



ITU-D STUDY GROUP 2 4th STUDY PERIOD (2006-2010)

## QUESTION 22/2:

*Utilization of ICT for disaster management, resources, and active and passive space-based sensing systems as they apply to disaster and emergency relief situations*



## THE STUDY GROUPS OF ITU-D

In accordance with Resolution 2 (Doha, 2006), WTDC-06 maintained two study groups and determined the Questions to be studied by them. The working procedures to be followed by the study groups are defined in Resolution 1 (Doha, 2006) adopted by WTDC-06. For the period 2006-2010, Study Group 1 was entrusted with the study of nine Questions in the field of telecommunication development strategies and policies. Study Group 2 was entrusted with the study of ten Questions in the field of development and management of telecommunication services and networks and ICT applications.

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**This report has been prepared by many experts from different administrations and companies. The mention of specific companies or products does not imply any endorsement or recommendation by ITU.**

## PREFACE

It is a pleasure to present the final report of the ITU-D Study Group 2 Question 22/2 on the Utilization of ICT for disaster management, resources, and active and passive space-based sensing systems as they apply to disaster and emergency relief situations. The report provides guidelines for the implementation of satellite telecommunications for disaster management in developing countries. The report builds on the findings of the recently published Guidelines on the Common Alerting Protocol (CAP) which was also published as collaborative work between the ITU-D Study Group 2 Question 22/2 and the ITU-D Doha Action Plan Programme 6.

Satellite services support a wider range of voice, data and video applications that enable first responders and relief workers to have access to critical communications when the terrestrial network infrastructure is damaged or the Public Switched Telephone Network (PSTN) is overloaded. Based on the extensive work that we are undertaking across the globe in the area of emergency telecommunications, satellite services have proved to be critical in addressing a wide range of telecommunications links such as fixed-to-fixed (connecting emergency response headquarters to the field), fixed-to-mobile (connecting emergency response headquarters to mobile response units), mobile-to-mobile, and point-to-multipoint (disseminating critical information to citizens). In addition, satellite networks can provide direct connectivity to remote areas, provide a rapidly deployable, short-term solution for emergency response or relief teams, and enable interoperability among user groups and between different systems and networks.

I take this opportunity to commend the exchange and sharing of information between the ITU-D Study Group 2 Question 22/2 and relevant ITU-R and ITU-T Study Groups. This has enriched this report. I am convinced that ICT policy-makers, satellite operators, humanitarian organizations, Non-Governmental Organizations, and researchers will find this report a vital resource in their work and activities. I hope that the contents of this report will provoke debate and stimulate analysis that will ultimately advance better understanding on the role that satellite communications play in disaster management.

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## QUESTION 22-2/2

### Guidelines for implementation of satellite telecommunications for disaster management in developing countries

#### 1 Introduction

In the wake of recent natural and man-made disasters, critical lessons have been learned about the necessity of radiocommunications networks and technologies for disaster management, including response, relief and recovery. Complete or partial breakdowns of radiocommunications systems challenge relief efforts and underscore the need for Administrations and organizations to develop or modernize disaster preparedness plans to include more reliable and redundant telecommunications systems. As satellites are not as susceptible to disruption during natural or man-made disasters, satellite applications have been demonstrated as an essential component of any country's disaster telecommunications management strategy.

#### 1.1 Scope

Space-based technologies are an integral part of disaster telecommunications management frameworks at all stages of disaster management. Whereas, Study Group 2 of the ITU-Development Sector (ITU-D), in close collaboration with ITU-R Study Group 7, has already reviewed those aspects related to environmental monitoring and disaster prediction and detection,<sup>1</sup> this Report focuses on the implementation of satellite-based technologies and applications for disaster preparedness, response, relief and recovery.

This Report also draws upon the ongoing work in ITU-D Programme 6 and provides an overview of satellite telecommunications technologies and applications appropriate for disaster response and relief and offers implementation guidelines for developing countries. This report is intended as a guide for policymakers, disaster relief officials, and emergency managers on the integration of satellite services in disaster communications management plans and strategies. The content draws upon the ongoing work of ITU-D Programme 6, as well as the technical expertise of the ITU Radiocommunication (ITU-R) and Standardization Sectors (ITU-T), and in some sections incorporates material from ITU-R and ITU-T Recommendations. Readers are encouraged to review the list of associated ITU reports, resolutions and recommendations referenced in Annex I for additional detail on the technologies described.

#### 1.2 Report Structure

1.2.1 *Section 2* contains a technical overview of satellite radiocommunications networks as applied to disaster management.

1.2.2 *Section 3* provides information on the activities of ITU-D Programme 6 in addressing the disaster telecommunications requirements of Member States.

1.2.3 *Section 4* provides case studies based on specific country experiences drawn from contributions to ITU-D Study Group 2 Question 22/2 during its 2006-2009 Study Period. This section also provides an overview of themes in implementation successes and challenges that have been drawn from those case studies.

1.2.4 *Section 5* provides implementation proposals, including consideration of technology selection, regulatory and licensing implications, access for persons with disabilities and special needs, and capacity building relevant to the effective deployment of satellite systems for disaster management.

1.2.5 *Section 6* offers additional information on the work of the ITU and the United Nations in providing disaster telecommunications support for developing countries.

1.2.6 *Section 7* is the report conclusion.

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<sup>1</sup> ITU-D SG2 *Report on Use of Remote Sensing for Disaster Prediction, Detection and Mitigation* (insert link to final report – when published in August 2009).

1.2.7 *Annex I* is a list of ITU Resolutions, Recommendations and Reports related to emergency communications, specifically those addressing satellite radiocommunications.

## 2 Overview of Satellite Radiocommunications Technologies and Applications

There are numerous satellite networks in orbit which provide support for disaster relief operations on a global basis and in accordance with the relevant ITU-R resolutions including ITU-R 53 and 55 (Radio Assembly Geneva-2007) and WRC Resolution 644 (Rev. WRC-07), Resolution 646 (WRC-03), and Resolution 647 (WRC-07), which will be detailed later in this report. Moreover, there is ongoing work within ITU-R Study Group 4 to consider technical aspects of the use of satellite telecommunications for disaster relief. This section provides an overview of the wide range of available satellite services and technologies and their applicability to disaster response, relief and recovery operations.<sup>2</sup>

### 2.1 Basic Characteristics and Functionality

Satellite services support a wide range of voice, data and video applications that enable first responders and relief workers to have access to critical communications when the terrestrial network infrastructure is damaged or the fixed and mobile PSTN is overloaded. Satellite services are capable of addressing a wide range of telecommunications requirements:

- Fixed-to-Fixed (connecting emergency response headquarters to the field)
- Fixed-to-Mobile (connecting emergency response headquarters to mobile response units)
- Mobile-to-Mobile (connecting mobile response units to teams in the air or at sea)
- Point-to-Multipoint (broadcasting critical information to citizens)

Satellite networks can provide direct connectivity to remote areas, provide a rapidly deployable, short-term solution for emergency response or relief teams, and enable interoperability among user groups and between different systems and networks. Importantly, satellite services are invaluable in developing countries where infrastructure may not have high levels of built-in redundancy to protect it from disasters, and in remote and rural areas where terrestrial networks may not be available. In the case of a disaster, satellite applications offer reliable solutions that should be incorporated in some way into disaster telecommunications management plans.

The underlying technical characteristics of satellite systems which make applications especially beneficial for disaster telecommunications management include:

- Enabling regional and/or global coverage (ubiquitous)
- Operating independently from terrestrial (local) infrastructures and oftentimes local power sources
- Capable of connecting to public networks
- Supporting rapidly deployable mobile and portable fixed solutions
- Offering redundancy, backhaul and surge capacity to complement critical terrestrial networks

### 2.2 Satellite Networks Overview

The ITU has three broad radiocommunications satellite service categories: Fixed Satellite Service (FSS), Mobile Satellite Service (MSS) and Broadcasting Satellite Service (BSS). While some of the basic characteristics of these services are similar, there are crucial differences in their network architecture, capabilities and service offerings.

FSS and BSS operators are capable of providing capacity for fixed-to-fixed and point-to-multipoint services. Both FSS and BSS typically operate from the geostationary (GSO) orbit 36,000 kilometers above the equator. GSO satellites circle the Earth once every 24 hours in step with the Earth's rotation, and so appear to be fixed in the same place in the sky, making antenna pointing relatively straight-forward for both the ground

<sup>2</sup> Some of the content in Section 2 has been derived from the *First Responder's Guide to Satellite Communications* developed by the Satellite Industry Association (SIA). Readers can find additional detail and an electronic version of the complete guide on [www.sia.org](http://www.sia.org).

station and satellite antennas. Depending on how the system is configured, a single GSO satellite can be capable of offering service coverage of up to one-third of the Earth's surface.

For relief operations, due to the essential requirement of having small antennas, it is preferable to operate the network in the 12/14 GHz band or in the 20/30 GHz band. Although bands such as 4/6 GHz require larger antennas, they are also suitable depending on conditions of transmission and coverage of satellite resources. In order to avoid interference, it should be taken into account that some bands are shared with terrestrial services.<sup>3</sup>

MSS systems offer voice and lower-rate data services to portable satellite phones and vehicle-mounted terminals for ships, aircraft, trucks or automobiles. MSS systems operate from both the GSO and Low Earth Orbits (LEO), but the user is usually unaware of the orbit used and can simply connect, similar to how someone would use a cellular phone or modem without reference to the specific terrestrial network they are on.

Global Mobile Personal Communications Systems (GMPCS) fall under the MSS category, and indicate highly-portable variants of MSS systems. These applications are particularly suitable for situations where a high degree of mobility is required. While a line of sight connection to the satellite is required, their mostly-omni directional antennas need not be aligned accurately.<sup>4</sup>

### 2.3 Fixed Satellite Service (FSS)

This section provides an overview of the use of systems in the fixed-satellite service (FSS) in the event of natural disasters and similar emergencies for warning and relief operations. Detailed technical specifications of systems and terminal designs suitable for use for emergency telecommunications can be found in Recommendation S.1001-1 "The use of systems in the fixed satellite service in the event of natural disasters and similar emergencies for warning and relief operations" and ITU-R Report S.[REP-1001], "Use and examples of systems in the fixed-satellite service in the event of natural disasters and similar emergencies for warning and relief operations."<sup>5</sup> Detailed characteristics, operational aspects and ground segment deployment considerations for FSS systems are found in the ITU-R fixed-satellite service Handbook.

#### 2.3.1 FSS Applications

FSS applications typically used for disaster telecommunications operations include fixed Very Small Aperture Terminals (VSATs), vehicle-mounted earth stations or transportable earth stations, with access to an existing satellite system. Dishes for disaster relief and recovery are often smaller to allow for rapid transportation to, and installation at, the disaster area. It is also desirable that the system relies on widespread standards so that equipment is readily available and interoperability and reliability are ensured. There also are applications that enable FSS systems to communicate with mobile platforms.

The basic telecommunication architecture for relief operations should be composed of a link connecting the disaster area and designated relief centers, supporting basic telecommunication services comprising at least telephony, any kind of data (IP, datagrams, facsimile), and video. FSS systems also support news gathering requirements that arise during disaster events. For such transmission, digital transmission technologies are employed in most cases.

#### 2.3.2 VSAT Systems

A very small aperture terminal (VSAT) is a type of earth station that is commonly used to meet emergency telecommunications requirements. A VSAT network consists of a pre-positioned, fixed or transportable VSAT that connects to a hub station to provide radiocommunications links to emergency response units and other related sites.

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<sup>3</sup> ITU-R Recommendation S.1001 *Use of systems in the fixed-satellite service in the event of natural disasters and similar emergencies for warning and relief operations.*

<sup>4</sup> *Compendium of ITU's work on Emergency Telecommunications* (2007).

