



PJ.17-01 TRL4 EXE1 Description

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Leonardo Rome, Italy



Founding Members



Outline (15')



- EXE1 overview
- Scenarios overview
- Q&A

EXE1 overview

PJ.17-01 EXE1 setup (1/3)



Selex-GmbH MET Provider
(and Consumer) (@Neuss)



- Leonardo, Selex EX GmbH and Frequentis V&V infrastructure (HL view)

Leonardo Cockpit+EFB
Simulator equipped with
SWIM Aircraft Access
Point (@Turin)



Frequentis ePIB (Electronic Preflight
Information Bulletin) Service (@Wien)



Leonardo Lab equipped with SWIM
Ground Access Point and SWIM
Certification Authority (@Rome)



Leonardo SWIM Viewer
(@Naples)

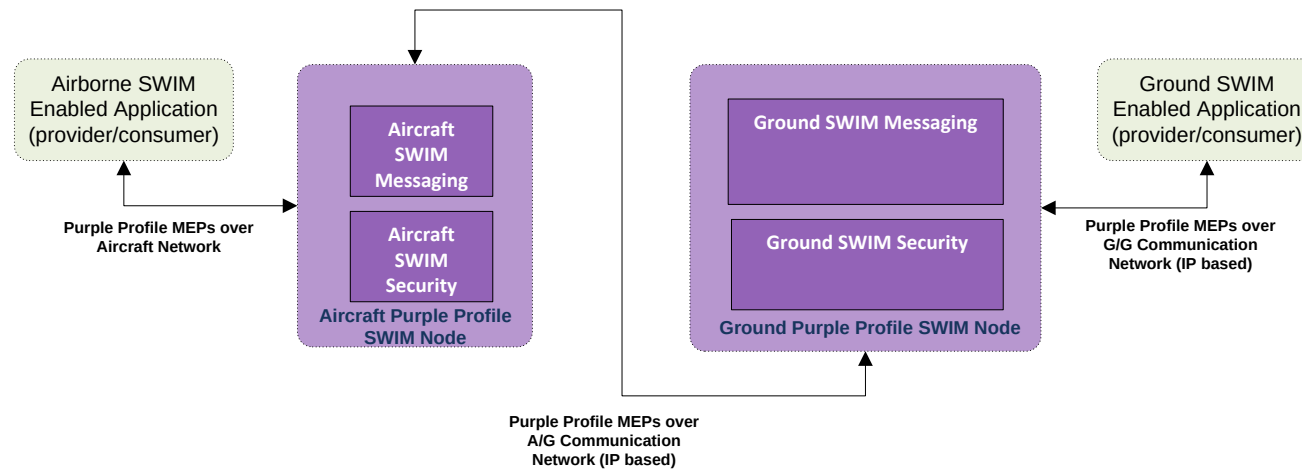


WAN VPN

EXE1 overview

PJ.17-01 EXE1 setup (2/3)

