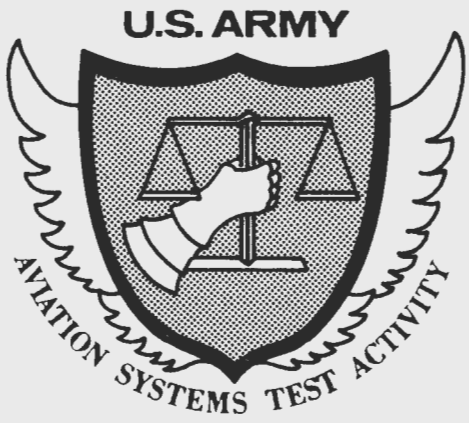
US ARMY AVIATION ENGINEERING FLIGHT ACTIVITY

Presents

RDAPS



"REAL TIME DATA ACQUISITION & PROCESSING SYSTEM"

For

ADVANCE FLIGHT RESEARCH & DATA PROCESSING

BACKGROUND

In 1977, the United States Army Aviation Engineering Flight Activity embarked on a program to modernize their aging flight test data processing system. A comprehensive one year study conducted by a five man committee resulted in the development of a specification to be used for purchasing a modern data acquisition and processing system. Further justification, funding and procurement actions resulted in a final award of contract for the system development.

Fairchild Weston was chosen in September of 1979 to provide the Army flight test community with a system that decreased time and cost of a total test cycle, from aircraft preparation to report generation. This was to be a multifaceted flight test tool, with operations focused on obtaining analytical results, during the test mission, that are required for mission control and report generation. Data bases of test results and other mission support data were to be generated for common use by a number of activity elements. The system was to link, through these data bases, valuable information needed for tasks ranging from test report generation to personnel bookkeeping functions. By developing a system design with such broad scope, the Army was provided with the necessary tools for automating the entire work place in a logical and productive manner.

FLEXIBILITY

The RDAPS architecture was developed to mold not only to the Army's needs, but also to the needs of the vast majority of telemetry users. In fact, during the normal course of Army testing, various airframe manufacturers will be required to use RDAPS for all data analysis and report generation of test flights for aircraft produced by themselves, but jointly tested with the Army. This requires RDAPS to be extremely flexible and have a wide range of capability while maintaining it's easy to use status.

CAPABILITY

The mission capabilities of RDAPS are so vast that for most Army test flight missions, the pilot will find over eighty percent of all final analytical data processing for his flight awaiting him when he lands. Hardcopy of these results are immediately available. Data bases are concurrently created with real-time analytical processing and are used by numerous elements of the Army organization for additional mission related use. RDAPS outstanding capabilities include:

- Acquisition of all major types of telemetry data.
- Detailed analysis and display of data in real-time.
- Automatic system setup. No more than three minutes are required to transition from a dead start to a mission support status.
- Automatic simulation of input data for setup validation.
- Creation of engineering unit data files in real-time.
- Dynamic alteration of data processing during real-time.
- Hardcopy production of data displays.
- Cross correlation of data from past missions with present mission data during real-time.
- Real-time statistical analysis of data and generation of a data base containing the results.
- Playback capability from engineering unit data files. RDAPS playback operations are identical to real-time operations.
- Time share terminal support for organizational functions other than real-time flight test data analysis.
- Expansion capability through readily available hardware and software. These expansions are possible both for real-time mission support and other organizational requirements, such as word processing, report generation and accounting.

USER FRIENDLINESS

Understanding the work place in which a system, such as RDAPS, must operate is paramount to developing a system that will be considered successful by the user community. Through this understanding, man and machine may become integrated in a manner that extends the user's capabilities and productivity in a natural and non-restrictive way. Innovations in technology must be made easy to use for realization of their full potential. RDAPS represents a new milestone in telemetry system design because of the strict adherence to this concept. By understanding the role of RDAPS in the Army mission and molding the elements necessary to meet this mission into a user friendly system, AAEFA has produced a successful system for the Army and learned valuable insights into expanding system user utility.

ARCHITECTURE

RDAPS stretches its umbrella of support beyond just flight test engineering needs to embrace a majorj portion of all efforts involved in the Army mission. By focusing on the functional needs of the entire work place, the RDAPS architecture was developed as a backbone of a capability that can be augmented with ease to meet new or changing requirements. An enormously capable DEC VAX 11/780 computer is the heart of this architecture and supports both real-time telemetry needs and normal time-share terminal users concurrently.

Telemetry data handling for RDAPS uses the very latest in telemetry receiving, decommutation, formatting, data routing, and preprocessing hardware. The Fairchild Weston 715 Multiplex Processor, the industry's most powerful data preprocessor, is used to augment the VAX 11/780 by performing the following data processing functions:

- Combining of input data streams.
- Engineering Units conversion.
- Data tagging for identification to follow-on processes.
- Compression of data.
- Merging of time with data.
- Limit and Slope checking of data.
- Statistical Analysis of data.
- Data formatting for input to VAX 11/780 and array processor.
- Generation of data structure for Engineering Unit data file.

A CSPI MAP 200 array procesor is also included in the system to augment the processing capability of the VAX 11/780. This processor accepts input data and performs complex mathematical array operations, such as Fast Fourier Transforms. The output of these operations are then transferred to the VAX 11/780 for display and storage.

User access to the system for real-time mission support is provided through two Megatek Megraphic 7000 terminals. One terminal is provided for setup and control of the telemetry subsystem, while the second terminal is exclusively for flight test data analysis. A wide variety of terminals are also interfaced to RDAPS for non-real-time work. These terminals provide for system development work, application software generation, indepth data analysis at remote locations, report generation, project management, etc.

OPERATION

Every effort was made to provide the user of RDAPS with an easily understood, yet highly capable system. All communications are in the language of the user and menu prompted. Parameters of interest are addressed by a mnemonic name and any input or output of data values will be in engineering units as opposed to units such as binary counts. A special Function Keyboard augments the Megatek terminal used for flight test data analysis and with a single keystroke, the operating engineer can activate or deactivate functions such as:

- **Vibration Analysis and Display.**
- **Time History Displays.**
- **Cross Plots of averaged data.**
- **Limit/Slope checking and display.**
- **Data file generation.**
- **Tabular data display.**
- **Hardcopy of terminal screen presentations.**
- **Rescale of plots.**
- **Curve fit of data.**
- **Synchronization of time and data.**

In addition to these types of mission support capabilities available to the flight test user at his terminal, RDAPS also provides:

- **Engineering unit strip chart generatiion.**
- **Time history generation of every data sample.**
- **Intercommunication to all RDAPS users during a fight test mission.**
- **Ground to air FM, VHF and UHF communications from all RDAPS users to the test aircraft.**
- **Automatic tracking of the test aircraft to maximize telemetry RF reception.**
- **Concurrent processing of programs input through remote terminals and used for non-real-time support.**