DIGITAL DATA IN VIDEO PROCESSING SYSTEMS

Bob A. Morse
Member Technicial Staff
BELL TECHNICIAL OPERATIONS
P.O. Box 5537
Yuma, Arizona 85364

ABSTRACT

Digital information in video systems is an expanding field. The use of digital video equipment is continuously being examined and updated at USAYPG. There are fully operational systems currently being used by BELL TECH. OPS at the proving ground. I shall cover some of the uses and capability of the systems as well as the individual pieces of equipment in the systems

INTRODUCTION

In the test environment encountered at USAYPG the data collection and reduction must be expedient and accurate, a video data system provides accuracy and a fast reduction turnaround. USAYPG has been a testbed for digital systems using video as a basis and in most cases has assisted in seting up video systems at other ranges. The main use of video data collection is in the area of impact location. In order to perform this function a target grid is designed and geographicaly surveyed on the range. The impacts are recorded from an aircraft above the impact field. The operational software for reduction then uses the surveyed points to perform a correction for the aircraft being of axis to the center of the impact field. The body of this paper will be presented in two parts. The first part will contain a system overview and the second part will be on the applications of the various pieces of equipment used in the systems.

SYSTEM OVERVIEW

The main computer system utilized with the equipment at USAYPG is an H.P. 1000 series computer. Also the H.P. 9845 series desktop computer is used. The prime function of the data reduction system is to perform image analysis, centroid location and level maping. Once the data has been reduced it is the plotted or in some other way graphicaly

displayed and tabulars run for the requesting party. Figure 1 shows the complete system. Listed below are the individual systems as they can be used.

Figure 2 shows the typical impact reduction system utilizing the HILL ELECTRONICS video reader and a 9845B or 9845A computer. In this system the main objective is location of impacts within a target grid located on the range. The system consists of a SONY recorder/player with search and freeze frame capability, a HILL ELECTRONICS video reader, a monochrome monitor, a desktop computer system.

Figure 3 shows the typical vertical target system utilizing the H.P. 1000, H.P.9845A, or the H.P.9845B computer for reduction. The main function of this system is the reduction of vertical target information. The system consists of a SONY recorder/player, an EIGEN video disk a sync generator, an AMPEX time base corrector, the DATAWARE ATTS dual tracker, and a monochrome monitor.

Figure 4 shows the typical image analysis system utilizing the H.P. 1000 and the QUANTEX DS-30. The function of this system is image analysis of video data. The system consists of a SONY recorder/player, an EIGEN video disk, a waveform monitor, a sync generator, an AMPEX time base corrector, the QUANTEX DS-30 digital video processor, the HILL ELECTRONICS video reader, and a high resolution monochrome monitor.

APLICATIONS

One of the major functions of the BELL video section at USAYPG is impact positional scoring. In most cases this is scored on an impact field located on the range with surveyed calibration markers. For the reduction of this a video reader manufactered by HILL ELECTRONICS Corp. is utilized. In the field as data is being collected a time annotator also built by HILL ELECTRONICS Corp., recieves range time and inserts it into the video signal. This annotator works in field mode so that in each field there is displayed an accurate time as to when that field occured. After the data is collected the tape is returned to the reduction center where the data is reduced yielding X,Y impact coordinates. To obtain the information required for reduction the video is viewed untill an impact is located, the video is then switched to playback in field mode, through the use of the recorder/player or a video disk. The fist sign of impact is then found and the time of that field is recorded. The video reader is then used to collect the x,y coordinates required by the computer system. Several video readers are in use in the video data reduction facility at USAYPG the most common of which is the HILL 582. The 582 generates a selectable crosshair which can be positioned anywhere on a video picture by the use of a rate stick or a track ball. The reader operates in field or frame mode making this unit ideal for most positional requirments, the scaling used by this reader is 700 miles in X axis and 225 in the

Y axis. The interface on the reader is the IEEE-488 interface bus which allows the computer the read the data directly from the device, the reader is also capable of setting the crosshair to a set of coordinates sent to it by the computer. The coordinates that the crosshair is located at also are displayed on an LED display on the front pannel.