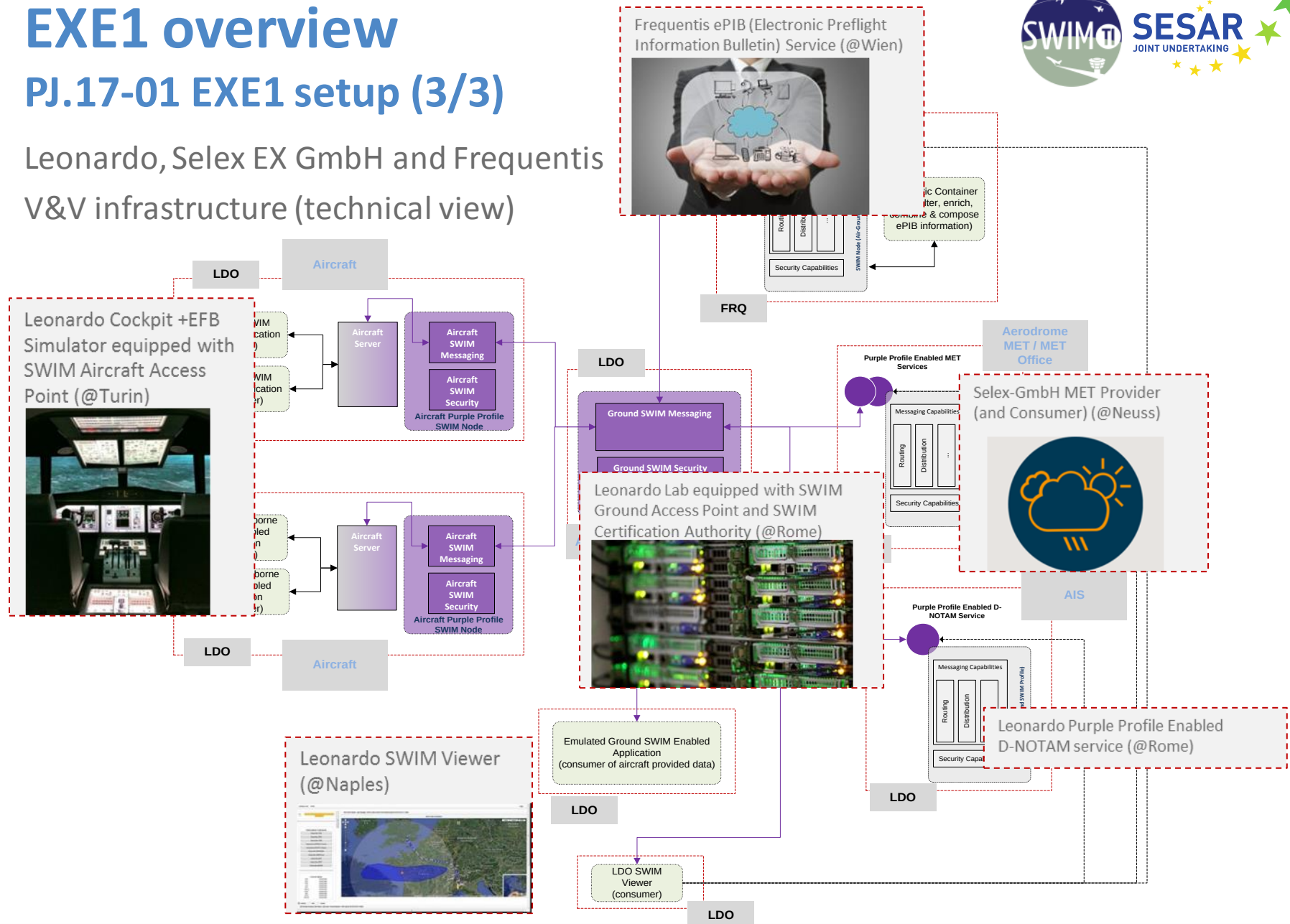
Leonardo, Selex EX GmbH and Frequentis
V&V infrastructure (technical view)



EXE1 overview

PJ.17-01 EXE1 setup (3/3)

Leonardo, Selex EX GmbH and Frequentis V&V infrastructure (technical view)



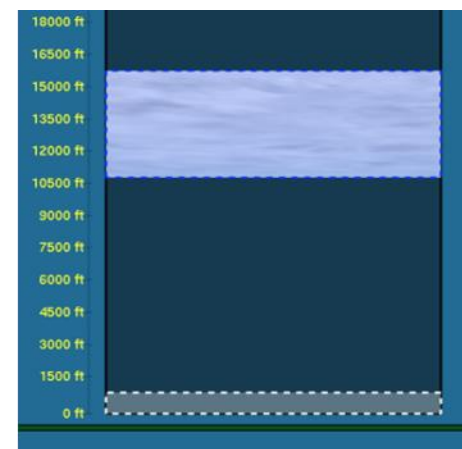
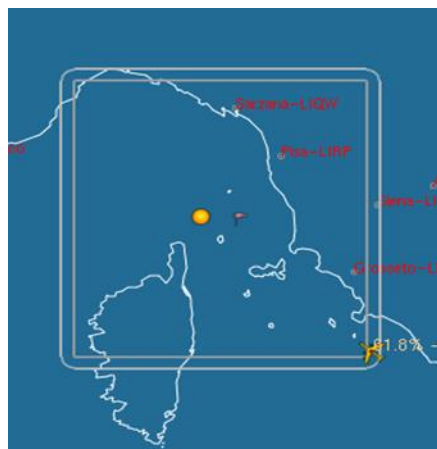
EXE1 overview

Leonardo EFB and Meteoprobe service

- Leonardo regional simulator equipped with Purple Profile enabled EFB capable of uplinking weather (METAR, TAF) and D-NOTAM.



