ANNUAL REPORT - YEAR 1

It is intended that this Annual Report be made available for publishing by the EC if they so wish. Consequently, it has been designed as a stand-alone document that provides details of the project, its achievements to date and reports from the individual project partners.

1. PROJECT OVERVIEW

The Proactive Use of Knowledge

The challenge that RIMSAT addresses is to develop a system whereby the best knowledge, know-how, experiences and information relevant to a particular event, potential situation or incident can be extracted, dynamically manipulated (elicited) and made rapidly available to provide best-practice decision support at the location and moment that it is needed.

The business idea behind the RIMSAT project is simply to enable the best knowledge, information and know-how available, to be easily and rapidly accessible to those involved in making safety-critical or mission-critical decisions.

Having implemented a knowledge management system, what does the organisation then do with its newly harnessed knowledge? How does it use the knowledge it has acquired to benefit the company? How and to whom does it make the knowledge accessible? IT obviously plays a part in supporting knowledge management, but in what way?

There is a powerful symbiotic relationship between knowledge management and IT. As information technology has become our personal desktop tool and our link to each other, so we grow to covet even more access to information and people's knowledge. The application of IT to KM is traditionally classical in its use - captured knowledge stored in relational databases accessed when required by the user.

We can call this a 'reactive' use of corporate knowledge - knowledge available as a source of information when the user determines it is needed.

The next major step forward will be the 'proactive' use of corporate knowledge. The manipulation of multiple sources of knowledge to provide reasoned, anticipatory support for the user.

This proactive use of knowledge is the foundation of the RIMSAT project.

Knowledge Management and Knowledge Engineering

The application of artificial intelligence to knowledge management is today at a very early stage in its commercial evolution.

From a research perspective, various knowledge-based techniques have been considered for knowledge management and reuse activities over the last three decades. For many years, the cost and performance of computing hardware was a major barrier to the practical, commercial adoption of these research results. Even today, despite the widespread availability of inexpensive, powerful personal computers, virtually all real-world diagnosis systems use simple decision trees rather than knowledge-based 'reasoned' techniques.

With the recent advent of algorithms sufficiently powerful for real-world diagnostic problems the application of knowledge-based techniques to knowledge management is poised to 'take-off' in commercial terms.

RIMSAT is at the forefront of these developments, integrating knowledge-based reasoning and knowledge management techniques to provide an innovative, anticipatory solution that makes the best use of acquired knowledge in a proactive manner.

The highly complex nature of organisations operating in a safety-critical or mission critical environment means that any one incident may result in many thousands of 'problems' being faced in a relatively short space of time. By 'problems' we mean issues or questions that need an action or response - either immediately on within a short space of time.

The human brain is capable of reacting to such highly complex situations and PSS personnel are trained to make 'snap' reasoned decisions when faced with life, economic or environmentally-threatening situations.

However, as such incidents become more complex across Europe (due to factors such as consumer demand and the opening up of trade frontiers thanks to the single market) the ability of the human brain to make the right decision from the complexity of the data available to it becomes more and more onerous.

The situations faced by the emergency services in handling ever increasingly complex incidents presents significant challenges to their skills, know-how and experience. Too many emergency response teams arriving at the scene of an incident lack both the experience and information resources necessary to make a correct incident control decision, potentially resulting in loss of life or serious injury to PSS personnel and the wider community, as well as increasing the risk of environmental and/or economic disaster.

A computerised reasoning system, available anytime and anywhere, utilising the best knowledge, know-how and experience available, will provide the additional support such incident response teams need in critical situations.

By integrating leading edge and innovative knowledge engineering techniques to support knowledge management, RIMSAT will develop an innovative, 'learning' knowledge-based decision support system, eliciting both tacit and explicit knowledge, information and data from a variety of formal and informal sources.

The RIMSAT solution will continually 'learn' from previous experiences and can also be used as a collaborative training tool. RIMSAT will be validated through real-world trials in UK Fire and Emergency Planning services

Project Objectives

The RIMSAT project has four main objectives:

- develop an innovative, 'learning' knowledge-based decision support system aimed at organisations involved in highly complex, safety and/or mission critical activities and events, irrespective of their location. Ensuring that the system will continually 'learn' from previous experiences, enabling the advice & guidance it determines to represent the best practice available at that specific moment in time.
- elicit both tacit and explicit knowledge, information and data from a variety of formal and informal sources to provide a best practice, dynamic advice and guidance system available at any fixed or mobile location that has access to any terminal with wired or wireless communication capability;
- prove the concept of the system through real-world trials in a highly complex, safety-critical environment;
- use the system as the basis for collaborative distance learning/training through customisable event/incident simulation. Enabling existing skills to be improved and new skills to be acquired without the need to remove personnel from their centre of operations for extended periods of time

Approach

The methodological approach will be to merge the KM aspects into the INRECA methodology for building industrial knowledge-based applications.

