EUROPEAN MOVEMENT MANAGEMENT BY A-SMGCS

EMMA Concept and Requirements Impact on ICAO

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Integrated Project of the
Sixth Framework Programme,
Priority 1.4:
Aeronautics and Space,
sponsored by EC, DG TREN
Contract FP6-503192

Overview

1. EMMA Concept
2. Feedback from V&V activity to Requirements
3. ICAO Regulatory documents
   - Related Documents
   - EMMA impact and possible updates
   - Eurocontrol A-SMGCS project
   - Recommendations to EC

EMMA Concept - Surveillance

EMMA2 Service Steps	Description	Comments
Step 1	• Detection and accurate position of all aircraft, all vehicles, and obstacles* • Identification of all cooperative aircraft and vehicles	on the Manoeuvring area EMMA / EUROCONTROL Level 1
Step 2	• Detection and identification of all aircraft	on the Apron area
Step 3	• *Step2 +* • *Detection and identification of **all vehicles*** • *Detection of **Obstacles***	*Movement* area

*obstacles are not part of EUROCONTROL Concept

EMMA Concept - Control

EMMA2 Service Steps	Description	Comments
Step 1	• **Runway** Conflict/Incursion detection and alerting • **Restricted area** infringement detect. EMMA / EUROCONTROL Level 2	Implementation of **conflict resolution** advisory may be initiated at any step
Step 2	*•**Taxiway** Conflict/Incursion detection and alerting*	
Step 3	*•Detection of plan / **route deviation*** *•Support to Communication (**CPDLC**)* *•ATCO coordination (**EFS**)*	
Step 4	*•Conflict/Incursion detection and alerting of **apron / stand / gate** conflicts*	

EMMA Concept – Guidance*
(Flight Crew+ Vehicle Drivers)

EMMA2 Service Steps	Description	Comments
Step 1	• Airport Moving Map incl. Surface Movement Alerting	•Surveillance and Monitoring Service for onboard users
Step 2	*•Ground-Air Database Upload* *•Ground Traffic Display* *•Traffic Conflict Detection* *•CPDLC Ground Clearance and Taxi Route Uplink* *•Braking and Steering Cue (landing roll and taxi)*	*•Ground TIS-B + DL needed*
Step 3	*•HUD Surface Guidance*	*•HUD is already available for approach*
Step 4	*•Automated Steering*	*•Major changes in equipments and procedures*

*Guidance is the wrong term here, pilots and veh. driv. receive different kinds of services

Feedback to EMMA operational Requirements
Example 1

Op_Perf-05	**For the surveillance service, the allowable error in reported position shall be consistent with the requirements set by the control task of the controller: 12m.**
ICAO 4.2.3	The actual position of an aircraft, vehicles and obstacle on the surface should be determined within a radius of **7,5m**.
TRD EMMA Tech_Surv_26	The reported position accuracy of the surveillance data transmitted from the SDF to clients should be **7,5m** or better at a confidence level of **95%**.

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Technical Tests (Verification)		PRG / MXP / TLS
VE-5	Reported Position Accuracy (RPA) [of antenna position]	RPA = 3,2m – 7,5m*

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VE-5	Reported Position Accuracy (RPA)	RPA = 3,2m – 7,5m*
Operational Feasibility (Validation)		
VA-1	When visual reference is not possible, the displayed position of the aircraft in the runway sensitive area is accurate enough to exercise control in a safe and efficient way.	M = 5,1*
VA-2	When visual reference is not possible, the displayed position of vehicles in the runway sensitive area …	M = 4,7*
VA-3	When visual reference is not possible, the displayed position of the aircraft on the taxi ways is accurate enough …	M = 5,4*
VA-…	…	…

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Comments:

- Today, a static RPA of 7.5m can easily met technically (3 test sites proved it)
- Controllers accept this performance to meet their operational needs
- However, 12m or even 20m could be sufficient for some operational needs (e.g. only surveillance)

Recommendations:

- Keep the ICAO requirements of 7.5m (ICAO 4.3.3 = validated)
- But allow lower accuracy, if the user accept it to meet their operational needs

Feedback to EMMA operational Requirements
Example 2

Op_Perf-01	**The probability that an actual aircraft, vehicle, or obstacle is detected and reported at the output of the surveillance element of the A-SMGCS shall be 99,9% at minimum.**
ICAO	No performance requirement, but recommend to prove it
TRD EMMA Tech_Surv_35	The probability that an actual aircraft, vehicle, or object is detected and reported at the output of the SDF should be 99,9% at minimum.

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VA-55	When visual reference is not possible I think the A-SMGCS surveillance display can be used to determine if the runway is cleared to issue a landing clearance.	M = 5,3*
VA-36	I can rely on A-SMGCS when giving taxi clearances even when visual reference is not possible.	M = 4,9*
VA-48	When an intersection is not visible line up from this intersection could be applied in a safe way when using A-SMGCS.	M = 5,1*
VA-…	…	….

