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Processing Solutions Ease Full Motion Video Challenges

With a deluge of incoming image and video data to deal with, today's military platforms face challenging design hurdles. Processing solutions help ease the way.

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In recent years demand for Intelligence, Surveillance and Reconnaissance (ISR) capabilities has driven a huge ramp up in data collection capacity. While that shows no signs of slowing, the ability to process that data-in the form of radar captured video or images-presents major system design challenges for developers of military platforms. Makers of embedded computers are easing these challenges with a variety of solutions that address the particular challenges of moving image-based data at high speed and processing it for the demanding real-time needs of military applications.

Along these lines, Curtiss-Wright Controls Embedded Computing offers its Radar Video Processor family of high-performance radar acquisition, tracking and distribution servers. These servers are designed to address a broad range of radar processing requirements from network radar video servers to ruggedized naval tracking solutions. RVP servers are designed to work with a range of radar client solutions for video and track display. Alternatively they may be used in standalone configurations providing, for example, radar plot extraction and tracking data into an existing display or fusion system.

Figure 1: The Air Force's Radar Airborne Signal Processor (RASP) system performs the radar signal processing capabilities on the Joint STARS aircraft – enabling it to process data that results in the ability to locate targets.

In March, Curtiss-Wright was awarded a contract by Northrop Grumman to provide an upgraded Radar Signal Processing (RSP) solution for use in the Joint Surveillance and Target Attack Radar System (Joint STARS) program. The initial portion of the contract, for $5.1 million, was awarded for the Joint STARS Prime Mission Equipment (PME) Diminishing Material Source (DMS). An additional $5.4 million was awarded to enhance the RSP solution so that it meets advanced radar processing capacity requirements necessary to support future radar performance needs. The U.S. Air Force's E-8 Joint STARS aircraft (Figure 1) is the world's premier ground surveillance platform, which is able to track slow moving or stationary targets at sea, on the ground or hugging the terrain in slow flight. The Air Force's Radar Airborne Signal Processor (RASP) system performs the radar signal processing capabilities of the Joint STARS aircraft, enabling it to process data that results in the ability to locate targets.

Video Processing on UAVs

Video processing presents a whole different kind of challenge for unmanned vehicles.

As the demand increases for greater visual awareness of the vehicle, and improved video for surveillance purposes, the burden on video capture and streaming electronics on board the aircraft has ballooned. New systems are adding more video sources and increasing the image resolution from lower quality to high definition at increased frame rates. To make matters even worse, communication links to and from the unmanned vehicle are often bandwidth-limited, so significant data compression is required to enable an operator to view even one video source at a control center.

To address those specific needs, GE Intelligent Platforms offers its ICS-8580 Rugged Video Streaming XMC (Figure 2) – a compact solution for the problem of capturing, compressing and delivering video. The

Figure 2: The ICS-8580 Rugged Video Streaming XMC supports numerous video formats with either two channels of high definition video or four channels of standard definition video. It provides an industry standard H.264 video compression codec, but is software-reconfigurable to enable it to support alternatives such as JPEG2000.

ICS-8580's XMC form factor means that it is small, lightweight at 100 grams/3.5 ounces, and consumes little power-typically, 10 to 15W. These features, in conjunction with its rugged design, mean that it can be deployed in a wide range of demanding military and aerospace environments. Its flexibility is further enhanced by its ability to support numerous video formats with either two channels of high definition video or four channels of standard definition video. The ICS-8580 features the ultra-efficient, industry standard H.264 video compression codec, but is software-reconfigurable to enable it to support alternatives such as JPEG2000.

The ICS-8580 provides input support for HD/ED/SD analog input signals, analog RGB formats from VGA to UXGA, as well as digital input formats such as 3G-SDI, DVI, and HDMI up to a maximum resolution of 1,920 x 1,080 or 1,600 x 1,200 pixels. An FPGA combined with TI DSP signal processing provides exceptional compute power in a video XMC platform. Two TI TMS320DM6467 DSPs provide processing capability to achieve two streams of up to 1080p H.264 (or JPEG 2000) encoding. Up to four streams of SD input data can be compressed in parallel. The encoded bitstream can be accessed via PCI Express, or output directly as Gigabit Ethernet RTP/UDP packets. High-speed A/D devices-supporting resolutions up to 1,600 x 1,200 for graphics type inputs and 1,920 x 1,080 for HD video inputs-provide input digitization of the various supported analog video formats. The FPGA controls data capture and routing and can be used in a variety of ways, while the TI DSP coprocessors provide efficient and streamlined video data processing.

