Project no. **FP6-2002-Aero-1-502817**

SIRENA

External EMC simulation for radio electric systems, in the close environment of the airport

PUBLISHABLE FINAL ACTIVITY REPORT

Period covered: 01/12/2003 to 01/12/2005 Date of preparation: 16/12/05

Start date of project: 01/12/2003 Duration: 24 Months

Project coordinator name: Jean LATGER
Project coordinator organisation name: Oktal Synthetic Environment

Revision: 1.0

1- Project execution

a) Original research objectives :

Project's S&T objectives:

SIRENA project addresses the strategic research area: "*Strengthening the Aeronautical Industry competitiveness*" in the domains of action: *New Aircraft Concepts* and *Aircraft Environment*.

Their overall objectives are: To assess the influence of EM signals on the airport/aircraft and to recommend for equipment location and protection.

- The SIRENA's first objective is to evaluate accurately the **impact** of the EM **environment** on the aircraft, the airport field and buildings, and close to the airport.
- The correlated second objective is to address **safety and security** issues in order to recommend for immune emitters and give advice for the EM airport environment.

Detailed scientific and technical objectives:

In order to achieve the general objectives, the research focus on intermediate scientific and technical objectives as indicated here below.

1. Obj1: To get airfields mock up as close as possible to reality.
2. Obj2: To get EM source mock up as close as possible to reality.
3. Obj3: To get EM field value as close as possible to reality.
4. Obj4: To have EM fields interpretation as simple as possible.
5. Obj5: To set up recommendation and advice.

SIRENA's Technological research challenges related to the objectives are:

1 - To set up a methodology and a modelling tool for airports (generic and dedicated)

- Basically for a generic airport i.e. not actually existing but representative of a standard airport
- For real airports, i.e. actually existing airports

The main technical challenges are:

- The **accuracy** (correlation to real world)
- The **rapid** modelling (flexibility of the method)

2 - To set up a methodology and a module for far and near field EM diagram computation. The main technical challenges are:

- The **accuracy** (correlation to real diagrams)
- The "**friendly parameterisation"** (synthetic ergonomic approach)

3 - To set up a methodology and a computation kernel to compute EM field. The main technical challenges are:

- The **reliability** (correlation to physics)
- The **computation times** (fast computing)

4 - To set up a coMERehensive visualisation of the computed EM field. The main technical challenges are:

The **interactivity** (3D EM filed analysis in Real Time)

b) Achievements:

Achievement are:

1. Ach1: Mastering *fast* methods for:

- Airfields 3D modelling to achieve a virtual geometrical mock up.

- Enhancement of the virtual geometrical mock up with EM physical data to achieve a virtual physical/geometrical mock up.

Fast means: One airport virtual mock up achieved within one month.

2. Ach2: *Accurate* processing far and near field EM diagram to characterize EM sources.

Accurate means: 20 percent max deviation between model and measured reality.

3. Ach3: To acquire an *efficient* and *accurate* method to assess the EM energy paths within the 3D scenes from sources to receptors (airfield and airplane) in order to quantify the level of received EM field.

Efficient means: low sensitivity to scene complexity (hundreds of thousands of polygons) and low sensitivity to the amount of reception points (tens of thousands of points). On standard PC based platform, the aim is about 1 hour long for 100 000 polygons and 10 000 points.

Accurate means: 5 dB max deviation between model and measured reality.

4. Ach4: Setting up of an interactive EM fields visualisation enabling a global EM phenomena understanding in the scope of recommendations for standardisation.

Interactive means: capability to move in real time (25 Hz) a probe enabling to analyse the EM field value at any location of the scene.

5. Ach5: Providing aircraft/equipment manufacturer with a solution to characterize the ambient EM field (input for accurate modelling of equipment behaviour vis-à-vis EM).

6. Ach6: Assessment of the limits of EM interferences from the exploitation of the generic parametric simulation.

7. Ach7: Recommendations for immune emitters and advice on EM impact on the airport and in the vicinity of the airport.

2- Dissemination and use

Summary of each exploitable result

MER 1: Airport EM device definition and description

Brief description of the result

This result consists in the description of EM devices that can be installed on an airport. This result consists in:

- a document, the WP1 report,
- a database with a more technical description of EM devices (UML database, provided in HTML format).

