WHEN DISASTERS STRIKE

Satellites Play a Critical Role in Saving Lives and Providing Critical Services Before and After a Weather Disaster

Prepared By:

SIA The voice of the satellite industry | Satellite Industry Association

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For more information regarding this report, please visit the SIA Emergency Response and Disaster Relief Webpage HERE

Further reference materials:

SIA Public Safety Policy Webpage, click HERE

SIA First Responders Guide for Satellite Communications, click HERE

WHEN DISASTERS STRIKE

Satellites Play a Critical Role in Saving Lives and Providing Vital Services Before and After a Weather Related Disaster

Since 2005, 40 Atlantic hurricanes have hit the United States, causing more than 2,100 casualties and damage estimated in the hundreds of billions of dollars.

The 2020 Atlantic hurricane season ended with a record-breaking 30 named cyclones and 12 storms making landfall in the continental U.S. The peak of the 2023 Atlantic hurricane season arrives on Sept 10th.

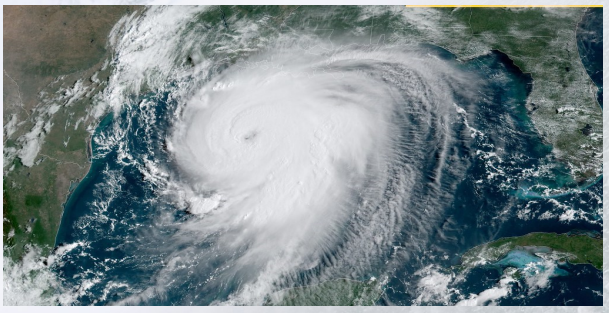
(Above) Since Hurricane Katrina, 28 U.S. States plus 2 U.S. Territories and millions of Americans have been severely impacted by Atlantic hurricanes and tropical cyclones.

Satellites to the Rescue — For 60 years, satellites have been helping save lives by supporting improved hurricane, tropical storm and other severe weather forecasting, preparation, search, rescue and recovery services as well as everyday utilities that become critically vital to citizens when a disaster strikes.

ADVANCED WEATHER FORECASTING VIA SATELLITE

As weather predictions are vital to saving lives, the new Lockheed Martin manufactured GOES-R satellites with advanced imaging allows meteorologists and emergency responders to more quickly and accurately predict when and where hurricanes will strike. Overall, the satellites in the Lockheed Martin-built GOES-R series are providing forecasters in the U.S. and western hemisphere with sharper, more defined images of severe storms, hurricanes, wildfires and other weather hazards. During the 2020 Atlantic hurricane season, GOES-16 and 17 images were critical in forecasting severe weather as it approached the U.S. Atlantic and Gulf coasts.

Spire Global small satellite radio occultation (RO) weather data is critical to industries and governments across the U.S. and around the world. This data is crucial as it helps local officials plan life-saving evacuations in areas predicted to be heavily impacted by severe weather. In late 2020, the U.S. National Oceanic and Atmospheric Administration (NOAA) signed an agreement with Spire and GeoOptics to purchase commercial satellite RO data for use in weather forecasting.



GOES-R advanced weather satellites provide life-saving images to forecasters and emergency officials like this image taken of Hurricane Laura as it approached the U.S. Gulf Coast in 2020. Satellite manufacturer Lockheed Martin is currently preparing to launch its next advanced GOES-T weather forecasting satellite in December. Photo Credit: NOAA

Spire Global satellites like the one pictured above provide commercial and government customers with radio occultation data for atmospheric temperature, pressure and humidity that can be vital for forecasting severe weather. Photo credit: Spire Global

SATELLITE CONNECTIVITY AND BROADBAND

Photo Credit: Jackson Lamar Cubic/GATR

In 2020, after Hurricane Laura made landfall as a Category 4 storm on the U.S. Gulf Coast, Intelsat General Corporation (IGC) and its customer Cubic provided critical internet connectivity to first responders and residents in Lake Charles, LA.

In 2022 and 2023, GEO and NGSO satellites provided crucial internet connectivity and other services post Hurricane Ian in Florida and following the devastating wildfires in Maui, Hawaii.

Satellites provide vital debit and credit card authorizations at gas stations and retail stores during storm preparations and after a hurricane has impacted an area.

