Space assets in support to CBRN: IAP potentials

P. Mancini Ph.D.
Head of the awareness and feasibility study division
European Space Agency
CBRN is an acronym for Chemical, Biological, Radiological, and Nuclear. It is in common use worldwide, to refer to incidents or weapons in which any of these four hazards have presented themselves. CBRN defence (CBRND) is used in reference to CBRN passive protection, contamination avoidance and CBRN mitigation.

The multidisciplinary CBRND crisis decision-making exercise codenamed Voyager took place on Wednesday 3 October 2007 in Rotterdam, Netherlands.

An ESA team coordinated by the Integrated Applications Promotion was asked to illustrate the potential of satellite-based applications during this exercise.
Objectives

• TNO requested ESA/IAP to support the execution of the exercise and to provide satellite communications between the command and control premises (VRR HQ) and on the field (zone of intervention):
  – VRR (Veiligheidsregio Rotterdam Rijnmond) request was to have two video links shooting the field operations. VRR indicated that “ESA tools” should not be intrusive into their operational environment

• For VRR the objective was to assess the potential of satellite-based tools in support to their operations and especially to gain “field awareness” from the Head-Quarters:
  – Better understanding of the field situation (e.g. extent of the accident)
  – Better coordination of field operators (e.g. firemen)

• For ESA the objective was to demonstrate the added-value of SatCom based solutions in support to CBRND:
  – Ease and rapidity of deployment
  – Independence from terrestrial networks
  – Interoperability with state-of-art ICT tools (e.g. IP video streaming)
• **The Voyager exercise partners:**
  - Ministries of Defence
  - Municipality of Rotterdam and its operational services (Fire brigades, First responders, Police, Special units, Health services)
  - Intelligence and communication organisations
  - Red Cross responsible for sheltering and treating victims during disasters
  - Coordinated by VRR (Veiligheidsregio Rotterdam Rijnmond) : risk control, incident suppression and crisis control.
  - Industrial partners (including TNO)

• **On ESA side:**
  - IAP team including experts from Telecom lab
  - Industrial support for the preparation and execution of the exercise: Thales Alenia Space (DVB-RCS hub), Antech (Transportable Communication Vehicle), Temix (EasyFlySat)
• The preparation of the demonstration started about one month before the date of the event:
  – Unit test of the tools (video-cameras, EasyFlySat, …) performed in ESTEC telecom lab
  – Architecture of the technical set-up
  – End-to-end validation and performance measurement

• Several meetings and surveys were performed to define the:
  – The end-users requirements
  – The locations where the components shall be deployed
  – The operational scenario to be followed by ESA/IAP team

• A dry run was held of 26th Sept and the final tune-up was performed the day before
3rd October Voyager exercise execution
The Voyager exercise was based on three main story lines:

- **1st story line**: involves a collision between a container ship and a passenger ship in the Rotterdam harbour. As a result, the containers land on the passenger ship. The chemical and infectious contents of one container are released into the water. There are injuries, drowning victims and other fatalities.

- **2nd story line**: involves the crossing of suspected terrorists from England to Vlissingen and the subsequent domicile search in Utrecht.

- **3rd story line**: involves a threatened terrorist attack on a petrochemical company in the Botlek area. In this “story line”, terrorists are threatening to blow up the installation with a tanker lorry with explosive cargo.

During the preparation of the exercise it was pointed out that no movie could be taken in the refinery in order to protect the identities of antiterrorist squad members. It was then decided that ESA would broadcast video only from on field story line 1.
1. Accident between the containers and passengers ships

2. Passengers are rescued and decontaminated

3. The ships are inspected against remaining pollution
ESA/IAP assets deployed on field
Story line 1

TCR (Pajero)

Fly Case

Camera 1
pos. 2

Camera 1
pos. 3

Disinfection area
H

Camera 2
pos. 1

Camera 2
pos. 2

Pajero
pos. 1

Pajero
pos. 2

Camera 1
pos. 4

Fly Case

ESA/IAP assets deployed on field
Story line 1
* No pictures from the Crisis monitoring room could be taken due to confidentiality matters
Cameras Snapshots (taken by ESA/IAP setup)
Evacuation
Feedback from stakeholders

• The exercise itself was a success for VRR
• The VRR officers in charge of coordinating the response (located in the HQ):
  – At first watched at ESA video monitors in a passive way (fixed angle)
  – After a couple of hours, started to remote control the video cameras and zoom in of specific details of the scenes
• They have acknowledged the added-value provided by the satellite based tools
  – Increased awareness from HQ
  – Flexible and quickly deployable tools
Health early warning: the IAP user driven experiences
• The THREAT of epidemics:
  ▪ Emerging or re-emerging diseases (avian flue, tuberculoses, Marburg fever, etc.)

