Advanced Imaging & Video Systems

TTC offers a full range of advanced high-speed imaging system solutions with new high-definition cameras and airborne video displays. TTC products provide all-encompassing solutions for all video, imaging and display needs.
ADVANCED IMAGING & VIDEO SYSTEMS

Teletronics Technology Corporation designs and manufactures a wide variety of high-speed, light-sensitive and high-definition format-capable cameras for airborne separation, aviation, aerospace, missile and range ground testing, and for industrial applications.

TTC HIGH-SPEED CAMERA SYSTEM
The nHSC-31-S1 and nHSC-35-S1 series of TTC high-speed cameras have the advantage of miniature enclosure size, which allows high-speed video data acquisition where space is limited. Both the nHSC-31-S1 and nHSC-35-S1 cameras have a resolution of 1280 x 1024 pixels and can record images at 500 frame images per second at full resolution. The camera records 2512 full resolution images to its 4GB of internal DRAM memory. On the nHSC-31-S1 camera, the integrated Compact Flash recorder (supporting up to a 32 GB card) provides non-volatile storage for mission data that is easily stored or transported to an analysis or viewing station. The nHSC-35-S1 camera does not contain an integrated recorder and therefore can download the images to a network recorder. The nHSC-35-S1 camera is perfect for space restricted applications with its miniature size and profile.

HIGH-DEFINITION CAMERA SYSTEM
TTC’s airborne-rugged High Definition (HD) camera can withstand the harsh environment of airborne equipment testing and capture high definition videos in 720p resolution. The automatic exposure quickly adjusts to changing light conditions and the High Dynamic Range (HDR) imaging assures high color accuracy by removing over and under saturation artifacts. The camera design allows the 720p camera to output video at 60 frames-per-second with no external buffering while providing fast auto exposure. The camera is designed to work with the new specialized Advanced Data Server Recorder (ADSR-4000) that will capture the video and transform the video to H.264 format for recording and serving applications.

HIGH-DEFINITION MISSION DISPLAYS
TTC has developed next generation flat-panel display systems merging technologies in new ways to solve current field problems based on commercial and military standards. The new airborne displays are a line of flat-panel LCD displays utilizing the industries latest technologies including night-vision ready LED backlighting, state-of-the-art innovative touch input capability that is ready for rugged field use. The LDP Series of displays provide innovative touch screen solutions and high-performance graphic processing and moving map software in a rugged enclosure package. The LDP displays provide full high definition imagery and interfaces to operators in the air, on the land and on the sea. These solutions TSO C-113 certified for airborne applications, provide sunlight readable operation, provide full color and monochrome NVIS-compatible operation, many of the displays are packaged to fit in standard 19’ rack mount with panel mount options and provide low power, long service life LED backlighting.

VIDEO ACQUISITION SYSTEMS
TTC offers a broad line of video (and audio) acquisition products. From video card modules that accept NTSC, PAL, SD-RGB, CVBS, S-Video, VGA, DVI, MPEG-2, MPEG-4, H.261, H.264, JPEG-2000 video sources, many cards can capture multiple channels, capture the video and provide PCM streams for IRIG-106 Chapter-10 recording, video transmission to ground stations for display.

VIDEO RECORD AND DEBRIEF STATION
The nMGR-2000 connects to one or many cameras using an Ethernet, trigger and sync signal connections. The nMGR-2000 network manager provides configuration and control of networked cameras, allowing them to communicate with other network components including switches and recorders. The cockpit control panel provides 100BASE-T to the nMGR-2000 for camera control and status and provides discrete power, camera arm and event trigger output for the cameras.

➤ TTC provides a wide variety of video acquisition products and system solutions, from acquiring various video formats such as NTSC/PAL through H.264 video, TTC DAUs and MUXs can integrate and convert the video for recording and telemetry operations.

APACHE HELICOPTER

RANGE HIGH-SPEED CAMERA AND IMAGING TEAMS AT YUMA PROVING GROUND IN ARIZONA, PATUXENT RIVER NAVAL AIR STATION IN MARYLAND AND OTHER AIR FORCE RANGES UTILIZE TTC’S HIGH-SPEED NETWORK CAMERA SYSTEM FOR AIRBORNE HELICOPTER AND FIXED-WING TESTING INSTRUMENTATION NEEDS. THE TURNKEY NETWORK SYSTEM INCLUDES TTC’S ETHERNET-BASED SWITCH, RECORDER, MULTI-CAMERA MANAGER AND THE NHSC SERIES CAMERAS. THESE TURNKEY CONFIGURATIONS WILL HELP THESE TEAMS DETERMINE WHAT THEIR FUTURE AIRBORNE TESTING REQUIREMENTS SHOULD INCLUDE.
VIDEO ACQUISITION SYSTEM DIAGRAM

VIDEO CARDS AND MODULES
TTC produces a complete line of video acquisition capture cards and modules to acquire a full range of video. TTC also produces a new high-definition airborne-rugged camera. The video acquisition cards and modules integrate into TTC DAU and MUX units to prepare the video data for time-tagging, recording and transmission.