<sup>5</sup> Both the revised ITU-R Recommendation and Report were approved by the September 2009 meeting of ITU-R Study Group 4 and are pending Member State Approval.

Antennas typically range in size from less than one meter to five meters, depending on factors including the frequency band used and the volume of traffic (data rate) required. They are mostly designed for fixed installation, but so-called “fly-away” systems are available for disaster recovery purposes and are transportable and quickly made operational with no special tools or test equipment for installation. Importantly, most VSAT ground networks use open standards supporting multiple systems, platforms and applications.

VSATs and other earth stations may be divided into the following major subsystems:

- antenna
- power amplifier
- low noise receiver
- modem
- ground network equipment
- control and monitoring equipment
- terminal equipment, including facsimile and telephones
- support facilities

VSAT systems typically used for emergency response provide two way connectivity of up to several Mbps for applications including voice, data, video and Internet. In order to best support requirements for disaster telecommunications management, satellite solutions should be evaluated based on size, ease of installation and transportation, weight of materials, and frequency and bandwidth requirements. Section 5 of this report provides additional guidelines on technology selection.

### 2.3.3 Transportable Earth Station System Description

Efforts have been made to decrease the size and to improve transportability of earth stations so as to facilitate use of satellite services. This allows the occasional or temporary use of these earth stations for relief operations anywhere a disaster might occur. Such temporary earth stations are installed either in a vehicle or transported as part of a hand-carried “communications suitcase.” In the 14/12 GHz and 30/20 GHz bands, transportable stations typically have antennas of 1.2 m diameter or less. A vehicle equipped earth station in which all the necessary equipment is installed in the vehicle, e.g. a four-wheel drive van, permits operation within 10 minutes of arrival including all necessary actions such as antenna direction adjustments.

A portable earth station is disassembled prior to transportation and quickly reassembled at the site. The size and weight of the equipment normally allow it to be carried by hand by one or two persons, and the containers are within the limit of the International Air Transport Association (IATA) checked luggage regulations if transported by air. Total weight of this type of earth station including power generator and antenna assembly is reported to be as low as 150 kg, but 200 kg is more usual.

### 2.3.4 Network Restoration<sup>6</sup>

VSAT networks can also support basic telecommunications infrastructure restoration requirements including the Public Switched Telephone Network (PSTN). When demand for emergency telecommunications increases, VSATs can offer high-speed Internet connections that are independent of the local Telco ground system infrastructure to re-establish voice, data and video connectivity. VSAT networks equally provide for restoration of wireless cellular nodes and WiMAX WAN (Wide Area Network) networks to be re-established for private first responders networks or to reconstitute local Telcos and Internet Service Providers (ISPs).

### 2.3.5 FSS Mobile Applications<sup>7</sup>

FSS has increasingly been extended to support mobile-type applications. Equipment is now available to permit a full 10 Mbps downlink channel to be delivered via FSS to a vehicle in motion and a 512 Kbps

<sup>6</sup> *First Responders Guide to Satellite Communications* (Satellite Industry Association)

<sup>7</sup> *Ibid*

uplink channel can be transmitted from a vehicle to the Internet using IP support for voice, video and data simultaneously.

## 2.4 Mobile Satellite Service (MSS)

MSS applications are ideally suited for emergency response coordination, where disaster response scenarios might cover wide areas, as they support communications on the move. Furthermore, most mobile earth stations (MESs) are battery powered, and can be operated from solar chargers, and so can function for some period of time even if the local electricity supply is disabled. There additionally are new integrated applications which enable integration of satellite and terrestrial cellular technologies. Such network architecture provides network redundancy in the event of failure of the terrestrial or satellite component.

This section provides an overview of systems in the Mobile Satellite Service (MSS) and their applicability for disaster response and relief efforts. Detailed characteristics, operational aspects and ground segment deployment considerations for MSS systems can be found in Recommendation ITU-R M.[MOBDIS] – “Use of mobile-satellite service (MSS) in disaster response and relief” and Report ITU-R M.[REP-MOBDIS] – “Use and examples of mobile-satellite service systems for relief operation in the event of natural disasters and similar emergencies.”<sup>8</sup> Readers are also encouraged to refer to the ITU-R Mobile-Satellite Service Handbook.

### 2.4.1 MSS Applications

The MSS systems currently in operation are able to provide voice and data communications and access to the Internet. Further, these systems can facilitate access to public and private networks external to the MSS system.

- Mobile voice
- Short Messaging Service (SMS)
- Internet access through handheld terminals
- Broadband data
- Short burst data services
- Push-to-Talk Radio
- Environmental tracking and alerting via remote transmitters
- Data transfer, including live video (using links at least 64 kbps)

MSS systems are also well suited to providing the distribution of information over widespread areas and of collecting information from remotely located transmitters over these same widespread areas. The information disseminated can be used to warn of impending disasters or announce relief provisions. Information useful in predicting impending disasters can be easily collected using unattended, remotely located transmitters. MSS systems may be used in conjunction with sensor or local environmental data collection systems to transmit such data back to a central location that would be responsible for making decisions based on this retrieved data.

## 2.5 Broadcast Satellite Service (BSS)

Broadcast Satellite Services (BSS) can provide means for alerting the public, for informing them of preventive measures and for disseminating information on the coordination of rescue procedures. Recommendation ITU-R BO.1774-1 provides characteristics of satellite and terrestrial broadcasting systems used for disaster mitigation and relief operations. Detailed descriptions of these systems are also given as guidance. The aim of this Recommendation is to help permit the rapid deployment of equipment and networks currently available in the terrestrial and satellite-broadcasting services. These services can provide means for alerting the public, for informing them of preventive measures and for disseminating information on the coordination of rescue procedures.

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<sup>8</sup> Both the ITU MSS Recommendation and Report were approved in September 2009 by ITU-R Study Group 4 and are pending Member State approval.

The Recommendation also gives technical guidance on the improved usage of terrestrial and satellite broadcast services in cases of natural disasters and contains information regarding an emergency warning system (EWS).

### **2.5.1 Common Alerting Protocol (CAP)**

The goal of public warning is to reduce the damage and loss of life caused by a natural or man-made hazard event. The Common Alerting Protocol is a standard that allows a warning message to be consistently disseminated simultaneously over different systems and applications.

The Common Alerting Protocol (CAP) v.1.1 developed by OASIS was the basis for ITU-T Recommendation X.1303. This Recommendation has helped ensure that CAP is deployed worldwide giving technical compatibility for users across all countries.

CAP is a simple, lightweight XML-based schema that provides a general-purpose format for the exchange of emergency alerts for safety, security, fire, health, earthquake and other events over any network. CAP associates emergency event data (such as public warning statements, photographs, sensor data or URIs) with basic metadata such as time, source and level of urgency, and with geographic locations. The original V.1.1 specification was enlarged by a binary ASN.1 specification of the CAP messages that will enable the transport of CAP messages to VoIP terminals using H.323 among other systems. Experts say the use of ASN.1 significantly reduces the size of the message and therefore the potential for network congestion. OASIS Emergency Management Technical Committee has also adopted the same extension.

CAP is successfully in use by a number of public emergency services and land management agencies today, and works with a wide variety of devices and messaging methods. ITU-D Study Group 2 published a Report to provide guidelines for developing countries in the implementation of CAP for public warning. Administrations and organizations, including satellite service providers, are encouraged to review this ITU-D Report for additional information on CAP implementation.

## **3 ITU-D Programme 6 Activities**

### **3.1 Overview of Implementation of Satellite Applications for Emergency Telecommunications**

The Doha Action Plan adopted by the World Telecommunication Development Conference in March of 2006 includes provisions for the implementation of satellite applications for emergency telecommunications. Within the Doha Action Plan, Programme 6 provides assistance on disaster communications/emergency telecommunications to ITU Member States while paying special attention to the needs of least developed countries and Small Island Developing States (SIDS) that are the most vulnerable to the effects of climate change and global warming. To encourage the use of satellite applications in disaster mitigation and management, Programme 6 has focused attention on providing hands-on training to users of different kinds of satellite terminals as part of disaster preparedness and on the resiliency of satellite systems in the event of an emergency by facilitating deployment of satellite services following disaster events.

### **3.2 Direct ITU Assistance to Member States for Disaster Preparedness and Planning**

Through the coordination of the ITU and other relevant governmental and non-governmental stakeholders, strategic planning, standards and best practices related to emergency telecommunications use have been adopted by national governments and are now being implemented across the developing world.

Programme 6 has helped countries to develop National Emergency Telecommunications Plans (NETPs) and Climate Change Adaptation Plans (CCAPs) to coordinate the effective use of telecommunications in the event of an emergency. Moreover, Programme 6 has sought to create Standard Operating Procedures (SOPs) on the application and use of ICT for early warning, response/relief and reconstruction. Countries that have been assisted in 2009 include Bulgaria, Zambia, Peru, Zimbabwe, Tanzania, Uganda, central American countries, central African countries, west African countries, Samoa, Indonesia, Tonga, and Philippines.

By establishing best practices for NETPs and SOPs through Programme 6, the ICT, working in conjunction with such agencies as the OCHA, WHO, FAO, WFP, UNHCR, has ensured that it will be at the core of

initiatives to create National Adaptation Programmes (NAPs) to help deal with the consequences of global warming.

Programme 6 is also working to coordinate the ratification and implementation of the UN's Tampere Convention in line with Resolution 34 (Rev. WTDC-06) by inviting those ITU administrations that have not yet ratified the Tampere Convention to do so. As a result, the total number of countries that have ratified the Tampere convention has increased to 40 from 34 in early 2008.

To further meet the needs of developing countries, Programme 6 has released a number of publications and best practices. Working with the Study Group 2 on Question 22/2, it also contributed to the publication of some guidelines documents. The publications include:

- The Compendium on ITU's Work on Emergency Telecommunications (2007)
- Best Practice on Emergency Telecommunications (2007)
- Guidelines on the Common Alerting Protocol (2008)
- Wireless Emergency Management Software (WEMS) for disaster alerting (2009).

### 3.3 Disaster Response

Through Programme 6, many Member States have requested assistance to enhance their natural disaster response efforts. Through the financial and in-kind support of ITU Sector Members and partners, the ITU has deployed large quantities of telecommunications equipment including satellite terminals to:

- Peru, in the aftermath of an earthquake measuring 7.9 on the Richter scale that struck on 15 August 2007
- Uganda, following floods that affected the eastern and northern regions of the country in 2007
- Zambia, following floods that inundated low-lying districts across the country and affected over 400,000 people in February 2008
- The Kyrgyz Republic, following an earthquake that struck the southern province of Osh in 2008.<sup>9</sup>
- Central China, following the severe earthquake that struck on 12 May 2008, with over 100 satellite terminals deployed to help restore vital communication links in the region.
- Myanmar, in the wake of Cyclone Nargis on 2 May 2008, with 100 satellite terminals to help restore communications in and around Yangon. ITU was one of the first agencies to arrive and deploy telecommunications resources in Myanmar and this rapid response was made possible thanks to the on-going implementation of the ITU Framework for Cooperation in Emergencies. Assistance was also provided in the area of Geographical Information Systems.
- Kingdom of Tonga after the sinking of the Princess Ashika on the 5th of August 2009. The ITU has deployed 10 Iridium satellite phones with solar panels to provide assistance for rescue operations. This disaster is the biggest that the island has faced in its history. The satellite equipment deployed by ITU was used by emergency services, the police and the line ministries involved in search and rescue operations that were carried out 85 kilometers North East of the main island Tongatapu. The equipment was also used by forensics teams to give real-time information to the operation base used for the identification of victims.
- Indonesia following two powerful earthquakes that struck near the city of Padang in the west Sumatra province. The main earthquake struck on 30 September 2009 with a magnitude of 7.6 some 85 km (55 miles) under the sea, north-west of Padang whilst the second quake of 6.8 struck close to Padang the following day. More than 1,000 people are known to have died and many more trapped after scores of buildings were sent crashing to the ground. The equipment provided by ITU was used to coordinate relief and rescue efforts by the government authorities and other humanitarian aid agencies.
- Samoa following the 8.3-magnitude quake that struck on 29 September 2009 and triggered the subsequent tsunami. ITU sent equipment which was used to help in search and rescue operations.

