REPORT ON DEMONSTRATION RESULTS FOR DEMONSTRATION LAD 3

METIS

D20-LAD3

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<th>M3S, Smile, ONDA, TPZ</th>
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## Summary Sheet

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### Abstract:
This document is the Report on demonstration results for Local Area Demonstration 3. It reports the results of the demonstration including:
- demonstration event preparation
- results of validation tests
- analysis of EGNOS measurement campaign
- demonstration execution and feedbacks
- recommendations and main results

### Keywords:
Civil Aviation, Casablanca, Airport surface area, Vehicle management, EGNOS

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1 INTRODUCTION

1.1 SCOPE AND PURPOSE OF THE DOCUMENT
This document reports the results of the demonstration event that validates the demonstrator and the associated applications implemented in the METIS Local Area Demonstration 3 – (LAD 3) dealing with use of GNSS (EGNOS) in the Civil Aviation domain for tracking and monitoring vehicles movements on airport surface. It gives the results of the METIS demonstration focusing on:
- demonstration event preparation
- results of validation tests
- analysis of EGNOS measurement campaign
- demonstration execution and feedbacks
- recommendations and main results

1.2 DOCUMENT OVERVIEW
The document is organised in the following chapters and contents:
Chapter 1 gives the introduction and demonstration overview
Chapter 2 and 3 provide the results of installation and validation phases
Chapter 4 focuses on EGNOS performances on Casablanca airport
Chapter 5 describes the execution of the demonstration event and gives main results and feedbacks
Chapter 6 reports the conclusions and lessons learnt.

1.3 DEMONSTRATION OVERVIEW
Due to the increasing of congestion on most of the airports, tools with extended capacities become necessary to guarantee security of the ground vehicle movements. It is a priority for the aeronautic community who developed the A-SMGCS (Advanced Surface Movement Guidance and Control System) concept to improve and/or to deploy surveillance, guidance, conflict detection, and sequencing and supervision services.

The EUROCONTROL agency has initiated a long term strategy to deploy A-SMGCS systems with different implementation levels. In order to improve safety of airport surface
movement and runway operations, the concepts of SMGCS and A-SMGCS have been dealt by considerable amount of documentation:

- ICAO SMGCS Manual Doc.9476 describes how traffic should be controlled on the surface of an airport, based on the principle of “see and be seen” and the use of visual aids.

- ICAO A-SMGCS Manual (Doc. 9830), EUROCAE (Doc ED.87B) and EUROCONTROL A-SMGCS Project have established the A-SMGCS Levels 1 and 2

- The European Commission (DGTREN) has also initiated major R&D projects (NUP-2, BETA, EMMA, EMMA-2 dedicated to the future evolutions of A-SMGCS)

The validation of the service for vehicle guidance on the manoeuvring area proposed for A-SMGCS Level 2 (optional service) has not been completely fulfilled due to lack of available systems in 2002. Since then several equipments are now proposed by system manufacturers to support the navigation of airport vehicles on the airport aprons and manoeuvring area. A key benefit sought through the introduction of the vehicle guidance service is to contribute to the safety of vehicle operations particularly in the vicinity of active runways. According to recent surveys of aerodrome operations safety and runway incursions, airside vehicle drivers operating on the manoeuvring area are involved in around 15% to 30% of reported incursions.

The objective of METIS LAD3 project is to develop and demonstrate a set of pre-operational A-SMGCS applications providing surveillance and conflict detection services to operators and vehicle drivers on airports, using EGNOS and wireless technologies.
Figure 1 Demonstration overview

An airport vehicle has an EGNOS-enabled receiver and uses a local wireless network to broadcast its position to a control centre. The control centre enables fleet management and relative surveillance of the equipped airport vehicle.