DATA ACQUISITION UNITS
Data Acquisition Units (DAUs) collect narrowband and high speed wideband data with signal conditioning cards and hundreds of available interfaces capable of 417 KSIPS or 5MBps per unit and acquire PCM to 20MBps. (See Encoders and Data Acquisition Systems brochure for more details.)

MULTIPLEXERS/RECORDERS, DATALINKS
IRIG 106 Chapter 10 multiplexers and recorders collect and record data from avionic buses and video and audio sources, PCM streams and Ethernet networks compliant with IRIG 106 Chapter 10 standard. The data is typically recorded on solid-state media at speeds from 20-160 MBps. (See Encoders and Data Acquisition Systems brochure for more details.)

COCKPIT UNITS AND DISPLAYS
Cockpit instrumentation data include TM, flutter, TISPI and video and is controlled and activated by pilot or operator. TTC has a full range of rugged airborne FAA qualified HD format displays.

TRANSMITTERS
Telemetry transmitters send test data to ground or other airborne receiving stations. TTC offers a full line of video, PCM and FM/SOQPSK transmitters at power output levels from 1-20W. Transmitters are available with video, analog and digital inputs at up to 20 Mbp and new SOQPSK transmitters have bandwidth efficiency improvements. (See RF Products and Systems brochure for more details.)

RECEIVE & DEMUX
Telemetry receivers are used to receive data from airborne data and video systems and convert to digital formats for ground station processing. Various modulation transmission techniques are used to balance reliability, data rates and bandwidth.

SYSTEMS
Ground Station System (TTCGSS) is a multi-platform, scalable and distributed system that facilitates data visualization and analysis, reporting and allows multiple users to simultaneously access, view and analyze data and video. The Video Debrief Station provides a high-performance computer with four high-resolution monitors and provides playback for IRIG 106 Chapter 10 video.

CONFIGURE, DATA MINING AND DEBRIEF
TTC Ground Station System (TTCGSS) is a multi-platform, scalable and distributed system that facilitates data visualization and analysis, reporting and allows multiple users to simultaneously access, view and analyze data and video. The Video Debrief Station provides a high-performance computer with four high-resolution monitors and provides playback for IRIG 106 Chapter 10 video.
Advanced Imaging & Video Systems

**ADVANCED IMAGING SYSTEM DIAGRAM**

**HIGH-SPEED CAMERAS**
The nHSC-31-S1 and nHSC-35-S1 high-speed cameras have a resolution of 1280 x 1024 pixels and record images at 500 frames per second at full resolution to the 4GB of internal DRAM memory in the camera. On the nHSC-31-S1 camera, the integrated Compact Flash recorder provides non-volatile storage for mission data. The nHSC-31-S1 also includes an onboard video encoder to allow immediate RS-170A output and PCM output of live preview video. The nHSC-35-S1 camera does not contain an internal recorder and therefore requires image download to a network recorder. The nHSC-35-S1 camera requires use of a network camera manager to cull video streams and provide preview RS-170A output. Cameras synchronize with other cameras and network devices utilizing IRIG-B signals or IEEE 1588-2002 PTP Ethernet communication protocol.

**NETWORK SWITCHES**
Switches are the center of a networked data acquisition system, managing the flow of all of the packet streams from the data sources to various locations, including recorders. Switches also deliver synchronized time to all of the network nodes. The NSW-8GT-TG Gigabit Ethernet managed-network switch provides interconnectivity to camera system components for communication, configuration and image downloading through multicast techniques. This 8-port switch also provides time gateway features to system components through IEEE-1588 and IRIG protocols. The NSW-5GTT-TG 5-port aggregate switch allows Gigabit Ethernet connectivity to four (4) upstream cameras to be connected to a downstream recorder or another network switch.

**NETWORK RECORDERS**
Recorders store all of the data that is acquired from the network cameras for later analysis. Since the network allows data to be sent and received simultaneously, recorders can also allow other network nodes random access to previously recorded data for real-time data mining and analysis, engineering unit conversions and other data processing functions.

**NETWORK CAMERA MANAGER**
The nMGR-2000 operates as the controller of a distributed high-speed camera system. It provides the configuration and control between multiple network-based cameras, a recorder, switches and the Camera Control Panel. The nMGR-2000 configures, operates, synchronizes and controls networked cameras for video recording systems. Using TTCWare, the nMGR-2000 can provide basic configuration and ready the cameras prior to a mission. During a mission, the nMGR-2000 communicates operation commands for reconfiguration and synchronization between the cameras in the network and provides a single channel of RS-170A (NTSC/PAL) video from a selected camera to view the cameras field-of-view. The nMGR-2000 also interfaces with the camera control panel for reconfiguring of the system and provides status through the network and through the discrete signals.

