Final Project Report

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Task contributors	
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Abstract

The project developed contingency solutions based on remote tower technology. The contingency solution will enable the air traffic controllers at an airport to relocate to a backup facility and to continue to provide air traffic service in situations where the control tower needs to be closed.

A Remote Tower Technical Specification was also produced in collaboration with 12.04.07

P12.04.08 developed and integrated prototypes in the framework of the Remote Contingency Tower (RCT).

NATMIG and INDRA have developed two prototypes and integrated at two medium to high level traffic density candidate airports. Remote Contingency Tower located at each airport, or in their vicinity, will provide the air traffic controllers with a reproduced visual out the window tower view. The prototypes have been based on the operational inputs from the 06.09.03 project and validated by 06.09.03 and 06.08.04

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N/A	N/A	N/A

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				the closure Gate

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This deliverable consists of SJU foreground.

Acronyms

Acronym	Definition
ATCO	Air Traffic Controller
ATM	Air Traffic Management
ATS	Air Traffic Service
AFISO	Aerodrome Flight Information Service Officer
HFDD	Human Factor Design Document
HMI	Human Machine Interface
IR	Infra-Red
KPA	Key Performance Area
PSM	Passive Shadow Mode
PTZ	Pan Tilt Zoom
OSED	Operational Services and Environment Definitions
RCT	Remote Contingency Tower
TWR	Tower
WG	Working Group
WP	Working Package

1 Project Overview

The purpose of the project was to develop remote tower platform prototypes and requirements based on P06.09.03 remote tower concept for provision of ATS in contingency situations.

The project also produced a technical specification in collaboration with 12.04.07.

1.1 Project progress and contribution to the Master Plan

The activities addressed by the project have contributed to the solution #13: Remote Provision of ATS during contingency situations.
Through these activities, the project has contributed to the following system enables captured in the ATM Master Plan.

Code	Name	Project contribution	Maturity at project start	Maturity at project end
AERODROME-ATC-51	Provide a remote tower controller working position that in a contingency situation hosts the operator - no longer be located at the local Tower.	Remote Tower Centre (RTC) position that in contingency situation hosts ATCO that will no longer be located at the local Tower.	TRL-4/V2	TRL-6/V3

The projects activities have been sub-divided into the following tasks:

Technical Specification

The project formulated generic System Requirements taking into account the operational requirements received from the operational counter-part project.

The project produced the technical specification in collaboration with 12.04.07, in four iterations that works as a generic specification for Remote Tower for the future. The Remote Tower is a new area without any earlier specifications and there is a need to write a specification foundation for the total concept. The specification includes an HFDD appendix that acts as a design guide on Human Factor issues on Remote Tower platforms.

Prototype Development and Test Execution

The project developed two different prototypes by the two different industry partners with different scopes.

The NATMIG prototype was used during a live Passive Shadow Mode (PSM) trial that was conducted at Gothenburg Airport. The overall aim of this exercise was to assess the technical and operational capability of an initial prototype at medium density aerodrome during contingency situations, at a TRL-4/V2 concept maturity. This exercise built upon the simulations and trials performed in the Remote Provision of ATC to Single Aerodromes.

To reflect the results from the validation exercises, the platforms was updated accordingly and matured to TRL-6/V3. Through a live PSM trial at Gothenburg Airport the prototype was tested on a TRL-6/V3 maturity level. The aim of this exercise was to mature the concept and contribute to the transition to V4 concept maturity by building on the earlier exercise (VP-059). Additional advanced technical enablers as well as amendments and improvements to the baseline functionalities were introduced to mature the prototype platform while using operational lessons learned from VP-059.

The INDRA prototype was used during a PSM trial that was conducted at a medium density aerodrome, Girona/Costa Brava Airport. In this validation the technical feasibility of the prototype was evaluated with information overlaid in the screens such as meteo, filters, highlight of different areas and the use of the PTZ

To reflect the results from the previous validation exercise, the platform was updated accordingly and matured to include more functionality. Through a PSM trial at Girona/Costa Brava Airport the prototype was tested on a TRL-6/V3 maturity level. The validation included advanced visual features such as detection/tracking functionality and IR camera.

All prototypes and tools have been subject to internal testing and verification before the validation exercises.

Support to Validation

During the Validation Exercises the project gave technical support for the integration and the usage of the prototypes. The project gave also support in the post-exercise analysis of the collected data.

The SESAR 12.04.08 project team was composed by one ANSP (Noracon) and three industry partners (Indra, Selex and NATMIG (Lead)).

1.2 Project achievements

The main achievement of the project is to contribute to the contingency remote tower concept being feasible and to also provide a benefit compared to existing contingency plans/procedures. All prototypes reached a maturity of TRL-6/V3

A result from the project is a solution that is able to operate with high air traffic capacity, both under good weather conditions as well as in low visibility scenarios.

A contingency implementation based on remote tower technology such as remote video surveillance will offer a cost-beneficial solution to medium to high traffic density airports in need of ATS contingency. It will also compete with the costs of building additional towers, and be able to maintain a cost-beneficial capacity when the control tower is out of operations.

