Satellite Services: Communications for Disasters and Emergency Response

Presented by:

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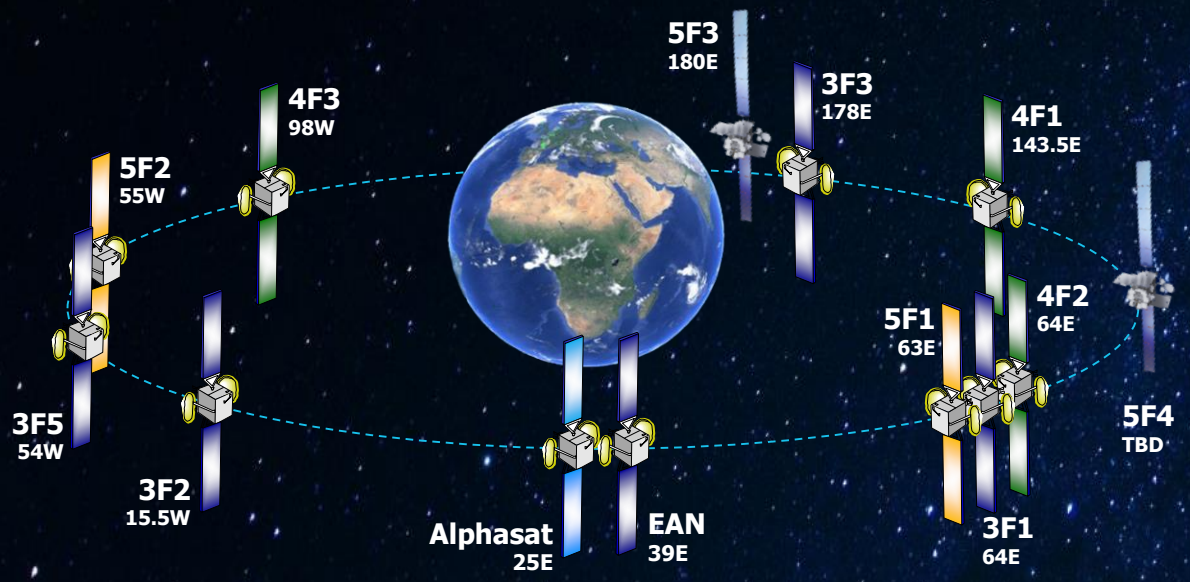
Global Forum on Emergency Telecommunications (GET-19)
6-8 March 2019, Balaclava, Mauritius

