SATELLITE-BASED DISASTER RECOVERY – A TOOLKIT

Over the past few years, the world has suffered a series of natural and manmade disasters and acts of terrorism that have left mankind feeling vulnerable.

In the aftermath of these disasters, satellite communications prove themselves time and time again to be invaluable.

SPPI NIGERIA establishes why and looks at the systems that help devastated areas get back on their feet.

Image of WINDS in orbit (Image: JAXA)

The Asian tsunami, 9/11, earthquakes in Peru and Pakistan, hurricanes in the United States – just a few examples of the disasters experienced by the human race in very recent memory. These occurrences are now part of our everyday lives and are tipped to become more frequent as a result of global warming and climate change.

In the event of a disaster communications are of paramount importance.

- Without them, requirements of the victims and organizations deployed there to assist cannot be met.
- Information must be allowed to flow in and out of the zone quickly, easily and efficiently and a line of communication must be open at all times.
- Without this aid and equipment, help cannot reach those that need it most.
- Administrations and businesses alike are now putting preparedness at the top of their lists.
- There is an emphasis put on ensuring that plans are in place before a disaster occurs instead of waiting for it to happen.
- Businesses in particular are looking for backing or failover' systems in the event of terrestrial infrastructure failure.

So what is this backup? It is satellite. Let's look at why and what capabilities are available.

THE SCENARIO

Once a disaster has occurred the first thing that must be re-established is communications.

- **The Asian tsunami** provides for us a comprehensive example of what **first responders** face in the aftermath of a devastating natural disaster.

- The **tsunami** completely wiped out any means of communication where it initially existed. The wave flattened everything leaving devastation.

WHAT NEEDED TO BE DONE

It was vitally important to restore communications so that the devastated area could communicate with the outside world to secure aid for the survivors and to begin the clean-up effort.

There are many considerations to be taken into account at this point. Issues such as;

- What, if any, infrastructure is left,
- The weather,
- Terrain,
- Gaining access to the area,
- Safety,
- Security

- **These must all be taken into account when deciding on the most effective means of communication to be used.**

WHAT IS I T ABOUT SATELLITE

It cannot be disputed that;

- Satellite-based solutions are often the only option available in times of crises.

- Satellite technology also facilitates the re-establishment of communications and is the most suitable means of communications in hostile and unstable conditions because:

•A natural disaster will often take out the available terrestrial infrastructure in an area and therefore there are no means of communication available to first responders acting on the spot.

•The beauty of satellite communications is that they may be easily transported to the area where they are required and deployed extremely quickly, often within minutes, so that communications are restored. The size and weight of equipment enable it to be flown and/or driven to its destination;

•Satellite communications have an **independent and instant infrastructure.** Once deployed in various locations via a star or mesh topology, they establish a network instantly;

•**Interoperability** is vitally important. The satellite network must be able to operator even using different equipment or solutions;

•Facilitate **shared capacity;**

•Satellite terminals are **robust and hard wearing** so that they may withstand even the harshest of conditions. They have been specially tested and modified to cope with all varieties of weather conditions;

•A satellite network is a **reliable network.**

Due to the situation of the network of satellite in Low Earth Orbit or Geosynchronous Orbit, there is excellent coverage of affected areas.

•Satellite can be deployed and operational in such a short period of time and can provide the vital services that are required in such situations such as voice, data and video through the use of various types of terminals.

•Satellite may provide narrowband and broadband IP communications for voice, data and video helping to move critical information around and in and out of a disaster zone.