- Purple Profile enabled Leonardo Embedded Meteo Server (EMS) 4D wind/temp capable of downlinking aircraft derived MET data.



EXE1 overview

Selex ES GmbH & Leonardo Purple Profile enabled GWMS

- The GWMS prototype provided by Selex ES GmbH is a platform to integrate all MET information relevant for a local airport and provide the information as tailored MET services .
- For the provision part, the Yellow Profile MET service “METAR” from SESAR1 has been extended (by Leonardo) to allow distribution of MET bulletins (not only limited to METAR) over Purple Profile service binding (iWXXM 1.1 over both Publish/Subscribe and Request/Response).
- For the downlink part, GWMS consumes the METEOPROBE service that conveys A/C measured MET data. These data are valuable for MET products to be cast into local MET services to be developed in SESAR2020 such as a glide path wind profile required for sequence management processes.



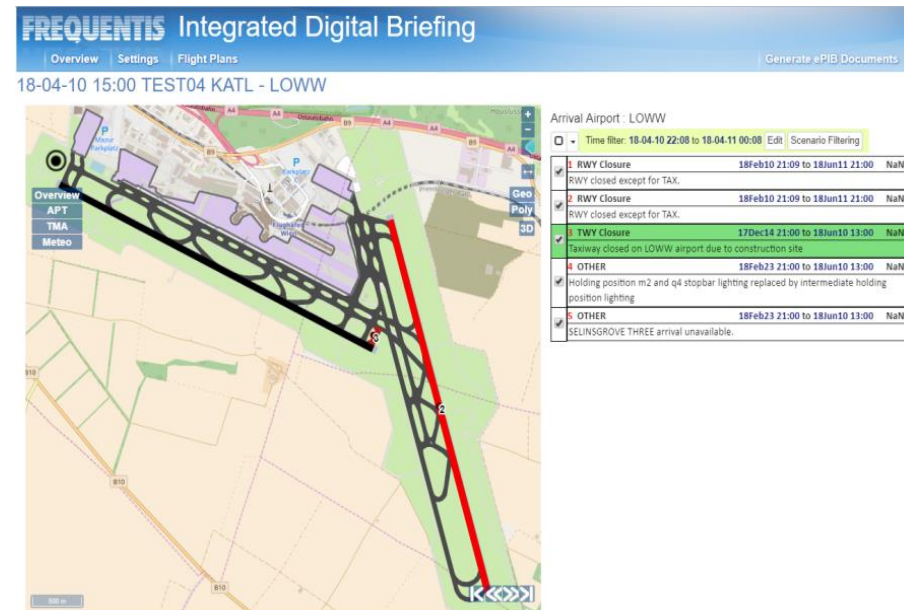
Selex-GmbH MET Provider
(and Consumer) (@Neuss)



EXE1 overview

Frequentis EPIB IDBS

- The EPIB IDBS provided by Frequentis AG is a SWIM application that provides digital briefing to pilots in both machine-readable and human-readable form.
- It was initially developed as part of SESAR1 SWIM WP13 and is deployed as part of a SWIM platform consisting of a AIXM 5.1 database, multiple data interfaces for weather, NOTAM and other aeronautical data, a semantic container that is the result of integration with the H2020 BEST SESAR Exploratory Research.
- For TRL4 EXE1 it is deployed with a set of test data that have been derived from real data. To ensure reproducibility for the purpose of this exercise, this dataset is well defined and predetermined.



