inmarsat
The mobile satellite company

Reducing the impact of natural disasters by using satellite communications in the Philippines

UK Space Agency International Partnership Programme

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UK SPACE AGENCY

Contents

Programme overview

The UK Space Agency's International Partnership Programme (IPP) is a five-year, £152 million programme designed to partner UK space expertise with governments and organisations in emerging and developing economies around the world to deliver a sustainable economic or societal benefit. All IPP projects are fully aligned to the United Nations' (UN) Sustainable Development Goals.

Inmarsat has been awarded IPP funding for three projects which began in 2017. This case study covers our project in the Philippines, which aims to reduce the impact of natural disasters by using satellite communications.

Key objectives

- Establish communications within 24 hours of the onset of a disaster
- Improve disaster response standard operating procedures
- Reduce dependency of sub-national and local government units on the national government
- Improvements in survivorship, disease, and hardship
- Lessening of economic damage through reinstatement of basic facilities as rapidly as possible

Executive summary

The 7,000 islands that make up the Philippines are regularly subjected to natural disasters because of their vulnerability to the natural hazards that are prevalent in the Pacific Ring of Fire. Cyclones are common, occurring over 20 times a year, while earthquakes, although less frequent, can be highly destructive.

Terrestrial communications often fail, especially in large-scale disasters, mostly due to the destruction of a network's physical components or its supporting infrastructure. This can be extremely detrimental to disaster response operations due to their dependence on fixed and mobile networks to coordinate their actions. Furthermore, the reliance on communications is growing because of the tools and systems used in disaster response.

To address this, the IPP project is supporting the Philippine government, through the Department of Social Welfare and Development, in improving their emergency communications system by providing them with a complete satellite connectivity solution for disaster response. The project delivers the latest equipment that can provide the best and fastest connectivity while also being highly mobile and portable.

The solution to the emergency communications issue was to deploy Inmarsat's high-speed Global Xpress service along with BGAN mobile broadband terminals and IsatPhone 2 handheld satellite phones to five regions in the Philippines chosen for their vulnerability to disasters. The project was first implemented in the Bicol region, the most exposed to natural hazards. Other kits were subsequently deployed to Eastern Visayas, Socksargen, and the Cordilleras, with Mimaropa due to come online in August 2018.

The primary objective is to provide immediate emergency communications to responders of all levels in the area of operations. The deployment at the regional level also reduces their dependency on national assets. Consequently, the rapid delivery of communications should improve response times of government operators and survivorship of the affected population.

Key insights

Positive results have been seen when the satellite communications kits have been deployed to disaster areas in the Philippines since the launch of the project in January 2017:

- In December 2017 a Global Xpress terminal was used in the communications hub that coordinated the return of evacuees to conflict-torn Marawi.
- BGAN terminals were deployed to geographically remote communities after the onslaught of Tropical Storm Tembin in Mindanao in December 2017, and used to transmit critical information on the needs of the affected community.
- GX was exclusively utilised during the response to the Mount Mayon eruption in Bicol in January 2018.

In each instance, the fast delivery of information and improved situational awareness made the delivery of aid quicker and more efficient, improving mortality and morbidity rates in evacuation centres.

Context

The Philippines is one of the most disaster-prone countries in the world. Due to its geographical location, the country is exposed to almost all kinds of natural hazards: earthquakes and tsunamis are a constant threat due to the Philippines' position within the Pacific Ring of Fire. It is also located in what is informally called the 'typhoon belt' – an area of the world where severe weather systems form more than anywhere else.

In the United Nations' World Risk Index of 2017[1], the Philippines is ranked third in the world in terms of disaster risk due to its high exposure and susceptibility to natural hazards.

Although hazards associated with tectonic activity pose the biggest threat of damage because of their unpredictability, severe weather is arguably the greater risk due to its frequency and intensity. Of the 529 disaster events recorded in the International Disaster Database for 2015[2], 450 were due to floods or storms.

Tropical cyclones have been major causes of devastation in the Philippines. The worst event in recent years was Haiyan which in November 2013 cut a swath of destruction through the country. The super typhoon, reaching up to 300 km/h, killed more than 6,000 people.

