.	Large reduction in safety margins or aircraft functional capabilities.	Significant reduction in safety margins or aircraft functional capabilities.	Slight reduction in safety margins or aircraft functional capabilities.	No effect on operational capabilities or safety
Effect on Occupants	Multiple fatalities.	Serious or fatal injury to a small number of passengers or cabin crew.	Physical distress, possibly including injuries.	Physical discomfort.	Inconvenience.
Effect on Air crew	Fatalities or incapacitation.	Physical distress or excessive workload impairs ability to perform tasks.	Physical discomfort, possibly including injuries or significant increase in workload.	Slight increase in workload.	No effect on flight crew.
Effect on Air Traffic Service	Total loss of separation.	Large reduction in separation or a total loss of air traffic control for a significant period of time.	Significant reduction in separation or significant reduction in air traffic control capability.	Slight reduction in separation or slight reduction in air traffic control capability. Significant increase in air traffic controller workload.	Slight increase in air traffic controller workload.

Appendix B: Identification of OH

Abnormal Events		Environmental Conditions						External Mitigation Means								Operational Hazards	
AE Ref	AE	EC 1 Ref	EC 1	EC 2 Ref	EC 2	EC 3 Ref	EC 3	EMM 1 Ref	EMM 1	EMM 1 F/S	EMM 2 Ref	EMM 2	EMM 2 F/S	EMM 3 Ref	EMM 3	EMM 3 F/S	OH Ref	OH
AE_01	Undetected loss of one message at Iris Precursor level	CU_01_a	Message is related to CPDLC application	CU_02_a	Message is an uplink message			EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_CPDLC_07	Unexpected interruption of a CPDLC transaction [single aircraft]
										Success							OH_ED228_CPDLC_01	Loss of CPDLC capability [single aircraft]
				CU_02_b	Message is a downlink message			EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_CPDLC_07	Unexpected interruption of a CPDLC transaction [single aircraft]
										Success							OH_ED228_CPDLC_01	Loss of CPDLC capability [single aircraft]
		CU_01_b	Message is related to ADS-C application	CU_02_a	Message is an uplink message			EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_ADSC_01u	Undetected loss of ADS-C capability [single aircraft]
										Success							OH_ED228_ADSC_01d	Detected loss of ADS-C capability [single aircraft]
				CU_02_b	Message is a downlink message			EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_ADSC_01u	Undetected loss of ADS-C capability [single aircraft]
										Success							OH_ED228_ADSC_01d	Detected loss of ADS-C capability [single aircraft]
AE_02	Undetected corruption of one message at Iris Precursor level	CU_01_a	Message is related to CPDLC application	CU_02_a	Message is an uplink message	CU_04_a	Uplink message is corrupted into an existing other UM	EMM_02	Aircraft system detects and rejects corrupted uplink messages	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_CPDLC_03u	Undetected reception of a corrupted CPDLC message [single aircraft]
													Success				OH_ED228_CPDLC_03d	Detected reception of a corrupted CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_03d	Detected reception of a corrupted CPDLC message [single aircraft]
						CU_04_b	Uplink message is corrupted into an unexisting UM										OH_ED228_CPDLC_01	Loss of CPDLC capability [single aircraft]
				CU_02_b	Message is a downlink message	CU_03_a	Downlink message is corrupted into an existing other DM	EMM_03	Ground system detects and rejects corrupted downlink messages.	Failure							OH_ED228_CPDLC_03u	Undetected reception of a corrupted CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_03d	Detected reception of a corrupted CPDLC message [single aircraft]
						CU_03_b	Downlink message is corrupted into an unexisting DM										OH_ED228_CPDLC_01	Loss of CPDLC capability [single aircraft]