In Puerto Rico and the USVI, Hughes Network Systems partnered with FirstResponse1 to establish emergency connectivity. Hughes VSAT connectivity has been a constant presence, supporting FEMA efforts in the aftermath of weather and seismic events that continue to plague the region. Satellite data services from Intelsat, Hughes, Inmarsat, Viasat and others provide essential lifesaving connectivity and data services to response and recovery agencies, hospitals and others when terrestrial services are damaged.

Retailers process purchases using satellite data services before and after a hurricane. Companies such as EchoStar, Hughes, Telesat and Telesat provide reliable business continuity services for point of sale (POS) credit/debit card authorizations and inventory management.

SATELLITE PHONES

Satellite phones from companies such as Iridium, Inmarsat (IsatPhone), Ligado and Globalstar can provide a vital service to first responders, recovery teams and survivors cut off from the world who wish to reach out to family and loved ones.

((Left) In Oct 2017, a Coast Guard Tactical Law Enforcement Team South crewmember provided a satellite phone to a local resident in Puerto Rico so she could call her son in Alaska who she hadn't been able to contact since Hurricane Maria struck. Photo Credit: U.S. Coast Guard photo by Petty Officer 3rd Class

Above) VSAT terminals restoring connectivity in Puerto Rico. (Photo credit: Colin Chaperon for the American Red Cross)

MOBILE COMPANIES RELY ON SATELLITES

Every day, terrestrial-based 7 billion mobile phones rely on GPS satellites for timing, but mobile phone companies also utilize satellite services during a disaster. In the 2017 hurricane season, AT&T utilized satellite phones and both Verizon and AT&T deployed satellite trucks in regions hit hard by hurricanes in order to restore service. T-Mobile and Sprint also used VSAT terminals to provide backhaul support for restoration of cellular and text services.

COMPARISON SATELLITE IMAGERY

Comparison Imagery - Before and After Imaging from satellite remote imaging and earth observation companies such as Planet, assists responders and recovery teams in locating areas of flooding and shelters/resources, performing search and rescues, evaluating damage to critical infrastructure, searching for navigable roads, and prioritizing aspects of the response and recovery.

Satellite imaging companies such as Planet can provide emergency responders and recovery agencies with high resolution before and after images. Such images taken from space before and after a hurricane or other disasters (such as a 2020 dam breach pictured above) emphasize the destruction that can occur due to flash flooding. Photo credit: Planet

GLOBAL POSITIONING SYSTEM (GPS) SATELLITES

Operated by the U.S. Air Force, GPS satellites built by Lockheed Martin and Boeing provide position, navigation, and timing data for GPS terminals and mobile phones before, during and after a disaster. This data enables critical precision location of disaster victims, relief team workers, and emergency responders and their equipment. GPS satellites also support the continuity of communications networks, electrical power grids and financial networks and ATM services by providing precise timing data that is critical for synchronization and operational efficiency.

SATELLITE COMMUNICATIONS (SATCOM)

Satellite Communications (SATCOM) Networks are highly survivable and robust compared to terrestrial communications infrastructure which may be damaged or destroyed in a hurricane. SATCOM equipment can also be pre-deployed to centralized "safe" locations within a region and in some cases, these systems can be pre-installed to enable operation before, during, and after a disaster. From federal, state and municipal public agencies including FEMA and NGO recovery organizations to everyday consumers, satellites provide robust services and business continuity when other networks are damaged, overloaded or unavailable. Satellite Communications also provides a load sharing or surge capacity solution and enable the creation of instant communications infrastructure. For a list of specific response initiatives by satellite companies in the wake of recent hurricanes, please see the appendix at the end of this report.

SATELLITE BROADCAST

Satellites from companies such as Eutelsat, Inmarsat, Intelsat, SES and Telesat support television news trucks and emergency responders to provide valuable onsite rescue and recovery information and services.

SiriusXM works with the Integrated Public Alert and Warning System (IPAWS) management office to distribute receivers in impacted regions such as PR and can dedicate additional channels to broadcast vital emergency safety information.

Satellite News Trucks pictured above were deployed following Hurricane Katrina.

