IMI - AN INFORMATION SYSTEM FOR EFFECTIVE MULTIDISCIPLINARY INCIDENT MANAGEMENT

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Abstract: The field of crisis response and disaster management can be characterized, upon many other factors, by distributed operations, not daily routine work and multidisciplinary aspects.

In designing and developing information systems for crisis response these factors need special attention. On behalf of regional emergency services, TNO Physics and Electronics Laboratory designed and guided commissioning of the IMI project (Information System for Multidisciplinary Incident Management). Four regional fire departments in Zuid-Holland decided to develop the information system. The Rotterdam region was selected as project pilot. The IMI-project was carried out with experiences and a background of military command and control where the above three factors also play a major role. In this paper we will elaborate on the reasons behind the design of the functionalities of the IMI-system.

1 INTRODUCTION

The field of crisis response and disaster management can be characterized, upon many other factors, by :

1. *Distributed operations*, the operation is managed from several geographically separated locations. Typically, one or more coordination posts are located on the effected area of the emergency. Municipal authorities have coordination posts in the local government offices. Police, fire brigades and the medical sector have their own mostly integrated coordination post.
2. *No daily routine*, although officials in crisis response and disaster management are specially trained and equipped it is not daily routine.
3. *Multidisciplinary,* Officials from different organizations have to co-operate in a crisis situation.

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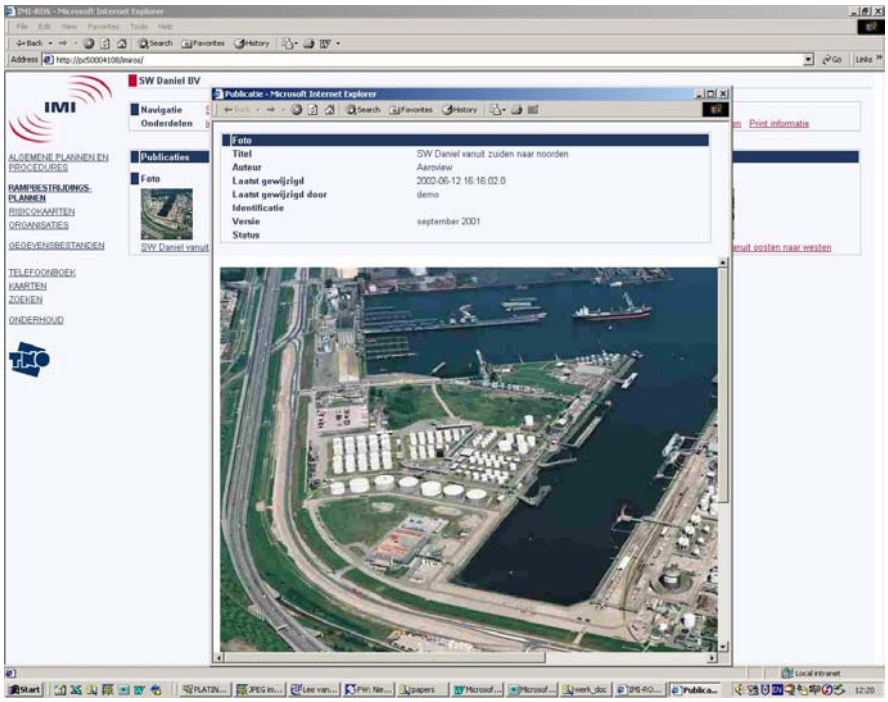

Figure 1: IMI-ROS screenshot

2 SYSTEM OVERVIEW

The IMI system comprises two main parts. IMI-ROS makes accessible the preparatory data pertaining to multidisciplinary incident management. It is used by all services involved in fighting disasters. The heart of the system is a centralized regional database which all the different emergency services can rapidly access via a web-based interface. The information includes such details as contingency plans, key addresses, municipal authorities information on hazardous substances etc.

The second main part is the IMI-EBUS system which has been designed for use during the repression and evaluation stage of a disaster. With IMI-EBUS[1] all co-ordination centres can exchange information on an easy, concise and precise way. Via an email-like system situation reports and actual incident information can be exchanged and via a specially designed whiteboard system geographical information can be exchanged.

The IMI-ROS system is in operational use in the Rotterdam region. The IMI-EBUS system will be operational in the Rotterdam region, the Den Haag region and the Dordrecht region in the first half of 2004.