Although the Philippines has very good early warning systems and a robust disaster preparedness system in place, the infrastructure and resource allocation to respond to disasters remains poor. The cost of damage due to disasters is far larger than the resources put in place to prevent, prepare, respond, and recover from them (United Nations World Risk Report 2017)[3]. This problem is escalated because of the growing population and the increasing hazards associated with climate change.

Project overview

There have been numerous instances in the past where reliable and stable communications could have helped to alleviate suffering and increase survival among the victims of disasters. The devastation caused by super typhoon Haiyan highlighted the relevance of satellite connectivity. Government first responders had to turn to the TV news 24 hours after the storm hit to see the destruction for themselves because the media networks covering the story were equipped with BGAN terminals. It took even longer time for government agencies to establish communications through a fixed VSAT terminal at 'ground zero' in Tacloban. Many more municipalities were affected, some taking weeks to establish contact with the government to request aid.

To improve the emergency communications capability of the Philippine government, the IPP project seeks to bring the latest in emergency communications equipment and connectivity to the disaster response system of the Philippines.

The project aims to transform disaster response by prepositioning powerful but easily deployable satellite equipment, supported by training for the workers who will need to use it.

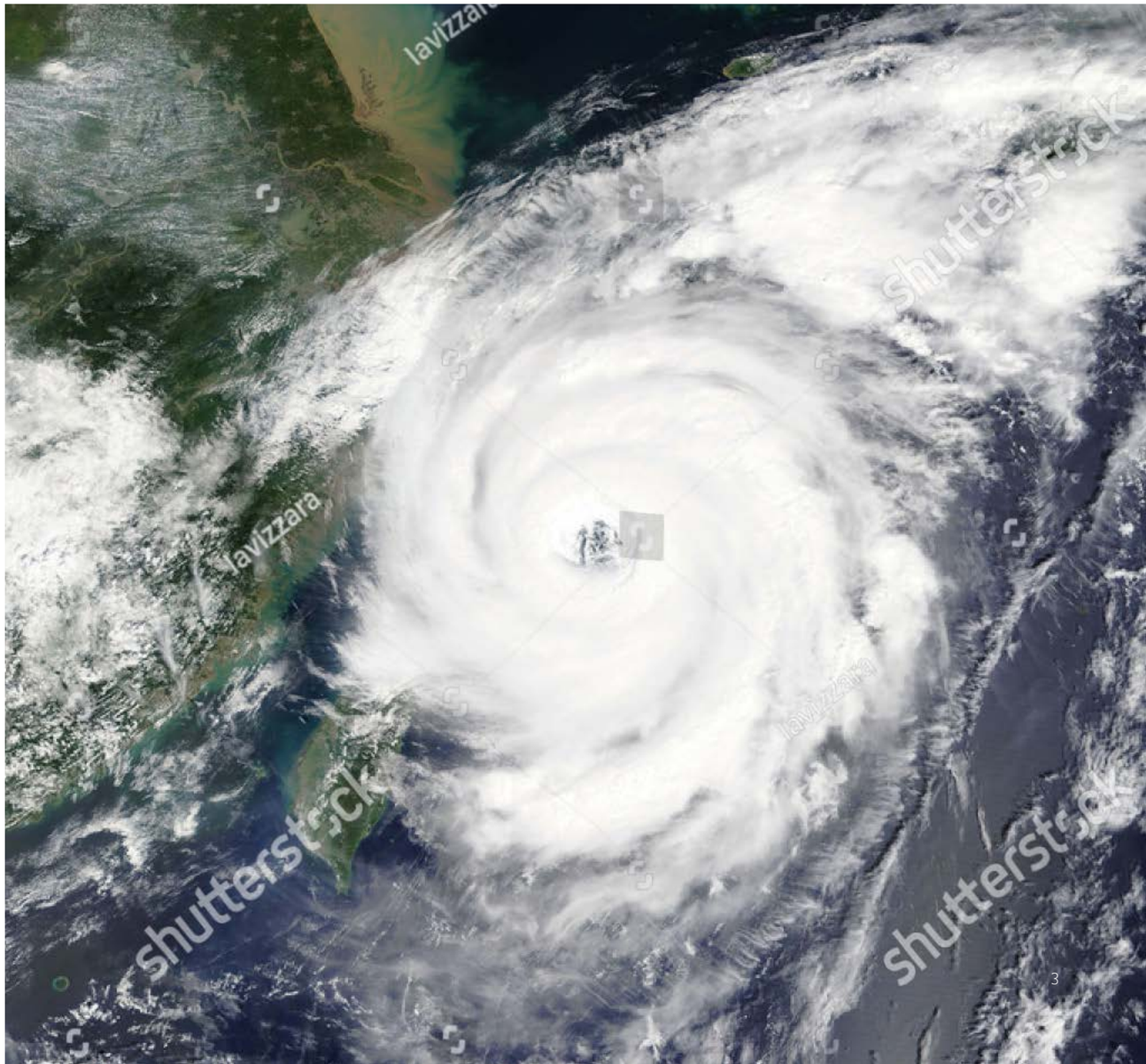
Deployment at the disaster area will provide the infrastructure to run national and local disaster response communications, at scale and quickly with the national coordinating authority as project partner. The project uses new Global Xpress (GX) satellite equipment, easily transportable and with capacity far greater than earlier VSAT systems. The rapid availability of robust and extensive communications provides critical, detailed data direct from the disaster site enabling health, rescue, water, shelter and food suppliers to evaluate the situation rapidly and support the proper coordination of the response effort. As a result, there will be reduction in the human cost of death, injuries and illness, and the economic impact mitigated.