Another major function of the video section is the scoring of impacts or other functions on vertical targets or in a predetermined field of view with the camera rigidly mounted. A dual channel auto tracker designed and built by DATAWARE for USAYPG, and is now being commercialy built, is utilized for this scoring function. The tracker contains two independent trackers that can be set up for specific functions. The tracker contains the ability to auto track and auto threshold as well as perform auto window sizing. The threshold can be referenced to white or to black as well as differential. The tracker also interfaces to the computer system using the IEEE-488 bus and all functions can be set up remotely by the computer interfaced to the tracker. Another capability of the tracker that was found useful at the proving ground was the frame differential scoring capability. The tracker has the capability of storing a video frame in memory when the video imput changes from the stored frame the difference is scored and the memory updated by the new frame. The tracker can select between 4 video inputs and also has a manualy positionable crosshair. The display on the tracker is a 20 character display capable of full alphanumerics which provides an information display that is selectable by the operator. The scale used for the tracker is

525 resolution
X -250 to 251 Y -117 to 116
875 resolution
X -147 to 148 Y -198 to 197

Analog Az and El error signals are also available on the rear panel for use in tracking systems, such as a videotheodolite

Also utilized at USAYPG is an ATLANTIC SCIENTIFIC encoder/decoder system. The encoder system designed for use in the field with the camera system has the capability of syncing the camera system to range time so multiple cameras would be in sync to each other. The encoder can also function as an annotator for range time and provide status markers. The prime function of the encoder is to encode information into the video signal where it cannot be seen on a standard monitor but can be decoded later by the decoder. It is capable of encoding 36 bytes of information including range time and the Az/El outputs from shaft encoders. The interface for the decoder is IEEE-488 and the decoder accepts sereral commands from the computer over this interface. The speed of the interface is capable of outputing the 36 bytes of information on every video field as it occurs. The

capabilities of the Encoder/Decoder system have greatly enhanced the video capabilities of the proving ground.

The most sophisticated piece of equipment utilized at the proving ground is the QUANTEX DS-30 DIGITAL VIDEO PROCESSOR. This unit is capable of storing a video frame into digital memory and enhancing the image as doing so if desired. After digitizing a frame the information contained in memory is the available to a computer over an IEEE-488 bus interface, the computer can then access any point in memory. The DS-30 is scaled in a 512 x 512 pixel array each pixel is a value from 0(black) to 256(white) (A pixel is a single point of video information.) The computer can also write to the DS-30's memory as well as remotly perform the same functions as the front panel. There is a built in summing and averaging function, the summing serves to add seccesive frames in order to provide a better image if the light level of the image is low, and the averaging serves to averages a preset number of frames and displays the result. The DS-30 is capable of 525 and 875 line operation. The DS-30 is an ideal unit for image analysis, the capabilites range from topographical mapping to level mapping, and low light level work as in astronomy.

The staff at USAYPG recognize the potential of video systems and try to maintain systems that are functional as well as state-of-the-art systems. In the years to come the use of high speed video combined with the ability to gather information from the video signal will replace conventional film data media due to its ease of use and rapid turn-around time.

CONCLUSION

The use of digital video equipment is greatly expanding the acceptance of video as a valuable tool in the field of testing and research. The only limit in the field of video digital analysis is ones own imagination. The rapid respose time in in which video can be viewed, in respect to film, makes it far superior to film media.