3 DESIGN PRINCIPLES

Based on experiences in the military command and control three principles are formulated which guide the IMI developments. Although the principles originate from another field we believe they are valid also for incident management:

1. First priority is to create a shared situational awareness among all workers in the co-ordination centres, which will lead to a synchronised way of operating.
2. Fight as you work. A prerequisite for a useful system is a regular use. Therefore the use of a incident management system should be incorporated in the daily work

[1] The IMI-EBUS system is developed in close co-operation with Han-Dataport Benelux. It elaborates on the Telebrains information system developed by Han-Dataport Benelux.

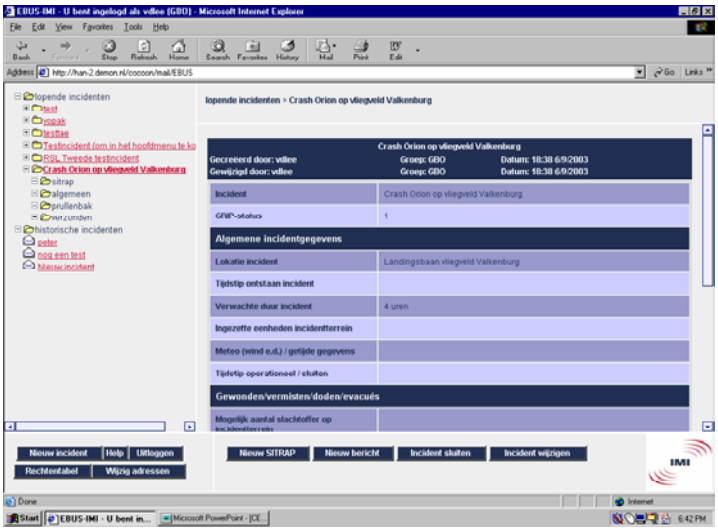

Figure 2: An example screenshot of IMI-EBUS.

3. Define clear areas of responsibility. A major source of misunderstanding originates from unclear responsibilities.

These principles are used as guidance for the functionality and user interface requirements of IMI. In the remaining we will show some user-interface examples.

3.1.1 Sensory compatibility

In order to reach a shared situational awareness in the different co-ordination centres, the exchanged information should be consistent and complete and adjusted (filtered) for their specific needs.
Information can be exchanged in different formats. For a few years the set of communication means where restricted to telephone, radio and fax. These means are still widely used in the field of incident management, but when we look more closely these means are often used in cases were they are not appropriate (Alberts, 2003). For example, the command post at the incident area comprises of commanders of different emergency services. They come together at regular intervals (normally each half an hour), exchange information and agree upon the content of the report and assistance requests to the higher, regional, command level. This higher command level normally is situated in a dedicated co-ordination centre, far from the incident area. Based on notes, a local commander reports by voice, over the telephone, to a regional commander, or assistant which on his turn makes his own notes, inform the other persons in the regional command centre and writes down his notes on a whiteboard. Thus, the information has been transformed from written notes, to voice and then back to written notes, which can result in loss or change of information, especially in a noisy environment. A far better solution is to avoid the transformation process and directly transfer the notes. A similar example is on the transfer of geographic information, which is difficult by voice or plain text but easy when a drawing can be sent.
In IMI-EBUS situation reports are sent by means of formatted email (Figure 2) to which pictures can be attached. Specific geographical information such as position of units, road-blocks, assembly areas, exact incident location, hazardous clouds is exchanged in IMI-EBUS by means of a whiteboard application.

3.1.2 Incident evaluation

In order to reconstruct decisions made during an incident, logging of exchanged information is important. First experiments with IMI-EBUS showed however a great caution, even a slight fear, by users to sent reports. Compared to the exchange of situation reports by telephone we observed a delay of report arrival when first using IMI-EBUS. People, more deliberately choose and reread their words before sending to the higher command post. It is assumed this effect will decrease when people are more used to IMI-EBUS.

