EUDEM2

The EU in Humanitarian Demining-State of the Art on HD Technologies, Products, Services and Practices in Europe

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EUDEM2 Technology Survey

Study of Demining Related R&D in France

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http://www.eudem.info/

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Executive Summary

The goal of this *Study*, entrusted to Convergence Innovations by the EUDEM2 EC IST Project, was to document demining related R&D programmes and efforts in France. This includes the establishment of a list of academic institutions, research centres, public organisations, associations, demining companies, small and large companies, NGO's, having a link with demining related R&D.

While field activities are indeed carried out by NGO's as well as commercial organisations, strictly speaking there is little research work on humanitarian demining in France. Exceptions are represented by the efforts of some research centres, academic and other public organisations, mainly sponsored by European programmes (ESPRIT and IST), by the Ministry of Industry and the Ministry of Research (through the RNMT and RMNT network programmes, mainly dedicated to sensors, materials and micro/nanotechnologies), as well as by the ANVAR (EUREKA programme). (Some of these efforts are only *indirectly* linked to demining applications.)

However, some results from the research activities financed by the DGA in the military demining domain could be very useful to help progress in the humanitarian demining techniques.
The main problem regarding these projects, either financed by the DGA or the Ministries, is that the corresponding results are generally confidential and belong either to the prime contractor, or to the contracting authority, or to both entities, on the basis of an operating contract and of non-disclosure agreements. This obviously impairs a good dissemination of these results.

The SALAMANDRE project entrusted to Thales (formerly Thomson-CSF), and the SYDERA project entrusted to CNIM, are among the main research activities financed by the DGA in the upstream studies framework. These projects had as a goal the development of a multi-sensor detection system, as well as the investigation of novel technologies and sensors for the detection of mines or fuses, including data fusion. Finally, the DGA is currently also interested in explosive detection and in the use of mini-drones.

The Ministry of Research has financed several projects dedicated to the detection of chemical molecules in the state of trace, without specifically targeting the detection of explosive, resulting in a call for proposals.

The actors having worked, or still working, directly or indirectly on demining applications in France can be summarised as follows:

Public Organisations: ANVAR, DGA, Ministry of Industry, Ministry of Research;
Academic Institutions: ENST, MINEX, IFSPE, ISEN, IUT de Mulhouse;
Research Centres: CEA/LIST, CEA DAM Le Ripault, CEA/DSM/CAPMAG, CNRS SUPELEC, CNRS Paris Michel Ange, CNRS Marseille, CNRS Nice, CREPHI, ISL, Laboratoire de Robotique Versailles, ONERA;
Associations: ARTID, Comité Richelieu;
Commercial Demining: ARPE, Geomines;
Large Companies: CAC Systemes, Capgemini, CNIM, CS Defense, Dassault Electronique, MS&I – EADS MATRA, MBDA, SAGEM, SODERN, Thales Airborne Systems, Thales Communications, Thales Underwater Systems, Thomson-CSF, Thomson Detexis;
SMEs: Bourgogne Hydro Technologie, CODETEL, Cybernetix, EPPRA, IXTREM, LEAS, METRAVIB, PEGASE Instrumentation, RTD, SEGG, X-Technologies;
NGOs: HAMAP, Handicap International, UNICEF.

Content

1 Objectives

Convergence Innovation, as a consulting company specialized in technical expertise and scientific information search with extensive knowledge of the French demining related R&D scene, has been entrusted by the EUDEM2 project with a *Study*, whose purpose is to:

- Document demining related R&D programmes and efforts in France, whether military or humanitarian, with particular but not exclusive emphasis on:
  - The results of work sponsored by the French DGA (Délégation Générale pour l'Armement) during the past years, and
  - Currently running activities.

- Document the corresponding results, duly taking into account intellectual property and confidentiality issues.

- Generate an "Organigram" of the demining related R&D in France, to be integrated with similar documents prepared at the European level by the EUDEM2 team.

This *Study* falls within the EUDEM2 project's (www.eudem.info) Technology Survey activities. Part II of this *Study* – the subject of the present document – consists in the release of the documentation identified during a first, preliminary phase, plus other R&D activities of relevance.

2 Main Research Actors and Programmes

The use of the IXTREM and EUDEM2 demining databases, as well as focussed Internet researches through different databases and search engines, have allowed to dress the following portrait of the main research actors and programmes in France, linked directly or indirectly to (humanitarian) demining activities.

2.1 DGA (Délégation Générale pour l'Armement)

Website – http://www.defense.gouv.fr/dga

The DGA implements *permanent collaborations* with the whole French scientific and technological community. These collaborations are diverse. For example, they concern the training of engineers, or the financing of theses with the CNRS as a partner. The CEA (Commissariat à l'Energie Atomique) does also carry out research, experimental and simulation work on behalf of the DGA.

The DGA also calls for tenders, targeting the expertise and consultancy capabilities of the following organisations:

- ✓ Organizations under the supervision of the Ministry of Defence: *Office National d'Etudes et de Recherches Aerospatiales* (ONERA) and *Institut Franco-Allemand de Saint-Louis* (ISL),
- ✓ Organizations sharing the supervision of their defence related research activities with other ministries (CNES in the space domain),
- ✓ Laboratories of engineering schools such as Polytechnique, Sup Aéro, ENSTA, ENSICA or ENSIETA.
- ✓ Some research centres of the industry having specific research means.

The DGA is establishing very strong connections with the Ministry of Research, which also puts at the disposal of the DGA experts for the evaluation of "upstream" studies. On the other hand, scientific experts from the DGA are participating to the "Académie des technologies".

The Ministries of Defence and Research have decided to structure their collaboration. On January 29, 2001, they have signed a convention for a better harmonisation of their research programmes (content, results, evaluation), and for the creation of a permanent exchange structure between the persons in charge of the respective technology domains.

The Ministry of Defence is also maintaining relations with other administrations. For example, with the Ministry of Economy, of Finances and Industry (DIGITIP), the Ministry of Transportation (DGAC), and the Ministry of Health (INSERM).

2.2 Research Programmes in Demining Applications, or Related Fields, Financed by the French Government

2.2.1 Overall Demining Actions and Programmes undertaken by the DGA

2.2.1.1 Generalities and Main Programmes

The threat that antipersonnel mines are representing is "multiform" as much by the means that are implemented (mechanical burial, manual positioning, dispersion), than by the design of the mines themselves, their activation and action modes. Treating this threat is a complex technical problem: today it is admitted that there is no simple solution and that a large range of technologies have to be sought for according to the nature of the mines and the environment (type of ground, atmospheric conditions …).

Important efforts regarding military countermining have indeed been undertaken in France since the beginning of the 1990's. In this way, the Délégation Générale pour l'Armement (DGA) has acquired, on behalf of the Army staff, a certain number of **countermine means**:

- 10 AMX 30 B2 DT remotely-operated mine clearance tanks by GIAT.I;
- 7 demining bulldozers, also remote-operated (TNL D9 DT), by CATERPILLAR/ SPIM;
- 8 Means for zone clearing (MADEZ) by AARDVARK (Scotland);
- 5 mined paths opening systems (SOUVIM) by RSD (South Africa).

Most of this material was used for external operations in order to settle international conflicts.

Research is also very active and the important allocated budgets allow the DGA to finance actions in *three technical domains* that are essential for mine clearance:

- **Detection**;
- **Decoying systems**, to activate mines at a distance by simulating the presence of a target;
- **Neutralisation systems**, to destroy mines by avoiding as much as possible to make them explode, in order to reduce collateral damage.

With regard to *mine detection*, the three-year "**SALAMANDRE**" project, assigned to the **Thomson-CSF** Detexis company (now part of the Thales Group), had as objective to realize a multi-sensor detection system demonstrator installed on a vehicle, by combining the best detection technologies available on the market (electromagnetic induction, ground

penetrating radar, radiometry, optronics). It has included outstanding information fusion algorithms. This project was complemented by long term studies aimed at selecting and improving other promising technologies: detection by neutron flow, by acoustic or seismic waves, by magnetic quadrupole resonance, olfactory technologies, etc.

The DGA is also regularly undertaking actualisation tests on new demining material which is appearing on the market.

The research work on **decoying techniques**, based on the simulation of target presence for the activation of mines at a distance, aims at enlarging the application field to all types of mine ignition devices, for antipersonnel as well as antivehicle mines (pressure, trap threads, magnetic, seismic, acoustic…). It is based on a permanent monitoring of the threat evolution; the DEDALE system by GIAT. Industries – MATRA represents an example.

Mine **neutralisation** calls, among other things, for mechanical or pyrotechnic means (shaped-charge cone for example). Other processes are being or will be evaluated in a near future: destruction by water blast, laser, plasma, high power microwaves, etc. The major part of this work constitutes a "federating project" that prepares the future development of a close-up mine clearance system called **SYDERA**, which is aimed at *path opening* and *area demining*. Within this framework, the DGA has financed a research project over 2 years (2002-2003), which has been assigned to the prime contractor CNIM. The study in itself targets the following *technical domains*:

1. *Magnetometric detection,*
2. *Bi-modal electromagnetic detection,*
3. *Off-road radiometric detection,*
4. *Infrared polarimetry,*
5. *Heat contribution to improve detection, mainly by infrared techniques,*
6. *Nuclear magnetic resonance,*
7. *Surface seismic waves detection,*
8. *Electronic detection of mine ignition devices.*

For each of these themes, the *following tasks* had to be realized:

- *State of the art placing the considered technique in relation to the existing ones,*
- *Theoretical study including signature acquisition,*
- *Feasibility trials,*
- *Contemplated technologies in order to get a demonstrator and evaluate it,*
- *Demonstrator realisation or adaptation of equipment,*
- *Demonstration Trials / performance measurements.*

A **reference minefield** will be realized at the *Etablissement Technique de Bourges (ETBS)*, belonging to the DGA, for the evaluation and the finalization of these new technologies. It will offer the best conditions regarding safety and reproducibility for the evaluation tests of countermine techniques on false and real mines.

This institution is also in charge of the centralized management and the storage of the 5000 antipersonnel mines whose ownership is authorized by the Ottawa Convention in order to "allow the finalization of techniques regarding mine detection, demining or mine destruction and for the training to these techniques". Legally, this stock can be renewed but can never surpass the number of 5000 antipersonnel mines. Mainly constituted of French mines, it will evolve towards foreign mines gathered during operations abroad.

To have at disposal a large variety of mines presents a scientific interest:

- Knowledge by expertise of the mine functioning process;
- Finalization of neutralisation or detection techniques and methods.

These mines will be entrusted to different French industrial and governmental centres in charge of developing, evaluating or finalizing countermining materials. They can be transferred, for countermine techniques or training finalization purposes, only to those countries that have signed the Ottawa agreement.

The stock management is extremely rigorous: the procedures put into place allow at any time to know the state, the geographic location of the national authorized stock, their holders as well in quantity as in nature of the mines. Moreover, all dispositions are taken in order to respect the quota even in case of a new mine arrival.

2.2.1.2 Other R&D Work that has been the Subject of Call for Tenders

The DGA is proceeding on a regular basis to calls for tenders in order to realize research work, among others on demining as well. These research activities are generally planned several years ahead and are part of the objectives of large projects such as SALAMANDRE or SYDERA. Examples of calls for tenders include the following.
(For completeness' sake they also include some activities targeting sea mines, although the latter are of lesser interest in this *Study*.)