Partner(s) involved in this exploitation

- OKTAL SE
- ONERA

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

Partner(s)	Stage of development
OKTAL SE	Guidelines, methodologies, technical drawings
ONERA	Scientific and/or Technical knowledge (Basic research)

Intellectual property rights granted or published

OKTAL SE and ONERA are authors of this MER (The UML database was pre-existing, and has been improved in the scope of SIRENA).

MER 2: Blagnac airport mock-up

Brief description of the result

This result is the 3D model of Blagnac airport. It contains a modeling of the terrain with altimetry, and an up to date airborne picture mapped onto it. Also it contains:

- 2D features: runways, taxiways, parking areas, fields…
- 3D features: buildings, vegetation, EM devices (antennas, radars…)…

This database can be used for generating visible images, and also it has been enhanced for performing EM simulations.

Partner(s) involved in this exploitation

- OKTAL SE

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

Partner(s)	Stage of development
OKTAL SE	**operational mock-up with potential improvements**

Intellectual property rights granted or published

Type of IPR	Tick a box	Type of IPR	Tick a box
Patent applied for	☐	Trademark applications	☐
Patent search carried out	☐	**Copyrights**	■
Patent granted	☐	Secret know-how	☐
Registered design	☐	other – please specify : **Author**	■

MER 3: AGETIM airport module

Brief description of the result

This result is a module of AGETIM, adapted to the generation of an airport environment. The core software AGETIM (existing before SIRENA project), has been enhanced with a library containing the 3D models of most common EM devices in airports. This library also contains the EM properties (emission diagrams) of devices.

Partner(s) involved in this exploitation

- OKTAL SE

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

Partner(s)	Stage of development
OKTAL SE	Software code

Intellectual property rights granted or published

Type of IPR	Tick a box	Type of IPR	Tick a box
Patent applied for	☐	Trademark applications	☐
Patent search carried out	☐	Copyrights	■*
Patent granted	☐	Secret know-how	☐
Registered design	☐	other – please specify : Author	■*

* pre-existing software kernel

MER 4: Multi-reception points module for FERMAT / SPECRAY EM software

Brief description of the result

This module enables to use FERMAT/SPECRAY EM ray tracing physical process in case of great amount of reception points, where the EM signal is to be simulated. This is useful to compute a local cartography of the airport scene field value.

Partner(s) involved in this exploitation

- OKTAL SE
- ONERA

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

- Software code

Intellectual property rights granted or published

Type of IPR	Tick a box	Type of IPR	Tick a box
Patent applied for	☐	Trademark applications	☐
Patent search carried out	☐	Copyrights	■[1]
Patent granted	☐	Secret know-how	☐
Registered design	☐	other – please specify : Author	■[1&2]

[1] pre-existing software kernel (OKTAL SE)
[2] ONERA would like to assert an intellectual property on the tasks where it is involved in order to be able to publish on the developed reflections

MER 5: Antenna design software

Brief description of the result

This result is a software that enables the modeling of antennas, in the scope of EM simulations within SPECRAY EM. The modeling is based on the knowledge of the antenna far field diagram. From this reference diagram, the user will be able to manage a configuration of elementary emitting elements, so that the diagram of the user defined configuration can coincide with the reference diagram.

Partner(s) involved in this exploitation

- OKTAL SE
- ICCS
- IKT

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

Partner(s)	Stage of development
OKTAL SE IKT	Software code
IKT ICCS	Scientific and/or Technical knowledge (Basic research)

Intellectual property rights granted or published

Type of IPR	Tick a box	Type of IPR	Tick a box
Patent applied for	☐	Trademark applications	☐
Patent search carried out	☐	**Copyrights**	■
Patent granted	☐	Secret know-how	☐
Registered design	☐	other – please specify : **Author**	■

MER 6: EM materials database

Brief description of the result

This result is a database in OKTAL SE format, that contains EM physical properties of generic materials (sand, concrete, wood…). This database is used in order to enhance a 3D model with physical properties, so that EM simulations can be performed.