**COCKPIT CONTROL**
The CCP-2000 multifunction camera control panel is installed in the cockpit and works with the nMGR-2000 to control up to 39 cameras on an individual basis, in groups of up to nine units, or as a group. It provides RS-422 clock and data output feedback of the nMGR-2000 system and camera status.

**CAMERA SYSTEM MANAGEMENT**
An important component of a networked data acquisition system is its configuration and management tools. Networked data acquisition systems provide far greater flexibility and power than conventional systems, and the complexity demands a powerful system management tool. TTCWare configures and programs all TTC’s standard and networked products. TTCWare allows users to configure their high-speed camera setup for stand-alone configurations and for network-based multi-camera systems with a network recorder. Camera parameters can be configured for multiple trigger events, groups of cameras and individual cameras. These parameters are configured as TTCWare projects and are downloaded to camera and system devices through XML. These XML files can be re-downloaded at anytime to allow quick configuration. This facilitates rapid configuration and maintenance of large projects. The Camera Manager utility allows for downloading image files from the CF+ recorder on camera or networked recorders. Another utility, Image/Viewer, allows for time correlation and conversion to industry standard file types, BMP, TIF, PNG, AVI etc.

**NETWORK CAMERAS**
- **nHSC-31-S1 Series**
- **nHSC-35-S1 Series**

**NETWORK SWITCHES**
- **Network Switch NSW-8GT**

**NETWORK RECORDERS**
- **Network Recorder nREC-8000**
- **Network Recorder nREC-4000S-2**

**NETWORK CAMERA MANAGER**
- **nMGR-2000**

**CAMERA SYSTEM MANAGEMENT**
- **TTCWare**

**ADVANCED IMAGING SYSTEM DIAGRAM**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-31-S1 Series**

**Network-Based High-Speed Camera nHSC-35-S1 Series**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-35-S1 Series**

**Network-Based High-Speed Camera nHSC-35-S1 Series**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-31-S1 Series**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-31-S1 Series**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-31-S1 Series**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-31-S1 Series**

**Network-Based High-Speed Camera with Built-in Recorder nHSC-31-S1 Series**
TTC has developed an airborne-rugged High Definition (HD) camera for the test engineering community. The design exhibits a rugged camera body that can withstand the harsh environment of airborne equipment testing and a powerful digital camera that captures high definition videos in 720p resolution. With its miniature size, the enclosure dimensions are 1.5 x 1.5 x 4.1 inches, the HDC-200 and HDC-210 cameras are able to be mounted in virtually any situation that arises on an aircraft in any test condition.

The TTC high-definition series camera design provides a unique solution for applications where space is at a premium, including airborne, automotive and ground testing. The fast exposure quickly adjusts to changing light. The High Dynamic Range (HDR) imaging assures high accuracy by removing over and under saturation artifacts. The HDC-200 camera has an HDMI/DVI output at 720p60 video resolution. The HDC-210 camera has an HD-SDI output also at 720p60 video resolution.

TTC engineers have crafted an FPGA-based image signal processing pipeline design that surpasses standard video cameras on the market for image quality, light sensitivity and high-dynamic range imaging. This unique design allows the 720p camera to output video at 60 frames-per-second with no external buffering and fast auto exposure with instant adjustment for changing light conditions. Utilizing this new design capability, the camera supports up to 32-bit (192dB) scene dynamic range; the camera can attain maximum detail under difficult lighting conditions in both light and dark areas on the same image. The camera is designed to work with the new specialized Advanced Data Server Recorder (ADSR-4003F) that will capture the video and transform the video to H.264 format for recording and serving applications.

**FEATURES**
- Amazing 720p video in an airborne package!
- Sensor pixel resolution: 1280H x 960V (1.2 Mp)
- Sensor type: 1/3-inch CMOS, active-pixel sensor array
- Lens mount: C-mount with adjustable back-focus
- Random vibration: 15 gms, 20 to 2000 Hz, 10 minutes, any axis
- Shock: 15g, half-sine, 11 mS, 6 shocks, any axis
- Acceleration: 25g, indefinite duration, any axis
- Operating temperature: -40ºC to +60ºC
HIGH-SPEED CAMERAS SYSTEMS AND ACCESSORIES

