AMD Powers Silvus StreamCaster Radios: Helps First Responders Manage Disaster Response & Public Safety Crises

Courtney Aviation Leverages Powerful AMD-Zynq™ SoC in Silvus StreamCaster MANET Radios to Stream High-Fidelity Aerial Video and Mapping Data to Front Line Personnel Battling America's Biggest Wildfires

PARTNER

SILVUS
TECHNOLOGIES

INDUSTRY
Aerospace and Defense

CHALLENGES
Silvus wanted to develop an advanced tactical data radio solution for use in complex military and first responder operations that was not bound by performance limitations of current cellular chipset solutions.

SOLUTION
The company built a flexible, software defined mobile ad hoc radio powered by the AMD Zynq 7000 SoC.

RESULTS
Silvus StreamCaster MANET radios and MN-MIMO waveform technology enable users to create massively scalable mesh communications networks in complex and RF congested environments.

AMD TECHNOLOGY AT A GLANCE
AMD Zynq™ 7000 SoC

Silvus offers a suite of StreamCaster MANET software-defined radios which use the AMD Zynq™ 7000 SoC.

"We've created a mobile network for tactical communications using a proprietary waveform technology called mobile-networked MIMO (MN-MIMO)," explained Greg Dunbar, director of public safety and commercial sales at Silvus. "It's a mesh-networked system that keeps groups of soldiers or emergency personnel in touch with one another when conducting remote operations."

The AMD-powered solution enables Silvus to produce high-performance tactical data radios capable of massive operational scalability, with the ability to support over 550 nodes. In addition, the processing power of Silvus StreamCaster MANET radios enables cognitive radio capabilities including firmware updates, software expansions and interoperability with IP devices and platforms.

Silvus' MANET radios and mesh network technology is used in public safety and natural disaster responses, including wildfires and urban search and rescue operations. First responders can quickly set up a "Tactical Bubble" that connects an aircraft to ground personnel, command center vehicles and unmanned assets. It even works in subterranean environments.

Dunbar said that a growing percentage of Silvus' business is dedicated to supporting public safety. Nearly every U.S. federal agency is a customer, and state and local business is growing as well.

"One thing that makes us unique is that we built everything from the ground up," Dunbar said. "We're not using a WiFi chip, as some of our competitors do. They have limitations with what they can do with their waveform. They can also be limited in throughput, range, and ability to establish radio links in complex multi-path environments. Because we developed our radio hardware technology from scratch, and we are focused on leading-edge MIMO research, we're able to customize our radios and enable customers to adjust to their operational environment."

Silvus Mobile-Networked MIMO (MN-MIMO) waveform, builds upon multiple advanced MIMO techniques. For example, through Transmit Eigen Beamforming its radios can amplify the phase & amplitude of the radio's signal, increasing its strength—achieving longer distance and wider range—without the radio consuming more power. The AMD device is helping in this area.

CHALLENGE

Dunbar said Silvus' StreamCaster MANET radios were built to solve a number of industry challenges. "When the cellular infrastructure becomes overwhelmed during an emergency, it makes it difficult for first responders to do their jobs. This is where Silvus radios shine," Dunbar said.

Dunbar said traditional Land Mobile Radio (LMR) networks used by police, require a dedicated infrastructure and don't always work well in times of crises.

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In some parts of the U.S., there is almost no coverage. Silvus radios let users create a 'Tactical Bubble' ranging in size from a couple city blocks to many square miles around a particular geography, and then all the needed technology operates within that bubble. An incident commander can then choose if he or she keeps everything in the bubble or shares it with the outside world via an ethernet connection.

Traditional radios don't always work in certain environments, such as in elevators, underground, in stairwells, canyons, or large industrial complexes. It's often because they often don't have LMR repeaters. The Silvus mobile ad hoc network solution addresses these issues, with each radio in the mesh network acting as a transmitter, receiver, and communications relay. This allows each radio link and the entire network to adapt to changing channel conditions and provide enhanced coverage and data communications throughput.

Robots and drones that are now more frequently used in rescue or military operations can also have some distance or line-of-sight limitations. Using Silvus radios for command and control of robotic systems can help alleviate some of these issues. In the cases where the drone is too small for Silvus radios, the unit can tie into the drone's controller and everything the drone pilot sees can be immediately broadcast over Silvus radios and throughout the mesh network.

"We were trying to produce a MANET radio that delivers high throughput with high reliability in harsh environments using MIMO-OFDM techniques, which was a first in the industry," said Weijun Zhu, vice president of engineering at Silvus Technologies. "Both the high-throughput and MIMO required significant, real-time signal processing resources that were not available via traditional DSPs. ASICs were also not suitable for a niche market, and we wanted to maintain the flexibility of making rapid changes for a non-standard based product. AMD FPGAs and SoCs were a perfect fit in terms of both processing power and flexibility. AMD provided the best performance, cost, and size tradeoff."

SOLUTION

Silvus' StreamCaster MANET radios provide up to 80W effective output power with data rates of up to 100 Mbps. They are available in single and dual-band configurations. Those in law enforcement or public safety can choose their preferred configuration without any additional hardware or modules required. Users only need two radios to create a mesh network, and then they can add on multiple nodes to expand its reach and capabilities.

"We are the only company whose technology is tested and validated to scale networks to over 550 nodes," Dunbar said. "They can be vehicles on the ground, unmanned aircraft systems, unmanned ground vehicles, and manned aircraft. Our MN-MIMO waveform even keeps up with supersonic jets."

