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BACKED BY THE SKY – Satellite applications as a tool for a better situational awareness

Evaluation in an operational environment

Streszczenie

Niniejszy artykuł przedstawia wnioski wypływające z eksperymentalnego wykorzystania zintegrowanego środowiska informacyjnego bazującego na technikach satelitarnych dla wsparcia dowodzenia podczas manewrów zarządzania kryzysowego i ratownictwa.
Eksperyment potwierdził, iż istniejące i dostępne rozwiązania mogą zostać skutecznie połączone, pozwalając na faktyczną poprawę świadomości sytuacyjnej kierującego działaniami. Kluczem do sukcesu w rozwijaniu takiego systemu jest właściwe określenie potrzeb i oczekiwań użytkownika, zintegrowanie różnego rodzaju informacji we wspólne środowisko i standaryzacja pozwalająca na wymianę informacji pomiędzy odrębnymi systemami.

Summary

The article presents operational use of integrated satellite applications for crisis management. The experimental information environment successfully supported commanding of a large-scale crisis management field training. The results prove that many crisis management needs can be served with existing, commercially available products. The key to success lays in understanding operational needs; integration into common information environment; and standardisation of information exchange.

Space community holds a strong belief that space applications could be used more intensively for coordination of crisis management activities. At the same time emergency services' user have difficulties in understanding what exactly space can offer them and what are the limitations. Practical demonstration of capabilities in operational environment appears to be the most effective method to overcome these communication problems and to facilitate evaluation of actual benefits.

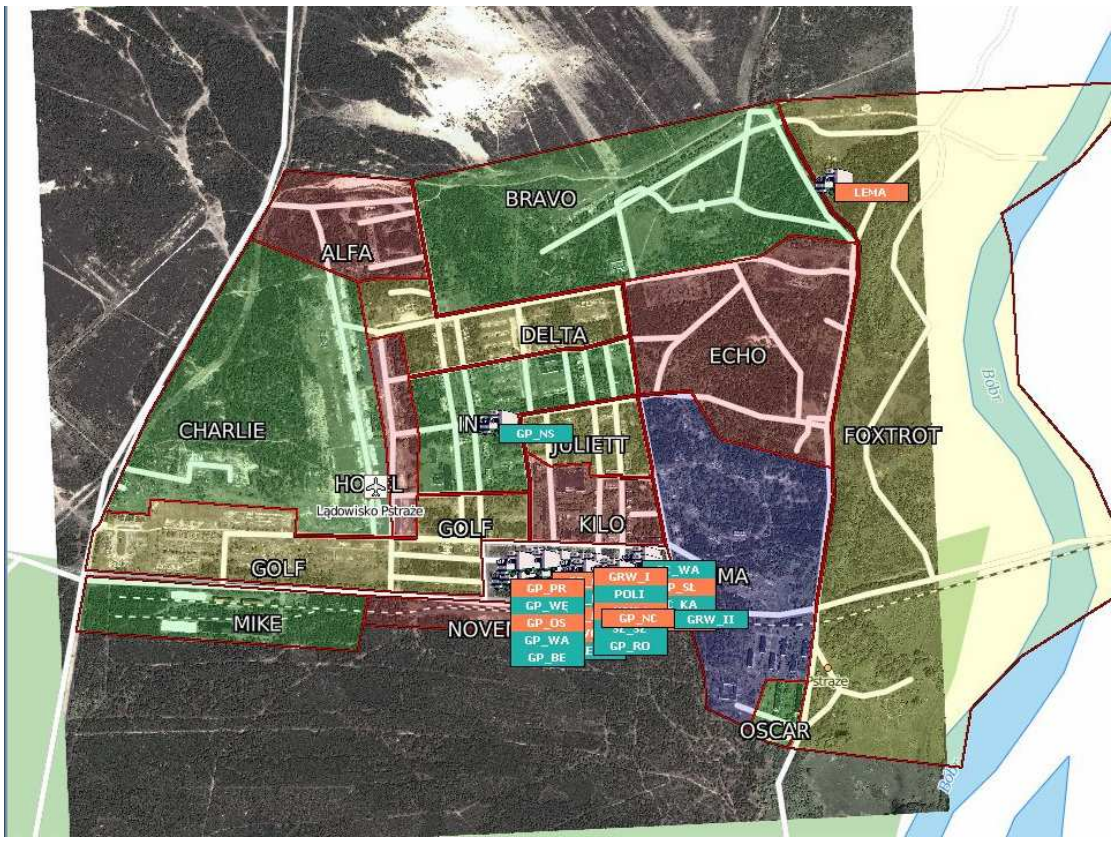
This paper is based on the research conducted within the framework of the Foresight project "Future of space technologies in Poland", which aimed at identifying the most promising space applications within a perspective of year 2020. It also built upon experience from demonstration and evaluation organised as an element of the EU Astro+ project.