The result..... knowledge elicitation, knowledge bases creation, exploitation, deployment, reuse.

The backbone of the planned system will be a 'knowledge server' co-ordinating a set of integrated knowledge/information resources, using knowledge-based cases and reasoning technologies.

Distributed servers will be maintained by individual user organisations as if they were their own central database servers. New incident information will be automatically cross-checked across all the other incident databases to ascertain if identical or similar information already exists, enabling multiple-cases of similar incidents to be linked together.

RIMSAT will result in a best practice, dynamic Decision Support System that can be used at both a mobile and fixed locations. It will enable collaborative simulated incident management training to be undertaken in remote locations, as well as the evaluation of performance in past emergency events that will be used as input system.

Results

The major exploitable result of the RIMSAT project will be a computerised reasoning system, available anytime and anywhere, utilising the best knowledge, know-how and experience to provide a dynamic decision support solution that can be used from both mobile and fixed locations. It can also be used as a planning tool for incident management - devising 'what if' type scenarios - and, being Web-based, can also be used as a collaborative distance-training tool.

The RIMSAT generic system can be likened to a honeycomb. Consider the various cells of the honeycomb as being the repositories for customer-specific 'cases'. The 'data' from which the 'cases' are created comes from the knowledge, know-how, information etc. that has been collected through the RIMSAT knowledge management processes. This detail - the pollen - is then transformed into 'cases' - or honey - through the RIMSAT knowledge engineering process.

Partners

The RIMSAT consortium comprises six partners: Three commercial companies specialising in knowledge management techniques, knowledge engineering, and mobile diagnostic systems, who develop their commercial solutions and services for organisations world-wide operating in a variety of industrial sectors including safety critical/mission critical environments; One specialist training and consultancy organisation with extensive experience of providing training and knowledge management expertise to organisations operating in safety critical environments; One university with a long history of research and development in the field of environmental decision support systems, data mining technologies and knowledge engineering tools; One emergency fire and civil defence organisations - plus additional UK fires services who are external to the project but have committed to working with West Midlands and the RIMSAT team. These external fire services include London - the largest fire service in Europe with a vast bank of incident data ranging spanning a huge spectrum of incidents including terrorist, chemical etc.

RIMSAT has a total budget of 4,125,613 Euros, of which 2,150,000 will be funded by the European Commission. The project will run for 30 months from 1st October 2001 through 31st March 2004.

2. PROJECT ACHIEVEMENTS DURING THE FIRST 12 MONTHS

The first year of the RIMSAT project was essentially a year when all the underlying research work was completed.

A thorough analysis was undertaken of the practices related to incident management and decision support currently employed in five UK fire services - West Midlands, London, South Wales, Staffordshire and Hampshire. This work resulted in Deliverable 2.0 - Current user practice. This deliverable will now be refined and enhanced with output from the RIMSAT user group and published as a report that can be disseminated and used by other fire services both in the UK and other European countries.

The potential range of scenarios and the environment in which RIMSAT will be used was defined This was accomplished by defining just two areas of incident command where RIMSAT would initially be trialed:

- Fires involving industrial premises
- Transportation incidents involving hazardous materials

The work was carried out initially by very experienced senior fire service personnel and validated by exposure to focus groups of users across a range of fire services.

Existing knowledge and information sources were identified. looked at the We researched the tacit knowledge of the incident commanders (principally through extensive focus groups across a wide range of fire services) and analysed the information sources used to aid decision-making. The way in which decisions were made by individuals in the incident scenarios was researched. It proved impossible to provide precise systems maps of the decision process because of the huge number of variables: local practice, individual knowledge and experience, the type of incident, the resources available etc. This conclusion has informed the discussion and work by the technical partners on appropriate technologies.