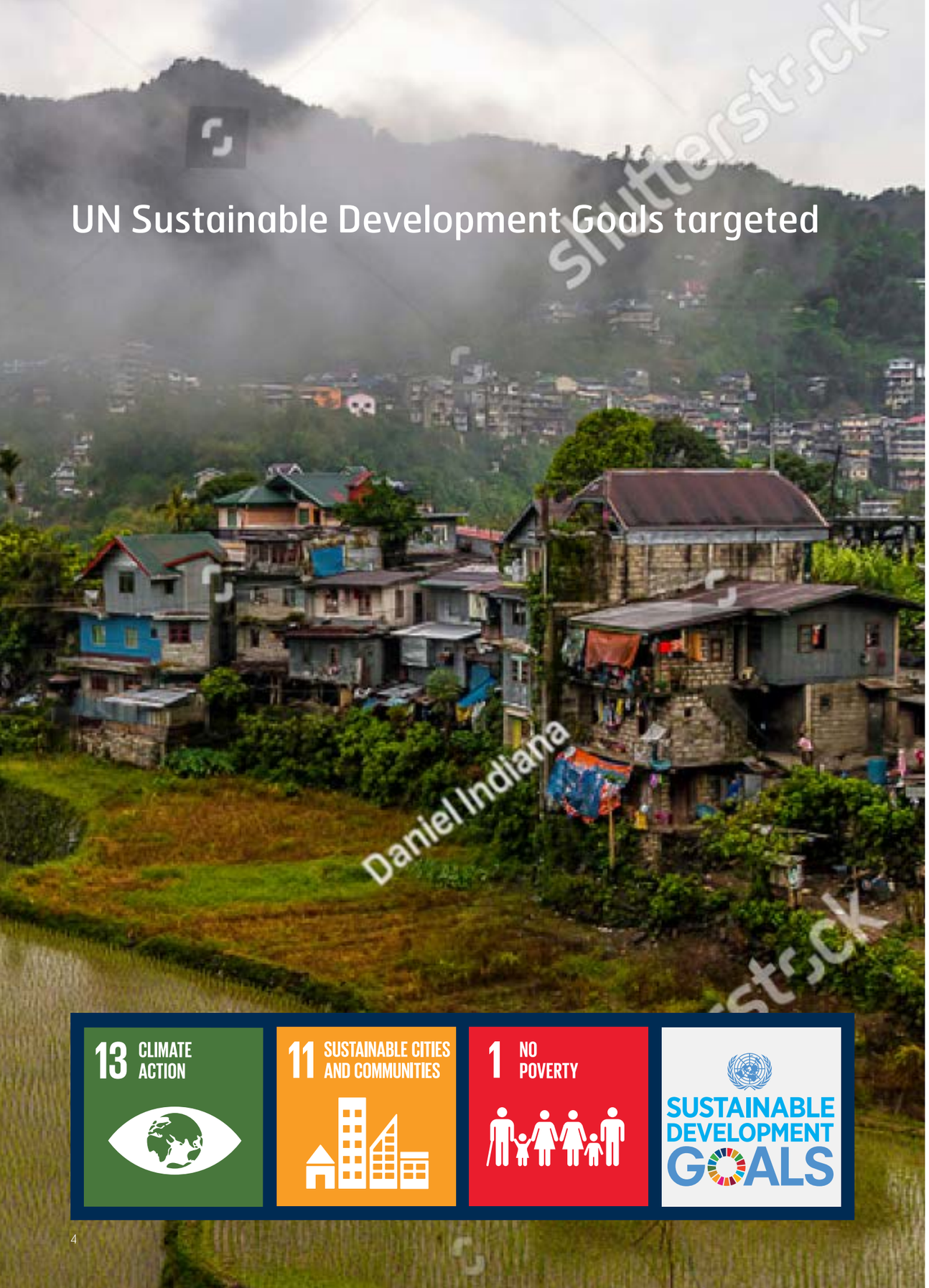
The project was first implemented in the Bicol, a region in the Philippines known for its very high exposure to natural hazards, with roll-out to four other regions – Cordilleras, Eastern Visayas, Socsksargen, and Mimaropa – over the course of the project.

