

## application of remote sensing for security needs of the wider European Union – the GMOSS Network of Excellence

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### APPLICATIONS OF SATELLITE IMAGERY

Most Europeans are accustomed to viewing satellite images every evening as part of the evening's weather forecast. And it is general knowledge that reconnaissance satellites began providing a stream of information to military planners, at least those of the superpowers of that time, very shortly after the launch of Sputnik in 1958 and that the quality and quantity of such information has been steadily increasing ever since.

But the usefulness of Earth observation satellites does not stop at meteorological forecasting and defence. A host of other satellites have been monitoring physical, chemical and biological processes of our planet for more than twenty years. And from the late 1990s these mostly science-oriented instruments have been joined by a number of satellites with specifications similar to previous generation military surveillance satellites but operated by strapped-for-cash former superpowers or by newly-created commercial companies. Images of Earth from space provided by these instruments are beginning to be a regular and familiar feature of news reports.

### GLOBAL MONITORING FOR ENVIRONMENT AND SECURITY

However there have been concerns that the potential benefits of the wealth of data provided by these scientific or commercial satellites is not being exploited to its full potential. Simplifying somewhat we can identify two main aims:

- 1) monitoring the environment. It is incontestable that the pressure of human activity on the planet is increasing at an unprecedented rate. The global population stands at over three times the level of a hundred years ago<sup>1</sup>. Global cereal production has doubled in the past forty years [1]. The world's annual consumption of primary energy has increased by 145% since 1965. Monitoring the impact of these accelerating changes on the planet requires an evolution of satellite deployment from a series of individual scientific experiments towards a joined-up operational system of observations providing a regular flow of reliable information on parameters such as desertification or deforestation that is reliable and fast enough for remedial action to be taken;
- 2) exploiting the growing technological capability of earth observation satellites to allow more effective actions on matters of security;

The joint European Union - European Space Agency Global Monitoring for Environment and Security, GMES, initiative [2], launched at Baveno, Italy, in

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<sup>1</sup> 5.9 billion in 1998 compared to 1.7 billion in 1900 according to the United States Census Bureau. 6 billion in October, 1999 according to the UN population division.

October 1998, is broadly aimed at making sure that European civilian public funding of earth observation activities supports these two overarching objectives. Its stated aim is to support Europe's goals regarding sustainable development and global governance by providing timely and quality data, information, and knowledge.

There are, of course, links between environment and security which need investigation. Research is ongoing to determine whether or not the degrading environment and dwindling resources of the planet will lead to such human misery that civil disorder and military aggression will be an inevitable outcome. However within this paper we will be more concerned with more immediate threats to life, property and well-being.

In broad terms these immediate threats can be caused by what St Augustine [3] would have termed natural evil – floods, fires, earthquakes etc – as well as those caused by moral evil – repression, civil war, terrorism, border conflict, ethnic cleansing, organized crime, inter-state war. Both are covered under the security component of GMES but here we consider only efforts to monitor the visible impact of the “moral” evil component and to support efforts to mitigate it.

## NON-MILITARY STAKEHOLDERS IN SECURITY

Without trying to define security too closely it is obvious that it is not now only military forces that require the information. Nor, unlike the days when any mention of a surveillance-satellite programme was deeply classified, are military forces the only bodies able to benefit from very high resolution satellite imagery. The commercialization of satellite earth observation means that access is now open to all. Thus humanitarian agencies needing to assess the scale of post-war damage, customs and excise officials patrolling long unmanned borders against smuggling or inspectors monitoring plants for clandestine nuclear activities can all benefit. And the information produced can be made available to the general public. Up to now the value of this dissemination to a wide anonymous public has not been fully appreciated and GMES has always been considered as a tool for “decision-makers” who are presumed to operate at regional national or European level.

However in a democratic society it is ultimately the public that takes the decisions. Satellite imagery contributes towards an informed process through the media – newspapers, television – and through organisations such as [globalsecurity.org](http://globalsecurity.org) or the Institute for Science and International Security. These bodies, mostly based in or near Washington DC, publish through the internet detailed and timely analyses – often including satellite images - on subjects such as clandestine nuclear plants or terrorist attacks.

There are two main consequences of the availability of this information. First it allows individuals to check on information provided by their own governments. An example of this was the dramatic and widely circulated Envisat image of the Prestige oil-slick which showed the extent of the problem to the Spanish public before aerial photography had been released. And second, by extending the number of participants in the process, it might allow a sounder and more robust decision making. This second point is one of the intellectual justifications for democracy and was articulated by Rousseau as *“From the deliberations of a people properly informed, and provided its members do not have any communication among themselves, the great number of small differences will always produce a general will, and the decision will always be good [4].”* Whilst one hesitates to overplay the lessons learned from the 2003 Iraq war, it does indicate an example of a case where the general public were able to reach an opinion on the probable state of Iraq's clandestine weapon programme that was sounder than that reached by small groups of experts deliberating in closed rooms.

## ENABLING EUROPE TO PULL ITS WEIGHT

As yet there are no European organizations with the mandate or financial muscle to routinely collect, analyse and distribute imagery on the scale of their United States counterparts – whether military such as the National Geospatial Intelligence Agency or civilian such as [globalsecurity.org](http://globalsecurity.org). However the GMES process is beginning to provide a focus for efforts to help Europe pull its weight. Progress is needed both institutionally – pooling the resources of small national efforts into a networked capability – and scientifically – developing algorithms and software that help the limited number of image interpreters cope with the enormous quantities of data flowing from spaceborne observations.

A first step has been taken on both counts with the inauguration on 1 March, 2004, of the Global Monitoring for Security and Stability Network of Excellence which gathers together 24 European organizations in a four-year research programme developed jointly between the partners and aiming to meet the needs of identified security stakeholders at a national and international level. The ambitious aim is to permanently link these organizations even beyond the formal 4-year term of the network.

The scientific work includes socio-political research to identify the threats that need to be monitored, generic research in the technology of feature recognition and change detection as well as specific applications such as treaty monitoring, damage assessment, population monitoring, infrastructure monitoring and border monitoring.

Progress has already been made in the first six months of the project. . A first assessment of present capabilities confirms that automatic classification of images – for instance to estimate damage after civil disturbances – is still slower than visual examination by a skilled operator. But by working on common test cases - monitoring changes in an Iranian nuclear facility, estimating the population density in Zimbabwe – the partnership has been able to share workloads avoid duplication and identify the most promising techniques for further exploration.

## REFERENCES

- [1] Communication From The Commission To The European Parliament And The Council Global Monitoring for Environment and Security (GMES): Establishing a GMES capacity by 2008 - (Action Plan (2004-2008)) Brussels, 3.2.2004 COM (2004) 65 final
- [2] Nature 418, 671 - 677 (08 August 2002);
- [3] Augustine of Hippo (354-430) "City of God"
- [4] Jean-Jacques Rousseau, 1762, The Social Contract or Principles of Political Right