- **Study and realization of a countermine evaluation system, and associated provisions of service.**
  Contracting Authority: DCE/ETBS

  Context: This tender is about studying and realizing a trial means whose function is to simulate the functioning of landmines. This system will be composed of instrumented mine substitutes, wireless transmission of the dated start signal, and a computerized supervision system. The definitive part [of this contract] will include the study and realization of a prototype system.

- **Clearance and inspection devices, each equipped with a demining arm and public works accessories. The device is destined to equip the aviation engineers units, in order to allow them to insure inspection and cleanup mission.**
  Contracting Authority: DCMAA/SMC

- **Study, detection, classification of mines buried at the sea bottom.**
  Contracting Authority: DSA/SPN/SPN Paris

  Context: Currently, the mine-hunting sonar systems are treating essentially the threat represented by traditional mines (bottom mines and moored mines), but they remain inefficient against a non-negligible part of the modern mines (buried or close to the surface).

  Services to be realized: The objective of this study was to extend the sonar's range of use to fight against buried mines. This means in particular: the determination of optimal transmission frequencies bands; the study of echo classification techniques; the finalization of processing algorithms adapted to the detection of mines buried in the sediment; the study of new antenna technologies adapted to the problematic of buried mines.

- **Technology demonstrator for an autonomous mine-hunting system**
  Contracting Authority: DSA/SPN

  Context: Mine hunting uses hull-mounted sonars or, more recently, variable immersion sonars, possibly propelled but physically linked to the main platform via an umbilical cord.
  However, in order to increase the system's performances and to preserve the ship's and crew's safety, it seems preferable to assign mine detection, classification, and localization tasks to autonomous systems, fully independent from the ship that is using them, i.e. to design systems based on submarine robots.

  Services to be realized: Study and realization of a technology demonstrator for an autonomous mine-hunting system; trials at sea of the developed system; system maintenance (operational condition maintenance (MCO) during 2 years, optional).
  Planned delivery dates for contract execution: around 36 months (outside MCO) from the contract notification (indicative length of time).

2.2.1.3 Other Interest Areas of the DGA

Finally, the DGA is interested in mine **neutralization** by medium/high-power microwaves, or also by high pressure water blasts. *Upstream proposals study invitations* have been launched in these fields. Another centre of interest is mine detection using **electronic noses**. Examples of calls for tenders include the following.

- Call for tenders: Study of a transportable means of high pressure water generation, even very high pressure water generation, applied to the destruction of landmines and UXO that are placed on the ground or are buried.
  Contracting Authority: DSA/SPART (Direction des Systèmes d'Armes, Service Programmes des Armements Terrestres / Ministry of Defence, Arms Systems Directorate, Land Armament Programmes Department).
  Date: January 6, 1999

- Call for tenders: Study of mine neutralisation by medium and high-power microwaves.
  Contracting Authority: SPART
  Date: April 19, 2002
  Titular: Thales Communication

- Call for tenders: Study of the magnetic technology potential for future mines and land vehicles detection systems.
  Contracting Authority: DSA/SPART/ SPART Bourges
  Date: December 12, 2003
  Titular: Not communicated

- Call for tenders: Realisation of a protection system demonstrator for land elements.
  Main characteristics: Sole contract. No possible variations. The army wishes to have at its disposals a demonstrator capable of protecting land elements (SPECTRE), by monitoring, controlling and even forbidding access itineraries to foot personnel, coherently with current international treaties.
  Contracting Authority: DSA/SPART
  Date: December 22, 2003
  Titular: Not communicated

2.2.2 Programme financed by the Ministry of Industry

IMNE: Magnetic Imaging for Non-Destructive Trials

Coordinator:	Partners:	Project Budget:
GILLES-PASCAUD Catherine	- SNECMA MOTEURS (Evry) - AIRBUS France (Toulouse) - EADS CCR (Suresnes)	2 099k€ Project Duration:
Company or Institution:	- FRAMATOME ANP (St Marcel)	2003-2006
CEA (Saclay)	- M2M (St Rémy) - STATICE (Besançon) - CEA LETI (Grenoble) - ENS – CNRS (Cachan) - SUPELEC (Gif-sur-Yvette)	

Project Summary:
IMNE's goal is to develop a process that allows the improvement of material control for complex shape parts (e.g. turbine disks and blades) or for large aircrafts structures. It means the realization of micro-sensor eddy current multi-elements on flexible supports, of dedicated electronics, and of real-time acquisition and analysis tools allowing the characterization of defects. IMNE will provide an answer to the needs of the interested industrial sectors by proposing an impressive and robust tool, allowing the improvement of detection and material characterization, to reduce control cycles, to increase productivity and to optimize the operators' decision reliability.
Even though this programme does not address the demining aspect, it could find application for **electromagnetic landmine imaging**.

2.2.3 Programme financed by the Ministry of Research

The following laboratories have received in 2003 a subvention from the Ministry of Research in order to realize hypersensitive trace detection sensors:

Laboratory Name	Project Name	Project Title
Institut d'Electronique, de Microélectronique et de Nanotechnologie UMR CNRS 8520 www.iemn.univ-lille1.fr	MBCH	Multifunctional micro-biosensor for biochemical analysis.
Laboratoire des Interactions Moléculaires et Réactivité Chimique et Photochimique IMRCP UMR 5623 www.imrcp.ups-tise.fr	Print sensors	Design of a chemical species detection micro- system after concentration on molecular print material.
Laboratoire de Photophysique Moléculaire (LPPM) www.ppm.u-psud.fr	Gas trace sensors	Gas trace sensor for the sensitive and simultaneous measurement of molecular constituents concentration, by local probing, fast, in situ and non-intrusive.
Laboratoire de Physique des Milieux Ionisés et ses Applications (LPMIA) UMR-CNRS 7040 www.lpmi.uhp-nancy.fr	SAWsensor	Development of an intelligent micro-system base on miniature SAW devices (Surface Acoustic Waves) and their associated electronics for gaseous atmosphere control.
IUSTI CNRS-UMR 6595 Polytech Marseille Département de Mécanique Energétique Equipe Instrumentation des Procédés et Systèmes en Ecoulement www.polytech marseille.com/rech_labo/pole_me.html	Trace sensor	Realization of a Fourier transformation based mass spectrometer by for the analysis of pollutant gases, and exploration of a new analytic method combining mass spectrometry and infrared spectroscopy.

2.3 Other Research Programmes of Potential Interest for Demining Applications

2.3.1 Ministry of Research

Website – http://www.recherche.gouv.fr

Its main vocation is to finance research at the domestic level. The strategy of the Ministry of Research is mainly articulated around research and technological innovation networks. The themes that are principally approached are the nanosciences, new sensors and analytic methodologies, food/health, as well as cellular biology and biotechnology.

There is *no action directly dedicated to humanitarian demining* at the moment.

2.3.1.1 RNMP Network

The Technological Research and Innovation Network *Materials and Processes*, created on March 23rd, 2000, assigns labels to research and development projects in view to:

- Stimulate technological research in order to develop new products and services that are answering to the market needs, with a particular attention to emerging technologies,

- Allow a tighter cooperation between the industrial world and the research one, by the creation of a consortium that is the result of a network implementation of industries and laboratories' competences, following a logic of demand of the "bottom up" type, thus identifying the market needs as well as the industrialists' wishes. The following 5 main domains are targeted:

    - Material design, elaboration and characterization,
    - Implementation processes – Optimisation,
    - Surface treatments and assembling,
    - Associated controls behaviour, durability and reliability,
    - Processes and materials that are respecting the environment – Recyclability.

2.3.1.2 RMNT Network

The French **R**esearch Network in **M**icro and **N**ano **T**echnologies (**RMNT**) is one of the Research and Technological Innovation Networks, whose creation was announced by the French Prime Minister during the Innovation Meetings in 1998. This network represents a new type of innovation funding set by the French Ministry of Research (Technology Direction) www.technologie.gouv.fr. The aim of this kind of networks is to promote technology transfers between public basic research and industry in government priority fields. RMNT is thus opened to all laboratories and companies working in these areas.

The application field of **RMNT** deals with sizing, operating, collective manufacturing and characterization of very small objects, down to molecular dimensions. This network operates in the following multidisciplinary, very high technology fields: biotechnology, microelectronics, opto-electronics, nanostuctures and nanomaterials, power and microenergy, MEMS and MOEMS, assembling, hybridization, connecting, ultra-precision, etc.

Working rules:

- There is no invitation to bid for a tender; each Consortium has to take the initiative. The projects are submitted on a current stream basis. After expertise, they are examined at fixed dates, three times a year (March, June and October).
- The presence of at least one company and one public laboratory in the consortium is mandatory.
- RMNT gives its seal of approval to the retained projects, which will be followed by the Network Orientation Board. The "Secrétariat d'Etat chargé de l'Economie, des Finances et de l'Industrie" (www.industrie.gouv.fr), the "Ministère de la Recherche" (www.technologie.gouv.fr), and the "ANVAR" (www.anvar.fr) are associated to fund this network.
- The consortium may include a foreign partner under specific conditions.

2.3.2 Ministry of Industry

Website – http://www.industrie.gouv.fr

This Ministry is financing in particular actions linked to the development of information technologies and new multifunctional materials.

2.3.3 ANVAR (Agence Nationale de la Valorisation de la Recherche)

Website – http://www.anvar.fr

The main mission of ANVAR is to promote and finance innovation in French industry, particularly for SMEs, facilitating the emergence of new products and processes in all fields of activity. ANVAR operates under the supervision of the Ministries of Industry, SMEs and Research.

The role of the Agency is to meet the needs and requirements of French SMEs, through its 25 regional offices, by offering a multi-faceted professional approach:

- Providing information, access to consultancy services and expertise;
- Establishing contacts with technical partners (laboratories, technology transfer agencies);
- Assisting in the search for partners to set up industrial and commercial partnerships, and in looking for capital funds for start-up or growing companies.

ANVAR organizes European technology exchanges and investment forums, and circulates information via its different regional offices on European R&D and EU programmes. ANVAR also insures the support of French companies in the EUREKA projects.

3 PUBLIC ORGANISATIONS / ACADEMIA / RESEARCH CENTRES

3.1 Public Organisations

ANVAR (Agence Nationale de la Valorisation de la Recherche)

Address: 43, rue Caumartin
Postal code: 75009
City: Paris
Country: France
Contact person: —
Telephone: +33 (0)1 40 17 83 00
Fax: +33 (0)1 42 66 02 20
Web site: http://www.anvar.fr

DGA (Délégation Générale pour l'Armement)

Address: 51, Bd La Tour Maubourg
Postal code: 75007
City: Paris
Country: France
Contact person: —
Telephone: +33 (0)1 44 42 30 11
Fax: depending on the department
Web site: http://www.defense.gouv.fr/dga

Involved Technology Related Activities

The DGA undertakes on a regular basis follow-up tests on new demining material appearing on the market; it also proceeds to calls for tenders in order to realize research work, among others on demining as well. These research activities are generally planned several years ahead and are part of the objectives of large projects such as SALAMANDRE or SYDERA.

