

# SESAR DEMO STAIRS

## Report Template - Part II - Safety

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# STAIRS

## 10 SESAR DEMO STAIRS

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13 grant agreement No 874476 under European Union's Horizon 2020 research and innovation  
14 programme.



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### 17 **Abstract**

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18 This document contains the Safety Assessment Report for the demonstration of Traffic Alerts for pilots  
19 in airport operations. This section specifies the safety assessment activities under two exercises that  
20 are related to VLD2 STAIRS demonstration conducted in acceptable safe conditions and providing  
21 results from safety point of view following the Safety Requirements in consistency with SESAR SRM.

- 22 • Exercise EXE-VLD-02-001 (EXE-H)
- 23 • Exercise EXE-VLD-02-002 (EXE-T)

24

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# 1 Executive Summary

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48 This document provides a summary of the VLD safety assurance activities conducted in accordance  
49 with the DEMO Report Part II (Safety Plan), including the VLD safety demonstration with regards to the  
50 suitability of the SESAR Solution for the deployment and the safety acceptability of the VLD impact on  
51 current operations.

52 The STAIRS demonstration of two exercises has been done under safe conditions without impact to  
53 ATS/ATM and reflected all the system performance aspects following from safety objectives in SESAR  
54 D4.1.191 PJ03B-05 SPR-INTEROP/OSD V3 - Part II - Safety Assessment Report.

55 Exercises executed with experimental business/mainline aircraft and bench testing has not requested  
56 operational approvals, certified systems and did not impact any existing ATS/ATC procedures.

57 The final planned demonstration campaign with experimental fleet has been postponed beyond the  
58 SESAR STAIRS schedule and does not represent any safety impact to existing ATM architecture or  
59 aircraft safety operation based on results of the safety assessment.

60 An experimental aircraft complied with all airworthiness guidelines, requirements with red label  
61 regression testing, possibility to switch to certified system configuration and to manually inhibit the  
62 system function.

63 The system performance with the nuisance/false alert rate has been identified as the key driver for  
64 the safety impact with future deployment and that requirements and concerns have been addressed  
65 within objectives groups OB1, OB2 and OB3.

66 Other interoperability aspects with safety impact to the ATM architecture have been covered with  
67 interoperability objectives of OB4 group.

68 For the future deployment and based on internal operational risk evaluation (ORE), each operator will  
69 assess the acceptance level of the risks and will decide to apply full/mixed/shadow mode of the system  
70 implementation in the cockpit. This optional configuration could be selected anytime also during final  
71 demonstration phase and deployment.

72 For aircraft with full/mixed system implementation, the crew will be properly trained with Airbus  
73 FCOM with recommended SOP and training material for the new system function, HMI and get familiar  
74 with VLD2 STAIRS program and objectives.

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76

## 77 2 Introduction

78 This report provides results of the execution of the applicable DEMO Plan Part II safety, in the way the  
 79 VLD have been set up and conducted in acceptably safe conditions and describes the outcome and  
 80 results of the VLD from a safety point of view.

### 81 2.1 VLD Objectives, Justification and Scope

82 Below table provides high level objectives on the STAIRS program also applicable to safety aspects of  
 83 the safety assessment for the STAIRS VLD.

STAIRS Objectives	Description	STAIRS KPI	Success criteria	Scope
OB1	<b>Controlled Entry Into Service (CEIS)</b>	(Safety, Human Performance) Operational:  Nuisance, false, missed alerts rate and human performance	Acceptable alert rates, System and HMI acceptance	System performance, system function inhibition and silent mode, Operational approval, Certification; Flight crew training
OB2	<b>Data replay in fast time</b>	(Safety) Fast time simulations, replay: Nuisance, false alerts, certification	Acceptable alert rates, System acceptance	System performance testing before flights
OB3	<b>ADS-B quality assessment</b>	(Interoperability): transverse analysis of ADS-B performance acceptability	Traffic detection rate of at least 70%  Navigation parameters accuracy (position, speed, heading)	Relevant and significant in-service data analysis, design solution for accuracy
OB4	<b>Interoperability review</b>	(Interoperability): ANSP operational expertise	Compatibility with ground safety net, alert timing, ATC procedures and phraseology	Assessment with no impact to ATS/ATC

84 Table 2-1 Safety Objectives with scope

85

## 86 **2.2 Scope of the VLD Safety Assessment**

87 The scope of the VLD safety assessment included activities related to each exercise before  
88 demonstration and also for future deployment.

89 Exercise EXE-VLD-02-001 (Work Package 3)

90 The scope of safety assessment included activity to address safety objectives and assumptions with  
91 DEMO1 hardware bench test and DEMO2 flight trial preparation.

92 Exercise EXE-VLD-02-002 (Work Package 4)

93 The scope of safety assessment included activity to address safety objectives and assumptions with  
94 DEMO3 hardware bench test at Thales/Airbus premises and DEMO4 demo flights preparation.

95 For more details see Table 4-1 with objectives, assumptions and results addressing the safety  
96 assessment for VLD and deployment safety impact.