Requirement for a space-based solution

For this project, we are focusing entirely on satellite-based solutions for emergency communications in times of disaster.

Space-based technology has a wide variety of applications for disaster risk reduction and management. Remote sensing satellites can provide high-resolution topographic data that can be used to model the characteristics of a hazard (i.e. flood, storm surges). Satellite imaging can help determine the extent of damage by observing the before and after images of a certain area. Satellite communications, undoubtedly the most resilient form of communication, can be used as an emergency back-up in the event of terrestrial communication breakdown.





Project consortium

The primary partners in the project are:

- Inmarsat – the world's leading provider of global mobile satellite communications.
- Department of Social Welfare and Development – the executive department of the Philippine Government responsible for the protection of the social welfare rights of Filipinos and the promotion of social development.

They are joined by:

- Télécoms Sans Frontières (TSF) – the leading NGO providing emergency communications in response to humanitarian crises. TSF is part of the training team teaching users how to effectively use satcoms in emergencies.
- TD International – a global strategic advisory firm. They are tasked with identifying opportunities in the private sector and recommending a business model suited to the Philippine market.
- CPRM – local experts in designing and delivering M€E.
- Satellite Application Catapult – an independent innovation and technology company, created to foster growth across the economy through the exploitation of space.
- Devex – a social enterprise and media platform for the global development community.

Solution development

The programme has been running since March 2017 with DSWD Rapid Emergency Response Teams (RETT) now trained in four out of five administrative regions earmarked for the pilot (there are 17 in total). In the period between December 2017 and April 2018, RETT was deployed to deal with four humanitarian crises.

Each participating region has:

- 1 x Global Xpress terminal
- 2 x BGAN mobile terminals
- 2 x IsatPhone 2 satellite phones

The composition of the kits was designed to respond to almost all eventualities. In the event of total telecommunications failure in a region, each element plays a certain role in the disaster response. Global Xpress is advised for use for in forward command centres or mobile operations centres as the network's high bandwidth capability gives multiple users in the field the data capacity and speed they require. Compact and lightweight BGAN terminals are ideal for deployment out in the affected areas for reliable transmission of information on the damage and needs. Satellite phones are there for a quick and easy way for responders to communicate with each other, and include inbuilt an safety function so their whereabouts can be constantly tracked.

Sustainability model

Nationally, disaster response in the Philippines is organised around an effective inter-departmental national disaster council, which has demonstrated the ability to innovate and learn from disaster scenarios. As a consequence, the Philippines provides an excellent testing ground for a new technology or practice into the disaster response toolkit – they have the need, they have the infrastructure to embed and sustain new capabilities, and lessons from the Philippines can be quickly scaled across the region and to other disaster-prone countries.

Sustainability will be achieved by demonstrating to DSWD the effectiveness and speed of implementation and ease of use of Inmarsat mobile satellite communication solutions.

