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TRENDS

A Flight Test Relational Database

USER'S GUIDE AND REFERENCE MANUAL

M. J. Bondi, and W. S. Bjorkman

DATAMAP Appendix by J. L. Cross

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Ames January 1990
by W.S. Bjorkman and M. J. Bondi

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Volume I (User's Manual) & Volume II (Systems Manual)

USAAVRADCOM-TR-80-D-30A (U.S. Army AVRADCOM)
December 1980

by Richard B. Philbrick
Bell Helicopter Textron

Section I: Introduction

General Introduction

TRENDS is an interactive Database Operating System developed by NASA to support rotorcraft research studies for NASA and for other government and non-government agencies. TRENDS services both project management and engineering personnel through the use of both narrative and numerical retrieval and analysis.

The acronym TRENDS was derived from Tilt Rotor Engineering Database System because the system was originally developed (beginning about 1982) to support flight testing of the XV-15 tilt-rotor aircraft. The system has been extended to support flight and wind tunnel test of other rotorcraft, but the name is still appropriate to the system's function and has been retained.

TRENDS is primarily built as a tool for the non programming aeronautical engineer, but it is also used by individuals of other disciplines with or without computer backgrounds. The system supports a wide variety of engineering disciplines from rotorcraft performance and handling qualities, aeroelastics, dynamics, flight control, and loads. Narrative data complement the numerical data, identifying data items and databased flight segments. The system is designed to provide all of the project information a user needs without having to contact the flight-test engineer. Users can access any of the multiple TRENDS databases with the same software.

Among the features which make TRENDS useful are:

1. Capabilities for multiple users and multiple databases.
2. Friendly, flexible user/computer interface
3. Capabilities for searching and plotting statistical data.
4. Narrative storage and searching features.
5. Support for different graphic terminals.
6. Flexible and capable time-history plotting.
7. Pseudo-flight creation and use (test-point clustering)
8. In-line formula specification and evaluation.
9. Built-in analysis capabilities.
10. Parameter matrix plotting operations
11. Parameter matrix function operations
12. Support for data output to exterior analyses
13. Support for user supplied database/s

NOTE:

TRENDS was designed to be used without a manual for the more fundamental uses of it like simple plots, narrative information and data searches. TRENDS contains its own on-line screen help for all user prompts. It is recommended that the new user start TRENDS by running the "GUIDED TOUR" in section II of this manual.

This manual is designed to assist both novice and experienced users in operating TRENDS. A user's guide leads the reader step-by-step through the main features of TRENDS, with examples and discussions of the results shown. A menu reference section shows examples and available options for each of the menu entries, listed alphabetically. A section addressing conventions, rules and syntax by topic is included for reference. A "guided tour" is presented for the novice to follow. Lists of database-specific information are attached.

This manual does not describe how to create or maintain a TRENDS database, nor does it describe storage layout, data formats, or program implementation. For this information, refer to:

TRENDS Procedures Manual	-- Database management
TRENDS Programmer's Manual	-- Program implementation

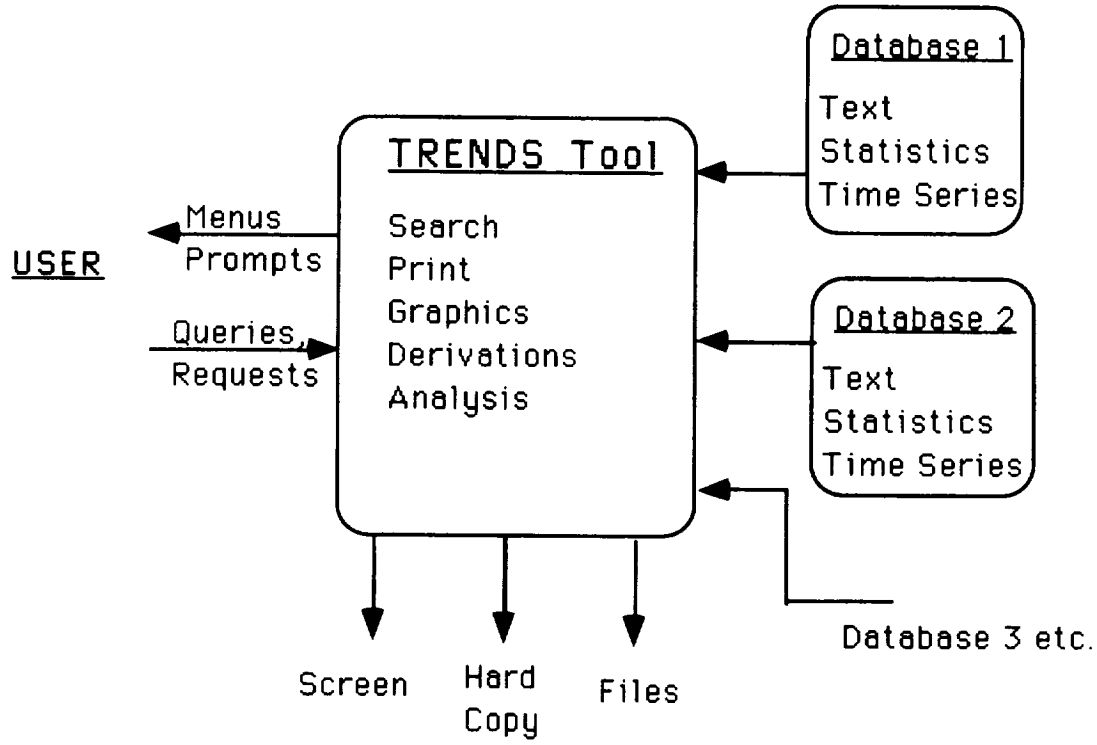
These are available upon request. For a description of the total TRENDS system, its history and philosophy, read:

TRENDS: The Aeronautical Post-Test Database Management System, NASA TM 101025, January 1990

The examples in this manual are from the XV-15 (703) database. Appendix A contains some differences for the UH-60 (748, BH2) databases.

TRENDS Overview

The TRENDS system consists of a group of databases and a set of software tools for accessing and exploiting those databases. The interaction between the user and TRENDS is depicted below.



The user executes TRENDS (the tool) and enters into a dialogue through which his/her requests are serviced. The user can choose any of the available bases and even compare data from two bases. Information stored in the databases consists generally of:

1. text — project, flight, counter, item descriptions
2. statistics — average, parameters, per-rev statistics
3. time series — measured and derived time histories.

This information cannot be changed by the user, but can be searched, analyzed, and displayed. Capabilities within TRENDS permit storage of measured or derived data in the user's directory for subsequent retrieval and display.

TRENDS is a relational database for which the primary index is counter number. "Counter" means "test point" or "maneuver" or "data burst." The terminology was developed in the XV-15 project, where events were numbered with a thumb-wheel counter in the aircraft. The counter was then recorded as part of the data stream to identify events. Each data item (or "parameter" or "channel") has two names in TRENDS: a mnemonic (1-8 characters) and an itemcode (4 characters). Either one may be used to refer to a data item. Two different data items are related by their counter numbers, allowing them to be cross-plotted, for example. To produce a plot or tabulate values, the user must specify the data items (itemcodes) of interest and the data region (set of counters). The following diagram shows the relationship between items and counters.

Counters	**Itemcodes**				
	Text	**P002**	**D021**	**M143**	**....**
9795	yes	x	x		....
9796	yes	x	x	x	....
9798	yes	x		x	....
9799	yes	x	x	x	....

The "x" in this diagram represents many different itemcode data types which usually consist of multiple records --e.g. statistical values (see Section III: User's Guide 3-10) or time series data types: e.g. TIM, SPC, RAW, AND MMR). Various Time series data types are used in TRENDS to reduce data storage requirements. e.g. spectral analysis only needs a few seconds of non filtered or raw data. It would be inefficient to store hundreds of itemcodes with minutes of data for each, when only 1024 samples or a few seconds of data are needed for each spectral analysis. Sometimes an itemcode will have no data for a counter number (e.g., M143 for counter 9795) or sometimes the counter sequence in the database will skip a counter number all together, meaning that there is no data at all for any itemcode (e.g., counter 9797). Text data is also saved relationally with counter numbers and is available via WORDSCAN and from other menu items. For example, a tabulation of statistical values will also be labeled with counter descriptions. Text searches which are successful will produce a set of counter numbers which can be save as "derived counter sets" to be used in subsequent searches on the numerical database. Likewise, the results of a successful numerical search can be used to define the portion of the database over which to perform a text search.

A second relational parameter is time. Each time series is stored with an epoch and a sampling rate, enabling two time series to be cross-plotted or used together in a formula.

The database farm accessible through the NEP/TRI VAX cluster maintained by Code FA in Building 237 at NASA/Ames includes 13 different databases at this time. These are distributed across several magnetic disks and on about 20 laser-optical platters of an 80-gigabyte jukebox. There is no need for the user to know where the data are located, because TRENDS takes care of that.

The XV-15 (703) database is the largest one maintained by Code FA. It encompasses 235 flights and 6,928 counters at this time. Not all of these counters have time-history data available, but 3,492 have some filtered time histories, 1,164 have raw data, and 148 have truncated raw time histories. Some counters have minmax/rev (pseudo time-history) data. 421 data items have numerical data; therefore providing the user access to 2,916,688*7 statistical measures/parameters or 20.416 million statistical values of data for this single XV-15 database. User access to any of this data is transparent and rapid.

General Term Definitions

Before proceeding with this section, let's define some terms which will be used frequently throughout this manual and in TRENDS dialogue as well.

Itemcode --

An itemcode is a 4-character label for a data item (or "item", "sensor", "channel", "parameter"). For example, P002 is the itemcode for indicated airspeed. The menu feature ITEMDEFS provides the correspondence between the physical quantity and its itemcode. Itemcode is sometimes used to mean the data item, as in "the itemcode's average-steady value."

Mnemonic --

Each data item has a mnemonic as well as an itemcode. For the 703 database, the mnemonic and itemcode are the same, but for other TRENDS databases, the 1-8 character mnemonic can provide a more recognizable label (e.g., LATSTK rather than D022). TRENDS will accept either mnemonic or itemcode in specifying a data item.

Counter --

A counter or counter number is used to identify a finite-duration test event. Other names for such events are "data bursts" and "maneuvers." "Counter" may be used when talking about the unique number which is assigned to the event or to the event itself, as in "the average across the counter." Counters are usually 10-20 seconds in duration for the 703 database, though they are sometimes longer. Counter numbers increase monotonically from the beginning of the test program. The counter number is the index by which the different data items and narrative are related to each other.

Flight --

A flight is made up of a group of contiguous counters. That is, data for several counters (up to 120, usually less) may be gathered during one flight. Flight numbers are used in TRENDS as an index for flight-descriptive data and as a short-hand grouping device for counters. The 703 database has hangar runs and ground runs as well as flights. Hangar runs and ground runs each have their own numbering sequence. The parallel to flight for a wind-tunnel database is a "run," which is a series of contiguous test points.

Derived Counter Set, DCS --

A derived counter set or DCS is a set of counter numbers developed by the user as a result of some search procedure executed in TRENDS. It is sometimes called a pseudo flight because, like a flight, it represents a group of counters which all have something in common. A DCS may be labeled and saved in the user's directory for later recall in TRENDS.

Menu Item Definitions (TRENDS)

CALIBS -- View calibration data by item and flight

This item was incorporated in the TRENDS menu because at times, when users feel like the parameter data is incorrect, they would like to check on calibration numbers. By being able to compare calibrations for the same parameter for various flights, one is able to see if some major calibration change has occurred which may be incorrect.

COMPARE -- Plot time histories across counters or databases

This item was incorporated into the TRENDS menu when it was necessary to compare the math model GTRSIM (GATEWAY-simulation) results with the actual flight data, hence different databases. However it has also been useful for looking at time-history plots of function for several parameters on different counters.

CPRINT -- Print item statistics in your own custom format

This item was incorporated into TRENDS, because users at times would like to control the format for the printout of their statistical data unlike the formats available in SEARCH. Also CPRINT's name is more indicative of its function than Search.

DATABASE -- Show a brief summary of data in the base

This item was incorporated into TRENDS to allow a user to easily know what category (e.g. aeroelastics, handling qualities, etc.) or what type of data (e.g. harmonics, spectrals, etc.) a flight had been flown for, thereby allowing the user to easily plot or look at the appropriate flight data of interest.

DERIVED -- Show the derived pseudo-items

This item was incorporated into TRENDS to allow the user to know the names of all (statistical & timehistory) derived parameters which are calculated from basic A/C measurements.

EXIT -- Exit the program, return to the operating system

This item is self explanatory

FILES -- Scan user-created files

This item was incorporated into TRENDS to view derived counter set files (*.DCS), save files, mask files, etc, because these type of files are "keyed access files" and cannot be viewed by using the DEC VMS directory commands DIR & Type.

FIND -- Counters with data for time-history items

This item was incorporated into TRENDS to provide a desperate user who had been trying unsuccessfully to find certain parameter/s of timehistory data in the database one more method to use, where the TRENDS system would use the most basic technique to search the database. Note, not all time-history data types are stored for a given counter.

FLIGHTS -- Display some or all flight descriptions

This item was incorporated into TRENDS to provide the user with some knowledge about why the flight had been flown, who were the key personnel involved, dates, flight times, any problems which may have occured during the flight, information about associated datasets produced from this flight, etc. Also the ability to easily search these flight logs provides the user with a way of forming derived counter sets.

FUNCTIONS -- List/verify/edit the derived-function file

This item was incorporated into TRENDS to provide the user with an easy way to use parameter functions, as opposed to simple parameters. By allowing the user to name his parameter functions, including lookup tables, he is then allowed to use the function name in place of the equation set in plot and search rountines

GATEWAY -- Branch out of TRENDS to DATAMAP or a simulation

TRENDS users needed a way to access non TRENDS programs (e.g. DATAMAP & GTRSIM) while still remaining in TRENDS; hence a GATEWAY was provided.

GEOPLOT -- Display minmax statistics vs. sensor location

This item was incorporated into TRENDS to provide the user with a way of handling multi-sensor data plots easily. Geoplot was used as the name; since the sensors are usually plotted as a function of their geometry on the wing, rotor, etc.

HARMONIC -- Display n-per-rev harmonics vs minmax items

This item was incorporated into TRENDS to provide the user with an easy way of viewing harmonic data in plot or numeric formats. Note, rotorcraft studies are highly concerned with harmonic data; hence its menu item status in TRENDS.

HELP -- Show help for TRENDS menu items and general use

This item was incorporated into TRENDS to provide on sceen help. It is advised that the new user at least look at the "HINTS" section prior to running TRENDS.

INFOFILE -- Display and edit the contents of an infofile

This item displays specific geometric groups from an Infofile. Infofiles are user-supplied files written in a format recognized by DATAMAP and TRENDS. Each geometrical group in an Infofile is a parameter list correlated with physical sensor location.

ITEMDEFS -- Show/search itemcodes and definitions

This item was incorporated into TRENDS to allow the user to find the names of all parameters used in the database along with their definitions/meanings. It also allows the user to find a parameter name by searching on these definitions.

KEYS -- Show value of primary condition keys for a flight

This item was incorporated into TRENDS to allow a user who was not familiar with the database or its parameters to easily look at the key parameters which numerically describe the flight condition the vehicle is in, on a counter by counter (test point) basis.

LOADS -- Show minmax/rev data and loads distribution

This item was incorporated into TRENDS to view special Min/Max/rev (MMR) data initially generated by the Bell Helicopter Corportion for N702. This data type format makes it possible to easily provide histograms for rotorcraft loads distribution.

LOGSCAN -- Scan the flight log and search descriptions

This item was incorporated into TRENDS to allow the non familiar database user to easily view all flights in a database rapidly, and to then be able to search the log for pertinent flights by scanning for text in the one line flight descriptions.

MINMAX -- Plot min/max-per-counter data (statistical summaries)

This item was one of the two major reasons TRENDS was initially developed, namely to allow the user to plot any or all statistical data in the database. This routine allows cross plotting of different statistical parameters.

MULTIPLT -- Plot families of min/max data

This item was incorporated into TRENDS to allow the user to plot families of min/max plots on one page. Initially SEARCH was used to obtain a derived counter set (DCS) for various pylon angles for a given test condition.

NORMALIZE -- Plot normalized time-histories

This item was incorporated into TRENDS in order to allow the experimenter to select time slices of prime data out of the UH-60 database by viewing key parameters to determine when they had reached a quiescent state. Superimposition of parameter plots along with parameter normalization functions are a part of this routine.

OUTDATA -- Print time-history data to an ASCII file

This item was incorporated into TRENDS in order to allow users to be able to import TRENDS database data into their own work stations or personal computers. ASCII formated time history data is more user friendly for the PC, Macintosh world than VMS binary files.

PERFPLOT -- Plot performance parameters 2x2, 3x3, 4x4 per page

This item was incorporated into TRENDS in order to allow users to view 4, 9 and 16 parameter plots/page. The ease of setting up ones own parameter set and saving it is made user friendly. PERFPLOT gives the user a timehistory snapshot of his key parameters during the prime data time.

PLTHDCPY -- Change plot-hardcopy option

This item was incorporated into TRENDS in order to give users the option of selecting if they want hardcopy plots and if so how. It is possible in TIMEHIST to use a wild card (*) for the y axis prompt and thereby generate timehistories for all parameters in the counter; however when doing this, one would not want to wait around to manually approve of each hardcopy plot; hence the (HO) option which automatically generates plots faster by not outputting them to the screen. Also if one knowns that he does not want any hardcopy plots, it is best to run with the (NO) option which allows the system to run faster because the number of prompts to the user are reduced.

PROJECT -- Display project and aircraft information

This item was incorporated into TRENDS in order to give the users access to important information about the database, be it rotorcraft, aircraft, simulation, windtunnel, etc. without the user having to contact the project engineer. For example, in tail number N703 the specifications of the rotorcraft are given, along with vehicle modifications, dates, purpose of the project, etc.

SCRATCHFILE -- View and operate on scratch files

This item was incorporated into TRENDS from the DATAMAP tool set to allow TRENDS users to perform functions on matrices of parameters and to plot them after applying the function/s. SCRATCHFILES are transferrable between both DATAMAP and TRENDS.

SEARCH -- Search for a specific set of flight conditions

This item was incorporated into TRENDS in order to allow a user to not only search on narrrative data via WORDSCAN but to also SEARCH on parameter data by setting numerical limits on each parameter. The counters that meet the successful parameter limit search can then be made into a derived counter set (DCS).

STRIPS -- Plot time-history strip-charts for multiple counters

This item was incorporated into TRENDS in order to allow a user to easily look at a single parameter timehistory data plot for multiple counters in a similar format, but not the same, as data displayed on strip chart recorders in the flight test control room. It is the key menu item to provide the user with output plots for multiple counters. COMPARE also gives multiple counter plot capability, but it is more difficult to use.

TAIL NO. -- Change aircraft of interest

This item was incorporated into TRENDS from its very beginnings; since TRENDS was/is a multidatabase management system. It merely allows the user to easily select the data base of interest.

TERMINAL -- Assign new gterminal characteristics

This item was incorporated into TRENDS to accommodate various user equipment from dumb terminals to the Macintosh. Note, TRENDS sends escape sequences when going from text to graphic plots and vice versa. These escape sequences are different for different terminals; hence it is necessary to select the correct terminal type for a user session. Unfortunately the PC type of terminal emulation is the weakest of the entire set given. One must use PROCOMM if they are to get better PC to DEC graphic terminal transparency.

TIMEHIST -- Plot time-history or spectral data

This menu item is one of the most important ones in TRENDS, because it provides the user with the ability to plot time-history parameter data against time, another parameter, or to plot spectrals of data, etc. (see 3-18). Secondly this plotting capability allows the user to apply virtually any function to the data in line with his user prompts or to use user defined functions out of the menu item FUNCTIONS file.

TSSTATS -- Compute and display time-slice statistics

This item was incorporated into TRENDS to provide a means for the user to define his own time limits for running statistical analysis, rather than using the statistics provided by the database itself. Note in the display of this TSSTATS data the TRENDS statistics are presented along side of the user TSSTATS statistics. This routine was initially used on the TRISTAR simulation database.

VIEW – View item statistics for specified counters

This item was incorporated into TRENDS in order to list all of the stored item statistics together by counter.

VMS CMDS – Execute VMS system commands from TRENDS

This item was incorporated recently into TRENDS to provide the user with an easy way of executing VMS commands without having to leave TRENDS. It should be known that when one leaves TRENDS certain TRENDS system house keeping chores are required, e.g. like unloading the Jukebox of data platters, user selection of what files are to be hardcopied, etc.; hence one may not want these tasks executed prior to the user really finishing his session.

WORDSCAN – Scan counter descriptions for words or strings

This key item was incorporated into TRENDS to provide the user with a way to search on narrative information in the database and generate a derived counter set (pseudo flight). It is considered as one of the three most important menu items in TRENDS along with TIMEHIST and MINMAX.

Section II: Guided Tour

Introduction

The purpose of this section is to introduce you to TRENDS and to illustrate its use. When you first enter TRENDS, you will see this menu.

```
                              TRENDS Main Menu

   Control       Descriptive   Numerical    Plotting     Analysis     Usage
703>TAIL NO.     PROJECT       SEARCH       TIMEHIST     GATEWAY      HELP
 MC>TERMINAL     DATABASE      KEYS         PERFPLOT     HARMONIC     ITEMDEFS
 VS>PLTHDCPY     LOGSCAN       VIEW         STRIPS       TSSTATS      DERIVED
    VMS CMDS     FLIGHTS       CPRINT       NORMALIZE    COMPARE      FILES
    EXIT         WORDSCAN      FIND         MINMAX       SCRATCHFILE  OUTDATA
                               LOADS        MULTIPLT                  FUNCTIONS
                               CALIBS       GEOPLOT                   INFOFILE

    YOUR CHOICE:

    TAIL_NO.     Change aircraft of interest                          -
```

You will notice that the menu items are arranged in columns, each of which has a somewhat different focus. Each column will be discussed later in this section. Each menu item relates to a different TRENDS feature or capability. Menu items are selected by moving to them with the keyboard's arrow keys or the space bar (or by typing in all or part of the menu-item's name) and then hitting return (later denoted <cr>). (As you move around, you will notice that a brief description of the high-lighted menu-item's purpose is shown below the menu.) When you return from using the selected TRENDS feature, your current menu position remains on the selected item. To leave TRENDS, select EXIT.

This section presents a sequence of commands you might logically use to become familiar with TRENDS or with an unfamiliar database. The guide will suggest entries for you and will provide a very brief explanation of what the response does, but it is up to you to observe what TRENDS does as a result, since the output will not be shown. Feel free to take some side excursions; the tour will wait for you to rejoin. Each outing will start from the main menu, so familiarize yourself with it by moving through it with the space bar and observing the function of each menu item. In the tour suggested responses are shown in boldface.

NOTE:

The tour will start by allowing the user to run a sequence of outings. Each outing is given a rating as to its importance in learning the critical elements of TRENDS. These elements are rated by asterisks. An outing having a single asterisk (*) rating is less important than one having a (****) rating. Well, that should be enough of an introduction; you're probably anxious to get started, so get your note pad ready and let's go!

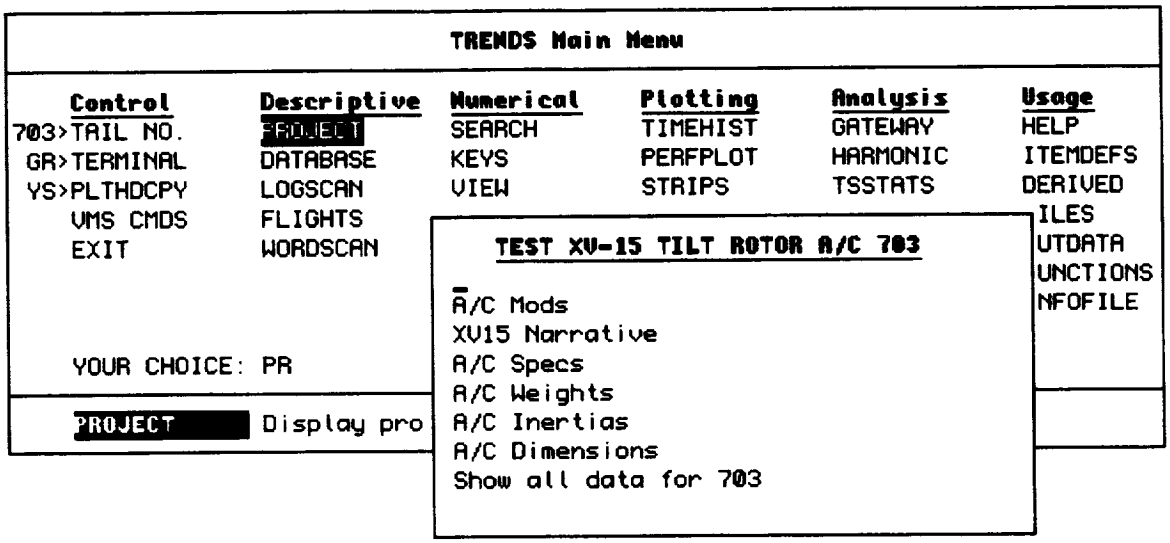
Outing 1: Finding out about the database (**)

A logical place to start a tour is PROJECT, which tells us about the aircraft and project which generated the current database. Make usre that you're in the 703 database and then:

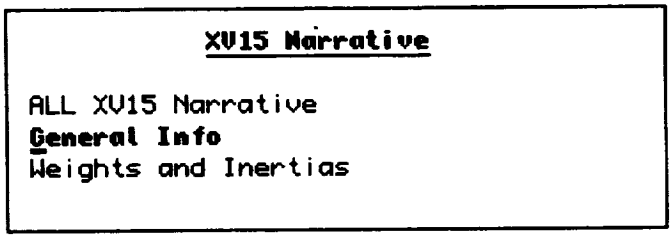
SELECT: **PROJECT**

Menu Item

- ***PROJECT***



now SELECT: **XV-15 Narrative**
and SELECT: **General Info**



The following is the beginning of the project narrative as a result of your selections:

```
                    The XV-15 Aircraft
                    ******************

The NASA/Army XV-15 is a tiltrotor research aircraft manufactured by Bell
Helicopter Textron.  Main features include a forward-swept high wing, wing-tip
nacelles containing the transmissions and engines, two 25-foot diameter
3-bladed rotors, tricycle retractable landing gear, and H-tail.

The fuselage is a non-pressurized, semi-monocoque, aluminum alloy structure.
The aircraft is entered through a cabin door on the right side of the fuselage.
The cockpit provides side-by-side pilot and copilot-observer crew stations with
ejection seats.  The pilot will normally occupy the right seat and the copilot,
or observer, the left seat.  The aisle between the pilot seats is used for
cockpit entry and exit.  Two pods are mounted on the lower mid-fuselage to
house the main landing gear.  The nose gear retracts into a well in the forward
section of the aircraft.
```

Menu Items
- *LOGSCAN*
- *FLIGHTS*

Outing 2: Scan some flight-test objectives (*)

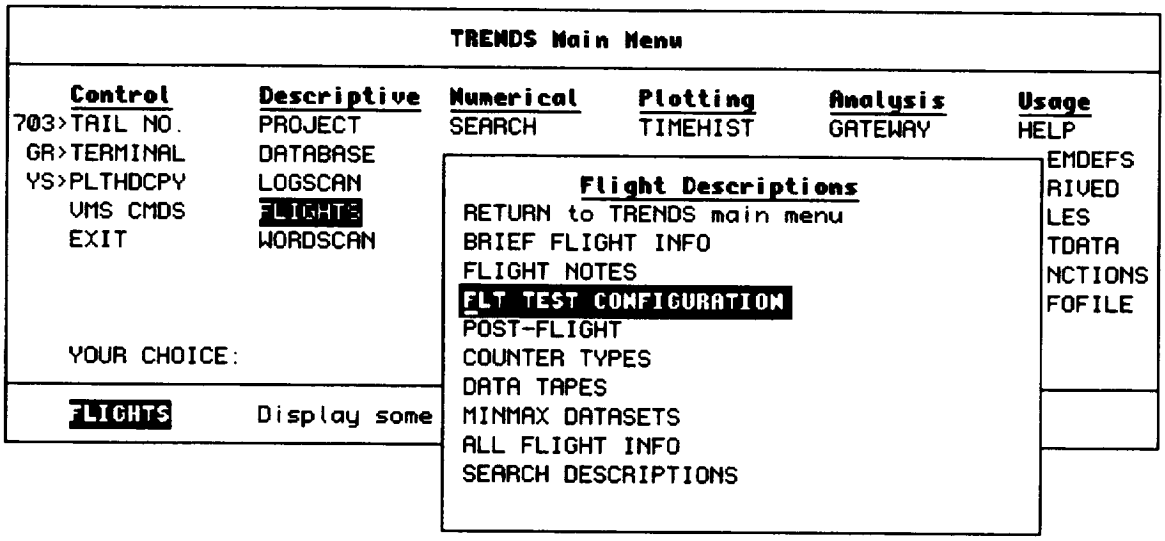
Next, we will visit LOGSCAN to find out about some of the types of flight tests which are included in the database. Notice that the most recent 15 flights are listed automatically.