Related Projects

· **SALAMANDRE Vehicle-based Multi-sensor Detection System Demonstrator**
· **PEA SYDERA Land Mine Detection** (2003)

Ministry of Industry

Address: 139, rue Bercy
Postal code: 75012
City: Paris
Country: France
Contact person: —
Telephone: +33 (0)1 40 04 04 04
Fax: +33 (0)1 53 18 36 48
Web site: http://www.industrie.gouv.fr

Ministry of Research

Address: 1, rue Descartes
Postal code: 75231
City: Paris
Country: France
Contact person: —
Telephone: +33 (0)1 55 55 90 90
Fax: according to the dept.
Web site: http://www.technologie.gouv.fr

3.2 Academia

ENST - Ecole Nationale Supérieure des Télécommunications - Département TSI (Traitement du Signal et des Images)

Address: Département Traitement du Signal et des Images, CNRS - URA 820, 46 rue Barrault
Postal code: 75634
City: Paris Cedex 13
Country: France
Contact person: Isabelle Bloch
Telephone: +33 (0)1 45 81 75 85
Fax: +33 (0)1 45 81 37 94
Web site: http://www.tsi.enst.fr/

The Department is in charge of high-level Education and Academic Research in the domains of Signal and Image Processing. These missions may be listed as follows:

- Initial Education: the Department's goal is to provide every ENST student with a complete education including the basic elements of maths, probability theory, signal and image processing theory needed for a real understanding of information technologies and their role in the modern society;
- Advanced Education for those students that are devoted to the expertise in signal and image processing for the industry as well as for academy;
- Education through research for which the department not only provides lectures (DEA Lectures, Doctoral Lectures, Scientific Workshops), but also training periods ranging from short (8 weeks) to long (3-4 years); Research, either methodological/fundamental or applied, in close partnership with national and international research centres, as well as with industries.

Related Projects

SMART (Space- and Airborne Mined Area Reduction Tool)
SMART aims to provide deminers (end-users) with safe, user-friendly, cost-effective, efficient and innovative tools for the monitoring of the environment and for the assistance to people in countries afflicted by landmines. The system is designed to achieve a higher quality of the service, which will efficiently improve level 1 minefield surveys. For that, SMART will collect data with an airship multisensor survey system and carry ground truth data collection sessions, process all data using data fusion techniques, landcover classification tools, anomaly detection algorithms. The system will provide integrated tools and data into the minefield survey system of the end-user and validate the results on validation test sites. SMART aims not at solving automatically the problem of mine suspected area reduction, but at helping the human analysts in their interpretation tasks.

MINEX - Ecole Supérieure et d'Application du Genie, Centre MINes EXplosifs

Address: Caserne Eblé – 106 rue Eblé
Postal code: 49000
City: Angers
Country: France
Contact person: —
Telephone: +33 (0)2 41 24 82 99
Fax: +33 (0)2 41 24 83 50
Web site: http://www.genie-militaire.com

National centre of demining training. The MINEX centre has asserted itself at the international level for the quality of its teaching, its personnel experience and its constant evolution in the development of pedagogic tools. The knowledge that it transmits wants to be concrete. To do so, the teachings coming from the different theatres of operations where the forces are engaged are constantly taken into account and the instructors are sent regularly on sites (Bosnia, Angola, etc…). The centre is training around 500 specialists per year.

Involved Technology Related Activities

Demining Training

Neutralisation Technologies
For several years, the ESAG specialists have developed a **data base** registering the quasi-totality of **mines and submunitions** (more than a thousand) encountered by the French armies while in operation. This data base, in the form of a CD-ROM, is one of the world references in this field. It contains two types of information:

- Non-protected technical information about the ammunitions' characteristics;
- Information regarding the neutralisation procedures that can only be given to the personnel having the necessary technical abilities to process them.

Note: During the conference of the Ottawa Convention States Parties at the, that took place in Maputo (Mozambique) from the 3rd to the 7th of May, 1999, France has confirmed its will to actively participate in the eradication of antipersonnel mines, and has officially handed over to the United Nations the data base realized by the ESAG.

This reference tool is improving the international data base being elaborated and it will then supply a unique set of reliable and tested knowledge and information to the persons in charge of the programmes, as well as to the actors on the ground.

IFSPE

Address: 320 avenue Berthelot
Postal code: 69371
City: Lyon Cedex 08
Country: France
Contact person: —
Telephone: +33 (0)4.72.78.46.06/+33 (0)6.71.96.01.82
Fax: +33 (0)4.78.74.40.74
Web site: http://www.ifspe-formation.com

IFSPE is fully approved to train in domains such as first aid, fire protection and also demining. These training actions are entirely assumed by professionals in risk prevention.

Involved technology related activities

Demining Training

ISEN - Institut Superieur d'Electronique du Nord, Département Signaux et Systèmes

Address: 41, Boulevard Vauban
Postal code: 59046
City: Lille Cedex
Country: France
Contact person: Emmanuel Duflos
Telephone: +33 (0)3 20 30 40 26
Fax: +33 (0)3 20 30 40 51
Web site:

Involved Technology Related Activities

Data Fusion , Multi-Sensor Hand-Held Systems

Related Publications

- Stéphane PERRIN, "Contribution à l'Algorithmique Multicapteur pour la Détection de Mines Antipersonnel", Ph. D. Thesis, University of Lille I, France, November 2001.
  http://www.k2.t.u-tokyo.ac.jp/members/sperrin/sperrin-e.html
- Delphine POTIN, "Modélisation par les méthodes de traitement de signal des phénomènes de propagation des ondes électromagnétiques en milieu hétérogène".

IUT de Mulhouse GMP

Address: 61 r Albert Camus
Postal code: 68200
City: Mulhouse
Country: France
Contact person: Michel Nikolic et Anthony Boulay
Telephone: +33 (0)3 89 33 74 00
Fax: +33 (0)3 89 33 74 05
Web site: http://www.iutmulhouse.uha.fr/gmp/actu.php3
http://gmp.mulhouse.free.fr/

IUT de Mulhouse GMP, which welcomes more than 1000 students per year, has as priority to keep an overview on the international world and to provide training actions fully adapted to the novel markets. With a well-located geographical position, close to Germany and Switzerland, GMP is pushing for training periods abroad and for teaching partnerships with German and Swiss engineering schools.
IUT is also developing research work for industrial applications and is proceeding to technology transfers. Four research laboratories are on campus, with the Génie Mécanique et Productique (GMP) Department being involved in supporting procedures with companies when they choose to improve competitivity and quality. GMP is intervening in all sectors dealing with Science and Industrial Production, both at the local and national level.

Involved Technology Related Activities

Vegetation Cutters
*Manufacturing of an **electric weed cutter** for manual demining – motorized probe and preventive probe (project executed in partnership with ARTID)*
The ground surface needs to be prepared for the different demining phases by taking into account surface mines and booby traps. This operation is done with heavy and armoured vehicles under certain conditions. It is however often necessary to weed by hand as well.

Manual Demining

A first detection technique is done by an **injection** of **water loaded with a chemical tracer** in the land to be demined. A second approach consists in using "**mechanical**" probes, in fact a kind of more or less sophisticated bayonets. Metal detectors are also used. Our projects aim at improving certain functions of these probes. The proposed solutions could be integrated with each other according to the condition of use of the probes.

- **Preventive probe**: Mines are activated with a bearing force of 3 to 4 daN. The principle is based on a compression spring device so that the deminer can constantly monitor the pressure that he is exerting on the probe.
  A prototype has been developed.

- **Motorized probes**: drought and freeze make the ground penetration more difficult. These studies were concerned with the motorization of a probe combined to a deep hole boring head: some tests with different tools, in particular boring tools from the Potash Mines of Alsace, have permitted to validate with success few proposed solutions.

- **Radio-monitored detector:** The objective of this study has consisted in reducing the excessive cost of the current radio-monitored detectors, to improve their manipulation, and to increase their performance.

Neutralisation Technologies

A few technical solutions have been proposed by GMP once mines have been detected:

- Make the mine explode by provoking a shock with a press mounted on a cart,
- Violently beat the ground with chains that are put in action with a mechanical means,
- Inject a hardening foam to allow the extraction of the mine without any danger,
- Extract the mine in order to neutralise it in a safe place.

The GMP group has chosen to bring its contribution to the development of the **extraction technique**. It proposes to pull out a core that encompasses the mine: this solution is without danger for the deminer and respects the site.
The study was related to the whole system: support, motorisation, training, and the core drilling head.

3.3 Research Centres

CEA/LIST

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Fax: +33 (0)1 69 08 87 86
Web site: http://www-drt.cea.fr/

A technology research laboratory in the Paris surroundings, the "Laboratoire d'Intégration des Systèmes et des Technologies" (CEA/LIST) is developing digital systems meant to be integrated with innovative products and processes. It gathers competences in the domains of embedded (autonomous) systems, interactive systems (man-machine interaction, virtual reality, robotics), instrumentation and metrology, as well as materials (assembly and non-destructive control of mechanical systems, elaboration of materials).

Involved Technology Related Activities

Trace/Vapour Explosive Detection Systems

The CEA/LIST has been working on **electronic noses** since the end of 2001. The following are among the contemplated civilian applications: the detection of illicit substances during road stops, the control of the efficiency of certain medicines by following their ratio in blood samples, and also the environment. Two complementary projects are running at present. The first one uses **Molecular Imprinting Polymers** (MIPs) to capture molecules. These materials, which have been studied for around 10 years, have the particularity of featuring cavities which are highly specific to the molecules to be detected. The latter can integrate themselves into such cavities, in the same way as a sculpture into a mould. Another advantage is that the chemical links put into action are weak links, for example hydrogen links. They come apart easily, making the MIP – and therefore the sensor – reusable.

The second project, carried out by the teams from the CEA's Direction of Material Sciences and of Life Sciences, is interested in the use of **metallic nanoparticles** as a **marking system** for signal transduction. Indeed, the specific properties of these nanoparticles make them suitable to be used as electronic markers, with a high potential. According to the properties put into evidence, the sensitivity gain linked to these nanoparticles could indeed be 10 to 100 times larger than the one of classic markers, such as the luminescent ones. The laboratory is also working in partnership with external teams, especially the IXL laboratory of the University of Bordeaux, a specialist in the transduction modes by acoustic waves.
(Information source: CEA website
http://www.cea-technologies.com/article/article.php?article=312)

CEA-DAM – Le Ripault

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Web site: www.dam.cea.fr

The CEA Le Ripault centre is concentrating all the scientific and technical competences and trades for the finalisation of new materials, from their design (computer modelling, synthesis…) to their manufacturing (materialisation, toolings…) and characterisation. This upstream and downstream expertise, which was developed for the Defence, finds several interesting applications for civilian activities, benefiting large industries as well as smaller companies.

Involved Technology Related Activities

Trace/Vapour Explosive Detection Systems
Though most of the gas sensors on the market are using metallic oxides, that are durable but possess little specificity, the DAM (Direction des Affaires Militaires) of the CEA has developed since two years **devices based on organic materials** that are resistant to aging, very selective, and able to detect in continuous mode some tenths of ppb of explosives derived products.
At the moment, based on a principle of mass variation, measured with a quartz micro-balance, the demonstrator detects in less than one minute contents in nitroaromatics components at the 3 ppm level.
(Information source: CEA website
http://www.ceatechnologies.com/article/article.php?article=98)

CEA/DSM/CAPMAG

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Web site: http://www-dsm.cea.fr

Research at DSM is focused on the following domains:

- Energy and environment,
- Sciences of the matter for industrial innovation (nanophysics, material science,
- instrumentation, cryogenic systems),
- Utilisation of nuclear technologies in biological research,
- Knowledge of the matter.

CEA/DSM/CAPMAG is specialized in magnetism research and its applications, including NMR and magnetic sensors.

Involved Technology Related Activities

Nuclear Quadrupole Resonance (NQR)
CEA has, firstly, expertise on **NQR** for explosive characterisation, acquired with the development of NQR spectrometers adapted to the determination of various explosives, as well as experience on real mine detection.

