A LAUNCH VEHICLE VIDEO TELEMETRY SYSTEM

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ABSTRACT

Collecting and analyzing vehicle performance data is an essential part of the launch process. Performance data is used to determine mission success. Performance data also provides essential feedback to the launch vehicle design engineers. This feedback can be used to improve the overall vehicle design and thereby improve the probability of a successful launch.

Various Telemetry products are used to gather and process critical information on board launch vehicles. Data is transmitted by RF links to fixed or mobile receiving stations. These Telemetry products are ruggedized for the extreme launch environments. This paper discusses the use of video telemetry as a means of providing launch vehicle performance data.

KEYWORDS

Launch Vehicle, S-Band, TDRSS, Telemetry, Video

INTRODUCTION

Gathering vehicle performance data has always been an important part of the launch process. Acceleration, audio, shock, temperature, and vibration transducers have successfully been used to capture vehicle performance data during flight. While these transducers often provide adequate information, there are occasions when “a picture is worth a thousand words.” Strategically mounted cameras could capture important launch events before and during the launch. Prior to launch, these cameras could serve a variety of pre-launch checkout needs including inspection and verification. During the launch, these same cameras can be used to provide visual monitoring of flight critical events. Implementing the launch vehicle video telemetry system involves several issues: where will cameras be located and what will they observe; how will the data get from the vehicle to the ground; what ground support equipment will be required.

DISCUSSION

A generic launch vehicle video (LVV) system is illustrated in Figure 1. The system shown consists of six cameras. For a given application, the actual number of cameras will vary depending upon the mission and depending upon the amount of data required. The LVV system includes an airborne segment and a ground based segment. The airborne equipment consists of cameras, a video coding unit, and a transmitter. The ground equipment includes a receiver, a video decoding unit, and display/recording devices.

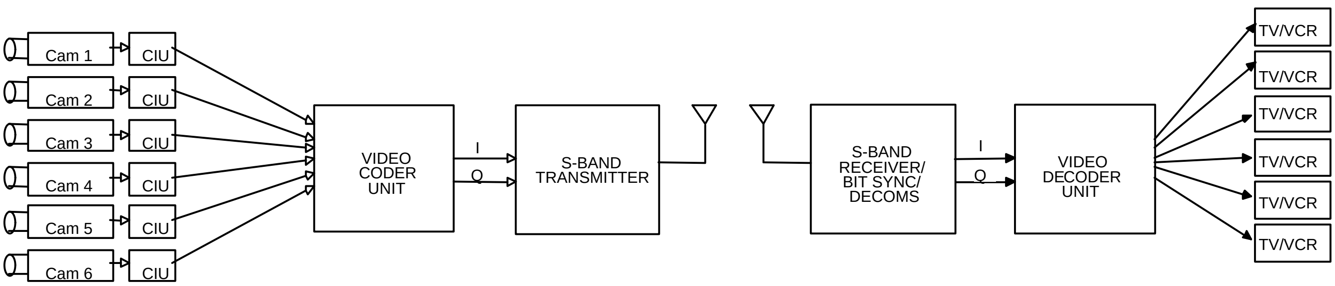

Figure 1 Launch Vehicle Video System Block Diagram

A variety of cameras can be used on the airborne side. Depending upon the required resolution, cameras range from relatively low resolution to the high frame rate variety. The SEKAI RSC-100 is a ruggedized color camera designed for harsh environments.

Video cameras mounted in strategic locations can be used to capture critical events as they occur prior to launch and during the flight. For example, a camera could be used to keep an eye on the payload. Prior to launch, the camera could help determine proper payload operation. During the launch, that same camera could be used to see what the actual environment inside the fairing looks like during ascent and to see if the payload inadvertently deploys some of its hardware prematurely. In a similar fashion, a camera could be used to view the engines.