The nHSC-31-S1 and nHSC-35-S1 series of TTC high-speed cameras have the advantage of miniature enclosure size, which allows high-speed video data acquisition where space is limited. Both the nHSC-31-S1 and nHSC-35-S1 cameras have a resolution of 1280 x 1024 pixels and can record images at 500 frames per second at full resolution. The camera records 2,512 full resolution images to its 4GB of internal DRAM memory. On the nHSC-31-S1 camera, the integrated Compact Flash recorder (supporting up to a 32 GB card) provides non-volatile storage for mission data that is easily stored or transported to an analysis or viewing station. The nHSC-35-S1 camera does not contain an integrated recorder and therefore can download the images to a network recorder. The nHSC-35-S1 camera is perfect for space restricted applications with its miniature size and profile. The nHSC-31-S1 also includes an onboard video encoder to allow immediate RS-170A output and PCM output of live preview video. The nHSC-35-S1 camera requires use of a network camera manager to cull video frames and provide preview RS-170A output. All cameras can synchronize to other cameras and devices utilizing IRIG-B signals and IEEE 1588-2002 PTP Ethernet communication protocol.

Suggested products

- nHSC-35-S1 Series
- Network-based high-speed camera
- nHSC-31-S1 Series
- Network-based high-speed camera with built-in recorder
- nMGR-2000
  - Network camera manager
- NSW-6GT-TG/NSW-5GT-TG
  - Network switches
- nREC-4000/nREC-4000S-2
  - Network recorders
- CCP-2000
  - Camera control panel
- MFD-100
  - Multi-function display
- ACT-100
  - Active camera target
- TTCWare, MediaManager & ImageViewer
  - Camera configuration, control and media control/software

ADVANCED IMAGING & VIDEO SYSTEMS: SHORT CATALOG

HIGH DEFINITION CAMERA AND ADVANCED DATA SERVER/RECORDER

The HDC High-Definition camera design exhibits a rugged camera body that can withstand the harsh environment of airborne equipment testing and a powerful digital camera that captures high definition videos in 720p resolution. With its miniature size, the enclosure dimensions are 1.5 x 1.5 x 4.1 inches, the HDC-200 and HDC-210 cameras are able to be mounted in virtually any situation that arises on an aircraft in any test condition. The High Dynamic Range (HDR) imaging assures high accuracy by removing over and under saturation artifacts. All image processing is done in Streaming Mode (no frame buffer) for extremely low latency. The HDC-200 camera has an HDMI/DVI output at 720p60 video resolution. The HDC-210 camera has an HD-SDI output at 720p60 video resolution.

Suggested products

- HDC-200 Series
  - High-definition camera
- HDC-210 Series
  - High-definition camera
- ADSR-4000
  - Advanced data server & recorder
- TTCGSS
  - Software for time indexing video
Suggested products

**LDP Series Displays**
High-Definition Flat-Panel Displays

**VDBR-2000**
Video Debrief System

**VIDEO ACQUISITION PRODUCTS: CARDS AND MODULES**

TTC provides a wide variety of video acquisition products and system solutions, from acquiring various video formats such as NTSC/PAL through H.264 video, TTC DAUs and MUXs can integrate and convert the video for recording and telemetry operations.

Suggested products

**VID-XXX**
Video/Audio Acquisition Cards

**MVID-XXX**
Video/Audio Acquisition Modules

**MCVC-XXX**
MCDAU/MEDAU Video Acquisition Modules

**XVID-30X**
MUX-300X Video/Audio Encoder Interface Cards

**HIGH-DEFINITION DISPLAYS AND DEBRIEF STATION**

The LDP line of displays provides a full feature set of signal input capabilities. Developed around displaying full High Definition (HD) imagery from today’s modern camera systems and signal sources, the LDP line of displays provides native high resolution capability for unprecedented operational image clarity. The display family service airborne and ground application to interface to industry leading EO/IR camera systems with panel sizes of 8.9”, 10.4”, 15.1”, 17.3” and 21.5” products. The Video Debrief Station provides a high-performance computer with four high-resolution monitors and provides playback for IRIS 106 Chapter 10 video.

**ADVANCED IMAGING & VIDEO SYSTEMS: SHORT CATALOG**

**VIDEO PRODUCT SELECTION GUIDE**

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air bag deployment · assembly lines 
bullistics/detonics · bubble formation 
combustion · crack propagation · crash 
testing · component tracking · drop 
tests · droplet formation · explosives & 
pyrotechnics · failure analysis · fluid & flow 
visualization · flying splice · fuel injection 
studies · human movement · Hi-G 
Crash testing · impact tests · industrial 
inspection · ink jet sprays · laser induced 
fluorescence · machine troubleshooting 
materias testing · missile launch 
motion analysis · non-destructive testing 
projectile tracking · particle image 
velocimetry · preventative maintenance 
production line · PIV · PSP · restraint 
testing · rollover testing · spray analysis 
spray & particle analysis · seat belt safety 
sporting events · testing & instrumentation 
vibration · water droplets · wind tunnel