2020 Atlantic Hurricane Season
by the numbers

12
Storms hit the U.S. coastline, (5 of which came ashore in Louisiana)
Previous record: 9 in 1916

13
Hurricanes
Average season has six

10
Named storms that formed in September
Most for any month on record

6
Major hurricanes
Average season has three

10
Rapidly intensifying storms sampled
by NOAA and the U.S. Air Force

30
Named storms

Arthur	Paulette
Bartha	Rene
Cristobal	Sally
Dolly	Teddy
Edouard	Vicky
Fay	Wilfred
Gonzalo	Alpha
Hanna	Beta
Isaias	Gamma
Josephine	Delta
Kyle	Epsilon
Laura	Zeta
Marco	Eta
Nana	Theta
Omar	Iota

NOAA Hurricane Hunters

86
Missions conducted

102
Hurricane eyewall passages

678
Flight hours

1,772
Dropsondes deployed
to gather vital atmospheric data

NOAA underwater hurricane gliders

47
Glider deployments

13,272
Gathered observations

179,401
Temperature and salinity profiles
These help improve forecasts for current storms

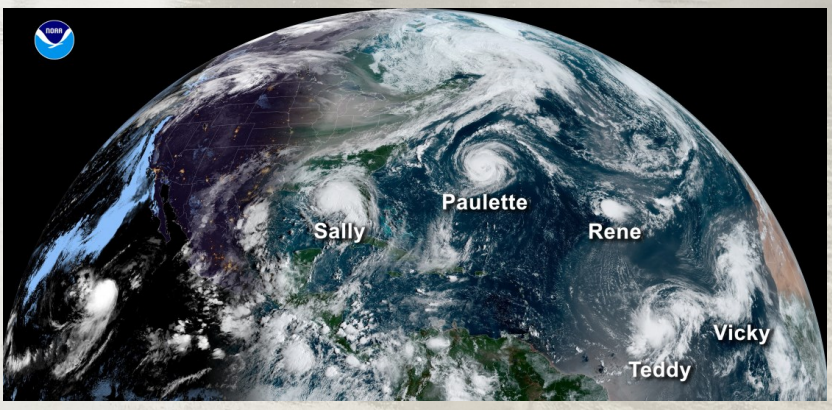
16
NOAA weather satellites in operation

5th
consecutive above-normal season
Previous record: 4 from 1998 to 2001

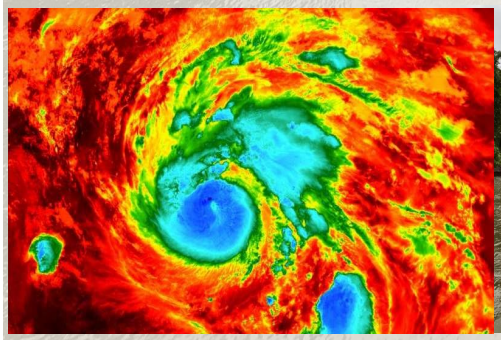
86
Facebook Live broadcasts
from Ithe National Hurricane Center

Image Credit: Graphic courtesy of NOAA.com

The 2020 Record-Setting Hurricane Season Produced 30 Named Storms - NOAA is Now Predicting an Above Average 2023 Hurricane Season



(Right) On September 14, 2020, the GOES-16 weather satellite took this image of five Atlantic tropical cyclones in the Atlantic basin. A total of 10 named storms formed in September, the most for any month on record. Photo Credit: NOAA



Hurricane Harvey Caused Massive Flooding in TX and LA (Photo credit Maxar.com and ESA)

Hurricane Sandy Destruction

SIA Satellite Industry Association

For more information, please contact the Satellite Industry Association via email at info@sia.org

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APPENDIX A: HURRICANE SEASON SATELLITE INDUSTRY RESPONSE AND RECOVERY INITIATIVES

Hughes Network Systems, LLC (HUGHES): Since the 2017 hurricanes in Puerto Rico (PR) and the US Virgin Islands when Hughes partnered with FirstResponse1 to establish emergency connectivity throughout the islands, Hughes VSAT equipment and connectivity has been a constant presence, supporting FEMA efforts in the aftermath of weather and seismic events that continue to plague the region. Hughes is in regular contact with USG agencies, FEMA and the National Weather Service, to support local connectivity in the wake of hurricanes, wildfires, tornadoes and other disasters. For further details regarding Hughes satellite internet in PR post-Hurricane Maria, please click HERE or view the video at https://youtu.be/FizJEH6HnKQ.