Select: **LOGSCAN** from the menu:

LOOK FOR:	**ENVEL**	(envelope expansion flights are listed)
LOOK FOR:	**PILOT**	(some test pilots' names are shown)
LOOK FOR:	**F218**	(lists a particular flight)
LOOK FOR:	**DFRC**	(lists flights at Dryden)
LOOK FOR:	**<cr>**	(exits LOGSCAN, returns to main menu)

Outing 3: Find out about a flight (**)

Now that we have some idea of the types of flight tests which were performed on the XV-15, we might be interested in more-detailed descriptions of a particular flight.



Select: **FLIGHTS** from the menu.

SELECT: **FLT TEST CONFIGURATION**

Enter flights, etc:	**218-220**	(view flights 218, 219, 220)
Enter flights, etc:	**<cr>**	(no more flights wanted)

Menu Item

- ***WORDSCAN***

Outing 4: Find what kind of test points were flown (****)

Each flight consists of a number of test points (counters). Let's see what kind of test points are in the database, then develop and save a particular set of them for later use.

Select: **WORDSCAN** (scan counter descriptions)
LOOK FOR: **?** (instructions and keywords shown)
LOOK FOR: **HOVER** (find test points with "HOVER")

```
                                WORDSCAN
  LOOK FOR : HOVER
Enter flight(s), :counter(s) or DCS name : _
                        Pilot Comments          Duration    Tzero
```

```
FLT 218  CTR 12174  HOVER H/K                    29.26  17:14:38.922
FLT 218  CTR 12216  50' HOVER                    23.53  20:02:32.984    ETC.
```

Enter flights, etc: **218-220** (hover counters in flights 218-220)
Enter flights, etc: **<cr>** (don't look in any other flights)
LOOK FOR: **<cr>** (don't look for any other keywords)
Save the DCS? **Y** (yes, save counters you found)
Output DCS name: **HOVERS** (name the DCS "HOVERS")
DCS description: **All hovers, flts 218-220**
(desc. for HOVERS)
(returns automatically to main menu)

Select: **WORDSCAN** (resume WORDSCAN)
LOOK FOR: **OGE** (look for out-of-ground-effect)
Enter flights, etc: **HOVERS** (look in DCS you saved above)

```
                                WORDSCAN
  LOOK FOR : OGE
Enter flight(s), :counter(s) or DCS name : _
                        Pilot Comments          Duration    Tzero
```

```
FLT 219  CTR 12271  OGE HOVER HANDS OFF          24.74  17:57:39.347
FLT 219  CTR 12294  LIFT TO OGE HOVER            40.27  20:50:20.185
FLT 219  CTR 12367  STEADY OGE HOVER 50' AR OFF  21.27  20:18:25.715
FLT 219  CTR 12370  STEADY OGE HOVER HANDS OFF   23.84  20:22:29.900
FLT 219  CTR 12372  STEADY OGE HOVER HANDS OFF   24.45  20:24:16.493
```

Enter flights, etc: **<cr>** (don't look in any other flights)
LOOK FOR: **<cr>** (don't look for any other keywords)
Save the DCS: **Y** (yes, save OGE+HOVER counters)
Output DCS name: **OGEHOVER**
(name for this DCS)
DCS Description: **Both OGE & HOVER in flts 218-220**
(returns automatically to main menu)

Menu Items
- *WORDSCAN*
- *ITEMDEFS*
- *A/C GROUPS*

The preceding example showed a way to find OGE hovers & to save the counter set. The following excursion shows how to do this in a single step.

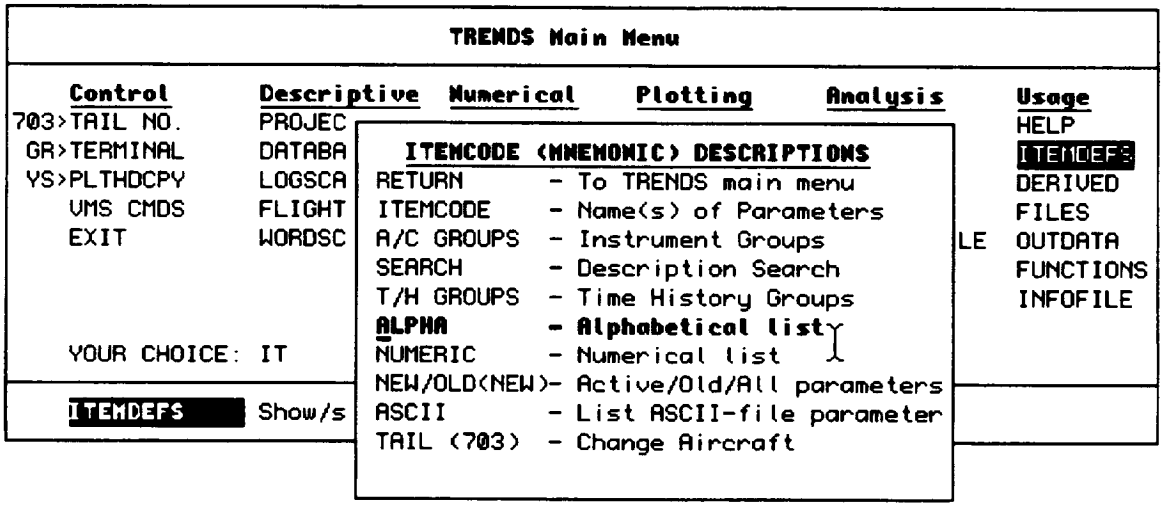
Select: **WORDSCAN** (resume WORDSCAN once more)

LOOK FOR: **HOVER&OGE** (the "&" means "AND")
Enter flights, etc: **200-220** (search a different data region)
Enter flights, etc: **<cr>** (no more flights to search)
LOOK FOR: **<cr>** (no more keywords to search)
Save DCS? **<cr>** (don't save, the default is "No")

Outing 5: Find the names of the data items (***)

Before you can plot or print any numbers in TRENDS, you must know the names of the data items (i.e., channels, parameters, etc.). The menu item used for this purpose is ITEMDEFS, which provides several different ways of finding the names.

Select: **ITEMDEFS** (show/search itemcodes/definitions)
Select: **ALPHA** (show all items alphabetically)
(use CTRL-C to terminate early)



Select: **A/C GROUPS** (get the menu of item groupings)
Select: **TEST** (list the test-condition items)
Select: **<cr>** (no more groups, return to menu)
Select: **SEARCH** (search the data-item definitions)
Search for: **VIB** (look for vibration items)
Search for: **<cr>** (no more searching, return to menu)
Select: **RETURN** (returns to the main menu)

Menu Items

- ***VIEW***
- ***SEARCH***

Outing 6: Look at some statistical data (*)

Now we're ready to look at some numbers. Our numerical tour starts with stored statistics. Under the "Numerical" column, we see VIEW, which will show us some of the different statistics stored for each data item and some of their values.

Select:	**VIEW**		(view item statistics for some counters)
	Enter flights:	**OGEHOVER**	(view the DCS you saved in outing 4)
	Parameter:	**A005,4**	(show c.g. vert. vib. to 4 places)
	Parameter:	**A30***	(show A301, A302, etc. for OGEHOVER)
	Parameter:	**<cr>**	(no more parameters for OGEHOVER)
	Enter flights:	**<cr>**	(exit VIEW to the main menu)

Outing 7: Search the statistical data (****)

We had to tell VIEW which counters to list, but we may not know which counters contain the particular conditions we're interested in, because our WORDSCAN search in outing 4 wasn't specific enough. SEARCH gives us a capability for searching for the counters which satisfy our numerical requirements by letting us place acceptable bounds on the values of a set of data items.

Select:	**SEARCH**		(search for specific flight conditions)
	ITEMCODE:	**P002**	(indicated airspeed, avg. steady stat.)
	Lower bound:	**200**	(accepts speeds above 200 kts)
	Upper bound:	**<cr>**	(don't care how much faster)
ITEMCODE:	**.5*(M143+M107)**		(list the average torque)
	Lower bound:	**<cr>**	(don't care how small or negative)
	Upper bound:	**<cr>**	(don't care how large)
	ITEMCODE:	**<cr>**	(no more conditions or items to list)

OK? [Y]: **<cr>** (setup shown is acceptable)

Save mask? [N]: **<cr>** (don't save this simple setup)

Enter flights: **215-230** (search only flights 215-230)

Enter flights: **<cr>** (don't search any more flights)

Save DCS? [N] **Y** (save what was found as a DCS)

DCS name: **HISPEED** (meaningful name for the DCS)

DCS description: **High-speed counters, flights 215-230**

ITEMCODE: **<cr>** (no more searches, return to menu)

Outing 8: Review our derived counter sets (DCS) (*)

Between SEARCH and WORDSCAN, we have saved several DCSs -- which are not printable but which we might like to review. To do this, we can use the FILES menu item.

Select: **FILES** (scan user-generated files)

Command: **DIR *.DCS** (list the derived counter sets)

Command: **DIRT *.DCS** (list the DCSs made today)

Command: **<cr>** (return to the main menu)

Outing 9: Let's plot some statistical data (****)

The two main menu items for plotting statistical values are MINMAX and MULTIPLT. The more general of these is MINMAX, which can plot any of the stored statistics, and formulas in those statistics as well.

Select: **MINMAX** (plot statistical summaries)

Menu Item

- ***MINMAX***

```
                    MIN/MAX DATA PLOTTING
                    *********************
EXAMPLES of valid responses to prompts:

          X-AXIS: CNTR                    (counter)
    or    X-AXIS: CNTR,5000,5500,100      (cntr. with scaling:strt,stp,inc
    or    X-AXIS: M143                    (ITEM CODE for X-axis,autoscale
    or    X-AXIS: ?                       (further INPUT INFORMATION)

          Y-CURVE 1: P002                 (Y-axis, autoscale)
    or    Y-CURVE 2: POLY(P002,3)         (curve fit to P002 data points)
    or    Y-CURVE 2: D186,0,90,10         (cross plot of D186 & M143)


Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.
```

PLOT 1 X-AXIS:	**D023**	(power lever as abscissa)
Y-CURVE 1:	**CPXX**	(pressure coefficient, cp)
Y-CURVE 2:	**<cr>**	(only one curve for this plot)
PLOT 2 X-AXIS:	**<cr>**	(no more plots this page)
Enter flights:	**HISPEED**	(use the DCS saved in outing 7)

(Notice that the points seem to fall into two straight lines; we will look into that later. Hit return to clear the plot from the screen.)

Save for hardcopy?	**<cr>**	(default is "don't save" the plot)
Enter flights:	**OGEHOVER**	(use our DCS from WORDSCAN)
Save for hardcopy?	**<cr>**	(default is "don't save" the plot)
PLOT 1 X-AXIS:	**<cr>**	(no more plots, return to main menu)

Menu Items
- ***FUNCTIONS***
- ***SEARCH***

Outing 10: Develop and use a function for analyzing results.

Points from the first MINMAX example fell into two groups. Let's try to find out why. First, we will divide the HISPEED DCS into two DCSs, using SEARCH. But before using SEARCH, let's use FUNCTIONS to define a straight line which will divide the two groups. (You may want to repeat the first plot of outing 9 to see what we're talking about here.) A straight line which connects the diagonals of the plot will do the trick.

Select: **FUNCTIONS** (List/edit the defined-function file)

Edit? **Y** (Use EDT on FUNCTIONS.703)

(At this point you will be in the EDT editor, editing FUNCTIONS.703. We won't go into how one uses this editor, but will assume that you know. Add the following line, starting in column 1, then exit from EDT. TRENDS will return to the main menu.)

DIVIDER = .0008 * (D023 - 50) / 25 + .0014

Select: **SEARCH** (Search for flight conditions)

ITEMCODE: **CPXX-(DIVIDER)** (distance of CPXX from the line)

Lower bound: **0** (accept points above the line)

Upper bound: **<cr>** (no upper bound)

ITEMCODE: **<cr>** (no more conditions)

OK? **<cr>** (yes, it's OK)

Save? **<cr>** (no, don't save this simple setup)

Enter flights: **HISPEED** (previously saved DCS)

Enter flights: **<cr>** (search no more flights or DCSs)

Save the DCS? **Y** (save this subset of HISPEED)

Output DCS name: **TOPSET** (name for the subset)

DCS description: **Upper part of CPXX vs D023: HISPEED**

ITEMCODE:**CPXX - (DIVIDER)** (distance from the line)

Lower bound:	**<cr>**	(don't care how negative)
Upper bound:	**0**	(CPXX must be below the line)
ITEMCODE:	**<cr>**	(no other conditions)
OK?	**<cr>**	(setup is OK)
Save the mask?	**<cr>**	(don't save)
Enter flights:	**HISPEED**	(previously saved DCS)
Enter flights:	**<cr>**	(no more flights or DCSs)
Save the DCS?	Y	(save the DCS)

Output DCS name: **BOTSET** (name for lower subset)

DCS description: **Lower part of CPXX vs D023: HISPEED**

ITEMCODE:	**<cr>**	(return to main menu)

(You have now separated HISPEED into TOPSET and BOTSET. Let's go to MULTIPLT and use them to re-plot CPXX vs. D023 as two families of points -- just to illustrate the multi-family plotting feature.)

Select: **MULTIPLT**

Multiple databases?	**<cr>**	(no, only database 703)
PLOT 1 X-AXIS:	**D023**	(power lever)
Y-AXIS 1:	**CPXX**	(pressure coefficient)
PLOT 2 X-AXIS:	**<cr>**	(only one plot per page)
Enter flight #1:	**TOPSET**	(upper set of counters)

Enter flight #2:	**BOTSET**	(lower set of counters)
Enter flight #3:	**<cr>**	(only two families wanted)
Weighting factor:	**<cr>**	(accept default for curve-fit)
Enter flight #1:	**<cr>**	(no more multi-plot families)
Multiple databases?	**<cr>**	(no, just 703)
PLOT 1 X-AXIS:	**<cr>**	(no more, return to main menu)

Outing 11: Print out minmax data in your custom format. (*)

You may want to tabulate data for a group of items by counter. You could use SEARCH for this purpose, but you would have to accept SEARCH's output format and have to answer questions about bounds for a search when you are not really interested in searching the database. The ideal menu item is CPRINT.

Select:	**CPRINT**	(custom print)
Enter filename, MAKE:	**MAKE**	(construct a format)
Enter filename:	**TESTCONDS**	(name the format file)
Enter an expression:	**P002**	(expression is an itemcode)
Enter a pseudonym:	**AIRSPEED**	(title on the printout)
Places to rt. of decimal:	**1**	(example: 125.1 shown)
Enter expression:	**M143-M107**	(expression is a difference)
Enter a pseudonym:	**TORK_DIFF**	(title on the printout)
Places to rt. of decimal:	**0**	(display as an integer)

This process continues as you specify more itemcodes or expressions to be printed.

Each item occupies a 10-character field, and each line hold from 1 to 7 fields. An empty return terminated the entries on one line. A custom format may have as many lines as you wish, but let's not go any further on this tour. (See the example under CPRINT in the User's Reference section for a little more general example.) We'll just close off the definition and proceed to evaluate our format for a flight.

Enter an expression:	**<cr>**	(no more fields this line)
Enter an expression:	**<cr>**	(no more lines -- done)
Enter flight(s), etc.:	**244**	(print data for flight 244)
Enter flight(s), etc.:	**<cr>**	(back out of CPRINT)
Enter filename or MAKE:	**<cr>**	(return to main menu)

Outing 12: Let's plot some time-history data. (****)

You are probably saying, "It's about time! We've seen enough of this statistical and narrative stuff. Where's the meat?" Well, here it is. TRENDS has several menu items dealing with time-history data, but the primary one is TIMEHIST. The basic instructions to TIMEHIST for making a plot are very simple -- in fact, you have seen the same format in MINMAX (Outing 9). As we go along, notice how some very powerful features of TIMEHIST are added as logical extensions to the basic input specifications.

Select: **TIMEHIST**		(plot time histories)
PLOT 1 X-AXIS:	**T**	(abscissa is time)
Y-CURVE 1:	**M143**	(rt. mast torque)
Y-CURVE 2:	**<cr>**	(only one curve this plot)
PLOT 2 X-AXIS:	**<cr>**	(only one plot this page)
Enter counter(s):	**17918**	(plot one counter)

Notice that the plot is produced -- complete with titles, axis labels, and scales -- with only a minimum of entries: abscissa (T), ordinate (M143), and counter (17918). Hit another <cr> to clear the plot.

Save for hardcopy?	**<cr>**	(don't save. "Y" saves)
Enter counter(s):	**<cr>**	(no more counters to plot)
PLOT 1 X-AXIS:	**T,2,5,1**	(plot from 2 to 5 secs)
	Y-CURVE 1: TORQUE_DIFF (FT-LB) = (M143-M107)/12,-2000,2000,1000	
	(above entry includes label, expression, plot scale)	
Y-CURVE 2:	**<cr>**	(only one curve this plot)
PLOT 2 X-AXIS:	**T,2,5,1**	(same interval on 2nd plot)
Y-CURVE 1:	**TOTAL_TORK (FT-LB) = (M143+M107)/12**	
	(above entry includes label, expression, auto-scaling)	
Y-CURVE 2:	**<cr>**	(only one curve this plot)
PLOT 3 X-AXIS:	**<cr>**	(only two plots this page)
Enter counter(s):	**"**	(quote for same counter)

Notice that there are now two plots on the page, with one curve on each plot. The scale for the upper curve is not big enough, so the curve is clipped. You could have as many as three curves on each plot and as many as three plots on a page. Hit a carriage return to clear the screen.

Save for hardcopy?	**Y**	(save to print later)
Enter counter(s):	**PLT**	(change hardcopy option)
Select:	**NO**	(do not save plots)

Enter counter(s):	**<cr>**	(no more plots this setup)
PLOT 1 X-AXIS:	**MRAZ(2),0,360,45**	(cycle-average 2 revs)
Y-CURVE 1:	**CVF(M143.RAW,30,1)**	(filter M143 at 30 Hz)
Y-CURVE 2:	**CVF(M107.RAW,30,1)"**	(filter M107 at 30 Hz) (" for common scale)
Y-CURVE 3:	**<cr>**	(only two curves)
PLOT 2 X-AXIS:	**<cr>**	(only one plot)
Enter counter(s):	**18192,18196**	(plot 2 counters in sequence)

When the plot is on the screen and you have observed it, hit a return to clear the screen. The plot for the next counter will then be drawn. Hit return to clear the screen.

Enter counter(s):	**<cr>**	(no more plots this setup)
PLOT 1 X-AXIS:	**FREQ,0,50,10**	(compute, plot spectrum)
Y-CURVE 1:	**M107.RAW**	(analyze M107)
PLOT 2 X-AXIS:	**FREQN,0,5,1**	(plot spectrum vs. per-rev)
Y-CURVE 1:	**M107.RAW**	(analyze M107 vs. per-rev)
PLOT 3 X-AXIS:	**<cr>**	(only two plots this page)
Enter counter(s):	**18193**	(only one counter)
Enter revs/sec [8.9]:	**<cr>**	(accept default rate)

Amplitude spectra are plotted. Notice the two different abscissa scales. The second one is in multiples of the fundamental main-rotor frequency. Hit return to clear the plot from the screen.

Enter counter(s):	**<cr>**	(plot no more counters)
PLOT 1 X-AXIS:	**<cr>**	(return to the main menu)

Outing 13: Superimpose data for two different counters. (**)

The COMPARE feature lets you superimpose time histories of items or expressions from two different databases on the same plot. It also lets you superimpose time histories from two different counters of the same database on one plot. Let's try this latter feature, with rotor azimuth as the independent variable.

Select:	**COMPARE**	(compare different counters)
Second source:	**703**	(same as current database)
PLOT 1 X-AXIS:	**MRAZ**	(plot vs. rotor azimuth)
Y-CURVE 1:	**M107.RAW**	(curve 1 is from current base)
Y-CURVE 2:	**#"**	(curve 2 is from second source) (# means repeat curve 1 input) (" means find common scale)
PLOT 2 X-AXIS:	**<cr>**	(only one plot this page)
Enter 1st counter:	**18192**	(for current database)
Enter 2nd counter:	**18196**	(for second (same) source)

The plot will be drawn, showing the behavior of M107 over one rev for two different counters (i.e., conditions). Hit a return to clear the screen.

Enter 1st counter:	**<cr>**	(no more counters)
PLOT 1 X-AXIS:	**<cr>**	(return to the main menu)

Menu Item

- ***PERFPLOT***

Outing 14: Plot 4, 9, or 16 time-history plots on a page. (**)

The PERFPLOT feature does not have all of the combinatorial or analysis capabilities of TIMEHIST, but it pops up an array of plots very simply, according to a template which you may set up.

Select:	**PERFPLOT**	("performance" plots)
Plot setup file:	**<cr>**	(accept the default layout)
Enter option etc.:	**2**	(choose the 3x3 array)
Enter counter(s):	**12733**	(a lateral-step maneuver)

The plot will be drawn. Hit return to clear the screen.

Enter counter(s):	**<cr>**	(no more counters plotted)
Enter option etc.:	**<cr>**	(return to the main menu)

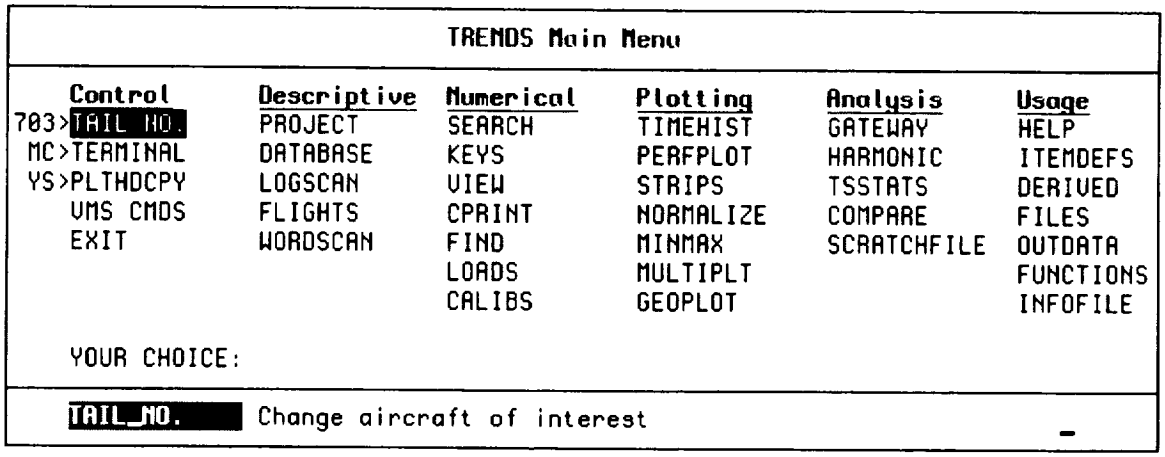
Conclusion

This is the end of the guided tour of TRENDS. We hope you have enjoyed it and have developed a "feel" for what TRENDS can do. There are many more capabilities and features in TRENDS than we could show you on this tour, but we have hit the highlights. Feel free to prowl around in TRENDS on your own and, if you get lost, read the rest of this manual.

Section III: Users' Guide

Introduction

The purpose of this section is to introduce you to TRENDS and to illustrate its use. When you first enter TRENDS, you will see this menu.



You will notice that the menu items are arranged in columns, each of which has a somewhat different focus, as denoted by the column header titles (**Control, Descriptive, Numerical,** etc.). Each column will be discussed later in this section. Each menu item relates to a different TRENDS feature or capability. Menu items are selected by moving to them with the keyboard's arrow keys or the space bar (or by typing in all or part of the menu-item's name) and then hitting return (later denoted <cr>). (As you move around the menu, you will notice that a brief description of the high-lighted menu-item's purpose is shown below the menu.) When you return from using the selected TRENDS feature, your current menu position remains on the selected item. To leave TRENDS, select EXIT.

The approach taken in this section is to give you an in-depth introduction, by examples and explanation, to certain key features such as WORDSCAN, SEARCH, and TIMEHIST. Other features will be described very briefly, but not elaborated. The "Menu Reference" section will provide an item-by-item reference to all of the TRENDS menu items. The section after that contains a topical reference.

NOTE:

The TRENDS menu will appear as shown above for each database; however at times all menu items will not be supported by the database. An example of this would be CALIBS which is supported by N702, N703, etc., but not by 748, BH1, BH2, BHD or 736.

Control

TAIL NO.

The first column of the main menu of TRENDS is devoted to "control" of the session. "TAIL NO." is the item for selecting which of the available databases you want to work in. (The name "TAIL NO" was adopted when each database was for a different aircraft, identified by its tail number.)

