International Charter-Space and Major Disasters - Experience of CNES and of the French Civil Protection. Haiti Earthquake January 2010

André HUSSON¹, Catherine PROY¹, and Pierre CHASTANET²

¹ CNES, 18 av E. Belin 31401 Toulouse Cedex 9 France
² Ministère de l'intérieur, de l'outre-mer et des collectivités territoriales. Direction de la Sécurité Civile 92600 Asnières-sur-Seine, France

Abstract. International Charter ‘Space and Major Disasters’ is a unique initiative employing space technologies to help save lives and assess the damage due to natural disasters that leave a trail of destruction around the world, including in Europe. The aim of the charter is to help get relief to those who need it. Earth-imaging satellites provide archive images or specifically tasked imagery of disaster areas that emergency response teams can use to organize the on the spot assistance and aid. Since its inception in November 2000, the Charter has been activated all over the world more than 250 times in more than 80 countries, in response to meteorological disasters such as hurricanes and floods (60% of the total number of activation), earthquakes (13%), volcano eruptions (7%), forest fires (7%), industrial accidents like oil spills (5%)... There is an increase of Charter events, with more than 40 to 45 activations per year. This increase, which is premature to directly connect to the climate change, is possibly due to a better involvement of the users and particularly UN agencies (responsible of 50% of the activations in 2009). The latest activations from the French Civil Protection are described with a special focus on the Haiti earthquake, the disasters assessment products obtained and the feedbacks from the Users.

Keywords. Earth-imaging satellites, disasters, emergency, Haiti earthquake.

Introduction

The contribution of space technologies in the management of disasters caused by natural phenomena or technical accidents are meteorology and positioning technologies, telecommunication and earth observation. Earth observation can improve the efficiency of services that may be provided to the victims of a catastrophe and to bodies called upon to help them.

After a general overview of the Charter, this presentation highlights the experience of the Haiti earthquake’s activation.

1. The International Charter

1.1. General overview

Following the UNISPACE III Conference in Vienna (July 1999) the French Space Agency (CNES) and the European Space Agency (ESA) conceived and approved a program to provide emergency response satellite data to those affected by natural disasters that leave a trail of destruction around the world, including in Europe. The purpose of this group of space agencies, which came to be “International Charter - Space and Major Disasters”, is to promote cooperation among space agencies in the use of satellite data to manage crises during and after disasters.
When tropical storms, floods, oil spills, earthquakes, landslides, volcanoes or fires endanger human life, the Charter member agencies provide valuable information about these events’ extent and impact. More specifically, when a major natural or man-made disaster is imminent or has happened and relief and reconstruction efforts are anticipated, space agencies respond with a review of applicable satellite data resources and archive retrieval capabilities, and determine appropriate priority spacecraft tasking. Data are processed at predetermined levels (e.g., as GIS-ready data sets), and in some cases value-added commercial data fusion capabilities are initiated.

The Charter was activated for the first time in November 2000 when a major landslide affected Slovenia. Original Charter members: the French Space Agency (CNES), the European Space Agency (ESA), and the Canadian Space Agency (CSA), provided optical and radar data to map the extent of the damage caused by the landslide. Following that event, the Charter’s value and early successes resulted in the growth of membership through other organizations (Figure 1):

- the U.S. National Oceanic and Atmospheric Administration (NOAA) and the Indian Space Research Organization (ISRO) in 2001;
- the Argentinean Space Agency (CONAE) in 2003;
- the Japanese Aerospace and Exploration Agency (JAXA) and the U.S. Geological Survey (USGS), as well as the Disaster Monitoring Constellation (DMC) via the British National Space Center (BNSC) in 2005; and,
- the China National Space Administration (CNSA) in 2007.

From the Charter’s formative days in 1999, its membership has up to now grown to ten space organizations. And moreover as the Charter is, indeed, a successful case of international cooperation, INPE (Brazil), Roscosmos (Russia) and Kari (Korea) currently intent on joining the Charter as full members.

The Charter is an international agreement between European and non European space agencies (not between States), making their resources available to emergency and rescue operations during the crisis situation at the request of a worldwide Authorized Users base. It is a simple but global data exchange mechanism relying on existing satellites resources with two fold missions:

- To task satellites in emergency situation (the Charter does not concern the prevention/rehabilitation phases),
• to supply emergency organizations, essentially the national civil protection agencies, with a timely, free and co-ordinated access to satellites data in case of major natural or man made disaster (the Charter does not concern the long humanitarian crisis). It deals only with emergency.

The Charter is open to space agencies and space system operators. The members endeavour to make satellite resources (including acquisition planning) available without delay during period of crisis, beyond the specific data policy restrictions of providers.