1.4 LIST OF REFERENCES

1.4.1 Applicable Documents

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1.4.2 Reference Documents

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Table 2 Reference Documents

1.5 ABBREVIATIONS

A

AP       Access Point
ATCO     Air Traffic Controller

C

COTS     Commercial Off-The-Shelf

E

EGNOS    European Geostationary Overlay System

G

GPS      Global Positioning System
GSA      GNSS Supervisory Authority

H

HMI      Human Machine Interface
HPE      Horizontal Position Error
HPL      Horizontal Protection Level

I

ILS      Instrument Landing System

L

LAD      Local Area-Demonstration
LAN      Local Area Network

M
<table>
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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>MOPS</td>
<td>Minimum Operational Performance Standards</td>
</tr>
<tr>
<td>METIS</td>
<td>Mediterranean Introduction of GNSS services</td>
</tr>
<tr>
<td>N</td>
<td>Non Precise Approach</td>
</tr>
<tr>
<td>PA</td>
<td>Precise Approach</td>
</tr>
<tr>
<td>PVT</td>
<td>Position, Velocity, Time</td>
</tr>
<tr>
<td>QFU</td>
<td>Aviation Q-code for Magnetic Heading of a Runway</td>
</tr>
<tr>
<td>RTCA</td>
<td>Radio Technical Commission for Aeronautics</td>
</tr>
<tr>
<td>UHF</td>
<td>Ultra High Frequency</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
<tr>
<td>VOR</td>
<td>VHF Omni directional Range</td>
</tr>
<tr>
<td>WiFi</td>
<td>Wireless Fidelity</td>
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2 DEMONSTRATION PREPARATION

2.1 METHODOLOGY

The LAD-3 demonstration preparation was divided in three main phases:

- Firstly, a development phase to implement needed adaptations of the existing product for the demonstration on Casablanca airport (map adaptation and communication interface).
- Then, a pre-validation phase in order to validate the software updates by simulations done in France before sending the equipment in Morocco.
- Finally, the installation phase to deploy the ground part of the system in the demonstration room and the embedded system into the vehicle.

2.2 DEVELOPMENT PHASE

2.2.1 Map adaptation

Map adaptation task was under responsibility of SMILE partner with the support of airport ONDA technical team. Aim was to provide to M3 Systems a map of the Mohammed V airport that could be upload in the system for the purpose of the demonstration.

An original map was provided by ONDA to SMILE in Autocad format.

Figure 2 Original airport map
In order to display a simple and clear map to the end users, SMILE adapted the original map by:

- Deleting useless information (diagonal line, legend…)
- Colouring background, taxiways and runways
- Adding restricted area (red colour) around the runways and ILS/GLIDE instruments

![Figure 3 Updated airport map](image)

### 2.2.2 WiFi communication interface

It was decided to use a WiFi datalink for communicating position of the equipped vehicle to the monitoring station. A software development has been performed to integrate this WiFi feature into the existing system. Although a WiFi built-in card is already embedded into the on-board equipment (Navigation/Communication box), M3 Systems implemented a WiFi controller and modify its communication manager module in order to route the data towards the WiFi interface instead of the UHF interface which is usually used.

Ground segment was a WiFi Access Point connected to the monitoring station using a dedicated private IP network (crossing neither airport IP network nor public Internet network).

### 2.2.3 Warning alerts

M3 Systems was responsible of adapting the surveillance module of the system in order to raise visual warning and sound warning each time a vehicle enters in a restricted area or runway protection area as defined in the previous map.
Using a WiFi datalink for communicating position of the equipped vehicle to the monitoring station implies that the vehicle shall stay in the WiFi coverage (in a perimeter of 150 meters around the WiFi Access point which is installed in the demonstration room). Since the restricted area around the runway is 500m far from the WiFi Access Point, M3Systems implemented a new “fictive” restricted area dedicated for the demonstration purpose near to the demonstration room.

**Figure 4 Example of warning alarm**

**Figure 5 Restricted area used for the demonstration**
2.2.4 Language

English is the language of the HMI for the METIS LAD3 demonstration. Only few changes on the configuration files of the system have been done to comply with it.