<sup>9</sup> <http://www.itu.int/ITU-D/emergencytelecoms/response/>

The emergency satellite equipment obtained by ITU through a number of partnerships is especially well-suited to the task of coordinating disaster relief operations and is compatible with existing government systems. The equipment uses both satellite and GSM networks and also provides accurate GPS coordinates to aid relief and rescue operations.

### 3.4 Forums, Workshops and Training

A series of global forums, regional training workshops, sub-regional workshops and national workshops on the role of telecommunications and ICTs including the use of satellite applications in disaster mitigation and management were held through Programme 6 of ITU-D's Doha Action Plan. These include:

International Cooperation on the Use of ICT (2007);

- The Global Forum on Effective Use of Telecommunications/ICT for Disaster Management: Saving Lives (2007). Details are available at: [www.itu.int/itu-d/globalforum](http://www.itu.int/itu-d/globalforum);
- A "Workshop on remote sensing in disaster management", held 10-11 December 2007, which included presentations from BR on the use of satellites in measuring and monitoring climate change and in assisting with emergency response to disasters;
- An ITU sub-regional workshop on the Role of Telecommunications in Disaster Management for the Central African region (Yaounde, Cameroon, 2007);
- A training workshop for the Central African region on Disaster Management including the integration of Emergency Telecommunications Plans into Disaster Management Plans (Kigali, Rwanda, 2008);
- The ITU Southern and Eastern Africa workshop on the Use of Telecommunications/ICT for Disaster Management: Saving Lives (Lusaka, Zambia, 2008);
- A workshop for countries from the West African region on the use of Information and Communication Technologies in Disaster Management (Dakar, Senegal, 2009);
- A Programme 6 organized joint ITU/League of Arab States/UN Agencies Regional Conference on Disaster Relief and Management;
- An advanced workshop on assisting central African countries cope with climate change and reduce the risks of disaster through the use of ICT to be held in Sao Tome and Principe in September 2009;
- A mission was undertaken during the third quarter of 2009 to Moscow to contribute to an event on the use of telemedicine in times of emergencies;
- A National Workshop on the Use of Information and Communication Technologies in Disaster Management was held in Kampala, Uganda (27-29 October, 2009). It brought together national stakeholders.
- A Central African Workshop on the Use of Telecommunications/ICT for Disaster Management was held in São Tomé & Príncipe, (21-25 September, 2009). It brought together central African countries. Participants were given hands-on training on operational and technical issues related to satellite terminals.
- A Central American Workshop on Disaster Management San Salvador, El Salvador (21-23 September, 2009). The workshop brought together central American countries to experience hands-on training on the latest satellite terminals that are deployed by ITU in the event of disasters.
- A joint ITU-Caribbean Comprehensive Disaster Management event held 7-11 in Jamaica. The event attracted all Caribbean countries.

Information, documents and results from these activities and events can be found on the ITU website.

### 3.5 Partnerships

Many partnership arrangements have been concluded by ITU/BDT and partners, including:

- Inmarsat Limited, providing funding for the procurement of high speed data and voice satellite terminals;



- The Australian Government, providing funding for emergency telecommunications related activities in the ASP region;
- Thuraya, providing a large number of satellite terminals supporting voice and data applications, as well as remote navigation services via the global positioning system;
- Télécoms Sans Frontières (TSF), promoting international cooperation and multi-stakeholder partnerships for emergency response;
- ICO Global Communications, providing funding to ITU's Framework for Cooperation in Emergencies (IFCE) and free airtime;
- A partnership agreement entered into with Iridium Satellite, LLC, providing satellite terminals, solar battery packs and free airtime worth millions of minutes;
- Terrestar Global, providing funding for ITU's emergency telecommunications activities in disaster relief;
- VIZADA providing satellite terminals
- International Amateur Radio Union (IARU), implementing joint projects and activities, and sharing information on emergency telecommunications and the role of the Amateur and Amateur-Satellite Services in disaster communications management;
- TANA Telemedicine Systems, collaborating to implement joint projects in telemedicine/e-Health aimed at saving lives when disasters strike;
- GEO, contributing to the IFCE through the coordination of earth observations and establishing a global, comprehensive and sustained system of earth observing systems;
- UNOSAT, providing a contribution through high resolution maps for relief and rehabilitation of telecommunication networks;
- Telemedicine and e-Health Training centre, Holy Family Hospital, providing e-health applications and services for disaster relief; and
- Qualcomm, providing a Qualcomm Deployable Base Station (QDBS) with a total estimated value of nearly USD 500,000.
- Inmarsat and Vizada SAS partnering with ITU to improve emergency communications for disaster preparedness and to coordinate relief activities in the aftermath of a disaster.

Programme 6 also collaborated in emergency telecommunications with the following organizations:

- The Civil Communications Planning Committee (CCPC) of the Euro-Atlantic Partnership Council
- The Asia Pacific Economic Cooperation (APEC) Telecommunications and Information Technologies Working Group
- The Humanitarian Development Programme
- The International Strategy for Disaster Reduction (ISDR)
- The United Nations Working Group on Emergency Telecommunications
- The World Meteorological Organization
- The Global Amateur Radio Emergency Communications (GAREC)
- The Rockefeller Foundation on Humanitarian Logistics.
- Commonwealth Secretariat and the Government of Uganda.

## **4 Case studies and country examples**

### **4.1 Introduction**

This section compiles relevant case studies and pilot programs considered throughout the 2006-2009 study period of ITU-D Study Group 2 Question 22/2. The case studies describe various ways in which countries, particularly developing countries, have used satellite networks and services for disaster response efforts.

ITU-D document numbers are cited so that readers may refer to the complete case study documentation on the ITU website.

## **4.2 Role of Satellite Telecommunications in Telemedicine during the Pakistan Earthquake (Pakistan)<sup>10</sup>**

### **4.2.1 Summary**

The effectiveness of emergency, diagnostic and preoperative telemedicine during disaster relief operations is a major field of interest. This case study describes the use of satellite links to support telemedicine operations following the 2006 earthquake in Pakistan, demonstrating the effectiveness of telemedicine to bridge the gap between the tertiary level health care setups and primary healthcare facilities.

### **4.2.2 Material and Methods**

The International Telecommunications Union (ITU) provided the Government of Pakistan with 40 Inmarsat Satellite modems during the earthquake of October 2005. 15 modems were provided to the Telemedicine & E-health training center at the Holy Family hospital, Rawalpindi. Mobile Telemedicine units were set up in the Northwest Frontier Provinces (NWFP) and Azad Kashmir, two of the areas most affected by the earthquake. Remote telemedicine mobile setups were stationed at Shohal Najaf field hospital Balakot NWFP, Hattian Bala and Muzaffarabad in Azad Kashmir to cater to the emergency and diagnostic medical needs of the affected areas of the earthquake. Equipment used was an IBM notebook, INMARSAT Satellite IP modem, webcam and digital camera. Training was given to persons conducting this study at the e-Health training center at Surgical Unit II Holy Family Hospital Rawalpindi.

### **4.2.3 Results**

The results at Balakot were based on a study of 28 patients who were present at the Shohal Najaf field hospital. These patients were provided with teleconsultations and were then sent to tertiary hospitals, where their hospital stays were minimized by the aforementioned consultations.

Mobile Telemedicine was also used effectively by Cuban teams providing emergency relief at the camp in Hattian Bala. By complementing emergency relief with mobile telemedicine units, the Cuban team improved outcomes and demonstrated the ease with which this telemedicine model could be replicated and deployed in the wake of disasters.

## **4.3 Usage of telemedicine to provide emergency assistance (Russian Federation)<sup>11</sup>**

### **4.3.1 Summary**

This section provides information on a project established by TANA Computerized Medical Systems Ltd. in collaboration with the Russian government. It describes satellite-based telemedicine support over three different disaster response stages: short, medium, and long term.

### **4.3.2 Materials and Methods**

In the event of an emergency, special Disaster Medicines Surveys units (DMS) respond along with conventional medical staff to assess the situation and provide medical immediate relief. DMS units can take the form of specialized trucks, airplanes, or smaller, trailer-based apparatus, and are equipped with diagnostic and therapeutic medical equipment in addition to satellite uplinks and an autonomous power supply.

DMS units can choose to deploy a mobile, multi-profile DMS hospital which, because of its enhanced telecommunications capacity, can more effectively coordinate the emergency response among regional medical centres. The DMS hospital can be deployed in 1 day to enhance the rapidity, adequacy and accuracy of the emergency response through the use of advanced information, communication and telemedicine technologies.

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<sup>10</sup> For additional information see ITU-D Study Group 2 Question 22/2 Document 2/31.

<sup>11</sup> For additional information on this project see ITU-D Study Group 2 Question 22/2 Document 2/36.

The DMS hospital is meant to play a pivotal role in the post-disaster triage process by sorting victims, providing first medical care and evacuating them to regional hospitals. The DMS hospital can also be used in the medium term to determine evacuation routes for victims. A field hospital based around the DMS unit can support up to 1000 injured victims with an average functioning time in the disaster zone of 7 to 10 days. In the longer term, the DMS hospital and other telemedicine complexes can be used to provide efficient communications with specialized clinics for the performance of remote treatment and rehabilitation of the injured.

#### **4.3.3 Results**

In the event of a disaster, the deployment of DMS units equipped with advanced communications equipment can speed and streamline the response to an emergency situation. Where fixed telecommunications infrastructure might otherwise have been destroyed, the DMS hospital can coordinate with other emergency responders while also disseminating information and instruction from the regional and national governments. Absent the capacity provided by this project, disaster response would be plagued by inefficient resource allocation in the immediate aftermath of a disaster. Moreover, in addition to responding to critical needs during a disaster, the mobile response unit is equipped to provide everyday social services for citizens, such as healthcare and communications services, making the equipment functional year-round.

#### **4.4 Disaster mitigation services in Indonesia – WINDS “Kizuna” satellite (Indonesia)<sup>12</sup>**

##### **4.4.1 Summary**

The Bandung Institute of Technology has been conducting experiments on the performance of ICT in disaster situations jointly with JAXA (Japan Aerospace Exploration Agency):

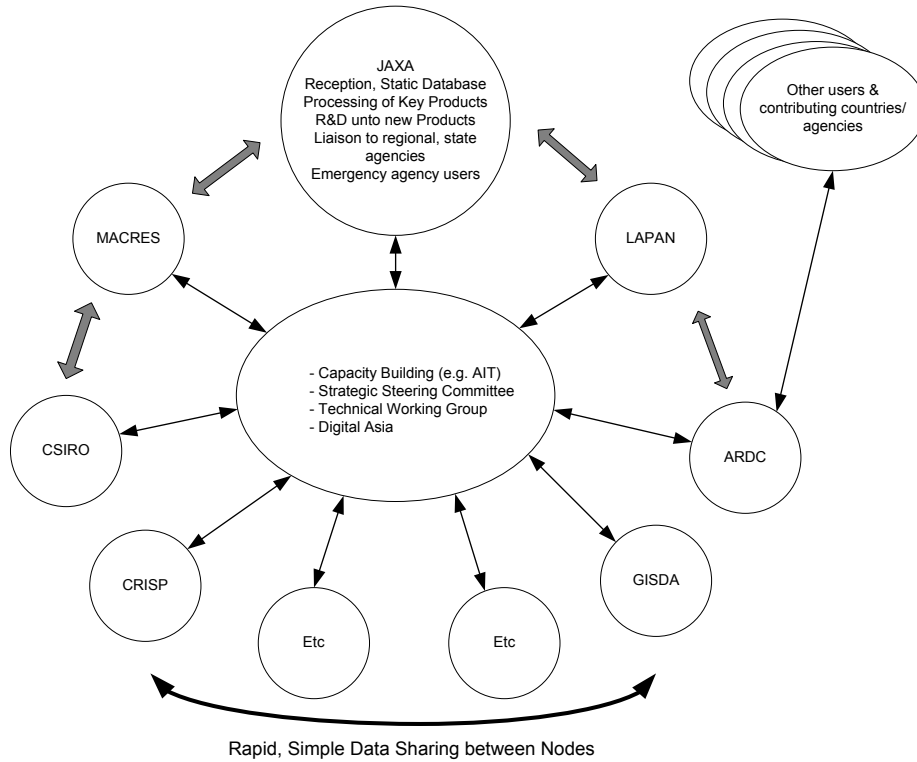
- Experiments on IP based Portable Rural Communication System using WINDS
- Technical performance of WINDS 30/20 GHz band satellite in Indonesia with its tropical environment
- Development of disaster mitigation management support and mobile telemedicine by WINDS system
- To accomplish disaster rapid response services
- To build satellite communication services that responds to crisis needs, and translates data into simple and useful information for the end users to accomplish the mission
- To refer to JAXA’s Sentinel-Asia, a satellite information distribution network for disaster management of Asia-Oceania.

