First amateur radio in geosynchronous orbit will aid disaster communications

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Hume Center Director of Research Robert McGwier (right) and research associate Zachary Lefke are building radio antennas that will be used in the Virginia Tech Ground Station.

Researchers at the Ted and Karyn Hume Center for National Security and Technology are preparing to send an amateur radio transponder into a geosynchronous orbit in 2017.

"Seven days a week, 24 hours a day, 365 days a year, a new ham band

will be available for the Americas," said Robert McGwier, a research professor in the Bradley Department of Electrical and Computer Engineering and the Hume Center's director of research. "It will allow rapid deployment to disaster areas and support long-haul communications for first responders."

This would be the first amateur or "ham" radio payload in a geosynchronous orbit, and would significantly enhance communications capabilities for amateur radio operators, in particular following natural disasters or other emergency situations. The Hume Center team met with Federal Emergency Management Agency Administrator Craig Fugate in September to discuss the project.

There are more than 2 million amateur radio operators around the world, and the community has a long history of assisting with emergency communications when traditional communications networks collapse, because they typically rely on cell towers and the Internet. Ham radio signals require only compact, mobile equipment that can be easily transported to an emergency site.

"Hams show up at every disaster, no matter what," said McGwier, referring to amateur radio operators. After events like Hurricane Katrina and the Indian Ocean tsunami, "for days, the only way that people communicated out of those communities was amateur radio."

In fact, the Federal Emergency Management Agency signed an agreement in 2014 with the American Radio Relay League, also known as ARRL, that describes how the two organizations will work together to provide disaster relief, and the Federal Communications Commission has specific regulations authorizing the use of amateur radio in situations which threaten life or property.

But even amateur radio isn't always available.

Currently, most amateur radio operators communicate by bouncing their signals off the ionosphere. Solar flares, geomagnetic storms, and other events that change the condition of the ionosphere can affect the efficiency of radio signal propagation, making it unpredictable.

Sending radio signals to a satellite, instead, would be much more dependable, allowing radio operators to help emergency personnel reliably access supplies, logistical support, and medical assistance. They key is to ensure that the satellite would always be accessible to the radio operators—which is why the geosynchronous orbit is critical.

A geosynchronous orbit has the same period as the Earth's rotation—just under 24 hours. A satellite in such an orbit is easy to locate and access. In this case, the satellite will always be within a band of longitudes over the Americas, continually accessible to any amateur radio operator there, including the students and researchers at the Virginia Tech Ground Station.

The satellite itself will be operated by Millennium Space Systems on behalf of the United States Air Force; the Radio Amateur Satellite Corporation, also known as AMSAT, will operate the radio, which will be designed and built by Virginia Tech students—making this project a unique collaboration among the university, nonprofit organizations, private companies, and the federal government.

The Hume Center team is also engineering a ground terminal that emergency personnel could use to relay their own existing communications channels through the satellite. This setup could be deployed through the American Radio Relay League and the Radio Amateur Satellite Corporation as a key part of a robust national emergency response system, allowing trained operators to reliably mobilize to disaster areas in the first critical hours after a devastating event.

Provided by Virginia Tech