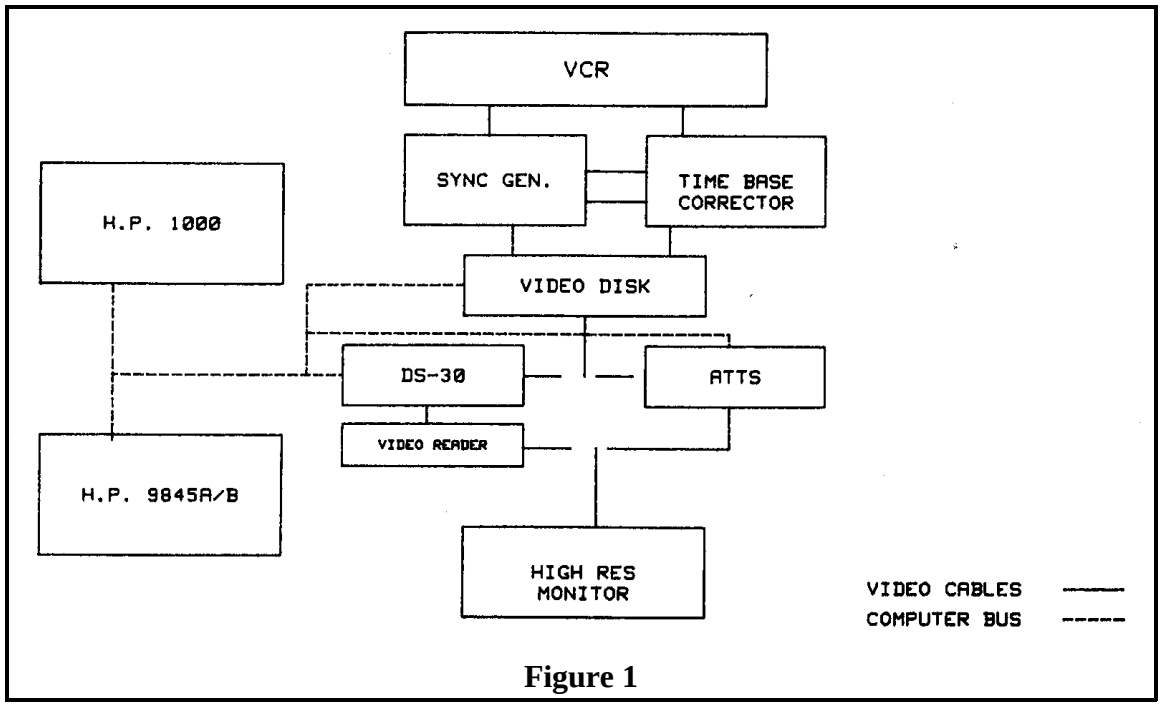

Figure 1

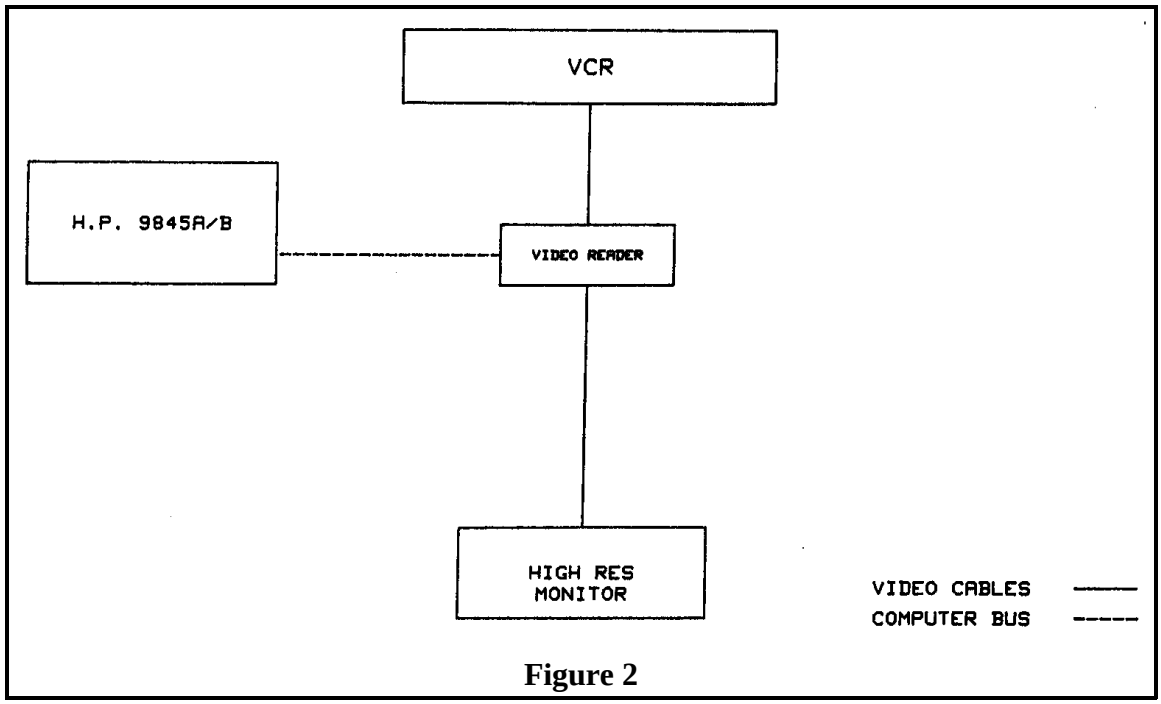

Figure 2