StreamCaster MANET radios are powered by the AMD Zynq™ system-on-chip (SoC). It combines fast processing with industry-standard Arm™ processors allowing Silvus to design what they wanted while shrinking the package down and optimizing power consumption. "The Zynq solution is really the brains of our radio, and by extension, it enables the mesh signal interface to our mobile MIMO mesh network," Dunbar said.

Silvus offers three different versions of its StreamCaster MANET radios. The StreamCaster 4200 comes in a battery-powered

hand-held unit that gives users 12 hours of battery life. The company has also made its radios interoperable with nearly any kind of power source—from AC power outlets all the way down to a cigarette lighter.

In addition to the radios, Silvus also makes high-gain antennas that give the radios further range and better coverage. In highly secured areas, public safety agencies have deployed discrete antennas that are always on and independently powered. If the event of a crisis , first responder teams can plug into the network and be up and running as soon as they turn the radio on.

"We developed our MN-MIMO waveform from the physical layer up, which means we are not reliant on 802.11 and not bound by its performance limitations or potential security issues," Dunbar said. "Thanks to the AMD Zynq device, we've also implemented computationally intense features, such as MIMO processing and real-time encryption, which greatly enhance the capabilities of our radios."

Silvus' history with AMD goes back several years. Dunbar said the company considered other FPGA, DSP, and ASIC solutions, but ultimately chose AMD because of value, performance, and design flexibility.

"Bringing AMD technology on board was quite smooth," Zhu added. "The team liked the tool's ease-of-use and reliability. Support from Avnet and AMD was also great throughout our design process."

RESULT

"Silvus' mission is to solve the toughest tactical communications problems on the planet, providing network connectivity to those who keep us safe in any operational environment," Dunbar said. "We couldn't do that without a powerful SoC and partner, like AMD, that gives us the horsepower, performance, reliability and flexibility to continue to innovate communications technology at the tactical edge and deliver on that mission.

"Our radios and MN-MIMO waveform are adaptive to complex,

congested environments," he continued. "One of our biggest plusses is our adaptability and flexibility to work in environments that are dynamically changing."

Dunbar added that the company is continuing to invest in AI and machine learning to make Silvus products even more capable and user friendly with the ability to conduct some operations autonomously, reducing the radio operator's cognitive load.

Today, Silvus StreamCaster MANET radios are used in a variety of applications from defense and public safety to disaster response.

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There are aviation companies that have Silvus radios on their aircraft and mobile command vehicles. The aircraft are equipped with ISR cameras that stream video downlink and geospatial data information to command vehicles on the ground, and from there, depending on the capability of the fire agency, they can deliver that video with mapping coordinates to the team working on the front lines.

"Several years ago there was a hotshot crew in Arizona battling a blaze, but 19 of the 20 firefighters were killed because base camp didn't know where they were," Dunbar said. "If they had this technology, perhaps they could have pinpointed where the crew was and dropped fire retardant around them."

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COURTNEY AVIATION HELPS BATTLE WILDFIRES WITH AMD-POWERED SILVUS STREAMCASTER MANET RADIOS

California-based Courtney Aviation uses AMD-powered Silvus StreamCaster MANET radios to provide aerial supervision, support, and intelligence services for wildfires, partnering with the U.S. Forest Service, Cal Fire, and other state and federal emergency response agencies.

"We work with agency personnel who are commanding air control of fire suppression to affect efficient and safe delivery of retardant for fires," said Hart Drobish, the company's president and director of operations. "We enable incidence awareness and assessment by providing mapping and real-time video support from above the fire to personnel on the ground."

The company serves agencies across the U.S.'s 48 contiguous states and Alaska, focusing primarily on the big fires in the West, including the recent Mendicino Complex and Dixie fires in California, and other major blazes in Oregon, Washington, Texas, and Utah.

Courtney Aviation has been using Silvus technology for more than 10 years. The company has installed two or three Silvus StreamCaster radios on each aircraft, plus additional equipment in satellite vans on the ground. It has also installed portable, mountaintop repeater kits to enhance the radio signal that run on solar power.

"We tried to use cellular radios to communicate, but we found that it did not work well based on the closeness to the surface of the Earth that you needed to be to access the signal. We had limited capability at various altitudes," Drobish said. "We needed something that was reliable and could provide a direct link to crews on the ground. We wanted to be able to hand them a radio and let them see the live video feed and mapping data that was coming out of our aircraft."

"Depending on what you have in terms of geography and antennas, you can have range of a few miles to well over a hundred miles working within just a few watts of power per channel," Drobish said. "The radio is a little bit of magic and remarkable in its ability to do what it does. It does not require a lot of frequency, and it is able to deliver intelligible data across far distances."

In 2016, the ferocious Canyon Fire was burning near Vandenberg Air Force Base in California, and its embers started a second fire that pushed flames toward the main facility, driven by 30 mph winds. "We used the Silvus system to downlink live video information to our satellite van, which streamed the data to the emergency operations center and incident management teams on the ground," Drobish said. "It gave them a direct view from our aircraft, so everyone knew what was going on at the same time."

That same year, the Soberanes fire in Monterey County burned more than 132,000 acres and destroyed 57 homes, but the results could have been much worse, Drobish said. "We covered a million acres with the Silvus system and provided a data link between two operation camps located between the Pacific Ocean and Salinas. Everyone was linked, and it helped crews gain an upper hand on the fire."

"A lot of the areas we work in are remote and do not have cellular coverage," Drobish said. "If more of the system could have Silvus technology installed, we could have a much better level of real-time tactical intelligence, which is what we're working for."

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