• The NEED for health early warning:
  ▪ Outbreak Management System in public health for the effective prevention, management, and response to epidemics.
  ▪ ...even in remote or isolated areas or after a disaster

• Risk of epidemiological crises after natural or man-made disasters
• + Risk of epidemiological crises after natural or man-made disasters

• **Among current biological threats:**
  
  • Current or emerging and re-emerging diseases
    
    • Global challenges for AIDS, Tuberculosis, Malaria, and many others
    
    • Environmental/climate changes influence microbial geographical distribution, persistence and transmission mode and can cause spread of local or species-specific diseases
    
    • On average, one new human disease per year, of which 75% is from animal origin
    
    • Diseases can re-emerge after containment if the reservoir of the virus still exists (Ebola, SARS)
    
    • Chikungunya in La Réunion island:
      
      • since March 2005 - More than 266 000 cases (InVS, 3/08/2006).
  
• **Bioterrorism: Anthrax (US, 2001)**
THE HEWS PROJECT
• **Need for an Outbreak Management System to prevent, predict and organize an optimized response.**
  - Network of experts, decision-makers
  - **Tools:**
    - To prevent or predict the outbreak
    - To issue early warning
    - To optimize the resources and the intervention to limit the extension of the crisis

• **Added value of satellite communications for health early warning in remote or prone to natural or man-made disaster areas.**
• **Access to communication from any place in the world especially remote areas or areas with difficult access.**
  
  • Data collection for electronic surveillance and early alert
    • Geolocalisation of events related to the outbreak of epidemics
  
  • Communication for management of biological crisis.
    • Satellite connectivity between experts, decision-making centers and coordination centers on the site of the crisis;
    • Access to Internet from remote areas or mobile field units;
    • Satellite communications for mobile field units;
  
  • Post disaster monitoring for data collection
Biological Terrorist Attack

Mortality rate 50%/m2 (1970)

* Conventional weapons $2,000
* Nuclear weapons $800
* Bacillus anthracis $1
• The proposed scenario is that of a terrorist attack in Lisbon downtown, with Anthrax spores causing panic among the citizens, traffic jams and saturation of GSM network;

• The rapid confluence of civil protection and health operators is hindered by the lack of coordination of the response effort, lack of field information,…

• The civil protection needs to coordinate the field teams, to request medical personnel from hospitals or to rapidly move patients to hospitals.
• A dedicated early warning satcom based unit will comprise a field unit with laboratory analyses capabilities;

• HEWS will assure real time information in different locations to all actors;

• HEWS will dispatch work instructions to different hospitals and health centers.
24

Marburg Fever in Angola

- 2004-2005 outbreak

- 252 cases
- 227 deaths
2004-2005 outbreak

- 75% of cases occurred in children aged < 5 years
- Health-care workers cases reported
Marburg fever in Angola

Marburg virus disease

- Acute febrile illness
- 6-8 days of progression to hemorrhagic manifestations
- Fatality rates between 25% to 80%
• A dedicate early warning satcom based service will offer communication services to villages health structures (Satcom-based);

• HEWS will gather, analyze, disseminate and store epidemiological reports on a daily basis;

• HEWS will geo-refer epidemiological events to support response plan definition and operation.
Multi-disciplinary Consortium, representative of a **User-driven** approach, fully committed with the exploitation of project feasibility and sustainability.
Key IAP application development objectives (I):

• Sustainability

• Reliability (end to end QoS)

• Interoperability

• Promote as much as possible modular approaches:  
  • Telecommunication modules, network modules, application modules

• Open standard approaches

• Integration of standard existing modules

• Interfaces developments among different modules
Key IAP application development objectives (II):

- **Flexibility** (support any network topology)

- **Versatility** (support IP applications and legacy protocols)

- **Scalability** (inexpensive start-up configuration)
Telecommunications and Integrated Applications

SUSTAINABILITY CYCLE

INSTITUTION

Technology Programme

INDUSTRY

Pilot, Pre-operational services

Operational service

Formal Partnership

OPERATOR or Anchor Tenant

BOTTOM-UP Approach (federated need)

TOP - DOWN Approach (estimated need)

FEDERATE USERS

Awareness

Growth

UNFEDERATED USERS

SUSTAINABILITY CYCLE