Hughes supported key USG agencies to ensure critical communications were available and made donations to key relief organizations in the affected areas to help ensure they had the services that were needed.

Inmarsat: From Inmarsat's inception in 1979 by the United Nations to provide safety communications for mariners at sea, Inmarsat has continued its commitment to saving lives for more than four decades. The company has forged strong links with government emergency planning teams and the humanitarian sector to help mobilize global satellite communications to aid disaster relief. Inmarsat's decades-long relationship with Télécoms Sans Frontières (TSF) is a testament to the vital importance of SATCOM. As the first official partner to the emergency telecommunications NGO in 2000, Inmarsat has provided airtime and financial aid to support its work in the aftermath of some of the most devastating disasters in over 70 countries. For example, during and in the aftermath of Hurricane Laura in the southern United States in 2020, when Inmarsat, with its valued partners, delivered rapidly-deployed voice and high-speed data services including IsatPhone handheld satellite phones, BGAN (Broadband Global Area Network) and Global Xpress to support official emergency and disaster response teams, providing vital communications and other important humanitarian services.

Inmarsat Government also provides SATCOM solutions for first responders under FirstNet as well as support in the operations of remote COVID19 Testing Sites in the U.S.

Intelsat General Corporation In 2020, after Hurricane Laura made landfall as a Category 4 storm on the U.S. Gulf Coast, Intelsat General Corporation (IGC) and its customer Cubic provided critical internet connectivity to first responders and residents in Lake Charles, Louisiana. IGC and Cubic sprang into action, providing crucial internet connectivity to the area's first responders, medical personnel, and other residents for eight days while their traditional communications infrastructure was re-established. Cubic deployed its GATR inflatable, ultra-portable satellite antennas and the GATR 950 modem –powered by Intelsat's FlexGround service – to several different sites in the Lake Charles area, providing communications-infrastructure support to Lake Charles Memorial Hospital; a Red Cross site enabling internet access to help residents call home and use instant messaging; the connectivity was also used for coordination between other Red Cross distribution points throughout the area.

Communications also supported Team Rubicon, a veterans' organization that serves communities by helping people prepare, respond and recover from disasters.

Intelsat Much needed communication relief arrived on the remote island of Vanuatu in the Solomon Islands thanks to Intelsat. Cyclone Harold battered the area, making landfall as a Category 5 storm, the second strongest tropical cyclone to ever hit the country. The storm caused extensive damage and knocked out communication networks, broadcast radio and television infrastructure, and power.

Intelsat, as part of its work with the United Nations Emergency Telecommunications Cluster (ETC), donated telecom capacity to the hard-hit island area on the Intelsat 18 satellite's South Hemi beam. This vital communication support helped connect the islands to the mainland areas, enabling families to get in touch with their loved ones and spur support for additional post-storm efforts.

Iridium: Iridium worked directly and through its partners with federal, state, and local government emergency management agencies to ensure access to reliable communications. Following the storms, Iridium worked with non-governmental organizations (NGOs) and first responder organizations to help supplement their communications capabilities by providing emergency 'seeder' phones where possible and appropriate. These devices proved to be vital in the initial days after the hurricanes hit in terms of providing communication for first responders responsible for rescuing people and saving as many lives as possible.

During the hurricanes of 2017, hundreds of Iridium phones were used to support emergency services through groups such as the International Telecommunications Union (ITU), Homeland Security, the U.S. Department of Defense, the State of Florida Governor's Office, and many NGOs. At one point, there were over 3,100 unique Iridium subscribers in the Caribbean region, enabling more than 221,000 total minutes of voice and data. Iridium Push-to-Talk provided real-time group communication and enhanced the coordination of life-saving efforts and evacuation of numerous areas in post-storm flooding conditions.

HURRICANE SEASON - SATELLITE INDUSTRY RESPONSE AND RECOVERY INITIATIVES (continued)

Ligado: Ligado's satellite network has been used by the DHS, FEMA and the FBI in PR and USVI and usage soared in the region. In the immediate aftermath of Maria, Ligado worked with the United Way's MISSION UNITED to meet the communications needs of those impacted by the Hurricane. Donated satellite phones and service were used by public safety officials, volunteers, and community organizations in PR so that they could stay in touch with areas where the communications infrastructure has been destroyed. The Company has fulfilled all requests for additional satellite phones and network capacity to support government and NGO relief. Additionally, Ligado responded to Hurricanes Harvey and Irma by getting hundreds of new satellite phone units into the hands of public safety officials and other first responders actively involved in disaster relief efforts.