inmarsat
The mobile satellite company™

Introduction to Inmarsat

The leaders in global mobile broadband connectivity



From 300 MB/sec to voice – all on the move globally

History
- 40 years
- Started as IGO
- 13 satellites in 5 generations

Global Focus
- 190+ nations served
- 70 nationalities in 42 offices

Breadth
- Global mobility
- Diversified across land, sea & air

Networks
- Ka-Band
- L-band
- EAN hybrid
- LPWAN & IoT

Fully-funded
- FTSE250
- £2.5B mkt cap
- Low leverage
- Profitable

Innovative
- R&D $600m pa
- VHT Satellites
- Products
- Digital agenda

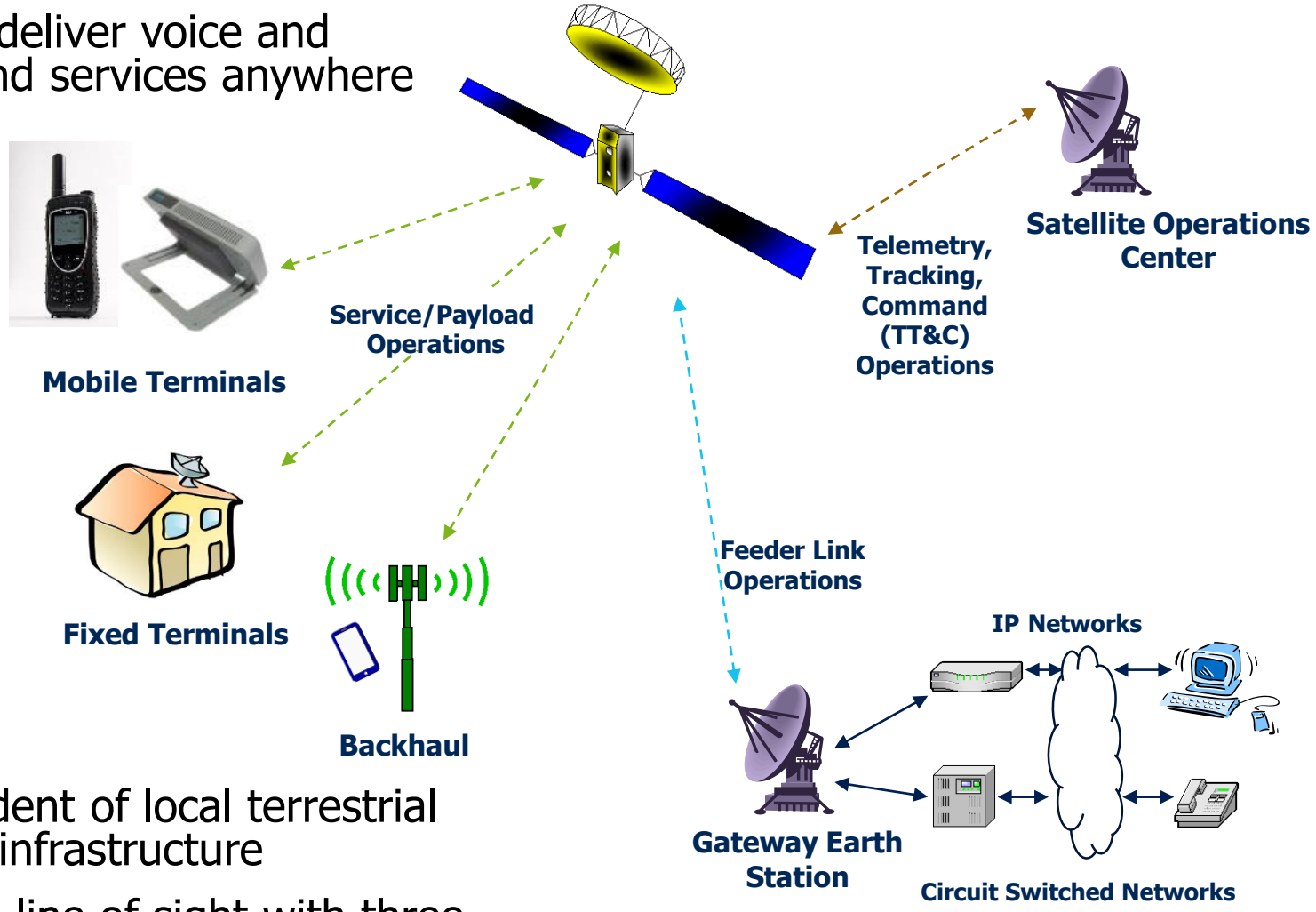
Why Are Satellite Communications Essential for Emergency Response?

Flexible	• Ideal for rapid deployment • Instant set-up on site as soon as a disaster happens • Can control and restrict access to services
Portable	• Compact terminals ideal for anyone travelling alone and moving from site to site
Easy to use	• Simple training can provide technical expertise required to set up and use most satellite devices
Global coverage	• Remote site connectivity • Extended team coverage
Simultaneous voice & broadband data	• Send status reports while joining conference calls • Accessing GIS (geographic information system) data for situational awareness • High Throughput Satellite (HTS) systems providing great capacity
Reliable	• Maximum reliability for critical data • Independent of the terrestrial infrastructure
Provides essential connectivity	• Provides backhaul for terrestrial infrastructure • Offers broadband connectivity at a cost that is not dependent on density of deployment

So lets start with satellites…

Satellite system architecture

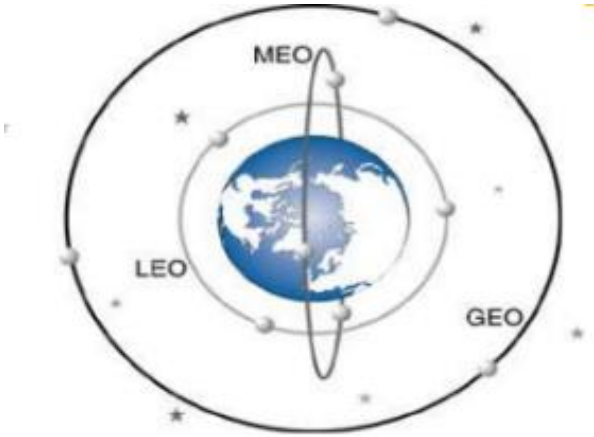
- Satellite deliver voice and broadband services anywhere