Profiles based on the competencies of the potential users were defined by identifying the common standards being applied in the UK fire services and as part of the definition of users contained in a users' 'Wish List'

The work undertaken and presented in deliverable 2.0 almost certainly represents the largest body of gathered information, interpretation and analysis of incident command in the UK fire services yet undertaken. The work has collated and reviewed a great deal of study in the area. Particularly, for example, by senior officers producing papers for the Fire Service College at Moreton in Marsh, and the major piece of work by the Chief and Assistant Chief Officers Association (CACFOA) on the management of data in incident situations. In addition the team gathered hundreds of thousands of words of interviews from practising personnel for analysis.

The application of knowledge management techniques was researched and defined with respect to the modus operandi of the UK fire services. A common language was defined, based on the operational processes of the UK Fire Services participating in the project and the work undertaken by the CACFOA Task Force in developing their data Dictionary.

Using the information gathered during the analysis of current user practice and the basic needs of the technology partners, a way of capturing, organising, validating, and standardising information and knowledge for use in the RIMSAT system was defined and detailed in the RIMSAT global knowledge model (GKM) .

In order to share experience, there must be a 'currency of exchange'. This currency of exchange for experiences in RIMSAT is called a 'unit of experience'. A unit of experience carries a lesson from one fire-fighter to another, from one incident to another, and from one organisation to another. Following an incident in which something was learned, a fire-fighter will organise the thoughts he/she wants to convey to others in a unit of experience and enter the unit of experience into the RIMSAT system. The user of the RIMSAT system, when seeking guidance at an incident, will pull a unit of experience out of the system. In order to do this the units of experience and his/her search will be organised according to the same structure. This is called the 'domain model'.

The GKM explains how to go about creating and updating the units of experience and domain model so that they fit with the needs of the fire service and the functioning of the RIMSAT tool. It also provides a number of tools for successfully carrying out these processes, including a sample draft of a domain model for HAZMAT (hazardous materials) transportation incidents and industrial fires. The GKM also suggests how CBR and MBR techniques can best enhance decision support in the emergency services and integrate with current information sources. The processes and concepts proposed will be tried and tested by the RIMSAT user group so that the GKM can be refined and validated before being incorporated into the RIMSAT Knowledge Management Handbook.

The major reasoning engine technologies that will be used in the RIMSAT system - case and model based reasoning - were researched in great depth to determine the best approach for their deployment. The research covered four main areas: A study of the theoretical foundation of Case Based Reasoning (CBR) and Model Based Reasoning (MBR) techniques. An analysis of partners' existing implementations of CBR and MBR components. An evaluation on ways to integrate CBR and MBR techniques within RIMSAT. And an software design for the RIMSAT system.

This first part of the CBR/MBR research work conclude that: the concrete MBR techniques identified were not directly applicable to model RIMSAT scenarios and provide an accurate and useful output for the users of the system. However, they could be valuable for solving specific problems of the whole domain. The local similarity functions that are currently being used in CBR systems are not optimal for the RIMSAT domain model where the variables are not so closely-related and their inter-dependencies are not well understood. Consequently, the idea of creating a model with the expressivity of a Bayesian network was considered. Such a model would enable the capture of the well known but complex network of dependencies between the attributes, and the creation of a new concept of a local similarity weighting function.

The analysis also determined that CBR and MBR could be used together at different levels of integration in the RIMSAT domain. From the outset, the role of CBR within RIMSAT was quite clear - having a case base for managing the knowledge needed when facing certain situations Conceptually, the kind of tasks that MBR could perform in the RIMSAT environment were identified as undertaking consistency checking and manipulating cases in the case base (factoring cases, correcting cases, branching cases...). MBR could also be used for temporal projection (prediction), features adaptation (refinement of a prediction), similarity assessment and for producing explanations.

Following this first area of research and the analysis of partners' existing implementations of CBR and MBR components, the next step was to evaluate potential ways to integrate CBR and MBR techniques. For the purpose of RIMSAT, four possible levels of integration between the CBR and MBR technologies were identified The first consists simply of keeping both technologies separate and letting the user organisation (system administrator) choose one or the other approach depending on the circumstances. It was decided that this toolbox approach should not be rejected because such a user may need only MBR or CBR. In the second level of integration, called the co-operative level, the technologies are kept separated but they collaborate. Each uses the results of the other to improve or speed up its own results, or both methods are used simultaneously to reinforce the results. For instance MBR can be used as an input for a case retrieved from the whole process of the CBR engine. The third level of integration, called the workbench level, goes a step further. The technologies are separated but a ‘pipeline’ communication, which is used to exchange the results of individual modules of each technology. The final level (the seamless level) aims at reusing the best components of each method to build a powerful integrated tool, which avoids the weaknesses of each separated technology and preserves their advantages.