97



## 98 3 VLD safety argument and assurance 99 activities

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100 Assurance and safety arguments have been covered during DEMO 1/3 bench testing with system  
101 performance validation on the real hardware and with fast time simulation using real in-service data  
102 proving expected system performance.

103 DEMO2/4 flight test preparation included flight crew training with testing of specific scenarios and/or  
104 preparation flight trial with the most critical SPR/OSED defined scenarios.

105 As the final demonstration take place primarily on experimental fleet, an authority cert and  
106 operational approvals were not needed at the time. With the following commercial flights and  
107 demonstration that will need to be secured in advance.

108 From the system perspective the system configuration on both exercises has requested possibility of  
109 silent mode and manual function inhibit implemented in the system design for the VLD and also future  
110 deployment.

111

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# 115 4 VLD safety Results

116 Below is the table including final results with safety objectives, scope and related assumption.

Objectives	Assumption Identifier	Title	Type of safety assumption	Description	Justification	Scope	Results
OB1/OB2	ASS-VLD-02-001	Maturity	Technology	VLD expects demonstration of V3 mature Solution PJ03B-05.	Readiness level of all system components. Objective of this VLD is to de-risk VLD and future deployment of mature solutions with CEIS.	Overall system performance verification	OK. DEMO1/3 bench test/DEMO2/4 prep; OBJ-VLD-02-001,-003,
OB1/OB2/OB4	ASS-VLD-02-002	AU users participation	AU	Trained AU users participate in the project	AU users play key role in the demo, training of the crew is necessary	AU feedback on operational scenarios and alerts, crew system training	OK. Verified with DEMO1/2 objectives OBJ-VLD-02-002,-009
OB1/OB2	ASS-VLD-02-003	SURF-A/ITA performance	Performance	No/minimum alerts during regular operations	System performance with nuisance, false and missed alerts rate. Alert timing below ATC procedures and separation	System performance from flights and FTS.	OK. Verified with FTS objectives OBJ-VLD-02-001,-003,-004
OB1	ASS-VLD-02-004	Silent mode	Implementation	Possibility to select silent version of the SURF-A/ITA implementation	Airlines/experimental operational procedures and inhibit preference	Silent mode, System inhibits in case of troubles	OK. Implemented and tested DEMO1/3 bench test/DEMO2/4 prep
OB1	ASS-VLD-02-005	Experimental/Commercial flights	Range	Number of flights will represent statistically significant sample	Operations; Operational approval, certification,	Statistics representing safety objectives	Partially OK (Impact change for number of flights)
OB2/OB3	ASS-VLD-02-006	ADS-B data	ADS-B	ADS-B data represent reality on existing airport	ADS-B analysis and representative results, existing	Relevant and significant in-service data	OK. Verified with FTS objectives

					environment, equipage rate		OBJ-VLD-02-003,-004
OB4	ASS-VLD-02-007	ATC	Interoperability	No change to existing ATS/ATC procedures and services	DEMO will not need any change to ATS, ATC, ATFM processes	No ATS/ATC impact	OK. Verified with interop objectives OBJ-VLD-02-001,003,005÷9
OB1	ASS-VLD-02-008	Certification	Regulation	System will be certified before DEMO 2.	Based on existing certification processes.	Certified system for commercial flights	Partially OK. Cert started, not completed for experimental fleet
OB2/OB4	ASS-VLD-02-009	ANSP data	Interoperability	Comparison of available ATC collected data from specific airport	Comparison of two data samples for main parameters accuracy analysis	Recent ANSP data for accuracy comparison	OK. Eurocontrol activity done
OB1	ASS-VLD-02-010	CAA	Operational	Operational approval before DEMO2 flights.	Operational approval with new safety application	Operational approval for commercial flights	Partially OK. OA not needed for experimental fleet

117 **Table 4-1 Safety Objectives results with assumptions and scope**

118 **4.1 Suitability of the SESAR solution(s) for deployment**

119 There has not been identified any significant hazard with safety impact of the VLD2 STAIRS on  
 120 deployment and with reference to Table4-1, therefore the VLD has been find as acceptable with very  
 121 low risk.

- 122 • The only hazard applicable to the future deployment is the nuisance alerts rate caused by ADS-  
 123 B quality issues.
  - 124 ○ The mitigation action is to use design solution to remove these impacts or to have  
 125 ability to configure/disable the system manually for specific use case or runway if  
 126 needed.

127  
 128 For the experimental fleet operations there is no need for any involvement of the authorities and their  
 129 associated operational approvals. With the final commercial demonstration and deployment these  
 130 artifacts will need to be secured in advance.

131 For the future deployment and based on internal Airbus operational risk evaluation (ORE), each  
 132 operator will assess the acceptance level of the risks and will decide to apply full/mixed/shadow mode  
 133 of the system implementation in the cockpit.

134 For aircraft with full/mixed system implementation, the crew will be properly trained with Airbus  
135 FCOM with recommended SOP and training material for the new system function, HMI and get familiar  
136 with VLD2 STAIRS program and objectives.

## 137 4.2 Safety impact of the VLD on current operations

138 Exercise EXE-VLD-02-001 (Work Package 3) has not identified any safety impact on current operations.  
139 Executed business aircraft flight trial and bench testing has not requested any operational approvals,  
140 finally certified systems and did not impact any existing ATS/ATC procedures.