Menu Items
- *TAIL NO.*
- *TERMINAL*

```
                              TRENDS Main Menu

    Control                    TRENDS Databases              Analysis    Usage
703>TAIL NO      BH2  for PHASE II BLACKHAWK ON NEP          GATEWAY     HELP
 MC>TERMINAL     BHD  for BLACKHAWK DNW WIND TUNNEL TEST     HARMONIC    ITEMDEFS
 YS>PLTHDCPY     702  for XV-15 TILT ROTOR A/C 702          TSSTATS     DERIVED
    VMS CMDS     703  for XV-15 TILT ROTOR A/C 703          COMPARE     FILES
    EXIT         XV3  for XV15 RADAR DATA                   SCRATCHFILE OUTDATA
                 736  for COBRA A/C 736                                  FUNCTIONS
                 741  for HARP WIND-TUNNEL TESTS @DNW                    INFOFILE
                 742  for BV-360 WIND-TUNNEL TESTS
    YOUR CHOI    748  for UH-60A A/C 748 PHASE I
                 TS1  for TRISTAR PROJECT
    TAIL_NO.     V22  for V-22 OSPREY DESIGN DATA
                 QSR  for QSRA JUMP TESTS - 1990
                 BH1  for UH-60A A/C BH1 PHASE I "NEW"
```

Databases are indexed by three-character labels -- "703" is shown alongside the menu item to indicate the XV15 tilt-rotor database here. If you select a database, TRENDS will remember and always open a new session for you into that database. When we select "TAIL NO," we see that there are a number of databases available. Your own private databases may be accessed, too, if they have the appropriate structure (See Section V for how to do this). You may select any of the databases shown by using the arrow keys or typing the database label, then hitting RETURN. The examples in this manual use database 703.

TERMINAL

TRENDS supports several different terminals. Most terminals have their own individual controls for clearing the screen, plotting, etc. TRENDS must know what type of terminal you are using in order to send it the appropriate commands.

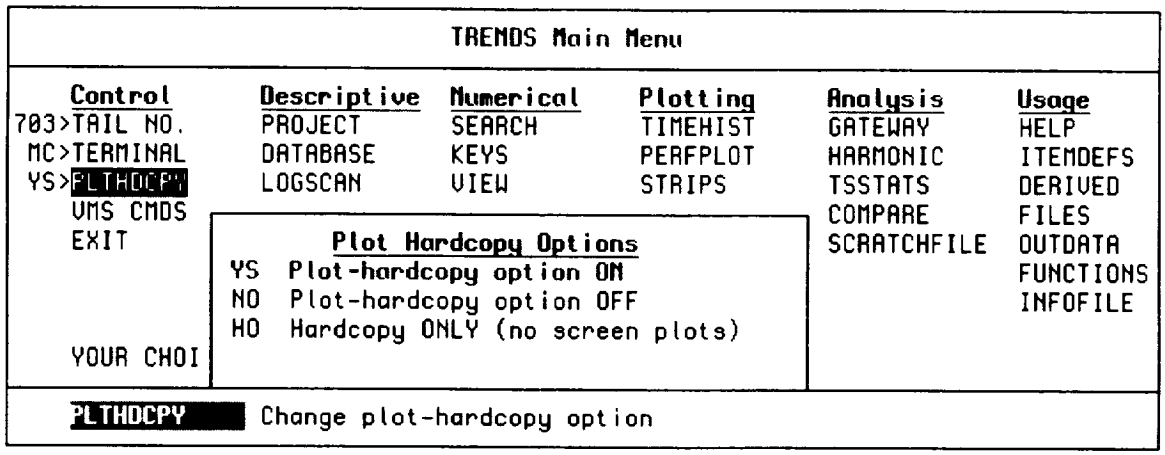
```
                              TRENDS Main Menu

    Control      Descriptive  Numerical  Plotting     Analysis    Usage
703>TAIL NO.
 MC>TERMINAL     Terminal Types Recognized            GATEWAY     HELP
 YS>PLTHDCPY     GR  GraphOn                          HARMONIC    ITEMDEFS
    VMS CMDS     MC  MACINTOSH using VersaTerm-PRO    TSSTATS     DERIVED
    EXIT         VT  DEC VT240                        COMPARE     FILES
                 RG  RetroGraphics VT100   (No DISSPLA) SCRATCHFILE OUTDATA
                 TK  Tektronix 4014                                 FUNCTIONS
                 IB  IBM PC using Kermit                            INFOFILE
    YOUR CHOI    HP  HP 2623A
                 EL  Televideo
    TERMINAL     PR  DEC Pro 350
                 NG  Non-graphic DEC (VT100,VT52)
                 DC  DECwriter
                 OT  Other nongraphic terminals
```

PLTHDCPY

TRENDS has three modes of operation for plotting:

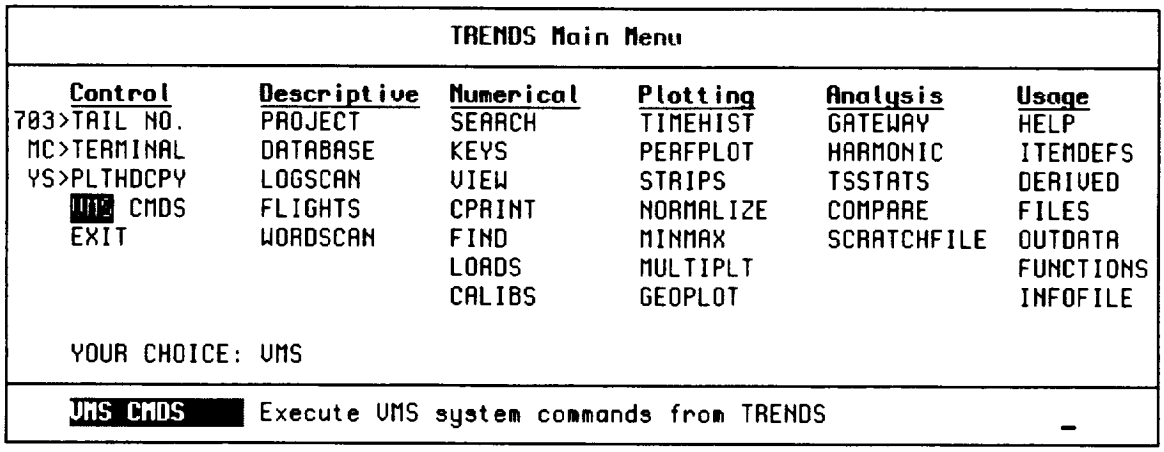
1. For screen and hard-copy plots type/select, (YS)
2. For screen plots only type/select, (NO).
3. For hard-copy plots only type/select, (HO). Note, no screen Display.

If you select both screen and hard-copy plots, you will be asked whether or not you wish to hard-copy each plot page after it has been shown on the screen.



VMS COMMANDS

VMS_CMDS is a way of issuing VMS operating-system commands without leaving the TRENDS program. This will be helpful in looking through your directory for files, changing terminal setting for VMS, etc.



This feature lets you enter system-level commands without leaving TRENDS. Warning: CTRL-C will not stop anything and CTRL-Y will abort TRENDS!!

Enter VMS command: **$ SHOW USERS**

EXIT is the way you leave TRENDS to return to the operating system. If you have produced any printable files or hard-copy plots, you will be prompted for their disposition. Prints and plots will be made in Bldg. 237 at Ames Research Center. Remote users should not print or plot at Ames unless they make arrangements for someone to send them the hardcopy.

Descriptive

PROJECT

The second column of the TRENDS menu contains features which help you to view and search the descriptive data stored for your database.

Menu Items

- ***PROJECT***
- ***WORDSCAN***

```
                              TRENDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                 LOADS         MULTIPLT                    FUNCTIONS
                                 CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE: PR

   PROJECT        Display project and aircraft information
```

PROJECT provides an overview of the aircraft and the test project for your current database. DATABASE displays a summary of the stored database, listing which flights are represented in the database by time-history, statistical, or narrative (text) data. LOGSCAN helps you search or simply display brief flight descriptions (flight objectives). FLIGHTS displays detailed narrative information for each flight, information usually taken from the pilot's or test engineer's flight report.

WORDSCAN

WORDSCAN is one of the most-frequently-used features of TRENDS, enabling search and-capture of those counters which contain specified keywords in their description. The counters which are found as a result of a successful WORDSCAN search form a "derived counter set" (DCS) or "pseudo-flight," which may be named by you and saved for later use to specify the desired data region for plots, analyses, or subsequent searches.

```
                              TRENDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                 LOADS         MULTIPLT                    FUNCTIONS
                                 CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE:

   WORDSCAN       Scan counter descriptions for words or strings
```

When you select WORDSCAN, TRENDS will first ask you what keyword or character string you are looking for, then what data region (i.e., flights, counters, DCS) to search. If you don't have any idea what to look for, you may use the wild card (*) for either the keyword or the data region response to specify "anything there is". A question mark at the "LOOK FOR:" prompt will call out an alphabetized summary of keywords. The following WORDSCAN example will illustrate the search-and-capture process.

To show you how WORDSCAN works, we will look for all occurrences of "CLIMB" in the descriptions of any counter of flights 220 through 260.

```
                                WORDSCAN
  LOOK FOR : CLIMB
Enter flight(s), :counter(s) or DCS name : 220-260
                        Pilot Comments              Duration   T-H Data

FLT 222  CTR 12562  RT CLIMB TURN                     14.058   HQ

FLT 226  CTR 12876  ASYM SWEEP 150 KTS CLIMB         26.777   HQ,SPL,MSC
FLT 226  CTR 12878  ASYM SWEEP 150 KTS CLIMB         27.932   HQ,SPL,MSC
FLT 226  CTR 12880  ASYM SWEEP 150 KTS CLIMB         28.510   HQ,SPL,MSC
FLT 226  CTR 12882  SYM SWEEP 150 KTS CLIMB          28.283   HQ,SPL,MSC
FLT 226  CTR 12884  SYM SWEEP 150 KTS CLIMB          27.589   HQ,SPL,MSC
FLT 226  CTR 12886  SYM SWEEP 150 KTS CLIMB          28.291   HQ,SPL,MSC
FLT 226  CTR 12941  TRIM CLIMB                        9.208   HQ

FLT 235  CTR 16066  SINK & THEN CLIMB TO 50'         55.743

FLT 241  CTR 16679  RT TURN & CLIMB                   37.510   HQ

FLT 260  CTR 18135  STEADY CLIMB                      12.814   HQ,SPL
```

```
                                WORDSCAN
  LOOK FOR : CLIMB
Enter flight(s), :counter(s) or DCS name : _
                        Pilot Comments              Duration   T-H Data
```

```
                                WORDSCAN
LOOK FOR :

                        Pilot Comments              Duration   T-H Data
```

```
  Save the derived counter-set? (Y/N) [N] : Y

  Output DCS name : CLIMBS

  WRITE OVER EXISTING FILE OF THAT NAME (Y/N) ? Y
DCS description (Climbs during flights 220-260          )

    11 COUNTERS.  FIRST =  12562, LAST =  18135
```

The second box shows that you will have a chance to search more (other) data regions for the keyword if you want to. We simply returned, indicating "no more data regions." This brings up the "LOOK FOR" prompt in the third box so that we could specify another keyword and then add counters for that other keyword to our list. An empty response at this point means "that's enough." TRENDS then asks if you want to save the DCS. Our answer was yes (Y), so we were asked to supply a name and a description for the DCS. Now we will repeat the process for "DESCENT" (not shown), then combine the two sets of counters as shown on the next page.

Menu Items

- **WORDSCAN**

```
                              WORDSCAN
  LOOK FOR : *
Enter flight(s), :counter(s) or DCS name : CLIMBS_
```

FLT 222	CTR 12562	RT CLIMB TURN	14.058	HQ
FLT 226	CTR 12876	ASYM SWEEP 150 KTS CLIMB	26.777	HQ,SPL,MSC
FLT 226	CTR 12878	ASYM SWEEP 150 KTS CLIMB	27.932	HQ,SPL,MSC
FLT 226	CTR 12880	ASYM SWEEP 150 KTS CLIMB	28.510	HQ,SPL,MSC
FLT 226	CTR 12882	SYM SWEEP 150 KTS CLIMB	28.283	HQ,SPL,MSC
FLT 226	CTR 12884	SYM SWEEP 150 KTS CLIMB	27.589	HQ,SPL,MSC
FLT 226	CTR 12886	SYM SWEEP 150 KTS CLIMB	28.291	HQ,SPL,MSC
FLT 226	CTR 12941	TRIM CLIMB	9.208	HQ
FLT 235	CTR 16066	SINK & THEN CLIMB TO 50'	55.743	
FLT 241	CTR 16679	RT TURN & CLIMB	37.510	HQ
FLT 260	CTR 18135	STEADY CLIMB	12.814	HQ,SPL

```
                              WORDSCAN
  LOOK FOR : *
Enter flight(s), :counter(s) or DCS name : DESCENTS_
                          Pilot Comments          Duration   T-H Data
```

FLT 220	CTR 12438	WM DESCENT R/D 2700'/M AR ON	30.749	HQ
FLT 222	CTR 12631	WINDMILLING DESCENT	52.663	HQ
FLT 222	CTR 12638	STEEP DESCENT	64.947	HQ
FLT 225	CTR 12710	STEEP DESCENT	10.708	HQ
FLT 225	CTR 12711	STEEP DESCENT TAIL BUFFET	25.720	HQ,SPL,MSC
FLT 226	CTR 12894	DESCENT TO IGE	18.323	HQ
FLT 229	CTR 13128	DESCENT TO IGE	25.651	HQ
FLT 229	CTR 13134	DESCENT TO IGE	21.777	HQ
FLT 245	CTR 17060	DESCENT	27.196	HQ,SPL
FLT 245	CTR 17097	600'/M DESCENT	15.220	HQ,SPL

```
                              WORDSCAN
LOOK FOR :
                          Pilot Comments          Duration   T-H Data
```

```
  Save the derived counter-set? (Y/N) [N] : Y

  Output DCS name : UPDOWN
DCS description ("CLIMB" + "DESCENT" on 220-260_          )
```

When the user is prompted in WORDSCAN by:

LOOK FOR:

he is being asked to provide a character string (or several strings separated by commas) for which to search the maneuver descriptions. An asterisk (*) or blank (not null) entry will result in success on every search. A final minus sign (-) at the end of the entered string will result in success only when the entered string is NOT found in the maneuver description. No distinction is made between upper case and lower case for the entered strings. A question mark (?) may be used to display the entire list of individual character strings available in the maneuver-description database. (You will then be prompted again for the string(s) to look for.)

The next WORDSCAN prompt is:

Enter the flight(s), :counter(s) or DCS name :

which may be answered by:

1. a flight number or list of flight numbers

2. a counter number or list of counter numbers preceded by a colon (:) to distinguish the entry from flights

3. the name of a previously-saved derived counter-set (the available DCS names will be listed if you enter a question mark).

A null entry (just a return) without any entry will return you to the "LOOK FOR:"prompt. Any other response will be interpreted as a list of flight numbers, a list of counters or a DCS filename whose maneuver descriptions are to be searched. The search then proceeds and the list of counters for which the search is successful is stored in memory. When you leave the WORDSCAN process, you will be given the opportunity to save this counter list as a DCS. The entire dialogue sequence is depicted in Figure 1.

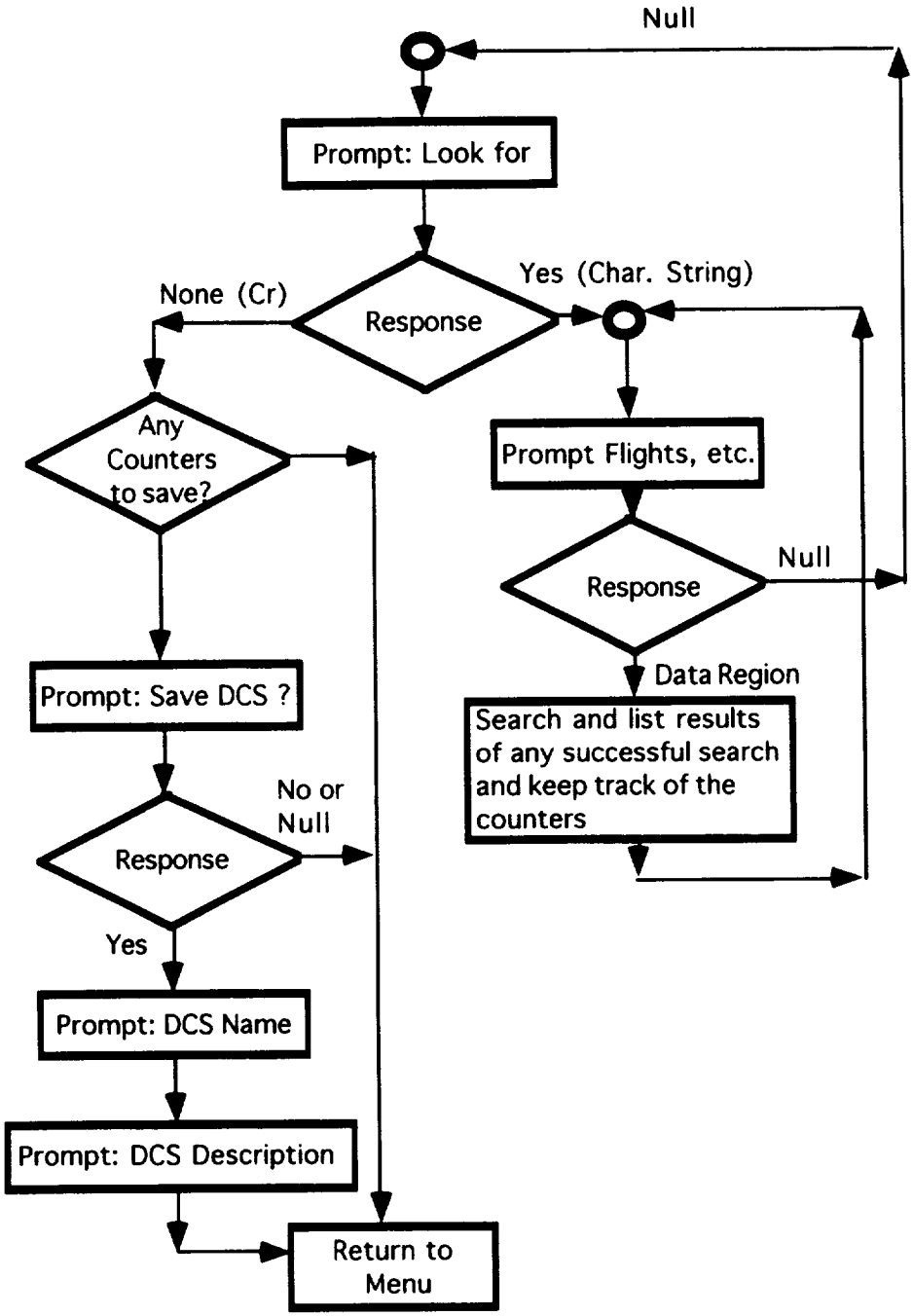
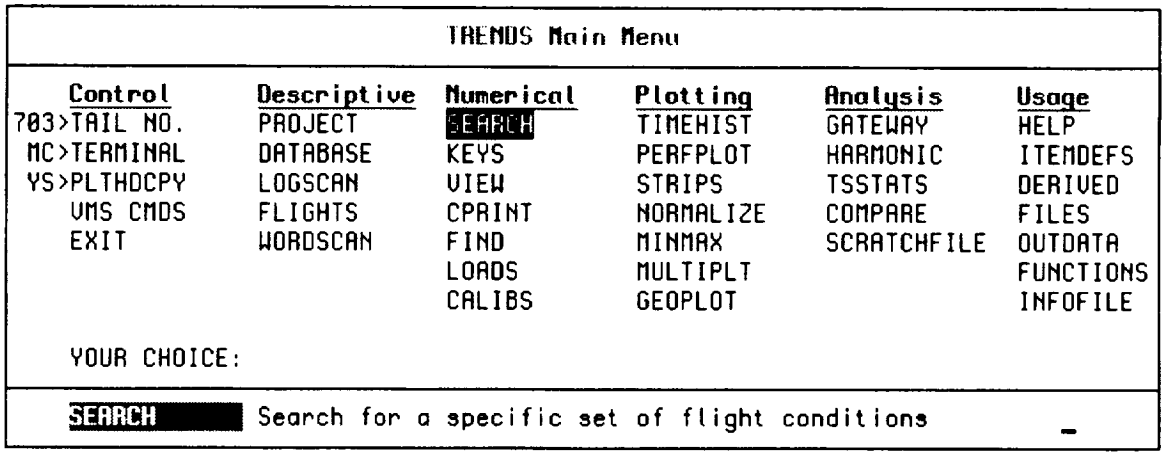


Figure 1: WORDSCAN Dialogue

Numerical

SEARCH

The "numerical" column of the TRENDS menu contains the tools which let you print values of data-item statistics and search the database.



SEARCH lets you specify upper and lower bounds on the statistics (e.g., mean) of a data item and then searches the database for values lying with the specified bounds. KEYS lists the average values of six key data items. VIEW displays all of the stored statistics for specified data items. CPRINT prints statistical values of specified data items by counter in a customized block format. FIND helps you search the database for available time histories of specified data items. LOADS presents minmax/rev data versus rev number. CALIBS displays calibration data by flight.

While each of the "numerical" menu items has its value, SEARCH is an especially useful feature when applied to a large (i.e., many-countered) database such as 703. The counter descriptions searched in WORDSCAN may not discriminate enough to find what you want, so you may have to specify numerical bounds on some data items and scan the database for the right conditions.

Before launching into SEARCH, we should describe the type of numerical data stored in a TRENDS database. Numerical data are broadly characterized as either

1. time histories, or

2. scalar measures.

Numerical searches in TRENDS are on scalar measures, not on time histories. These scalar measures are primarily (but not always) statistics derived from time histories as these are processed by the TRENDS database manager, although the time history itself may not be stored. The following two pages describe the types of scalar measures stored and searchable in TRENDS.

Scalar Measures and Data Types

The TRENDS database for the XV-15 includes several different scalar measures which can be searched, manipulated and displayed:

1. Minmax-per-counter values of recorded items
2. Derived pseudo-items
3. Harmonic amplitudes and phases
4. Rates (mean slopes) of selected items

1. **MINMAX:** The most commonly available scalar measures or data types are the "minmax-per-counter" statistics. These are:

itemcode.AVS	average-steady, average of the "steady" value: for all prime-data revs in the counter steady = (max + min)/2
itemcode.OSC	average-oscillatory, average of the "oscillatory" over all of the prime-data revs in the counter oscillatory = (max - min)/2
itemcode.MAX	maximum (over all revs in the counter) of the oscillatory (half-amplitude) component
itemcode.SMO	steady value on the rev in which the maximum oscillatory value occurred
itemcode.CMN	counter-minimum, the algebraic minimum of all samples of the item during the counter
itemcode.CMX	counter-maximum, the algebraic maximum of all samples of the item during the counter
itemcode.FSC	full-scale engineering value associated with 126 counts (one count less than a full byte)
itemcode.HMn	n-th harmonic amplitude (n between 0 and 6, inclusive)

2. **Pseudo-items:** A number of "pseudo-items" are standardly derived from the average-steady values of recorded items and stored for retrieval in TRENDS. These pseudo-items, such as RSHP (rotor shaft horsepower), HDFT (density altitude) or KTAS (true airspeed), are available only in the average-steady (AVS) form. A complete list of these pseudo-items can be obtained, together with a listing of the algorithms used in their derivation, by invoking the DERIVED feature in the TRENDS menu.

NOTE:

Not all databases have the same statistics. For UH-60 databases (BH1, BH2 & 748) see appendix A, UH-60.

3. **Harmonics:** Harmonic amplitudes and phase angles are pre-computed and stored for all items in the spectral (SPC) time-history group. The amplitudes (7) are accessible to the user for searching (in SEARCH), plotting (using HARMONIC or MINMAX) or listing (through the PRINT or HARM options in HARMONIC). They may be used in user-defined mathematical expressions in either SEARCH or MINMAX. The phases (6) are presently accessible only for listing, using the PRINT or HARM options within the HARMONIC capability. The amplitudes are specified in searching or plotting applications by use of the "HMn" extension:

itemcode.HM0	Zero-th harmonic (mean)
itemcode.HM1	First harmonic (one-per-rev) amplitude
:	
:	
itemcode.HM6	Sixth harmonic (six-per-rev) amplitude

4. **Computed rates:** The mean slope or first time-derivative or rate is standardly computed (along with some other measures) and stored for a group of performance items. These items are:

Item	Rate Itemcode	Description
P342	HDOT	Climb rate
P002	IASD	Airspeed rate
D186	PCAD	Pylon conversion angle rate
E719	GOVD	Governor LVDT rate
D007	BETD	Sideslip rate
D008	ALFD	Angle of attack rate
D009	PHID	Roll angle rate (slope)
D010	THTD	Pitch angle rate (slope)
D645	AILD	Right wing aileron rate
D617	FLPD	Flap angle rate

Numerical Searches

Menu-item SEARCH is used to search the database for occurrences of specified conditions (i.e., flight regimes, configurations, etc.). The search is applied to any of the available scalar measures or statistics or to mathematical expressions involving them, but not to time-history data. The first part of the dialogue sequence is for creating a "condition mask" or template which defines a successful search condition. The basic prompt for forming the condition mask is:

ITEMCODE:

Your response to this prompt may be a simple itemcode (e.g. P002) or an expression. The general syntactical form is as follows:

{label=} **Itemcode or expression** {,decimal places} {,units label}

where the curly brackets indicate "optional" fields which need not be specified

label	is an optional label for the tabulation column (only the first 4 characters are used)
expression	is any of the allowable mathematical expressions for scalar measures
decimal place	is an optional one-digit or two-digit number of decimal places in the tabulation (def: usually 2)
units label	is an optional units designation of 6 or fewer characters used in the tabulation header.

You may also respond to the "ITEMCODE:" prompt with

MASK	to call back a previously-defined condition mask (you will be prompted for its name)
KEYS	for a "standard" condition mask consisting of six itemcodes (D186,R338,D617,P342,P002,M143)
itemcode-	to delete an entry from the current condition mask, where "itemcode" here is the entry name in the condition mask. See example on pg. UG(17)

The default (unspecified) statistic for an itemcode or pseudo-item is the average-steady (.AVS) value. Should you want to specify another statistic for a recorded item (i.e., not for a pseudo-item), you may do so by means of the extension. For example,

RANGE=M143.CMX-M143.CMN/12,FT-LB,2 Note: units & decimal place syntax is free form

would specify the difference between the counter-maximum and the counter-minimum of M143 in ft-lb as the parameter to be searched and would display it with a label of "RANGE," units of "FT-LB" and with two decimal places shown.

In addition to the minmax statistics (AVS, OSC, MAX, SMO, CMN, CMX, FSC), the harmonic amplitudes (HM0, ..., HM6) may also be specified. For example,

M143.HM3/M143.HM1

which specifies the ratio of the third harmonic to the first, is a valid expression.

When your response to the "ITEMCODE:" prompt has been processed, you will be prompted for

Lower bound:

and

Upper bound:

This prompt is asking you to set numerical limits within which the search is considered to be successful. The default (null entry) value for lower bound is -9,999,999 and 9,999,999 for the upper. These default bounds are intended to be all-inclusive. If the lower bound you specify exceeds the upper bound, the search will be defined as successful when the expression's value lies **outside** the specified bounds (i.e., when the value found is not in the interval). See example on 3-17). Your entry may be any positive or negative number with or without a decimal point. Scientific (E) notation is acceptable.