The MBR and the CBR techniques can be integrated in the RIMSAT system in different ways :

- The system will act in proactive phase, through the strategic filter to get a view of the case query.
- In a reactive phase of the system, the MBR will be used to adapt the results retrieved from the case-base to get best recommendations to the current situation.
- To apply an MBR model on an element of the case query.

Having identified these four integration scenarios and how they could be integrated into RIMSAT, they were then applied to the RIMSAT environment with the conclusion that RIMSAT could realistically offer three types of sessions:

- Incident session - used during an incident in order to deliver decision support to the user.

- Test and training session - used offline in order to test the system on specific cases or procedures and to enable the users to get trained on specific aspects of an incident .
- Management session - used to create and modify the content of RIMSAT (document, cases, models…)

Each of these sessions was analysed to determine precise requirements and how they would be used. From this analysis, it was possible to identify precisely where CBR and MBR techniques would be best used as separate entities or in their integrated state.

The culmination of this research work was a first software design for the RIMSAT system, which was validated in a pre-build simulation.

In addition to the research foundation work, much work has been undertaken in identifying dissemination and exploitation opportunities for RIMSAT. Dissemination activities have been planned around four target sectors: Fire and Emergencies Services; Knowledge Management; Knowledge Engineering; and the European Commission.

Contact has been established with several key fire-service associations including Comité Technique International de prevention et d'extinction du Feu (CTIF), the European Fire-fighters Union (FEU) and the Chief and Assistant Chief Fire Officers' Association (CACFOA). Many fire-related Web sites have been identified and articles have been written for Fire Service journals. A paper has been accepted for presentation at the UK Fire Services College research event in November. The RIMSAT project has also been presented to fire services in Sweden and in the Republic of Ireland.

The project will participate in KM 2002 exhibition (November 2002) in London, where it will have a space in the EC Village. A Special Interest Group is in the process of being formed and will be launched on 14th November 2002 as part of the EC's KnowledgeBoard exchange and the European Knowledge Management Forum (EKMF).

3. REPORTS FROM INDIVIDUAL PARTNERS

KAIDARA

Contribution and Role

The project is led by Kaidara, specialists in knowledge management systems based on the reusing of past experiences (case-based reasoning technology). Kaidara's suite of software is used world-wide by major companies in various domains such as security, transportation and energy, for mission-critical equipment. Together with other European companies, Kaidara has developed a methodology for building industrial knowledge management applications based on CBR. The integration of this technology and methodology with the complementary approaches offered by model-based reasoning will greatly improve the scope and the competencies of both the RIMSAT system and the product range currently offered by Kaidara.

In addition to the project co-ordination, Kaidara provides the RIMSAT project with technical and practical skills for system integration in a client-server architecture with wireless connectivity, and is developing jointly with Teradyne both the generic RIMSAT engine and the applications dedicated to the project's end-users.

Experience gained

Apart from the experience gained from a project management point of view (which is always worth and reusable for any other type of large / international project, during the first year of the project, Kaidara has gained significant experience in two domains:

- From a practical point of view, the requirements derived from user's current practices analysis have demonstrated the limits of the CBR approach as developed in the KaidaraAdvisor system for

handling this kind of problems: very large domain model, reduced number of cases, difficulty to acquire the cases, unknown similarity metrics etc. Based on this analysis, Kaidara has started to review and enhance default components of KaidaraAdvisor in order to handle these limits.

- From a technical point of view, some of the issues described in the user's requirements will be handled through a multi-layer integration with a third-party framework (e.g., GradeX from Teradyne). Whilst all the functionalities of Kaidara are available through a XML server (but the ones to be improved / developed as stated in the previous paragraph), it has been found that the level of granularity of the functions is not adequate for communicating and integrating both software. Therefore it will be necessary to review the functional specifications of the Kaidara XML server and / or to create an extended API (Application Programming Interface) for RIMSAT, based onto the standard Kaidara API.

Issues arising and their resolution

From the management point of view, the main issue we had to deal with has been the fact that two of the partners did not get advanced payment for their work. This had been a high risk for the project (partners were reluctant to advance 200 000 Euros to the European Commission), that has been leveraged thanks to the efficiency of the RIMSAT project manager…

On the technical side, the main issue that has been faced right at the beginning of the project was the inadequacy of existing models for building typical MBR systems. The risk for Kaidara was to be unable to integrate our CBR system, since there was no models to be integrated with! After having spotted around (rule-based methods etc.), it was decided to clearly separate two categories of models: the ones used for representing general information (workflow, generic information about user's behaviour), that will be used in the workflow and the profiling of the information, and the ones used locally (e.g., models explaining the impact of rain on a specific substance), that will be used to correct or adapt a case, to improve similarity computation etc.