141 The final planned demonstration campaign with experimental fleet has been postponed beyond the  
142 SESAR STAIRS schedule and therefore did not represent during VLD demo any safety impact to existing  
143 ATM architecture or aircraft safety operation.

144 The system performance with the nuisance/false alert rate has been identified as the key driver for  
145 the safety impact with future deployment and that requirements and concerns needed to be assessed  
146 related to available exercise objectives and assumptions.

147 Other interoperability aspects with safety impact to the ATM architecture have been covered with  
148 interoperability objectives led by DSNA.

149 Exercise EXE-VLD-02-002 (Work Package 4) has not identified any safety impact on current operations.  
150 Mainline aircraft was expected to execute commercial flights with already certified SURF-A/ITA  
151 systems by EASA, implemented by approved Airbus SB with operational approval of local CAA.

152 Based on the impact changes as described by the deviation chapter **Error! Reference source not found.**  
153 (DEMO STAIRS report part I) to the original plan, the final demonstration has been descoped for  
154 campaign including experimental Airbus fleet only.

155 Implementation of the SURF-A function in the shadow mode presents no additional risk as no SURF-A  
156 related information is outputted to the pilot. Thus, installation of SURF-A in shadow mode is no  
157 different than not having this system on-board. Stating that, actions had to be performed to assure  
158 that no SURF-A alert will occur during flight with SURF-A function in the shadow mode caused by a  
159 malfunction of the system or installation error.

160 Airbus has performed safety analysis and system laboratory tests to assure that. Correct configuration  
161 of the system in shadow mode is also part of the ground tests performed on the aircraft after  
162 installation of the unit.

163 There has been also applied a system HW failure assessment and regression testing of the red label  
164 software installed in the final platform.

165 This Safety assessment to be reviewed along the progress of the system design approval, airworthiness  
166 approval and operational approval process.

167

## 5 Acronyms and Terminology

Acronym	Definition
<b>ADS-B</b>	Automatic Dependent Surveillance – Broadcast
<b>ADS-R</b>	Automatic Dependent Surveillance – Rebroadcast
<b>A-SMGCS</b>	Advanced Surface Movement Guidance and Control System
<b>ATC</b>	Air Traffic Control
<b>ATM</b>	Air Traffic Management
<b>ATSA-SURF</b>	Enhanced Traffic Situational Awareness on the Airport Surface
<b>CDTI</b>	Cockpit Display of Traffic Information
<b>CNS</b>	Communication Navigation and Surveillance
<b>CONOPS</b>	Concept of Operations
<b>CR</b>	Change Request
<b>DEMOP</b>	Demonstration Plan
<b>DEMOR</b>	Demonstration Report
<b>EATMA</b>	European ATM Architecture
<b>FTS</b>	Fast Time Simulation
<b>HMI</b>	Human Machine Interface
<b>HPAR</b>	Human Performance Assessment Report
<b>ICAO</b>	International Civil Aviation Organization
<b>INTEROP</b>	Interoperability Requirements
<b>IPR</b>	Intellectual Property Rights
<b>KPA</b>	Key Performance Area
<b>OI</b>	Operational Improvement
<b>OPAR</b>	Operational Performance Assessment Report
<b>OR</b>	Operational Requirements
<b>OSED</b>	Operational Service and Environment Definition
<b>OSR</b>	Operational Service Requirement
<b>OSRec</b>	Operational Service Recommendation
<b>PAR</b>	Performance Assessment Report
<b>RWY</b>	Runway

<b>SAC</b>	Safety Criteria
<b>SAR</b>	Safety Assessment Report
<b>SESAR</b>	Single European Sky ATM Research Programme
<b>SESAR Programme</b>	The programme which defines the Research and Development activities and Projects for the SJU.
<b>SJU</b>	SESAR Joint Undertaking
<b>SJU Work Programme</b>	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
<b>SPR</b>	Safety and Performance Requirements
<b>V&amp;V</b>	Validation & Verification

**Table 5-1: Acronyms**

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## 172 6 References

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### 173 Safety

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- 174 [1] DEMO Plan Part II Safety Assessment Plan -latest edition accessible in STELLAR Program Library
- 175 [2] SESAR Safety Reference Material - latest edition accessible in STELLAR Program Library
- 176 [3] Guidance to Apply SESAR Safety Reference Material - latest edition accessible in STELLAR  
177 Program Library
- 178 [4] STELLAR Slideboard, Safety part (complementary guidance)
- 179 [5] (EU) No 2017/373 laying down common requirements for service providers and the oversight  
180 in air traffic management/air navigation services and other air traffic management network  
181 functions, repealing Regulation (EC) No 482/2008, Implementing Regulations (EU) No  
182 1034/2011 and (EU) No 1035/2011 and amending Regulation (EU) No 677/2011 (and  
183 associated AMC and GM)
- 184 [6] SESAR P16.01.04, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August  
185 2015
- 186 [7] DEMO STAIRS report Part I D1.4
- 187

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**THALES**



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