EXE1 overview

Leonardo Aeronautical Information Notification service



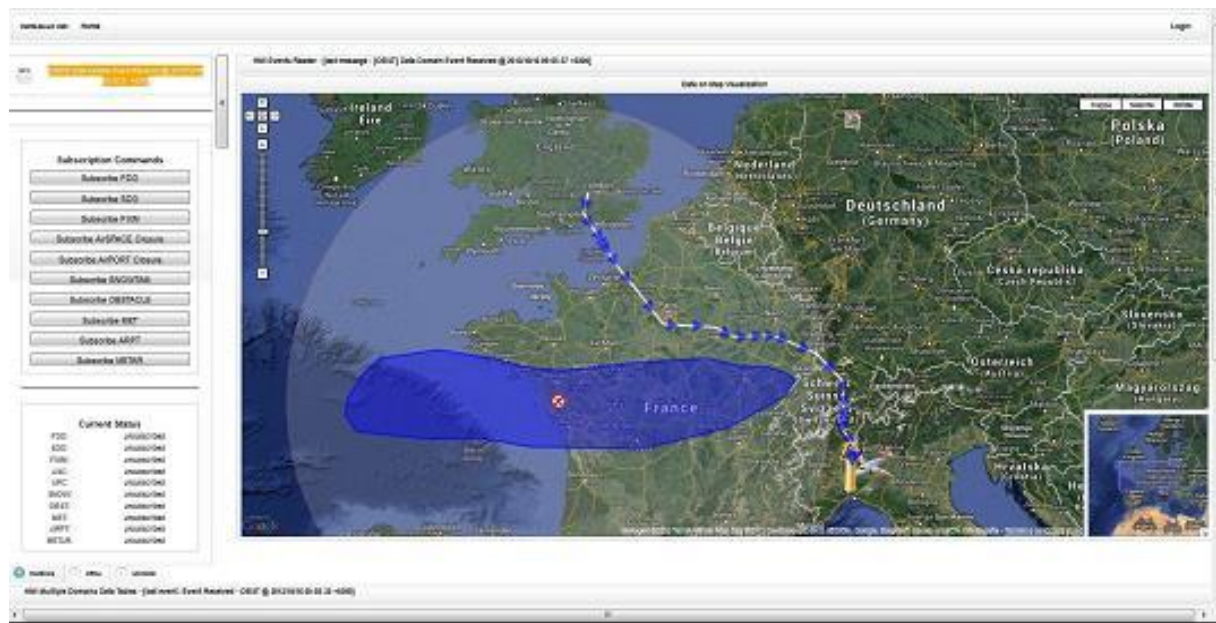
- This service is a basic application able to publish D-NOTAMs according to Purple Profile SWIM service binding (PS-MEP).
- It is based on a layered architecture allowing it to be plugged in more complex applications.
- The information model used by this service is AIXM 5.1.

EXE1 overview

Leonardo SWIM Viewer



- The SWIM Viewer is a web based Human Machine Interface that allows to receive and visualize on a map (Google Map, in this case) most of the types of information exchanged via SWIM.
- In the context of PJ17-01, SWIM-Viewer application has been extended in order to be capable to receive and visualize some of the data exchanged among Ground and Aircraft SWIM Nodes including METAR, TAF and “MeteoProbe” data.



EXE1 overview

Leonardo Aircraft and Ground PP SWIM Nodes



- Full support of PP technical use cases (uplink and downlink):
 - Publish/Subscribe, Request/Response, Request/Multi-Response
 - Subscription management including static and dynamic subscription policies.
 - Subject-based and context-based message routing including static and dynamic routing policies.
 - Subject-based and context-based message filtering.
 - Full support of all the technical and deployment options described in the TS.
- Full support of transport and message level security controls including:
 - Authentication, Authorization, Integrity, Authenticity Confidentiality.
 - Static & dynamic authentication and authorization policies.
 - X.509 certificates revocation status check (local CRL, HTTP CDP, OCSP).
- LDO provides also PP enabled client libraries simplifying applications integration with aircraft or ground SWIM Nodes.

