Trends in Telemetry Systems

TRENDS IN TELEMETRY SYSTEMS

(A Tutorial)

Presented by

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This tutorial is an examination of trends in telemetry systems as we approach the 1990s. . . a look at where we are, and where we appear to be headed in the near future.

Historically, the typical change in our technology is brought about by one of three conditions. First, users demand performance improvements in order to facilitate their analysis of test programs. Second, manufacturers make performance improvements because continuing advances in component technology enable them to offer improved products for telemetry applications. Third, developments in non-telemetry applications, both hardware and software, are adapted to our needs by system designers. We will see the results of all three conditions as we look at trends in telemetry systems.

Trend 1: Higher data rates.

System users have always wanted more data points and higher frequency response per point, in order to achieve more thorough testing results. We see continuing changes in most of these devices in the typical telemetry system to meet these needs:

Encoder	Receiver
Tape Recorder	Bit Synchronizer
Format Synchronizer	Preprocessor/Compressor
Host Processor	Peripheral Storage Devices
Software	

Trend 2: More complex formats.

Gone are the days when telemetry data measurements were acquired as analog values in a simple sequence. Now, many telemetry systems handle data from one or more vehicle computers; often the computer data is contained in imbedded asynchronous formats. The

data from a MIL-STD-1553 avionics bus must be handled also, plus an assortment of other data in unusual formats and codes. Some systems are hybrid (PCM and FM) in order to accommodate both conventional and higher-frequency data. Some of the system devices which are affected are:

Encoder	Format Synchronizers
Preprocessor/Compressor	Host Processor Software

Trend 3: Better Synchronization

For several years, little was done to improve the quality of data synchronization. Now, improvements are again being made to assure faster, more accurate synchronization. This involves:

Bit Synchronizer	Format Synchronizers

Trend 4: Data Accuracy.

This relates to the acquisition, transmission, storage, and display of data, and affects the:

Encoder	Bit Synchronizer
Format Synchronizers	Preprocessor/Compressor
Host Processor	Peripheral Storage Devices

Trend 5: Multiple Users.

A few years ago, we were content in many cases to have a system which could accommodate only one data analyst. We have moved from that situation to the multiple-user system, and find that in some applications a system should serve even 10, 20, or 30 data analysts. Contributors to this trend are:

Preprocessor/Compressor	Host Processor
Display Devices	Soft-ware

Trend 6: Better Displays.

Since many system users are not telemetry experts nor computer experts, there is a continuing emphasis on making data displays simple to operate and more meaningful. This involves:

Preprocessor/Compressor	Host Processor
Display Devices	Software

Trend 7: Simpler Setup and Operation.

With complexity of the typical telemetry system increasing from year to year, device designers, system designers, and programmers are continually working on techniques to hide this complexity behind an operator-friendly man-machine interface. This involves all the elements of the system, both hardware and software, and includes the system documentation and training as well.

One of the most useful trends in this regard is the growing use of data base software, such that the operator may predefine all data stream characteristics and all measurement parameter characteristics. These definitions are stored in the system data base, and the software handles all details of front-end setup, preprocessing/compression, and display processing automatically.

The system data base and all other operating characteristics are entered via menus. The software even includes on-line documentation for the operator, available via the HELP request.

Trend 8: Simpler Maintenance.

Fortunately, many new devices used in telemetry stations have imbedded microcomputers for control and housekeeping. The trend is to use this power for diagnostics as well. This, along with the trend toward construction with modules having well-defined functional boundaries, helps to reduce the time required for diagnosis and module-level repair. All the devices in the system are affected, as is the system software and the technical documentation.

Trend 9: Expandability.

Each of us has dreamed of designing the system which would serve present-day as well as well as future needs without modification. Unfortunately, such a system is still in the dreamer phase. In the real world, today’s system will be inadequate tomorrow. The trend,

therefore, is to recognize this and build devices and systems (both hardware and software) with that inevitable expansion in mind. This involves modular construction, the use of data buses, and other techniques. Virtually every part of the system is affected by this trend.

Trend 10: Move Processing Power:

Even though the processing power of a minicomputer per unit of cost increases each year, our demands on a telemetry computer increase more rapidly. We are never quite satisfied with the realtime processing power of our systems. The trend, therefore, is toward extending the computer's power by adding a special-purpose hardware preprocessor/ compressor. Proper use of such a device often multiplies the system processor by four to 400. Another hardware device, the array processor, is used in some systems also, to perform high-speed frequency analysis outside the computer. This trend affects the:

Preprocessor/Compressor Software	Host Processor Array Processor

Trend 11: More, Faster Data Storage.

In many cases, telemetry data rates are too high for realtime entry into a host computer, yet the computer must have access to some of the information in near realtime. The new input/output computer with disk storage offers a solution to the problem, storing data at rates to 6 megabytes per second and providing backdoor access to the host processor. The devices affected are the:

Preprocessor/Compressor Software	Host Processor I/O Computer

All of these trends are discussed in the technical session, with detailed examination of the various hardware and software elements which comprise the typical telemetry systems.