- Independent of local terrestrial network infrastructure
- But need line of sight with three different wireless communications paths

Satellites by Orbit

- Geostationary earth orbit (GEO)
  - Satellites orbit at 22,300 miles (35,700 km) above the equator at the same speed as the earth's own rotation
  - 3 satellites can cover most of the globe
  - Inmarsat, Intelsat, SES, Echostar, Thuraya, Rascomstar
- Medium earth orbit (MEO)
  - Satellites are closer to users on Earth (5000-15000 miles) (8000-24000 km)
  - 10-18 are required for continuous coverage
  - GPS, O3b
- Low earth orbit (LEO)
  - Satellites are closest to users (300-1000 miles) (480-1600 km)
  - At least 40-70 satellites are required for full coverage
  - Iridium, OneWeb



Credit: Satellite Industry Association

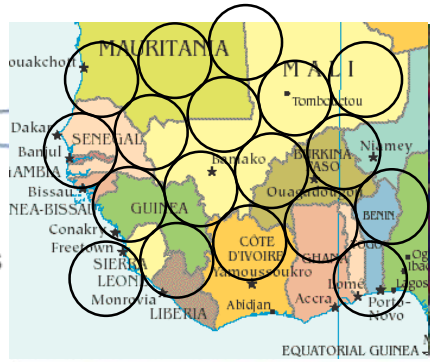
Different Frequency Bands Enable Different Solutions

Increasing Frequency

Increasing Miniaturisation

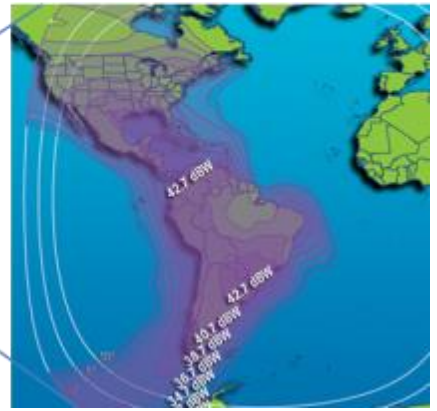
Frequency Range (GHz)	"Band"	Utilisation
18 to 40	Ka	High Data rate comms
12 to 18	Ku	Continental Broadcasting
8 to 12	X	Military in-theatre
4 to 8	C	Global broadcasting
2 to 4	S	Mobile Broadcasting
1 to 2	L	Mobile

