

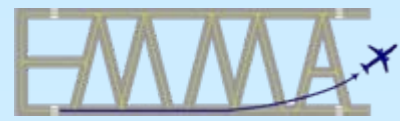
EUROPEAN MOVEMENT MANAGEMENT BY A-SMGCS

# EMMA Concept and Requirements Impact on ICAO

S. Dubuisson (EEC) & J. Jakobi (DLR)

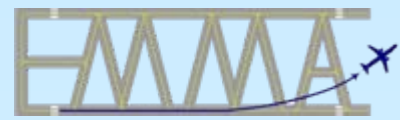
Integrated Project of the  
Sixth Framework Programme,  
Priority 1.4:  
Aeronautics and Space,  
sponsored by EC, DG TREN  
Contract FP6-503192





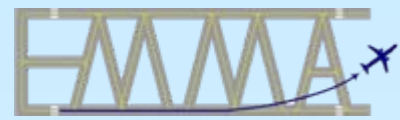
# Overview

- 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**



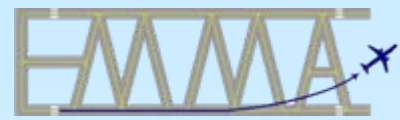
# EMMA Concept - Surveillance

EMMA2 Service Steps	Description	Comments
Step 1	<ul style="list-style-type: none"> <li>• Detection and accurate position of all aircraft, all vehicles, and obstacles*</li> <li>• Identification of all cooperative aircraft and vehicles</li> </ul>	<p>on the Manoeuvring area</p> <p><b>EMMA / EUROCONTROL Level 1</b></p>
Step 2	<ul style="list-style-type: none"> <li>• Detection and identification of all aircraft</li> </ul>	<p>on the Apron area</p>
Step 3	<ul style="list-style-type: none"> <li>• <i>Step2 +</i></li> <li>• <i>Detection and identification of all vehicles</i></li> <li>• <i>Detection of <b>Obstacles</b></i></li> </ul>	<p><i>Movement area</i></p>



# EMMA Concept - Control

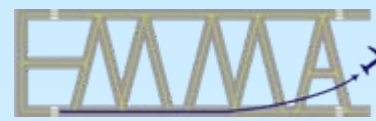
EMMA2 Service Steps	Description	Comments
Step 1	<ul style="list-style-type: none"> <li>• <b>Runway Conflict/Incursion</b> detection and alerting</li> <li>• <b>Restricted area</b> infringement detect.</li> </ul> <p style="color: red; font-weight: bold; font-size: 1.2em;">EMMA / EUROCONTROL Level 2</p>	<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: auto;"> <p>Implementation of <b>conflict resolution</b> advisory may be initiated at any step</p> </div>
Step 2	<ul style="list-style-type: none"> <li>• <i>Taxiway Conflict/Incursion detection and alerting</i></li> </ul>	
Step 3	<ul style="list-style-type: none"> <li>• <i>Detection of plan / route deviation</i></li> <li>• <i>Support to Communication (CPDLC)</i></li> <li>• <i>ATCO coordination (EFS)</i></li> </ul>	
Step 4	<ul style="list-style-type: none"> <li>• <i>Conflict/Incursion detection and alerting of apron / stand / gate conflicts</i></li> </ul>	



# EMMA Concept – Guidance\*

## (Flight Crew+ Vehicle Drivers)

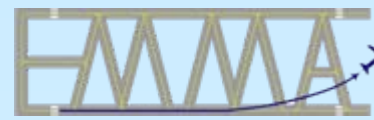
EMMA2 Service Steps	Description	Comments
Step 1	<ul style="list-style-type: none"> <li>Airport Moving Map incl. Surface Movement Alerting</li> </ul>	<ul style="list-style-type: none"> <li>Surveillance and Monitoring Service for onboard users</li> </ul>
Step 2	<ul style="list-style-type: none"> <li>Ground-Air Database Upload</li> <li>Ground Traffic Display</li> <li>Traffic Conflict Detection</li> <li>CPDLC Ground Clearance and Taxi Route Uplink</li> <li>Braking and Steering Cue (landing roll and taxi)</li> </ul>	<ul style="list-style-type: none"> <li>Ground TIS-B + DL needed</li> </ul>
Step 3	<ul style="list-style-type: none"> <li>HUD Surface Guidance</li> </ul>	<ul style="list-style-type: none"> <li>HUD is already available for approach</li> </ul>
Step 4	<ul style="list-style-type: none"> <li>Automated Steering</li> </ul>	<ul style="list-style-type: none"> <li>Major changes in equipments and procedures</li> </ul>