Magnetic Sensors (Magnetometers)
Secondly, it has a great experience in the development of **very sensitive magnetic sensors**, in particular femtoTesla range magnetic sensors with wide bandwidth capabilities.

CAPMAG is involved in a number of national and European projects on the applications of very low noise magnetic sensors for DC to HF applications.
CAPMAG is also involved in NMR and NQR spectrometers and NMR, NQR methodology development for various applications ranging from medical applications, to material studies and mine detection.
(Information source: CEA website)

NOTE: *The techniques developed by the three entities of the CEA are of major interest for the demining sector, in particular regarding explosive detection by electronic nose technology or Nuclear Quadrupole Resonance. These laboratories are interested in working with small and medium-sized companies in order to develop applications of these technologies, some of them directed to the demining sector.*

CNRS SUPELEC (Ecole Supérieure d'Electricité)

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Web site: http://www.lss.supelec.fr/

The Signals and Systems Laboratory (L2S) welcomes researchers from the Paris suburbs who are working in the following fields: signal processing, communications, systems theory, automatism, information transmission, electromagnetic and acoustic waves.

Involved Technology Related Activities

Ground Penetrating Radar
The waves division of the Electromagnetism Research Department is looking into the problem of radiation, of the propagation and diffraction of electromagnetic waves, and to a lesser degree, acoustic waves, by insisting particularly on the modelling of complex configurations and digital simulations, without forgetting at the same time the experimental validation. The waves division is federated with the Electromagnetism Department of Supélec inside the Electromagnetism Research Department (DRÉ).

CNRS Délégation Paris Michel-Ange

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Web site: http://www.cnrs.fr/CMA

The Délégation Paris Michel-Ange is in charge of laboratory management in tight partnership with the Collège de France, ENSCP, ESPCI, the Curie Institute and the Pasteur Institute. It also hosts, manages and follows up, especially on the technical and logistic aspects, the entities located at the CNRS headquarters.

Involved Technology Related Activities

Robotics and tele-operated platforms
Targeting intervention on dangerous sites (**autonomous off-road robot Lama**):
The objective is to provide it with functional and decisional abilities that allow to execute missions that are specified by a remote operator, such as "reach such objective", or "explore such region", without the operator's intervention during the different steps of the mission. Research is concentrated on different aspects, from environment perception and modelling with the help of sensors (mainly cameras), to task planning, via the autonomous generation and execution of change of locations. Applications are numerous: scientific exploration (in particular on a global scale), intervention on dangerous sites (demining, reconnaissance in a military context), environmental monitoring…
(Information source: http://www.laas.fr/~simon/eden/robots/lama.php)

CNRS – Laboratoire de Neurobiologie Marseille (UPR 9024)

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Country: France
Contact person: Pr. Jean-Luc Clément
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Fax: +33 (0)4 91 71 49 38
Web site: www.lnb.cnrs-mrs.fr

The main objectives of the research carried out at the Laboratory of Neurobiology (UPR 9024), created in January 1994 inside the Neurosciences department, is to find answers to fundamental questions in the three following main scientific themes:

1. Nervous system receptors
2. Communication systems
3. Neuropeptides: neurotransmitters and neuroregulators.

With its activity, the Neurobiology laboratory is contributing to the action of the Research Federation "Brain Sciences", one of the excellence elements of the local research, as the community around Marseilles, with its 200 researchers and 200 engineers and technicians spread over more than 20 laboratories, is at the second place just after Paris and its surroundings.

Involved Technology Related Activities

Explosive detection by animals other than dogs

The laboratory is interested in the **olfactory perception of the invertebrates** (identification and expression of the olfactory receptors). Being very discreet regarding its activities in this domain, the laboratory has made few communications about it; certain works were even the subject of a thesis and in particular on the bees' chemical ecology.
The **bees** can be of interest for explosive detection as their sense of smell is largely more developed and sensitive than the one of the dogs (Other information source: http://www.algerie-dz.com/article958.html).

CNRS - University of Nice - Sophia Antipolis / LEAT (Electronics, Antennas & Telecommunications Laboratory)

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Web site: http://www.elec.unice.fr

The Electronics, Antennas and Telecommunications Laboratory (LEAT) is a joint Research laboratory from CNRS and University of Nice-Sophia Antipolis (Faculty of Sciences). The total staff includes 25 permanent and 10 non-permanent researchers (PhD students).
Research activities are focused around the four main topics listed below. They are carried out with a strong emphasis on applicability, and include in particular Radar, Non-destructive Testing, Subsurface Radar for Civil Engineering, and **Mine Detection** (military as well as humanitarian demining).

Main Research Topics:

1. Numerical Modelling and Simulation

2. New Antennas for Telecommunications
- Small and Compact Antennas,
- Multi-Standard/Multi-Band/Broadband Antennas for Mobile Communications (GSM, DCS, UMTS, WLAN and GPS),
- Dielectric Resonator Antennas for Spatial or Indoor Communications.

3. Active Integrated Antennas & RF Microelectronics
- Frequency, and/or Radiation and/or Polarization Agile Antennas,
- Design of MEMS with Associated Integrated Active Antennas,
- Behavioural Modelling (VHDL-AMS),
- RF Systems (RFID, UWB,...).

4. Detection and Microwave Imaging
- Reconstruction Algorithms for Buried Object Detection, Localization & Identification,
- Ultra-Wide Band (UWB) Antennas,
- Synthetic Impulse Microwave Imaging System (SIMIS),
- Reconstruction Algorithm Based on a Level Set Method for Radar Imaging,
- Millimetre-Wave Antennas for radar applications.

Involved Technology Related Activities

Ground Penetrating Radar
Laboratory equipment includes a technology unit enabling the realization of large printed antennas, measurement facilities for antenna assessments, e.g. measuring return loss up to 40 GHz, and an anechoic chamber for measuring radiation patterns up to 110 GHz; computer resources for analysis, simulation and CAD software (TLM, Zeland IE3D, Momentum, Ansoft HFSS, Ansoft Designer, ADS), connected to large French academic Computer Centers.
All investigations are carried out through research contracts and collaboration agreements with private companies: ALCATEL, RADIALL, FRANCE TELECOM, THALES, with research institutions, and academic laboratories: French Public Works Research Laboratory (LCPC), ONERA, THALES, ENRI (Japan), Queen's University of Belfast (UK), University of Florence (Italy),...
[See also Section 4. ***Detection and Microwave Imaging*** above.]

CREPHI

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Fax:
Web site: http://www.crephi.org

CREPHI (Centre Recherche en Electromagnétisme de Puissance Hyperfréquence et Impulsionnel – Hyperfrequency and Pulsed Power Electromagnetism Research Centre).

Objective:
To constitute a high level pole of competence in high frequency and high power electromagnetism by leaning on the scientific knowledge of the university laboratories and the technological know-how of local industrialists.

Involved Technology Related Activities

Ground Penetrating Radar, Neutralisation Technologies

Researchers, laboratory research engineers and local industry engineers are working together on technology transfers in the domains of:

- Microwave and pulsed power sources.
- Power transportation and radiation.
- Detection and protection.
- Research applications.
- Microwave heating.
- Harmonic power transmitters.
- Telecommunication applied to the defence domain.
- Generation and detection of ultrashort high power impulses.
- Design of fast transient detectors.
- Electromagnetic compatibility of power devices.
- The equivalent transient radar surface.
- Electromagnetic impulse simulators.
- Power transient phenomena.

ISL – Institut Franco-Allemand de Saint-Louis

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Fax: +33 (0)3 89 69 50 02/58 58
Web site: http://www.isl.tm.fr

Demining related research at ISL is/was focused on the following topics:

- *Research and test of physical concepts for detection of AP/AT mines (and UXO),*
- *Deminer protection,*
- *Research on laser and pyrotechnical devices for neutralisation devices,*
- *Database modelling and analysis,*
- *Smart sensors, data processing and data fusion.*

Involved Technology Related Activities

⇨ Acoustic Sensor
Contact Person: Pierre Naz
Details: See for example the report "Détection acoustique et sismique d'objets enterrés" (Acoustic and seismic detection of buried objects; ISL rep. Nr R 126/98).

⇨Test Facilities
Details:
ISL has in-house a number of test facilities for research and development purposes. Amongst these, the following are related in one way or another to demining research:

1) Laser: directed energy is used against inert or reactive materials (e.g. when neutralizing mines). This requires detail knowledge of the interaction processes between laser radiation and matter. The fast energy input results in thermally induced phase changes, transient mechanical stresses and pressures as well as chemical reactions which remove or even destroy the material.

2) The ISL Test Site: The test site covers an area of 90 ha and is composed of several ballistic test facilities and shelters for detonic tests in the widest sense (maximum explosive charge: 5 kg) and for tests in the areas of internal, intermediate and external ballistics.

⇨ Personal Protective Equipment (PPE)

⇨ Neutralisation Technologies
Details: Research on laser and pyrotechnical devices for neutralisation devices.

⇨ Enhanced Metal Detector

Contact Person: Lionel Merlat

Related Project

- HOPE (Hand-held Operational Demining System)

Contact Person: Pierre Wey
Details:
ISL (Institut de Saint-Louis) designed the database where all data and metadata about models and demining campaigns was stored.
(Information source: EUDEM2 database, Nov. 2004)

Laboratoire de Robotique de Versailles

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Web site: http://www.robot.uvsq.fr

The laboratory's activities are mainly focused on articulated locomotion systems, virtual reality, and intelligent road transport and vehicle systems.

Involved Technology Related Activities

Robotics and tele-operated platforms
Solution for position change on uneven ground during demining operations.

ONERA

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Web site: http://www.cert.fr http://www.onera.fr

The Office National d'Etudes et de Recherches Aerospatiales (National Office of Space Studies and Research) - French Aeronautics and Space Research Center, is a public, scientific and technical establishment with both industrial and commercial responsibilities. ONERA reports to the French Ministry of Defence and enjoys financial independence. Its expertise covers all the scientific disciplines involved in aircraft, spacecraft and missile design.

Mission:

- To assist government agencies in charge of coordinating civil and military aerospace policy,
- To direct and carry out aerospace research,
- To design, produce and operate the resources needed to perform research and testing for manufacturers,
- To make available and commercialize the results of its research and facilitate application of this research by industry, including non-aerospace sectors,
- To support the French training policy for scientists and engineers.

From Basic Research to Flight Testing
Through the teamwork of its scientists recognized internationally in their respective fields and its engineers with a systems approach, ONERA promotes ongoing dialog between basic and applied research, medium and long range approach, areas of special expertise and an optimized overall approach. Mathematical models, numerical simulation, laboratory and wind tunnel experiments and flight testing combine to give a better understanding of the physical phenomena encountered and enable to validate aircraft, spacecraft and missile performance predictions.

Transfer to Industry
ONERA is a gateway between scientific research and industry, cooperating with CNRS (National Scientific Research Centre) and the most prestigious universities. Since its creation in 1946, it has worked on all the major French and European aeronautical and space programmes. ONERA continuously upgrades its research and test facilities, unique in France.

Laboratories
ONERA operates a number of laboratories, including LAERTE (Reactive Flow and Research Techniques Laboratory), L3C (Sensors, Characterization and Non-destructive Testing Laboratory), LEM (Microstructure Analysis Laboratory, run jointly by ONERA and CNRS), L. PRIAM (Reactive Plasma/Materials Interaction Laboratory, run jointly by ONERA and CNRS), plus laboratories on EMC analysis, signature analysis, powder metallurgy, structural strength, etc. These laboratories use state-of-the-art techniques to develop new materials and processes, conducting experiments and making measurements designed in particular to validate mathematical models and numerical simulations.