O3b: O3b, an SES subsidiary, utilized the Ka band spectrum through its Medium Earth Orbit non-geostationary satellite constellation to help bring local wireless networks in PR online while the terrestrial infrastructure was being repaired.

Planet In 2020, Hurricane Eta and Hurricane Iota made landfall only days apart, heavily impacting several countries in Central America. These Category 4 and 5 hurricanes resulted in widespread flooding, damage, and lives lost. Planet made disaster imagery available through Planet Explorer, the Company's online imagery browser. Planet provided limited access to Explorer for up to 30 days to qualified disaster volunteer organizations, humanitarian organizations, and other coordinating bodies. In addition to hurricanes, Planet has also focused its imagery on other disasters including the 2020 dam breach in Michigan, last summer's wildfires in California and the flooding in Kentucky in the March 2021. Explorer is also continuously updated with the most recent imagery. To learn more or to gain access to Planet's Explorer, please email disaster-access@planet.com.

SES: In 2017, SES provided C-band services to relief workers in PR and utilization of Emergency.lu rapid deployment kits in Saint Martin, Sint Maarten and Dominica. These terminals were quickly brought in for use by responders in response to Irma and Maria to provide internet connectivity. Once installed, teams deployed Wi-Fi access points so that humanitarian aid organizations could have connectivity, numbering around 400 registrations. Emergency.lu was also used to restore communications at Princess Juliana airport. Additionally, SES provided C-band capacity at no charge for the benefit concert to benefit victims of hurricane Irma and Maria.

SES-GS: SES-GS used its Ku-band capacity for U.S. Government Responders in PR and other islands in the Caribbean.

In 2022, SES GS rapidly deployed high-throughput low-latency medium earth orbit (MEO) satellite service and ground terminals to restore broadband connectivity for local communities and first responders in Lee County, Florida, who were impacted by Hurricane Ian in 2022.

SES GS, alongside SES and SimbaCom, responded with the deployment of the high-performance connectivity service in support of the AWS Disaster Response program and their standby partner, Help.NGO. The interim service was provided over the affected very large territories in the hours immediately following the major devastation caused by Hurricane Ian in September.

Spire Global Throughout the 2020 hurricane season, the severe impact of the COVID-19 pandemic on aircraft flights is well known. Less obvious and equally important was the reduction in aircraft-based weather observations available to weather prediction centers and the related negative impact on weather models. Spire helped mitigate this loss by providing its own GNSS radio occultation ("GNSS-RO") data. Spire GNSS-RO harnesses the power of global navigation systems to capture weather data. As Spire's LEMUR satellites orbit the Earth, they receive signals from GPS satellites rising and falling on the horizon. These signals, which travel through the atmosphere, are bent by the atmospheric conditions that they encounter. Once analyzed, the bent signals provide critical information about air temperature, pressure, and humidity, resulting in improved weather predictions.

Spire offered its global GNSS-RO data on an emergency basis during the COVID-19 crisis free of charge to Federal agencies to support the Federal crisis response and to help alleviate the adverse impacts of the crisis on weather forecasting. This helped alleviate the adverse impacts on weather forecasting caused by grounded aircraft, which in turn benefitted the general public and assisted Federal crisis response efforts.

Telesat: In response to an urgent request from a telecommunications service provider (TSP), Telesat established two VSAT networks in PR following hurricane Maria, utilizing Telstar 12V capacity and hub VSAT services at Telesat's Mount Jackson Teleport. Telesat also assembled remote hardware kits that were delivered to the TSP customer in PR, and engaged an on-site field service representative to deploy the two networks and assist the TSP customer.

Viasat: During the 2017 hurricane season events, in Texas and Florida, the NGO recovery teams deployed 26 Viasat portable satellite broadband terminals to help volunteers connect online to provide critical medical attentions, place people in shelters, and help continue to heal the impacted communities.

Florida: In 2022, according to the Government of the State of Florida, 100 portable cell phone towers were being deployed to support connectivity in Southwest Florida post-Hurricane Ian. Portable cell sites are useful because they can connect to satellites for data and then act as temporary cell towers that phones connect to.