Benefits to Kaidara

As stated above, Kaidara has already benefited from end-users requirements, which will serve as benchmark to enlarge the capacity of KaidaraAdvisor. From the integration point of view, the initial work done with Teradyne enabled to effectively locate possible improvement of various components, and the way these components will interact with external environment (integration layers). Finally, at the end of the day, it is expected that the integration work will cover a broader scope than the one purely related to PSS needs.

Exploitation and dissemination achievements

Two main results have been realised during the first year:

- Most of the collateral material (leaflet, logo, poster, participation to web site, participation to the SIG formation) is now ready, and will be used during our first conference in London (KM2002)

- The project exploitation strategy has been defined in an initial exploitation document, which will be regularly refined during the project

In parallel to these project actions, Kaidara has initiated an internal work about company strategy, which includes how to use the results of R&D projects.

Future Plans related to Project Outputs

The main output of the project for Kaidara is the integrated RIMSAT system that will be built on top of KaidaraAdvisor and Teradyne's GradeX.

As described in the first version of the exploitation document, and as refined during the internal strategy meetings, the project outputs have been clearly specified. The main idea for Kaidara will be to grow in a niche market, e.g., PSS-like market, where the proposed solution is unique and is fine-tuned for this specific market. From this initial market, we will identify other specific application areas suitable for the RIMSAT results, in order to grow in this bubble. Finally, based on product definition and positioning in this initial and adjacent markets, we will derive from the initial RIMSAT product a more generic offer, e.g., for security issues in the automotive industry.

Anticipated Return on Investment from the Project

Since the R&D effort delivered in the project provides direct input to the internal R&D effort of the Kaidara engineering team, we consider that the project RoI is almost immediate.

From a market point of view, we have to assess the market opportunities and competitive analyses before entering in an "industry-like" approach, involving heavy marketing etc.

TERADYNE

Contribution and Role

The core business of Teradyne Diagnostic Solutions Ltd. is the design, manufacture, deployment and maintenance of effective knowledge based solutions for configuring and diagnosing complex, distributed electromechanical systems. As an example, within the automotive sector, Teradyne products and services are used to configure the software stored in sophisticated passenger cars during their manufacture and to diagnose in the field faults of vehicles as diverse as combine-harvesters and luxury cars.

Teradyne has extensive experience in producing complete software and hardware solutions in turnkey projects for major global clients. These solutions are reliable enough for continuous use on a production line, rugged enough for use in hostile field-service environments and flexible enough to meet the technical and presentation needs of users working with diverse target systems throughout the world.

Within RIMSAT Teradyne acts as a main software developer of the core knowledge technology.

Experience gained

During the first year of the project, Teradyne has gained a wider theoretical knowledge of both case and model based reasoning, together with practical aspects of their integration into a knowledge management framework

None

Benefits to Teradyne

To date these have been slight, mostly in extensions to the Grade-X tactic library.

Exploitation and dissemination achievements

Through business planning meetings and market research Teradyne have identified a strategic need for integration of CBR into Teradyne's core product offerings. In addition, a RIMSAT specific meeting between business unit management, the Teradyne RIMSAT team and other key technologists used the RIMSAT integration experience to identify key technical requirements for further integration.

Future Plans related to Project Outputs

Work closely with Kaidara to develop features in both companies' products to enable seamless integration. Build on RIMSAT prototypes to demonstrate integration in our core (automotive diagnostics) business area.

Anticipated Return on Investment from the Project

Not yet quantified

TMPL

Contribution and Role

TMPL provides a management and training consultancy to clients in Europe and has well-established expertise and experience in the public safety services (PSS) sector. It operates from two locations in the UK, with its core consultancy team - including partners in Sweden and Germany - working telematically using leading edge collaborative and a decision making tools (which it also provides for its clients).

TMPL's key roles in RIMSAT are: to ensure accurate identification of the knowledge needs of the PSS partners (through skilful gathering of tacit and explicit knowledge in formal and informal domains); to co-ordinate with the technical partners the likely training needs of users; to ensure that the knowledge system outputs can be effectively used by a wide range of learning tools - to pilot such training; to develop the quality and feedback loop to ensure project deliverables are met to the required standard, and to manage the dissemination plan.