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Comments:

- 99,9% of detection could not be met easily
- But, controller accepted the lower PD performance to meet their operational needs
- PD Parameter is very weak (operational performance behind is not visible)

Recommendation:

- Better: Matrix of Detection (shows number and durations of gaps) [EMMA VE-16]

Matrix of Detection

Gaps	1 sec	2 sec	3 sec	4 sec	5 sec	>5 sec	Total
0							
1							
2							
3							
4							
5							
>5							
Total						e.g. 0,001%	

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Recommendation:

- Better: Matrix of Detection (shows number and durations of gaps)
- OP_Perf-01 shall be replaced by a comprehensive set of PD requirement, w.r.t.
  - •Number and durations of gaps
  - •Aerodrome area (RWY, TWY, Apron)
  - •Objects (aircraft, vehicle, unknown)
  - •Weather conditions (snow, precipitation)
  - •Short vs. long-term measurements

ICAO Regulatory Documents

EMMA 1 Concepts and Operational Requirements potentially impact the following ICAO documents:

- Annexes 2,10,11 and 14
- **ICAO PANS ATM (Doc 4444) and ICAO Regional Supplementary Procedures Doc7030/4-EUR**
- Doc 9426 (ATS planning manual)
- Doc 7754 (Air Nav.Plan,Europe,Vol1)
- Doc 9432 (Manual of radiotelephony)
- Doc 9476 (SMGCS manual)
- Doc 9365 (Manual of all weather operations)
- **Doc 9830 A-SMGCS Manual**
- **Doc 8168 PANS-OPS (Flight procedures : Transponder Operating Procedures)**

ICAO DOC 4444 – PANS ATM

PANS ATM DOC4444:

- CHAPTER 7. PROCEDURES FOR AERODROME CONTROL SERVICE
- CHAPTER 8. RADAR SERVICES
- CHAPTER 12. PHRASEOLOGIES
- CHAPTER 15. PROCEDURES RELATED TO EMERGENCIES, COMMUNICATION FAILURE AND CONTINGENCIES

ICAO DOC 4444 – PANS ATM

CHAPTER 7. PROCEDURES FOR AERODROME CONTROL SERVICE

7.1 FUNCTIONS OF AERODROME CONTROL TOWERS

7.1.1 General

- *A-SMGCS may replace visual observation*

7.10 PROCEDURES FOR LOW VISIBILITY OPERATIONS

New definitions

- *Visibility conditions: as defined in the ICAO A-SMGCS Manual (Vis1, Vis2, Vis3, Vis4)*

New procedures

- *To define the use of A-SMGCS in Vis2,*
- *Update of Low visibility procedures taking into account A-SMGCS*

ICAO DOC 4444 – PANS ATM

CHAPTER 8. RADAR SERVICES

8.2 PRESENTATION OF RADAR INFORMATION

Information available from A-SMGCS data fusion are used for display to the controller

8.5 USE OF SSR TRANSPONDERS

8.5.3 Operation of SSR transponders

8.x USE OF MODE S TRANSPONDERS

8.x.x Operation of Mode S transponders

8.6 GENERAL RADAR PROCEDURES

8.6.2 Identification of aircraft

Use of A-SMGCS Identification procedure

8.6.3 Transfer of radar identification

identification is no more a radar identification but A-SMGCS Identification

8.10 USE OF RADAR IN THE AERODROME CONTROL SERVICE

8.10.2 Use of surface movement radar (SMR)

8.1.x Use of Advanced Surface Movement, Guidance and Control System (A-SMGCS)

- ***8.1.x.1 Use of A-SMGCS Surveillance***
- ***8.1.x.2 Use of A-SMGCS Alerts***

ICAO DOC 4444 – PANS ATM

CHAPTER 12. PHRASEOLOGIES

To take into account incorrect Mode-S Transponder setting preventing identification procedure

ICAO DOC 4444 – PANS ATM

CHAPTER 15. PROCEDURES RELATED TO EMERGENCIES, COMMUNICATION FAILURE AND CONTINGENCIES

15.5 ATC CONTINGENCIES

15.6 OTHER ATC CONTINGENCY PROCEDURES

- **15.6.2 Short term conflict alert**
- **15.6.3 Procedures in regard to aircraft equipped with airborne collision avoidance systems (ACAS)**
- **15.6.4 Minimum safe altitude warning (MSAW) procedures**
- **15.6.5 Change of radiotelephony call sign for aircraft**
- **…….**

New procedures

- ***Procedures with regard to A-SMGCS Alerts***

Advanced Surface Movement Guidance and Control System (A-SMGCS) Manual

Appendix A: A-SMGCS Categorisation

- **categorisation is of less practical use**

EMMA Concept facilitates this categorisation

ICAO DOC 9830 A-SMGCS Manual

Advanced Surface Movement Guidance and Control System (A-SMGCS) Manual

Appendix B: A-SMGCS Implementation Level

- **“one means of grouping A-SMGCS implementation” (“an example”)**

EMMA Services and associated Implementation Packages

- **More guidance for users to define what they need to implement**

Advanced Surface Movement Guidance and Control System (A-SMGCS) Manual

Chapter 4: Performance Requirements

- See examples before
- Work is still in progress

ICAO DOC 8168 – PANS OPS

Aircraft Operations. Volume I — Flight Procedures

This volume describes operational procedures recommended for the guidance of flight operations personnel.

- **Mode S Transponder Operating Procedures on the GROUND**

Update of ICAO Manuals

Doc 4444 – Main document to update

- **Manual used by regulators as a reference**
  - **– Either directly or to derive national regulations for procedures to be used for Air Navigation Services**
- **Any update is carefully considered and is a long process**

Update of ICAO Manuals

Doc 7030/4-Europe part – *As a first possible step*

Three amendments are prepared

- **Definition of "Reduced Aerodrome Visibility conditions"**
- **Definition of A-SMGCS, surveillance function, identification procedures and Alerts function**
- **Introduction of Mode S transponder procedures on the ground**

Recommendations to EC

With respect to changes to ICAO

– **EC and EUROCONTROL should formalise a joint European approach to ICAO for adoption**

With respect to SESAR

– **EMMA Concepts and Requirements should feed in SESAR Definition Phase**

Questions ?