Final Project Report

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Task contributors

*AIRBUS, AENA, DFS, ENAV, EURONTROL, **NATMIG**, SELEX.*

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Abstract

This final project report summarises the achievements of P16.01.03. Three main contributions are highlighted. Deliverable D03 provides an overview of Dynamic Risk Modelling (DRM) methodologies. Deliverable D09 presents in detail an application of a DRM methodology to a SESAR case. Deliverable D11 Guidelines for DRM application describes steps required for applying a DRM methodology. D11 can be used to develop DRM guidance material for safety assessment to be part of the Safety Reference Material.

Authoring & Approval

Prepared By – *Authors of the document.*		
Name & Company	**Position & Title**	**Date**
███████████ NATMIG (SINTEF)	████████████████████████	08/10/2014

Reviewed By – *Reviewers internal to the project.*		
Name & Company	**Position & Title**	**Date**
████████ NATMIG (SINTEF)	████████████████████	27/09/2014
████████		08/10/2014

Approved for submission to the SJU By – *Representatives of the company involved in the project.*		
Name & Company	**Position & Title**	**Date**
█████████ DFS	████████████████████	29/09/2014
█████████ AIRBUS		29/09/2014
█████████ AIRBUS		29/09/2014
█████████ EUROCONTROL		29/09/2014
█████████ DFS		29/09/2014
█████████ AENA		29/09/2014
█████████ ENAV (SICTA)		29/09/2014
█████████ NATMIG (SINTEF)		29/09/2014
█████████ SELEX		29/09/2014

Document History

Edition	Date	Status	Author	Justification
00.01.00	29/09/2014	Revised version	NATMIG (SINTEF)	Document created and minor review comments included.
00.01.01	08/10/2014	Revised version	NATMIG (SINTEF)	Comments provided by SJU during closure gate implemented.
00.01.02	20/03/2015	Final	SJU	Minor corrections to make suitable for publication

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This deliverable consists of SJU foreground.

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1 Final project report

1.1 Project objectives and progress achieved

The objectives and achievements of the project are summarized as follows:

- Demonstrate the **added value of DRM** with respect to static risk modelling

    - Achieved and documented in Deliverable "D09" Dynamic Risk Modelling SESAR test case application and lessons learned. This comprehensive report includes all steps and results of DRM application. Agent-based DRM has been shown to be workable and useful for ATM applications.

- Produce a **guideline** for *when* and *how* to apply DRM techniques in real world analysis situations

    - Achieved and documented through iterative approach from initial guidelines until final guidelines. The result was coordinated with P16.06.01 that addresses the SESAR Safety Reference Material and its application.

1.2 Development process

Figure 1 presents technical activities of the project. The work started early in 2012 mapping DRM methodologies that could be of relevance. Then, a relevant method and SESAR test case were was selected. The selected method was agent-based DRM. The selected test case was Conflicting ATC clearances "Landing vs. Line-up". The preparation of the DRM guidelines was performed in an incremental manner. First, the selected methodology was described including the steps needed to apply the methodology. Each step included an example from existing literature showing how the step should be performed. This description called "initial guidelines for DRM" application was used to apply DRM in a SESAR test case. The test case demonstrated added value. The final guidelines were updated to take account of experiences from the SESAR test case application.
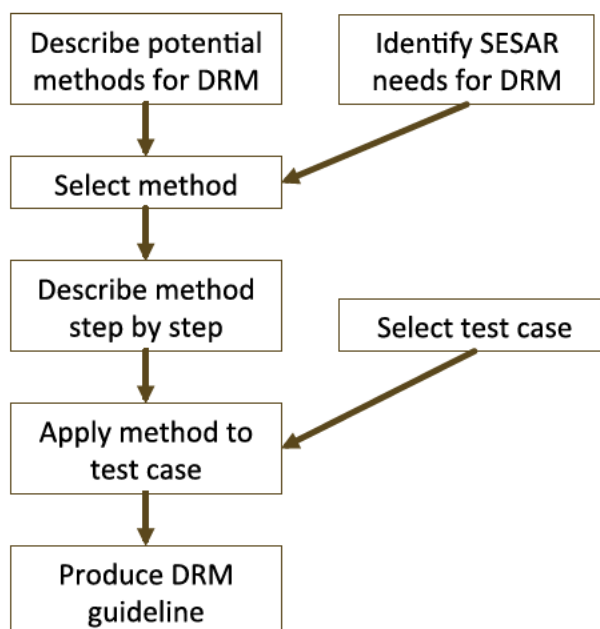

Figure 1. Overview of P16.01.03 DRM project

The project delivered Final DRM guidelines as D11 consisting of two documents, an overall description and a more detailed description, to 16.06.01 for inclusion in the SESAR Safety Reference Material. This concluded the work of project P16.01.03.

1.3 Deliverables

The target audience is safety practitioners from P16.06.01 interested in advanced risk modelling techniques. Deliverables are shown in the reference list.