A null entry in response to the "ITEMCODE:" prompt interrupts the input condition sequence and causes the current condition mask to be displayed. You will then be prompted

OK ? [Y]

A negative response (N, NO) returns you to the "ITEMCODE:" prompt where you may add entries to the mask, delete entries from the mask or change bounds on an existing entry. A positive response or null entry will terminate the condition-mask-definition process and lead to the next prompt:

Do you want to save this condition mask ? [N]

If you answer affirmatively (Y), you will be asked for a name and description before proceeding. If the condition mask is extensive or complex and has potential for later application, it will be to your advantage to save it for later recall. To recall a mask, respond "MASK" to the "ITEMCODE:" prompt and you will then be prompted for the name. If you can't remember it, enter a question mark (?) and you will be shown the list of existing saved masks in your directory. If you decide you really don't want an old condition mask after all, just respond with a null entry and you will be returned to the "ITEMCODE:" prompt. The names and contents of the existing condition masks may be listed through use of the "FILES" feature accessed from the main menu.

Once you have accepted (and perhaps saved) the condition mask, you must supply a data region to search. You will be prompted to

		Comments
Enter the flight number(s):	**225**	(Flight Number)
Or Counter Number by :	**: 14034**	(Colon, Counter Number)
Or Derived Counter Set :	**MyFlt**	(DCS Name)

and you may respond with flight(s), :counter(s) or DCS name which define the data region you want to search. Note when the prompt is for a flight, it is defined just as a straight number, while the counter number at a flight number prompt, must be preceded by a colon. After searching the specified region of the database for the specified conditions (and listing or tabulating the results for those counters for which the conditions were found), TRENDS will re-prompt you for more flight numbers. A null response will get you past this prompt and, if your search was successful to any extent, cause TRENDS to prompt you for saving the DCS of satisfying counters. Control then returns to the beginning of SEARCH where you may define a new condition mask or, with a null entry in response to the "ITEMCODE:" prompt, return to the main menu.

An example of a numerical search will be shown on the following pages. For this example, suppose that we want to find high-speed helicopter-mode test points. Then we might ask for counters for which (the average-steady component of) pylon angle (D161) exceeds 75 degrees and airspeed (P002) exceeds 100 knots.

SEARCH Examples

```
Searches the database for counters for which prescribed
conditions are satisfied.

Define the conditions -- first "itemcode",  then its acceptable bounds.
"ITEMCODE" may be a simple itemcode OR a derived/stored pseudo-item
OR a mathematical expression or defined function.
Enter "MASK" for condition mask or "KEYS" for standard keys.
Type "?" for a full explanation.  Have fun!

 ITEMCODE (or expression) : d161

          D161.AVS    RT PYLON CONVERSION POSITION      DEG


             Lower bound : 75

             Upper bound :


 ITEMCODE (or expression) : p002

          P002.AVS    AIRSPEED - NOSE BOOM              KNOTS


             Lower bound : 100

             Upper bound :

 ITEMCODE (or expression) :

                                        CONDITION MASK :

ITEMCODE       LOWER       UPPER
D161.AVS        75.00   9999999.00        RT PYLON CONVERSION POSITION    DEG
P002.AVS       100.00   9999999.00        AIRSPEED - NOSE BOOM            KNOTS
     OK ? [Y] :
 Do you want to save this condition mask [N] ?
```

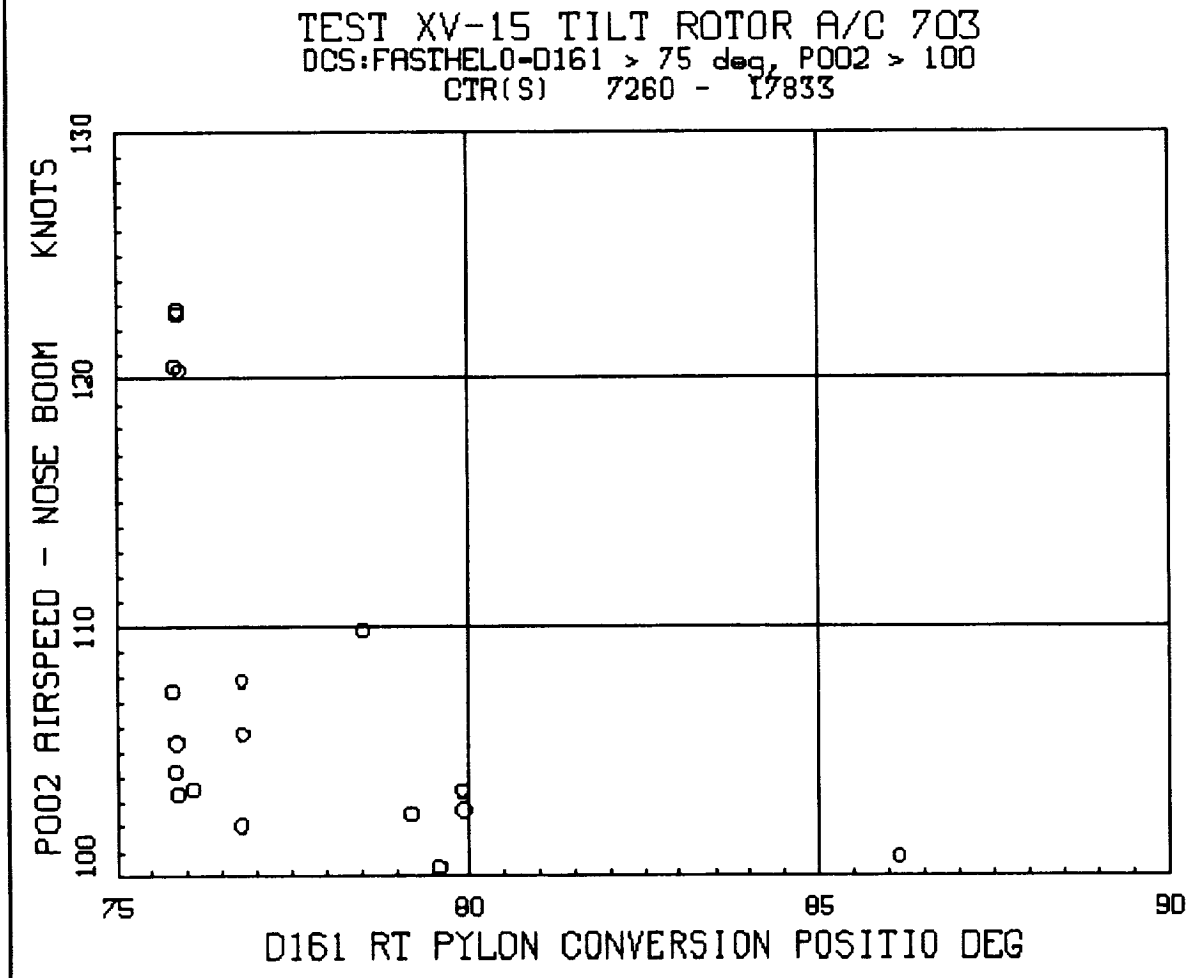
The asterisk as a response asks **TRENDS** to search the entire database. A great deal of information scrolls by on the screen, but a **CTRLC** will stop it. Part of this information looks like this:

```
                    N703   D161.AVS  P002.AVS
                            DEG       KNOTS

                  17719       76.08    103.51
                  17720       75.79    107.45
                  17721       75.83    104.22
                  17722       75.85    105.38
                  17723       75.86    103.29
                  17724       75.90    120.35
                  17725       75.84    120.48
                  17726       75.86    122.59
                  17727       75.86    122.78
                             --------  --------
                  MAXIMUM     86.74  99999.00
                  MINIMUM     75.79    100.43
                  AVERAGE     78.25  15092.08
                             --------  --------
```

When the entire database has been searched, you will be prompted again for data region (flight number). An empty return gives you the chance to save the derived counter set (DCS).

```
 Enter the flight number(s) :


 Save the derived counter-set? (Y/N) [N] : y

 Output DCS name : fasthelo

 WRITE OVER EXISTING FILE OF THAT NAME (Y/N) ? y
DCS description (D161 > 75 deg, P002 > 100 KT          )

   21 COUNTERS.  FIRST =   7260, LAST =  17833
```

This DCS may be used to make a plot of P002 vs. D161, using **MINMAX.** When asked for the data region, specify FASTHELO and you will see the plot below. It shows that the XV15 can fly faster than 100 knots in near-helicopter mode.



EXAMPLE OF -- deletion of itemcode in SEARCH mask:

```
 ITEMCODE (or expression) :

                                        CONDITION MASK :

ITEMCODE       LOWER       UPPER
P002.AVS  -9999999.00   9999999.00      AIRSPEED - NOSE BOOM            KNOTS
M143.AVS  -9999999.00   9999999.00      LT ROTOR MAST TORQUE    12      IN LB
P342.AVS  -9999999.00   9999999.00      ALTITUDE - NOSE BOOM            FEET
     OK ? [Y] : N

 ITEMCODE (or expression) : M143-
   M143 HAS BEEN DELETED
                                        CONDITION MASK :

ITEMCODE       LOWER       UPPER
P002.AVS  -9999999.00   9999999.00      AIRSPEED - NOSE BOOM            KNOTS
P342.AVS  -9999999.00   9999999.00      ALTITUDE - NOSE BOOM            FEET
     OK ? [Y] : _
```

EXAMPLE OF -- specification of exclusive bounds:

```
                          SEARCH
                          ******

Searches the database for counters for which prescribed
conditions are satisfied.

Define the conditions -- first "itemcode",  then its acceptable bounds.
"ITEMCODE" may be a simple itemcode OR a derived/stored pseudo-item
OR a mathematical expression or defined function.
Enter "MASK" for condition mask or "KEYS" for standard keys.
Type "?" for a full explanation.  Have fun!

 ITEMCODE (or expression) : M143

          M143.AVS    LT ROTOR MAST TORQUE    12        IN LB


             Lower bound : 120000

             Upper bound : 0

LOWER BOUND EXCEEDS UPPER !




 Enter the flight number(s) : 243

              N703      FLIGHT  243      GW = 13000. LBS     CG = 300.0 IN.


    N703   M143.AVS
             IN LB

16833        120326
16834        121414
16847        123085
16848        124418
            --------
MAXIMUM      124418
MINIMUM      120326
AVERAGE      122311
            --------

    N703   M143.AVS
             IN LB
```

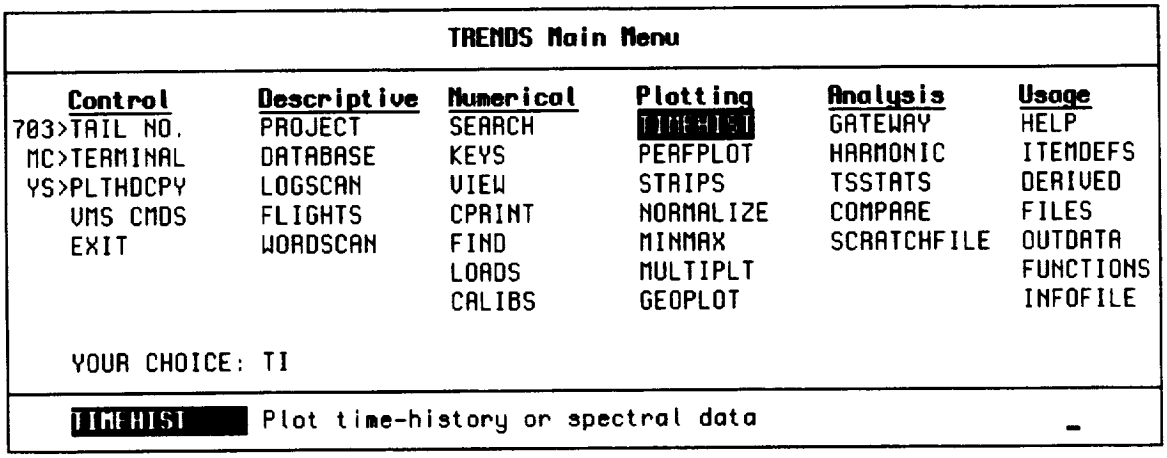
Plotting

TIMEHIST

The "plotting" column of the TRENDS menu provides the tools to set up and plot time-history and minmax (statistical) data.

Menu Items

- *TIMEHIST*



TIMEHIST is the most versatile and powerful plotting feature of TRENDS and, as its name implies, plots (and also prints) time-history data. This most-used capability will be described in some detail later in this section. PERFPLOT displays time histories of groups of selected data items in a square 2x2, 3x3, or 4x4 array. Use of this feature to give a snapshot of groups of "performance" items led to the name of this feature. It is limited (relative to TIMEHIST) in its options for manipulating, combining, or scaling the data for plotting, but is easy to use. STRIPS is also limited in these options, but provides a capability for displaying strip-chart-type plots of one data-item's time histories for multiple counters together on one page. NORMALIZE provides the special-purpose function of biasing each of 12 curves by its individual mean and plotting them all at a common scale on one plot. The curves may be individual data-item time histories or functions of several data-item time histories. This feature has been used to co-plot several key performance items to see when the ensemble's transients die out -- thereby locating the right "time slice" for a supposedly steady maneuver.

The last three menu items in the "plotting" column are for plotting statistical-type data, not time histories. MINMAX is similar in operation to TIMEHIST and is used to plot scalar measures (See the discussion of scalar measures under the SEARCH discussion earlier.) versus other scalar measures or versus counter number. All of the capabilities for formula evaluation in TIMEHIST are also available in MINMAX except, of course, the calculus functions and filters only operate on a time series. MULTIPLT is a variation of MINMAX which permits data from 1-5 data regions to be plotted as separate curves on the same plot. GEOPLOT (geometric plotting) enables plotting of scalar data versus physical distance along a rotor blade, wing or fuselage.

Usage of TIMEHIST

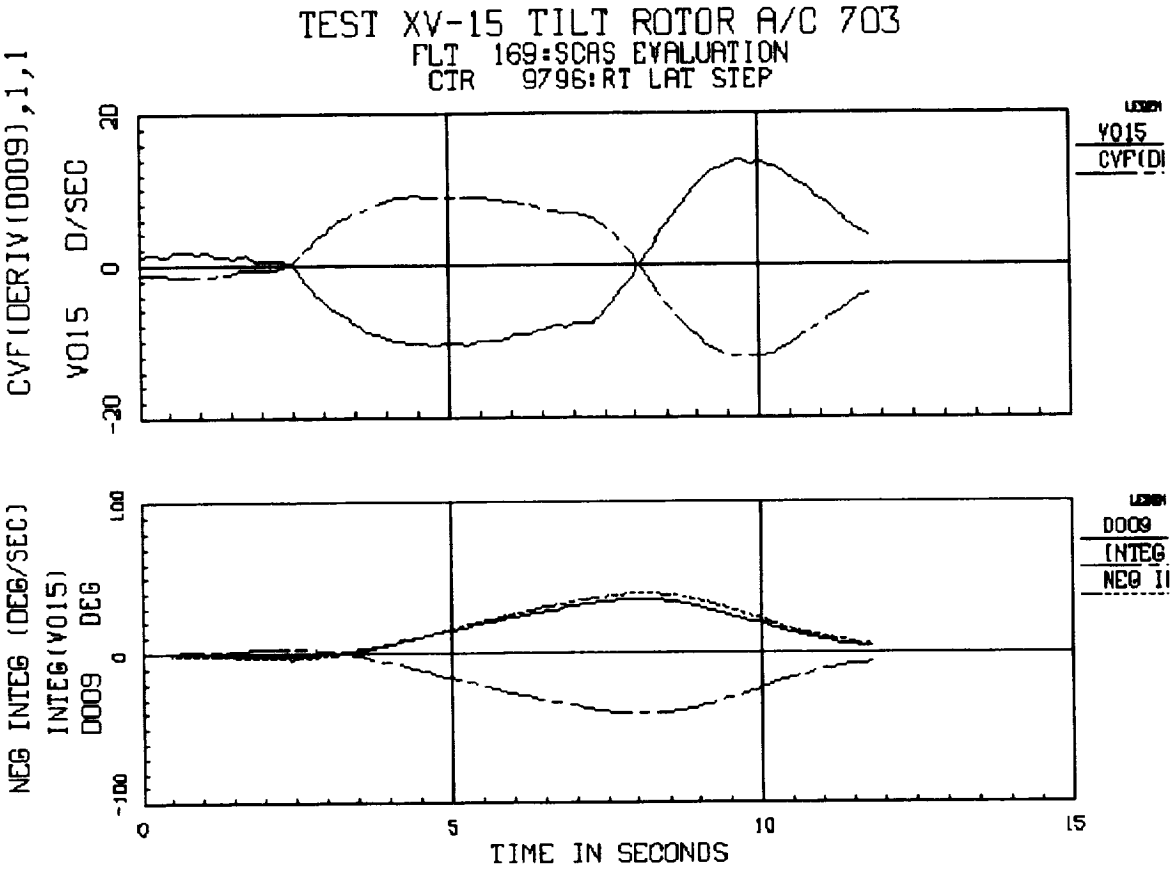
A description of the TIMEHIST plotting feature follows. An example will be shown first; then the more general capabilities will be described.


```
                              TRENDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
    VMS CMDS      FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
    EXIT          WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                 LOADS         MULTIPLT                    FUNCTIONS
                                 CALIBS        GEOPLOT                     INFOFILE

    YOUR CHOICE: TI

    TIMEHIST      Plot time-history or spectral data                        -
```

```
                        TIME-HISTORY PLOTTING
                        *********************
EXAMPLES of valid responses to prompts:

              X-AXIS: T                          (time on x-axis, auto scale)
        or    X-AXIS: T,0,20,5                   (time, 0 to 20secs, inc=5)
        or    X-AXIS: M143                       (ITEM CODE for X-axis,autoscale)
        or    X-AXIS: MRAZ(3),0,360,45           (Cycle-avg. 3 cycles vs azimuth)
        or    X-AXIS: FREQ,20,30,2               (SPECTRAL, with freq. scaling)
        or    X-AXIS: INT=5,8                    (Interval of time = 5 to 8 secs)
        or    X-AXIS: PRINT                      (DUMP TIME HISTORY FILE)
        or    X-AXIS: ?                          (HELP for more INPUT INFO)

              Y-CURVE 1: P002                    (Y-axis, autoscale)
        or    Y-CURVE 2: POLY(P002,3)            (curve fit to P002 data points)
        or    Y-CURVE 2: DIFF=M143-M107          (DIFF becomes plot label)
        or    Y-CURVE 3: RSIM                    (RSIM or FSIM=function Gen Input

   Enter itemcode, TIME or (cr) when prompted
   and, optionally, the scale min,max,inc.

                    ITEM
                    ----
    PLOT 1  X-AXIS: T
        Y-CURVE 1 : V015
        Y-CURVE 2 : CUF(DERIV(D009),1,1)"
        Y-CURVE 3 :

                    ITEM
                    ----
    PLOT 2  X-AXIS: T
        Y-CURVE 1 : D009
        Y-CURVE 2 : INTEG(V015)"
        Y-CURVE 3 : NEG INTEG (DEG/SEC)=-1*INTEG(V015)

                    ITEM
                    ----
    PLOT 3  X-AXIS:


    Enter the counter number(s) : 9796
```

Menu Items

- ***TIMEHIST***



Explanation of the Example

Using TIMEHIST, one can plot 1, 2, or 3 plots per page, with 1, 2, or 3 curves per plot. The example has two plots on the page. The third plot was omitted because the response to the "PLOT 3 X-AXIS" prompt was a null entry. The first (upper) plot shows roll rate (V015) plotted versus time (T), together with a roll rate derived by differentiation (DERIV) and filtering (CVF) the roll angle (D009). The reflection effect occurs because the signs of the sensor mounting (or calibration) are not consistent between the angle and the rate. The second (lower) plot shows the roll angle (D009) and two representations of the integrated roll rate (V015). For the third curve of this second plot, the integrated rate was multiplied by -1 to correct the sign inconsistency. The scales were automatically generated for both plots because we did not specify (i.e., force) scaling for either plot. The titles and labels are automatically assigned, except for the third curve of the second plot, where the label was included in the specification. In TIMEHIST plotting, each page shows data for only one counter -- in this case, counter 9796. The full time interval spanned by the counter (about 12 seconds) is shown in the plot because we did not specify otherwise in setting up the example.

Overview of TIMEHIST

Capabilities of TIMEHIST extend well beyond the simple plotting of a stored time series versus time. TIMEHIST is also the tool used for:

- deriving pseudo time histories (functions, calculus)
- time-history cross-plots
- azimuth plotting with cycle averaging (MRAZ)
- spectral analysis (FREQ)
- filtering (convolution, Butterworth)
- curve-fitting (Fourier series, polynomials).

These operations can be applied in combination.(e.g., the curve fit (poly) of a derivative; n cycle-averaging of a function; the cross plot of two filtered parameters; etc.) all available through a straight-forward, logical specification syntax. Functional definitions (formulas) used in deriving time histories may be entered "in line" or recalled by name from pre-stored definitions (See menu-item FUNCTIONS). Derived time series can be stored in the user's directory for later recall.

TIMEHIST can display from 1-3 curves on each of 1-3 plots on a page. These plots may be displayed on the screen, sent to a device-independent-plot (DIP) file for later hardcopy printing, or both. TIMEHIST will accept the user's labeling and scaling specifications, but does not require them and will auto-label and auto-scale if the specifications are omitted. Plot setups can be saved by name for future recall and application. An editing feature is included to permit modification of a setup, thereby eliminating the need to re-type the entire setup in order to change one line or part of a line.

The capability exists for identifying and storing engineering-unit coordinates of particular points on a plot. Points are registered by moving cross-hairs across the screen with keyboard arrows or a mouse and then hitting a key. The registered coordinates are displayed on the screen and may be written to a printable file.

TIMEHIST can also print the curve data (rather than plot it) to the screen, to a file, or both, with optional decimation, in fixed-point, scientific, or hexadecimal format.

Source time histories may be pulled in from DATAMAP-style scratch files or from user-supplied (properly structured) formatted ASCII files, as well as from a TRENDS database. Examples of the use of scratch and ASCII files may be found in the Topical Reference, Section V. Software logic is included for searching and commanding a laser-optical jukebox to retrieve time-history files which may not be available on the magnetic disk farm.

Abundant HELP may be obtained at any prompt by entering "?". A menu shows the available entries and topics.

Plot Setup Syntax

Like most of TRENDS' features, the TIMEHIST/user dialogue is divided into two sections:

1. setup specification, and

2. data-region specification.

During the setup dialogue, the user specifies what data-items or functions or formulas are to be plotted as which curves and on which plots and with which labels and scales. Setups can be saved for recall and may be edited line by line. When the setup step has been completed, the data-region specification step takes place and is repeated as often as the user wants. Then a new setup step is enabled, and the user may specify a brand-new setup or RECALL the previous setup (or a stored one) and edit that by line number.

The setup prompts for each plot (1-3 per page) are of the form:

PLOT n X-AXIS:	(abscissa definition, n=1, 2, or 3)
Y-CURVE 1:	(first curve, this plot)
Y-CURVE 2:	(optional second curve, this plot)
Y-CURVE 3:	(optional third curve, this plot)

You must provide a valid entry for the first two of these prompts, not just a carriage return (CR), in order for a plot to be drawn. A null response (CR) to the x-axis prompt terminates the setup dialogue. The syntax of your response is basically the same for abscissa and ordinates, although certain responses are invalid for one or the other (e.g., POLY cannot be used in an x-axis response because the abscissa variable is the independent variable of the polynominal fit).

TIMEHIST will allow you to plot more than three curves (11 maximum) on the first plot page, but will then limit you to only one plot/page and will use a common scale for all curves. See the example in Section IV (4-75).

Responses to prompts for abscissa ("PLOT n X-AXIS :") or ordinate ("Y-CURVE 1 :") have the general form:

{label=} expression {,scale-min {,max {,increment}}} {"}

The label and forced scales are optional (as indicated by the curly brackets { } in the general form above).

Example:

AVG TORQUE (FT-LB) = (M143+M107)/24,-10000,10000,5000
(label=) (expression) (min) (max) (inc)

The expression may be:

- a simple itemcode or mnemonic (e.g., P002 or M143)
- a mathematical formula, using operators +, -, *, /, ^ on
  - itemcodes or mnemonics (with optional extensions)
  - literal numbers (E-notation OK)
  - names of previously-defined formulae (functions)
  - defined arithmetic functions of 1, 2, or 3 arguments
  - names of STOREd time-series functions
  - individual scratch-file elements (e.g., SCF3(3,4,T))
  - library functions with math-expression arguments
  - defined univariate table names
  - #X or # to duplicate abscissa or Y1 arguments, respectively
  - TIME or MRAZ
- CVF(expression,arg,arg) (convolution filter)
- BF(expression,arg) (Butterworth filter)
- DCVF(expression,arg,arg) (derivative of CVF result)
- DBF(expression,arg) (derivative of BF result)
- FSS(expression,arg) (Fourier Series synthesis)
- POLY(expression,arg) (polynomial fit of order arg)
- SCREEN(expression,arg) (data screening, threshold arg)

  (See Special TIMEHIST topic for example of screening)

- any of the above preceded by STORE to store curves
- a wild-card specification (e.g., P*, *.RAW, SCF2(*,3,T))
- special keywords, FREQ, FREQN, MRAZ (x-axis only)

TRENDS uses a Reverse Polish Notation implementation to evaluate formulas. The implementation has no operational hierarchy, but evaluates the expression string left-to-right, one character at a time. An operator (e.g., *, ^) works on whatever is in the "accumulator" unless told by parentheses to do otherwise, so parentheses should be used to clarify the input if there is any doubt. See Section V for elaboration of the rules for mathematical formulas (functions) in TRENDS.

If scaling is not specified, the plots will be automatically scaled to fit the range of data. If you wish to force all curves of any one plot to be drawn to the SAME scale, you may indicate this by ending your specification with quotation marks (ditto). Otherwise a separate axis and scale will be drawn for each curve.