Partner(s) involved in this exploitation

- OKTAL SE
- ICCS

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

Partner(s)	Stage of development
OKTAL SE	Dataset in numeric format
ICCS	Scientific and/or Technical knowledge (Basic research)

Stage of development

Please tick one category only ✔

Scientific and/or Technical knowledge (Basic research)	■
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.): Dataset in numeric format	■

Intellectual property rights granted or published

Type of IPR	Tick a box
Patent applied for	☐
Patent search carried out	☐
Patent granted	☐
Registered design	☐
Trademark applications	☐

Copyrights	☐
Secret know-how	☐
other – please specify : **Author**	■*

* the database was pre-existing. It has been enhanced in the cope of SIRENA.

MER 7: EM materials bibliography

Brief description of the result

This result is a set of scientific documents and publications related to the physical properties of many artificial and natural matters in various bands from some MHz to some tenths of GHz. Some documents are available in numeric format, others in paper format.

Partner(s) involved in this exploitation

- OKTAL SE
- ONERA

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

- Dataset in numeric and paper format

Intellectual property rights granted or published

Type of IPR	Tick a box
Patent applied for	☐
Patent search carried out	☐
Patent granted	☐
Registered design	☐
Trademark applications	☐
Copyrights	☐
Secret know-how	☐
other – please specify : Author of the bibliographical study	■

MER 8: Measurements campaign on Blagnac airport

Brief description of the result

This result is a set of measurements of the field strength of a set of typical sources performed at Blagnac airport, that can be used in order to prove the validity of the EM simulation software over a large frequency range starting at about 100 MHz up to about 3 GHz.

Partner(s) involved in this exploitation

- OKTAL SE
- TUBS

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

Partner(s)	Stage of development
OKTAL SE	Results of demonstration trials available
TUBS	Scientific and/or Technical knowledge (Basic research)

Intellectual property rights granted or published

Type of IPR	Tick a box
Patent applied for	☐
Patent search carried out	☐
Patent granted	☐
Registered design	☐
Trademark applications	☐
Copyrights	☐
Secret know-how	☐
other – please specify : Author of the measurements	■

MER 9: Module for VEM 3D compatibility with SPECRAY

Brief description of the result

This result is a software module that enables to visualize interactively in a 3D view, the EM field values with a color scale display:

- on a tracking plane,
- on surfaces,
- on 3D iso-surfaces,

in the SPECRAY EM environment.

Partner(s) involved in this exploitation

- OKTAL SE

Possible market applications

- Air transport
- Airport and air-traffic control activities
- Computer and related activities

Stage of development

- Software code

Intellectual property rights granted or published

Type of IPR	Tick a box	Type of IPR	Tick a box
Patent applied for	☐	Trademark applications	☐
Patent search carried out	☐	Copyrights	■*
Patent granted	☐	Secret know-how	☐
Registered design	☐	other – please specify : Developer / Author	■*

* this software has been enhanced in the scope of SIRENA project, but was pre-existing

Search for Collaboration through Commission services (Optional)

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COLLABORATIONS SOUGHT

Please tick appropriate boxes (✔) corresponding to your needs.

R&D	Further research or development	■	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	■
MKT	Marketing agreement/Franchising	■	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify) _____	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

We offer the use of the SIRENA software package, knowledge and methodologies in the scope of a collaboration with:

- other FP6 IP participants (SAGEM…)
- Civil aviation standards official services (DGAC, OACI…)
- European Aeronautical manufacturers (AIRBUS, SNECMA, BAE, HAI…).

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

- With other FP6 IP participants (SAGEM…) : we expect a commercial collaboration
- With civil aviation standards official services (DGAC, OACI…): we expect that our software is recognized as a tool for assessing the level of EM field in airports, in accordance with official rules.
- European Aeronautical manufacturers (AIRBUS, SNECMA, BAE, HAI…): we expect the use of the software for the assessment of aircraft equipment susceptibility.

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Euro Inter confirms that they do not claim for any result; Euro Inter has no intention to exploit the results generated by the other SIRENA Partners. Nevertheless, Euro Inter as Dissemination Manager will go on its dissemination activities on request of the Partners and will maintain as long as possible the aero-scratch SIRENA home page.

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