All in all, the Charter members and associates, managing more than twenty earth observing satellites, provide a variety of data from a wide range of satellite systems. The wealth of archived and current satellite data have proven useful to disaster management agencies, international relief organizations, and the science community at large. The data from these satellites have helped emergency managers worldwide to deal with a variety of natural and anthropogenic disasters: earthquakes, landslides, volcanic eruptions, weather related catastrophes, and emergencies such as oil spills and hazardous materials outbreaks. The Charter has been activated more than 260 times in 90 countries over all continents.

1.2. Charter operation

Effective managerial and operational procedures ensure that information is delivered to emergency responders in a timely manner. As shown in Figure 2, the On Duty Operators and Emergency On-Call Officers receive and process the requests for relevant satellite data on a 24/7 basis. Key to activation is a list of authorized users. Authorized users are civil protection, relief organizations, or national authorities with a mandate related to disaster management from within the country of a Charter member. The Charter works in close cooperation with United Nations bodies such as the UN Office of Outer Space Affairs (UN OOSA) and the UN Institute for Training and Research (UNITAR) Operational Satellite Applications Program (UNOSAT). Both UN OOSA and UNOSAT are authorized to request data from Charter members in response to an emergency and UNOSAT has also provided value added processing services for many Charter activations over the years. These organizations play an important role in maximizing the Charter’s use with UN member states.

Figure 2. Overview of Charter approach to data access after request for data.
Project managers quickly assess the severity of particular disasters and the relevancy of satellite data holdings and capabilities. Satellite image capturing plans and feasibility are determined and the appropriate space agencies are contacted to conduct satellite imaging operations.

The Charter members unanimously endorsed the principle of “universal access”, as necessary for the benefit of societies everywhere in the world. The International Charter has the goal of improving Charter access to address the needs of disaster response users engaged in supporting affected countries world-wide.

There are three main mechanisms for a user organization to submit requests for Charter activation.

- Direct activation happens when authorized users within member countries request data after a disaster within their countries. The only bodies authorized to directly request the services of the Charter are the authorized users (typically civil protections, governmental relief organisations, authorities with a mandate related to disaster management, etc) from the country of a Charter member.
- Activation via ‘sponsor AU’: an authorized user may request activation for a disaster within another country.
- Activation via the UN: Users may request assistance via UN intermediaries UNOOSA and UNITAR/UNOSAT, two organisations that have been granted the possibility to request activations.

The success of the International Charter is demonstrated by the steady growth in Charter activations throughout its history. Charter members quickly respond when called upon by national emergency management authorities. Satellite data are made available free of charge to these emergency managers: the Charter operates on a voluntary, no-exchange-of-funds basis. When the data are delivered by the image providers, there is a network of Project Managers who are trained to handle the distribution and value-added processing so that the end users get not only the images they requested, but the information they need to support their response efforts. These Project Managers are located in emergency operations centres, universities, other government agencies, UN agencies, and volunteer organizations that have a role in remote sensing and emergency management. They are trained by Charter member agencies to provide the necessary services and play a vital role in the success of the Charter. The Project Manager training classes are offered several times a year in different locations around the world.

For more details regarding the International Charter, for opportunities of involvement, and for examples of the information products which its members have provided, please see: [http://www.disasterscharter.org/](http://www.disasterscharter.org/).

2. CNES and French Civil Protection experience.

2.1. CNES involvement

A major test of the Charter’s capabilities occurred in 2004 when a tsunami caused massive destruction throughout Southeast and South Asia and Africa. Both government- and privately-owned satellite systems provided data to identify and analyze areas impacted by the tsunami. Relief teams were able to use these data and derived information products to rush medical supplies, food and clothing to coastal communities devastated by the enormous waves. After immediate concerns were addressed, satellite data acquired before, during and after the event illustrated the profound impact of the flooding. Major disasters, such as earthquakes and tsunamis have highlighted the vital importance of satellite imagery and its rapid delivery to emergency services on the ground.

The French Civil protection benefited from the Charter partnerships as well. When Klaus stormed through the South-West of France in 2009, and more recently after the HAITI Earthquake.
On January 12th a major earthquake of magnitude 7 struck the Port au Prince region in Haiti causing major casualties and damages. It was followed by several aftershocks with magnitude over 5.0. Two hours after his event, the French Civil Protection authorities, followed by the UN Stabilisation Mission in Haiti, the Public Safety of Canada and the American Earthquake Hazards Programme of USGS, requested satellite data of the area from the International Charter ‘Space and Major Disasters’.

As project manager for this activation, in liaison with the world space community, whether members of the Charter or not, CNES was in charge of organising and coordinating the programming and acquisitions of satellite imagery from a range of sensors, both optical and radar. It worked in close link with the relief organisations to elaborate damage mapping to support the on the field disaster-response teams.