The conceptual information architecture developed in the project has been experimentally implemented and evaluated in an operational environment.

Several commercially available systems were integrated into the information environment enhancing situation awareness and command and control. This environment was employed as a support command system during the largest European rescue services' field training "Cooperation 2008", conducted in Poland in April 2008. It involved more than 900 people from 7 countries and its 2-day scenario covered, inter alia: chemical accident, VIP evacuation, accident during transporting of nuclear materials, terrorist attack, bio-weapon incident, building collapse and consequent search and rescue activities and population evacuation.

The environment was developed by the Polish Space Office in cooperation with commercial companies Autoguard SA and Techmex SA.

The purpose of the experiment was to evaluate usefulness that can be achieved through integration of already available solutions into an integrated information environment, common for all players involved. This article presents the results.



Picture 1. Overview of Żagań training ground. Tactical overlay is visible over satellite image. All units are gathered in the concentration point.

System architecture

For the purpose of the training a dedicated information system has been created through integration of existing, commercially available, off-the-shelf products. Its function was to provide a better situational awareness for officers in headquarters, visualising area of operation, basic tactical information and location of different groups participating in the exercise.

During the exercise different operations were realised by different units: fire fighters, medical units, search and rescue groups, police, military, chemical and biological teams, anti-terrorist units. Participants represented services of 7 different nations. The secondary function of the information environment was to create a common operational picture for different command structures and to facilitate exchange of information.

To visualise the training ground a one-year old high resolution satellite images were used. The picture has been enhanced by adding simple GIS information, showing separate areas of operations, roads and contours of buildings.

Vehicles of commanders of all groups (25 in total) were equipped with satellite navigation terminals transmitting their position. This transmissions were conducted through GSM network and it was the only element of the system dependent on ground infrastructure.

The server, physically located safely 400 km from the training ground, collected position information and combined them with background images and GIS data.

Two separate headquarters commanding operations and a backup centre were independently accessing the server through a satellite communication. In the main headquarter situational picture was presented on the large screen visible to all officers and the Polish Space Office team provided an operational support. In the other locations situational picture was presented on the screens.

Operational experience

The system was operational since the beginning of field activities. The situational picture was visible at all times. Initially the visual information was ignored by the HQ personnel conducting operations in a traditional manner. After approximately 4 hours satellite support staff started to actively point relevant pieces of information to different officers following related activities. From that moment their interest started to grow and soon officers themselves started to ask for particular information. After a few next hours satellite team learnt the procedures and needs of officers and the officers better understood capabilities and

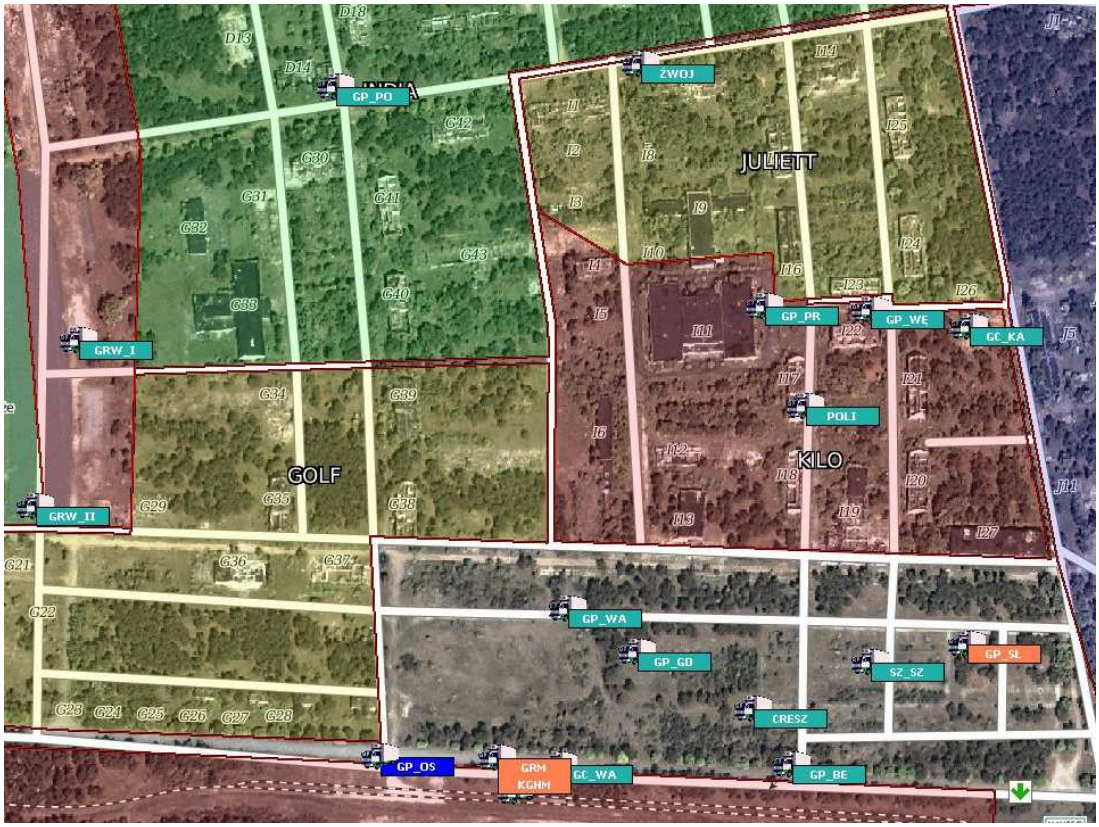
limitations of the system. From that moment system's utilisations performed seamlessly, with growing reliance on new capabilities.