During the launch, a camera could be used to capture separation events. These events include the following:

- Solid rocket booster (SRB) jettison
- Payload fairing jettison
- Stage separation
- Payload separation

Video data from the launch vehicle could be sent to the ground via NASA's Tracking and Data Relay Satellite System (TDRSS). TDRSS consists of a space-based network of geosynchronous satellites and a ground terminal complex located at the White Sands Complex (WSC) in New Mexico. TDRSS is capable of providing communications services to low-earth orbiting (LEO) spacecraft and sub-orbital vehicles. Forward data is uplinked from the ground segment to the TDRS and from the TDRS to the customer spacecraft. Return data is downlinked from the spacecraft via the TDRS to the ground segment and then on to a data collection location. TDRSS based video data collection is illustrated in Figure 2.

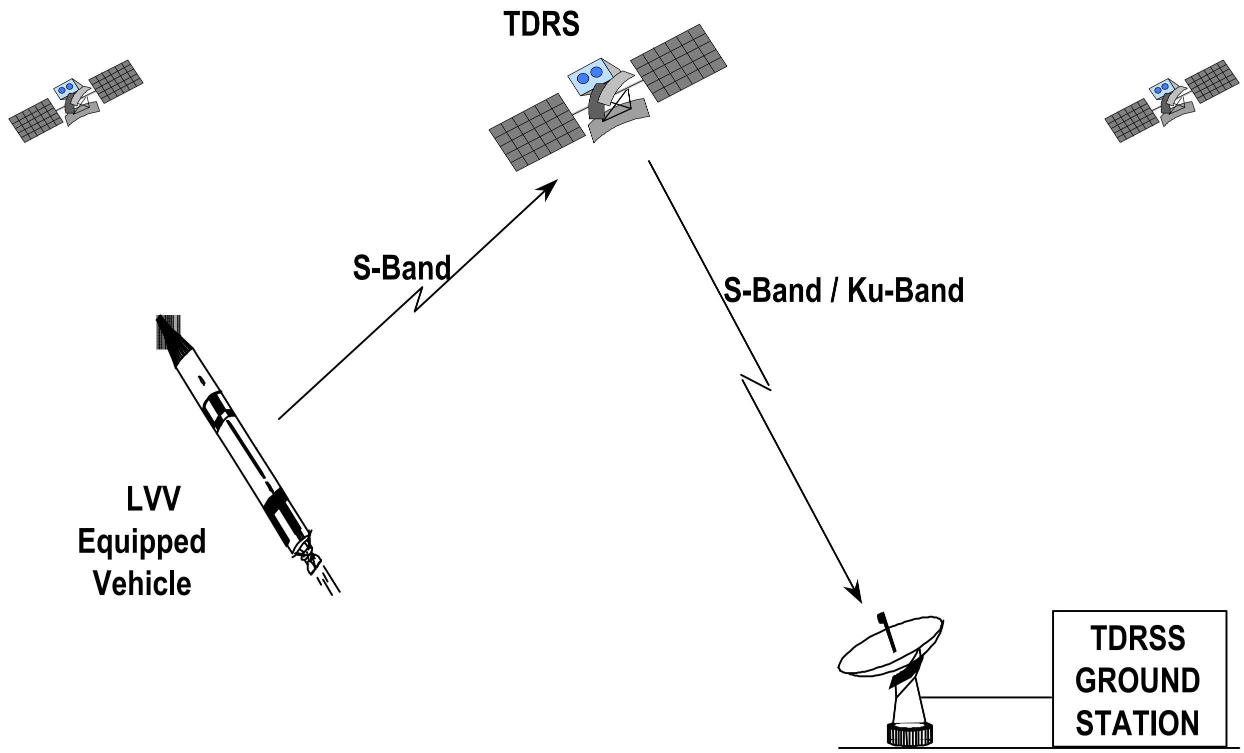

Figure 2 TDRSS Based Video Data Collection

CONCLUSION

Video Telemetry systems involve familiar system design tradeoffs including cost, bandwidth, resolution, bit error rates, power consumption, size, and weight. Video can be perceived very easily without the need for a lot of interpretation; video data speaks for itself. While video telemetry systems will not replace existing telemetry systems, they do represent the next logical step in telemetry.