Example-1:
```
PLOT 1  X-AXIS :  TIME
        Y-CURVE 1 :  ROLL (DEG) = D009
        Y-CURVE 2 :  PITCH (DEG) = D010"
```
See example pg. 3-25

Example-2:
```
PLOT 1  X-AXIS :  TIME
        Y-CURVE 1 :  ROLL (DEG) = D009,-5,10,5
        Y-CURVE 2 :  PITCH (DEG) = D010"
```

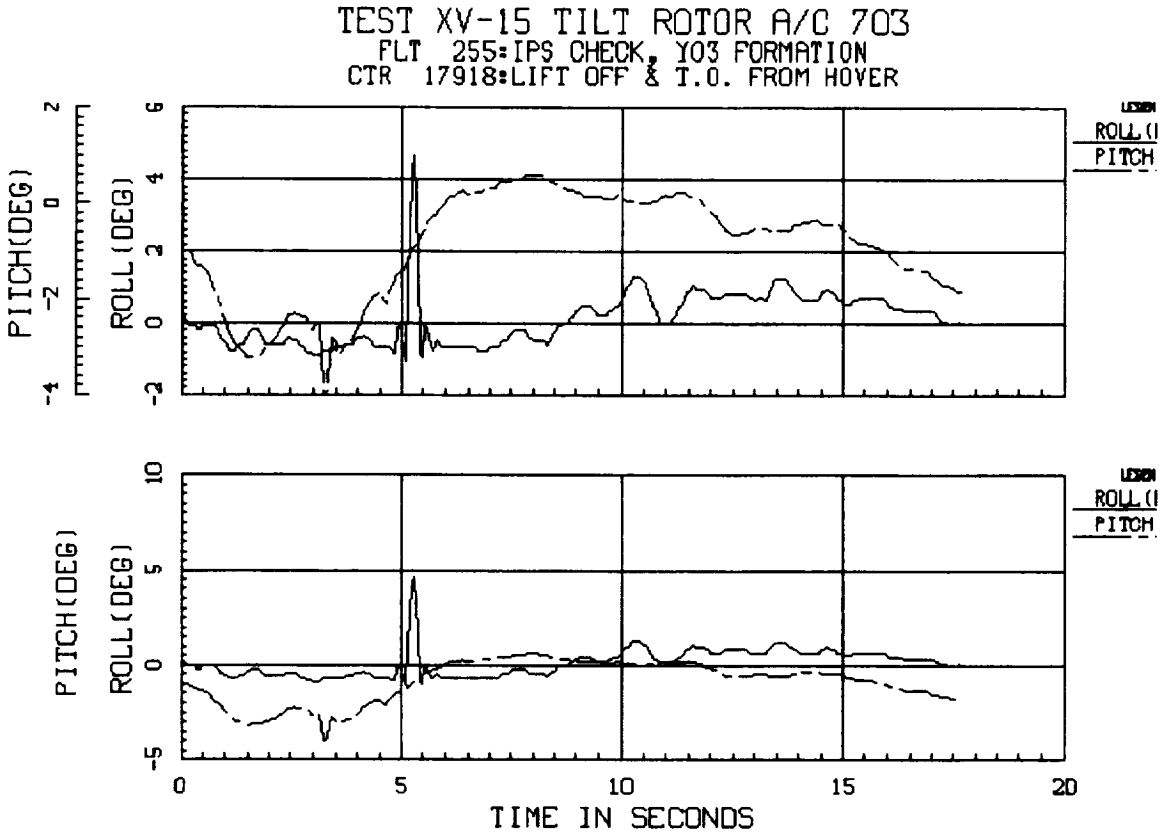
TRENDS has a repeat-string capability which works in TIMEHIST or MINMAX to save you from having to enter the same long string more than once in the same plot.

```
PLOT 1 X-AXIS : SQRT(A005.SPC^2+(A300.SPC^2))
       Y-CURVE 1 :  SQUARE OFFSET=#X^2+.05
       Y-CURVE 2 :  POLY(#,3)
```

In the above example, #X is replaced in Y-CURVE 1 by the expression specified for the x-axis. Then the # in the specification of Y CURVE 2 is replaced by the expression (not label or scales) from Y-CURVE 1. This feature works only within one plot. Expressions from PLOT 1 cannot be pulled in for PLOT 2, for example, with the exception that the x-axis specification from PLOT 1 can be duplicated on PLOT 2.

Scaling Example

The following plot-pair shows the difference between letting two curves auto-scale and forcing them to find a common scale. The upper plot resulted from a simple specification, with no particular scaling specified. TRENDS will auto-scale each curve independently and display the two scales. The specification for the lower plot includes the ditto mark (") at the end of the string defining the second curve. As a result, TRENDS finds a single scale which accommodates both curves, plots the curves to that scale and displays only one scale on the left.



Calculus Functions

Derivatives -- DERIV(X)

The derivative is computed as the difference between two successive samples of the argument, x, divided by the inter-sample time increment, dt. The first (t=0) derivative value is set equal to the second (t=dt) value because of the lack of a previous x-value initially. DERIV has the same limitations in usage as INTEG has: it must not appear more than once in an entry line (because of a program shortcoming) and may not have POLY or CVF involved in an argument. The following are valid examples of the use of DERIV:

```
PLOT 1  X-AXIS:  SIN(D186)*DERIV(P002/P342)
        Y-CURVE 1:  POLY(DERIV(INTEG(M143-M107)),2),0,1000,50
        Y-CURVE 2:  INTEG(DERIV(M143-M107))/57.3,-5,5
```

Integration -- INTEG(X)

This integral is simply a weighted sum of sequential values of the integrand, x, where the weight is the time-interval, dt. The initial (t=0) value of the integral is zero. The integrand, x, may be a mathematical expression (but not POLY(..) or INTEG) or a simple itemcode. INTEG may itself be used in a mathematical expression, BUT cannot appear twice on the same entry line.

Valid examples:

```
PLOT 1: X-AXIS:  TRYINT=7.3*INTEG(P002^2)/3.14
        Y-CURVE 1:  POLY(INTEG(D747),3)
        Y-CURVE 2:  INTEG(M143-M107)
```

Cross-Plots

There is nothing special about specification of cross-plots in TIMEHIST. Simply specify the data-item or expression to be plotted against (the "independent variable") as the abscissa instead of TIME. TIMEHIST will handle the interpolation to synchronize the different time series if they should have different sampling rates or span different time intervals.

Cycle Averaging -- MRAZ

The primary purpose of the cycle-averaging feature is to plot time-history data for cyclic items against rotor azimuth, rather than against time. Conditions usually vary somewhat from cycle to cycle, however, so data from several consecutive cycles (rotor revolutions) may be averaged together to smooth out differences.

The keyword which invokes this feature is MRAZ, entered in the expression field of an x-axis response. The default for number of cycles to "average" is one. If two or more cycles are to be averaged, the number of cycles is appended in parentheses (e.g., MRAZ(3)). You may override the automatic labeling and scaling, if desired.

Examples: PLOT 1 X-AXIS: NULABL=MRAZ, 0, 360, 90
PLOT 2 X-AXIS: MRAZ(10) (10 revs)

See figures on page 3-28 for an example.

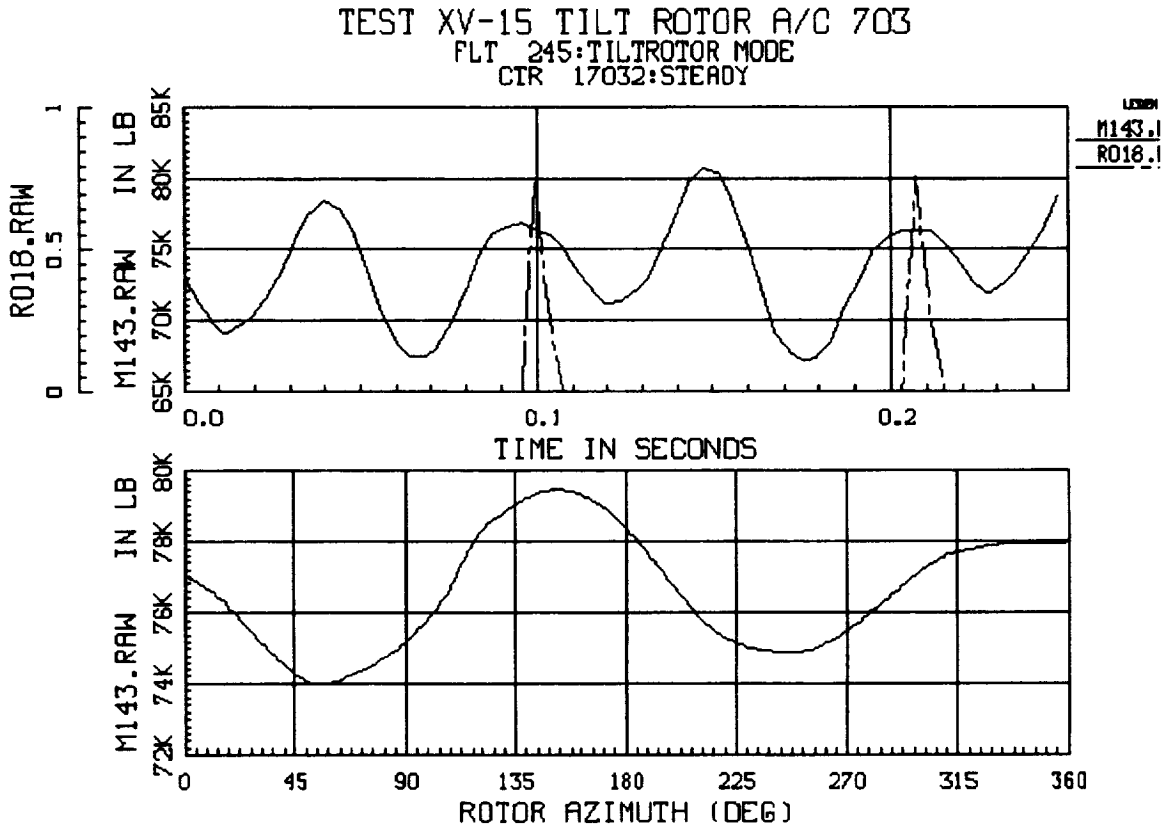
Rotor azimuth is usually synthesized from an available one-per-rev "blipper" signal and a database-dependent default phase angle (the azimuth when the "blipper" event occurs). If there is a bona fide recorded azimuth angle to be used in the cycle-averaging process instead of a blipper, it must be specified in an info-file(see Menu Reference Section; INFOFILE); otherwise, the blipper will be used to synthesize azimuth. The default phase angle can also be overridden (only) by use of an info-file entry. The cycle-averaging syntax in TRENDS does not permit specification of which cycle to start from; this can be done only by use of the INTERVAL keyword to specify a time slice. Rotor azimuth will usually not be zero when time is zero, so time-zero data samples will usually not be included in the average. The initial cycle to be used in the averaging is the first complete (full) cycle following the initial time requested. The time series to be averaged is interpolated to a series of evenly-spaced azimuth angles across each cycle.

TIMEHIST also recognizes the particular string, MRAZ, in expressions other than the first four characters of an x-axis response to mean "rotor azimuth." If MRAZ is used in an expression, TRENDS will synthesize an azimuth angle from the one-per-rev blipper.

Menu Items

- ***TIMEHIST***
  - ***CYCLE AVERAGING***
    - ***MRAZ***

```
                    ITEM
                    ----
PLOT 1  X-AXIS: T,0,0.25,0.1
    Y-CURVE 1 : M143.RAW
    Y-CURVE 2 : R018.RAW
    Y-CURVE 3 :

                    ITEM
                    ----
PLOT 2  X-AXIS: MRAZ(3), 0,360,45
    Y-CURVE 1 : M143.RAW
    Y-CURVE 2 :

                    ITEM
                    ----
PLOT 3  X-AXIS:


Enter the counter number(s) : 17032
```



The first curve in the first plot shows the RAW data type of mast torque, M143, plotted for a short time interval. The one-per-rev "blipper", R018, is superimposed in the same plot as the second curve. The lower plot is the result of averaging M143. RAW over three (3) cycles, plotted against rotor azimuth. Note the similarity of the lower curve to the part of the upper curve lying between blips.

Spectral Analysis – FREQ or FREQN

When FREQ is entered as the abscissa variable, the ordinate variable will be fed through an FFT computation to produce an amplitude spectrum which will be plotted versus frequency. FREQ may not be used in formulas or as an ordinate variable, but may be used with the forced label and scaling options. The default label is FREQUENCY (HZ) and the default scale is 0 to 60 Hz by 10 Hz. Only one spectrum will be drawn per plot, so you will get only one Y-CURVE prompt when x is FREQ. The ordinate variable may be any expression which would be valid if TIME were the abscissa. If you want to limit the time interval of the data for the FFT, use the INTERVAL feature (see page UG(36) to select the times. When FREQ is specified, the default data type changes from .TIM to .SPC, but if no .SPC data are available for the requested items. TRENDS will try to find .TIM data to use in the analysis. The default abscissa is frequency in HZ, but if you would like to plot versus "per-rev" or multiples of the rotor frequency, use FREQN rather than FREQ.

Convolution Filtering – CVF(x,co,w)

This feature provides an in-line filtering of the argument, x, with cutoff frequency, co, and window-type, w, using the convolution-filter algorithm from DATAMAP. The argument, x, may be a mathematical expression or a simple itemcode. The cutoff frequency, co, is a literal number in Hertz. The window flag, w, is 1 or 2:

w = 1 Half-cosine window
w = 2 Hanning window.

CVF may be used as an argument ONLY of the POLY function and may NOT be used in mathematical expressions. The reason for this limitation is that CVF is a post-processing function (after all of the samples of its argument have been computed and stored) and POLY is a post-post-processing function (computed after the x-column values and POLY-argument-column values have been computed and stored. The following are valid examples:

```
PLOT 1  X-AXIS: CVF(P342*12.,.2,1)
        Y-CURVE 1: POLY(CVF(P342,1,2),3)
        Y-CURVE 2: SMOOTH H (FT)=CVF(P342,5,1),2000,4000
        Y-CURVE 3: POLY(CVF(DERIV(INTEG(M143-M107)),.5,2),3)
```

Butterworth Filtering -- BF(x,co)

A third-order Butterworth filter operates on the argument, x, using a cut-off frequency, co, specified in Hertz. BF is a post-processing function like CVF, so it may not be part a formula, but can take a general expression in its argument and may be operated on by POLY.

Example: Y-CURVE 1: BFTORKDIF = BF(M143-M107,0.5)

Polynomial Regression -- POLY(X,n)

TIMEHIST permits curve-fitting by up to third-order polynomials. Polynomial fits of ordinates data to the abscissa data (y=f(x)) may be obtained as "y-curves" by a response of the form

POLY(expression,order)

The expression obeys the rules described earlier for mathematical expressions. The order is a number between 0 and 3, inclusive.

Order	Fit	
0	Constant or mean,	y=A
1	Straight-line,	y=A + B*x
2	Quadratic,	y=A + B*x + C*x^2
3	Cubic,	y=A + B*x + C*x^2 + D*x^3

The response may specify axis label and scaling overrides, but may not use POLY in a mathematical expression. The domain of the fit is over the range of the x-axis scales. Default axis scales for the polynomial curve itself are those which would automatically bound the unfitted expression(i.e., automatic ordinate scales for "expression"). When POLY is specified, the coefficients of the fit (A,B,C,D values) are shown in the legend of the plot.

Fourier Series Synthesis -- FSS(X,n)

TIMEHIST will synthesize a time series for the argument, X, as a truncated Fourier Series of n terms. This is a post-processing function like CVF and BF, so it cannot be used in a formula. The coefficients will be shown if the PRINT option (described later) is set.

Example: Y-CURVE 1: APPROX = FSS(F163.RAW,3)

(See Menu Ref. Sec IV, Special Timehist Topics (4-82))

Editing Plot Setups -- EDIT/RECALL/SAVE

If you have set up a plot page, but want to change one or two lines or add a plot, you may type EDIT or RECALL. TRENDS will show you the current numbered lines of your setup and prompt for the number(s) of the line(s) to be changed. Enter the number(s), then type the line(s) as you want it/them to be. At a null entry in response to "Lines to change:", TRENDS will parse your edited setup and move to the data-region prompt. Syntactical errors will return you to the editor. If you want to save the setup for later recall, type SAVE plus the filename. A file will be created in your directory with the extension -.PPG<db>. EDIT? or RECALL? will cause the names of your saved setups to be displayed. Typing "RECALL <filename without extension>" at an x-axis or data-region prompt will pull in the setup and leave you in the line-editing state for potential modification before execution. Refer to the "EDITING SETUPS" topic of Section V for elaboration of this feature.

The EDIT command, issued at the counter-region prompt, lets you modify one or more lines of your setup without returning to the setup-prompting mode. You may also use EDIT <filename> to recall a setup you saved earlier. If you wish to store away the setup you have, type SAVE or SAVE <filename>. The EDIT feature is described in greater detail in Section V.

Data Types

TIMEHIST recognizes four standard **time-history datatypes.** These types are TIM, SPC, RAW, and MMR. The default type is TIM; to specify one of the other types, follow the example:

Y-CURVE 1: F163.SPC or
Y-CURVE 1: F163S

These are equivalent ways of referring to the spectral (SPC) datatype of item F163. SPC is the default type for spectral analysis. If you refer to the minmax/rev (MMR) datatype, you will get as default a pseudo time history of the steady component of the data (see the discussion of "scalar measures" earlier in this section for a definition of "steady"). To plot the oscillatory part, prefix the specification by "OSC:", as in:

Y-CURVE 1: OSC:F163.MMR

Miscellaneous Setup/Specification Features

Storing Curves

The STORE command is used to name and store away curves (derived time histories) for later use. An example of this is:

```
Y-CURVE 1:  STORE HDOT = CVF(DERIV(P342/60),1,1)
```

When this specification is evaluated over a data region, HDOT will be stored in your file SCRATCH.KEY for each counter in the data region. HDOT would be used as follows:

```
Y-CURVE 1:  HDNOISE = DERIV(P342/60) - HDOT
```

The STORED? command will show you the existing stored curves. UNSTORE provides a dialogue to help you clean up SCRATCH.KEY.

Sorting/Ordering

The SORT: prefix on an x-axis expression causes the individual points of a cross-plot curve to be ordered by ascending values of the abscissa. The following example draws a filled-in ball.

```
PLOT 1 X-AXIS:      SORT:COS(360*TIME)
Y-CURVE 1:          SIN(360*TIME)
```

Wild-Card Specification

You may use the asterisk (*) in TIMEHIST to specify all or several of the stored time-history items to be plotted. Itemcodes which match your wild-card specification will be plotted with one, two orthree plots per page, but not with more than one curve per plot. Any single-item (not wild-card) x axis may be specified, including MRAZ and FREQ, but no formulas are currently permitted on the wild-card items. The following are valid examples of the syntax.

```
Y-Curve 1: *
Y-Curve 2:      (must be empty return -- only one curve/plot)
Y-Curve 1: P*
Y-Curve 1: P1*.RAW
```

If you want more than one plot per page, repeat the identical specification for each plot. TRENDS will cycle through the items. If you're into DATAMAP-style scratch files, you may use a syntax like:

```
Y-Curve 1: SCF3(*,4,BOT)
```

to plot all of the bottom 4th-row elements.

Data Region Syntax

The data-region prompt in TIMEHIST is:

Enter counter(s), "F"flights(s) or DCS filename :

Your response is either (1) one or more counters, (2) one or more flight numbers preceded by F, (3) one derived counter set (DCS), or (4) one of several commands or control options. Examples of the first three are:

Enter counter(s), etc. :	11208-11400,12210	(counters)
	F180,182-186,216	(flights)
	HELIMODE	(DCS)

To access XV15 hangar or ground runs, use H or G instead of F in the flights example. Responses cannot be mixed (i.e., counters with flights) and only one DCS can be used at one data-region entry. The prompt will be repeated after your plots are made, so you will get another chance to add data regions, maybe in another form. The numbers do not have to be in ascending order. The hyphen (-) in the example means "inclusive," as in "flights 182 through 186, inclusive."

The command/control options entered at the data-region prompt let you change such things as time intervals, hard-copy flags, titles, etc. Following treatment of the entered option, the "Enter counter(s)" prompt will be repeated. Only the first 3 characters of the options need be entered. The following options are available.

CACHE	Returns to caching operation
CACHED?	Displays cached files for current database
COUNTS	Plots or prints measured data in counts
EDIT {file}	Recalls plot setup for editing
ENSEMBLE	Enables multiple counters on one plot
FILE: or @	Specifies and opens ASCII file for reading data
INTERVAL	Sets time interval for plots or analyses
JKA?	Shows jukebox drive status
NOCACHE	Forces use of jukebox without caching
NOP	Returns PRINT to "plot"
PLTHDCPY	Lets you change the plot-hardcopy option
PRINT	Turns on print flag with optional switches
RESCALE	Enables overrides of current plot scales
SAVE {file}	Saves current plot setup
TERMINAL	Enables changing of terminal type
TITLE	Enables override of default plot titles
TSHIFT	Shifts curves relative to each other in time
VMS	Lets you issue VMS operating system commands
W80 or W132	Sets screen with to 80 or 132 characters
+ (cross-hair)	Toggles the cross-hair feature on/off
?	Obtains in-line help menu

Printing Time-history Data -- PRINT{/././.}

TIMEHIST can print the data instead of plotting. This capability can be used to write an ASCII file for hardcopy printing or for sending to another program or computer, as well as for simply viewing the numbers which would otherwise be displayed graphically. The PRINT command may be entered at any X-AXIS prompt or at the prompt for data region. This command simply sets the print-flags, after which the X-AXIS prompt or data-region prompt will be repeated. The print-flag will persist as long as the plot setup does not change and will be applied for as many counters as you wish to display. The CTRL-C can be used to interrupt printing and send control back to the data-region prompt. The PRINT command syntax includes six option switches which may be specified in any order, each set off with a slash (/) and with no imbedded blanks.

Option:

/O=filename	Output is written to "filename" (default .LIS)
/S=number n	Output only every "n-th" point (decimation)
/N	No screen-display while outputting to file
/E	Use scientific notation (E15.7)
/H	Display in hexadecimal after fixing data
/D=number n	Decimal places (F15.n, default=F15.5)

Valid examples:

```
PLOT 1  X-AXIS: PRINT
PLOT 2  X-AXIS: PRINT/N/S=2/OUT=POLYP342.DAT/E
Enter counter(s) etc.:  PRINT/D=3
```

The output format is for an index plus eight (8) data columns (8F15.5 or 8E15.7) with a second optional line if you specify more than 8 data columns for printing

Cross-hair(+) Measurement of Plot-points

This feature lets the user measure and (optionally) record x,y points in a plot by positioning cross-hairs and marking the points. The feature is available with any of the plotting applications in TRENDS except STRIPS and PERFPLOT. Your setup must have

1. only one plot (i.e., one x,y grid) per page and
2. only one y-scale (multiple curves at the same scale are OK)

To invoke the cross-hair feature, type a "+" at the prompt for data region (i.e., flight or counter). If your plot configuration is valid, you will see:

```
*** CROSS-HAIR CURSOR ON ***
DO YOU WANT TO STORE CROSS-HAIR DATA? (Y/[NO]) :
```

If your answer to the question is Y, you will be asked for a filename in which to record the registered points. The default filename is POINTS.DAT and the default extension is DAT. The + works as a toggle to turn off the cross-hair mode and close the file. Otherwise, the cross-hair mode stays on until you return to the main TRENDS menu and new measurements will be added to your recording file. For more information on this topic, see "Cross-Hair Measurements" in the Topical Reference Section V.

Time Slicing – INTERVAL=t1,t2

This feature permits the specification of the time interval of interest for plots. For frequency spectra for which only part of the available data is to be analyzed, this feature is quite useful. It is also useful in cross-plots of part of the data, in choosing the initial cycle for cycle averaging, or for homing in on a region of interest in the plot. The interval may be specified in the plot setup at an x-axis prompt. In that case, it abides for the current and later plots on the same page, but not for the next plot-page. Specified at the data-region prompt, it applies to the whole plot page. The following are valid examples.

```
PLOT 1  X-AXIS:  INT=3.4,5          (plot setup entry)

PLOT 1  X-AXIS:  P002,100,150
Y-CURVE 1:  POLY                    (M143,2),50000,100000

Enter counter(s) etc. : INT=3.4,5   (data-region entry)
```

The above example will use only those data samples which fall between 3.4 and 5 seconds from the beginning of the counter and will fit a polynomial of M143 in P002 through those which fall in the rectangle

```
        100 kts <= P002 <= 150 kts
50000 in-lb <= M143 <= 100000 in-lb )
```

TIMEHIST will also accept the name of an intervals file containing three columns: col 1=counter, col 2=t1, col 3=t2. The entry syntax is

```
Enter counter(s) etc. :  INT=SOMENAME.XXX
```

Custom Plot Headers – TITLE

This feature lets the user override one or all three of the title lines at the top of TRENDS plots. The default titles are application-dependent, but usually contain the aircraft tail number (database) and flight and counter descriptions. To override any of the title lines, enter TITLE at the prompt for flight or counter. For example,

```
Enter counter(s) etc.: TITLE
```

You will then be prompted as follows:

```
Enter the main (top) plot-title :
Enter upper sub-title :
Enter lower sub-title :
```

A simple carriage return (null entry) for any line gives the default auto-titling for that line. A space may be used to produce a blank line in the plot header. Your titles will persist (only) for the duration of your current session in TRENDS or until you change them.

Rescaling Plots Outside Setup -- RESCALE

This plotting feature lets you re-scale your x- or y-axes in TIMEHIST or MINMAX after you have scaled them during the setup phase or TRENDS has scaled them automatically. To invoke the re-scale feature, enter RES at the data-region prompt You will then be shown the existing scales for each plot on the plot-page. You will then be allowed to enter new scales and increments for each abscissa and ordinate on the page. A simple carriage return to the prompt means "no change."

Example:

```
     Current scale bounds for plot #1
X-axis: Min =  0.00  Max =   15.00  Delta =  5.00
Y-axis 1:      Min = 94000.0 Max = 102000.00  Delta = 2000.00
Y-axis 2:      Min = 90000.0 Max = 105000.00  Delta = 5000.00

New scale bounds for X-axis (Syntax: Min,Max,Inc. or AUTO) : 5,10,1
New scale bounds for Y-axis 1 (Syntax:Min,Max,Inc. or AUTO): AUTO
New scale bounds for Y-axis 2 (Syntax:Min,Max,Inc. or AUTO):
```

As you see in the example, AUTO may be used to let TRENDS autoscale a curve which has previously been given forced scaling. NOTE: The re-scales will not be automatically saved as part of a SAVEd plot-page setup file for recall with EDIT. Scales may be included in the SAVEd files, but only if they are entered as part of the plot-page setup procedure or with external editing.

Settings -- TERMINAL, PLTHDCPY, VMS, W80/W132

The control-option commands TERMINAL, PLTHDCPY, and VMS are available at the data-region prompt as well as from the main TRENDS menu. You may want to change settings, but don't want to leave TIMEHIST. Enter at least the first three characters of the command you want. After using one of these commands you will be prompted for counter(s) again.

The W80 and W132 commands set the screen width to 80 or 132 characters. These are used primarily with the PRINT option.

Curve-shifting -- TSHIFT

This feature lets you shift one curve left or right in time relative to another curve. For example:

```
Enter the counter number(s) : TSHIFT
Time shift for plot #1 [0.10] : .05
Time shift for plot #2 [0.00] :-.05
```

will cause the Y1 curve of plot #1 to be shifted to the left approximately 0.05 seconds relative to the abscissa (which need not be TIME) and to the Y2 curve, if there is one. The amount of shift actually used is not usually the exact value specified, but is rather at the resolution of the highest sampling rate of any of the variables involved in the plot. That is, the curves are not interpolated to satisfy the specified time-shift exactly. A negative time specification moves the abscissa and the Y2 curve (if any) to the left relative to the Y1 curve (i.e., the Y1 curve is shifted relatively right). The best way to understand this is to try it. Time-shifts are reset to zero when you set up a new plot page, but persist for changes of data region (i.e., different counters for the same plot setup) or until they are re-specified. Time shifts are not carried into STOREd time-histories (see STORE). STOREd time-histories may be shifted by means of the INT function.

Jukebox operations -- NOCACHE/CACHE, CACHED?, JKA?