Ka-band – 0.5 degree beams



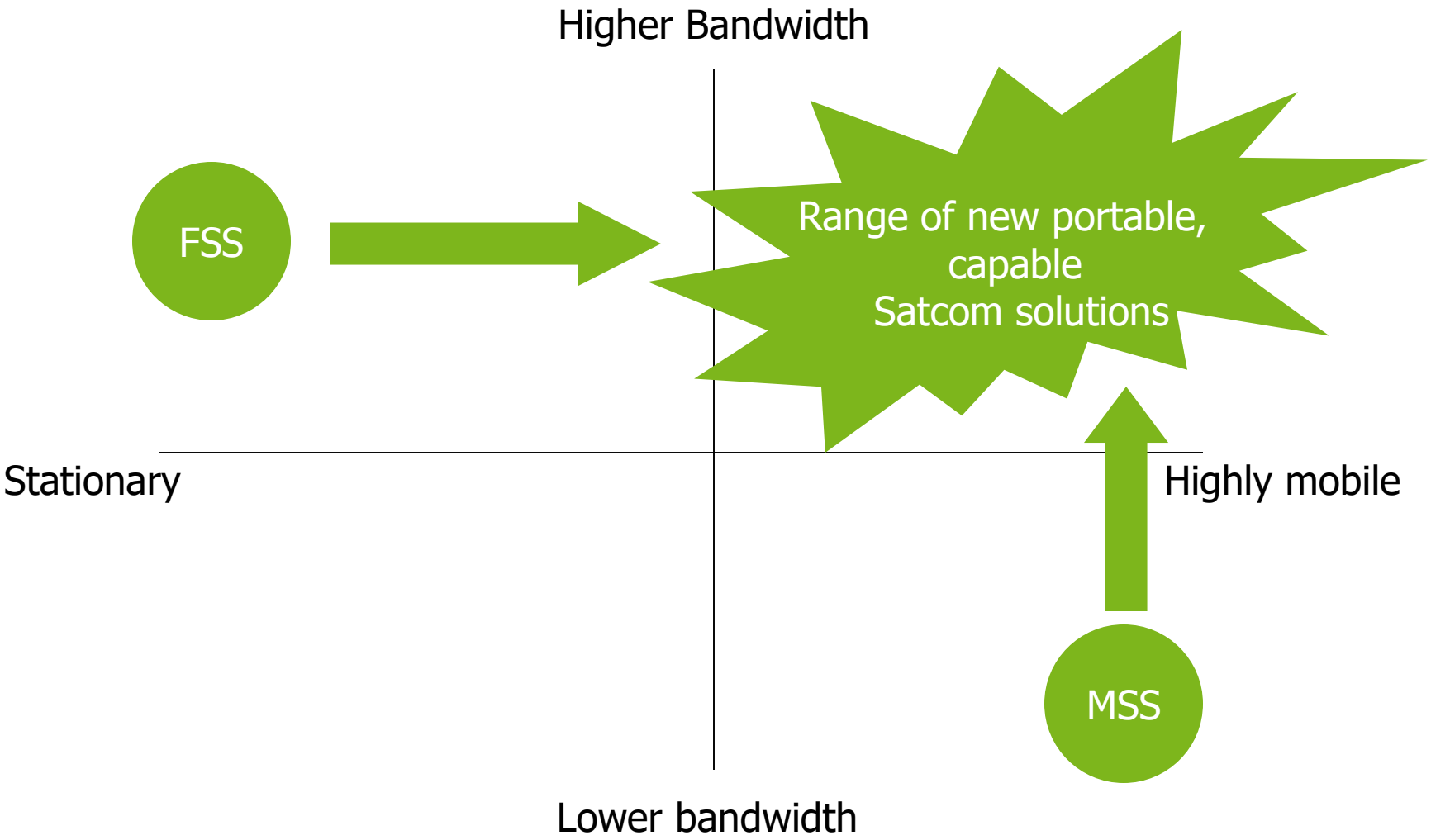
Ku-band – 3 degree beams

C-band – 8 degree beams



Source: Avanti Applied Technologies

Convergence of Fixed and Mobile Satellite Services



Today, Satellites Can Deliver…

Seamless worldwide coverage

- Same interface globally.
- Land, sea, and air mobile services, including safety services for maritime and aeronautical users.
- Mobile broadband network available anytime, anywhere.

Small portable devices that are easily set up and get online

Differences among satcom options

- Size
- Mobility
- Bandwidth

Emergency Communications and Disaster Preparedness

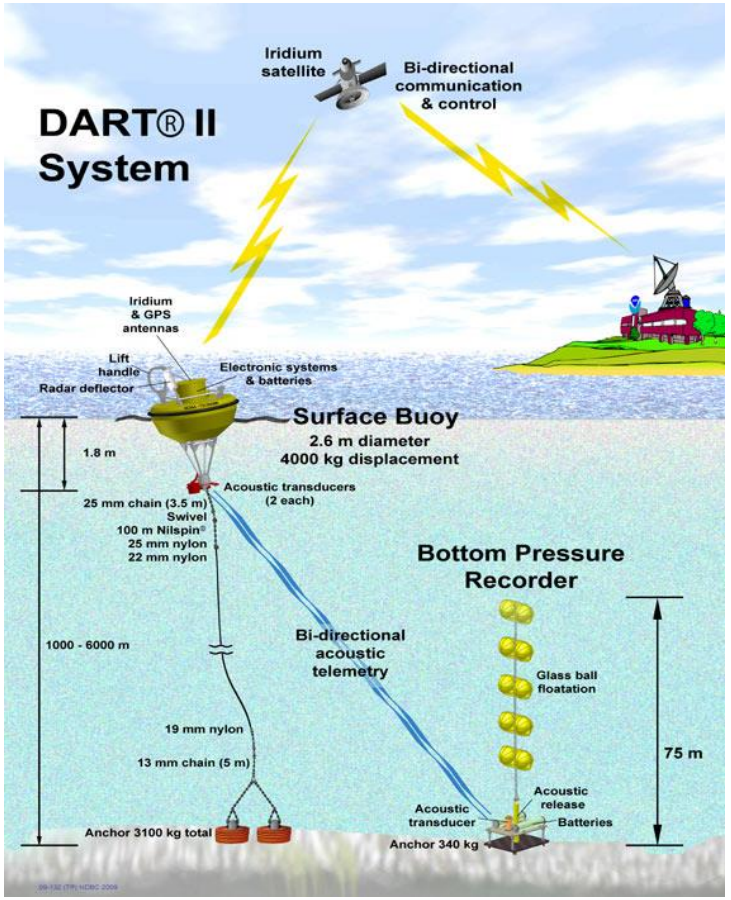
The Role of Communications in an Emergency Phase I: Before Disaster Strikes