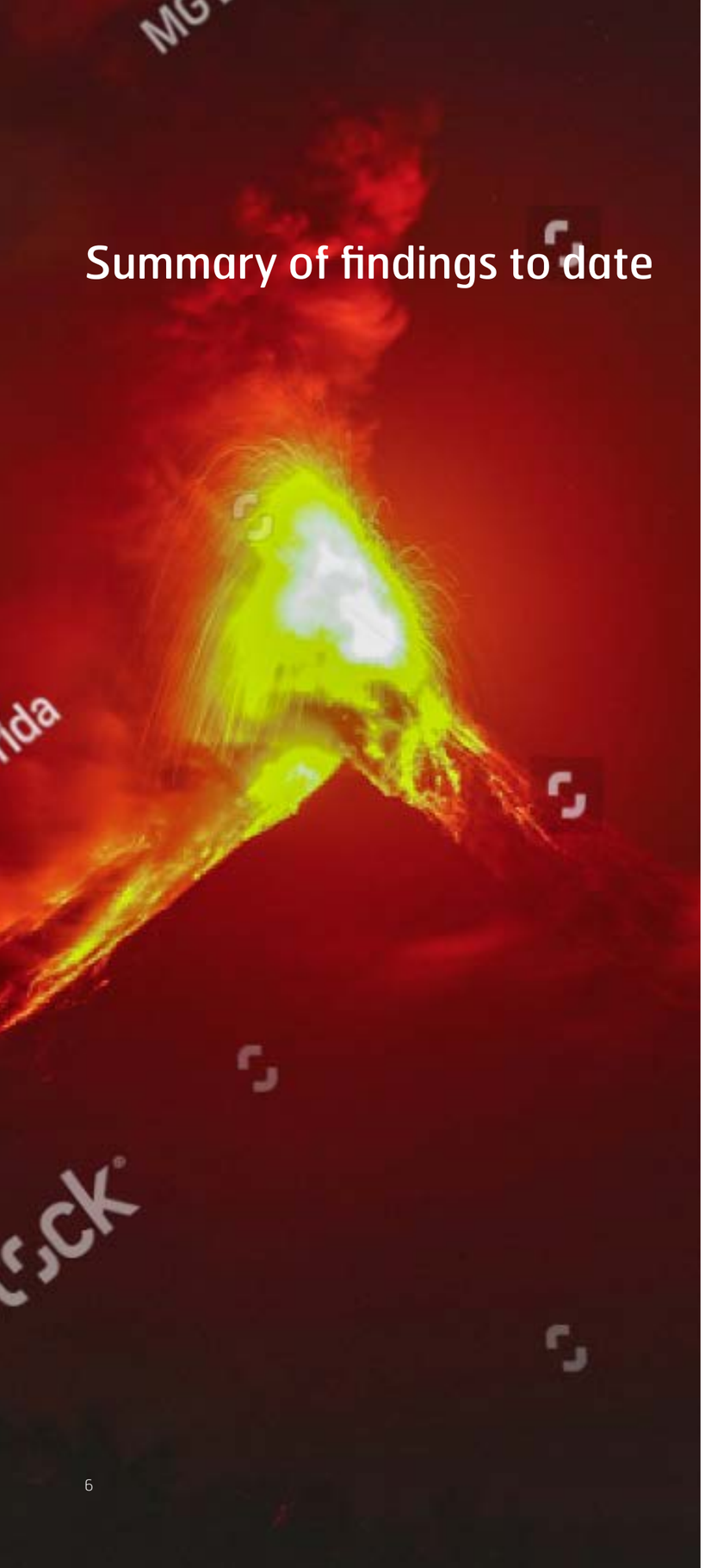
If the project KPIs are met, both in actual disasters and national and regional exercises, then DSWD has stated that it will add the capability into its national budget ask and has started explorations already. This will be to operate the satellite solution beyond the duration of the project by becoming a customer of Inmarsat's service partner in the region. Successful experience in the Philippines will also quickly be transferable to other countries, initially through the Association of Southeast Asian Nations (ASEAN) and then through other regional and global development players such as the development banks and aid donors, who can play a major role in supporting transfer of successful technologies in disaster preparedness and response.

The prospects for sustainability will be improved by an efficient and economic use and pricing model which avoids unnecessary use of capacity and keeps operational cost reasonable and sustainable. An innovation with Global Xpress allows bandwidth management and usage-based charging, so Philippine government agencies will improve usage efficiency and thereby keep costs to reasonable levels.