##### **4.4.2 Materials and Methods**

The proposed ‘Sentinel Asia’ system is planned to operate as a collection of national nodes, all in direct internet communication with each other, which upload to the network simple, pre-processed satellite-derived information products for rapid incorporation into each nodes’ web-mapping system. The JAXA, AIT, Keio-University ‘Digital Asia’ project has offered to assist with establishment of hardware systems in countries which require such infrastructure. A central data delivery portal (of full web-based mapping server) at ADRC HQ’s will help in provision of the relevant data products to regional emergency agency users and/or re-direction to the national nodes for more detailed information of specific in-country disasters.

<sup>12</sup> For additional detail on this project see ITU-D Study Group 2 Question 22/2 Document 2/37.

**Figure 1: Proposed Concept of Operations:**



(E.g. distributed regional space-agency nodes)

Two types of nodes are envisioned: **NODE\_A** (Satellite-data providers) : those that already operate satellite receiving stations and associated data processing and archiving and distribution centre (e.g. MACRES, EORC-JAXA, CRISP, LAPAN); and, **NODE\_B** ('Digital Asia' nodes) those that receive the satellite information via the internet and then place it on the web-mapping system.

Figure 2: Communication Configuration to be used in the experiment

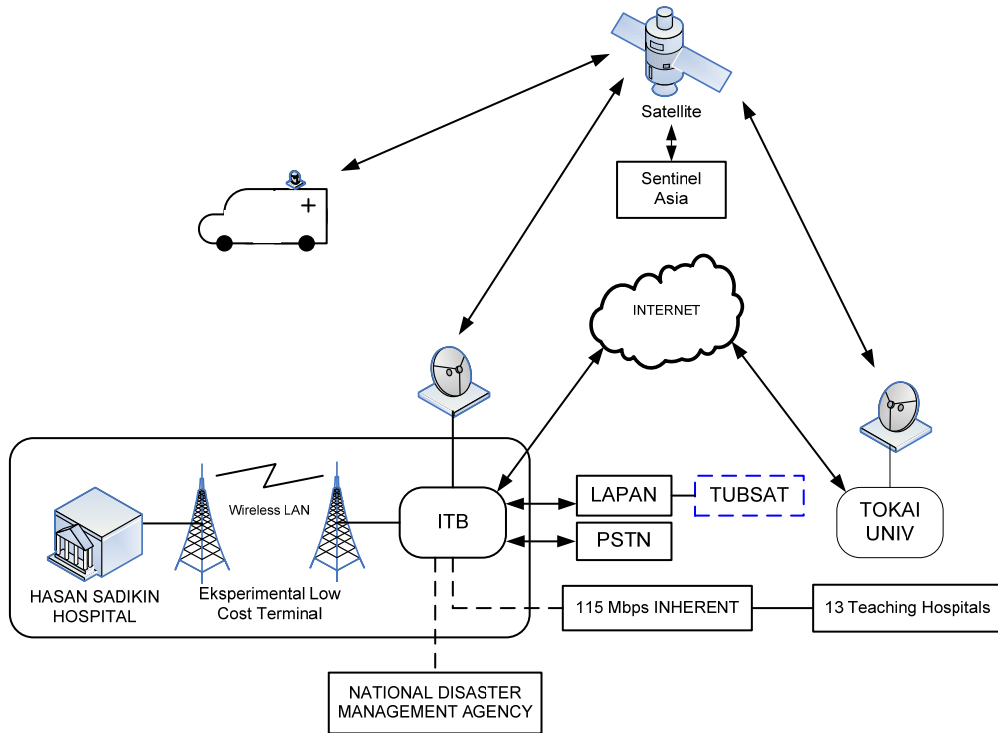
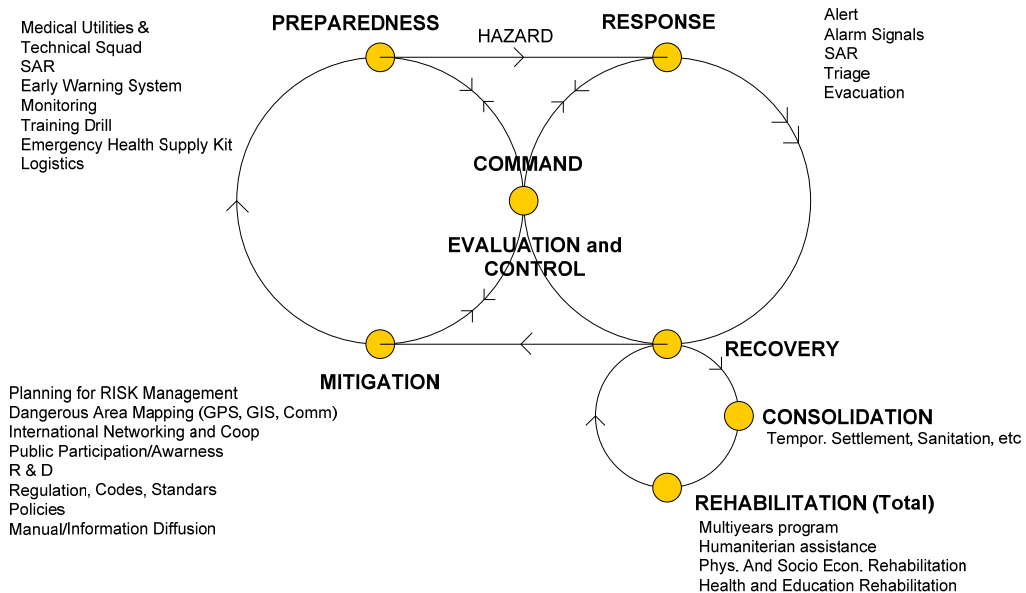


Figure 3: Strategic Disaster Management Cycles



#### 4.4.3 Expected Results and Applications

- Integration with Global Communication Network
- Ultra High Speed Communication Satellite
- Real time Data acquisition Processing and Information Dissemination
- More Accurate Earth Observation Satellites
- Precise location of landmarks, streets, buildings, emergency services resources, shelters and disaster relief sites, and evacuation paths
- Introduction of GNSS (Global Navigation Satellite System) coupled with other space-based Remote Sensing System
- Specific applications include: hazard and risk modeling of tsunami earthquakes, storms, diseases, pandemics; models of extreme oceanic, land and atmospheric phenomena as well as pandemic outbreaks; damage assessment using satellite and airborne sensors; damage and loss estimation.
- Implementation of the Common Alerting Protocol (CAP), a standard for public alerting and hazard notification in disasters and emergency situations, will be evaluated in connection with this project. Maintained by the Emergency Management Technical Committee of the Organization for the Advancement of Structured Information Standard (OASIS), CAP was also adopted as ITU-T Recommendation X.1303.<sup>13</sup>

#### 4.4.4 Partners and Networking

Institutions both in Indonesia and abroad that will be working closely with the WINDS application experiments include:

- Tokai University, Institute of Medical Research, Japan
- Ohkura National Hospital, Hibia, Tokyo, Japan
- JAXA's Sentinel Asia, Bangkok
- APT Telemedicine Working Group, Bangkok, Thailand
- LAPAN Indonesia
- Hasan Sadikin Hospital Emergency Division, Bandung, Indonesia
- Army's Central Hospital, Jakarta, Indonesia
- Padjadjaran University, Faculty of Medicine, Bandung, Indonesia
- City of Banjar, Health Stations, West Java, Indonesia

Many of these institutions have gleaned experience from the tsunami disaster in 2004 at Banda Aceh and earthquake at Nias, and tsunami disaster at Pagandaran, West Java 2005.

#### 4.5 Satellite Communications for First Responders: Case Study on Chinese Earthquake (SES New Skies)<sup>14</sup>

##### 4.5.1 Summary

The following case study highlights the use of FSS and BSS links in the aftermath of the May 2008 earthquake in China. It also demonstrates the use of satellite communications by first responders and in the provision of important information to citizens following a disaster.

In the wake of the magnitude 8.0 earthquake in the Chinese province of Sichuan on May 12, 2008, thousands were killed and large swaths of transportation and telecommunications infrastructure were destroyed. Families were unable to contact one another and first responders were unable to communicate with their command centres to coordinate the allocation of rescue resources and relief goods.

<sup>13</sup> For additional information on implementation of CAP for developing countries, refer to: ITU-D Study Group 2 Report, *Guidelines for the Common Alerting Protocol (2009)*.

<sup>14</sup> For additional information on this case study, see ITU-D Study Group 2 Question 22/2 Document 2/55.

#### 4.5.2 Materials and Methods

In preparation for just such an earthquake, the Chinese Earthquake Administration Bureau had already contracted in 2007 a satellite-based VSAT network, which came into operation for the first time in May 2008. The nationwide network consists of 20 fixed stations, five vehicle stations and 16 Fly-Away stations covering Beijing and 19 Chinese provinces.

##### *Disaster management VSAT network*

An emergency VSAT satellite communication network based on ND SatCom's SkyWAN® platform supported a coordinated relief effort between Chinese first responders in the command center in Dujiangyan, not far from the earthquake's epicenter, and the Earthquake Administration Bureau's command centre in Beijing. Immediately after the earthquake occurred, the nationwide network was split into two sub-networks: one for daily conventional data traffic and one dedicated to crisis communication with a hub station in Beijing; a fixed station in the Sichuan region and various vehicle-based stations and transportable Fly-Away antenna systems. One vehicle station from Kunming, the capital city of the adjacent Yunnan province, was driven close to the earthquake's epicenter to establish satellite communications within the emergency network. Additional Fly-Away and vehicle stations from Shijiazhuang (Hebei province) joined the emergency network to support disaster recovery communication services.

##### *Applications*

A total of eleven fixed and mobile stations formed an emergency network, enabling one-way high quality video transmission, two-way video conferencing, VoIP, data communication, file transmission and internet access 24/7. Without any terrestrial facilities and only by means of the SkyWAN® satellite network, a large amount of images and videos of the earthquake area were transmitted from the disaster site to the Earthquake Administration Bureau in Beijing. Many video conferences were held, giving the central command unit a much better understanding of the disaster situation.

##### *Satellite News Gathering for Local TV station*

During the first two weeks after the earthquake, ND SatCom Beijing provided the local TV channel, Sichuan Broadcasting Group (SBG), with an SNG uplink for on-site news coverage. SBG operates a smaller SNG fleet in Chengdu, Sichuan's capital with more than eleven million inhabitants. Thanks to ND SatCom and the provision of an additional compact SNG vehicle, Sichuan TV's broadcasting capacity was increased by 30% informing Sichuan's 87 million inhabitants on latest developments in the crisis region – almost the only source of information during several weeks after the earthquake.