Scenarios overview

High level “operational” scenario disclaimer



- Scenarios are just used for having reference «Ops like» environment to demonstrate:
 - Purple Profile infrastructure capabilities.
 - Infrastructure usage via Purple Profile enabled SWIM services and consumers.
- They are not meant to be fully correct

Scenarios overview

The high level storyboard



A Flight departing from Wien (LOWW) to Milan Malpensa (LIMC)

Shortly before departure:

- While still at the Airport, flight crew requests a «PIB» (Pilot Information Bulletin) to FOC regarding its planned route (PIB includes latest NOTAMs and aeronautical info). Flight crew receives the first PIB and (still before the departure) an update (NOTAM event).
- Before departing the Flight crew “registers” to receive in-flight PIB updates (if any) and MET Information about destination airport.

During En-route:

- Flight crew receives (asynchronously) updated PIB indicating that the NOTAM reported before departing is now no more valid.

During descent/approach:

- Flight crew is requested to activate provision of MET information (“Meteo-Probes” data) to ground systems (aircraft acting as a MET sensor) . MET data are published by the aircraft and received by ground systems (including Airport MET).
- Flight crew receives (asynchronously) MET Information (METAR(s)) related to Milan Malpensa (same information is also received by other ground systems).
- Flight crew receives (asynchronously) D-NOTAM (SAA) impacting the flight trajectory (same information is also received by other ground systems). Received information requires the flight crew to change route

Scenarios overview

Why the “OPS” scenarios?



- The «OPS» scenarios allow to more easily figure out the links among «Technical» use cases (defined in PJ17-01) with wider «ops»
- PJ17-01 defines «Technical Use Cases» centered on «Data Link modes» (defined in ED-151 document) and SWIM «MEPs» (Message Exchange Patterns)
- E.g.:
 - “ED-151” Data Link mode “Demand” is mapped on “Request/Reply” MEP and “Publish/Subscribe” Pull MEP
 - So, (e.g.) Step “Flight crew requests a «PIB» (Pilot Information Bulletin) to FOC” translates into a “Request/Reply” MEP from an Aircraft towards a Ground System/Application (relying on a “SWIM Service”).
 - Aircraft and Ground Systems’ Applications are used to solicit the “SWIM Infrastructure” with Information Exchanges (using different MEPs) allowing to check correct “end-to-end” behavior and enforcement of Security Controls (in particular, for those in charge to the SWIM Infrastructure).

Scenarios overview

Storyboard and technical systems



- The storyboard is split in 3 scenarios as per TVALP:
 - Scenario 1: Integrated digital briefing exchange before departure and inflight updates.
 - Scenario 2: Aircraft provided MET data during descent/approach.
 - Scenario 3: METAR and D-NOTAM exchange during descent/approach.
- Each scenario is then decomposed in steps and each step linked to systems and Purple Profile technical use cases.

Scenarios overview

Storyboard and technical systems: scenario 1



Step	Description	Aircraft role	Ground-based system role	SWIM Service(s)	Aircraft/Ground consumer application(s)	Options identification	Options
EXE1-SCE1-S01	Before departure, Pilot retrieves latest ePIB providing latest aeronautical and weather information relevant for the intended flight plan. This step consists in consuming a ground provided SWIM service by an aircraft application.	Consumer	Provider	FRQ IDB Service	LDO Emulated aircraft application(s)	Two options (links with OBJs) have been identified: 1. PPUC-01a (RR) + PPUC-02 (PS) (for updates as per step EXE1-SCE1-S03. 2. PPUC-01b (RMR) covering both EXE1-SCE1-S01 and EXE1-SCE1-S03 (updates)	EXE1-SCE1-OPT01 (PPUC-01a): <u>Requestor</u> = aircraft app(s), <u>Responder</u> = IDB service. EXE1-SCE1-OPT02 (PPUC-01b): <u>Requestors</u> = aircraft app(s), <u>Responder</u> = IDB service.
EXE1-SCE1-S02	This information is taken into consideration for trajectory optimization.	N/A	N/A	N/A	LDO Emulated aircraft application(s)		
EXE1-SCE1-S03	Pilot visualizes on EFB current weather and aeronautical information and gets notified upon information change.	N/A	N/A	N/A	LDO Emulated aircraft application(s)	As per EXE1-SCE1-S01	EXE1-SCE1-OPT01 (PPUC-02): <u>Subscribers</u> = aircraft app(s), <u>Publisher/Subscription handler</u> = IDB service. EXE1-SCE1-OPT02 (PPUC-01b): <u>Requestors</u> = aircraft app(s), <u>Responder</u> = IDB service.