Images Need Reliable Power

Power is an often overlooked segment of video processing on board UAVs. Several UAVs use Lynx SAR/GMTI radar systems to transmit near real-time, full-motion images of objects on the ground. Amazingly, these images can be captured from around almost 20 miles above ground, in total darkness, through clouds and rain. Equipped with advanced sensors and cameras, the Predator B can remain in the air for 30 hours to produce high-resolution photographic quality SAR imagery. Without reliable amplifiers however, these SAR images would not be possible. dB Control's traveling wave tube (TWT) amplifiers, for example, are integrated on a number of these radar platforms on UAVs such as the MQ-9A Reaper UAS, Predator B UAS, I-GNAT UAS, RQ-MQ-8A Fire Scout, RQ-4A/B Global Hawk and MQ-1C Sky Warrior UAS.

Figure 3: Designed for use in military manned and unmanned airborne applications, the dB-4522 TWT amplifier operates in the 11-18 GHz frequency range and provides 450W CW (at 11-17.5 GHz) and 400W CW (at 17.5-18 GHz) peak output power.

The dB-4522 traveling wave tube (TWT) amplifier (Figure 3) is designed for use in military manned and unmanned airborne applications, electronic countermeasures (ECM), EW threat simulation and high-power communications. The dB-4522 TWT amplifier operates in the 11-18 GHz frequency range and provides 450 watts CW (at 11-17.5 GHz) and 400 watts CW (at 17.5-18 GHz) peak output power. It features very stable RF performance and built-in forced air cooling. The dB-4522 TWT amplifier meets MIL-E 5400T equipment standards and is designed for use in harsh environments with temperatures between -40° to +71°C ambient and at altitudes of up to 50,000 feet. In addition, the high-efficiency design and modular construction of the dB-4522 facilitate options such as custom frequency bands, prime power inputs, RF gain control and custom interface protocols.

www.dbcontrol.com

SIDEBAR:

Persistent Intelligence, Surveillance and Recognizance (ISR)

Mounted on long endurance, unmanned platforms, an array of sensor technologies can provide the Persistent Intelligence, Surveillance and Reconnaissance (ISR) needed to find an elusive, insurgent enemy. Today's sensors survey increasingly wider areas and deliver data and images with incredible detail, providing overwhelming volumes of multisensor data that swamp existing tasking, processing, exploitation and dissemination systems. The enormity of the data would require tens of thousands of analysts deployed across the globe to analyze and interpret it. Not only is this cost-prohibitive, but the expertise is limited and the information is needed quickly. The challenge is to extract truly critical information and deliver it to the people who need it, so they can take action in a timely manner.

A long-standing strategy is to store the data on board the platform, download and transmit it after the mission has been completed. An emerging, more efficient way is to integrate advanced processing on the platform and perform the initial stages of processing and analysis directly on board, rather than on the ground, and disseminate on an as needed basis. The platform sorts through the data, flagging information for closer review, and transmitting it immediately to analysts on the ground and to forward-deployed personnel closest to the critical tactical issue.

A new kind of smart processing can multiply the effectiveness of human analysts and reduce the delivery time for actionable intelligence. Onboard real-time embedded computing systems using advanced signal and image processing algorithms will make a first pass through the incoming data in milliseconds, prioritizing the data for downstream analysis, and tasking the collection of additional data to more rapidly find and fix targets. It will allow real-time, cross-cueing, using multi-intelligence sensors to detect, track and engage threats with a higher degree of precision, delivering mission-specific, tailored sensing to every warfighter across a network of sensors. With technology like this, analysts will be able to focus rapidly on the significant items within the huge streams of sensor-generated data and ensure that tactical elements can access real-time surveillance information at any time.

At minimum, this technology requires small, powerful, rugged, embedded, real-time computers that support standard, open software and can be networked and configured/re-configured dynamically into flexible, mission-focused systems. Most recently Mercury introduced the Intel-based Ensemble HDS6600 High Density Server for rugged deployed ISR systems, which achieves new performance levels in traditional signal and image processing applications. The high-performance communications among HDS6600 modules is facilitated by Mercury's new Protocol Offload Engine Technology (POET), which is the underlying technology that enables server class assets, signal and sensor technologies to be embedded into one high-performance platform.

As data-especially full motion video-continues to grow in orders of magnitude, Mercury will continue to develop new technology that streamlines analysis and distribution; ensuring forward-deployed personnel have immediate access to the mission-critical, potentially life-saving intelligence.