#### 4.5.3 Results

While the earthquake was devastating, preparations with respect to communications helped to coordinate the relief effort. In particular, satellite uplinks provided readily deployable communications capacity where other fixed infrastructure had been destroyed. Both emergency and information services relied almost entirely on satellites to disseminate information among first responders and citizens.

#### 4.6 Use of Mobile Satellite Services to Support Relief Efforts Responding to Gulf Coast Hurricanes in the United States (Iridium Satellite)

##### 4.6.1 Summary

On August 28th, 2005, Hurricane Katrina hit the southern coast of the United States with devastating effect. The storm surge breached the levees of New Orleans, Louisiana at multiple points, leaving 80 percent of the city submerged, tens of thousands of victims clinging to rooftops, and hundreds of thousands scattered to shelters around the country. Three weeks later, Hurricane Rita re-flooded much of the area. The devastation to the Gulf Coast by these two hurricanes places them among the greatest natural disasters in U.S. history.

The twin storms downed telephone poles and wires and caused long-term power outages, which prevented service to the digital gear and cell-phone towers that formed the terrestrial network. When the bridge which connected New Orleans with the mainland collapsed, so did the fiber-optic cables that transported calls and

internet traffic to and from the city. The systems and devices that were most relied upon for day-to-day communications were rendered useless when they were most needed.

Due to their reliance on land, cell and radio-based communications, first responders could not communicate once the land-based infrastructure was damaged. Key personnel could not talk to each other to coordinate rescue and relief operations in the immediate wake of the storms. Moreover, even if systems were operational, they couldn't 'talk' with other systems because there was no interoperability component connecting them. There was a total breakdown in communications.

#### **4.6.2 Materials and Methods**

Due to integration of mobile satellite service (MSS) solutions into their disaster response inventory, the U.S. Government already had thousands of satellite phones available for deployment into the disaster area. MSS handsets and devices provided the voice and data connectivity demanded by those responding to the hurricanes. Essential, life-saving communications could now be delivered via satellite connections.

Iridium Satellite is one of several MSS providers whose networks were relied upon following the hurricanes. Iridium quickly moved MSS equipment into the hands of first responders at the federal, state and local levels. In order to meet the surge in demand, Iridium shifted to a 24x7 manufacturing schedule and then worked to quickly move equipment directly from the manufacturing facility into the field. Importantly, Iridium phones were not affected by the failed electricity grid, as their batteries could be charged using solar power chargers and chargers that could be plugged into cars.

#### **4.6.3 Results**

In the first 72 hours of the disaster, Iridium traffic in the region increased more than 3000 percent, while the number of subscribers increased more than 500 percent. The US Federal Communications Commission (FCC) also recognized the essential nature of satellite communications for response efforts. To help accommodate critical network traffic and minimize the risk of congestion resulting from first responder use in the affected areas, the FCC granted Iridium use of additional spectrum to ensure needed connectivity. The essential role of satellites in providing connectivity following these Hurricanes was evident, and since that time, more attention has been given to better integrating satellite communications systems into disaster response frameworks.

### **4.7 Hurricane Felix in Nicaragua: case study of role of MSS for initial response and for disaster preparedness (Inmarsat Mobile satellite services, Télécoms Sans Frontières)**

#### **4.7.1 Summary**

On September 5<sup>th</sup> 2007, the Atlantic coast of Nicaragua was hit by Hurricane Felix winds of over 260 km/h, leaving hundreds of thousands homeless without electricity and running water. According to the Nicaraguan Civil Security, 90% of infrastructure was destroyed and communications were nearly completely cut off. 80% of land lines were destroyed and many areas were not covered by cell networks.

Nicaragua had never before been hit by such a disaster. The Northern Atlantic Autonomous Region (RAAN), one of the most affected regions, is also the poorest region of the country, with an economy driven largely by agriculture and fishing. More than 200,000 people (34,000 families) were affected and almost 300 were killed. More than 10,000 houses were seriously damaged of which 8,000 were completely destroyed.

The remoteness of these affected communities required the deployment of satellite-based telecommunications to reinforce rescue and relief coordination in the field and to run civilian calling operations.

#### **4.7.2 Materials and Methods**

Within the first days of the disaster, Télécoms Sans Frontières deployed an emergency crew from its Americas base in Managua and more staff was sent from its headquarters in France. TSF was on site for 3 months: 1 month since September 6<sup>th</sup> 2007 to respond to the emergency, and 2 months to train local institutions to deploy the latest satellite technology right at the heart of the humanitarian crisis, in order to quickly establish reliable communication in the field and thus optimize the response to emergencies.



A crew of 21 telecom responders installed 3 Emergency Communication Centres (ECC) for the United Nations and the humanitarian community in the region. The first centre was based at the Emergency Operations Centre (COE) in Puerto Cabezas, the second at the Waspam townhall and the third ECC in Sahsa.

Voice and data communications were immediately re-established by means of Inmarsat Mobile satellite services using BGAN, GAN/M4 and mini-M terminals. Together with laptops and printers these centres, fully equipped for voice, fax and high speed data communications, were the focal points for the coordination of relief operations in the RAAN. In total, for nearly one month, 52 organizations from the United Nations and NGOs (45 daily users) exchanged more than 13,000 MB of data and consumed more than 100 hours of satellite voice communications at these centres. In addition, TSF led humanitarian calling operations to enable civilians to give news and request personalized assistance. 1125 families benefited from the telephony services. In total, 2781 calls were offered.

### **4.7.3 Results**

Following the success of these centres in the disaster relief efforts, a coalition of national and international groups sought to push telecommunications planning beyond the emergency phase of the disaster response. TSF was requested by the Humanitarian Aid Department of the European Commission (ECHO) to strengthen the National System for Disaster Prevention, Mitigation and Attention (SINAPRED).

This follow-on effort, in coordination with all stakeholders, was aimed at increasing SINAPRED's capacity to deploy rapid communications in emergency situations by installing an emergency communications network in vulnerable and remote areas of the Northern Atlantic Autonomous Region (RAAN) and by training SINAPRED staff on its usage.

Mobile satellite communication equipment, in the form of Inmarsat BGAN terminals, were given to 3 Operational Centres in the strategic points of Puerto Cabezas, Bluefields and Managua to provide for a quick and reliable emergency response in this country regularly affected by natural disasters. In total, 11 institutions were then trained on the utilization of the satellite equipment.

This project was based on experience in Haiti, where TSF trained the Red Cross on the usage of mobile satellite solutions for an improved emergency response to natural disasters. It was also inspired by the experience in Niger where TSF deployed Inmarsat's Regional BGAN data service to strengthen the National Food Crisis Prevention System.

The TSF mission in Nicaragua was funded by the European Commission Department of Humanitarian Affairs (ECHO), the Vodafone Group Foundation, the United Nations Foundation and TSF's partners: Inmarsat, Eutelsat, Vizada, AT&T, Cable & Wireless and the Region of Aquitaine.

## **4.8 Planned Satellite Radio in Bangladesh (Bangladesh)<sup>15</sup>**

### **4.8.1 Summary**

Due to its geographical location, Bangladesh suffers from many disasters. Recovery time from these disasters could be mitigated by better implementing ICTs for disaster management. In the upcoming regulations of 3G, Bangladesh Telecommunication Regulatory Commission (BTRC) has emphasized disaster management. Moreover, BTRC is examining ways to better manage disasters through community radio and satellite based sensing systems.

### **4.8.2 Materials and Methods**

At present, there is no significant infrastructure for disaster management in Bangladesh. However, Bangladesh has plans to examine and adopt disaster management systems as implemented by developed countries in the upcoming years. Early warning is very important in disaster management. Because of this, the BTRC has plans to issue community radio which may be especially helpful for the people of coastal areas.

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<sup>15</sup> For additional information see ITU-D Study Group 2 Question 22/2 Document 2/51.

Satellite radio can play a key role during both disaster warning and disaster recovery phases. It has the key advantage of working even outside areas not covered by normal radio channels. Satellite radios can also be of help when the transmission towers of normal radio stations are damaged in a disaster. GIS-based space technology solutions have become an integral part of disaster management activities in many developed and some developing countries. The United Nations Office for Outer Space Affairs has been implementing a Space Technology and Disaster Management Programme to support developing countries in incorporating space-based solutions in disaster management activities.

#### **4.8.3 Conclusion**

Bangladesh has been taking a pro-active approach in better integrating ICTs including satellite technologies to ensure that in the event of a disaster, more effective systems for public warning and communication will already be in place.

### **4.9 Usage of satellite infrastructure to manage a disaster situation (France)<sup>16</sup>**

#### **4.9.1 Summary**

The satellite infrastructure has significant value for the provision of communications in the event of a disaster event. To this end, GSM and satellite networks have been integrated on test equipment to provide bandwidth on demand capabilities and to better manage quality of service. Furthermore, it is possible with this test system to send alert messages from portable devices and to receive acknowledgement messages within fixed or mobile environments.

It is to be noted that this kind of equipment already exists and can be used in real emergency situations. It is possible to use FSS or BSS links to send and receive alert messages when the terrestrial infrastructure is down and is no longer in operation.

#### **4.9.2 Materials and Methods**

Two existing vehicles have been modified: Tracks (Astrium) and Mobidick (CNES) while one telecom solution has been designed and manufactured: Recover (CNES/ Astrium). Recover is a transportable (by helicopter/plane/boat/truck) kit of Telecom containers. These 3 mobile stations allow DVB/RCS satellite access for Voice and Ethernet/WIFI networks.

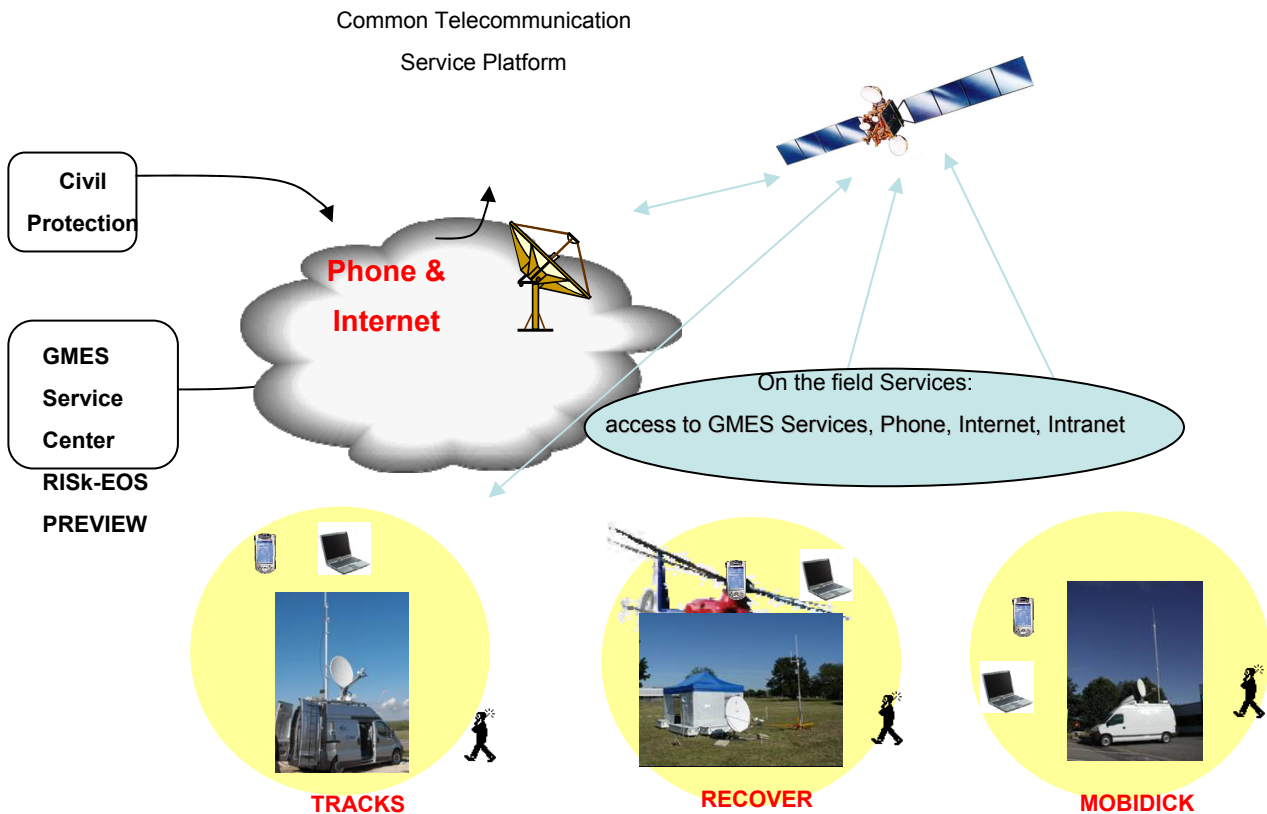
These 3 mobile stations are part of the TANGO (Telecommunications Advanced Networks for GMES Operations) project. Tango is a European Commission FP6 Integrated Project focusing on the use of satellite telecommunication solutions to serve the needs of the GMES (Global Monitoring for Environment and Security) community. The TANGO Voice Network is made of:

- GSM, DECT & VoIP cells, deployed on the field
- satellite link managed by DVB-RCS Hub and remote terminal
- Internet link that connects the satellite provider services hub to the GMES provider communication network
- Intelligent Media Gateway (IMG) to allow access to the Public Switched Telephone Network (PSTN)

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<sup>16</sup> For additional detail on this project, including detailed system information and diagrams of Mobidick and Recover, see ITU-D Study Group 2 Question 22/2 Document 2/51.

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**Figure 4: Overview of Mobidick, Recover and Tracks solutions**



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### 4.9.3 Results

The usage of satellite infrastructure is appropriate in connection with a disaster event. The 3 mobile stations will allow for the connection of laptops or PDAs by wifi to the internet, the sending of emails, downloading of pictures, videoconferencing, etc. Thanks to VoIP, users can make phone calls between themselves around the stations, between the mobile stations, and of course from/to the public telephone network (fixed or mobile). For voice, several handsets are usable, including wired VoIP phones, DECT (cordless phones), and WIFI handsets.

All these terminals are interoperable. The network radius coverage is 600 m for DECT and 300 m for WIFI. The GSM has been also tested during the development phase. This kind of equipment has been tested within actual demonstrations and provided successful results. In 2008, a demo was performed in the Southern part of France with the involvement of a large firemen team. In late 2009, another demo is planned to be held in Portugal with The European Union and the authorities of Portugal for the simulation of an evacuation of population within the island of Madeira.

### 4.10 Use of Satellite Telecommunications to Support Response to 2005 SE Asian Tsunami (Intelsat)

#### 4.10.1 Summary

On December 26, 2004 the Indian Ocean region was devastated by a tsunami, an enormous tidal wave caused by an undersea earthquake. After such devastation, it is vital to disseminate warnings, call for help,

describe the level of damage, discuss needs and deliver information. Dependable two-way telecommunications are essential to ensure effective distribution of critical supplies, equipment and human resources.

#### 4.10.2 Materials and Methods

##### Team Effort

Intelsat General provided the satellite access, teleport, services, hub services, overall project management and platform and network management. Partners included:

- IBM: Incident response team, Secure Wireless Infrastructure System (SWIS), telephones, Thinkpads, still image digital cameras and fingerprint readers.
- Future Technologies: Remote site VSAT/Worldwide Interoperability for microwave Access (WiMAX) installation with 24/7 support.
- iDirect: Hub/remote equipment and systems support.
- Bcom: Remote site installation.
- Go-To-Call: VoIP call switching/management

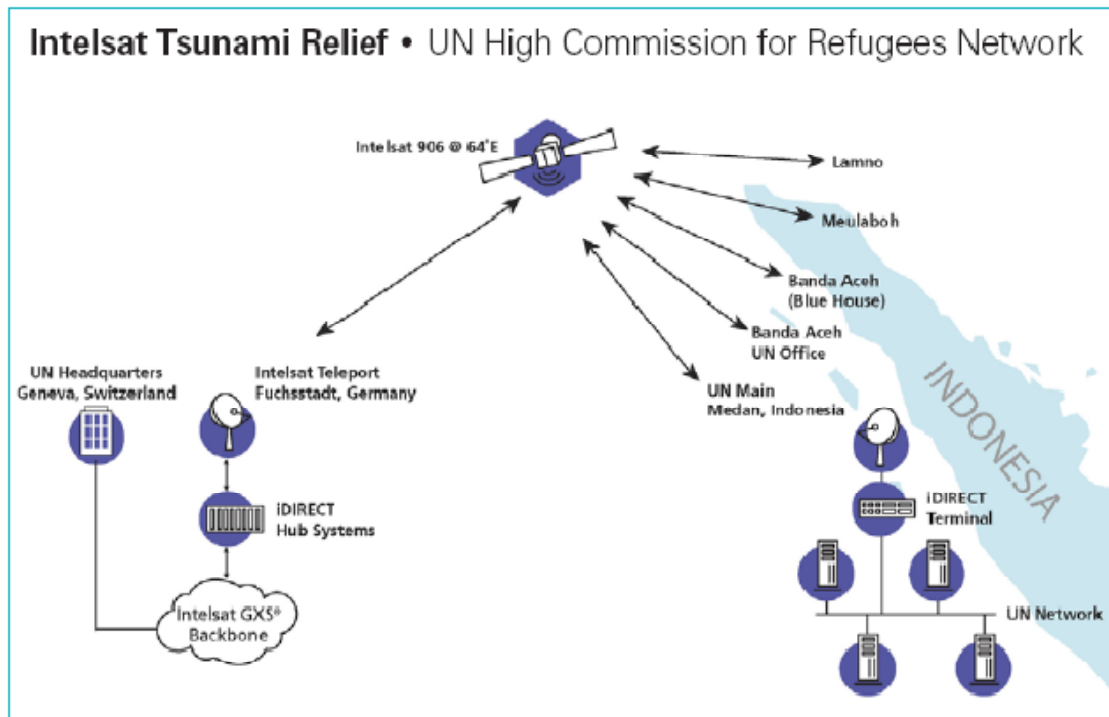
##### *Network Details*

One network provided high-speed telecommunications outbound at 2.2 Mbps, and five returns shared  $2 \times 703$  Kbps inbound. City sites, included Banda Aceh (two sites), Medan, Meulaboh and Lamno.

The second network provided 3.3 Mbps outbound. To sites, Banda Aceh and Teunom, shared 3.4 Mbps inbound.

2.4 meter VSATs were interconnected via the Intelsat 906 satellite at 64°E to the Intelsat General Fuchsstadt teleport in Germany.

Traffic was then routed terrestrially through the Intelsat fiber optic network. A software-secure Virtual Private Network provided connectivity to UN headquarters in Geneva, Switzerland.



### Application Details

The Intelsat General network supported applications including voice (using VoIP connected to the Go-To-Call switch), data, Internet access, intranet connectivity, file transfer and video.

- For each network, 15 to 20 VoIP phones were provided, along with wired telephones to support domestic and international telephony.
- Ten laptops were connected in a wireless LAN configuration using 802.11 standard Wi-Fi.
- The network was extended to a German/French-run Red Cross/Crescent hospital using a WiMAX 802.16 standard wireless metropolitan area network platform supporting telemedicine applications. The WiMAX system enables network extension for distances exceeding 50 miles, creating, in effect, a wireless broadband bubble that allows PCs with 802.11 capability to easily connect and transfer data.

### 4.10.3 Results

Intelsat General's telecommunications support was essential for government coordination of relief efforts. The SWIS unit installed in Banda Aceh served as the main data transmission point from the office of the governor to senior officials in Jakarta.

### 4.11 Themes in implementation successes and challenges

A review of these case studies helps illuminate several key themes in how disaster communications management projects relying upon satellite communications links can be implemented successfully. The following section provides additional details and best practices for consideration of some of these elements.

- *Satellite connectivity is essential:* These case studies highlight the important role that satellite links play in disaster response and relief efforts, given their geographic coverage, independence from terrestrial infrastructures, and mobile and transportable applications that can be used anywhere. In

many cases terrestrial network failures meant that satellite services were the only available means of communications in the immediate aftermath of a disaster.

- *Preparedness, preparedness, preparedness*: Having satellite communications already on the ground when a disaster strikes, or integrated into a disaster communications management and response system, is the best way to ensure connectivity when and wherever a disaster strikes. Advance coordination across relevant response groups – locally, nationally or regionally – can help ensure that essential communications are available for those who need it most.
- *National and Regional Emergency Communications Plans and Systems*: Satellite-based services – FSS, MSS, and BSS – are increasingly being incorporated directly into national, regional and international disaster preparedness and response plans and projects. Countries and organizations are taking steps to ensure that satellite systems are incorporated as back-up links or as primary communications mechanisms for disaster scenarios.
- *Advance coordination among stakeholders*: Disaster response and relief efforts involve numerous stakeholders – national and local governments, ITU and international organizations, NGO's and relief agency workers, private sector, etc. all may arrive on the scene to provide support and equipment immediately following a disaster. Advance coordination with likely stakeholders can help ensure that ICTs including satellite services are most effectively deployed and implemented. Several countries have pilot programs where systems are developed and tested well in advance of a disaster.
- *Telemedicine*: Emergency medical care is very much a part of disaster relief and response efforts. The presence of emergency medical units that can link to remote central healthcare centers can provide the additional added support for a surge in demand for urgent care. Importantly, such telemedicine centers can serve rural or remote populations, particularly in developing countries, year-round to meet primary care needs.
- *Power supply*: Many projects have demonstrated the importance of independent power sources, and the use of solar powered batteries, to ensure continued functionality in the event of a failure of the power grid.
- *Role of the media*: The media plays an important role in delivering important information to citizens, and the additional presence of news organizations following a disaster results in a surge in activity. Satellite news gathering links can help provide needed capacity to ensure that critical information gets to those in need.
- *Interoperability*: Communication exchanges between divergent systems and organizations is an essential component. Systems should examine ways to ensure interoperability as needed.
- *Integration of disaster communications in national telecommunications development plans*: In some cases, countries have taken disaster communications into account when developing overall plans for telecommunications development. Developing countries, when considering how to ensure connectivity for citizens, particularly in remote and rural areas, should take emergency communications aspects into account. In many cases equipment and services, as with the case of mobile telemedicine units, can serve dual purposes of providing essential every-day services to citizens and serving critical needs during a disaster.

## 5 Best Practice Guidelines for Implementation of Satellite Radiocommunications Technologies for Disaster Management

### 5.1 Guidelines for Technology Selection

Administrations and organizations may wish to take into account the following considerations when evaluating satellite systems and applications for managing telecommunications during times of disaster:

#### 5.1.1 Equipment Transport and Deployment

Engineers should choose equipment that is capable of being deployed in isolated sites, and in all sorts of environments around the world. Likewise, they should consider equipment that can be transported easily to a

disaster site, whether by hand, truck, boat, plane, or helicopter. The impact of a disaster, such as damage to the roads or transportation infrastructure, could affect one's ability to transport equipment to the desired site and should be considered in advance.