2.3 Pre-Validation

All of these development activities have been pre-validated by M3Systems in France before transferring the equipments and software in Morocco. Flight Simulator software was used to simulate environment and vehicle movement on the Casablanca airport. Unit tests and simulation of main demonstration use cases were executed in M3Systems laboratory (especially generation of warning alerts corresponding to pre-defined restricted areas).
2.4 INSTALLATION PHASE

2.4.1 Selection of the demonstration room

The demonstration room is the place where the audience assists to the demonstration event. It should comply with the following requirements:

- Visibility of the demonstration area
- Quite and spacious environment for the demonstration event
- Can host the monitoring station
- Can host the WiFi Base Station

Casablanca airport staff allocated us a public room in the terminal1 that complied with all these requirements:

![Demonstration room location](image1)

*Figure 7 Demonstration room location*

![View on the demonstration area with equipped “Follow me” vehicle](image2)

*Figure 8 View on the demonstration area with equipped “Follow me” vehicle*
2.4.2 Ground part installation

We installed an outdoor antenna in order to improve the datalink coverage of the WiFi wireless link. Maximum coverage measured with that 3dBi gain antenna reached up to 400m.

![3dBi gain antenna](image)

*Figure 9 3dBi gain antenna*

The PC screen of the monitoring station was displayed on a whiteboard in the demonstration room enabling good visibility on both the monitoring station and the demonstration area for the attendees.

![Monitoring station](image)

*Figure 10 Monitoring station*
2.4.3 Embedded system installation

Since the embedded system shall be removed from the vehicle each day in order to secure the equipment, it has been decided to not fix the embedded equipment. The radio-navigation box was simply laid under the passenger's seat.

For the same reason, a dedicated portable battery was used instead of using the battery of the vehicle in order to minimize manipulations and connections needed each time we wanted to install/de-install the equipment.
3  RESULTS OF VALIDATION TESTS

This section is dedicated to the results of the assembly and integration test, done to verify the correct functioning of the various elements and relevant interfaces. These have been proven before the demonstration, in order to verify the readiness of the system to be operated in a real environment.

3.1  ON BOARD VALIDATION TESTS

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<td><strong>Installation</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Verify that all the equipment are installed and well fixed</td>
<td>Ok</td>
</tr>
<tr>
<td>2</td>
<td>Verify that alimentation circuit is secured (fuse is needed if battery of the vehicle is used)</td>
<td>N/A since we did not use the battery of the vehicle</td>
</tr>
<tr>
<td>3</td>
<td>Verify that all connections are made</td>
<td>Ok</td>
</tr>
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<td></td>
<td><strong>General functions</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Verify that the Nav/Comm box start correctly</td>
<td>Ok</td>
</tr>
<tr>
<td>5</td>
<td>Verify that the HMI starts correctly</td>
<td>Ok</td>
</tr>
<tr>
<td>6</td>
<td>Verify that the displayed information are in English</td>
<td>Ok</td>
</tr>
<tr>
<td>7</td>
<td>Verify presence of the speed vector on the HMI</td>
<td>Ok</td>
</tr>
<tr>
<td></td>
<td><strong>HMI configuration</strong></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Verify luminosity level / orientation of the HMI</td>
<td>Ok</td>
</tr>
<tr>
<td>9</td>
<td>Verify that zoom level can be adapted through the “config map” menu (only while the vehicle is stopped)</td>
<td>Ok</td>
</tr>
<tr>
<td>10</td>
<td>Verify that translation on the map can be done through the “config map” menu (only while the vehicle is stopped)</td>
<td>Ok</td>
</tr>
<tr>
<td>11</td>
<td>Verify that either “follow-me” view or “satellite” view are available</td>
<td>Ok</td>
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</table>
### Warning alerts

12 Verify that the zoom level is modified following the current speed of the vehicle  

Ok

13 Verify that a visual warning and sound warning alerts are raised each time a vehicle enter in a restricted or protected area  

Ok (only for the restricted area defined for the demonstration)

14 Verify that a warning alert is raised if no GPS position is available (by disconnecting GPS antenna)  

Ok

### EGNOS related tests

15 Verify precision of the EGNOS corrected location information displayed on HMI map (with and without WiFi communication link)  

