Talking to Shooting Stars With Meteor Burst

Little-Known Communication System Uses Space Rocks

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Have you ever talked to a shooting star?

Those brilliant trails of light, falling through the atmosphere, are telling power companies about the depths of rivers, and poor countries about the quality of their soil. They're even telling a California company where to find its ambulances.

This isn't a fairy tale. It's meteor burst communications, one of the best-kept secrets in the communications industry. For the past 50 years, meteor burst systems have used the ionized trails of evaporating space rocks as a poor man's satellite, bouncing radio signals off them to receivers located more than 1,000 miles away.

Meteor burst is cheaper than satellites and more reliable than cellular technology, but it has its downsides: it's slow, and only works in brief spurts with delays of seconds or minutes between transmissions.

"It's never going to be something that everybody uses — you couldn't use it for a continuous voice call," said Carl Baum, a professor at Clemson University who has studied meteor burst systems.

Talking to Shooting Stars

Earth is continually moving through space, and space is dusty. Space rocks are continually burning up in our upper atmosphere, turning into trails of ionized gases. Those gases can reflect radio signals — so if you send a radio signal to the right spot at the right time, you can bounce a radio signal as far as 1,400 miles away.

(The low-frequency waves used by meteor burst systems normally have a 90-mile range, much longer than cellular phone waves. They need the range because the meteors they seek can be more than 60 miles up in the sky.)

A typical commercial or military meteor burst setup involves a large base station with about 5,000 watts of radio power and eight 20-foot antennas, and several remote radios with about 100 watts of power apiece. The base station continually transmits a carrier tone toward various parts of the sky, and the remote radios sit in receiving mode.

When a meteor comes into range, the carrier tone reflects off the meteor and is suddenly audible to the remote station. Quickly, the remote station switches into transmission mode and bursts back with a shot of data to the place where the carrier tone came from. When the meteor trail dies down, the remote station goes back into receiving mode until it hears the carrier again.

The main problem with meteor burst is, the trails evaporate very quickly. A meteor trail lasts anywhere from a fifth of a second to one second, and then you've got to find another one. Fortunately, there's usually one in a few seconds, but it could take up to a few minutes until you have another window through which to burst information.

Amateur radio operators have been using "meteor scatter" since the 1950s. Without a huge base station, amateurs just alternate periods of transmitting and listening when they hear a meteor "ping," hoping their signal is reflected, said Shelby Ennis, a retired pastor in Kentucky who has been doing meteor scatter since 1955.

Meteor burst systems are able to get between 9,600 and 14,400 baud data transfer rates, experts said, much like modems from the mid-1990s. That's not enough for live video or voice. But it's fine for transmitting location data, the depth of snowpacks, simple messages or even limited e-mail.

Global Thermonuclear War

America's last words may be carried by meteor burst.

That is, if its last words are "drop the bombs." The military likes meteor burst technology because it can work in an upper atmosphere fouled by nuclear blasts and even through the Aurora Borealis, which is pretty but interferes with most radio communications. If all of the nation's satellites were knocked out, the government could still beam important messages off meteor trails.

Meteor burst started playing a key role in U.S. war games in the 1980s, said John Pike, director of defense policy research organization globalsecurity.org.

"If the war thus far has pretty much fried the ionosphere, then an awful lot of your communications systems aren't going to work. So here comes meteor burst," he said.

Meteor burst is fine for transmitting short messages. But its low data transmission rate makes it less useful for the kind of remote-control video warfare that's become more popular since Desert Storm, Pike said.

"Conventional war fighting capabilities have become as much of a bandwidth hog as any Web junkie," he said, referring to how much data can go through a network in a given amount of time.

But meteor burst may still play an important role. After war games run by the U.S. Air Force Space Command in January, Space Warfare Center commander Brigadier Gen. Doug Richardson told New Scientist magazine the U.S. is over-reliant on commercial satellites for data transmission. Meteor burst can't replace satellites, but Pike said it could be used for emergency message transmission.

Old Reliable

Two civilian companies have found more uses for meteor burst, though. Meteor Communications in Kent, Wash. has been using meteor burst for 25 years; StarCom Wireless in Bellingham, Wash. has been testing its system for two.

For remote data collection purposes, meteor burst systems are cheaper and more reliable than satellites, said Jay Creech, marketing manager for Meteor Communications.

"They can be left unattended for, usually, up to a year or more. You don't need to schedule satellite time … [and] some of these units have been out in the field now for 20 years," he said.

That's made meteor burst the system of choice for SNOTEL (short for "Snowpack Telemetry"), a Department of Agriculture system which checks snowdrift depths in the Western states. Power utilities use the technology to check the depth of rivers near hydroelectric plants to make sure they're at sustainable levels and the government of British Columbia uses meteor burst radios with climate sensors to monitor weather in the Canadian province's forests. All those applications transmit relatively little data and are way, way out of cellular range.

SNOTEL and others could theoretically use satellite systems, but they're tremendously expensive. The first effort at a global satellite phone system, Iridium, collapsed under the cost; the second, Globalstar, is teetering financially.

Meteor Communications has also sold systems to Pakistan, Nepal and Egypt — countries that don't have their own satellites. Other third-world countries, such as those in Africa, could use meteor burst to send and receive e-mail from hubs in remote areas without telephone service, Creech said.

"This is a lot cheaper way to collect data over a wide, national area, without a satellite, and they own it," he said.

Saved by a Meteor

But StarCom's meteor burst effort is the most dynamic. The wireless company partnered with an ambulance company, American Medical Response, and put GPS receivers and radios in their ambulances.

But on the long drive from Seattle to Spokane, there are spots where radio reception just drops out. Rather than lose their trucks in the dead spots, AMR's radios switch to meteor burst mode, sending back their GPS data on the falling stars every three minutes or so to keep track of the vehicles.

That's improved management of the ambulance fleet, said Greg Sim, communications director for AMR Washington. Now they can tell when their ambulance drivers are taking donut breaks — and when they're not following directions.

"If they're going northbound when they should be going southbound, we can redirect them," Sim said.

And just this month, StarCom has started marketing its radios and meteor burst systems to other companies, such as shipping companies and railways whose work pulls them out of cellular range.

"The applications are virtually endless," said Steven Becker, CEO of StarCom.