Weeks Before

- Prediction, pre-positioning and disaster preparation

Immediately Before

- Detection and early warning



Tsunameters use satellite communications to detect tsunamis early, providing an invaluable early warning capability.

Phase II: During a Disaster

First 0-4 Hours

- Notification and emergency responders
- Social media updates – Twitter feed
- Military and government communications
- Evacuation

Phase III: Immediately After the Disaster

First 4-24 Hours	First 24 -48 Hours	First 5-10 days
Disaster inventory Rescue Command and Control	Humanitarian calling, C2, Rescue, recovery, news	Restoration Recovery operations

Increasing bandwidth requirements as response expands over time

Case Study: Hurricane Matthew Response in Haiti (October 2016)

Cat. 4 hurricane. More than 1000 dead and 1.5 million others in need of relief

- Local mobile network disabled, restoration in many areas took more than a week

Satellite communications were essential to response and recovery efforts

- Pre-positioned emergency comm's kits made available to the humanitarian community in the first hours following the disaster
- Satellite connections installed at Departmental Emergency Operations Centres (COUD) carried nearly 28 GB of data to support recovery in 11 days after the hurricane
- In 9 days before mobile networks were restored, satellite phones helped 2,461 people across 19 communities restore family links

VSAT equipment deployed to COUD to replace local Internet connection stayed in place for months after the event

Case Study: Hurricane Irma Response in Saint Martin (2017)

Télécoms Sans Frontières (TSF) deployed to Guadeloupe 24 hrs after Irma – authorization to enter Saint-Martin and Saint-Barthelemy 3 days later

Satcoms at the island Coordination Centre, Airport, and fire brigade HQ support emergency response efforts with voice and data

- coordinate medical evacuations,
- conveyance of material and human assistance,
- provision of emergency accommodation

Satellite phones utilised by TSF's mobile calling teams provide free telephone calls to enable families to let loved ones know they are safe and to seek assistance

Case Study: Hurricane Maria Response in Dominica (2017)

Installed satellite Internet connection at Roseau stadium to support relief teams

- 72 GB of data transferred in the first week
- distribution coordination,
- provision of relief supplies
- mobilisation of logistics to reach remote areas of the country

Wi-Fi zones

- Portsmouth town center - >1500 devices in first week
- VSAT enabled Wi-Fi bridges in towns enable citizens to access social networks and communications apps
- Ambulant Wi-Fi – bringing access to social media, messaging apps and news sites village to village

Case Study: Disaster relief effort Sulawesi, Indonesia (2018)

Télécoms Sans Frontières (TSF) and Team Rubicon deploy after a 7.5 magnitude earthquake strikes followed by a tsunami caused devastation

- TSF the first NGO on the scene
- Internet connectivity for humanitarian coordination centre (100 GB exchanged)
- Provision of itinerant WiFi Hotspots
- Mobile equipment used to reach still isolated villages

Lessons Learned from Disasters

- First-in responders and media well trained
- Efficient coordination and network sharing by NGOs and other end-users
- The business of disaster response is conducted BEFORE a disaster strike
- Disasters expose unexpected gaps in disaster-based business plans
- Prepared users drive satellite usage
- Social networking and mobility-based applications are revolutionizing disaster response
- Data requirements on-the-ground likely to grow dramatically

Lessons Learned from Disasters (cont)

Terrestrial Systems

- Terrestrial infrastructure vulnerable
- Damage from events (flooding, earthquake, etc), lack of power/fuel, lack of redundant pathways
- Operability can fail
- Interoperability unsolved

Satellite Systems

- VSATs have high capacity, but require set-up and training
- Smaller satellite terminals more easily deployable and offer broadband IP data and voice, but less capacity than VSAT
- Satphones offer basic voice and data and most mobility, but users are unfamiliar with use and supply is limited

Key Lesson: *First Responders need a mix of connectivity solutions, including satcom in their daily toolkit!*

Thank You

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