During a two day exercise, the system proved to offer several functionalities:

1. General picture of the area allowed for easy grasping of units dislocation.
2. Particular unit could be easily located. It allowed for limiting of radio communication normally needed to request position information and reporting it.
3. Satellite image – even one-year old – gave HQ officers a good understanding of environment a reporting unit was operating in. Such understanding would be difficult to establish through radio reporting and would require significant transmission time.
4. Information from the image could be communicated to the unit, providing information about surrounding not obvious from the ground. This could also include information about other units operating in the neighbourhood.
5. Tracking units allowed for monitoring their route. This was particularly useful when unit was not following the instructed path. It was also useful to correct mistakes, e.g. unit reporting arrival to the target position, when position tracking showed that they are not in an expected destination.
6. Images were used to locate particular places and identify their geographic coordinates that were radioed to units.
7. Monitoring units route allowed for alerting in case they were entering dangerous area, e.g. contaminated terrain or vicinity of ongoing anti-terrorism operation. Such area can be marked and alerts can be generated automatically [last function was not implemented during the experiment]
8. The same information was seen by two headquarters commanding different groups of units. This allowed for easy understanding of activities of units commanded by other HQ without radio reporting, in particular whether requested tasks are performed. It also resulted in limiting amount of radio communication between two HQs.
9. Areas that are dangerous can be marked accordingly, what is immediately visible to all commanding centres and may save lives. The same system can be used to mark particular areas – e.g. chemical cloud where helicopters are not allowed to fly to avoid cloud dispersal [not implemented operationally].

10. During the exercise a real unexploded device was found. The system was used to monitor evacuation, to guide mine teams to the location and to confirm the area clear of rescue units.

From a technical point of wiew, the system was fully operational since the beginning of the exercise and performed as expected. During the training two medium issues appeared, but they resulted in only a limited inconvenience. Firstly, due to different mechanics of electric connections in vehicles, some terminals were not powered after switching off vehicles' engines. Their locations during static operations was therefore presented not as "current", but as "last known". Secondly, the interface presented the time from last position check in a not sufficiently obvious manner – it was not immediately evident whether location represents situation 30 seconds or 2 minutes ago.



Picture 2. Several rescue groups are visible in the area of operation. Location of buildings and roads can be easily identified, together with tactical zones.

Conclusions

The basic functionality of tracking systems is well known among emergency services and is increasingly popular in their daily operations. However, the experiment clearly showed

that usefulness of such systems can be significantly enhanced. In particular, benefits can be gained through standardised systems – exchanging information can establishing a common operation picture shared by different services involved.

The experience gathered during the experiment will be implemented in the command and control module of the Proteus system[1]. Proteus is the next generation system to support crisis management and rescue operations with the most modern robotic and IT technologies. It is developed by the consortium of 10 Polish R&D entities, led by PIAP.

The more detailed conclusions are the following:

- Ability to track all units/groups participating in operation (belonging to different services and structures) and visualise their location on satellite map greatly enhances situational awareness.
- Ability to access exactly the same data in different locations results in a common operational picture for all actors involved, both different services and authorities supervising them.
- Both abovementioned factors allow for significantly better coordination of common operations.
- Automatic transmission of status information together with position information may provide for much clearer situational picture.
- Satellite support team physically present in headquarter is a very effective method to ensure efficient use of available space technologies.
- Geospatial products (satellite maps and analytical products) should use standardised marking (e.g. NATO standard symbols) to make them easily readable for users.
- Standards for such products made available electronically are also necessary.
- Users (commanding officers) require certain time (several hours) to get accustomed to new capabilities, understand them and use effectively.
- Operational demonstration is a very effective method to validate crisis management systems' concepts and to convince users about their usefulness.

[1] Proteus is developed within the framework of the project co-financed by the European Regional Development Fund (the Innovative Economy Operational Programme, 2007-2013)