Experience gained

This falls into two distinct areas: experience gained as a result of working in a large scale collaborative project, and that relating to the emergency services sector.

In the first area, the first years' work has been a steep learning curve in managing a relationship with a complex project where there is a strong interdependence between partners. TMPL's experience and expertise in developing and supporting collaborative work methods (including technologies such as QuickPlace) has been usefully tested. Since this is a collaborative project, where working practices have to be agreed by all, it differs substantially from ones where TMPL sets up the operating practices and then supports them. The actual management processes required for cross project reporting are also more formalised and time consuming than those that TMPL normally needs to employ.

With over ten years of hands-on work within the emergency services it was not anticipated that TMPL would gain a great deal from this first part of the project. This proved to be an incorrect assumption. A great deal of the research work has provided valuable new insights - firmly corroborated - into working practices.

Issues arising and their resolution

The uncertainties regarding funding the project have placed a huge pressure on a small, knowledge based business. At a time when demands from the company's client base doubled in work and turnover, where full time staff doubled, and additional management resources had to be sourced. The RIMSAT project funding issues were a compounding issue to effective business management. This impacted on the work output since priorities became an issue. This issue was resolved by TMPL ensuring that it could cash flow from its own resources the project funding. This is not appropriate but it was the only way to avoid dropping out of a project for which TMPL was the genesis.

There was an issue early on in the project about the level of knowledge of technical partners with the emergency services domain. This led to misunderstandings. Once identified it was quickly and easily addressed.

Whilst multi-cultural working can always be an issue, in this project the working environment with the other partners has been excellent so no issues have arisen.

Benefits to TMPL

The work on Workpackage 2 has developed even further TMPL's knowledge of the sector and places it in an excellent position to exploit its status as an expert in the field. The collaboration with technical partners has enabled key personnel to develop additional understandings in the knowledge management arena, whilst also being able to bring different KM perspectives to the project.

Exploitation and dissemination achievements

At this stage these are limited to increased exposure in the emergency services. TMPL expects to be able to exploit its increased KM knowledge, particularly at a strategic level, in advising major public sector organisations. It also expects to be able to exploit the decision support aspects of the project with other clients.

Future Plans related to Project Outputs

The development of the user trials will be a major work effort ensuring that these are practical, valid and reliable for the users. It will provide more exploitable experience in the user sector.

Anticipated Return on Investment from the Project

This is still difficult to quantify prior to development of the product and its potential exploitation. However, TMPL is already getting benefit from the increased knowledge held by its staff, the ability to contribute to large scale projects, and having a focussed R&D project central to the business for a relatively long period.

NEMESIA

Contribution and Role

Nemesia offers services, consulting and tools dedicated to Corporate Memory and Organisation of Corporate Knowledge Management. Nemesia activities for organisations include:

- Identifying the actual sources of knowledge, and actual needs of knowledge and information (knowledge mapping);
- Characterising knowledge (tacit, explicit, durable, ephemeral, …);
- Analysing the ways knowledge is actually created (training, tutoring, experience, …), diffused (document, mail, mouth to mouth, …), conserved (library, database, ask George!, ..) and reused;
- Preparing, gathering, formatting and exploiting memory within the context of the corporation;
- Studying, analysing and optimising the circulation of information.

Nemesia's success resides in the correlation of very diverse skills within the field of cognitive sciences: Linguistics; Corporate History; Engineering of Information; Information Technology; Ergonomics (human factors); Quality Assurance; Organisation and Project Management; Risk Management - thus transforming the untapped knowledge of the company's employees into a ready source of capital.

In the RIMSAT project, Nemesia are the knowledge management experts, using their skill and technology to help in investigating the current practices, identify sources and needs of the knowledge required in critical situation, and provide the adapted techniques to gather this knowledge and structure it in such a way it can be exploited by case/model based reasoning engines.

Experience gained

Nemesia has benefited through learning how to adapt knowledge management tools, techniques, and processes to the demands and constraints of critical incident management. Furthermore, we have gained valuable experience in the preparation (particularly modelling) of knowledge for use in decision-support systems (particularly those using CBR and MBR engines). We have taken advantage of the collaboration with Kaidara to gain in-depth knowledge of CBR concepts, configuration, and functionality.