3.1.3 Information filtering

Users of information systems like to retrieve/input information from the computer in an intuitive and efficient way. That is, without having to follow special training courses they want to see the, for them, relevant information. In IMI, the menu-structure and the way information is stored depends from the service the user belongs to and

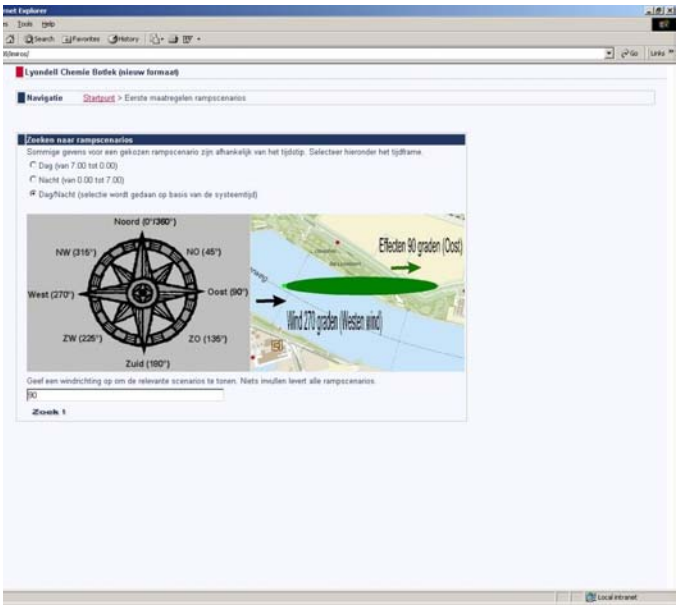

Figure 3: Selection of the wind direction

from the characteristics of the incident while all information remains accessible to all emergency-service users. In the 'golden hour' phase (the first hour of incident management) users get only the most necessary information while in a later stage they retrieve more necessary details. Figure 3 shows the main incident selection menu where a selection is made upon the name of the building or chemical plant where the incident takes place, the wind direction and the time of the day.

3.1.4 Access rights

Although all emergency services have access to all information, not all services are allowed to input all types of information. In close co-operation with the operational services, each service has got limited rights to input information on the actual incident situation. The police department is responsible for the reporting on the road blocks and traffic situation, the fire department is responsible for reporting on the fire fight status, the medical department is responsible on the number of casualties report and so on. This restriction follows past experiences where for example different services reported on the same casualties resulting in a wrong number of assumed casualties.

Such restricted input rights can have one danger, in that people observe important facts relevant to other services which they are not allowed to input in the system and therefore are unable to communicate. In order to avoid this, free text messages can be sent to each service.

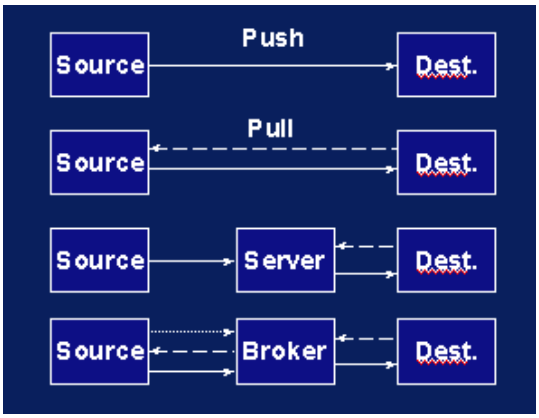

Figure 4: Moving from a push-pull to a broker structure

4. FUTURE TRENDS

One of the main issues in command posts is to get a clear shared situation awareness. Current procedures for information transfer rely upon a 'push' structure. Lower command posts send situation reports to higher command posts at regular intervals. The current IMI system is also based on a 'push' structure. Filtering of the content of a situation report is done at the sender side, at the lower command level. They decide what they think is of interest for the higher levels. This is a potential source of miscommunication. How does the lower command level knows what information the higher command level wants to receive? Especially, in large and complex incident situations where many things happen to occur in a short timeframe filtering can become a source of information loss. Moreover, sending reports at regular intervals implies a delay.

Information is stored for a while until the next report has scheduled. The ideal situation would be the situation where the information system knows the interests of the different command levels and different services. The information then can act as a kind of broker that instantaneously transmits parts of information to those who are interested in.

Another trend that might be foreseen is the increase of competence centres where specialists on a specific area are gathered. These centres can be located on a fixed location in a country. Communication technology should be mature enough to transport information from the incident area to the competence centre and vice versa. Experts are no longer forced to be physically present at an incident location.

5. CONCLUDING REMARKS

The IMI interface complies with the principle of creating a shared situational awareness among the users of the system. It also defines clear areas of responsibility by the implemented access rights and information filtering. But the principle of 'fight as you work' is a tough one. Large incidents do not occur at a daily basis. The daily work of members of co-ordination centres is different from incident management. We partly comply with this principle by striving to a simple as possible user interface, which requires as little training as possible.

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