THE STAGES OF A DISASTER

Once an NGO or government or humanitarian agency arrives at the scene of a disaster, decisions need to be made on how to progress. **One such organization is NetHope.**

- **NetHope** is based in the United States and is a non-for-profit IT consortium of leading NGOs, serving beneficiaries in over 150 countries every year.
- **NetHope** began as an informal collaboration and now operates as a non-profit corporation governed by its member NGOs. **Their members have well-established information and communications technology departments that use technology strategically to support their programmes. They work together through NetHope to collectively solve problems and leverage their technology investment to achieve higher levels of efficiency, quality and reach for their organization programms so that communities indeed can be better served.**
- **NetHope** enables member NGOs to deliver information and accelerate response to the most disadvantaged communities in remote developing areas by:
  - Sharing ICT knowledge for rapid and effective deployment and efficient operations
  - Collaborating with non-profit and industry leaders to development for best practices for public benefit technology deployment in the NGO world; and
  - Facilitating innovative and cost-effective use of ICT.
- **NetHope** aims to be catalyst for collaboration in the international NGO community **and enable best of technology for connectivity in the developing parts of the world.**

NetHope has participated in the rehabilitation of areas affected by disasters and produced a compendium of learning from their engagement in various parts of the world including **Indonesia, Sri Lanka and Pakistan. They define clear stages of a disaster;**

Stage 1 – within hours of disaster striking, **first relief workers** arrive on the ground.

- **The most urgent and immediate need in hostile environment is to survey and assess damage, transmit pictures, security information, relief material and personnel requirements to Head Offices.**

- **Agencies secede at this stage how deeply involved they will be with highly mobile, temporary and transient computing, communication and power solutions;**

Stage 2 – Within two week s of a disaster striking; Teams begin to arrive on the scene as risk of disease and malnutrition escalates .

- **Requirements** are continuous mentoring of disaster, assessment of victim needs, management of relief material deployment between and across aid agencies, personnel security, application and reporting of donated funds, uploading of case studies, pictures and relief reports.

- **This stage is characterized by small (up to 10 people), often roving groups who need easy-to-setup-and-takedown computing, communication and power solutions;**

Stage 3 – From one month of a disaster striking to multiyear;

- Agencies provide resources for building reconstruction, counseling, family reunification, food distribution, water purification, etc and becoming part of the community over a long period of time.

- **This stage is characterized by large (20 or more people) groups in fixed office scenarios, with the potential of moving to different office locations as the situation unfolds.**

WHAT KIND OF SATELLITE COMMUNICATION IS REQUIRED

As we have seen, when an NGO or government agency is considering their options on arrival at a scene of devastation, it is important that the choices they make regarding **satellite communcations are the right one and that they decide upon the correct type of satellite terminal for the job they are carrying out.**

There are various options available on the market at present. Let's look at the choices a humanitarian or governmental organization has.

Mobile Satellite Services

Mobile Satellite Services or MSS are available in the form of telephone handsets and also terminals that may be transported on vehicles, vessels and aircraft such as helicopters.

Applications Supported by MSS Services:

- Mobile telephony;
- Push to talk radio;
- Emergency Response Co-ordination;
- Communications-on-the-Move;
- Asset tracking;
- Data transfer;
- Lone worker protection;
- Environmental mentoring;
- Event reporting' and
- Messaging.

Handheld mobile satellite phones are a versatile and reliable way of keeping in touch whilst moving around.

- ACeS of the Philippines has introduced the R190. this is the world's smallest mobile satellite phone. It weights less than 200 grams, measures similar to contemporary GSM phones and is a dual mode phone: ACeS Satellite and GSM 900.
- The ACsS system also includes several high-quality personal mobile satellite communication capabilities that makes it user-friendly and extremely flexible.

For example, digital voice, alerting and paging services, data transmission, call transfer, call forwarding, call waiting, call holding, conference calls, three-party service, call baring, operator intervention, assistance, call trace.

- The ACsS handset provides a voice quality similar to digital cellular systems.

Features:

- Full regional coverage;
- Dual mode ACeS/ GSM 900;
- Seamless roaming capability in ACeS and GSM900 networks;
- Pocket size;
- New icon-driven menu;
- Smart dialing;
- Flexing phone book features; and
- Full range of accessories

It supports supplementary services (network operator dependent) such as:

- Short message (SMS) in GSM mode;
- SMS, cell broadcast in GSM mode;
- CLI (CLIP/CLIR) in GSM mode;
- AoC/I (advice of charge/information) in GSM mode
- A0C/C (advice of charge/charging) in GSM mode;
- Call hold/wait in ACeS and GSM mode;
- Multiparty in ACeS and GSM mode;
- Call divert in ACeS and GSM mode;
- Call barring in ACeS and GSM mode;
- Call transfer in ACsS and GSM mode; and
- Fixed dialing numbers.
- **Inmarsat** have also joined the handheld satellite market with the introduction of the **iSatPhone** in June 2007 which is a lightweight and pocket sized handset with a rugged design to cope with demanding environments.
- It is the first handheld satellite phone in the Inmarset portfolio and is a dual mode satellite/GSM phone **targeted at business and personal users who travel and work in areas where local telephone networks are unreliable or non-existent.**
- The service comes with additional features such as call hold and call waiting, conference calls for up to five participants and, in GSM mode, SMS.

- BGAN is Inmarsat's mobile satellite service that offers broadband data and simultaneous voice through a single, truly portable device. It also offers guaranteed data rates on demand –up to 256kbps – for live feeds and video conferencing. Ideal for first responders, it provides a mobile 'command post' helping to maintain situational awareness. It is easy to transport and quick to set up and use.

- BGAN is also very reliable due to the fact that network capacity may be dynamically re-directed to areas of high usage and can maintain bandwidth availability even as other agencies arrive at the disaster zone.

- BGAN is accessible all over the world in Asia, Europe, Africa, the Middle East and North and South America.

FIXED SATELLITE SERVICES

Fixed Satellite Services or FSS are suitable where humanitarian or governmental organizations require a more permanent means of communications and know they will be situated in a certain location for a certain period of time. FSS uses terrestrial terminals to communicate with satellites.

Applications for FSS include:

- Cellular restoration;
- Wi-Fi restoration;
- Emergency phone;
- Communications-on-the-move;
- PSTN backhaul;
- VoIP;
- Broadband internet;
- Live video;
- Telemedicine; and
- Video conferencing.

APPLICATION OF VSAT TECHNOLOGY

The challenge of restoring communications is easily met with VSAT technology.

- The VSAT may be deployed in a timely and efficient manner.
- The nature of the technology means that it is able to integrate into an existing system but also has the ability, using a Mesh topology, to communicate with any site without the use of a central hub.
- A star topology will enable two-way communications between any site ands a central hub and can provide access to voice, data, Internet and video.
- Above all, VSATs are cost effective and are now easy to use. A small antenna of only 1m in diameter can provide all the communication required in a disaster situation and may be transported easily to the site due to the fact that the dish will, in many instances, break down into smaller, more manageable and more transportable pieces.
- The VSAT is also suitable for longer periods of deployment and is perfect for establishing a hub for connectively in affected areas for use by NGOs and also inhabitants of affected locations.

Regulation

Satellite services cannot be deployed in a disaster situation without the relevant clearance and licensing from the authorities of any country.

It is vital that all paperwork is pre-arranged and licenses obtained before deployment.

- The Tampere Convention on the Provision of Telecommunications Resources for Disaster Mitigation and Relief operations was unanimously adopted by the delegation of 60 states participating in the Intergovernmental Conference on Emergency Telecommunications in 1998.

- The Convention is an international tool for ensuring the prompt delivery of communications in the event of a disaster.

- The Convention came into force just two weeks after the devastating Asian tsunami when it was ratified by the necessary 30th country. There have been several moves to encourage more countries to adopt this incredibly important Convention that ultimately saves lives.

- The Tampere Convention calls on States to facilitate the provision of prompt telecommunication assistance and operation of reliable, flexible telecommunication services.

Regulatory barriers that impede the use of telecommunication resources for disasters are waived. These barriers include:

the licensing requirements to use allocated frequencies, restrictions on the import of telecommunication equipment as well as limitations on the movement of humanitarian teams.