Ok (verification has been done on APRON, taxiway and runway)

16 Verify presence of integrity level information (use of EGNOS)  

Ok

17 Assess availability and level of precision of the integrity information at different places of the demonstration area  

Ok

18 Assess modification of the integrity level around buildings or obstacles  

Ok

19 Assess modification of the integrity level while an aircraft is taxiing near from the vehicle  

N/A (not close enough to see any modification)

20 Assess modification of the integrity level depending on meteorological condition  

N/A (test have been done only in clear condition)

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**Table 3 On board validation tests**

### 3.2 GROUND VALIDATION TESTS

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<tr>
<td></td>
<td>Installation</td>
<td></td>
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</table>
21 Verify that all the monitoring software is installed and that the monitoring application can be launched. | Ok  
22 Verify that the monitoring station is connected to the WiFi base station | Ok  

**General functions**

23 Verify that the displayed information are in English | Ok  
24 Verify correctness of location information of the equipped vehicle displayed on monitoring map (use to validate WiFi communication link) | Ok  
25 Verify presence of identifier of the equipped vehicle | Ok  
26 Verify presence of integrity level information (use of EGNOS) | Ok  
27 Verify presence of the speed vector on the monitoring map | Ok  

**Monitoring view configuration**

28 Verify the screen resolution | Ok  
29 Verify that zoom level can be adapted with the mouse | Ok  
30 Verify that translation on the map can be done with the mouse | Ok  

**Warning alerts**

31 Verify that a visual warning and sound warning alerts are raised on the monitoring map each time a vehicle enter in a restricted or protected area | Ok  
32 Verify that a warning alert is raised if no GPS position is available (by disconnecting GPS antenna) | Ok  

*Table 4 Ground validation tests*
3.3 **WiFi Datalink Coverage**

A WiFi datalink coverage analysis has been done in order to define the boundaries of the demonstration area and to confirm the choice of the warning alert area location.

The equipment from M3S and a freeware called Iperf have been used to check the WiFi coverage.

![WiFi Coverage Image]

*Figure 11 WiFi coverage*

The positions and the logs from Iperf have been merged automatically by the equipment. Then, the final logs have been converted in KML files to be displayed in Google Earth. The result can be seen on the image above.

The positions are represented by dots which have a specific colour depending on the network performance. No dots or red dots mean the network is unavailable. Yellow dots mean that the “ping” command is ok. Orange dots mean the bandwidth is low and green dots the bandwidth is good (>1MBps).

The blue rectangle is the alert area chosen for the demonstration.

Measurements show that the WiFi coverage is about 300 meters and the demonstration area is well covered.
4  EGNOS DATA COLLECTION & PERFORMANCES ANALYSIS

4.1  EGNOS MEASUREMENT CAMPAIGNS

Once the WiFi coverage done, EGNOS measurement campaigns have been initiated in two steps.

4.1.1 Measurements with Ublox evaluation kit

First, the team of Smile Morocco made measurements with an Ublox evaluation kit, in order to validate the EGNOS availability and to prepare the further campaigns of the demonstration week.

![Ublox evaluation kit measurements](image)

Even if the records are short, it was important, at early stage of the project, to demonstrate that EGNOS was available in Morocco.

4.1.2 Measurements with SAFEDRIVE receiver

Several campaigns have been done during the demonstration week to analyse more precisely the EGNOS coverage and performances.
The following screenshot shows all the records done within the week (the colour code is the same as in 4.1.1 section).

**Figure 13 SAFEDRIVE measurements**

There are some dots in red near the buildings which can be easily explained by the masking and the time required to get all the EGNOS messages just after the equipment has started.

Most dots are in green which is fine but there are also a lot of them in orange (HPL > 12m), even in areas with good visibility.

The following detailed analysis will explain why.

### 4.2 GNSS/EGNOS PERFORMANCES ANALYSIS

#### 4.2.1 Methodology

The main goal of the data analysis activity is to validate availability of EGNOS services and compare the real performances with the theoretical ones.