# Feedback to EMMA operational Requirements

## Example 1

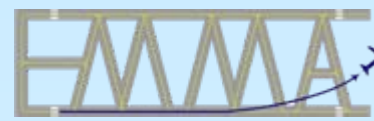
Op_Perf-05	For the surveillance service, the allowable error in reported position shall be consistent with the requirements set by the control task of the controller: 12m.
ICAO 4.2.3	The actual position of an aircraft, vehicles and obstacle on the surface should be determined within a radius of 7,5m.
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%.



# Feedback to EMMA operational Requirements

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

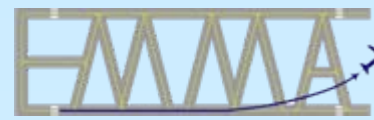


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Technical Tests (Verification)		PRG / MXP / TLS
VE-5	Reported Position Accuracy (RPA)	RPA = 3,2m – 7,5m*
<b>Operational Feasibility (Validation)</b>		
VA-1	When visual reference is not possible, the displayed position of the <u>aircraft</u> in the 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 <u>vehicles</u> in the runway sensitive area ...	M = 4,7*
VA-3	When visual reference is not possible, the displayed position of the <u>aircraft</u> on the <u>taxi ways</u> is accurate enough ...	M = 5,4*
VA-...	...	...





# Feedback to EMMA operational Requirements

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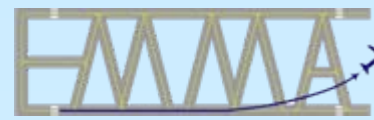
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### Comments:

- 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:

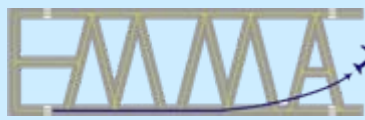
- Keep the ICAO requirements of 7.5m (ICAO 4.3.3 = validated)
- But allow lower accuracy, if the user accept it to meet their operational needs



# Feedback to EMMA operational Requirements

## Example 2

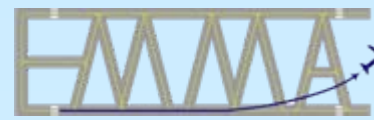
Op_Perf-01	<b>The probability that an actual aircraft, vehicle, or obstacle is detected and reported at the output of the surveillance element of the A-SMGCS shall be 99,9% at minimum.</b>
ICAO	No performance requirement, but recommend to prove it
TRD EMMA Tech_Surv_35	The probability that an actual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



# Feedback to EMMA operational Requirements

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<b>Technical Tests (Verification)</b>		PRG / MXP / TLS
VE-2	Probability of Detection (PD)	PD (short) = 99,65 – 99,9% PD (long) = up to 99,9%



# Feedback to EMMA operational Requirements

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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-...	...	....



# Feedback to EMMA operational Requirements

## Example 2

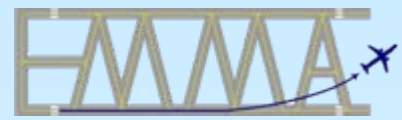
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**Comments:**

- 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)

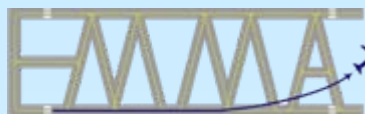
**Recommendation:**

- 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%	



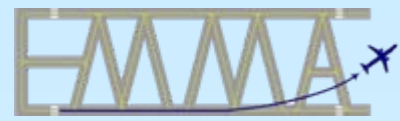
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### Recommendation:

- 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

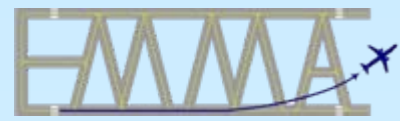


## ICAO Regulatory Documents

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)**

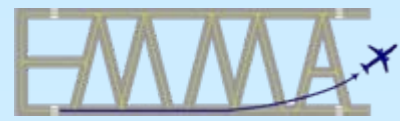




# ICAO DOC 4444 – PANS ATM

## 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**



## CHAPTER 7. PROCEDURES FOR AERODROME CONTROL SERVICE

### 7.1 FUNCTIONS OF AERODROME CONTROL TOWERS

#### 7.1.1 General

- *A-SMGCS may replace visual observation*

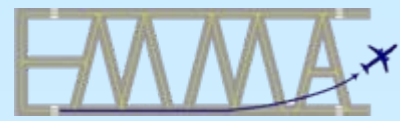
### 7.10 PROCEDURES FOR LOW VISIBILITY OPERATIONS

#### 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*



## 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*

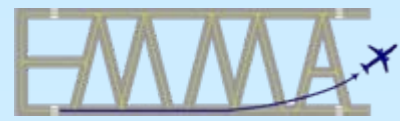
### 8.10 USE OF RADAR IN THE AERODROME CONTROL SERVICE

#### 8.10.2 Use of surface movement radar (SMR)

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

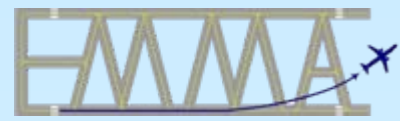
*- 8.1.x.1 Use of A-SMGCS Surveillance*

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



## 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)

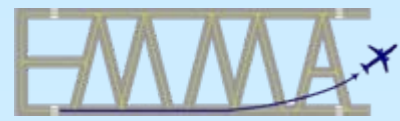
#### 15.6.4 Minimum safe altitude warning (MSAW) procedures

#### 15.6.5 Change of radiotelephony call sign for aircraft

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#### *New procedures*

- *Procedures with regard to A-SMGCS Alerts*

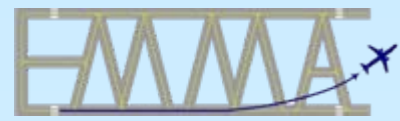


## Advanced Surface Movement Guidance and Control System (A-SMGCS) Manual

### Appendix A: A-SMGCS Categorisation

- categorisation is of less practical use

EMMA Concept facilitates this categorisation



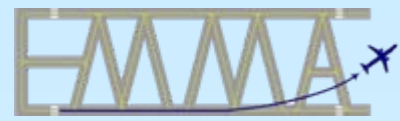
## Advanced Surface Movement Guidance and Control System (A-SMGCS) Manual

### 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

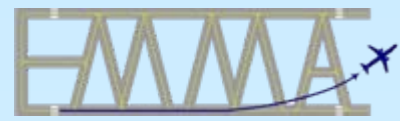


## Advanced Surface Movement Guidance and Control System (A-SMGCS) Manual

### Chapter 4: Performance Requirements

- See examples before
- Work is still in progress



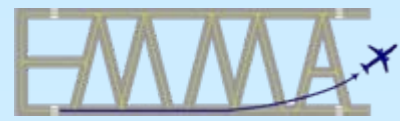


# ICAO DOC 8168 – PANS OPS

## 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

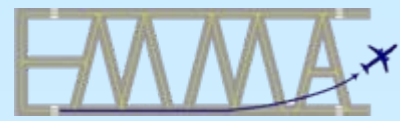


# EUROCONTROL A-SMGCS Project (1)

## 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**



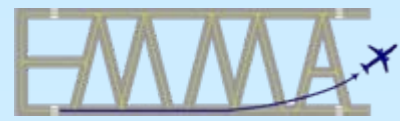
## EUROCONTROL A-SMGCS Project (2)

### 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**



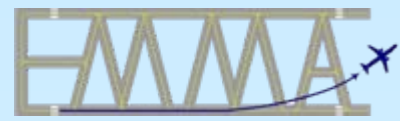
## Recommendations to EC

### 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**



# EMMA Concept and Requirements Impact on ICAO

## Questions ?