Abnormal Events		Environmental Conditions						External Mitigation Means									Operational Hazards	
AE Ref	AE	EC 1 Ref	EC 1	EC 2 Ref	EC 2	EC 3 Ref	EC 3	EMM 1 Ref	EMM 1	EMM 1 F/S	EMM 2 Ref	EMM 2	EMM 2 F/S	EMM 3 Ref	EMM 3	EMM 3 F/S	OH Ref	OH
AE_02	Undetected corruption of one message at Iris Precursor level	CU_01_b	Message is related to ADS-C application	CU_02_b	Message is a downlink message	CU_04_a	Uplink message is corrupted into an existing other uplink message	EMM_03	Ground system detects and rejects corrupted downlink messages.	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_ADSC_03u	Undetected reception of a corrupted ADS-C message [single aircraft]
													Success				OH_ED228_ADSC_03d	Detected reception of a corrupted ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_03d	Detected reception of a corrupted ADS-C message [single aircraft]
						CU_04_b	Uplink message is corrupted into an unexisting uplink message										OH_ED228_ADSC_01d	Detected loss of ADS-C capability [single aircraft]
				CU_02_a	Message is an uplink message	CU_04_a	Uplink message is corrupted into an existing other uplink message	EMM_02	Aircraft system detects and rejects corrupted uplink messages	Failure							OH_ED228_ADSC_03u	Undetected reception of a corrupted ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_03d	Detected reception of a corrupted ADS-C message [single aircraft]
						CU_03_b	Downlink message is corrupted into an unexisting downlink message										OH_ED228_ADSC_01d	Detected loss of ADS-C capability [single aircraft]
AE_03	Undetected misdirection of one message at Iris Precursor level	CU_01_a	Message is related to CPDLC application	CU_02_a	Message is an uplink message			EMM_07	Aircraft system detects and rejects misdirected uplink messages	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_CPDLC_07	Unexpected interruption of a CPDLC transaction [single aircraft]
																	OH_ED228_CPDLC_05u	Undetected reception of an unintended CPDLC message [single aircraft]
													Success				OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
				CU_02_b	Message is a downlink message			EMM_08	Ground system detects and rejects misdirected downlink messages	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_CPDLC_07	Unexpected interruption of a CPDLC transaction [single aircraft]
																	OH_ED228_CPDLC_05u	Undetected reception of an unintended CPDLC message [single aircraft]
													Success				OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]

Abnormal Events		Environmental Conditions						External Mitigation Means									Operational Hazards	
AE Ref	AE	EC 1 Ref	EC 1	EC 2 Ref	EC 2	EC 3 Ref	EC 3	EMM 1 Ref	EMM 1	EMM 1 F/S	EMM 2 Ref	EMM 2	EMM 2 F/S	EMM 3 Ref	EMM 3	EMM 3 F/S	OH Ref	OH
AE_03	Undetected misdirection of one message at Iris Precursor level	CU_01_b	Message is related to ADS-C application	CU_02_b	Message is a downlink message			EMM_08	Ground system detects and rejects misdirected downlink messages	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
													Success				OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_05	Detected reception of an unexpected ADS-C message [single aircraft]
				CU_02_a	Message is an uplink message			EMM_07	Aircraft system detects and rejects misdirected uplink messages	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
													Success				OH_ED228_ADSC_05	Detected reception of an unexpected ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_05	Detected reception of an unexpected ADS-C message [single aircraft]
AE_04	Undetected delay of one message at Means of Communication level	CU_01_a	Message is related to CPDLC application	CU_02_a	Message is an uplink message			EMM_06	Ground system time stamps uplink messages Aircraft system checks the time stamp of a delayed uplink message and rejects it	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_CPDLC_05u	Undetected reception of an unintended CPDLC message [single aircraft]
													Success				OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
								EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_CPDLC_07	Unexpected interruption of a CPDLC transaction [single aircraft]
										Success							OH_ED228_CPDLC_01	Loss of CPDLC capability [single aircraft]
				CU_02_b	Message is a downlink message			EMM_05	Aircraft system time stamps downlink messages Ground system checks the time stamp of a delayed downlink message and rejects it	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_CPDLC_05u	Undetected reception of an unintended CPDLC message [single aircraft]
													Success				OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
								EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_CPDLC_07	Unexpected interruption of a CPDLC transaction [single aircraft]
										Success							OH_ED228_CPDLC_01	Loss of CPDLC capability [single aircraft]