If you use TRENDS on the NEP computer, you will often see:

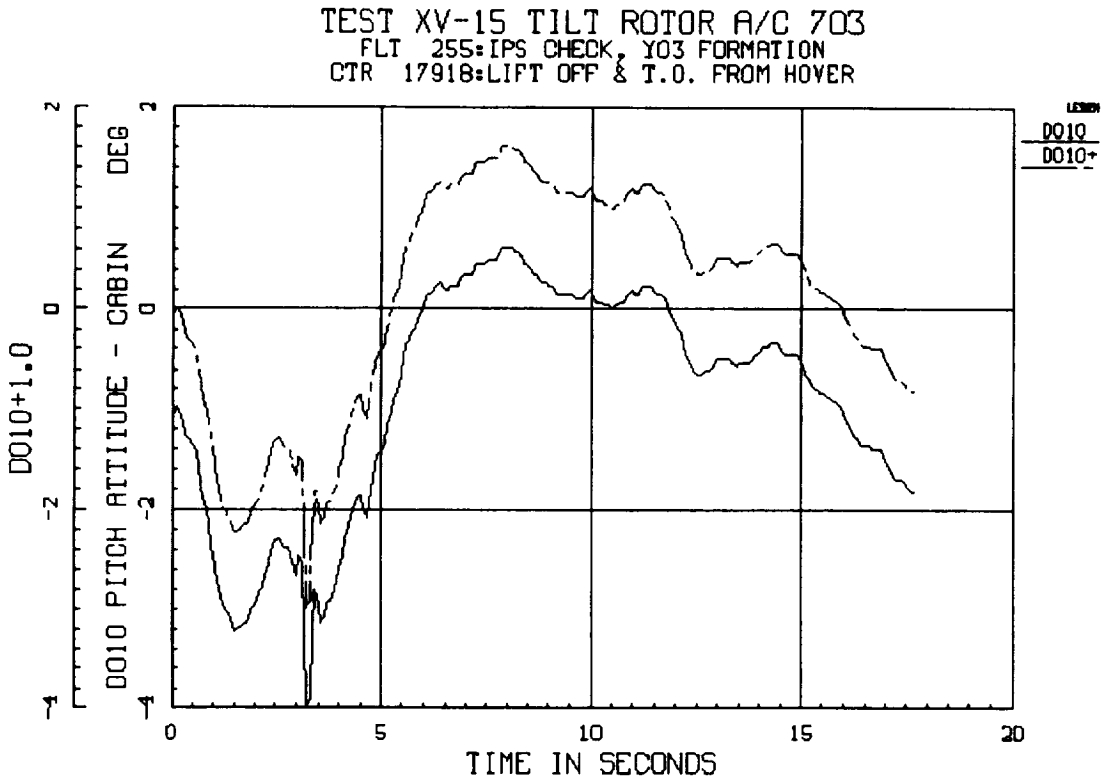
```
-- <filename> is not cached ... looking in the jukebox --
```

This refers to the laser-optical jukebox used to archive most of the TRENDS flight-test data at NASA/Ames -- and to an implemented procedure for restoring data temporarily to a magnetic disk for faster access and less contention for jukebox resources.

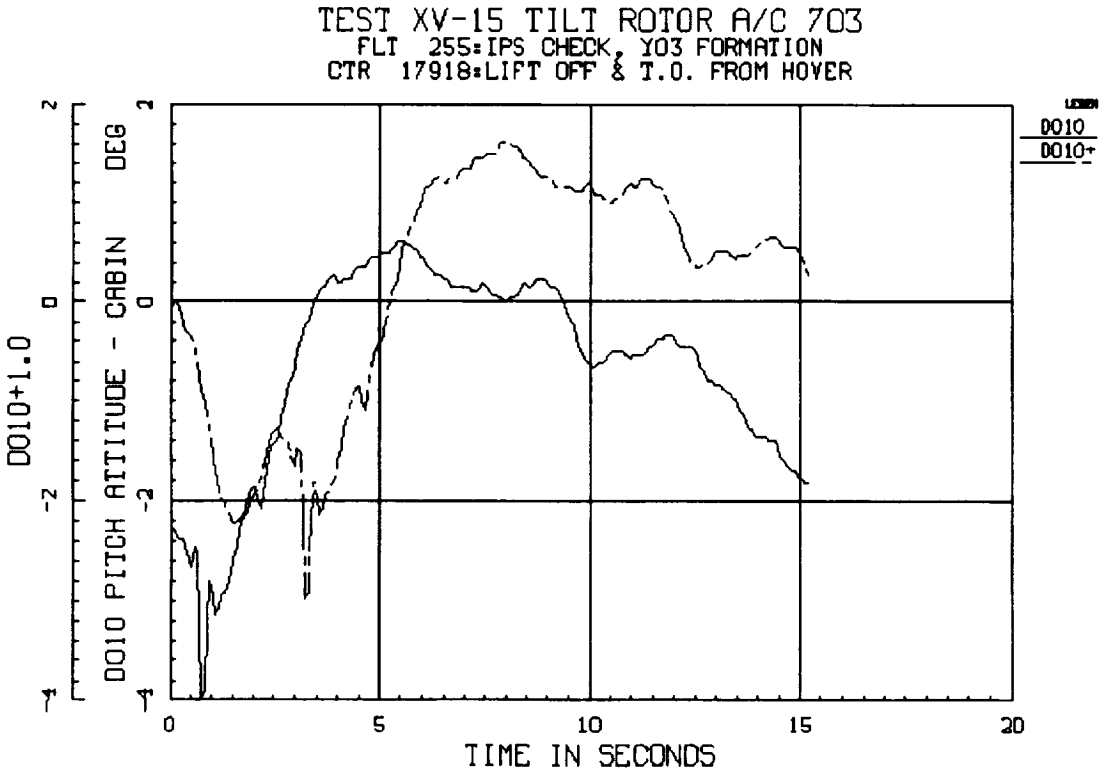
Most of the jukebox operations are automatic and transparent to the user. When a counter is requested, TRENDS will first check to see if the time-history file for that counter already resides on magnetic disk for opening and reading. If not, TRENDS will issue the commands to retrieve the file from the jukebox and standardly spawn a process to copy ("cache") it to magnetic disk while your plot is being made in TIMEHIST. The following jukebox-related commands are available.

NOCACHE	Do not read from or write to the cache
CACHE	Resume standard operation with caching
CACHED?	List the files (i.e., counters) currently cached
JKA?	Show current status of the jukebox's 4 drives

Time-Shift Example




```
Enter the counter number(s) : tshift

Time shift for plot #1 [-1.50] : -2.5

Enter the counter number(s) : 17918
```



Specifying ASCII input files -- FILE: or @

TIMEHIST can read from the user's properly-structured tabulated time-history file. It is named at the data-region prompt as follows:

```
Counter(s) etc. :  FILE: MYFILE.INP
Counter(s) etc. :  @MYFILE.INP
Counter(s) etc. :  @MYFILE.INP,2040,5160
```

This last example lists the (2) counters to be plotted as well as the filename. If counters are included in the specification, TIMEHIST will proceed to try to plot them. If not, you will be re-prompted for counter(s) and you can name them at that time, and TRENDS will remember the filename until you re-specify it. You cannot mix ASCII file data with normal database data, so the counters are unambiguous.
Specifications for ASCII input files may be found in the Topical Reference, Section V.

Concatenating counters -- APPEND:

You may want to concatenate some counters, especially for spectral analysis of some data item over a longer data span than is available for several short counters of interest. At the data-region prompt, enter:

```
Counter(s) etc. : APPEND:12425,12427-12429
```

to append counters 12425, 12427, 12428, and 12429. You may also enter a derived counter set (DCS) as in the following example.

```
Counter(s) etc. : APPEND:SHORTY
```

Multiple counters in one plot-- ENSEMBLE

You may want to plot curves of the same data item for several counters together. This can be done using the ENSEMBLE or ENS command at the data-region prompt..

```
Counter(s) etc. : ENS          (sets mode)
Counter(s) etc. : SHORTY       (DCS entry)
```

The command persists only for one plot, then reverts back to non-ensemble mode. ENSEMBLE is limited to one-plot-per-page setups. If scales are not forced by the user, the automatic scaling for the plot is determined from the first counter's data and later counters' data may not fit on the plot.

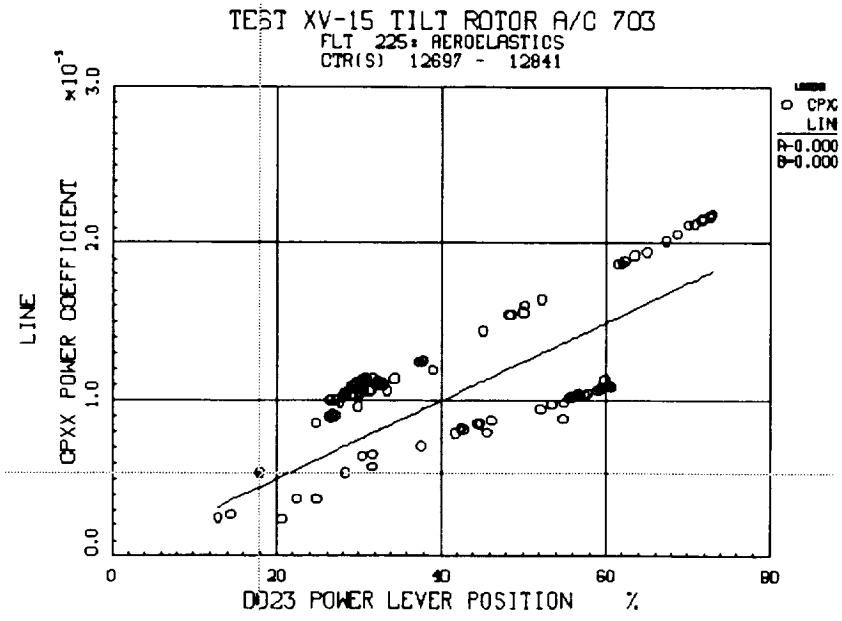
MINMAX

The MINMAX menu item is used for plotting statistical data for a range of counters. The following example illustrates its use.

Example:

```
                              TREMDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis     Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY      HELP
MC>TERMINAL       DATABASE       KEYS          PERFPLOT      HARMONIC     ITEMDEFS
YS>PLTHDCPY       LOGSCAN        VIEW          STRIPS        TSSTATS      DERIVED
   VMS CMDS       FLIGHTS        CPRINT        NORMALIZE     COMPARE      FILES
   EXIT           WORDSCAN       FIND          MINMAX        SCRATCHFILE  OUTDATA
                                 LOADS         MULTIPLT                   FUNCTIONS
                                 CALIBS        GEOPLOT                    INFOFILE

   YOUR CHOICE: MIN

   MINMAX  Plot min/max-per-counter data (statistical summaries)
```

```
Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

                ITEM
                ----
 PLOT 1  X-AXIS: D023
     Y-CURVE 1 : CPXX
     Y-CURVE 2 : LINE=POLY(.002*D023/80,1)"
     Y-CURVE 3 :

                ITEM
                ----
 PLOT 2  X-AXIS:

 Enter the flight(s), :counters (or DCS filename) : *_

*** CROSS-HAIR CURSOR ON ***

                        !!!  ATTENTION  !!!
You can now DELETE points (pickle with D) or SELECT points (pickle with S)

DO YOU WANT TO STORE CROSS-HAIR DATA (Y/[NO] : Y
[DEFAULT] = POINTS.DAT , ENTER FILENAME OR <CR> : DELPTS.OUT

 Enter the flight(s), :counters (or DCS filename) : 225_
```



Discussion of the Example

The preceding example illustrates not only the standard use of MINMAX to cross-plot two items for a range of counters, but also the use of the plot-editing (cross-hair) feature available in most of TRENDS' plotting programs. First, it should be noted that the plot-setup dialogue is identical to that already seen in TIMEHIST. MINMAX allows 1-3 plots per page and 1-3 curves per plot, just like TIMEHIST, although a curve is usually a set of discrete points here, rather than a line. Most of the rules for entry syntax are the same, although filters, cycle-averaging, calculus functions and such are, of course, not applicable to MINMAX.

The particular plot shown in the example displays derived power coefficient, CPXX, versus power-lever position, D023. The resulting plot shows that the CPXX data fall into two near-linear sets. Investigation reveals that the two sets are for different RPM settings -- one at 85% of full and the other at 96%. The straight line shown in the example results from the expression entered at the "Y-CURVE 2" prompt. The entry says "fit and plot a first-order polynomial through the equation:

.002 * D023 / 80

and label it LINE on the plot." The quotation (ditto) mark at the end of the entry says to find a common scale for all curves of the plot and to suppress display of a second y-scale. You may ask why the line was plotted. It was an empirically determined line drawn simply to illustrate a capability. Without POLY, the points of the line would be plotted as discrete symbols. Each curve is plotted with a different symbol and identified in the legend. The A and B seen under the legend in the example are values of the polynomial coefficients. The slope, B, is too small to be shown in the example, where the right margin was truncated.

Cross-Hair Point Editing

The example also shows how to tell TRENDS to turn on the cross-hair mode (See "Cross-Hair Measurements" in the Topical Reference Section V) to measure and register plot points. Digital values of registered points are saved in a file called DELPTS.OUT. The file will be complete with labels and titles as well as numerical data.

The plot setup shown in the example has only one plot on the page and only one y-scale. This is the only configuration for which TRENDS permits the cross-hair mode to be used.

Section IV: Menu Reference

Introduction

This section discusses each of TRENDS' menu items, listed alphabetically. Each menu item's discussion begins with the menu as you will see it, showing the item highlighted with its brief description shown. Following the main menu, the first response by TRENDS is shown, along with some description of how to exploit the feature. When control of an item is by cascaded menus, little description is necessary. Not all sub-menu options are shown in this manual, but are left for the user to explore in TRENDS.

CALIBS

```
                              TRENDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                 LOADS         MULTIPLT                    FUNCTIONS
                                 CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE:

   CALIBS          View calibration data by item and flight                 _
```

```
                          CALIBRATION DATA FOR A/C 703
  LOOK FOR : PITCH HOUSING
  FLIGHTS : 244_
```

```
                          CALIBRATION DATA FOR A/C 703
  LOOK FOR : PITCH HOUSING                                        SAMPLE
FLT BOX SEQ ITEM LOC   UNITS      SCALE          BIAS        RATE/DEC    DESCRIPTION
F244 C  15 F224  12-0  IN-LB  P    49.546          20604.     251/1   LT RED PITCH HOUSING
F244 C  16 F225  13-0  IN-LB  P    49.177          8490.4     251/1   LT RED PITCH HOUSING
F244 C  17 F226  14-0  IN-LB  P    49.409          2699.9     251/1   LT RED PITCH HOUSING
F244 C  18 F227  15-0  IN-LB  P  0.00000E+00    0.00000E+00            LT RED PITCH HOUSING
F244 C  19 F228  16-0  IN-LB  P    49.596         -5252.2     251/1   RT RED PITCH HOUSING
F244 C  20 F229  17-0  IN-LB  P    49.460         -3810.9     251/1   RT RED PITCH HOUSING
F244 C  21 F230  18-0  IN-LB  P    4002.8     -0.23202E+07    251/1   RT RED PITCH HOUSING
F244 C  22 F231  19-0  IN-LB  P    49.793          5539.8     251/1   RT RED PITCH HOUSING
 <Hit RETURN to continue>
```

Calibration values are stored by item and flight. Selecting CALIBS, your first prompt is "LOOK FOR:" and you may specify all or part of the itemcode (e.g., "A0") or part of the sensor description (e.g., "HOUSING") or a space or asterisk (*) for everything. An empty return sends you back to the main menu. After a non-null answer to "LOOK FOR:" you will be prompted for "FLIGHTS." Answer with one or more flight numbers. After showing the information for the item and flight specifications, you will be asked for flights again. A null entry backs up to the "LOOK FOR:" prompt again.

Header Descriptions

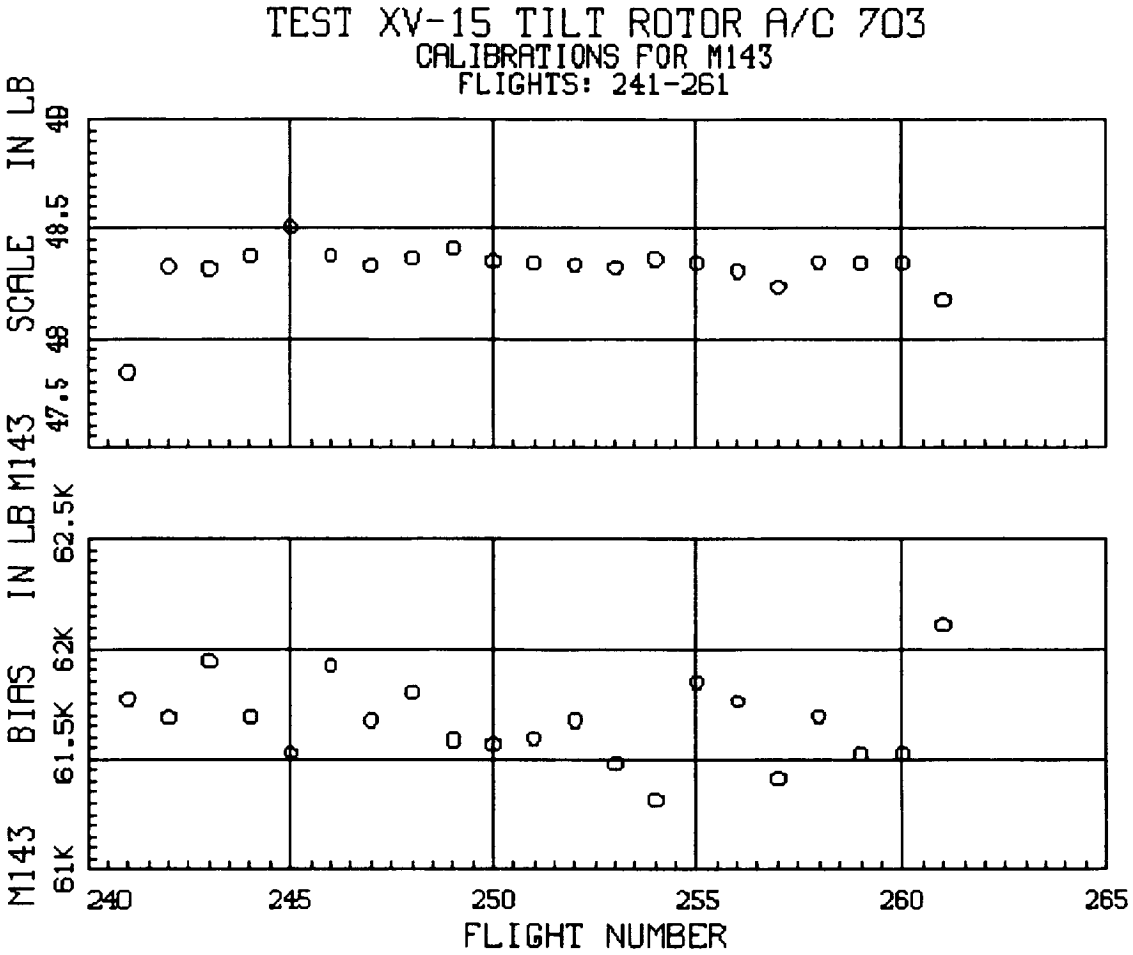
FLT = Flight Number; BOX = 1 of 3 data acquistions systems called BOX A, BOX B, & BOX C; SEQ = Item Line number in this summary calibration report; ITEM = Item Code parameter name; LOC = Parameter location in telemetry stream (First number is parameter Main Frame location, second number is parameter subcom location in frame); Units = parameter units, Scale & Bias = Parameter calibration, RATE/DEC = original sample rate on aircraft/DEC= rate that data is stored in TRENDS, e.g. 251/1 means data sampled at 251 samples/sec./DEC = 1 = no decimation; Description = Parameter description.

Example of plotted calibration data over multiple flights.

```
                              TRENDS Main Menu

    Control          Descriptive      Numer
703>TAIL NO.         PROJECT          SEARC
 GR>TERMINAL         DATABASE         KEYS
 YS>PLTHDCPY         LOGSCAN          VIEW
    VMS CMDS         FLIGHTS          CPRIN
    EXIT             WORDSCAN         FIND
                                      LOADS
                                      CALIB

                    CALIBRATION DATA FOR A/C 703
                    RETURN - Return to TRENDS main menu
                    SEARCH - Search Calibration file
                    PLOT   - Plot scale and bias
                    HELP   - Call ITEMDEFS                              S

    YOUR CHOICE: CAL

    CALIBS          View calibration data by item and flight
```

```
ITEMCODE(S) : M143
   1 MATCH TO YOUR SPEC
 FLIGHTS : 241-261_
```

Patience, Collecting the data



COMPARE

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS         CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN        FIND          MINMAX        SCRATCHFILE   OUTDATA
                                  LOADS         MULTIPLT                    FUNCTIONS
                                  CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE: COM

   COMPARE          Compare time histories across counters or databases
```

COMPARE
****

This TRENDS feature lets you compare time histories:

1. between databases (e.g., 702 and 703, BH1, 748, and BH2
2. between counters of the same database.

The control, or reference, database is the currently active one. You will be given the opportunity to name the other (second) one. COMPARE has some limitations at this time, but you may do most of the things you can do in TIMEHIST. The primary limitations are that TIME must be the abscissa and that ONLY ONE (1) counter may be specified as data region for each database. Only two databases can be compared at a time.

Since it is unlikely that the data being compared will align properly in time, the TSHIFT command should be used at either or both of the counter prompts to shift the curves into time alignment.

Current (first) data source is 703

Source choices are : BH2 BHD 702 703 XU3 736 741 742 748 TS1 U22 QSR BH1

SIM

Second source : 702

OK. We will compare 702 against 703

COMPARE (Use "?" for TIMEHIST help)

The syntax for plot setup looks like TIMEHIST's, with the following conventions:

PLOT n X-AXIS : (must be T or TIME with optional scaling)

Y-CURVE 1 : (applies to current or reference database)

Y-CURVE 2 : (applies to database to be compared)

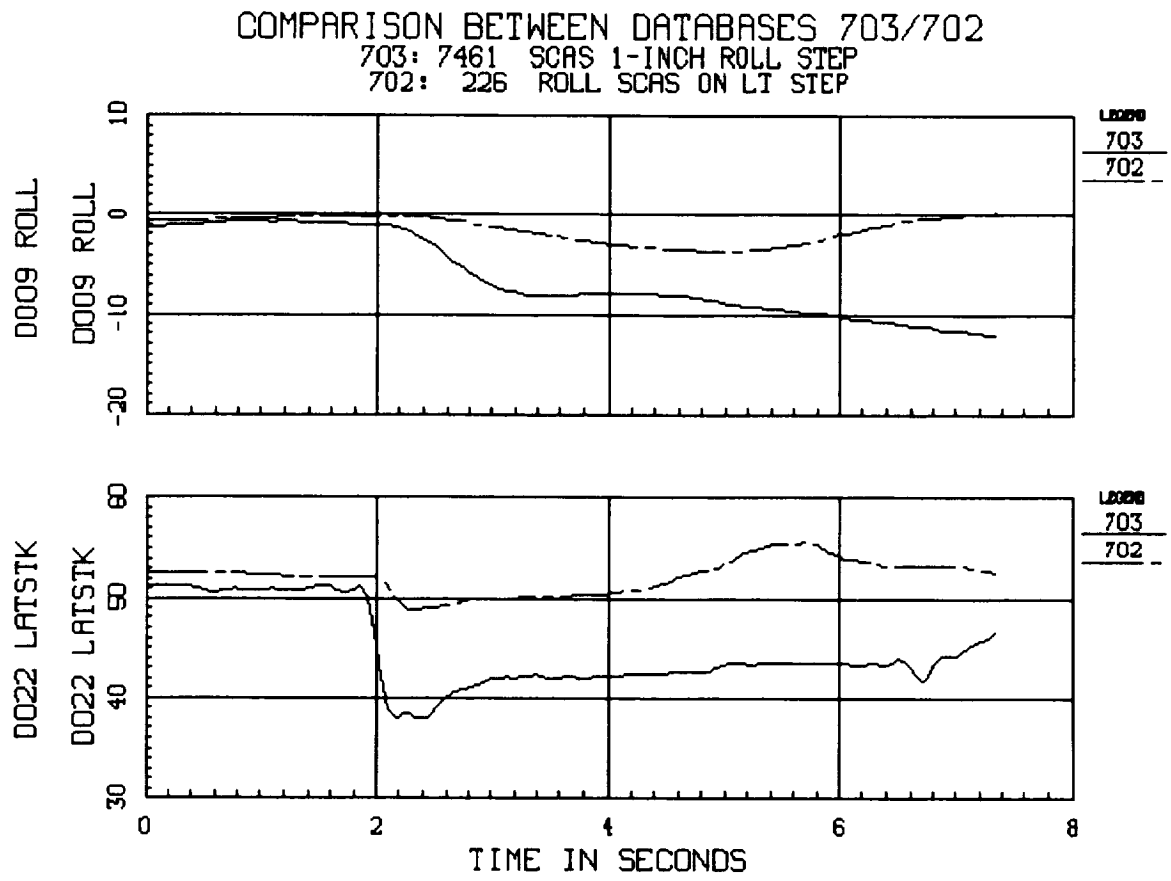
There are two prompts for data region:

Enter first counter : (enter ONE counter from current database)

Enter second counter: (enter ONE counter from comparison database)

********** enjoy ! **********

```
Enter itemcode, TIME or (cr) when prompted
and, optionally, the scale min,max,inc.

                    ITEM
                    ----
 PLOT 1  X-AXIS: T
     Y-CURVE 1 : D009 ROLL=D009
     Y-CURVE 2 : D009 ROLL=D009"

                    ITEM
                    ----
 PLOT 2  X-AXIS: T
     Y-CURVE 1 : D022 LATSTK=D022
     Y-CURVE 2 : D022 LATSTK=D022"

                    ITEM
                    ----
 PLOT 3  X-AXIS:

 Enter first counter (for 703) : 7461

 Enter second counter (for 702) : 226
```



◆ ***SETUP EXAMPLE***

CPRINT

```
                              TRENDS Main Menu

    Control        Descriptive    Numerical   Plotting     Analysis     Usage
703>TAIL NO.       PROJECT        SEARCH      TIMEHIST     GATEWAY      HELP
 MC>TERMINAL       DATABASE       KEYS        PERFPLOT     HARMONIC     ITEMDEFS
 YS>PLTHDCPY       LOGSCAN        VIEW        STRIPS       TSSTATS      DERIVED
    VMS CMDS       FLIGHTS        CPRINT      NORMALIZE    COMPARE      FILES
    EXIT           WORDSCAN       FIND        MINMAX       SCRATCHFILE  OUTDATA
                                  LOADS       MULTIPLT                  FUNCTIONS
                                  CALIBS      GEOPLOT                   INFOFILE

    YOUR CHOICE: CP

    CPRINT         Print item statistics in your own custom format
```

```
                     CUSTOMIZED PRINTING
                     *******************

          Enter a format filename [PRINTFILE.703] or ? or MAKE : mjb1
           AIRSPEED            ALTITUDE            DIFFERENCE
           M143
           M107
           P342

       Enter flight(s), :counter(s) or DCS : 244

              Flight   244

              ---------------------------------------------------
      (703)   AIRSPEED            ALTITUDE            DIFFERENCE
              M143
              M107
              P342
              ---------------------------------------------------

      16951      3.46               -50                  686
           31566.27
           30879.69
              -50.42

      16952     15.60                -8                  373
          100657.46
          100283.61
               -8.05
```

* *

The above example makes use of an existing custom format file, MJB1.FMT703, which defines the data items to be plotted, their positions, and number of decimal places. CPRINT contains a prompting capability to make such a format file. The keyword MAKE at the first prompt will invoke this capability and lead you through the steps, as shown on the next page.