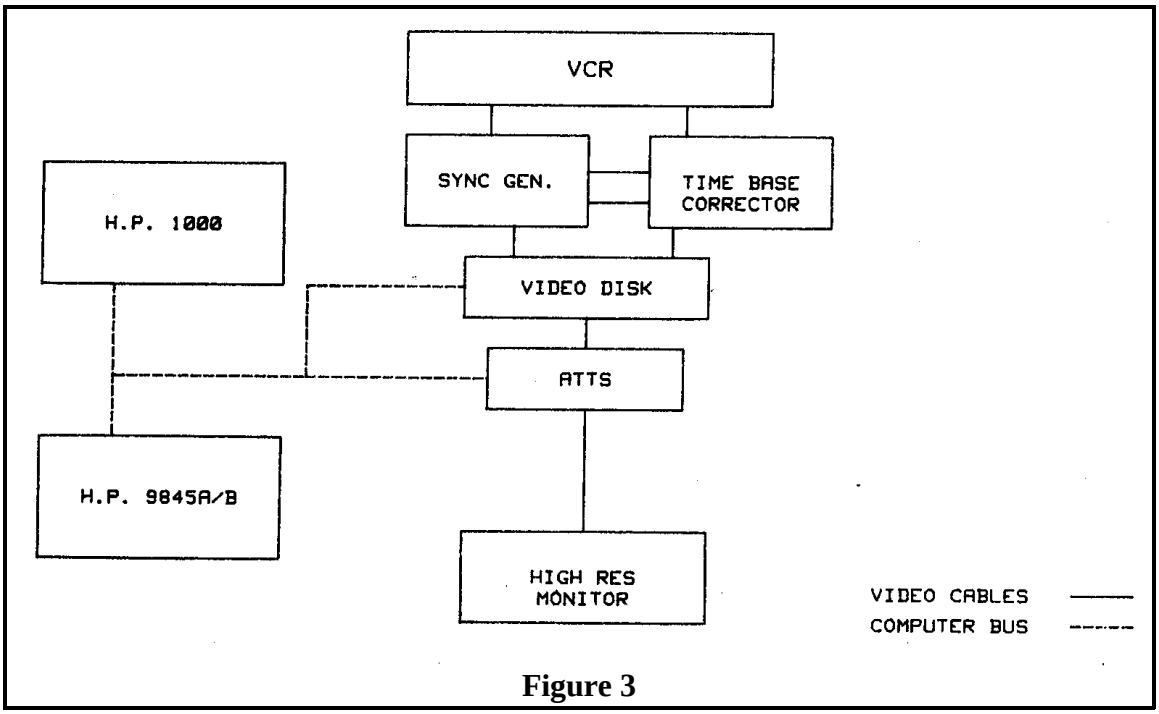

Figure 3

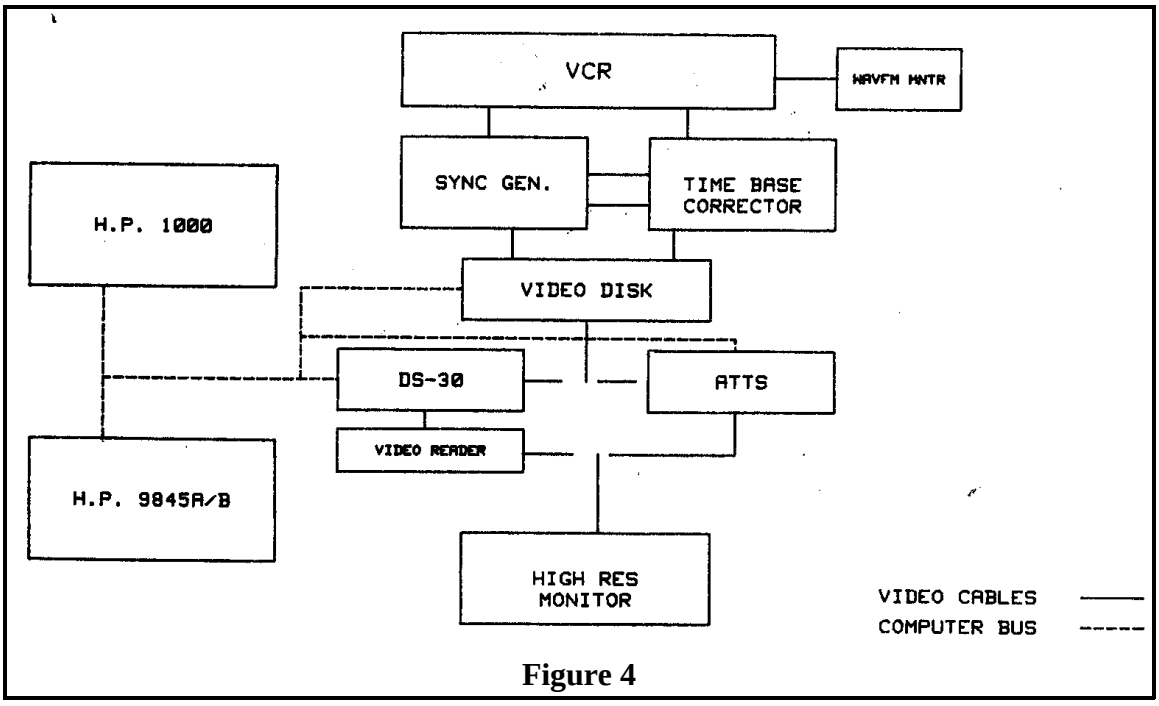

Figure 4