Issues arising and their resolution

Confidentiality has been a recurring issue with regard to the capture of units of experience – the issue that the fire service currently strives to minimise any possibility of the circulation of blame or the exposure to liability by maintaining strict rules of confidentiality. We have discovered that this is a recurring issue in all areas of safety-critical action and thus intend to investigate how it has been handled in the medical profession, where surgeons appear to have achieved an advanced state of knowledge management prowess, while still protecting themselves from liability.

For RIMSAT, we believe that improvements are being made within the fire service to cope with the conflict between knowledge management and privacy – but the subject deserves further investigation by Nemesia. In the current global model, we specify:

> ***As a general rule, units of experience should never place blame on any member of the fire service. The goal of the units of experience is to advise on how to effectively manage incidents. Units of experience should not focus on who was responsible for an unsuccessful action.***

Yet, it remains to be seen what the reaction will be in the unit of experience training and extraction exercises in the coming months.

Benefits to Nemesia

Nemesia has concluded that the unit of experience concept developed in RIMSAT can be applied to many KM projects where knowledge must be easily encapsulated in a structured, electronically exploitable form. Likewise, the Incident Analysis Process is a versatile process that may be applied to many types of incident. The time and stress constraints on RIMSAT users are in fact extreme cases of constraints that are experienced by users of most KM processes across our usual clientele. Our experience with RIMSAT has already been useful in showing our savoir-faire to new clients.

Exploitation and dissemination achievements

Nemesia has created awareness within the company by a general meeting as to our newly developed skills acquired through RIMSAT. We have met with the sales force to discuss ways of selling this expertise to new clients.

Future Plans related to Project Outputs

Nemesia intends to use the KM Handbook as internal reference material for future safety-critical KM projects.

Anticipated Return on Investment from the Project

Specific areas of expertise developed during the RIMSAT project which Nemesia plans to exploit in order to ensure a return on their investment in the project include:

- Complex and/or safety-critical incident analysis
- Modelling knowledge for use with CBR technologies
- Knowledge modelling for decision support systems

UNIVERSITY OF GIRONA

Contribution and Role

Laboratori d'Enginyeria Química i Ambiental (LEQUiA), research group of the University of Girona, is involved in the project as the only academic partner. The heterogeneous profile of LEQUiA (joining chemical engineering, artificial intelligence engineering, and environmental sciences), together with its long research experience, provides a wide theoretical view of the RIMSAT overall objectives. The University of Girona's key roles in this project relate to the identification, use and test of different knowledge engineering techniques, applied to the acquisition, codification, (re)use, and learning of the specific and general knowledge contained in a huge number of different sources. LEQUiA also brings its skills to the definition of a flexible architecture that can combine the technology developed by the commercial partners to manage the overall knowledge, and in the definition of the ontology, which will help to define the common language that will be used to describe any incident/scenario.

Experience gained

During the evolution of the project, the research group has consolidated their experience in the knowledge management area, acquiring new insights in concrete technical fields such as Case Base Reasoning and Model Based Reasoning.

Reviewing numerous papers during research process, UdG has get in touch with the last research tendencies and innovations in emergencies domain.

Issues arising and their resolution

Due to the complexity of modelling emergencies situations, the viability of Model Based Reasoning techniques was questioned. The main issue was the non-existence of models wide enough to apply in our wide domain, and due to this, UdG had to redefine our research in order to find new ways of using Model Based Reasoning techniques that can cope with our domain issue. UdG finally suggested some ways of applying MBR in collaboration with CBR and reducing the scope of action of MBR (applying it just for sub-parts of the entire domain)

Benefits to the University

The main benefit to the University was the experience gained during the reported period as described in the sections above, as well as the acquisition of new industrial point of view thanks to the relationships established with our partners.

Exploitation and dissemination achievements

UdG decided the academic events (Workshops and conferences) in which RIMSAT's concepts will be related. UdG also selected IIIA as peer reviewers for deliverable 4.1.

Many ideas have risen from research done in RIMSAT; UdG will develop collateral work and write papers from them, where RIMSAT be promoted as the start point from where the ideas emerged.

Future Plans related to Project Outputs

During the research we have discovered certain aspects that have been considered as not useful or just with potential interest for RIMSAT. However, these aspects have enough interest from the academic point of view for carrying on an investigation in the future. Some of these topics are the use of agent technology for managing emergency situations, the use of Bayesian networks for modelling dependencies between attributes of the domain, the use of transition networks for modelling procedures, etc.