The main mission of the ***Electromagnetism and Radar Department (DEMR)*** is to perform upstream research work that would help the DGA and the industrialists to improve existing systems and to determine future systems in the main electromagnetism application fields, i.e. Radar, Stealth, Electromagnetic Compatibility, Electronic War, and Telecommunications. Due to the nature of these activities, in certain cases the DEMR is playing an expert role for the benefit of the DGA and the civilian sector.

Coordination tasks, strategy and prospective in the domains of the EMC (ElectroMagnetic Compatibility), stealth, signal processing, radar imaging, new types of radars, **demining** and diversification designs are assigned in particular to seven "Chargés de Mission".
(Information source: ONERA website)

Involved Technology Related Activities

Ground Penetrating Radar

Related Project

- HOPE (Hand-held Operational Demining System)

ONERA-CERT (Office National d'Etudes et de Recherches Aerospatiales – Centre d'Etudes et de Recherches de Toulouse) is developing models for the environment and the false alarms.
(Information source: EUDEM2 database, Nov. 2004)

4 ASSOCIATIONS / CONSULTANCY

ARTID Association de Recherche de Techniques Innovantes en Déminage Humanitaire

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Fax: —
Web site: http://www.artid.org

Several scientists of Saint-Louis decided to launch research and basic studies, with a strictly humanitarian motivation, via the creation of the *Association of Research for Innovative Techniques in Humanitarian Mine Clearance (ARTID).* ARTID aims at improving the efficiency of the humanitarian mine clearance process by means of scientific and technical studies, carried out on a benevolent basis.

Involved Technology Related Activities

Vegetation Cutters , Manual Demining

Neutralisation Technologies
The new demining techniques that ARTID wants to develop have to be integrated in the framework of new procedures, enhancing those currently used by the demining personnel. The deminer will be equipped with new tools that are completing its current tools: a metal detector, a manual probe, shears and clippers to remove vegetation, a trowel to unearth the buried mine, explosives to make it explode.
The studies that ARTID proposes to launch do normally not require sophisticated instrumentation nor high-level laboratory equipment. Some promising domains (for example, nuclear quadrupole resonance) are therefore not part of the research fields that ARTID wants to approach.
[Additional information available in the "IUT de Mulhouse GMP" entry.]

Related Project

· **DEMICHAIN: Demining system by chains dropping**

Comité Richelieu

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The Objective of the Comité Richelieu is to facilitate the development of small and medium-size companies (SMEs) in view to create new large European companies.
Members from the Comité Richelieu are innovating companies, whose technologies are directed to numerous markets.

Main actions :

- SMEsearch
Contact links with large companies and public institutions.

- SMEadvocate
Mediation in case of difficulties during negotiation or during the course of a contract.

- SMEwatch
Registration of the public markets attributed to the medium-sized and small companies.

- Programme [met]
Meetings over a day with large companies and public institutions.

5 DEMINING COMMERCIAL

ARPE

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Web site: http://www.arpe.fr

A.R.P.E is a geology, geophysics and hydrogeology consulting and services company, specialized in non-destructive auscultation of the underground by magnetometry and electromagnetic methods.

A.R.P.E. offers today its services in the demining domain, from on-site intervention and R&D, to the assistance to prime contractors (study of mine detection systems, pyrotechnic site cleanup, coordination of demining zone – debombing, methodological assistance on the demining zone, advice in the purchase of material, operator training…).

Involved Technology Related Activities

Ground Penetrating Radar , Magnetic Sensors (Magnetometers)
Ordnance Disposal
Since several years, A.R.P.E. has pushed for studies and several developments in the particular domain of demining, a strong need being felt, and the techniques implemented by A.R.P.E. in sub-surface auscultation – **geological radar, magnetometers** – have shown to be very well adapted to the localization of Explosive Remnants of War (ERW).

Geomines

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Web site: www.geomines.com

GEOMINES was created from the merger of two companies, GEOCEAN, specialized in marine works, and EOD-NT-FRANCE, specialized in the land and underwater demining sector. This association has allowed the creation, since 1995, of a private French demining company that is active at the international level.
Since then, GEOMINES has developed itself by feeding on the two companies' expertise: GEOCEAN brought its structure and knowledge in the management of large international marine projects, whereas EOD-NT-FRANCE brought its know-how in the explosives implementation and in the realization of demining operations.

To this day, GEOMINES is an autonomous commercial company carrying out demining activities. Mr. G. Velez is the Chairman and Managing Director.

Involved Technology Related Activities

Ordnance Disposal

A representation bureau in Bosnia Herzegovina exists since 1999 and the humanitarian demining contracts are constant, allowing the rehabilitation of agricultural and urban zones. Numerous demining contracts have been realized worldwide, on land and at sea, the Kinmen Islands in the China sea, in Burma, in Morocco, etc.

On French soil, GEOMINES is present on the pyrotechnic cleanup market and performs each year more than twenty contracts, allowing the neutralisation of hundreds of ammunitions dating from the last two World Wars.

(Source: Geomines website)

6 LARGE COMPANIES

CAC Systemes

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Telephone: +33 (0)2 54 52 65 65
Fax: +33 (0)2 54 52 65 75
Web site: http://www.cacsystemes.fr

CAC Systemes' main activities are the manufacturing of remote controlled devices, aerial targets, armament and robotics.

Involved Technology Related Activities

Multi-Sensor Vehicle Platforms

The **Single Target Location Vehicle (STLV)** is an unmanned, all terrain vehicle (ATV). This vehicle, light and manoeuvrable, is capable to enter minefields in order to locate and classify each single explosive device: Anti-personnel mines (APM), Anti-tank mines (ATM) and UXO´s in general. An advanced on board software system will provide Automatic Target Recognition (ATR) using Data Fusion and is able to adapt to different environmental circumstances. The technology on board ranges from improved Metal Detectors and Ground Penetrating Radars (GPR) to extremely advanced X-ray spectrometers.

Neutralisation Technologies

The **Neutralisation / Destruction Vehicle (NDV)** is an unmanned, all terrain vehicle (ATV). This vehicle is capable to automate in a safe way many of the risk activities related to the neutralisation and/or destruction of the explosive devices. The vehicle is equipped with tele-operated robotic arms and is capable to clean-up the surface around explosives, to place neutralisation charges, to pick-up devices and to reduce the common risks to which deminers are exposed.

Related Project

ANGEL (AdvaNced Global system to Eliminate antipersonnel Landmines - EUREKA).
ANGEL aims to design a demining system to detect and neutralise or destroy the mines and UXOs in a minefield. This is arranged in a four-level task distribution to define the suspicious area, identify probable target fields, detect each single mine and, finally, destroy or neutralise each mine.

Capgemini

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Capgemini is the first European group in computer systems development and integration. With 12 000 collaborators located in five business units, Capgemini proposes consulting, study and realisation services in all economic activity sectors: industrial, services, public services, transportation, telecommunications as well as defence. Towards the Ministry of Defence, its main customers are: CELAR, SPART, SPOTI, STTC, ETAS, ETBS, DCN, CEV, CEL, CEM, DCAe, GESMA, etc.

Involved Technology Related Activities

Data Fusion
Capgemini claims to master all advanced computer technologies, among other in the domain of signal processing (imaging, acoustic, telecommunications…), **data fusion**, and supervision by operators.

Radiometers
Study related to passive millimetre wave technology applied to land mine detection (PEA SYDERA).

Related Projects

· **PEA SYDERA Land Mine Detection** (2003)
Study related to **passive millimetre wave technology applied to land mine detection**.
· **PEA Virtual Mining** (2005)
Study and definition of zone concept for virtual land mine application.

CNIM

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Web site: www.cnim.fr

CNIM brings turnkey industrial solutions with a high technological content in the defence systems domain. The company provides equipment and advanced technologies for the Defence sector, the space industry, and scientific research.

Related Projects

· **PEA SYDERA Land Mine Detection** (2003)
CNIM has been lead contractor of the **SYDERA** project, financed by the DGA, whose goal was to **test numerous landmine detection technologies**. Although this information is public, no additional elements about the results are at present directly or indirectly accessible.

CS DEFENSE

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CS-DEFENSE is part of the "Compagnie des Signaux", specialized in the integration and manufacturing of civilian and military systems, and located in more than 50 countries. Its major industrial branches are CS-DEFENSE, CS-TELECOM and CS-ROUTE.

The CS-DEFENSE branch is active in the naval and land sector, as well as for the aviation. References include DGA, DGAC, EUROCONTROL, NATO...

Involved Technology Related Activities

Multi-Sensor Systems

Dassault Electronique

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Web site: http://www.dassault-elec.fr

Formed by several companies which associate innovation with advanced technologies and modern production facilities, the Dassault Electronique Group has mastered numerous products derived from the defence industry (on-board electronics, real time, teletransmissions, mobile robots...). Dassault Electronique is involved in large national and international electronic and computer engineering projects regarding the civilian, military and space domains. Among others, Dassault Electronique has developed electromagnetic systems regarding missiles and sensors guidance, land and aerial radars, digital systems and electronic warfare.

Related Projects

GEODE (Ground Explosive Ordnance DEtection systems) – 1998
The objective of the GEODE project was to demonstrate advanced **architecture and fusion software** for **multi-sensor** detection, localisation and classification of Anti-Personnel Landmines (APL); by combining complementary sensors and using innovative processing techniques, GEODE wanted to demonstrate a higher detection probability than achieved by existing systems, a lower false alarm rate and a capability to classify the various detected objects.

MS&I - EADS MATRA Systemes & Information SA EADS Systems & Defence Electronics

Address: 6 voie l`Occitane - BP 171
Postal code: 31676
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Country: France
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Fax: +33 (0)5 61 00 35 35
Web site: http://www.eads.com

Defence Electronics (DE), the "Sensors and Avionics House" of EADS, unites sensor technologies for all platforms deployed within armed forces and security forces worldwide.
DE provides components and subsystems based on the latest radar and electronic warfare technologies as well as avionics subsystems and electronics for air defence systems. The portfolio comprises avionics equipment such as military mission systems, digital map generators, data link systems, as well as radars and electronic self-protection and jamming systems.
Multi-sensor integration counts among this Business Unit's core competences. Applications in the fields of **multi-sensor fusion**, sensor networks, and tactical and broad-band data links all represent core elements of network enhanced capabilities.
(Information source: EADS website)

Involved Technology Related Activities

Data Fusion

MBDA (Matra BAe Dynamics)

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Country: France
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Telephone: +33 (0)1 34 88 30 00
Fax: +33 (0)1 34 88 22 88
Web site: http://www.mbda.net

Matra BAe Dynamics (MBDA) is n°1 in Europe and represents nearly 50% of the French missile industry and the greatest part of the British missile industry. According to the terms of the 20th October, 1999, agreement, Aerospatiale Matra, Bae Systems and Finmeccanica had determined to unify their missile and missile systems activities within Matra BAe Dynamics. Firmly established in France, Great Britain and Italy, the new organisation has a presence in 70 countries.