The following analysis have been done:

- on all the records:
  - HPL geographical distribution
  - EGNOS position type statistical distribution
  - HPL statistical distribution
  - Percentile analysis
- On one ride
  - HPL geographical distribution
Quality of EGNOS reception (signal to noise ratio and messages reception)
GPS satellites geometry (number of satellites used and HDOP)
HPL chart

HPL statistical distribution and geographical distribution have been purposely done for this LAD3 in Morocco, as the demonstrations were running in zones at the border of the EGNOS service area.

4.2.2 Protection level analysis

4.2.2.1 Theoretical EGNOS performances

Theoretical HPL values, reported by GSA website, indicate that Mohamed V airport is at the border of EGNOS coverage with an expected mean value of HPL between 10 and 20 meters. One of the aims of the demonstration was to confirm the availability and the performance of the EGNOS signal in that region.

Figure 14 Theoretical HPL
Here is the HPE (Horizontal Position Error) percentile on the demonstration day:

![Figure 15  Horizontal Position Error percentile](image)

### 4.2.2.2 Measured EGNOS performances

The study has been done on all the records gathered during the demonstration week. About 30,000 positions have been computed (4 a second, approximately 2 hours in all).

This set is divided in three kinds of position: GPS only, EGNOS NPA (Non Precision Approach) mode and EGNOS PA (Precision Approach) mode.

The following chart emphasizes that 88% of the positions were in EGNOS PA mode. It means that EGNOS provided enough data to have a high level of accuracy, most of the time.
Next chart illustrates the distribution of the HPL values. Except for a few cases (presumably due to particular circumstances such as temporary limited view of the sky for the receiver), about 50% of the values are in the range of 12-25 meters and almost 40% of them are between 8 and 12 meters. This confirms what has been observed in 4.1.2 section.
Hereafter, the results of the percentile analysis: in 95% of the cases, the HPL is less than 41.14 meters with a mean value at 25.61 meters.

<table>
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</tr>
<tr>
<td>Average</td>
<td>25.61</td>
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</tbody>
</table>

### 4.2.2.3 Analysis on one of the recordings

The following section focuses on a ride on the Mohamed V airport.

Next figure shows the HPL values on the way.
The colour code is still the same. The HPL value was less than 12 meters on more than half the way. Then, between the two runways, its value increased higher than that. This behaviour is pretty unusual in an open area like there.

The two following picture illustrate the EGNOS reception quality.

It represents the signal to noise ratio of the EGNOS satellite used (here it was the PRN 120). The colour code is: red dots are lower than 36dbHz, green ones are upper than 38dbHz and the orange are between them. Except close to the buildings, the signal to noise ratio is good (about 43dbHz).
Figure 20 Number of EGNOS messages by second

This one represents the number of EGNOS messages received each second. The colour code is: red means no message within the last second, orange, one message received and green, two messages (which means that two EGNOS satellites were in view). Two messages have been received almost everywhere.

So, the EGNOS reception quality was good.

Here is a picture showing the number of GPS satellites used to compute the position.

Figure 21 Number of GPS satellites used
The colour code is: red dots mean less than 7 satellites have been used, green, 8 or more and orange, 7. The figure highlights that the HPL increase is caused by the lost of one or more GPS satellites. This makes sense because this is one of the reasons which can increase the HPL value.

Here are the evolutions of the number of GPS satellites used, the HDOP and the HPL during the recording.

**Figure 22** Number of GPS satellites used chart

**Figure 23** HDOP chart

**Figure 24** HPL chart
The HDOP parameter is linked to the number of satellites used and their relative geometry. Its value gives an immediate feedback about the quality of the positioning data.

The HPL is linked to the HDOP too.

The three charts shows that there was a good geometry (the perfect HDOP value is 1), with a good number of satellites usable during the trial. They emphasize the slot where the HPL increased due to the lost of 2 GPS satellites.