```
   Enter a format filename [BASICS.FMT703] or ? or MAKE : MAKE

 Enter a filename (e.g. PRINT1) : TESTCONDS

 Enter an expression : P002

 Enter a pseudonym (<= 10 chars) [Def=P002] : AIRSPEED

  Places to the right of the decimal [2] :

AIRSPEED=P002

 Enter an expression : P342

 Enter a pseudonym (<= 10 chars) [Def=P342] : ALTITUDE

  Places to the right of the decimal [2] : 0

AIRSPEED=P002 ALTITUDE=P342,0

 Enter an expression : M143-M107

 Enter a pseudonym (<= 10 chars) [Def=M143-M107] : TORK_DIFF

  Places to the right of the decimal [2] : 0

AIRSPEED=P002 ALTITUDE=P342,0 TORK_DIFF=M143-M107,0

 Enter an expression :

 OK. NEW LINE.

 Enter an expression : D186

 Enter a pseudonym (<= 10 chars) [Def=D186] : PYLON_ANG

  Places to the right of the decimal [2] :

PYLON_ANG=D186

 Enter an expression : R338*6.01

 Enter a pseudonym (<= 10 chars) [Def=R338*6.01] : ROTOR_RPM

  Places to the right of the decimal [2] :

PYLON_ANG=D186 ROTOR_RPM=R338*6.01

 Enter an expression :

 OK. NEW LINE.

 Enter an expression :

           AIRSPEED  ALTITUDE  TORK_DIFF
           PYLON_ANG ROTOR_RPM

        Enter flight(s), :counter(s) or DCS : 244

              Flight   244

               ------------------------------
       (703)   AIRSPEED  ALTITUDE  TORK_DIFF
               PYLON_ANG ROTOR_RPM
               ------------------------------

       16951     3.46       -50       686
                90.17    537.59

       16952    15.60        -8       373
                89.70    539.34

       16953    11.85        20      -693
                89.62    538.14

       16954     9.35        -8     -1111
                89.70    538.88

       16955    46.28        76      2565
                72.56    551.86
```

DATABASE

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical      Plotting       Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS      FLIGHTS         CPRINT         NORMALIZE      COMPARE       FILES
    EXIT          WORDSCAN        FIND           MINMAX         SCRATCHFILE   OUTDATA
                                  LOADS          MULTIPLT                     FUNCTIONS
                                  CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE:

    DATABASE      Show a brief summary of data in the base
```

```
                              TRENDS Main Menu

   Control        Descriptive                                              ge
703>TAIL NO.      PROJECT                                                  P
 MC>TERMINAL      DATABASE                                                 MDEFS
 YS>PLTHDCPY      LOGSCAN                                                  IVED
    VMS CMDS      FLIGHTS                                                  ES
    EXIT          WORDSCAN                                                 DATA
                                                                           CTIONS
                                                                           OFILE
    YOUR CHOICE: DA

    DATABASE      Show a brief

                  A/C 703 Database Summary
                  Return to Main Menu
              TH  All available Time History data
              HQ  Handling Qualities - Filtered
              AER Aeroelastics       - Filtered
              MVR Maneuvers          - Filtered
              SPC Spectrals          - Unfiltered
              HRM Harmonics          - Unfiltered
              CNV Conversions        - Unfiltered
              XFR Transfer Functions - Unfiltered
              MMR Minmax/Rev
              MMC Available Minmax/Counter Data
              FLT Flights with Narrative Data
              DSC Show Brief Descriptions
```

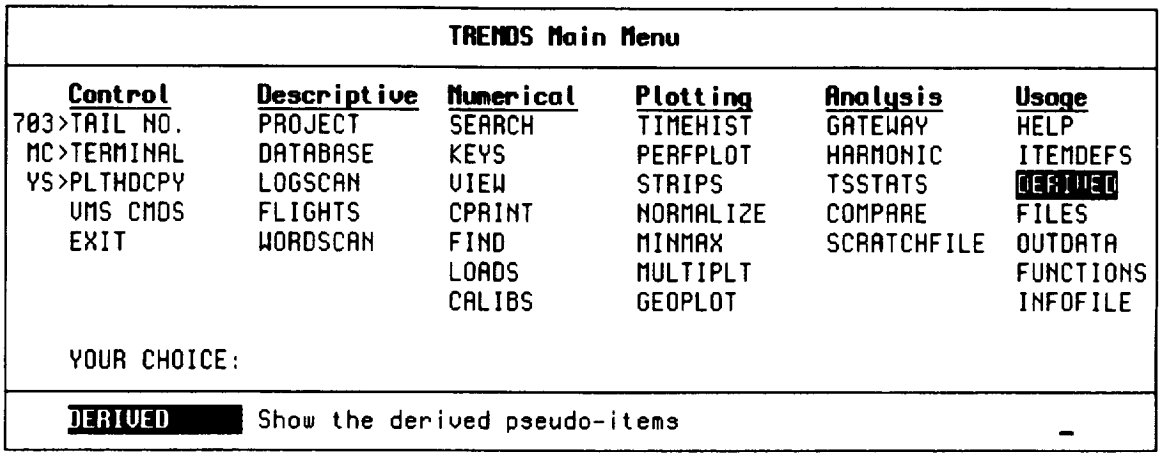
Use the DATABASE menu-item to scan data types. Note in the above sub-menu, the **AER** flight category has been selected. Raw data is not available in this category. The sub-menu allows the user to easily select flight/s whose primary function falls into one or more of the categories that are shown in the sub-menu. In WORDSCAN one can also see the type of parameter data taken for each test point.

```
The A/C 703 filtered-TIME-HISTORY database includes these flights:counters

AEROELASTICS:      204:11403-11419     208:11560-11616     217:12110-12129
                   205:11431-11443     212:11863-11867
                   207:11482-11544     213:11885-11889
```

In the above printout are shown Flights and counters for which data are available in the form:

	FLIGHT:	first counter	–	last counter
e.g.	204 :	11403	–	11419

DERIVED



DERIVED
****

The following derived pseudo-items are available
in minmax/counter, average-steady form

AILD	AT AILERON RATE (SLOPE D645)	DEG/S	AILD
ALFD	ANGLE OF ATTACK (D008) RATE	DEG/S	ALFD
BETD	SIDESLIP RATE (SLOPE D007)	DEG/S	BETD
CDUR	COUNTER DURATION	SECOND	CDUR
CPXX	POWER COEFFICIENT		CPXX
CRPM	COMPUTED RPM	RPM	CRPM
CTXX	THRUST COEFFICIENT		CTXX
DNLD	DOWNLOAD COEFFICIENT		DNLD
ETIM	ELAPSED TIME SINCE ENGINES ON	MINUTE	ETIM
FLPD	FLAP ANGLE RATE (SLOPE D617)	DEG/S	FLPD
GOVD	GOV. LVDT RATE (SLOPE E719)	%/S	GOVD
GWJW	GROSS WT USING ADJ FUEL WEIGHT	LBS	GWJW
GWT0	RAMP GROSS WEIGHT	LBS	GWT0
GWT1	GROSS WEIGHT, FUEL WT METHOD	LBS	GWT1
GWT2	GROSS WEIGHT, FUEL FLOW METHOD	LBS	GWT2
HDFT	DENSITY ALTITUDE	FEET	HDFT
HDOT	CLIMB/DESCENT RATE(SLOPE P342)	FT/SEC	HDOT
IASD	AIRSPEED RATE (SLOPE P002)	KNOT/S	IASD

Hit RETURN to continue.

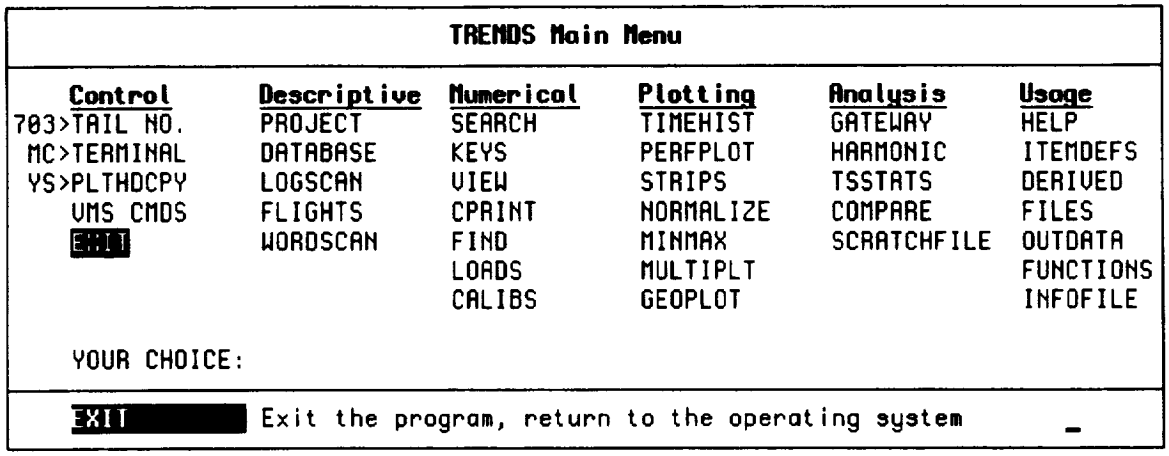
KCAS	CALIBRATED AIRSPEED	KNOTS	KCAS
KTAS	TRUE AIRSPEED	KNOTS	KTAS
OATC	CORRECTED TEMPERATURE	DEG C	OATC
P1WX	ADJUSTED HORSEPOWER	HP	P1WX
PCAD	PYLON CONVERSION RATE	DEG/S	PCAD
PHID	ROLL ANGLE RATE (SLOPE D009)	DEG/S	PHID
RHPN	NORMALIZED HP (RSHP/SIGP)	HP	RHPN
RSHP	ROTOR SHAFT HORSEPOWER	HP	RSHP
SIGP	DENSITY RATIO		SIGP
TDAY	COUNTER START TIME OF DAY	MINUTE	TDAY
THTD	PITCH ANGLE RATE (SLOPE D010)	DEG/S	THTD
TOCG	C.G. FOR RAMP GW	INCHES	TOCG

End of list. Hit RETURN to continue.

Type return to return to the menu.
Type * to see the formulas.
Type a string to search the formulas (12 characters, max).

LOOK FOR :

EXIT



This keyword in TRENDS terminates the program and returns control to the command level ($ prompt) of the VMS operating system.

As you exit from TRENDS, you will be prompted for whether or not you want to print any log files (menu-item.TRX<db>) e.g. VIEW.TRX703, created during the current session and whether you want to route any hard-copy plot (DIP) files to one of the hardcopy devices available at ARC.

TRENDS purges your TRX and DIP files automatically at exit, keeping the two (2) highest versions of each. If you don't want this to happen, you should not use EXIT, but abort the run with CTRL-Y. You may want to copy or rename your TRX or DIP files before calling TRENDS, now that you know they will be purged.

Example

$ You have created the following typable list-files during this session:

FIND.TRX703
VIEW.TRX703

$ Do you want to print any? (Y/[N]) : Y
Print FIND.TRX703 ? (Y/[N]) : <cr> (don't print)
Print VIEW.TRX703 ? (Y/[N]) : Y (laser-printed at Ames)

FILES


```
                              TRENDS Main Menu

   Control        Descriptive    Numerical      Plotting       Analysis       Usage
703>TAIL NO.      PROJECT        SEARCH         TIMEHIST       GATEWAY        HELP
 MC>TERMINAL      DATABASE       KEYS           PERFPLOT       HARMONIC       ITEMDEFS
 VS>PLTHDCPY      LOGSCAN        VIEW           STRIPS         TSSTATS        DERIVED
   VMS CMDS       FLIGHTS        CPRINT         NORMALIZE      COMPARE        FILES
   EXIT           WORDSCAN       FIND           MINMAX         SCRATCHFILE    OUTDATA
                                 LOADS          MULTIPLT                      FUNCTIONS
                                 CALIBS         GEOPLOT                       INFOFILE

   YOUR CHOICE:

   FILES          Scan user-created files
```

<< FILES >>

FILES enables you to list, delete, or copy user-generated files. The syntax is similar to VMS command syntax for these functions, but not identical.

Syntax: Command{optional suffix} space filespec

If you enter only the command (no filespec), you will be prompted for filespec. The COPY command will only pull (no pushing!). You have to confirm all deletes.

File types *.DCS = Derived Counter Set files
*.MSK = Mask files (from SEARCH)
*.ITM = Item-list files from FIND

commands	suffixes	filespecs	examples
DIR	T = today	*.DCS	DIRT *.DCS (all DCS files today)
DEL	M = month	*.MSK	DEL DUM.MSK (delete one file)
		NOTE:	DEL REQUIRES CONFIRMATION TO DELETE
TYPE	Y = year	*.ITM	TYPM [AMESFHP.MJB]ROD*.*
COPY	/B:date	*.*	COPY FHT0:[AMESFHP.MJB]NEW.*
none=exit	/S:date	*string*.*	DIR/B:1-JAN-1986/S:22-AUG-85 *HOV*.DCS

```
Command : _
```

FIND

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical      Plotting       Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW           STRIPS         TSSTATS       DERIVED
   VMS CMDS       FLIGHTS         CPRINT         NORMALIZE      COMPARE       FILES
   EXIT           WORDSCAN        FIND           MINMAX         SCRATCHFILE   OUTDATA
                                  LOADS          MULTIPLT                     FUNCTIONS
                                  CALIBS         GEOPLOT                      INFOFILE

   YOUR CHOICE: FIN

   FIND           Find counters with data for time-history items
```

```
                              TRENDS Main Menu

   Control        Descriptive     Numeri
703>TAIL NO.      PROJECT         SEARCH
 MC>TERMINAL      DATABASE        KEYS
 YS>PLTHDCPY      LOGSCAN         VIEW
   VMS CMDS       FLIGHTS         CPRINT
   EXIT           WORDSCAN        FIND
                                  LOADS
                                  CALIBS

                    FIND TIME-HISTORY DATA
                RETURN     - Return to TRENDS main menu
                ITEMCODES  - List available counters
                COUNTER    - List available items
                DATATYPE   - Itemcodes by datatype

   YOUR CHOICE:

   FIND           Find counters with data for time-history items
```

FIND is used usually as a last resort to find time-history data. When one is plotting in TIMEHIST, or other plot routines, and finds that data cannot be plotted or that certain paramter plots are missing, one should use FIND in order to determine if there was any time-history data for the group of parameters being plotted for the user-requested counter numbers. FIND can also be used to take a Derived Counter Set (DCS) and check it to see if all the parameters which are to be plotted exist prior to the actual plotting of those parameters.

```
Enter 1-5 itemcodes (or ?) : P002,P342,M143_

                    AVAILABLE STORED DATA FOR A/C 703
                      .TIM      .SPC      .RAW      .MMR      .HAP      .MMC
P002        CTRS  3255         0       538         0         0       ALL
          FIRST  2862         0      7406         0         0       CTRS
           LAST 18198         0     18198         0         0

P342        CTRS  3255         0        48         0         0       ALL
          FIRST  2862         0     17419         0         0       CTRS
           LAST 18198         0     18198         0         0

M143        CTRS  3259       146       549       287       296       ALL
          FIRST  2862      2958      7406      2958      2958       CTRS
           LAST 18198     13793     18198     11298     11633

(TIM,SPC,RAW,MMR,HAP,MMC,?) : _
```

```
(TIM,SPC,RAW,MMR,HAP,MMC,?) : TIM
Enter Flight(s), :counter(s) or DCS filename :    249_
```

AVAILABLE TIM DATA FOR FLIGHT 249			
COUNTER	P002	P342	M143

AVAILABLE TIM DATA FOR FLIGHT 249

17406 MIN POWER	41.4	41.5	41.5
17408 STEADY IGE	16.9	17.0	17.0
17414 STEADY 98%	17.3	17.4	17.5
17418 DECEL @ LT TURN	23.5	23.3	23.5

```
Enter Flight(s), :counter(s) or DCS filename :  _
```

TRENDS Main Menu

Control	Descriptive	Numeri
703>TAIL NO.	PROJECT	SEARCH
MC>TERMINAL	DATABASE	KEYS
YS>PLTHDCPY	LOGSCAN	VIEW
VMS CMDS	FLIGHTS	CPRINT
EXIT	WORDSCAN	FIND
		LOADS
		CALIBS

FIND TIME-HISTORY DATA

```
RETURN     - Return to TRENDS main menu
ITEMCODES  - List available counters
COUNTER    - List available items
DATATYPE   - Itemcodes by datatype
```

YOUR CHOICE:

FIND Find counters with data for time-history items

```
Enter one counter number: 12697_
```

```
COUNTER : 12697   FLIGHT :  225     MIN POWER
      There are    93 items for counter 12697
                   91 items of type: TIM
```

A005	A019	A020	A300	A301	A302	A304	A352
A380	D007	D008	D009	D010	D011	D021	D022
D023	D024	D025	D026	D027	D156	D157	D158
D159	D160	D161	D181	D182	D183	D184	D185
D186	D281	D284	D305	D306	D307	D308	D309
D314	D315	D317	D318	D327	D349	D509	D510
D617	D645	D646	D746	D747	D799	D800	E717
E718	E719	E720	E721	E722	E723	E724	E748
E749	E750	E751	F030	F031	F033	F162	F163
F164	F187	F188	F189	M107	M143	P002	P342
R106	R328	R329	R338	R339	R503	R515	T322
V015	V016	V017					

TRENDS Main Menu

Control	**Descriptive**	**Numeri**
703>TAIL NO.	PROJECT	SEARCH
MC>TERMINAL	DATABASE	KEYS
YS>PLTHDCPY	LOGSCAN	VIEW
VMS CMDS	FLIGHTS	CPRINT
EXIT	WORDSCAN	FIND
		LOADS
		CALIBS

FIND TIME-HISTORY DATA

RETURN - Return to TRENDS main menu
ITEMCODES - List available counters
COUNTER - List available items
DATATYPE - Itemcodes by datatype

YOUR CHOICE:

FIND Find counters with data for time-history items

TIME HISTORY DATATYPES

HQ	HANDLING QUALITIES OR PERFORMANCE ITEM CODES
MVR	MANEUVERS ITEMCODES (IN ADDITION TO ALL HQ ITEMS)
AER	AEROELASTIC ITEMCODES--FILTERED
RAD	RADAR AND LASER ITEMCODES
SPC	SPECTRAL ITEMCODES
HRM	HARMONIC ITEMCODES (SUB-LIST OF SPECTRAL ITEMS)
HAP	HARMONIC AMPLITUDES AND PHASES
CNV	CONVERSION RATE ITEMCODES
XFR	TRANSFER FUNCTION ITEM CODES
ARO	AEROELASTIC ITEMCODES--NOT FILTERED
BLD	BLADE ITEMCODES
RWA	RAW WING AEROELASTIC ITEMCODES
SPL	SPECIAL LIST OF ITEMCODES--UNFILTERED
MMR	MINMAX/REV ITEMCODES
TIM	FILTERED DATA INCLUDING HQ, MVR, AER
RAW	FULL COUNTER, UNFILTERED DATA

```
Choices : (HQ  MVR AER RAD SPC HRM HAP CNV
           XFR ARO BLD RWA SPL MMR TIM RAW ) : MVR_

No MVR data available for A/C N703

Choices : (HQ  MVR AER RAD SPC HRM HAP CNV
           XFR ARO BLD RWA SPL MMR TIM RAW ) : _
```

FLIGHTS

♦ *FLT. TEST CONFIG EXAMPLE*

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical        Plotting         Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH           TIMEHIST         GATEWAY        HELP
 MC>TERMINAL        DATABASE         KEYS             PERFPLOT         HARMONIC       ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW             STRIPS           TSSTATS        DERIVED
    VMS CMDS        FLIGHTS          CPRINT           NORMALIZE        COMPARE        FILES
    EXIT            WORDSCAN         FIND             MINMAX           SCRATCHFILE    OUTDATA
                                     LOADS            MULTIPLT                        FUNCTIONS
                                     CALIBS           GEOPLOT                         INFOFILE

    YOUR CHOICE:

    FLIGHTS         Display some or all flight descriptions
```

FLIGHTS is used to allow the TRENDS user to understand the purpose of the flight and to see what the aircraft configuration was at the time of the flight test. Also one is able to search for descriptive words that may be in any flight description to determine when such events occurred, e.g. a search on "SCAS" would provide the user with the flight numbers where SCAS was of interest.

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical        Plotting         Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH           TIMEHIST         GATEWAY        HELP
 GR>TERMINAL        DATABASE                                                         EMDEFS
 YS>PLTHDCPY        LOGSCAN                                                          RIVED
    VMS CMDS        FLIGHTS                                                          LES
    EXIT            WORDSCAN                                                         TDATA
                                                                                     NCTIONS
                                                                                     FOFILE
    YOUR CHOICE:

    FLIGHTS         Display some

                    Flight Descriptions
                    RETURN to TRENDS main menu
                    BRIEF FLIGHT INFO
                    FLIGHT NOTES
                    FLT TEST CONFIGURATION
                    POST-FLIGHT
                    COUNTER TYPES
                    DATA TAPES
                    MINMAX DATASETS
                    ALL FLIGHT INFO
                    SEARCH DESCRIPTIONS
```

```
Enter Flight(s) 218

  AIRCRAFT:  703              STOL PERFORMANCE AT CROWS        T/O GW: 14961
    FLIGHT:  218 (G270)    LOCATION: CROW                         CG: 300.4
  FLT DATE: 21 OCT 86      COUNTERS:  12168- 12261      HRS TO INSP:  25.0
  DIRECTOR: MAISEL           PILOTS: WILSON/MORRIS         FLT TIME:   3.2

CONFIGURATION: TACAN ANTENNA RECONNECTED.
               REPLACED S/N 3 TRIM ACTUATOR WITH S/N 5 FORCE FEEL ACTUATOR.
               PUT LEFT TRIM ACTUATOR IN PLACE OF FF ACTUATOR.
               TO FACILITATE OTHER MAINTENANCE:
                   REMOVED LOWER BELLY PANEL AT STA 240.
                   LH UPPER POWER LEVER REMOVED.
```

```
        Flight Descriptions
RETURN to TRENDS main menu
BRIEF FLIGHT INFO
FLIGHT NOTES
FLT TEST CONFIGURATION
POST-FLIGHT
COUNTER TYPES
DATA TAPES
MINMAX DATASETS
ALL FLIGHT INFO
SEARCH DESCRIPTIONS
```

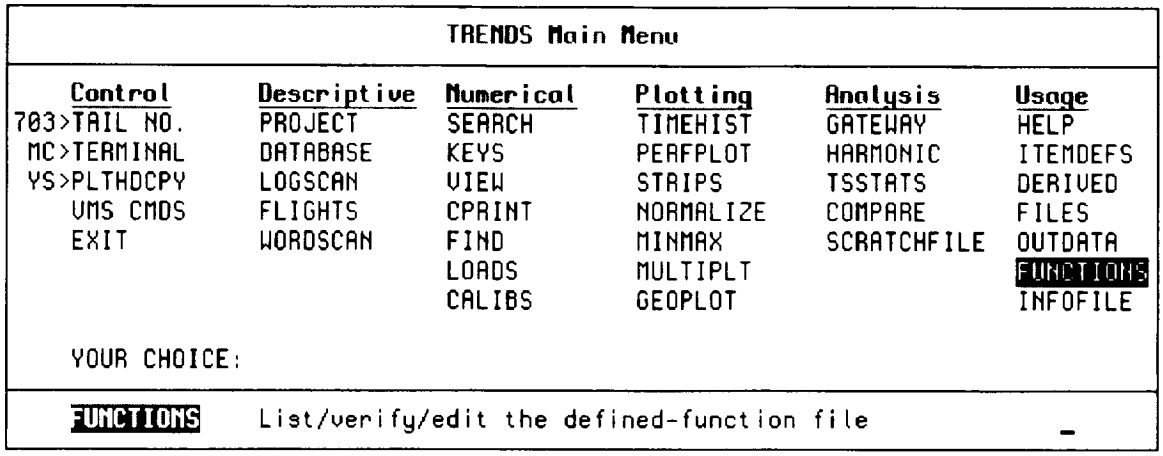
```
LOOK FOR : HOV

Enter Flight(s) : 240-250
     HOV was not found in flight  240
     HOV was not found in flight  241
     HOV was not found in flight  242
     HOV was not found in flight  243
     HOV was not found in flight  244
     HOV was not found in flight  245
     HOV was not found in flight  246
     HOV was not found in flight  247
********************************************************************************



   AIRCRAFT:  703              HOVER FLIGHT                        T/O GW: 14050
     FLIGHT:  248 (G333)     LOCATION: ARC                            CG: 300.1
   FLT DATE: 31 JAN 91       COUNTERS:  17356- 17369      HRS TO INSP:   8.0
   DIRECTOR: WELLMAN           PILOTS: SIMMONS/TUCKER       FLT TIME:   0.0
                HOVER FLIGHT
********************************************************************************


   AIRCRAFT:  703              HOVER & LOW SPEED FLT               T/O GW: 14050
     FLIGHT:  249 (G334)     LOCATION: ARC                            CG: 300.1
   FLT DATE: 22 FEB 91       COUNTERS:  17404- 17434      HRS TO INSP:   7.9
   DIRECTOR: WELLMAN           PILOTS: TUCKER/MORRIS        FLT TIME:   0.0
              HOVER AND LOW SPEED FLIGHT EVLAUATION IN HELICOPTER MODE

********************************************************************************


   AIRCRAFT:  703              HOVER & LOW SPEED FLT EVA           T/O GW: 14050
     FLIGHT:  250 (G335)     LOCATION: ARC                            CG: 300.1
   FLT DATE:  6 MAR 91       COUNTERS:  17460- 17507      HRS TO INSP:   7.5



Enter Flight(s) : _  CR

NOTE:  Your searches have found the following list of Flights.
Enter LIST to retrieve them.
   248   249   250

Do you want to save a DCS of the flights [N] ?  CR
```

NOTE:

One can enter "LIST" for the "Enter flight" prompt and get a complete list of all flights that one has had a successful search on.

```
Enter Flight(s) : LIST_
```

FUNCTIONS



FUNCTIONS allows a user to define a formula with a single name which then can be called out in any of the plot routines (MINMAX or TIMEHIST) or SEARCH menu items in TRENDS. e.g. In the user function file below GWM, SPEEDFS, COSWT, etc have been defined. In addition, one can define a parameter lookup table, e.g. in the user function file below DEMOTAB (X, Y) and TENT (X, Y) tables have been defined. These look-up tables can be used as follows: TENT(P002) would perform a lookup on the parameter P002 and do a straight line interpolation from the TENT table to determine the new value of P002. Arithmetic functions of 1, 2, or 3 arguments may also be defined.