To meet the requirements of the rescue teams in Haiti, Very High Resolution imagery was needed from both optical and radar sensors. Through the Charter, the international space community acquired satellite imagery as quickly as possible. Date were being collected from various satellites including Japan’s ALOS, CNES’s Spot-5, the U.S.'s WorldView and QuickBird, Canada’s RADARSAT-2, the Chinese HJ-1-A/B and ESA's ERS-2 and Envisat. Other satellite missions also provided data in complement to those from the Charter such as for instance TerraSar X, GeoEye and Komsat 2.

Satellite imagery acquired immediately after the event is used to generate emergency maps to provide rescue services with an overview of the current state of the area. Crisis data were compared with situation maps generated from archived satellite data to identify major changes on the ground caused by the disaster.

Comparison of the maps from before and after the event allowed areas that have been hit hardest to be distinguished and identify passable roads for relief and rescue workers. Additionally, they helped to identify areas which were suitable for setting up aid camps where medical support and shelter can be provided to people.

The European GMES’s SAFER project collaborated with the Charter to provide a specialised Value Adding capacity to produce damage maps over the area:

- SERTIT from Strasbourg (mainly for Charter Users)
- DLR –ZKI: German Aerospace Centre's centre for satellite-based crisis information (mainly for the German Red Cross)

UNITAR/UNOSAT also generated products from US VHR optical for UN entities and shared them within the Charter and Safer Users.

Speed was of the essence and imagery has to meet the precise needs of civil protection, United Nations and Red Cross teams. The first location map of Port aux Prince in the aftermath of the earthquake, with an overlay of the main road network, was produced the same day.

Intense and frequent coordination has been achieved between Users, Value Adders, Project Manager and Safer team to take into account the Users needs (priority areas, information to be delivered) in the damage mapping activities.

2.2. French Civil Protection return of experience

The crisis products sent to the direct Charter Users (French Civil Protection, UN Stabilisation Mission in Haiti, Public Safety of Canada and USGS) and to many other additional Users were dedicated to damaged buildings mapping, damage density evaluation and location of visible spontaneous assembly areas (see example in Figure 3).

More than 30 products were generated, in the frame of the GMES/SAFER project, by SERTIT and DLR between 14th and 22nd of January on the following locations: Port au prince, Carrefour,
Pétionville, Léogane, Jacmel, Gressier, Petit Goave, Grand-Goave and Miragoane. The main used data sources were ALOS, GEOEYE, KOMPSAT-2, DIGITAL GLOBE, and SPOT 5 satellites.

Figure 3. Example of product: Refined damaged buildings and Damage density evaluation. All products can be found on the Charter Webpage http://www.disasterscharter.org/web/charter/activation_details?p_r_p_1415474252_assetId=ACT-287

For the French civil protection (DSC), this experience on Haiti constitutes a perfect case in terms of precision and of quality of products:

- The products (maps) from Charter data were supplied very rapidly and were directly exploitable.
- The thematic contents of maps were defined during the daily phone conferences between the DSC/COGIC, SERTIT (value adder) and the CNES PM.
- Charter products have been directly used in DSC operational chains.

Three types of use have been detailed by DSC:
- Decision-making tool: maps were systematically ingested into the COGIC GIS displayed on the walls of the command room (see figure 4). These maps provided a synoptic picture to organize and plan the activities of onsite relief workers who lack this bird’s eye view.
- Support on the ground: maps were transferred to the head of intervention teams and contributed to the elaboration of their strategy. Besides, the Units of Interventions left France with paper printings of Charter products.
- Information of the governmental authorities: maps were used as a basis information during meetings with the French President and Ministry of the Interior.

Another Charter User return of experience strengthens the judgment of the French DSC. Public Safety of Canada pointed out that:
they had direct contact with the Project Manager and they were kept up to date on any changes or modifications and when the products were ready.

- the products were widely used and distributed amongst their organization
- the overall contribution was excellent, it allowed to visualize the situation and provide situational awareness products and data to Senior Government Officials so they can in turn make better more informed decisions.

USGS Earthquake hazard program and UN-OSOOC (On-site Operations Coordination Centre) also send thanks and congratulations.

3. Conclusion

During an emergency situation, the challenge is to obtain a quick, reliable and clear view of the situation, in support of rescue operations.

Regarding the return of experience of the Haiti activation, the main points to be mentioned are:

- The good reactivity of the Charter: a few hours for first ALOS data provision
- The huge mobilization of Charter space agencies, and the most valuable contribution of US with VHR optical data, essential for earthquake (in total, downloading of around 50 satellite images).
- The very good coordination between Charter Users, Value Adders, Project Manager and Space agencies : 700 emails exchanged in 10 days

The interest of the Charter compared to other initiatives is the capacity of emergency tasking of satellites, which enables a rapid global assessment of situation to help decision making. The Charter represents an excellent example of a successful international collaboration for rapid satellite imagery and information provision.

References


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