- The Convention also safeguards the privileges, immunities and facilities granted to persons providing disaster assistance by granting them immunity from arrest and detention and exempting them from taxation and duties. As the first treaty of its kind;

- the Convention also defines the non-governmental organizations and non-State entities whose personnel would be granted these privileges and immunities when engaged in supporting the work of UN humanitarian and recourse organization each as United Nations High Commission for Refugees (UNHCR), OCHA and the International Federation of Red Cross and Red Crescent Societies (IFRC).
- The Convention defines the overall framework for the cooperation among States parties and all other partners in international humanitarian assistance.
- It describes the procedures for request and provision of telecommunication assistance, recognizing the right of a State party to direct, control and coordinate assistance provided under the Convention within its territory.
- It defines specific elements and aspects of the provision of telecommunication assistance, such as termination of assistance and settlement of disputes.
- **It requires States to make an inventory of the resources – both human and material – available for disaster mitigation and relief, and to develop a telecommunication action plan that identifies the steps necessary to deploy those resources.**

THE RIGHT DECISION

The decision to use satellite-based solutions in order to restore communications to disaster-hit areas is not just the right one but it is more often than not the only one.

- Versatile, robust, flexible, accessible, easy to deploy – it addresses all the principal areas of concern and play a part from the immediate aftermath of a disaster right to the end, where communications are re-established and months have passed.
- It can even help introduce new business and prosperity to an affected area.
- The importance of communication cannot be underestimated and the fact that an agency can simply ship and move in an entire communications system that is independent of any terrestrial infrastructure is surely a gift in a box.
- If the correct decisions are made at each stage of thee recovery, all communications including voice, video, data, email, Internet access can be made available and those dealing with disaster on the ground, no matter where they are can have direct contact with those back at a base or at headquarters.
- The lifeline that satellite communication provides is invaluable not just to those working in an affected area but even more so those who have lived through the devastation.

SPACE TECHNOLOGY AT NEMA MCC FOR SEARCH AND RESCUE OPERATION

Nigeria has acquired and deployed space technology (using **COSPAS-SARSAT**) as part of efforts towards facilitating disaster management in the country.

- The **COSPAS-SARSAT** is satellite-based equipment which provides distress alert and location information for search and Rescue services for Maritime, Aviation and Land Users in distress.
- The **COSPAS-SARSAT** secretariat serves as a gateway for space-based information for disaster management support for the entire West African sub-region.
- The **COSPAS-SARSAT** system calls for:
  - Simulation and assessment tools for emergency readiness and response training
  - Acquisition of facilities and strategies required to set-up functional satellite based regional support offices for search and rescue operations.
  - Designing a network of spacecraft and regional facilities of distress beacon during emergencies.
  - Creation of space-based information using data-based system and a Knowledge Portal Content Management System (KPCMS) for the West African sub-region.
  - Putting satellite Earth observation information to use: Applications of satellite Imagery and Remote sensing

EMERGENCY RESPONSE

When a natural disaster occurs, emergency responders equipped with high-resolution satellite imagery can quickly:

- Locate areas in danger
- Identify at-risk structures
- Map evacuation routes
- Monitor areas regularly to help prepare for events

For example, for fire planning and mitigation, <u>Multi-spectral satellite imagery help:</u>

- Identify fire-prone areas.
- Predict fire spread with fire-behaviour software.
- Support monitoring and control measures.
- Map and measure damage in the aftermath of the disaster.

Note that:

Remote sensing satellite:

- Survey the global ecological system – provides invaluable insight into factors such as the greenhouse effect and the ozone hole.
- Survey the global meteorological processes – Meteorological satellite systems watch the worlds weather patterns, warning of storms and potential climatic disasters with ever increasing precision.

CASE STUDY: Uganda floor victims receive telecommunication links – ITU deploys satellite terminals in affected districts.

- The International Telecommunication Union deployed 25 satellite terminates to help restore vital communication links in the aftermath of the floods that have affected the eastern and northern regions of Uganda since August 2007.
- Several districts were ravaged by torrential rains and flash floods that swept through the country taking lives, marooning over 140,000 people, destroying road and communication links, and submerging crops, compelling the government to declare a state of emergency.
- With the restoration of communication links, designated government officials and other humanitarian agencies were able to more efficiently coordinate relief operations.
- The mobile terminals were transported by helicopter to serve people most in need.

Image of WINDS in orbit (Image: JAXA)

SSPI NIGERIA is a non-profit member-benefit International Professionals Development Society that serves satellite communications industry professionals throughout their working lives.

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