Aerostats

By David Perera

No communications system lacks a failure point. With the specter of Hurricane Katrina to urge them on, emergency planners have struggled in recent years to find the best solution for connectivity when local infrastructure is destroyed. Much of the thinking centers around wheeling in a cavalry of high-tech trucks, each equipped with satellite links.

But some states are investigating another possibility: blimps. Though they may evoke thoughts of a flaky last-century technology suitable today only for joyrides, lighter-than-air balloons are enjoying a revival among high-tech communication types.

"It's a low-cost, low-orbiting satellite, is the way we look at it," said Philip Ardire, President of Western DataCom, an Ohio-based Internet protocol router developer. The company participated in an Alabama-sponsored homeland security exercise April 7-10 that tested the viability of deploying a tethered blimp – technically, an "aerostat" – during emergency situations. In cooperation with the Army Space and Missile Defense Command, officials flew a 70-foot-long aerostat up to 3,000 ft. and equipped it with a camera and Wi-Fi transmitter.

"It's the ideal platform for any kind of radio, wireless communications, because of height," Ardire added. The higher above ground an antennae (combined with its power strength) is, the wider area a radio signal will reach. A satellite truck with

a pneumatic antenna mast can throw a communications footprint measured in yards. In the Alabama exercise, the aerostat-mounted Wi-Fi transmitter cast a bubble about 20 miles long. In cases where disaster topples local communication towers, an aerostat-borne payload could beam down spectrum signals across a wide swath of land, allowing responders to avoid a New Orleans-like mess.

Alabama is not the only state intrigued by balloons. State communication officials in Ohio, in conjunction with the NASA Glenn Research Center, will hold an aerostat exercise there Sept. 24.

The Arizona Air National Guard is looking into another lighter-than-air option: weather balloons flying to stratospheric heights of 65,000 ft. The idea, developed by Arizona-based wireless company Space Data, is to attach recoverable communications equipment to free-floating high-altitude balloons. As they drift downrange in winds that at that altitude average only 20 miles per hour, replacement balloons maintain connectivity.

"With our payload up in the air, we've talked as far as 500-plus miles," said Arizona Air National Guard Maj. Len Bettendorf. "We could respond to really any type of incident … any type of scenario where they would need communications quickly," Bettendorf added. Space Data says it has also demonstrated to the Customs and Border Patrol agency how its technology could fill out communications in hard-to-reach landscapes along the border. (CBP, citing a policy of not endorsing commercial vendors, had no comment.)

Nothing's Perfect

Driving the interest in blimps and balloons is a certain dissatisfaction with satellites. Alabama officials say mounting bandwidth requirements during an emergency – caused by desires for real-time video and Web-powered tools – make relying on satellites for data transmission cost prohibitive.

"If you can get these aerostats up, then however big a package you want to put up there, bandwidth-wise, is a lot less expensive than going through satellites," said Norven Goddard, Alabama Homeland Security Assistant Director for Science and Technology. (Goddard is on loan to the state by the Space and Missile Defense Command, where he's stationed at the Future Warfare Center.) Companies developing aerostat-based routers – including Western DataCom and also Maryland-based Tecore Networks – report downlink speeds of about three megabits per second and uplinks of around 1.5 megabits. Space Data says its system has downlinks of up to four megabits.

Detractors also point to satellite signals' propensity to scatter during cloudy or rainy weather – although aerostats are hardly exempt from bad weather. Winds can destroy them, as they did in 2005 to two Air Force aerostats deployed in Florida as part of the Tethered Aerostat Radar System (TARS) program, which monitors the southern border with radars. Air Force officials said at the time that hurricane winds arrived too quickly for them to deflate the balloons.

Wind could also cause random displacement of the antennae that might make connectivity on the ground spotty. "It would be a problem for any sophisticated application," said Tim Tozer, a United Kingdom University of York senior lecturer in electronics and co-author of several papers on high-altitude communications platforms. "If you're just trying to put a very wide beam down over a largish area … it doesn't matter that it jiggers around." Technology, of course, exists to stabilize antennas, but they add weight and cost, Tozer noted.

But aerostats can make possible things that would otherwise be difficult to achieve; a short path to end-user interoperability, for example. Software can convert radio frequency transmissions into data packets, making it possible for otherwise incompatible handsets to connect via Internet protocol. An aerostat makes it possible for that software solution to extend in range for miles over terrain that otherwise might be bereft of communication towers. Western DataCom's Ardire said his company was aiming for 50 miles of coverage in the September Ohio exercise.

No Easy Answers

If much of the activity surrounding aerostats seems vaguely military in nature, that's because it is. This aerostat revival began when the Army and the Marine Corps started deploying them in Iraq and Afghanistan. Many of the companies involved in exploring the homeland security market already have Defense Department contracts. Goddard said an aerostat equipped with a rudimentary payload and ground station might be had "for under a million dollars" – a price tag hardly worth batting a Pentagon eyelash for, but one (not including operations and maintenance) that might make states think twice.

States would also have to grapple with the logistics of getting an aerostat within the vicinity of a disaster scene. "When you deploy an aerostat, the deployment becomes a lot more complex" than a satellite system, said Juan Godoy, a Global Industry Solution Director with Unisys. Godoy helped set up satellite communications in New Orleans days after Hurricane Katrina. Among the requirements would be an area for launch, helium to inflate the blimp and a ground crew versed in metrological equipment, he said.

Winds might also make aerostats' presence in big cities a

problem, said Philip Paulsen, a NASA Glenn Research Center official involved in preparations for the upcoming Ohio demonstration. "Aerostats are fairly big, and they tend to move around in the wind. So you're probably not going to use one if there was a big disaster in a densely populated urban area," he said.

Indeed, costs and logistics might be two hurdles that many states find they individually cannot surpass. Alabama is studying the relative merits of possibly acquiring time-share rights to an aerostat versus buying one, Goddard said. In Ohio, state officials said it's too early yet to think about costs, because they're still in the early stages of investigation.

One jurisdiction where it might make sense to buy an aerostat is the federal level, suggested Godoy. But federal agencies aren't keen to acquire and hold assets for states, he added.

Department of Homeland Security spokeswoman Amy Kudwa said answering a question about whether DHS might support acquiring an aerostat for state use would be "getting too far down into the weeds on a hypothetical."

Meanwhile, another DHS official has sounded a note of caution. "Unfortunately, public safety is unlikely to be able to make effective use of systems they do not work with regularly," said David Boyd, Director of DHS's Command, Control and Interoperability Office within the Science and Technology Directorate. Without regular training, an aerostat deployment could turn ineffective. In the end, suggested Boyd, satellites might still be a cheaper solution, "but a detailed cost analysis for specific situations will be needed to answer this definitively." ■

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