Modern Video Display Technologies For Next-Generation Warfighters

Ultimately, proper display selection for an application depends on the operational environment, the type of data to be displayed, and how the user will interface with that data.

By Drew Castle, Chassis Plans

To be effective, today's warfighters have to be able to quickly analyze a staggering amount of data from a diverse range of inputs — including Advanced Tactical Data Links (ATDLs), improved mapping and terrain data, and weather forecasting. As a result, it is increasingly critical to provide better human-machine interfaces so information can be quickly digested, and decisions be accurately made and acted upon.

To properly handle all this data, modern user terminals need high-resolution displays with a variety of enhancements — such as touch screens and enhanced pointing devices, gesture support, biometric authentication, and voice recognition.

The evolution from cathode ray tube displays to early thin-film transistor liquid-crystal displays (TFT LCDs) enabled smaller overall sizes and decreased power consumption. Recent advances in display technology include the mass availability of ultra-high-definition (UHD) and 4K displays, as well as their subsequent hardening for deployment in mobile military use.

However, the adoption of new technology is rarely without missteps.

The rugged requirements for deployed electronics exposed the weaknesses of many of the early consumer-grade displays, showing them to be unsuitable for in-theater use. Aside from environmental and rugged packaging considerations, these older LCD panels were not able to meet many of the visibility requirements for outdoor display applications. The backlight levels and light polarization in displays, designed for indoor office use, weren't equipped to handle the harsher lighting of outdoor environments and were not compatible with night-vision optics.

How To Make A Display "Sunlight Readable"

The term "sunlight readable" has become popular when referring to displays that incorporate enhancements to off-the-shelf panels to make them more useful in delivering information to the user in adverse lighting conditions.

There are a variety of enhancements to improve outdoor readability. Anti-reflective (AR) cover glass, polarizing films, and increased backlight output can make on-screen information more visible to the viewer. However, it is important to note that, while often used interchangeably, a "sunlight readable display" and a "high-bright display" do not always mean the same thing.

Even without modification to backlight brightness, dramatic increases to the visibility of outdoor displays can be achieved by the proper application of AR coatings and circular polarizing films. These enhancements remove light that is counterproductive to the display on the screen as well as adjust the light polarity to where it is most functional to the user. Of course, both of these treatments can be applied to a high-bright panel for optimal harsh-environment visibility, as well.

Creating a high-bright display by changing the LED backlight strings is a very straightforward and common upgrade that often fits into the same mechanical envelope as the base panel. This simple modification can increase the light output from a panel's native 300 cd/m2 brightness to 1000 – 2000 cd/m2 or greater.

On the alternate range of the spectrum, a similar LED string replacement can equip the identical base panel used in a high-bright modification for use as an NVIS compatible display by changing the LEDs on the backlight strings to versions which are compatible with NVIS optics.

New Video Display Technologies

Advancements in display technology are not only improving the quality of the information being delivered, but also the very nature of the delivery mechanism. It is no secret that increased display resolution has been a primary focus of every display manufacturer.

The amount of information required to be displayed often exceeds the limitations of a single screen.

Cell phone devotees and home theater aficionados have seen LCD panel resolutions increase from XGA to High-Definition to 4K-UHD displays and beyond. Similarly, the requirements for ultra-high-definition displays in military environments is also increasing. Large format rugged displays, frequently installed in shipboard applications, are taking advantage of the increased resolution available on large screens to more accurately display information.

As the information being presented has shifted — from simple alphanumeric text data and low-resolution two-dimensional images to broadcast-quality surveillance video and three-dimensional terrain maps — providing tactical advantage in real-time has become a priority for military display functionality.

3D Video Technologies For Battle

With military and defense agencies no longer content with two-dimensional displays, stereoscopic and hologram display technology is becoming more common, enabling presentation of visual data in novel ways.

Stereoscopic 3D (S3D) displays take advantage of the binocular disparity of the left and right eyes by sending alternate images to each eye, creating the illusion of a 3D image.

New technologies that combine the temporal and spatial interlacing of images based on color and temporal interlacing are creating a more seamless 3D image for the viewer. In the same way, technology companies are looking to display true 3D data and images via holographic displays.

Technological increases in displays have provided the ability to deliver a higher quality product upstream. Video interfaces beyond the classic analog-RGB and DVI connections have gained traction in military space, where greater fidelity and resolution are required than can be provided by standard HD video, or when the requirements call for multiple displays to run simultaneously.

New Video Interfaces For Big Data

Serial digital interfaces (SDI) offer improved functionality when compared to traditional VGA, DVI, or HDMI video interfaces. While classical SDI has been available for nearly 30 years, increased display and digital camera resolutions have required new standards with higher transfer speeds. Original HD-SDI connections provided nominal transfer rates of 1.485 Gb/s, but currently available 3G-SDI interfaces double that speed — meaning that a single 3G-SDI connection can replace dual-link HD-SDI.

These data transfer speeds allow for a large amount of uncompressed and unencrypted video data streams, enabling broadcast-quality video signals to be displayed on any properly equipped display panel.

In one typical example, a camera payload on a military reconnaissance airplane had multiple video feeds that were being transmitted wirelessly to a ground control station, but the feeds also needed to be displayed in the aircraft interior, simultaneously, for review by flight crew personnel. Providing 3G-SDI functionality in the displays allowed viewing of uncompressed video from the payload cameras without interruption of the feed to the ground control station.

Looking forward to the future, the standards for 6G-SDI and 12G-SDI, offering double and quadruple the data transfer speeds of 3G-SDI, have been published by the Society of Motion Picture and Television Engineers (SMPTE). As adoption of updated standards increases and more products capable of supporting them come to market, the availability of lossless video transfer in high-resolution imaging will be seen in many tech refreshes of existing imaging systems.

Touchscreens For Defense Tech Applications

Along with the ability to display the wealth of available information to soldiers in any number of different scenarios, methods of interacting with displays and data are evolving, as well. Touchscreens that once were relegated to kiosk and industrial automation lines now have found their way into the phones in everyone's pockets, as well as onto larger-format displays on Navy vessels.

Touchscreen communication and gesture support has grown to include multiple different technologies, including Glass-Film-Glass (GFG) Resistive Touch, Projected Capacitance with 10-Point Multi-Touch, InfraRed Multi-Touch, gesture recognition, etc. Additionally, security technologies like biometric authentication and speech recognition are improving the security of data in sensitive environments. Displays with dual-factor authentication are becoming more common as upgraded requirements for security keep pace with technology advances in the fields which support them.

Making The Right Choice For Video Displays

With numerous advances and available enhancements in display technologies, it is increasingly more important for OEMs and integrators to study and make the right specification choices.

Selecting the appropriate combination of display attributes for each soldier's application can seem a daunting task when considering and evaluating the many available configuration options in today's off-the-shelf military marketplace. Ultimately, the proper selection of displays for each use is going to be dependent on several factors — driven largely by the environment in which the display will be used, the type of data required to be displayed, and requirements for how the user prefers to interface with the displayed data. ■

Drew Castle is VP of engineering for Chassis Plans. He has spent nearly two decades in various roles within the information technology sector. Drew joined Chassis Plans' design team in 2009 and has worked closely with vendors and customers to bring both emergent and legacy technologies into rugged environments. He oversees the design, development, and release of all new products and customer-driven solutions that Chassis Plans manufactures. Drew received his Bachelor of Science from the University of California, San Diego, and holds a Master of Science in mechanical engineering from San Diego State University.