Involved Technology Related Activities

Multi-Sensor Systems

SAGEM

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Postal code: 75512
City: Paris Cedex 15
Country: France
Contact person: Jean Charles Pignot (Chargé de mission)
Telephone: +33 (0)1 40 70 63 54
Fax: +33 (0)1 40 70 66 00
Web site: http://www.sagem.com

Group SAGEM is an internationally based high-technology group. The second largest French group in the field of telecommunications and the third largest European company in electronics for defence and security, SAGEM is maintaining a presence in more than twenty countries.
The Defence Activity covers three fields: Defence (guidance, navigation, guided weapons, military avionics, aeronautic systems), Avionics and Optronics (avionics and flight control systems, optronic systems, observation UAV's, optics and engineering, and surveillance), and Security (biometric identification and systems, secure terminals, smart cards and certification).
SAGEM is working for the DGA in different sectors, including in the R&D of emerging sensor technologies for landmine detection, but the corresponding information is confidential and there is no open communication about this subject.

SODERN

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Fax: +33 (0)1 45 95 71 77
Web site: http://www.sodern.fr

SODERN is a firm specialised in space, optical & neutron activities (in particular neutron technology targeting applications in landmine detection and chemical weapon analysis). The main shareholder (90%) is the European company EADS (European Aeronautic Defence and Space company). The remaining 10% are held by AREVA. The company employs approximately 380 people, 270 of them having engineering and technical degrees.

Involved Technology Related Activities

Thermal Neutron Analysis , Fast (Pulsed) Neutron Systems
Simplifying, the principle of landmine detection based on nuclear techniques is to illuminate the soil, possibly containing a mine, with neutrons, and to analyse the gamma ray energies of the photons emitted by the atoms of the soil and the mine.

The interest of nuclear techniques is related to their unique capability of detecting in-depth and recognising the sensitive elements of the explosives in the mines.
Thermal Neutron Analysis (TNA) allows the detection of the nitrogen of explosives. **Fast** (FNA) and Thermal **Neutron Analysis**, which can be performed by using the GENIE 16 Neutron Generator, allow to detect the relative proportion of nitrogen, hydrogen, carbon, oxygen and all other current elements.
On the other hand, by using the new GENIE TPA (**Associated Particle Technique**) neutron generator, it should be possible to reduce the detection time, thanks to a better signal to noise ratio.
Taking into account the measuring speed of this technique, neutron analysis is a perfect sensor for **confirming** a first detection previously done by another conventional tool.
A field demonstration of such a sensor is now under development at SODERN.
(Information Source: http://www.sodern.fr/eneutron.html)

Thales Airborne Systems

Address: Centre Charles Nungesser - 2, Avenue Gay-Lussac
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Country: France
Contact point: info@fr.thalesgroup.com
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Fax: +33 (0)1 30 66 79 66
Web site: http://www-v3.thalesgroup.com/airbornesystems/home/

Formerly *Thomson-CSF Detexis*, member of the Thales Group which specialises in supplying high-tech systems and equipment in the areas of electronic warfare, airborne radar and missile electronics.

Involved Technology Related Activities

- Radiometers

Details:
Thales Airborne Systems' activity is focused on the generation and processing of microwave and analog signals up to 100 GHz.
Thales Airborne Systems engineers are responsible for the design of the architecture of the analog part of products, for the management of R&D programs and for operational maintenance; they also control space microwave technologies and are developing new signal processing architectures.
Fields of expertise: Thales Airborne Systems uses an analog and microwave know-how for products such as high frequency sources, broad band signal receivers, active networks (particularly phased arrays), antennas and power modules.
Millimetric circuits, optical technologies, hyper-frequency technologies on printed circuits and wide band analog and digital hyper-frequency processing represent the Company`s four main development axes using dual (civil and military) applications. Objectives to widen the range and the passband and to increase the number of functions are adopted in parallel to costs and volumes reduction objectives.

- Thermal Infrared

Details:
Research and Development of Infrared Search and Track (IRST) and Infrared/Thermal Imaging (TI) Cameras and Systems.

- X-ray Backscatter Techniques

- Test Facilities

- Airship/UAV Multisensor Survey Systems

Web Link:
http://www-v3.thalesgroup.com/airbornesystems/activities/systems/airborne_radars/1_187_207_74.html

Details:
Thales is developing observation systems for a range of platforms, from satellites to Unmanned Aerial Vehicles that combine Synthetic Aperture Radar (SAR) and Moving Target Indication (MTI) Technologies.

Related Projects

- **SYDERA (Vehicle-Mounted Close-in Mine Detection System) - 1998**

(Information source: EUDEM2 database, Nov. 2004)

Thales Communications

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Postal code: 92704
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Fax: +33 (0)1 41 30 33 57
Web site: http://www.thales-communications.com

Thales Communications France (TCF) is a major player in the field of tactical, airborne and naval communications. Its activities also cover the Intelligence/Surveillance/ Reconnaissance segment for Joint services. In 2002, its sales amounted to 1015 M€.
Thales Communications France is a major supplier of information and communications systems to the French Land Forces. In addition, 30 % of its sales are to customers outside France.
The Company headquarters are located in Colombes (near Paris) and it has three manufacturing plants at Laval, Cholet and Brive. The Company employs a total of 5,400 employees.
TCF is present in all the growing segments of this market, and is organized in four strategic business lines: Information Dominance Systems, Networks, Battlespace Radio, and Customer Service & Support.

Thales Underwater Systems (formerly Thomson Marconi Sonar)

Address: 525 Route des Dolines
Postal code: 06903
City: Sophia Antipolis
Country: France
Contact person: Yvon Caro
Telephone: +33 (0)4 92 96 30 00
Fax: +33 (0)4 92 96 39 50
Web site: http://www.thales-naval.com

Ex-Thomson Marconi Sonar until 2001, Thales Underwater Systems is a world leader in solutions for the underwater battlespace. Drawing on its 50 years' experience in the development of **sonar** and related systems, Thales offers underwater sensors and systems for aircraft, surface combatants, mine countermeasure vessels, nuclear and conventional submarines, UUVs, torpedoes and diver defence.

Involved Technology Related Activities

Acoustic Sensor

Related Projects

BULRUSH (Humanitarian Demining in Water)
Contact person: Yvon Caro
(Information source: EUDEM2 database, Nov. 2004)

Thomson-CSF (now part of the Thales Group)

Address: 23-27 rue Pierre Valette
Postal code: 92245
City: Malakoff Cedex
Country: France
Contact person: —
Telephone: +33 (0)1 53 77 86 71
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Web site: http://www.thalesgroup.com

Involved Technology Related Activities

The French Defence company Thomson-CSF (now part of the Thales group) had a large experience in different detection techniques and platforms. Thomson-CSF first participated in the **CIMIC project** (**multiple sensors devices** for landmine detection in civilian demining operations) in 1996, with different European companies, in particular with the German Dornier and Daimler-Benz Aerospace and the Dutch Signal USFA.

The CIMIC project has studied a system installed on a vehicle combining several techniques such as radars, metal detectors, thermal infrared and visible images. The objective was to analyse the feasibility of a system based on the combination of several sensors, and achieve better performances than the ones obtained by each sensor individually. It was also to develop mine signatures data bases.

Thomson-CSF directed the follow-up project, carried out within the framework of the European ESPRIT programme, in 1998. The **DREAM project** (Data fusion as a Remedy Against Mines) aimed at finalizing a **multi-sensor data fusion system** by using the results of the CIMIC project. The information supplied by the sensors was transmitted to the operator to help him take a decision.

Thomson-CSF also coordinated the **MACADAM project**, which aimed at establishing a **multi-sensor mine signatures data base**. Sensor tests and data acquisition were carried out at the EC's JRC in Ispra during August 1998, by using metal detectors, ground penetrating radars, passive radiometers and thermal infrared detection.

Related Projects

- **MACADAM (Multisensor Acquisition Campain for Analysis and Data fusion of Antipersonnel Mines in support of ESPRIT projects) – 1998**
- **DREAM (Data fusion as a Remedy Against Mines) – 1998**
- **INFIELD (High performance Computing and Networking, Humanitarian Demining) - 1999**
- **Multisensor fusion designed for demining – 1999**

Thomson Detexis (now part of the Thales Group)

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Country: France
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Fax: +33 (0)1 34 81 31 04
Web site: http://www.thalesgroup.com

Related Projects

LOTUS (Light Ordnance detection by Teleoperated Unmanned System) – 1999

7 SME's

Bourgogne Hydro Technologie

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Country: France
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Fax: +33 (0)3 85 41 69 28
Web site: http://www.bourgogne-hydro-technologie.com

Bourgogne Hydro Technologie is a company that operates patents and licences developed in different domains related to the application of hydraulic techniques.

Involved Technology Related Activities

Neutralisation Technologies , Ordnance Disposal
Complete range of materials working at 2000 to 4000 bar for the neutralization of explosive devices and mines.
Industrial applications in the neutralization of stockpiled ammunition as well as UXO.

Related Projects

· **Decoupot**: Developed in collaboration with the DGA/SPN, BREST, Pyrotechnie Saint Nicolas. Moving equipment that is piloted and monitored at a distance, and installed on a trailer, for the cutting and neutralization of devices.

CODETEL

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Involved Technology Related Activities

The CODETEL Company is commercializing detection, protection and safety material, dedicated in particular to ground access monitoring, demining, cleanup, and also to the fight against improvised explosive devices (booby traps): portable detector, detection portal, inspection mirror, metal detector, mine detector, bomb and buried ammunition detector, sub-marine detector, magnetometer, demining probe, demining suit or vest, helmet, visor, pneumatic shoes, neutralisation materials, exploder, stethoscope, radioscopy generator, portable radioscopic system, non-linear junctions detector, radio transmitter detector, cell phone detector.

Cybernetix

Address: Technopôle de Château-Gombert - 306 rue Albert Einstein - BP 94
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Contact point: group@cybernetix.fr
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Web site: http://www.cybernetix.fr

Involved Technology Related Activities

Robotics and tele-operated platforms
The core activities of Cybernétix are industrial automatisms and robotics, and the company is focused on innovation and technological research. Once the studies have been carried out and the prototypes developed, Cybernétix uses the acquired know-how to manufacture repetitive products in small series.

EPPRA

Address: bat N1 – 16 avenue du Quebec, Silic 706
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Contact person: Carmen Dumitrescu (Managing Director)
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Web site: http://www.eppra.com

EPPRA, born from the Polytechnique incubator, has for object the management of research and development contracts as well as the building of pilot devices in all scientific and technological domains linked to pulsed power.
With less than twenty people, among them young engineers trained in apprentice contracts and hired by EPPRA at the end of the training, very high-tech technology systems are being developed, patented and commercialized with the means at one's disposal.

Involved Technology Related Activities

Enhanced Metal Detector , Fast (Pulsed) Neutron Systems
A laboratory prototype system for **explosives detection** (humanitarian demining and baggage monitoring) is one of the three new generation technologies visible in situ.

Related Projects

- **MINESEYE**: Antipersonnel mines detection and identification – (Development and Optimization of a dual sensor system with real time digital signal processing for the detection and identification of buried landmines and Unexploded Ordnance) – 2001

(Information sources: EUDEM2 database, Nov. 2004, and EPPRA website)

IXTREM

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Web site: http://www.ixtrem.fr

IXTREM is a private study and research company whose main activities are: scientific project management, research work in the test and measurement field as well as in the magnetism one (magnetization and demagnetization systems, magnetic marking, metal detection, magnetic environments study), and environment characterization (magnetic, electric and acoustic properties).

