

## **Expert Account #1:**

Humans have progressed through many forms of communication, ranging from message runners, carrier pigeons, smoke signals, the telegraph, and in the modern age, telephones and satellites. Over time, we have become more efficient with our methods of communication, have reached greater distances, and have even advanced to the point of transmitting data of all forms, beyond speaking to other humans. A solar storm of great magnitude has the potential of interfering with and destroying our technologies, rendering humans incapable of losing the ability to communicate and transmit data as efficiently as we are used to. With networks down globally, it almost becomes necessary to start anew with our technologies, or at least work towards repairing what has been destroyed.

Technologies (mostly uplink stations) on Earth transmitted either radio waves or microwaves into space to a satellite. The satellite then reflected those waves back to a downlink station, phone, or vehicle, in order to communicate some form of data, whether it be voice, video, global positioning data, and many other human technologies. Satellites function in two different ways. Geosynchronous satellites remain in orbit in a specific position above the Earth's surface, rotating and revolving at the same rate as that of the Earth, and remains at the same altitude so that an uplink at one position on the surface on the planet will always reflect microwaves to the same downlink station. Low orbit and polar satellites are much lower in the atmosphere, and revolve much more quickly and reflect radio waves at much more specific time intervals. Sometimes, such as in the case of global positioning systems, multiple satellites are involved, and are adjusted accordingly to simultaneously transmit a wave to the same location.

Functionally, these networks of waves would constantly stream data to and from many different locations on Earth simultaneously, but with a massive solar storm, all of these networks would be rendered useless, if the satellites even survived the initial brunt of the storm at all. Solar storms are fueled by coronal mass ejections (CMEs), which affect Earth with the electromagnetic waves that come into contact with Earth's own geo-magnetosphere. Satellites that operate in space are usually attuned to very particular frequencies, demonstrated clearly when you would change the frequency on the radio or television to get a different channel (which operates on a different frequency than the rest of the channels). When a solar storm comes into proximity of Earth, the magnetic fields interfere with one another, causing massive changes of magnetic strength, which in turn affects how waves are transmitted, and how effectively electricity is transferred. An incoming storm effectively makes it impossible for radio and microwaves to pass through the atmosphere, disrupting network communications and rendering ground services unable to control the satellites to the same extent, if at all. Magnetism also drastically affects electric currents, and is capable of turning inductors in electrical components into conductors, overloading the component and effectively frying the whole system. When this happens to a satellite in space, the entire satellite is damaged or knocked out completely, which means that likewise, the network it was communicating with would no longer function either, since it can no longer physically transmit waves. Damage like this could last hours or months on a smaller scale, but with a global event, having all satellites affected could mean it could take several years and potentially several trillions of dollars to get everything back up and running as it was before.

In the short term at the time of the event, a solar storm could cause massive impacts globally in more ways than just satellite communications. If this storm were absolute worst case scenario, power grids all over the world would have been completely overloaded and knocked out, which means that any way we have of communicating with emergency services, controlling the satellites, radio transmissions, even dealing with international trade would stop abruptly, making it nearly impossible to act quickly and

make immediate reparations. Traffic lights, hospitals, even prisons would have also momentarily gone without power, even with backup generators, so it is very likely that many people were killed indirectly due to people's dependency on these technologies. Data banks were overloaded globally, and while some of that data is recoverable, a lot of it is completely lost, setting us back tremendously. If this storm resulted in a proton particle event in the upper atmosphere, the astronauts and lower orbiting satellites would have been exposed to extremely high levels of radiation, either killing or incapacitating them and making us incapable of using even those satellites.

NASA and NOAA did actually have some precautions in effect before the storm, as the space weather forecast allowed flights to ground themselves before the incident, backup power was prepared to be put into use, and people were advised not to use networks or electronics, to minimize the amount of damage done. While most satellites were knocked out, it is still possible that some very expensive and powerful ones had sufficient magnetic shielding on the outside to protect them from the storm and keep them running. However, since there were so few of these among the few thousand that were in orbit, most of them have been reserved for government usage, so that the issue can be completely resolved at a larger scale as quickly as possible. Companies have begun to invest lots of time and resources into developing satellites with better magnetic shielding, so that the planet can be more prepared when the solar cycle comes back to its peak 11 years after this devastating hit. Landline telephones and telegraphs run on electricity instead of sending waves through the atmosphere, so once the power grid was restored we were able to at least have some degree of communication. However, this has been incredibly expensive for the general public to access, as companies have capitalized on the need for people to remain connected.

## **Expert Account #2:**

The human species has long considered themselves to be far superior to any other forms of life whether it be animals on top of the food chain or the power of Mother Nature. We allowed ourselves to become solely reliant on a system of communications that could be felled in one swoop and didn't even have the forethought to establish a backup system. In essence we became our own worst enemies. During the decade prior to the solar storm in 2020 technology had managed to shove its way to the forefront until people found themselves unable to live without these luxury items that humans had done without for thousands of years. Over the years we have seen numerous forms of communication, but never before has one ruled over our minds in the ways that cellphones and computers did. That single-minded reliance ended up being our downfall.

The solar storm of 2020 was considerably larger than what had been predicted. Power grids all over the world were impacted, but the United States suffered the most. Communications with emergency services were completely wiped out and the stock market came to a crashing halt. The country went black and many people died in car accidents when the traffic lights stopped working. Hospitals lost power and although many of them had backup generators in place, they didn't always turn on in time to save a life. Our reliance on various technologies that had come to rule our lives led to the deaths of innocents. People have become so disconnected from reality that when technology fails so do they. In order to prevent future reliance on any such technology, the government has limited the use of wireless communications to high level government officials and emergency service workers. Everyday Joe Schmo's are no longer allowed access to what was once a necessity. Many of the satellites that were damaged during the storm faced irreparable damage. The satellites that are still functioning are considered unsafe for use. People are left with the most basic forms of communication, landline telephones and telegraphs. This privilege however has become rather expensive for a member of the general public to access as companies are attempting to recoup their losses by driving up the prices of these basic utilities.

A new system is slowly being put into place. The very basic forms of communication are still in place, but most cannot afford to pay for it. Companies have been investing large amounts of money into building satellites with better magnetic shielding on the outside to protect them from solar activity. Once these satellites reach orbit, communications will be easier for everyone to access. Electricity was restored shortly after the storm and the country was illuminated once more. Those who had become addicted to cellphones and computers have learned their lesson; never let your survival become reliant on something that can be destroyed in one fell swoop.