TSF already has extensive experience with bandwidth management during disaster response from using Inmarsat's well-established lower bandwidth (>500kbps) BGAN solution. BGAN terminals are also being used in this project to complement the larger bandwidth GX solution.

This project aims to demonstrate and stimulate sustainability through effective operations, working out from initial deployments to implement in five pilot regions over three years. Towards the end of the project the partners will prepare a scaling-up strategy and promote the solution through workshops at Devex events. A business plan will be prepared for business continuity use of satcom equipment for non-state actors such as financial institutions – this will be led by the former head of the Asian Development Bank's (ADB) Security and Emergency Services Department at its Manila headquarters (TD International).

The Philippines is an important country for the space sector as it is an experienced and heavy user of all capabilities, and there is substantial operational knowledge of the benefits of satellite communications within the government.



Summary of findings to date

There have been four crisis situations where DSWD Rapid Emergency Response Teams have been deployed with the Inmarsat satellite communication kits since the project began in March 2017.

- **Marawi** – Following an insurgency, 77,170 families comprising 353,921 people were displaced. The DWSD and other departments opened 58 evacuation centres in 17 municipalities in Lanao del Norte and Lanao del Sur.

  A GX terminal was deployed by the DSWD Main Command Centre in early December 2017 to improve command and control capabilities and communicate with the main ministry in Manila, and provide Wi-Fi access for evacuees.

- **Storm Tembin, Mindanao** – On 22 December 2017, Tropical Storm Tembin made landfall. Massive amounts of rainfall triggered widespread flooding, flash floods and mudslides in impacted areas. The storm caused over 240 fatalities and affected 184,278 families (871,757 people). Provinces affected included Lanao del Norte, Lanao del Sur, and Zamboanga del Norte in Mindanao.

  DSWD RETT teams deployed BGAN terminals and IsatPhones to areas impacted by flooding for immediate impact assessments to bring aid where it was needed via on the spot communications.

- **Storm Agaton, Mindanao/Mimaropa** – On 1 January 2018, Storm Agaton hit the areas in Mindanao previously affected by heavy flooding and also caused disruption in Mimaropa and Caraga affecting 18,547 families or 83,908 people.

  Again, DSWD RETT teams in the field were able to establish immediate communications using BGAN broadband data and IsatPhone 2 satellite voice to send impact assessments and aid requests.

This case study focuses in detail on the DSWD response to the Mount Mayon eruption in January 2018.

Mount Mayon, an active volcano in the province of Albay in the Bicol Region of the Philippines, began showing volcanic activity on 13 January. The Philippine geological institute, Phivolcs, reported a phreatic, or steam-driven, eruption. This type of eruption is not typically calamitous but repeated events are usually precursors to a much more violent eruption.

The following morning, two more phreatic eruptions were observed, prompting Phivolcs to raise the volcano alert from zero to level two[4]. This prompted the pre-emptive evacuation of thousands of people in the municipalities of Guinobatan and Camalig in Albay away from the volcano.

Phivolcs later raised the alert to level three as lava flows were detected, meaning an "increased tendency toward eruption is likely" within days or weeks. This increased the radius of the Permanent Danger Zone from 6 km to 7 km, forcing the evacuation of thousands more.

Mayon continued to show dangerous volcanic activity for the next several weeks. Phivolcs further raised the alert to level four, warning that a hazardous eruption was imminent. This is just one level below the highest level of five, which means the volcano is already erupting.

Several incidents of rockfalls, landslides, pyroclastic and lava flows were recorded. One of the more dangerous hazards associated with volcanic eruptions is the ash cloud due to the dangers it poses to a wider area. Ash spewed by Mayon suspended flights to and from Albay, seriously hampering relief efforts. The resultant ash fall from the sky can be poisonous to humans and livestock. The towns of Guinobatan and Polangui were buried in ash. Lahar, or mudflow, was also a threat due to the continuous rains that occurred during the period.

The situation affected an estimated 24,000 households in nine municipalities in the Albay province of Bicol.

The Philippine Government immediately mobilised its response assets in all levels of governance[5]. Nearby municipalities quickly evacuated people to safer areas at the first sign of eruption. Evacuation centres, aid supplies, and humanitarian workers were deployed in anticipation of an escalation of events.