Usually, in an open area, the lost of satellites can be caused by a low elevation (the satellite disappears from the horizon) or by radio interferences. But it is strange to loose two satellites in the same times. Deeper investigation revealed what could be obvious to the people knowing EGNOS.

The reason of the high values of HPL in the region comes mainly from the Ionospheric corrections grid. Morocco is at the edge of the EGNOS coverage and some satellites cannot be used in EGNOS PA mode, since they don’t have EGNOS Ionospheric corrections.

The following picture is a screenshot of the ESA software UAS SISNET which allows receiving the EGNOS messages from the Internet (former EDAS service).

![Figure 25 Ionospheric corrections grid](image)

It shows the EGNOS ionospheric correction grid. Some points near Morocco are not monitored. That’s why some satellites cannot be used, even if they are in view. Moreover, the grid changes within the day and that’s what probably happened for this ride. The grid has changed and 2 satellites lost their EGNOS ionospheric correction.
5 MAIN RESULTS

5.1 PERFORMANCES

The measured EGNOS performances are a little bit different than the theoretical one. The HPL value is not steady and its average (25.61m) is higher than the expected value. This can be explained by the lot of measurements done near buildings or obstacles which decrease the average statistic. But it has been shown that even in an open area, the HPL value can be too high. An improvement of the Ionospheric grid coverage in the east of Morocco would allow the use of all the GPS satellites in view, in EGNOS PA mode, increasing average EGNOS receiver performances in such MEDA countries. Thus, it confirms the interest of the EGNOS development plan supported by the GSA that aims to build additional EGNOS ranging and integrity monitoring stations (RIMS) in the region (Morocco at Agadir, in Egypt at Alexandria and in Greece at Athens).

5.2 AWARENESS

The demonstration was conceived to give the opportunity to the users to become familiar with the new technology and services based on EGNOS for airport mobiles surveillance and control. The demonstrated services are focused on the elaboration of integrity and accurate position information computed from EGNOS messages. The demonstration event was held on the 22nd October on the Mohammed V airport of Casablanca. That public demonstration and press conference was organised with an attendance of around 90 people, mainly from the Civil Aviation domain from MEDA (Morocco, Egypt, Tunisia and Jordan).

Figure 26 Demonstration area
It involved a driver of the follow-me vehicle and an ATCO controlling the monitoring station in the demonstration room. The demonstration executed the following scenario with main associated actions for driver (in green) and ATCO (in yellow) end users:

**Step0**: start ground segment and on board system and wait for initialisation of the vehicle position

- Check display of the vehicle position on the driver HMI

**Step1**: request permission to the ATC operator for executing the demonstration

- Check precision of the location (regarding the position of the vehicle) and ask for demonstration execution permission by VHF

- Check display of the vehicle position on the monitoring station and give permission for starting the demonstration

**Step2**: drive on the APRON until the fictive stop bar and cross fictive stop bar without asking permission to the ATC controller

- Check display of the warning alarm on the driver HMI (sound and visual)

- Check display of the warning alarm on the monitoring station and order the driver to exit the restricted area

**Step3**: Turn back and exit the restricted area

- Check stop of the warning alarm on the driver HMI (sound and visual)

- Check stop of the warning alarm on the monitoring station

**Step4**: come back at the starting point crossing the APRON area.

- Check variation of the integrity level near from buildings, obstacles or other vehicles

### 5.3 Users & Audience Feedbacks

This demonstration has allowed showing the EGNOS-assisted function for EGNOS integrity use in the civil aviation domain, in order to create the awareness of MEDA countries. Here bellow are given the feedbacks of the end user (ATCO) that has been involved in the demonstration preparation and execution.

Interview was done after the demonstration with the Air Traffic Controller: Mr ADARRAK Ismail (ATCO at Mohamed V airport)
Main questions raised by the audience of the press conference/demonstration are also reported at the end of this table.