Table 1. Overview and status of P16.01.03 deliverables

Deliverable Name	Description
Interimediate_Deliverable: Chapter Identified DRM	Provides an overview of DRM methods based on existing published material
Intermediate_Deliverable: Chapter SESAR DRM needs and criteria	Consolidates SESAR needs in terms of DRM assessment and criteria for DRM selection
DRM principles, criteria and relevant solution for SESAR	Final report collecting DRM principles, criteria to select SESAR project suitable for DRM. Including selection of optimal DRM solution. Relevant DRM examples from existing documentation are included.
Initial guidelines for DRM application	A report consolidating the initial guidelines for DRM application to be used by safety practitioners. It consists of a description of a method step-by-step. Furthermore, it includes the steps for selection of relevant test cases.
DRM test case application and lessons learned	Test case and lessons learned from the application of the DRM method are consolidated
Final guidelines for DRM application	This deliverable is the final result documenting guidelines for DRM application to be integrated in the Safety Reference Material for P16.06.01.

1.4 Communication and coordination

External coordination and communication was mainly with P16.06.01. The complexity of the composition of the consortium required internal communication and coordination focusing attention on achieving progress within the project.

Internal P16.01.03
Two DRM dedicated internal workshops and coaching from experienced partners were performed to the partners within P16.01.03. The purpose of these workshops was to facilitate application of agent-based DRM and production of guidelines.

External P16.01.03
- Support sub-contracting of SW - Monte Carlo simulations on the Dynamic Color Petri Net model
- Presentations to P16.06.01 regarding P16.01.03 progress were performed when results were available:
  P16.06.01 Project F2F meeting Vienna May 2012 – Criteria for DRM selection presented
  P16.06.01 Project F2F meeting Trondheim June 2013 – DRM initial guidelines presented
  P16.06.01 Project F2F meeting Madrid January 2014 - DRM test case status P16.01.03 presented
  P16.06.01 Project F2F meeting Vienna May 2014 – DRM test case results presented
  Emails concerning DRM final guidelines content exchanged. P16.06.01 Project manager review of DRM final guidelines

- Paper prepared and presented at ESREL 2014. SJU provided feedback before paper was submitted and presented

1.5 Project recommendation

Dynamic Risk Modelling is gaining more attention in different domains and further developments in this area are expected. Within the context of SESAR, Dynamic Risk Modelling is considered to be required if the level of uncertainty in the risk results of an initial risk evaluation using a conventional (static) method is such that it cannot be conclusively argued whether the risk is acceptable or not. It should be noted that Dynamic Risk Modelling is rather advanced work that requires significant resources and skills; this may be costly for some projects. Tutorials, friendly and open source tools are recommended and required so a larger community can access Dynamic Risk Modelling methodologies.

Regarding management of SESAR projects, it has been a challenge to agree on work when project management has no control of efforts. The project manager depends on partners' willingness to perform specific tasks. Therefore, for future programs more specification of work expected for each partner is recommended.

2 References

[1] SESAR Programme Management Plan, Edition 03.00.01

[2] European ATM Master Plan, Edition 2

[3] Multilateral Framework Agreement ("MFA") signed between the SJU, EUROCONTROL and its 15 selected members on August 11, 2009, amended on 14 June 2010, 19 October 2010 and 2 July 2012

[4] [WP 16.01.03], SESAR WP 16.01.03 Project Initiation Report PIR Part 1 Edition 00.01.02.

[5] [WP 16.01.03], SESAR WP 16.01.03 Project Initiation Report PIR Part 2 Edition 00.01.04.

[6] [WP 16.01.03 D01], SESAR WP 16.01.03 Deliverable D01: Project management plan Part 1.

[7] [WP 16.01.03 D01], SESAR WP 16.01.03 Deliverable D01: Project management plan Part 2.

[8] [WP 16.01.03 D03], SESAR WP 16.01.03 Deliverable D03: Identification of Dynamic Risk Modelling for SESAR needs, Need for DRM in SESAR, December 2011. This deliverable contains extensive references to DRM methods mentioned in this document with the exception of Modelica references. A few Modelica references are included in this deliverable.

[9] [WP 16.01.03 D04], SESAR WP 16.01.03 Deliverable D04: Identification of Dynamic Risk Modelling for SESAR needs, Selection of DRM solution for SESAR, March 2012.

[10][WP 16.01.03 D05], SESAR WP 16.01.03 Deliverable D05: Description of Dynamic Risk Modelling step by step, July 2012.

[11][WP 16.01.03. D07], SESAR WP 16.01.03 Deliverable D07 Initial guidelines for DRM application. Edition 00.01.03

[12][WP 16.01.03. D09], SESAR WP 16.01.03 Deliverable D09 Dynamic Risk Modelling SESAR test case application and lessons learned. This document contains detail references of all documents used for the test application.

[13][WP 16.01.03. D11], SESAR WP 16.01.03 Deliverable D11 Final Guidelines for Dynamic Risk Modelling (DRM) application, July 2014.

[14]WP 16.01.03. D11 doc 2], SESAR WP 16.01.03 Deliverable D11 Document 2: Revised Initial guidelines for Dynamic Risk Modelling (DRM) application, July 2014.

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