Involved Technology Related Activities

Enhanced Metal Detector , Magnetic Sensors (Magnetometers)
Biosensor System

The company's activities are partly dedicated to demining research, mainly for military applications. IXTREM participates on a regular basis to research work in this field through the DGA's upstream study programmes (SALAMANDRE and SYDERA projects).
IXTREM has developed, within the framework of European projects (Imosens, Aframilk, Microqual, Bodylife, Rapinspec), new means of **optical**, **acoustic** and **electromagnetic measurements** that can be applied to the landmine problem, **explosive detection and identification techniques**, even **neutralisation** by laser beam, as well as microwave or magnetic and acoustic environment simulation allowing the activation of intelligent anti-tank mines.

The strength of this company is to be surrounded by a network of European scientific partners, created over several years to find answers to complex measurement themes. The latter are calling for extensive competences in material science, the physics of optical, acoustic, magnetic and electromagnetic phenomena, as well as biology and in particular nanobiology (biosensors). Moreover, the company has developed an intelligent signal acquisition and processing console that allows it to realize research work on different types of sensors, in the form of multifunction multi-sensor networks.

Related Projects

- **Bacterial Magnetic Marking System:**
  IXTREM has finalized, on behalf of the DGA, a magnetic marking system for bacteria, whatever their origin, and a system of remote manipulation for magnetic fields. This biological system would allow the realization of very sensitive and silent magnetic sensors whose presence cannot be detected.
- **Biomagnetism:**
  Biomagnetism opens interesting perspectives for the detection of explosives in the state of trace. Feasibility studies have been carried out in the European framework within the Microqual and Aframilk projects, in order to identify the presence of undesirable bacteria in food products, or also fraudulent or dangerous products in the state of traces in the food.
- **Mine Detection and Characterization System (Optimization Studies):**
  The company has participated as a subcontractor of a large industrial armament group in order to realize optimization studies for a mine detection and characterization system (AP and AT mines).
- **EM and Magnetic Signature Acquisition and Fine Imaging of Metallic Parts:**

IXTREM has at its disposal a prototype system allowing the characterization of the mines' electromagnetic and magnetic signatures, as well as a fine imaging system allowing the reconstitution of the mines' metallic parts.

- **Biosensor:**
  In association with the IBA Institute (Germany), the company is working on the biosensor based detection of a mine's explosives, employing electric, electromagnetic, acoustic or optical interfaces.
- **Hypersensitive Magnetic Sensors:**
  Collaborations are being discussed in order to develop new hypersensitive magnetic sensors that could reach femtoTesla sensitivity levels for magnetic, electromagnetic and NQR applications.
- **Inductive Tomographic System:**
  In association with the University of Lancaster, the company has developed an electromagnetic tomographic system based on induction effects.

LEAS

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Web site: http://www.lab-leas.fr/

LEAS, an electronics studies bureau funded in 1980, is a specialist in the realization of client specific products in the domains of the industry and research.
LEAS is developing solutions in particular in the sectors of metallurgy and seismology.

Métravib RDS

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Telephone: +33 (0)4 78 66 34 00
Fax: +33 (0)4 78 66 34 34
Web site: http://www.metravib.fr

METRAVIB RDS is a small company specialized in acoustics, vibrations and materials.
Métravib designs and realizes acoustic detection systems regarding threats (infantryman, vehicles), vibration and shock detection systems (naval system), passive and active solutions to reduce noise and improve the ergonomy of defence systems (submarine, surface ship, vehicle), and solutions (microvibration reduction and pyrotechnic shock absorption) to preserve the structural integrity (missiles) and improve the earth observation capacity (satellites).

Involved Technology Related Activities

Acoustic Sensor

PEGASE instrumentation

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Country: France
Contact point: pegase@wanadoo.fr
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Fax: +33 (0)4 67 42 99 01
Web site: http://www.pegase-instrumentation.com

PEGASE instrumentation studies and realizes measurement, detection and simulation systems regarding maritime and road security. It is also involved in the conception of demining devices.

Involved Technology Related Activities

Manual Demining , Robotics and tele-operated platforms
Pegase instrumentation has developed a **demining robot** ("Mine Picker") for mine detection and characterisation. The robot is equipped with a sensor, consisting of **mechanized probes**, that **visualizes the mine geometry** as well as **the nature of its envelope**. Its main qualities are its detection reliability (including plastic mines), user safety, and low cost.
Other models are apparently available or are currently being developed.

RTD – Radar Technologies France

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Contact person: Alain Gachet
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Fax: +33 (0)4 90 43 57 79
Web site: http://www.radar-technologies.com

RTD is specialized in radar imagery interpretation. RTD is working in close collaboration with Spot Image and RADARSAT INTERNATIONAL and can merge radar data either with optical images (Spot, Landsat), magnetic or radiometric data, or even with existing geological or topographical maps.

Specificities:
• Satellite radar expertise • Mine and oil expertise • Expertise environment on radar image, aquifer research.
Technical means:
• High resolution satellite radar • High resolution optical satellite IKONOS • Geographical information system GIS.

Involved Technology Related Activities

Synthetic Aperture Radar
Main realizations (of interest to demining):
• Intensive cartographies in Central Africa.
• European expertises (EC) on war zones demining.

SEGG

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Web site: http://www.segg.com

SEGG is a private study and research company operating in the field of geophysical and geotechnical instrumentation and measurement technologies. SEGG has developed a high level of competence in **applied geophysics**, particularly in seismic, electric, electromagnetic and gravity techniques. SEGG intervenes all around the world in large civil engineering works and in research programmes with major French companies. Examples of activities include the following:

- **SNCF** (French Railways Board) – Detection of underground cavities; experiments and studies for the seismic monitoring of embankments.
- **EDF** (French Electricity Board) – Experiment and studies for the electrical and electromagnetic monitoring of embankments and dikes.

Involved Technology Related Activities

Enhanced Metal Detector , Magnetic Sensors (Magnetometers)
SEGG has also carried out **geophysical surveys for the detection of UXO** using magnetic and electromagnetic techniques.

X-Technologies (Centre Technologique de l'Ecole Polytechnique)

Address: Ecole Polytechnique
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City: Palaiseau Cedex
Country: France
Contact person: Monsieur de Lapparent
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Fax: +33 (0)1 69 33 30 44
Web site: http://www.xtec.polytechnique.fr/

X-Technologies is the technology centre of the Ecole Polytechnique, Paris. It works as follows on the principle of Research-Industry "mixed teams":

- Start of the project by 2 to 3 "researchers", doctoral candidates or post-docs, and 2 to 3 "industrialists", within the framework of an R&D partnership protocol or a legal entity, Ltd style, in a "business incubator" like environment, allowing a strong support;
- Realization of a technological demonstrator and, in parallel, redaction of a pre-business-plan;
- Presentation of the results (technological demonstrator and pre-business-plan) to industrial and financial partners able to promote the industrial and commercial launching phase;
- Start of the production in a normal activity zone.

Related Projects

- **MINESEYE**: Antipersonnel mines detection and identification – (Development and Optimization of a dual sensor system with real time digital signal processing for the detection and identification of buried landmines and Unexploded Ordnance) – 2001

8 NGO

HAMAP Demineurs

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Contact person: Anne Bouriez
Telephone: +33 (0)4 73 79 09 66
Fax: —
Web site: http://www.hamap.com

HAMAP-Démineurs has a permanent "action team" composed of members who have an extensive experience in demining throughout the world, in central Europe (Yugoslavia, Bosnia), in Africa (Mozambique, Angola) and in Southeast Asia (Cambodia), and are ready to put their knowledge at the disposal of States where their action can play an important role in the implementation of safety operations.
They are mainly ex-civilian and military French demining experts.
In time, the association hopes to train its own demining experts in a civilian demining training centre.

Handicap International

Address: 14 avenue Berthelot
Postal code: 69361
City: Lyon Cedex 07
Country: France
Contact person: Bill Howell (Director – Mines Coordination Unit)
Telephone: +33 (0)3 78 69 79 79
Fax: +33 (0)3 78 69 79 94
Web site: http://www.handicap-international.org/

HI works with more than 400 organisations in 30 countries which seek to achieve a total and comprehensive ban on the use, trade and fabrication of anti-personnel landmines.

HI undertakes political lobbying and international campaigns for the general public at both the national and international levels. These activities have contributed to significant political progress towards unilateral moratoriums or bans in a number of countries. HI was a leading participant in the campaign which let Belgium's unilateral decision to ban all types of landmines activity, while lobbying in Paris led to a call from the French government which resulted in the recent Review Conference on Conventional Weapons. Among landmines affected regions, HI has participated in national campaigns in Cambodia, Mozambique and Afghanistan. HI is developing different actions such as:

- Mine Impact Surveys and Studies (To assure a better understanding of the effects of landmines at the community level, and better to inform continuing and future interventions such as in Laos, Angola).
- Mine Risk Education Programmes (To involve local population in self-protection from landmines by promoting a continuing appreciation of the dangers of

landmines in their environments such as in Afghanistan, Angola, Mozambique and former Yugoslavia).
- Mine Clearance Operations (Building skills capacities, organisational structures and strengthening local institutions is a development task that can result in a solid local capacity for confronting the challenge of mines over time – Cambodia, Angola, Mozambique, Bosnia).

Involved Technology Related Activities

⇨ Manual Demining
⇨ Mechanically Assisted Demining
⇨ Mine Dogs

Related Projects

TELSAT4: Change detection in Satellite Image Sequences for minefield delineation.

Related Publications

- The Use of Mechanical Means for HD Operations
- The use of dogs for operations related to humanitarian mine clearance
- Living with UXO, Final Report

(Information sources: EUDEM2 data base and HI website)

UNICEF

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Web site: http://www.unicef.fr

UNICEF is supporting mine action, in particular, mine awareness and victim assistance; between 8,000 and 10,000 children are killed or maimed by landmines every year.

Child-friendly spaces were first established in **Albania** in 1999 to provide integrated care for children in Albanian refugee camps and to bring landmine awareness.
In **Colombia,** UNICEF, together with government and NGO partners, supports mine awareness education, including data collection and national advocacy directed at youth and community leaders.
In the **Lao People's Democratic Republic**, UNICEF supports a 'sport-in-a-box' project for children in mined areas not attending school. Messages about the dangers of landmines are promoted through games in safe play areas. Emphasis is placed on including vulnerable groups of children, notably young people not attending school, ethnic minorities and disabled children.

9 PROJECT SHEETS

Title: Project SALAMANDRE (Vehicle-based Multi-sensor Detection System Demonstrator)
Acronym: SALAMANDRE
Type: F-National Funded Project
Start Date: ———
End Date: ———
Budget:
Prescriber Department: DGA/SPART St Cloud
Contact Person Name: Gambey
Contact Person First Name: Jean-Paul
Details:

The three-year "**SALAMANDRE**" project, assigned to the **Thomson-CSF** Detexis company (now part of the Thales Group), had as objective to realize a multi-sensor detection system demonstrator installed on a vehicle, by combining the best detection technologies available on the market (electromagnetic induction, ground penetrating radar, radiometry, optronics). It has included outstanding information fusion algorithms. This project was complemented by long term studies aimed at selecting and improving other promising technologies: detection by neutron flow, by acoustic or seismic waves, by magnetic quadrupole resonance, olfactory technologies, etc.