<table>
<thead>
<tr>
<th>items</th>
<th>questions</th>
<th>Answers (Level 1low → 5very good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance</td>
<td>Do you think that the level of details of the airport map is relevant?</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Is the vehicle identifier useful</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Is the vehicle position/information easily clear on the map</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Do you think that a such system can ease and improve efficiency of your ground surveillance activity?</td>
<td>4 (Ok for Runways and taxiways but information displayed to ATCO for vehicles on APRON shall be limited in order to not overload the ATCO screen)</td>
</tr>
<tr>
<td>Monitoring and alarms</td>
<td>Did you observe unjustified warnings (false)?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Are you disturbed by the warnings (too many or irrelevant)?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Is the visual / sound warning representation relevant?</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Is the warning sound level efficient (neither disturbing, nor too low)?</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Is the detection time of an alert situation not too long?</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Is the warning accuracy level good? (warning generated precisely on a stop bar)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>May audible warnings hinder communications with ATC?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Would an alarm in case of excessive speed be useful?</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Post processing: Do you think that storage of vehicle movement can be useful? (in order to support analysis in case of accident or runway incursion) 5 (very useful!)

Audience remarks

<table>
<thead>
<tr>
<th>Audience question</th>
<th>Does the system display also the position of aircraft?</th>
<th>No, the system is dedicated to vehicle. But position of aircraft from an other sensor can be merged with the vehicle position using a data fusion center at ground.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audience question</td>
<td>Will this GNSS system substitute the existing ground radar stations?</td>
<td>No, GNSS solution and radar systems are complementary. Redundancy is a leitmotiv for aeronautical security items.</td>
</tr>
<tr>
<td>Audience question</td>
<td>Is there degradation of the accuracy due to an increasing speed of the vehicle?</td>
<td>No degradation has been reported since speed of equipped vehicle is limited on the airport surface.</td>
</tr>
<tr>
<td>Audience question</td>
<td>Can the warning alarms and restricted areas be modified by the airport operational team?</td>
<td>All is configurable and can be updated easily.</td>
</tr>
</tbody>
</table>

Table 5 Feedbacks

5.4 DISSEMINATION

The demonstration was accompanied by a promotion/awareness activity that included:

- Production of a leaflet specifically dedicated to the Civil Aviation domain
- Production of a movie specifically dedicated to the Civil Aviation domain
- A press-conference in Casablanca in coincident with the demonstration, targeting the Civil Aviation community
- Contribution to the METIS final promotion event in Tunisia (in coincidence with the end of the METIS project)
- Contribution to the final METIS Newsletter.
6 Conclusion & Lessons Learnt

METIS project is running since more than 3 years and did various demonstrations. This METIS LAD3 demonstration in Casablanca was the first opportunity to promote the use of EGNOS in the civil aviation domain. This demonstration and press conference event were the successful result of a joint MEDA and EU countries effort. The support of ONDA and the commitment of the METIS team were fundamental to make this demonstration event a reality.

The demonstration proved the use of EGNOS for mobile surveillance & control in the airport area. An ONDA service vehicle operating in the Casablanca Airport was equipped with EGNOS-enabled mobile unit. Positions were sent to the Monitoring Centre, for remote surveillance and control. Benefits of EGNOS rely on the capability to provide guaranteed positioning and reliable remote localisation, supporting safe and efficient operations.

Very interesting results have been collected thanks to the trial demonstrating the easiness to deploy such EGNOS services in covered MEDA countries. Result of the performances analysis show that the HPL is less than 22.14 m in 90% of the cases with a mean value of 25.61 m. This result confirm the need of additional EGNOS ranging and integrity monitoring stations (RIMS) that are being built in the region (Morocco at Agadir, in Egypt at Alexandria and in Greece at Athens). The deployments are designed to extend EGNOS signal coverage and performances to other parts of northern Africa.

Possible next steps are:

- Involving of a more significant number of mobiles for a longer period of time in order to refine performances analysis with a larger amount of collected data.
- Use of operational EDAS (ex: near building or gateway when EGNOS satellite signal is poor).
END OF DOCUMENT

REPORT ON DEMONSTRATION RESULTS FOR DEMONSTRATION LAD 3