### 5.1.2 Installation and Operation

During times of crises, emergency personnel value radiocommunications equipment that is easy to install and operate. During the planning stages, engineers should consider the installation requirements for the satellite equipment including whether there is a need for engineers to be on site or whether a line-of-sight to the satellite is needed. Turn-key VSAT satellite solutions are widely available to allow for ease of installation, with set-up times often varying from 30 minutes to 3 hours, depending on system complexity. MSS handsets and terminals offer additional ease of use and near instant connectivity.

Training of radiocommunication personnel in system planning, installation, maintenance and operation is also an important aspect of the selection of appropriate technologies.<sup>17</sup> Satellite systems, while essential given their capabilities for functioning in a disaster, are often not implemented for routine daily communications. For such situations, the planning team should test the equipment periodically, such as weekly or monthly, under simulated emergency conditions.

### 5.1.3 Communications Requirements

Satellite services can support a wide range of telecommunications applications including voice, data and video. Technologies should be evaluated based on the type of communications needed to support disaster relief and response efforts and the appropriate amount of bandwidth required to support those applications. FSS solutions typically offer higher data rate applications as compared to MSS.

### 5.1.4 Coverage Areas

Unlike many terrestrial networks, satellite systems have the ability to cover large geographic areas, including remote and rural areas. Administrations and organizations should bear in mind their anticipated geographic requirements when selecting a satellite application or system.

### 5.1.5 Mobility<sup>18</sup>

Mobility is a desired user requirement allowing roaming from one network to another regardless of technologies. For example, if the user is under a Land Mobile Radio (LMR) narrow band network with urban coverage and moves out to a satellite wide area coverage and then to an in-building WLAN network, the user wants continuity of service without any action. Hand-over to maintain the communication is a necessity. Emerging integrated MSS applications may help to facilitate mobility with a seamless transition between terrestrial and satellite networks.

### 5.1.6 Spectrum Considerations

Management of the international radio-frequency spectrum and satellite orbit resources is done by the ITU and its Member Administrations. The ITU requires only one country to authorize the space segment of a satellite system (typically notified to the ITU by the authorizing country). Therefore, any satellite in orbit has had its launch and operation licensed by a country and registered at the ITU.

The use of spectrum should be assigned by Administrations in accordance with the ITU Radio Regulations and the relevant Resolutions. Since satellite systems provide very large coverage areas, spectrum coordination is accomplished on a regional or global basis. However, each system is required to operate on frequencies authorized by individual administrations.

When implementing ITU-R Resolution 647 (WRC-07) in order to identify global and/or regional frequency bands/ranges for emergency and disaster relief in their national planning, Administrations are invited to take into consideration that there are many FSS, MSS and BSS networks in orbit which are capable of providing support for disaster relief on a global basis, and to take those operating frequencies into account.

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<sup>17</sup> Compendium of ITU's Work on Emergency Telecommunications (2007).

<sup>18</sup> *Ibid.*

Administrations should consider frequency availability to support the various requirements emerging during a disaster situation, particularly given that demand for satellite services will surge following a disaster and can place strain on existing networks and services.

Although the use of transportable earth stations for disaster management makes it impractical to undertake detailed interference analysis in advance, attention should be paid to these aspects when using shared frequency bands.

### **5.1.7 Interoperability**

The capability to communicate with the local public protection organizations such as police, fire and medical, the local military, international disaster relief organizations and neighboring countries is an important consideration.

### **5.1.8 Power supply**

Satellite services can operate via autonomous power supply or solar powered batteries. Consideration should be given to the use of independent power sources when selecting a suitable application for disaster relief and response.

### **5.1.9 User Requirements**

The planning team should consider whether the satellite services are needed to support telecommunications for private user groups (first responders) or for communicating essential information to the public. FSS and MSS applications more typically offer support for closed user groups or for first responders; BSS applications are well suited to provide broadcasting services over wide areas to the public.

### **5.1.10 Satellite Capacity**

Administrations and organizations should take satellite capacity requirements into account when integrating satellite services into disaster telecommunications management plans. In the case of a disaster, the demand for satellite services surges, potentially placing a strain on satellite capacity. Satellite operators have taken these spikes in capacity demand into account in their system design and can address them in a variety of ways, including arrangements for pre-emptive capacity (where lower-priority users agree to be bumped off the network in times of crisis or enhanced need), reconfiguring the satellite payload to deliver additional capacity to the 'affected region', or migrating capacity demand via steerable beams.

## **5.2 Preparedness and ensuring access for persons with disabilities and special needs**

### **5.2.1 Overview**

**5.2.2** About 18% of people worldwide live with some kind of disability, including those related to aging; 10% – more than 600 million people – live with life-altering disabilities, two thirds of which are in developing countries. As prominently recognized at the World Summit on the Information Society, these demographic circumstances present considerable challenges on the one hand, and enormous opportunities on the other, for the increasingly important role of ICTs.<sup>19</sup>

### **5.2.3 Creating a Preparedness Plan**

Preparedness is one of the most important aspects of disaster telecommunications management, and has a particular emphasis when ensuring access for persons with disabilities and special needs. Preparedness can help ensure that communications at the right time and in the right format trigger the most appropriate reactions by citizens. Persons with disabilities often require additional considerations of preparedness to ensure that warnings are received in a timely manner, and in an accessible format, and that specialized needs are addressed during recovery periods.

An important lesson learned following the 1995 Kobe, Japan earthquake was that more than 90% of the thousands of victims were killed within 30 minutes after the earthquake. Given this fact and that rescue

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<sup>19</sup> (ITU-D Study Group 2 Document 2/88-E – Annex 1).



teams do not often arrive within 30 minutes when a wide area is hit by a major disaster event such as an earthquake, people must help themselves and their neighbors first and foremost. When it comes to persons with disabilities, preparedness is even more critical. How will special needs be taken into account during and following a disaster?

The use of telecommunications/ICTs should be incorporated throughout the whole process of disaster relief and recovery, including planning and implementation including exercise of evacuation. And within that context, it is essential to take into account the ways to accommodate the specialized needs of those who are most at risk during the early phases of a disaster.

One example relates to testing undertaken in Samoa of a text messaging alert service for tsunami warnings. Phones were distributed to village chiefs who would receive text message alerts and then warn village citizens. However, consideration was not given to the ability of all chiefs to read these messages, and the tsunami alerts were not being distributed in some cases. Literacy was then taken into account, with phones distributed also to school teachers who would help with tsunami alerts.

Each of these may impact the provision of satellite services during emergencies and could be considered either in terms of the overall telecommunications regulatory framework, or as it relates specifically to disaster management. Addressing these issues often requires the input of a wide range of government agencies including telecommunications, customs, and/or public safety. The most important thing is to adopt the regulatory framework before a disaster or emergency occurs.

#### **5.2.4 Relief and Recovery**

In order to build preparedness on individual and community levels, governments, communities and relief and response agencies must give consideration to mobility, sight, hearing, intellectual capacity, cognitive characteristics, mental health, linguistic and cultural background, etc., and how these may impact a person or groups' ability to receive critical information and respond in an emergency scenario.

#### **5.2.5 Online Resources**

There are numerous reference guides available to address issues of accessibility and telecommunications/ICTs and disaster relief and response:

Red Cross offers information designed to assist people with disabilities and medical concerns to prepare for disasters: <http://www.prepare.org/disabilities/disabilities.htm>

The United States Interagency Coordinating Council on Emergency Preparedness and Individuals with Disabilities was established to ensure that the federal government appropriately supports safety and security for individuals with disabilities in disaster situations. The Council has an online guide, which also links to other US government resources on this topic: <http://www.disabilitypreparedness.gov/>

The ITU is the main sponsor of the IGF Dynamic Coalition on "Accessibility and Disability" and which is open to outside membership to examine best practices to resolve accessibility needs in ICT and emerging technologies.

<http://www.itu.int/themes/accessibility/dc/index.html>

The ITU also supports the Joint Coordinating Activity on Accessibility and Human Factors which coordinates and assists Study Groups within ITU on accessibility and human factors issues in technical standardization.,

<http://www.itu.int/ITU-T/accessibility/index.html>

The ITU's main accessibility website has links to the accessibility pages in ITU-T, ITU-D and ITU-R for further information.

<http://www.itu.int/themes/accessibility/>

### 5.3 Amateur Radio Satellite Service

The Amateur Radio Satellite Services (RR Art.5.10 § 6) complements the capabilities of the Amateur Radio Service as a resource for emergency and disaster radiocommunications, as recognized *inter alia* in Rec. ITU-R M.1042-3 (2007) and the documents referenced therein. More than 100 amateur radio satellites have been launched, frequently as secondary payloads and in orbits ranging from LEO to Highly Elliptical orbits. Fourteen of the presently eighteen operational satellites of this Service carry transponders for voice and/or data communication with fixed, mobile and in some cases portable ground stations.

Like the terrestrial Amateur Radio Service, the Amateur Radio Satellite Service provides two equally valuable assets for emergency and disaster telecommunications: Global networks, and skilled operators who are thoroughly familiar with communications under often particularly difficult conditions.

### 5.4 Licensing and Regulatory Considerations

Knowledge of the most appropriate technologies available to respond to a disaster is only helpful if the applicable policies and regulations are in place to allow for their timely use in the disaster-stricken area. As more attention is given to the essential role that satellite telecommunications play in disaster response and relief, it is important to consider how existing regulations may affect the deployment of satellite services in times of emergency or even serve as a barrier to use of satellite networks. This section provides a review of the licensing and regulatory issues that countries may consider when determining how to implement satellite telecommunications services for disaster response and relief efforts, and provides best practices for ensuring that satellite-based equipment and services can be deployed effectively during a disaster event.

#### 5.4.1 Licensing Consideration and Best Practices

When a disaster or emergency strikes, countries may either waive or ignore the regulations which hinder use of satellite services. As part of developing a disaster communications policy in advance, countries may consider how the following aspects of their existing licensing and regulatory frameworks might affect the rapid deployment of telecommunications/ICT equipment and services to support disaster response. Policymakers should focus on creating a regulatory framework that enables the timely deployment of satellite services:

- Developing expedited licensing procedures for short term or emergency use
- Creating class or temporary licenses for emergency use
- Adopting transparent and non-discriminatory authorization procedures and license conditions
- Establishing license exempt regulations for satellite dishes and handsets operating in certain frequencies or within certain power limits and operating in accordance with the relevant Resolutions adopted by ITU-R.
- Eliminating local incorporation and capitalization requirements and performance bonds as a condition for issuance of a license for short term or emergency use
- Establishing customs duties – and possible waivers of duties – for equipment imported in emergency response scenarios
- Facilitating testing and type approval requirements by recognizing foreign type approvals
- Analyzing import and export rules and their impact on rapid import of equipment
- Easing requirements for landing rights or restrictions on use of specific satellite resources to maximize the number and kind of satellite networks available to assist during times of crises
- Developing procedures to efficiently address interference considerations and coordination requirements
- Increasing ability for foreign service providers or operators to provide services in a country, including assessing whether licensing regulations can be streamlined to cover only the service provider and not the satellite system itself
- Lessening the impact of licensing on satellite news gathering operations

- Removing requirements for in-country gateways if none are needed for the functioning of portable terminals or handsets
- Facilitating the trans-border flow of satellite end-user equipment
- Implementing regulations that facilitate the integrated use of satellite and terrestrial mobile systems

#### 5.4.2 Existing International Regulatory Frameworks

The international community already has taken some steps to implement a regulatory and licensing framework that promotes the rapid deployment of equipment and services for disaster relief efforts.

##### 5.4.2.1 GMPCS MOU

The Global Mobile Personal Communications Services (“GMPCS”) Memorandum of Understanding (“GMPCS MOU”) developed by the ITU and its Members includes the following provisions:

- Facilitate arrangements for mutual recognition of type approval of terminals
- Promote the use of general licenses (*e.g.* class licenses or blanket approvals) and a means by which these general licenses will be mutually recognized
- Adopt a method of marking terminals to permit their recognition as subject to the GMPCS MOU
- Exempt GMPCS terminals from customs restrictions when brought into a country on a temporary or transitory basis
- Impose a requirement on GMPCS operators to provide duly authorized national authority which so requests, appropriate data concerning traffic originating in or routed to its national territory, and to assist it with any measures intended to identify unauthorized traffic flows therein.