The platforms consisted of a controller working position with all the ATM systems and other capabilities found in an ordinary control tower. The aerodrome view was shown on a panoramic view of displays and the binoculars in the tower were replaced by a manoeuvrable pan-tilt-zoom camera. The contingency implementation has functionalities such as infrared vision, additional camera viewpoints, tracking of moving objects in the video image (fused with radar data and presented on top of the video in the panoramic view).

The overall conclusion from the two TRL-6/V3validation exercises is that the Remote Provision of ATS to an aerodrome during contingency situations at Small to Medium Aerodromes (with a Single Main Runway) is acceptable to the controller and is operationally feasible. Therefore, the proposed maturity of SDM-0204 following the validation exercises is to exit TRL-6/V3and be selected for transition to V4.

1.3 Project Deliverables

The following table presents the relevant deliverables that have been produced by the project.

Reference	Title	Description
D22	NATMIG V3 Verification Plan	This document is the Verification Plan for the NATMIG TRL-6/V3Contingency Remote Tower verification. It provides a test- and verification plan that describes how the project output is intended to be verified.
D23	NATMIG V3 Verification Report	This document is the Verification Report for the NATMIG TRL-6/V3Contingency Remote Tower verification. It describes the verification result from the executed verification exercises specified in the Verification Plan.
D45	INDRA V3 Verification Plan	This document is the Verification Plan for the INDRA TRL-6/V3Contingency Remote Tower verification. It provides a test- and verification plan that describes how the project output is intended to be verified.
D46	INDRA V3 Verification Report	This document is the Verification Report for the INDRA TRL-6/V3 Contingency Remote Tower verification. It describes the verification result from the executed verification exercises specified in the Verification Plan.

1.4 Contribution to Standardisation

Deliverables from the project have been used as inputs for the ongoing standardisation work within EUROCAE Working Group (WG) 100 Remote and Virtual Tower (RVT), the primary input being the P12.04.07/P12.04.08 consolidated delivery TS

1.5 Project Conclusion and Recommendations

The project has contributed to mature the concept of Remote Provision of ATS to an aerodrome during contingency situations at Small to Medium Aerodromes (with a single main runway). The overall conclusion by the project is that the controllers assess the concept to be acceptable and operationally feasible.

The main contribution of the remote tower concept is to the KPA cost effectiveness and resilience. The productivity of the operator is a major input to the cost effectiveness. The solution makes the airport more resilient to threats such as; fire or smoke in the control tower, technical failures of vital systems and/or acts of unlawful interference.

Compared to current contingency baselines the controllers clearly agreed that the visual presentation had the potential to increase the amount of traffic that could be handled during contingency. The visual presentation had a positive impact on flexibility and increased controller trust; both aspects the ATCOs felt would positively impact capacity. The visual presentation also allowed the solution to be more robust, and hence allowed them to more confidently apply ATS in a wider range of scenarios and in a more flexible manner.

Recommendations from the project is that a CWP replica of the local tower, or at least a similar CWP would facilitate a smooth transition into contingency operations, with particular benefits to controller trust and in allowing for a smooth transition in working methods and also lower the need for recurrent training and thus reduce cost.

It is also recommended that the above results will be used as basis for further developments in more complex environments and higher density aerodromes.

2 References

[1] SESAR Programme Management Plan, Edition 03.00.01

[2] European ATM Master Plan

[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] 12.04.08, NATMIG V2 Contingency prototype, D14, 01.00.00 2013-09-12

[5] 12.04.08, NATMIG V2 Verification plan, D15, 01.00.00 2013-09-02

[6] 12.04.08, NATMIG V2 verification report, D16, 01.00.00 2013-12-03

[7] 12.04.08, NATMIG V2 validation support, D17, 01.00.00 2014-06-27

[8] 12.04.08, NATMIG V3 Contingency prototype, D21, 01.00.00 2015-02-16

[9] 12.04.08, NATMIG V3 Verification Plan, D22, 01.00.00 2015-02-02

[10] 12.04.08, NATMIG V3 Verification Report, D23, 01.00.00 2015-02-16

[11] 12.04.08, INDRA V2 contingency prototype development, D36, 00.01.00 2015-01-30

[12] 12.04.08, INDRA V2 Verification Plan, D37, 00.01.00 2014-11-05

[13] 12.04.08, INDRA V2 Verification Report, D38, 00.01.00 2015-01-30

[14] 12.04.08, INDRA V3 contingency prototype development, D44, 00.01.00 2015-09-30

[15] 12.04.08, INDRA V3 Verification Plan, D45, 00.01.00 2015-09-16

[16] 12.04.08, INDRA V3 Verification Report, D46, 00.01.00 2015-09-30

[17] 06.09.03, Final OSED, D35, 00.06.02 2015-11-20

[18] 06.09.03, Project validation strategy, D05, 00.01.01 2011-03-15

[19] 06.09.03, Contingency TWR trial 1 & 2 validation report, D12 00.03.01 2015-11-02

[20] 06.09.03, HF case-report for Contingency TWR applications, D27 00.01.01, 2015-11-06

[21] 06.09.03, Safety Assessment Report Contingency TWR, D31 00.01.01 2015-11-25

[22] 06.09.03, Rules and Regulations Assessment Report, D03 00.01.01 2012-11-28

[23] SESAR Project B.01 Integrated Roadmap Dataset DS14

[24]

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