ADVANCE PLANNING FOR THE TELEMETRY INDUSTRY

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ABSTRACT

Testing into the 21st Century will entail significantly different techniques than those presently used. Processing of data sources such as telemetry, radar, optics, and others will change from a merging of data for post flight reduction, to a real time fusion of data for mission support.

Change in the philosophy of what is telemetry data will drive the entire processing and display systems used for real time support. Telemetry will move further from being used primarily for airframe performance reporting, to being a source of precision TSPI, video, and endgame performance.

This paper will touch on these aspects and explore the processes such as techniques, displays, and standards that will evolve to meet these requirements.

Advance Planning For The Telemetry Industry

Program tests leading into the 21st Century will follow the basic concepts of being smaller, faster in velocity, and higher in operation. These concepts will strain the resolution capabilities of traditional instrumentation systems like radars, and optics. Methodology for display and analysis of high altitude testing will need to be developed. Traditional instrumentation will become sources to a multitude of instrumentation including telemetry, GPS, and on board video.

Telemetry data will continue to evolve in the types of data processed. Telemetry began primarily as a measure of the internal performance of an individual test article. Temperatures, vibration, and attitude rates were among the standard parameters measured. With the arrival of on board computers, telemetry began giving more of a system measurement of the test article. Standard parameters that previously had been reported individually, could now be quantitized to show changes in relationship to each other. Avionics performance could now be monitored in real time, which lead to a new source of Time, Space, Position

Information (TSPI) for mission control, the Internal Navigation package of the test article. This made possible the comparison of where the test article thought it was, compared to where standard range instrumentation said it was. The process of data comparison laid the foundation to move from data merging to data fusion.

With data fusion, display of real time missions will move to more sophistication than is presently used. Rather than data being merged, that is using one source at a time, data sources will be fused to build composite displays of mission performance.

A typical mission scenario would begin with a live High Definition Television (HDTV) video of a missile on a launcher. Overlaid on the video screen would be user specified measurements and displays for monitoring critical parameters. Use of the HDTV digital format would result in a seamless presentation to the user.

Upon launch, the user could select to continue watching live video or specify a set image size. When the physical image provided by optics decreased, a virtual reality image (VRI) would appear. Controlled through the telemetry information being received, the VRI would create a real time presentation of the actual missile. As the VRI continues to fly out, the user could select the viewpoint most meaningful to him; a view from the tail, flying formation from the side, or through the video seeker of the missile itself.

The target vehicle display would be processed in identical fashion. As the interceptor and target vehicles came together, the VRI screen would be scaled to show the flight path of the two approaching objects. Countermeasures employed by the target, or other sources, would be represented by color coded shaded areas of the display. As the interceptor flew into these areas, the interceptor's seekers field of view would be shown as different color shaded areas. The effects of the countermeasures to the interceptor's seekers will be readily apparent as the various shaded areas merge.

Having switched from an actual view to a VRI during the fly out, a switch back to live video would be done as the vehicles approached the endgame. Utilizing the interceptor's video seeker data, the user would have the actual view of events leading to intercept.

After the viewing in real time of this type of display system, the true power of this system would become apparent in the post flight analysis. During the actual mission, all data sources will have been recorded on a mass storage system, insuring precise time correlation. Playback of data then offers several options to the user. During the flyout, the VRI of the vehicles could be generated using any data source as a clock for display update rate. Thus, a vehicle's attitude changes would be viewed as a stop action sequence of the roll, pitch, or yaw update rate. Actual values would be displayed as either analog gauges, or digital readouts, giving the user a quantizied perspective of the flight. Key sequences could be stopped, replayed, perspective changed, and analyzed at the user's leisure.

Reduction of fixed camera HDTV data is simplified by digital subtraction techniques. By subtracting out the pixels corresponding to fixed parts of the frame such as poles, landscape, and buildings, the remaining data would correspond directly to the missile itself. Measurement of the missile's trajectory, velocity, and attitude would be then be read automatically. Similarly, through a fusion of actual video, and a VRI clocked at a higher rate via telemetry, the complete instrumented flight path of the missile would be analyzed.

The challenge to industry becomes developing the tools needed to realize this scenario. The basic building blocks of computers, sensors, and video are available now. The major challenge is to define the pathway to bring this data together.

Now, more than any time, it will be necessary to define and enforce standards. Industry and Government must work together to ensure commonality exists to reduce test costs. Government can learn from industry by making extensive use of the work done by the ANSI and ISO communities in standardization. Industry can work with Government by committing to Government standards for areas not covered by ANSI/ISO.

Examples include the use of the HDTV standard currently being developed by the Grand Alliance. Government should use this standard as they make the conversion from film to video optical systems. Industry use of this standard to transmit on board video or IR seeker data would allow processing of the data by standard industry equipment adapted for range use.

ANSI/ISO standards for computer network protocols are being used now in the setup of intra-range networks. As inter-range networks move from the special one-of-a-kind hookups to fixed dedicated links, Government must use existing ANSI/ISO standards. Adaptation of these standards to Government peculiar formats is being done by the Range Commanders Council various groups, with the Data Reduction and Computing Group having the lead. This effort, known as DR19, is currently in pink sheet status leading to acceptance as an RCC Standard. This type of approach, where RCC standards use ANSI/ISO standards as the foundation on which to build, will need to become method of operation for future government standards.

As packet telemetry begins to move from the satellite field to the range testing field, the RCC Telemetry Group will be faced with a similar challenge. Following the lead of the DR&CG, the TG should look to incorporate the international CCSDS standards for packet telemetry into the IRIG 106 telemetry standard. Incorporation could be as simple as an update to the Telemetry Measurements Attribution Transfer Standard (TMATS) to refer to the CCSDS documentation.

Technology will continue to push program performance and capabilities, with a corresponding push on the type of support the test ranges will be expected to provide. Through a concerted effort of industry and government to work together on techniques and standards, tests of the future will be supported in a timely and cost effective manner.