Abnormal Events		Environmental Conditions						External Mitigation Means								Operational Hazards	
AE Ref	AE	EC 1 Ref	EC 1	EC 2 Ref	EC 2	EC 3 Ref	EC 3	EMM 1 Ref	EMM 1	EMM 1 F/S	EMM 2 Ref	EMM 2	EMM 2 F/S	EMM 3 Ref	EMM 3	EMM 3 F/S	OH Ref	OH
AE_04	Undetected delay of one message at Means of Communication level	CU_01_b	Message is related to ADS-C application	CU_02_b	Message is a downlink message			EMM_05	Aircraft system time stamps downlink messages Ground system checks the time stamp of a delayed downlink message and rejects it	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
													Success				OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
								EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
										Success							OH_ED228_ADSC_01d	Detected loss of ADS-C capability [single aircraft]
				CU_02_a	Message is an uplink message			EMM_06	Ground system time stamps uplink messages Aircraft system checks the time stamp of a delayed uplink message and rejects it	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
													Success				OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
								EMM_04	Ground system detects that a message has not been responded to within the expected time	Failure							OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
										Success							OH_ED228_ADSC_01d	Detected loss of ADS-C capability [single aircraft]
AE_05	Generation of one spurious message at Means of Communication level	CU_01_a	Message is related to CPDLC application	CU_02_a	Message is an uplink message			EMM_10	Aircraft system checks UM/DM association and rejects spurious uplink messages	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_CPDLC_05u	Undetected reception of an unintended CPDLC message [single aircraft]
		CU_01_a	Message is related to CPDLC application	CU_02_a	Message is an uplink message			EMM_10	Aircraft system checks UM/DM association and rejects spurious uplink messages	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Success				OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
				CU_02_b	Message is a downlink message			EMM_11	Ground system checks UM/DM association and rejects spurious downlink messages	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_CPDLC_05u	Undetected reception of an unintended CPDLC message [single aircraft]
													Success				OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]
										Success							OH_ED228_CPDLC_05d	Detected reception of an unintended CPDLC message [single aircraft]

Abnormal Events		Environmental Conditions						External Mitigation Means									Operational Hazards	
AE Ref	AE	EC 1 Ref	EC 1	EC 2 Ref	EC 2	EC 3 Ref	EC 3	EMM 1 Ref	EMM 1	EMM 1 F/S	EMM 2 Ref	EMM 2	EMM 2 F/S	EMM 3 Ref	EMM 3	EMM 3 F/S	OH Ref	OH
AE_05	Generation of one spurious message at Means of Communication level	CU_01_b	Message is related to ADS-C application	CU_02_a	Message is an uplink message			EMM_10	Aircraft system checks UM/DM association and rejects spurious uplink messages	Failure	EMM_01	Flight Crew detects uplink message is inappropriate	Failure				OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
													Success				OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
				CU_02_b	Message is a downlink message			EMM_11	Ground system checks UM/DM association and rejects spurious downlink messages	Failure	EMM_09	Controller detects downlink message is inappropriate	Failure				OH_ED228_ADSC_07	Unexpected interruption of the delivery of an ADS-C report [single aircraft]
													Success				OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
										Success							OH_ED228_ADSC_05	Detected reception of an unintended ADS-C message [single aircraft]
AE_06	Permanent failure to communicate with one aircraft																OH_NEW_ALL_01	Failure to exchange any message with a single aircraft
AE_07	Permanent failure to communicate with more than one aircraft																OH_NEW_ALL_02d OH_NEW_ALL_02u	Failure to exchange any message with more than one aircraft

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