Involved Technology Related Activities:

Enhanced Metal Detector
Ground Penetrating Radar
Radiometers
Thermal Infrared
Multi-Sensor Vehicle Platforms

Involved Organizations:

Organization Name Thales (formely Thomson-CSF Detexis)
Prime Contractor: (yes/no) yes
Contact Person Name: Courtonne
Contact Person First Name: Jean-Luc
Contact Person Function: Project Engineer
Contact Person E-mail: ———
Contact Person Telephone: ———
Contact Person Fax: ———
Web Link: www.thalesgroup.com

Title: Evaluation programme of potentially usable technologies for land mine detection
Acronym: SYDERA
Type: F-National Funded Project
Start Date: 2001
End Date: 2003
Budget: ———
Prescriber Department: SPART St Cloud
Contact Person Name: Gambey
Contact Person First Name: Jean-Paul
Details:

Preparation of the future development of a close-up mine clearance system, aimed at *path opening* and *area demining.* The following technical domains were targeted:

- *Magnetometric detection,*
- *Bi-modal electromagnetic detection,*
- *Off-road radiometric detection,*
- *Infrared polarimetry,*
- *Heat contribution to improve detection, mainly by infrared techniques,*
- *Nuclear magnetic resonance,*
- *Surface seismic waves detection,*
- *Electronic detection of mine ignition devices.*

For each of these themes, the *following tasks* had to be realized:

- *State of the art placing the considered technique in relation to the existing ones,*
- *Theoretical study including signature acquisition,*
- *Feasibility trials,*
- *Contemplated technologies in order to get a demonstrator and evaluate it,*
- *Demonstrator realisation or adaptation of equipment,*
- *Demonstration Trials / performance measurements.*

Involved Technology Related Activities:

Enhanced Metal Detector	Ground Penetrating Radar
Radiometers	Magnetic Sensors (Magnetometers)
Thermal Infrared	Acoustic Sensor
Data Fusion	Nuclear Quadrupole Resonance
Multi-Sensor Vehicle Platforms	Test & Evaluation

Involved Organizations:

Organization Name CNIM
Prime Contractor: (yes/no) yes
Contact Person Name: Hoehn
Contact Person First Name: Gérard
Contact Person Function: Project Engineer
Contact Person E-mail: ———
Contact Person Telephone: ———
Contact Person Fax: ———
Web Link: www.cnim.fr

10 ANNEXES

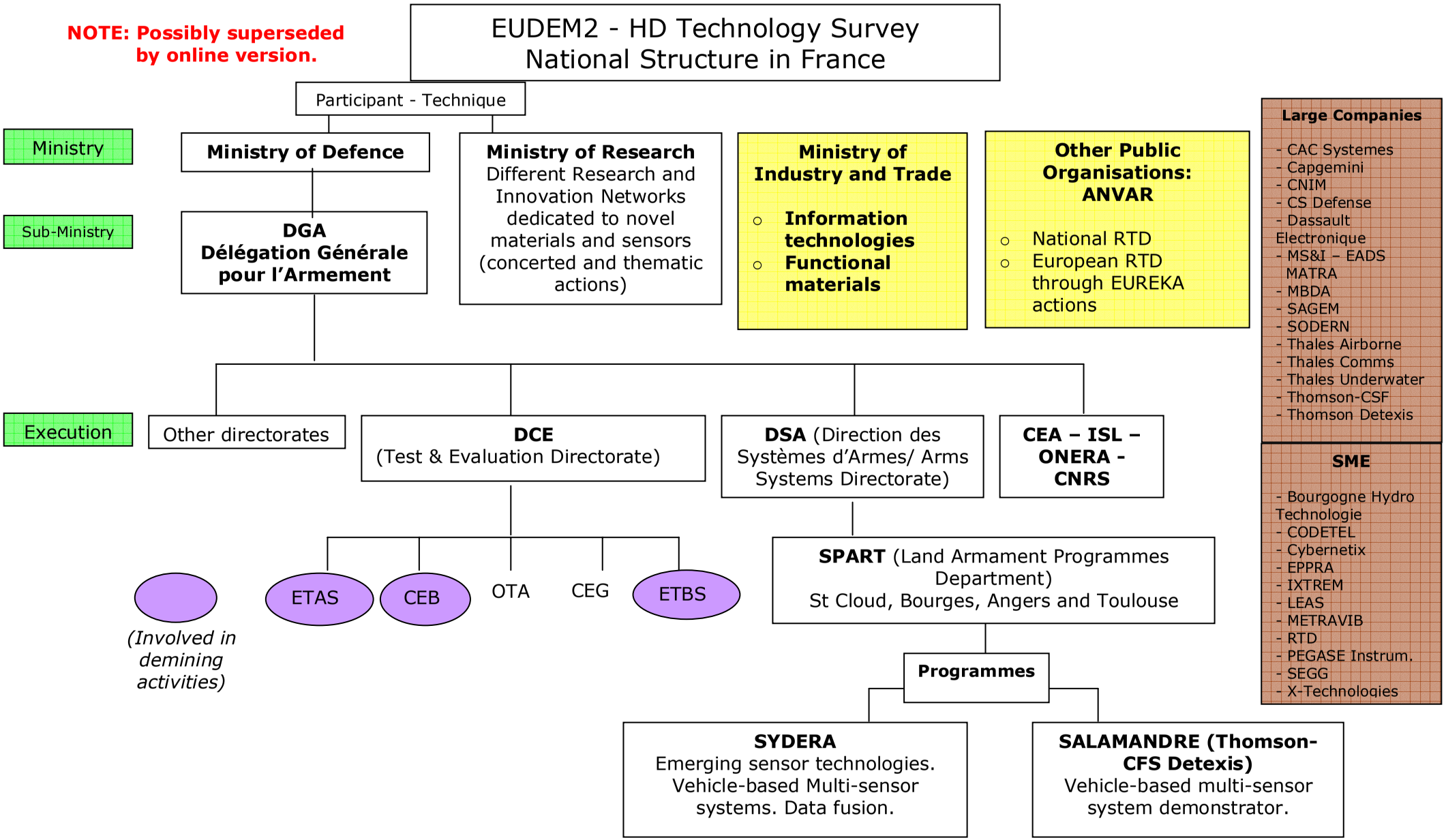
Overview of all listed organisations:

Public Organisations, Academia, Research Centres	Associations, Consultancy	Demining Commercial	Large Company	SME	NGO
ANVAR	ARTID	ARPE	CAC Systemes	Bourgogne Hydro Tech.	HAMAP
DGA	Comité Richelieu	Geomines	Capgemini	CODETEL	Handicap Intnl
Ministry of Industry			CNIM	Cybernetix	UNICEF
Ministry of Research			CS Defense	EPPRA	
			Dassault Electronique	IXTREM	
ENST			MS&I–EADS MATRA	LEAS	
MINEX			MBDA	METRAVIB	
IFSPE			SAGEM	PEGASE Instrument.	
ISEN			SODERN	RTD	
IUT de Mulhouse			Thales Airborne Systems	SEGG	
			Thales Comms	X-Tech.	
CEA/LIST			Thales Underwater Systems		
CEA-DAM Le Ripault			Thomson-CSF		
CEA/DSM/ CAPMAG			Thomson Detexis		
CNRS SUPELEC					
CNRS Paris Michel-Ange					
CNRS Marseille					
CNRS Nice					
CREPHI					
ISL					
Laboratoire de Robotique de Versailles					
ONERA					

11 ANNEX 1

ORGANIGRAM

NOTE: Possibly superseded by online version.



12 ANNEX 2

LIST OF WEB SITES

ANVAR
www.anvar.fr

ARPE
www.arpe.fr

ARTID (Association de Recherche de Techniques Innovantes en Déminage Humanitaire)
www.artid.org

Bourgogne Hydro Technologie
www.bourgogne-hydro-technologie.com

CAC Systemes
www.perso.wanadoo.fr/cacsystems

CAP Gemini
www.fr.capgemini.com

CEA – Commissariat à l'Energie Atomique
www.cea.fr

CEA/LIST
www-drt.cea.fr

CEA-DAM Le Ripault
www.dam.cea.fr

CEA/DSM/CAPMAG
www-dsm.cea.fr

CEDRAT
www.cedrat.com

CNIM
www.cnim.fr

CNRS – Laboratoire de Neurobiologie Marseille (UPR 9024)
www.lnb.cnrs-mrs.fr

CNRS - University of Nice - Sophia Antipolis - Electronics, Antennas & Telecommunications Laboratory (LEAT)
www.elec.unice.fr

CNRS Délégation Paris Michel-Ange
www.cnrs.fr/CMA

CNRS SUPELEC Ecole Supérieure d'électricité
www.lss.supelec.fr/

Codetel
www.codetel.fr

COFRAS (Compagnie Française d'Assistance Spécialisée)
www.groupedci.com

Comité Richelieu

www.comite-richelieu.com

CREPHI
www.crephi.org

CS DEFENSE
www.c-s.fr

Cybernetix
www.cybernetix.fr

Dassault Electronique
www.dassault-elec.fr

DGA (Délégation Générale pour l'Armement)
www.defense.gouv.fr/dga

Ecole supérieure et d'application du génie (Centre MINes EXplosifs)
www.genie-militaire.com

EPPRA
www.eppra.com

GEOMINES
www.geomines.com

GIAT industries
www.giat-industries.fr

HAMAP Démineurs
www.hamap.com

Handicap International
www.handicap-international.org/

IFSPE
www.ifspe-formation.com

Institut d'Electronique, de Microélectronique et de Nanotechnologie
www.iemn.univ-lille1.fr

ISL – Institut Franco-Allemand de Saint-Louis
www.isl.tm.fr

IUT de Mulhouse GMP
www.iutmulhouse.uha.fr/gmp/actu.php3
http://gmp.mulhouse.free.fr/

IXTREM
www.ixtrem.fr

Jane's Mines and Mine Clearance
www.janes.com

Laboratoire de Photophysique Moléculaire (LPPM)
www.ppm.u-psud.fr

Laboratoire de Physique des Milieux Ionisés et ses Applications (LPMIA)
www.lpmi.uhp-nancy.fr

Laboratoire de Robotique de Versailles
www.robot.uvsq.fr

Laboratoire des Interactions Moléculaires et Réactivité Chimique et Photochimique
www.imrcp.ups-tise.fr

LEAS
www.lab-leas.fr

MBDA (Matra BAe Dynamics)
www.mbda.net

Métravib RDS
www.metravib.fr

Ministère de la Recherche
www.technologie.gouv.fr

Ministry of Industry
www.industrie.gouv.fr

Ministry of Research
www.recherche.gouv.fr

MS&I – EADS MATRA Systemes & Information SA
www.eads.com

ONERA
www.onera.fr
www.cert.fr

PEGASE instrumentation
www.pegase-instrumentation.com

Polytech Marseille - Département de Mécanique Energétique - Equipe Instrumentation des Procédés et Systèmes en Ecoulement
www.polytechmarseille.com/rech_labo/pole_me.html

RMNT (Research network in Micro and Nano Technologies)
www.technologie.gouv.fr

RTD – Radar Technologies France
www.radar-technologies.com

SAGEM
www.sagem.com

SCOPEX
www.scopex.net

Secrétariat d'Etat chargé de l'Economie, des Finances et de l'Industrie
www.industrie.gouv.fr

SODERN

www.sodern.fr

Thales Airborne Systems
www-v3.thalesgroup.com/airbornesystems/home

Thales Communications
www.thales-communications.com

Thales Underwater Systems
www.thales-naval.com

Thomson-CSF
www.thalesgroup.com

Thomson Detexis
www.thalesgroup.com

Thomson Marconi Sonar SAS
www.thalesgroup.com

UNICEF
www.unicef.fr

X-Technologies (Centre Technologique de l'Ecole Polytechnique)
www.xtec.polytechnique.fr/