Implementation of each of these parts is contained in the GMPCS MOU Arrangements.<sup>20</sup> Countries that have implemented the GMPCS MOU have benefited from the immediate availability of satellite telecommunications in times of natural disasters and emergencies.

##### 5.4.2.2 Tampere Convention

The Tampere Convention on the Provision of Telecommunications Resources for Disaster Mitigation and Relief Operations is a legal framework through which countries have begun to address the use of telecommunications/ICT for disaster relief. It covers all types of telecommunications, not just satellite networks and services.

The Convention includes specific provisions regarding the reduction or removal of regulatory barriers to the use of telecommunication resources for disaster mitigation and relief, such as making allowances in regulatory frameworks for waivers of certain import, type approval or telecommunications usage requirements to facilitate use of equipment during a disaster. Section 6.4 provides more detail on efforts by the ITU-D Programme 6 to help with implementation of the Tampere Convention.

#### 5.5 Discussion of Capacity Building and Training Components

Training is an essential component of disaster telecommunications management and preparedness, particularly when considering satellite based equipment. If personnel are unable to operate the equipment or keep systems and equipment maintained, there may be telecommunications failures when links are most needed. Satellite-based services are often used only as a back-up system when primary networks fail, and only imported into a disaster site when the need arises. First responders or system operators may not have as regular interaction with satellite equipment as with other devices, so may not have the level of familiarity required to respond to a critical situation.

While developments in satellite equipment have led to ease of installation and use, operators should be trained on any device or equipment that will be used to support emergency telecommunications. For the smooth operation of satellite earth stations in the event of a disaster, regular training for potential operators and preparatory maintenance of the equipment is essential.

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<sup>20</sup> *Id.*

The response to Hurricane Katrina (see section 4) highlighted the need for proper preparedness and training. While emergency communications professionals often had MSS phones available for use when terrestrial networks failed, handsets had not been fully charged or first responders were not familiar with the use of the phones. It is essential that government officials, businesses, educational institutions and medical facilities who may need to rely upon satellite devices for critical emergency response operations be trained on the equipment so that they are prepared when the need arises. It is also critical that equipment be maintained and functional for rapid deployment.

Administrations and organizations are urged to develop regularized approaches for the training of personnel and testing of equipment. For three years now, in partnership with The U.S. Association of Public-Safety Communications Officials (APCO) International, Iridium Satellite has organized an annual Test Your Phone Week to encourage emergency workers and first responders to prepare in advance to ensure that satellite phones work properly. The goal of the initiative is to increase satellite phone user preparedness and to help users confirm their satellite phones are ready to provide critical communications services before they are needed in an emergency. In addition to having the necessary equipment available in a disaster radiocommunications inventory, such training and annual reviews are a helpful way to ensure that systems and first responders are prepared.

## **6 ITU and un Mechanisms for Enabling Communications Access During a Disaster Event**

### **6.1 Inter-Sectoral Communications Team**

ITU established an inter-sectoral emergency telecommunications team in order to improve coordination of work between the three sectors: ITU-D, ITU-R, and ITU-T. The publication of the Compendium of ITU'S Work on Emergency Telecommunications (2007)<sup>21</sup> is a result of the team's work. Programme 6 under the Telecommunication Development Bureau recently published the ITU Handbook on Emergency Telecommunications (2005)<sup>22</sup>; the Best Practice on Emergency Telecommunications (2007)<sup>23</sup> and in coordination with the ITU-D Study Group 2 Question 22/2, the Guidelines on the Common Alerting Protocol (2009)<sup>24</sup>. Programme 6 of BDT also developed a document on emergency telecommunications terminologies that was submitted to ITU-D Study Group Question 22/2 and is being considered for publication after ongoing consultations with ITU-R and ITU-T. Consultations and information sharing is ongoing between the three Sectors and between their Study Groups and ITU-D Question 22/2.

### **6.2 ITU Framework for Cooperation in Emergencies**

Given that the role of telecommunications in disaster reduction is critical in order to improve the timely flow of crucial information needed for appropriate assistance to be delivered before, during and after the disaster, ITU forged many partnerships with the private sector to finance activities related to disaster mitigation. Many of these partners have provided MSS handsets and other communications equipment, as well as free or reduced charges on airtime via their networks. Over the past few years, ITU has been able to leverage these partnerships to provide direct assistance in a wide array of disasters. Some of the partnerships that resulted in ITU receiving financial and in-kind contributions were with Iridium, Inmarsat Limited, Thuraya, Terrestar, ICO Global, VIZADA, QUALCOMM and Saudi Telecom Company (STC). The following are some of the countries that have benefited from ITU's assistance through the deployment of satellite equipment for voice and high-speed data: Sri Lanka, Pakistan, Suriname, Peru, Bangladesh, Uganda, Zambia, Indonesia, Myanmar, China, and Kyrgyz Republic. Detailed information can be found in Section 3 and at: [www.itu.int/itu-D/emergencytelecoms](http://www.itu.int/itu-D/emergencytelecoms)

<sup>21</sup> The publication presents the work being undertaken by ITU's three Sectors in the field of emergency telecommunications.

<sup>22</sup> This handbook addresses policy, regulatory, and technical issues related to emergency telecommunications and was produced by the ITU-D.

<sup>23</sup> The Best Practice on Emergency Telecommunications is a publication of the BDT that seeks to share information among ITU Member States on preparing and responding to emergencies through telecommunications/ICT. It presents case studies from ITU Member States.

<sup>24</sup> This publication is meant to facilitate the implementation of the Common Alerting Protocol standard for public alerting and hazard notification in disasters and emergency situations.

Five eminent persons were appointed to the High Level Panel for the ITU Framework for Cooperation in Emergencies (IFCE). The newest eminent person is the Chairman and CEO of Inmarsat satellite company.

### **6.3 UN Working Group on Emergency Telecommunications (WGET)**

The UN Working Group on Emergency Telecommunications led by the U.N. Office for the Coordinator for Humanitarian Affairs and brings together UN Agencies that have a role to play in emergencies, such as the World Food Program, the UN High Commissioner for Refugees, UNICEF, the World Health Organization, etc. Non-governmental organizations, such as the International Red Cross and Oxfam, also participate, as well as a number of private sector companies. The ITU participates to provide technical inputs into the meetings.

The WGET has a number of activities:

- Ensure strategic monitoring, oversight and review of the U.N's Emergency Telecommunications Cluster
- Develop inter-agency standards to facilitate implementation of emergency telecommunications services for disaster preparedness and response
- Ensure inter-operability among agency equipment
- Work with the private sector to develop new technologies, adopt common standards by equipment manufacturers for use in humanitarian operations
- Promote the ratification and implementation of the Tampere Convention

### **6.4 Tampere Convention Implementation**

The Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations covers all telecommunications without differentiation between terrestrial and satellite communications. Its ratification and implementation are essential for the full utilization of satellite communications in the services of humanitarian assistance which involves cross-border movement of such equipment in times of disasters.

The Tampere Convention has now been ratified by 40 states. The numbers are increasing as there are more than six countries that are in the process of ratifying this treaty. Entry of satellite terminals and other related equipment provided by ITU has been well facilitated by all countries affected by disasters. The majority of those countries that facilitated the deployment of ITU equipment already ratified the convention. This is a positive sign as these countries are already implementing the treaty. ITU organized workshops have been held at the national and regional levels to help countries put in place a framework that would help them implement this convention.

## **7 Conclusion**

As countries develop national emergency telecommunications plans, satellite radiocommunications should be part of those plans. Countries should allow for maximum flexibility in how the wide range of available solutions – whether terrestrial, satellite or integrated technologies – can be implemented. It is important to take into account the special characteristics of satellite technologies and how licensing and regulatory frameworks can serve to impede or facilitate deployment of satellite networks and services for disaster relief, response and recovery.

As countries, particularly developing countries, work to evaluate their existing licensing and regulatory frameworks to take account of next generation technologies and services and facilitate broadband deployment, emergency telecommunications aspects should be considered as part of this transition. Emergency telecommunications should be taken into account at an early stage so that technologies are available when they are most needed.

The use of satellite infrastructure is critical within the context of an occurrence of a disaster event. Administrations and organizations are encouraged to consider these guidelines and implementation report when evaluating various satellite telecommunications technologies and applications for use during a disaster and for integration in national emergency telecommunications preparedness plans.

## ANNEX I

The following is a list of ITU (ITU-R, ITU-T and ITU-D) Resolutions, Recommendations and Reports Applicable to Use of Satellite Communications for Disaster Relief.

Resolution 136 (Antalya, 2006) – The use of telecommunications/information and communication technologies for monitoring and management in emergency and disaster situation for early warning, prediction, mitigation and relief

Resolution 34 (WTDC-06) – The role of telecommunications/information and communication technology in early warning and mitigation of disasters and humanitarian assistance

Resolution ITU-R 53 – The use of radiocommunications in disaster response and relief

Resolution ITU-R 55 – ITU studies of disaster prediction, detection, management and relief

Resolution 644 (Rev.WRC-07) – Radiocommunication resources for early warning, disaster mitigation and relief operations

Resolution 646 (WRC-03) – Public protection and disaster relief

Resolution 647 (WRC-07) – Spectrum management guidelines for emergency and disaster relief radiocommunications

Resolution 673 (WRC-07) – Radiocommunications use for Earth observation applications

Recommendation ITU-R S.1001-1 – Use of systems in the fixed-satellite service in the event of natural disasters and similar emergencies for warning and relief operations (*pending Member State approval as of September 2009*)

Recommendation ITU-R BO.1774-1 – Use of satellite and terrestrial broadcast infrastructures for public warning, disaster mitigation and relief

Recommendation ITU-R MOB-DIS – Use of the mobile-satellite service (MSS) for disaster response and relief (*pending Member State approval as of September 2009*)

Recommendation ITU-R M.1042-3: “Disaster communications in the amateur and amateur-satellite services”

Recommendation ITU-R M.1043-2: “Use of the amateur and amateur-satellite services in the developing countries”

Recommendation ITU-R M.1044-2: “Frequency sharing criteria in the amateur and amateur-satellite services”

ITU-T Recommendation X.1303 – Common alerting protocol (CAP1.1)

### *Handbooks and Reports:*

Report ITU-R S.[REP-1001] – Use and examples of systems in the fixed-satellite service in the event of natural disasters and similar emergencies for warning and relief operations (*pending Member State approval as of September 2009*)

Report ITU-R M.[REP-MOBDIS] – Use and examples of mobile-satellite service systems for relief operation in the event of natural disasters and similar emergencies (*pending Member State approval as of September 2009*)

The Compendium on ITU’s Work on Emergency Telecommunications (2007)

Best Practice on Emergency Telecommunications (2007)

Satellite communications (fixed-satellite service, second edition 1988). With this Handbook are also three supplements:

- Supplement 1: “Effect of WARC ORB-88 Decisions”
- Supplement 2: “Computer programs for satellite communications” (1993)

- Supplement 3: “VSAT systems and earth stations” (1994)

A third revised edition of the Handbook on Satellite Communications (FSS), including all new technical and operational developments, was published in 2002.

Handbook on “Specifications of transmission systems for the broadcasting-satellite service” (1993).

Handbook on “Terrestrial and satellite digital sound broadcasting to vehicular, portable and fixed receivers in the VHF/UHF bands” (2002).

Handbook on “Mobile-satellite service (MSS)” (2002)

- Supplements No. 1, 2, 3 and 4 to Handbook on Mobile-satellite service (MSS) (2006).







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