Scenarios overview

Storyboard and technical systems: scenario 2



Step	Description	Aircraft role	Ground-based system role	SWIM Service(s)	Aircraft/Ground consumer application(s)	Options identification	Options
EXE1-SCE3-S01	MET reports from one or more Flights are transmitted on an event basis and/or sent in response to a request to one or more ground based systems. This step consists in consuming aircraft provided SWIM services.	Provider	Consumer	LDO Meteoprobe service	LDO SWIM Viewer, LDO emulated ground applications, Selex GmbH GWMS for further use in local 4DWxCube.	One option is feasible: PPUC-04.	PPUC-04: <u>Subscribers</u> = emulated ground app(s), SWIM Viewer, Selex GmbH GWMS. <u>Subscription handler</u> = LDO Aircraft SWIM Node. <u>Publisher</u> = LDO Meteoprobe service.
EXE1-SCE3-S02	MET reports are received and processed by ground based systems. For simplicity the MET reports processing consists in displaying the received meteorological information.	N/A	N/A	N/A	LDO SWIM Viewer, LDO emulated ground applications, Selex GmbH GWMS for further use in local 4DWxCube.		

Scenarios overview

Storyboard and technical systems: scenario 3



OPTs	Step	Description	Aircraft role	Ground-based system role	SWIM Service(s)	Aircraft/Ground consumer application(s)	Options identification	Options
OPT1	EXE1-SCE2-OPT1-S01	Pilot is informed (via voice communication) that bad weather at arrival airport is expected.	N/A	N/A	N/A	N/A	One option is feasible: PPUC-01a.	PPUC-01a: <u>Requestors</u> = aircraft app(s), SWIM Viewer. <u>Responder</u> = One of the LDO Weather services.
	EXE1-SCE2-OPT1-S02	Pilot decides to retrieve latest MET bulletins for the destination airport for analysis on the EFB. This step consists in consuming ground provided SWIM services by an aircraft application (FDRR-MEP).	Consumer	Provider	Selex Gmbh METAR Service, LDO TAF Service, LDO METREPORT Service.	LDO EFB (Flight 2.a enabled by LDO prototypes) LDO SWIM Viewer LDO emulated aircraft.		
OPT2	EXE1-SCE2-OPT2-S01	Latest MET bulletins for the destination airport are asynchronously received on the EFB for analysis. This step consists in consuming ground provided SWIM services by an aircraft application (PSPUSH-MEP).	Consumer	Provider	Selex Gmbh METAR Service, LDO TAF Service, LDO METREPORT Service.	LDO EFB (Flight 2.a enabled by LDO prototypes) LDO SWIM Viewer LDO emulated aircraft.	One option is feasible: PPUC-02.	PPUC-02: <u>Subscribers</u> = aircraft app(s), SWIM Viewer. <u>Publisher/Subscription handler</u> = LDO Weather services.
OPT1, OPT2	EXE1-SCE2-S03	Pilot receives on the EFB an SAA D-NOTAM informing that a portion of the airspace has been closed (e.g. due to MIL operations). This step consists in consuming ground provided SWIM services by an aircraft application (PSPUSH-MEP).	Consumer	Provider	LDO Aeronautical Information Notification service	LDO EFB (Flight 2.a enabled by LDO prototypes) LDO SWIM Viewer LDO emulated aircraft.	One option is feasible: PPUC-02.	PPUC-02: <u>Subscribers</u> = aircraft app(s), SWIM Viewer. <u>Publisher/Subscription handler</u> = LDO Aeronautical Information Notification service.
OPT1, OPT2	EXE1-SCE2-S04	Pilot determines the preferred trajectory to avoid the closed airspace and coordinates with ground for acceptance.	N/A	N/A	N/A	N/A		



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PJ.17-01 TRL4 EXE1 Description

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