As the crisis worsened, government response agencies at the national level began augmenting the efforts at the region level. The armed forces assisted local governments in the evacuation of tens of thousands of people away from the danger zone into the pre-established evacuation centres. The DSWD began sending food and non-food items to the evacuees. Health emergency workers began stockpiling medical supplies while government search and rescue teams (both military and police) were put on standby in preparation for any emergency.

At the height of the response, the government (specifically the DSWD) cared for an estimated 80,000 people in 97 evacuation centres in the province of Bicol.

As part of its response protocol, an Incident Command Post (ICP) was established near the affected area to coordinate the response efforts of various government agencies including the Philippine armed forces. The ICP is a temporary area set up for tactical level command and control operations and is generally made up of the different government agencies involved in disaster response.

For the Mayon eruption response, the Bicol Regional Training and Teaching Hospital was chosen as the ICP because of its proximity. It was also the only government building capable of hosting a large contingent of responders.

Although the eruption did not knock out terrestrial communications, the ICP had no access to them. The hospital had no fixed line communications and mobile networks outside Manila do not have the capacity to run large quantities of data. In fact, the Philippines is last among Asia Pacific countries in terms of internet speeds[6].

The incident command team members reported that they could not properly coordinate operations without internet access and so DSWD offered them the IPP Philippine project's Global Xpress terminal.

The DSWD Rapid Emergency Telecoms Team (RETT) set up the GX terminal on the roof of the hospital. To maximise the use of the bandwidth the RETT team prioritised the connectivity to email and commercial instant messaging and apps such as Viber and Facebook Messenger. Thirty users from various government agencies were able to use chat functions, VoIP, file transmission (for reports, images, etc.) and video conferencing simultaneously, with access to internet connectivity at all times.

Additionally, RETT deployed Explorer 710 and MCD-4800 BGAN terminals to various evacuation centres, expediting the delivery of data from the ground to the command centres. Government humanitarian workers were able to send reports from the evacuation centres straight away.

One game-changing ability highlighted in this instance was the ability to send and receive photos. It is one thing to send a report with bald facts and figures but a picture is a more compelling way to tell a story. A photo of families huddled together due to the cold is more powerful than a report that states "ten families need blankets". This was previously not possible because of the humanitarian workers' reliance on radio communications. According to DSWD RETT member Joseph Teston, decision makers quickly acted on requests because they were able to see the actual situation through the images sent from the ground.

Conclusions

To date the IPP Philippines project has been able to demonstrate to the DSWD in real life situations that resilient, flexible and easily deployable satellite communications enables:

- The ability to quickly deploy digital technologies in the most difficult situations.
- A faster initial response – the ability to provide instant situational reports rather than paper documents being transported to the nearest local centre with communications access, meaning help can be directed faster to the points of need.
- Reliable connectivity – terrestrial communications were up and running in all the situations outlined with the exception of Tembin, where they were restored the day after the storm passed. However, the unreliability and capacity of fixed and mobile communication networks, especially in remote areas in the Philippines, remains a challenge to responders. They need a more dependable form of communication and the satellite terminals provided to the responders delivered this essential requirement.

In addition, satellite connectivity can improve the efficiency of post-event activity, such as enabling the faster processing of individual families' needs – this will be tested in the second half of 2018/early 2019.

Challenges to overcome

- More awareness on how satcoms can be utilised is needed. Training sessions and general discussion with stakeholders in the Philippines have shown that people associate satellite connectivity with a satellite phone but are not aware of the broadband data capabilities provided by BGAN and Global Xpress. An effective knowledge sharing and communications campaign must be put in place to educate potential users of the different applications of satellite communications.
- Satcoms need to be included in the disaster response protocols. The use of satellite communications in emergencies is not common in disaster management operations in the Philippines. Therefore, the need for it is not immediately obvious to responders. Lack of awareness about its capabilities and how it can be helpful to their operations may leave the equipment unused. By including it in their procedures, they will learn how effective it is in their operations and maximise its use in the future.
- Some knowledge of IT is needed to operate the satellite communication kits. Turning the satcoms kits on and getting online is simple. However, troubleshooting may be an issue for someone who has very limited understanding of technology. Someone with IT knowledge must be always part of the team.

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