Anticipated Return on Investment from the Project

The investment on the project has given us three main benefits: Knowledge in a domain different than those that UdG usually deals with, experience in the research activity and management skills, and populating our social knowledge network for future collaborations.

WEST MIDLANDS FIRE SERVICE

Contribution and Role

West Midlands Fire Service (WMFS.) is an end-user in the project consortium, their role in the project will include: definition of user requirements and functional specifications, the capture and validation of knowledge/information/data inside the service, the identification of external sources of knowledge/information/data than can be used to enhance the system, and the validation the RIMSAT prototype through proof-of-concept trials.

WMFS has responsibility for two major cities - Birmingham and Coventry - as well as for the rural areas around and between these two centres, enabling the RIMSAT solution to be exercised in both an urban and a rural environment. These two UK civil defence authorities must be prepared to cope with serious incidents ranging from the accidental spillage of toxic substances to terrorist bombing attacks, from traffic accidents to the full-scale evacuation of the population. Their contribution to the RIMSAT project is critical in exercising the system in the most complex of operational environments.

Experience gained

The project has required WMFS to assess the performance of the organisation in the field of emergency response, specifically the:

- manner in which information is collected and used prior to and during incidents
- approach that is taken to capturing the learning outcomes from incidents
- impact of individual officers' interpretation upon the application of the Incident Command System.

Materials gathered during the course of WP2 has contributed to a review of incident command. The review has identified a range of issues, which are to be discussed by the Brigade's Principal Management Team during November 2002. The possible outcome of the discussion could lead to changes in systems of work, equipment and training related to incident command.

Issues arising and their resolution

none

Benefits for West Midlands Fire Service

The work of the project has already contributed to the development of safer more effective incident management. Successful trials may lead to the adoption of the tools and techniques developed by the project consortium.

Exploitation and dissemination achievements

Publication of an article about the project in Fire (November 2002). Collaboration and sharing of project work with the CACFOA mobile data group. Presentation of the project's work at the Fire Service College Research event 2002.

Future Plans related to Project Outputs

Presentation of project results at the Fire 2003, FSC Research Event 2003 and events organised by the CTIF and FEU.

Anticipated Return on Investment from the Project

Any improvement in service quality and safety levels on the incident ground will represent a return on investment for WMFS.

LONDON FIRE BRIGADE

Contribution and Role

The London Fire Brigade are the largest fire service in Europe. In terms of the RIMSAT project, they were the original instigators of the business ideas behind the project and are one of the four External Fire Services.

Along with West Midlands, South Wales, Staffordshire and Hampshire, the London Fire Brigade are contributing personnel and resources to defining user requirements and the functional specification for RIMSAT, together with the capture and validation of knowledge/information/data inside the service. They will also participate in the RIMSAT prototype proof-of-concept trials. The incident command simulation system used by the London Fire Brigade will be a valuable tool for the initial testing of the RIMSAT system.

Experience gained

The project has required the examination of working practices and procedures within London as well as within other fire brigades in the UK and across Europe. This widening of the experiential horizons of the officers involved has benefited the training and development processes with the London Fire Brigade.

Issues arising and their resolution

The compatibility of some Incident Command procedures and practices with those of neighbouring fire brigades had already been highlighted as an issue. The RIMSAT research has reinforced the need to examine and develop compatible procedures. The RIMSAT research has informed the training developed to minimise possible conflicts. Specific cross-border training has been scheduled for the next training year.

Benefits for London Fire Brigade

The information, ideas, and processes developed for the RIMSAT project are being utilised within Incident Command training design and delivery. Apart from that the overall benefits at this stage are limited.

Exploitation and dissemination achievements

Limited involvement as London Fire Brigade are not a project partner.

Future Plans related to Project Outputs

There will be a widening of involvement within the London Fire Brigade for the next stages of the project. Preparations and adaptations to existing Incident Command Simulations will be carried out to ensure that the testing of RIMSAT is possible and successful. In addition work will soon be undertaken to build cases to populate the RIMSAT database.

Anticipated Return on Investment from the Project

Improved understanding of the decision making process will continue to inform the development of procedures and training within the London Fire Brigade. This should lead to an increase in safety both for firefighters and the public. In addition there will be an increase in the capture of ‘organisational memory’ by the research into events required to develop cases for RIMSAT. The process will be invaluable as a training tool during both the design and the deliver phases. The lessons will be shared not only across the fire service, but through our existing links, will also prove useful to other emergency services.