```
!Table Lookup 1
DATA DEMOTAB (1,101,  2,202,  3,303,  4,404,  5,505,  6,606,  7,707,  8,808,
9,909,  10,1001, 11,1111, 12,1212,  13,1313, 14,1414, 15,1515,  16,1616)
!-------------------------------------------------------------------
!Table Lookup 2
DATA TENT (0,0, 100,100, 200,0)
!-------------------------------------
GWM=12600-(R320+R321)
SIN2010=10*SIN(7200*TIME)+(5*SIN(3600*TIME))
AVGQ=(M107+M143)/24
SPEEDFS=P002*1.69
COSWT=COS(360*TIME)
SINWT=SIN(360*TIME)
ARITH(X$,y$)=(X$^2+(Y$^2))^0.5
 Edit the function-file ? (Y/[N]) : _
```

NOTE:

Function files are database specific and can be edited outside of TRENDS, but this is not recommended, because TRENDS will check all parameter names and syntax for validity. Function file names are:

e.g. Functions.703
Functions.748
etc.

GATEWAY

♦ *DATAMAP*

```
                              TRENDS Main Menu

    Control        Descriptive     Numerical     Plotting      Analysis      Usage
703>TAIL NO.       PROJECT         SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL       DATABASE        KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY       LOGSCAN         VIEW          STRIPS        TSSTATS       DERIVED
    VMS CMDS       FLIGHTS         CPRINT        NORMALIZE     COMPARE       FILES
    EXIT           WORDSCAN        FIND          MINMAX        SCRATCHFILE   OUTDATA
                                   LOADS         MULTIPLT                    FUNCTIONS
                                   CALIBS        GEOPLOT                     INFOFILE

    YOUR CHOICE: GA

    GATEWAY        Branch out of TRENDS to DATAMAP or a simulation
```

```
                              TRENDS Main Menu

    Control        Descriptive     Numerical     Plotting      Analysis      Usage
BH2>TAIL NO.       PROJECT         SEARCH        TIMEHIST      GATEWAY       HELP
 GR>TERMINAL       DATABASE        KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY       LOGSCAN                                                   DERIVED
    VMS CMDS       FLIGHTS                                                   FILES
    EXIT           WORDSCAN                                                  OUTDATA
                                                                             FUNCTIONS
                                                                             INFOFILE
    YOUR CHOICE: GA

    GATEWAY        Branch o
```

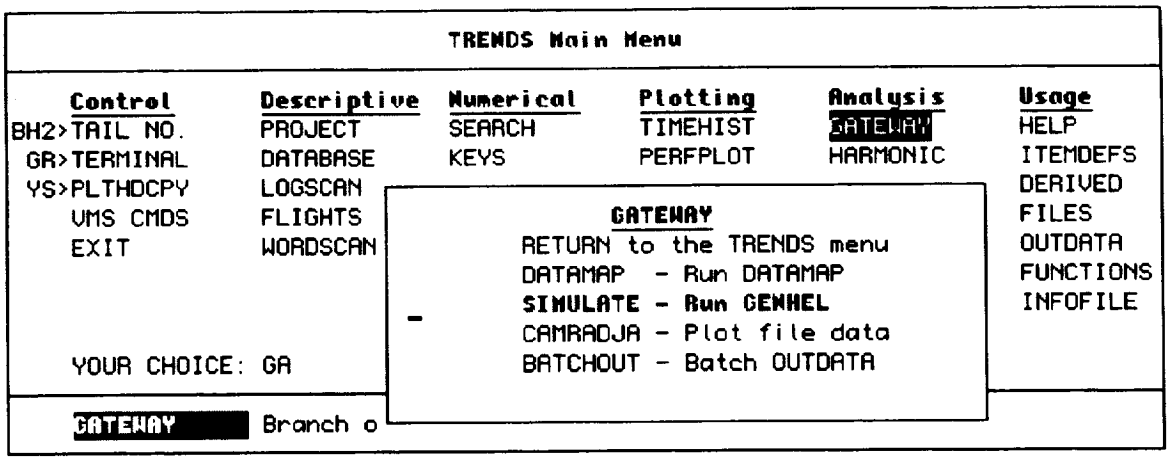
```
                    GATEWAY
          RETURN to the TRENDS menu
          DATAMAP  - Run DATAMAP
          SIMULATE - Run GENHEL
          CAMRADJA - Plot file data
          BATCHOUT - Batch OUTDATA
```

```
  USERNAME = "703DFLT.USR"
  NOW INITIALIZING DATAMAP
%DCL-I-SUPERSEDE, previous value of DMDFLTUSR has been superseded
 ---------- DATAMAP COMMAND PROCEDURE ------------
TYPE "RESTART" IN RESPONSE TO ANY "Data:" PROMPT
IN ORDER TO RETURN TO THIS POINT IN THE PROCEDURE.
ENTER NUMBER TO SELECT DESIRED OPERATION:
    1 = RUN PROCESSING PROGRAM INTERACTIVELY
    2 = RUN PROCESSING PROGRAM IN BATCH
    3 = TRANSFER BHT-GCD FORMAT DATA TO MASTER FILE
    4 = TRANSFER DTF FORMAT DATA TO MASTER FILE
    5 = EXIT

Data:
```

```
                *** DATAMAP Version 5.7 ***

          DATAMAP (VERS 5.7  - 06/20/91) - PROCESSING PROGRAM


            NASA ARC
 ENTER OPERATING MODE:
   1 = BATCH
   2 = INTERACTIVE (NO PLOTS)
   3 = INTERACTIVE GRAPHICS (TEKTRONIX NEEDED)
3


     RUN SETTINGS:                                    KEYWORD
  TERMINAL DATA RATE 960 CHARACTERS/SECOND            'LINE'
  ROTOR MODE 'MAIN'                                 'MAIN','TAIL'
  PLOT GRID MODE  'GRID'                           'GRID','NOGRID'
  PLOT TICS MODE 'NOTICS'                          'TICS','NOTICS'
  PLOT FRAME WIDTH 12.00 INCHES                       'PWID'
  OPERATOR PEN PLACEMENT IN 'X' -1.50 INCHES          'PENX'
  OPERATOR PEN PLACEMENT IN 'Y'  0.50 INCHES          'PENY'
  PRINT BLOCKS OF 5 LINES/BLOCK   6/PAGE              'BLOCKS'
  SCRATCH FILES SIZE (EACH)  900 RECORDS            'FILESIZE'
  SCRATCH FILES ARE PERMANENT                      'TEMP','PERM'
  CPU SECONDS TO TRIGGER WARNING900.00                'WARN'
  STEP EXECUTION TIMES WILL NOT BE PRINTED        'STEP','NOSTEP'
  DEFAULT TAIL #          703                         'A-C#'
  DEFAULT DATA TYPE: TIM                              'TYPE'

  ENTER 'YES' TO ACCEPT THESE VALUES OR
  A KEYWORD TO MODIFY A SETTING.
```

NOTE:

See DATAMAP Appendix in this manual for an introductory description of DATAMAP.



Simulation Using GTRSIM

The Generic Tilt-Rotor Simulation (GTRSIM) at NASA/Ames Research Center (ARC) is a revised version of a program (IFHC80) which was developed by Bell Helicopter Textron (BHT) for design and analysis of tilt-rotor aircraft. GTRSIM was developed at ARC by Systems Technology, Inc. (STI) under NASA contract. Its features include:

1. Two distinct rotors represented by algebraic equations
2. Aerodynamic tables and equations for each component of the airframe (fuselage, wing, pylon, horizontaland vertical stabilizers, control surfaces and wake effects),
3. The entire control system, including phasing and mixing,
4. The engine, drive system and controls,
5. Rotor collective governor,
6. Stability and control augmentation system (SCAS),
7. Landing gear aerodynamics.

GTRSIM can be accessed through TRENDS. Selecting SIMULATE from the GATEWAY menu initiates a guided procedure for helping you to set up input for a run, execute GTRSIM and display results of the run. Complete instructions for GTRSIM's use are very well documented in NASA Contractor Report CR-166535, "Generic Tilt-Rotor Simulation (GTRSIM) User's and Programmer's Guide, Volume 1: User's Guide," by G.D. Hanson and S.W. Ferguson of STI. GTRSIM's input and output procedures have been somewhat modified from those found in the User's Guide to assist the TRENDS user to set up runs and execute interactively. The TRENDS interface is a command procedure which presents the following menu.

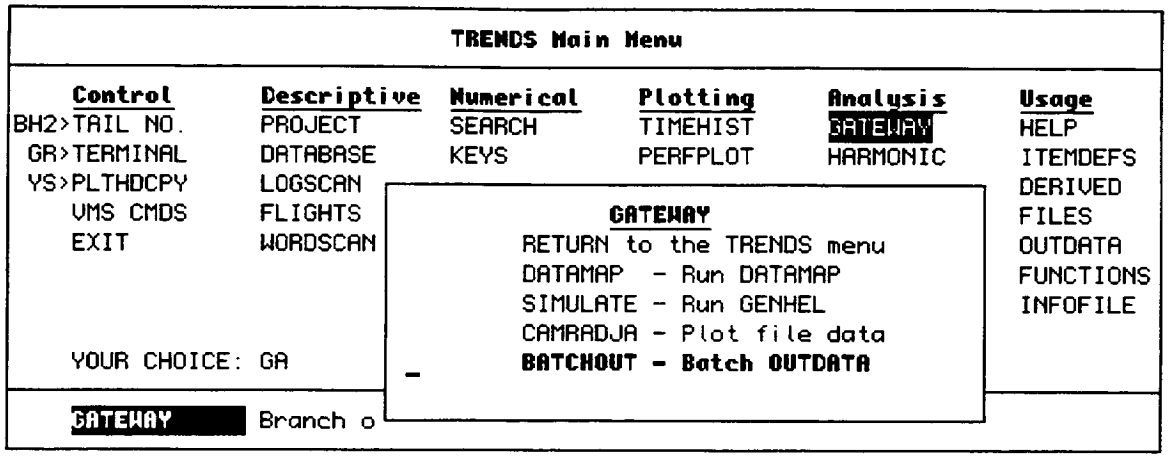
Generic Tilt-Rotor Simulation

The simulation options are:

MC	Modify model configuration parameters
PI	Prepare input for the simulation
RS	Run the simulation program, GTRSIM
TS	Tabulate (print out) sweep results
PS	Plot the sweep results
PM	Plot maneuver (time-history) results
EX	Exit to TRENDS program

NOTE:

For more information on the running of GTRSIM, see Section VII.




```
Name of OUTDATA input script (or ? or PROMPT): prompt

     Supply a name: outfile

   Opening new file: outfile


  Enter a counter number:                    18047
  Name the output file []:                   TP18047
  Enter data items (or LIST:,GROUP:)         P002, P342
  Enter more items:
  Enter a print interval []:
  Enter output rate in samples/sec []:
  Enter a counter number:

        Contents of outfile
-------------------------------------------------------------------------------
Enter a counter number:                    : 18047
Name the output file []:                   : TP18047
Enter data items (or LIST:,GROUP:)         : P002, P342
Enter more items:                          :
Enter a print interval []:                 :
Enter output rate in samples/sec []:       :
Enter a counter number:                    :
Type the file now?                         :
-------------------------------------------------------------------------------

   OK ([Y]/N): y

   OK. Now submitting OUTDATA batch
Job BATCHOUT (queue TRENDS_SPAWN$BAT, entry 881) started on TRENDS_SPAWN$BAT
```

- *BATCH*
- *OUTDATA*

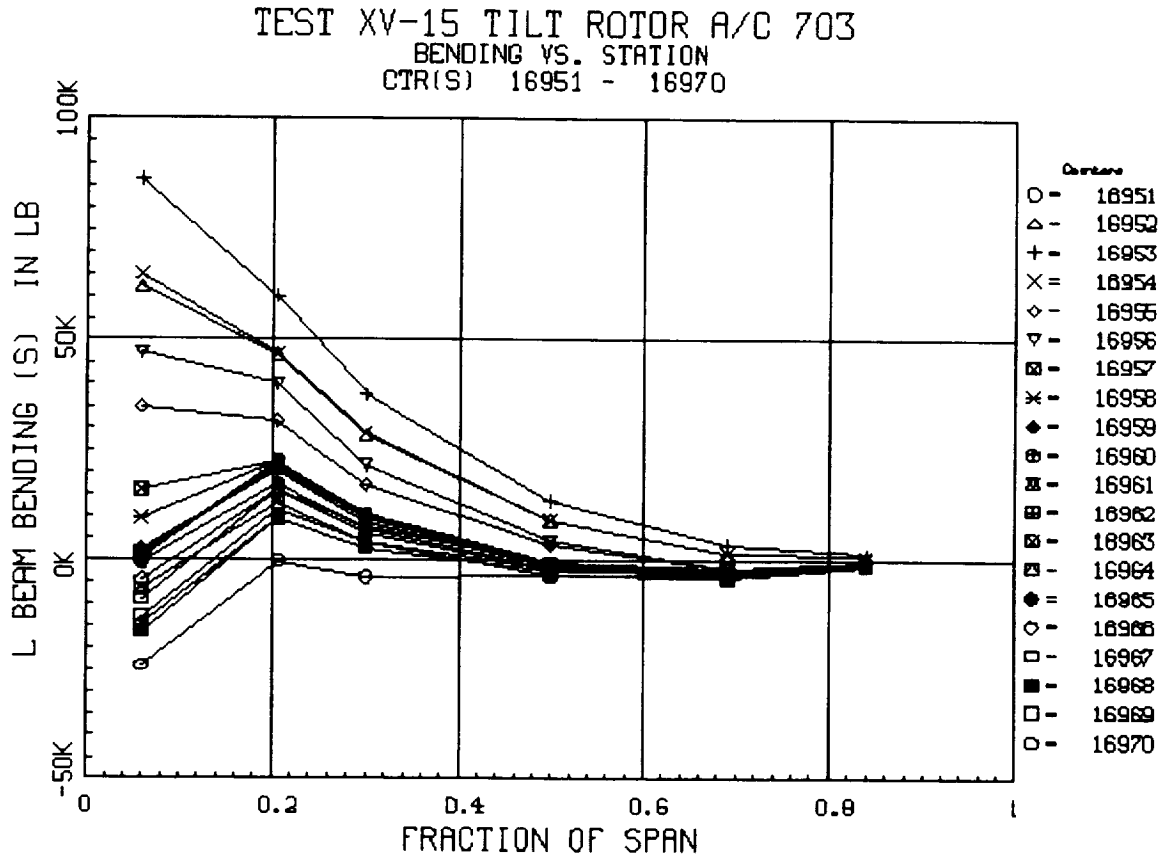
C-2

GEOPLOT

```
                              TRENDS Main Menu

   Control      Descriptive   Numerical    Plotting     Analysis     Usage
703>TAIL NO.    PROJECT       SEARCH       TIMEHIST     GATEWAY      HELP
 MC>TERMINAL    DATABASE      KEYS         PERFPLOT     HARMONIC     ITEMDEFS
 YS>PLTHDCPY    LOGSCAN       VIEW         STRIPS       TSSTATS      DERIVED
   VMS CMDS     FLIGHTS       CPRINT       NORMALIZE    COMPARE      FILES
   EXIT         WORDSCAN      FIND         MINMAX       SCRATCHFILE  OUTDATA
                              LOADS        MULTIPLT                  FUNCTIONS
                              CALIBS       GEOPLOT                   INFOFILE

   YOUR CHOICE: GE

   GEOPLOT      Display minmax statistics vs. sensor location
```

```
                                GEOPLOT
                                *******

        Displays blade bending moments vs. station

        Output is being echoed to GEOPLOT.TRX

                    PRE-ATB BENDING SENSOR LAYOUT
              STATION   LT BEAM   RT BEAM  LT CHORD  RT CHORD
                 9.0       B114      B112      B115      B113
                22.8       B130      B120      XXXX      XXXX
                52.5       B132      B122      B133      B123
                75.0       B134      B124      B135      B125
               112.5       B136      B126      B137      B127

                    POST-ATB BENDING SENSOR LAYOUT
              STATION   LT BEAM   RT BEAM  LT CHORD  RT CHORD
                 9.0       B114      B112      B115      B113
                30.9       B036      B034      B037      B035
                45.0       B046      XXXX      B047      XXXX
                75.0       B050      XXXX      B051      XXXX
               103.5       B040      B038      B041      B039
               126.0       B044      B042      B045      B043


     Your choices are : LB for Left Beam
                        RB for Right Beam
                        LC for Left Chord
                        RC for Right Chord

                        *** OR ***
IF YOU HAVE AN INFOFILE.703, YOU MAY ENTER A GEOMETRIC GROUP FROM IT.

With GROUP:, you may enter a "?" or such as:
       FYUR            for 1-dimensional groups
       S2PA(*,3)(TOP)  for 2-D double-row groups

Please enter GROUP:xxxx or LB, RB, LC, or RC : LB

     Your choices are :  S for steady
                         O for (average) oscillatory
                         M for (max) oscillatory
                         OS or SO for oscillatory plus steady

 Please enter S, O, M, or OS : S

>>> Note: Enter PRINT to list without plotting.

 Enter flight(s), :counter(s) or DCS : 244_
```

```
Sorry, but I must limit you to 20 counters.
Your first 20 are:
 16951   16952   16953   16954   16955   16956   16957   16958   16959   16960
 16961   16962   16963   16964   16965   16966   16967   16968   16969   16970
```

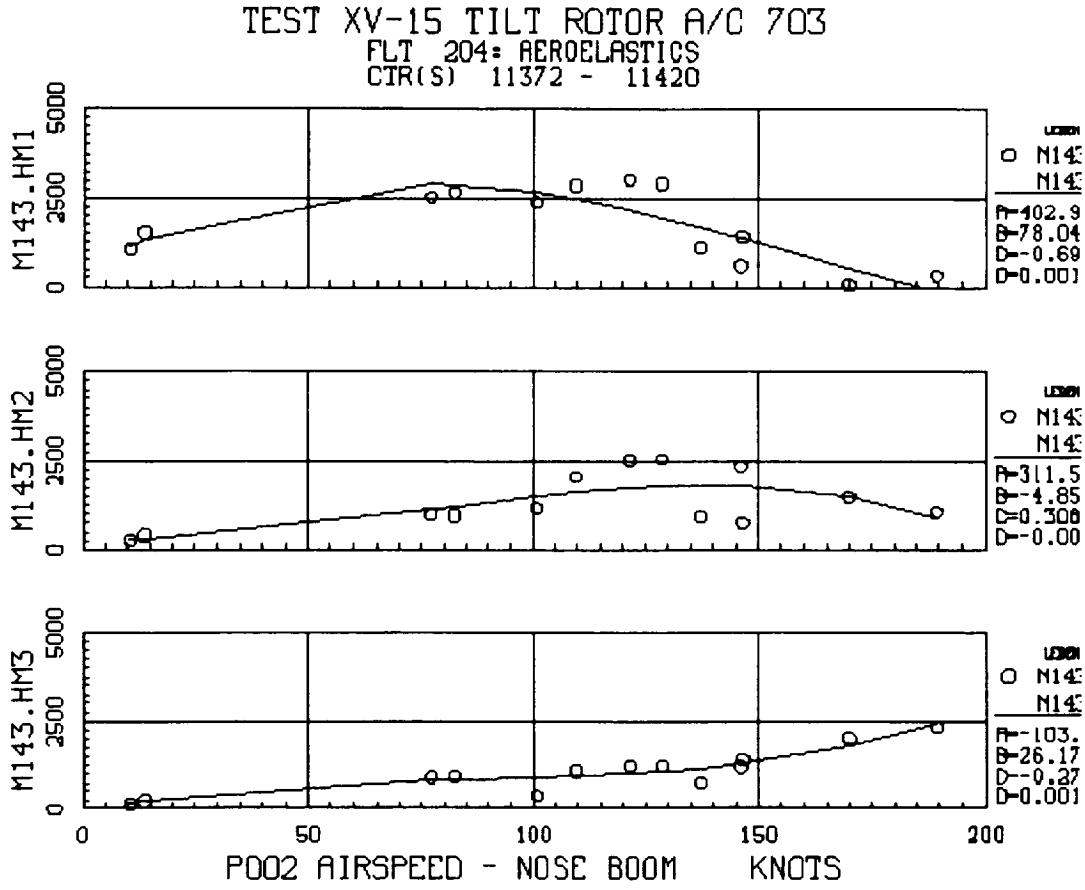


HARMONIC

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS         CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN        FIND          MINMAX        SCRATCHFILE   OUTDATA
                                  LOADS         MULTIPLT                    FUNCTIONS
                                  CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE: HAR

   HARMONIC      Display n-per-rev harmonics vs. minmax items
```

```
            HARMONIC ANALYSIS
            *****************

You may either:
  (1) plot pre-stored harmonics versus minmax stats, or
  (2) calculate and plot harmonics from time-history data.

     Please enter 1 or 2 or <cr> : 1

                        HARMONIC DISPLAY
                        ****************

EXAMPLES of valid responses to prompts:

                X-AXIS: HARM                    (print out of harmonics)

        or      X-AXIS: P002,0,250,50           (PLOT of P002 vs harmonics of IC


Enter mnemonic for parameter of interest : M143

   (At the X-AXIS prompt, you may type PRINT)

                ITEM
                ----
PLOT 1  X-AXIS: P002
PLOT 1. Y=M143    , HARMONIC # 1
PLOT 2. Y=M143    , HARMONIC # 2
PLOT 3. Y=M143    , HARMONIC # 3


Enter the flight(s), :counters (or DCS filename) : 204
```

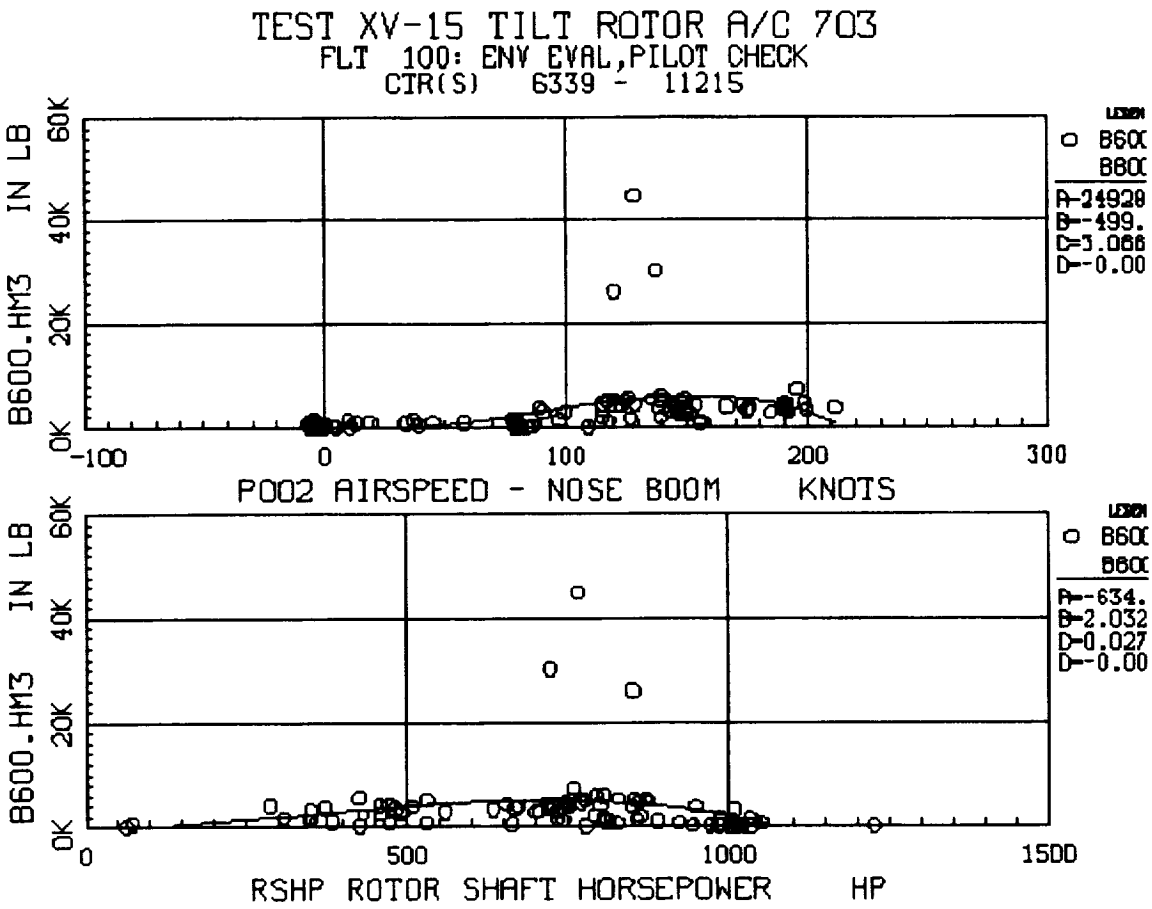
♦ *CROSS-PLOT EXAMPLE*
♦ *HELP*



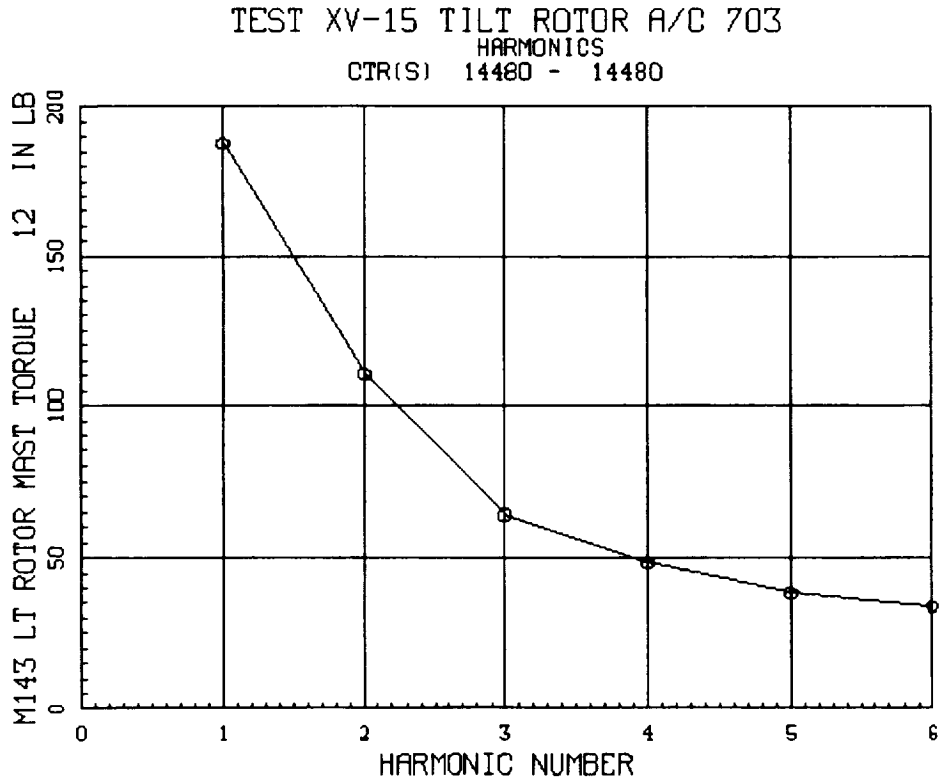
The plot shown here displays the first, second and third harmonics of M143 versus indicated airspeed for all counters of flight 204. A third-order polynomial of the M143 harmonics as functions of airspeed is fit to the points and plotted as a solid curve. Coefficients of the polynomial are printed in the legend.

```
Enter mnemonic for parameter of interest : ?

                HARMONIC ITEMS AVAILABLE
                ************************

A005  A019  A020  A150  A151  A152  A175  A176  A177  A300  A301  A302  A304
A340  A341  A350  A352  A353  A627  B108  B109  B112  B113  B114  B115  B120
B122  B123  B124  B125  B126  B127  B130  B132  B133  B134  B135  B136  B137
B140  B141  B165  B166  B171  B172  B173  B174  B190  B191  B192  B193  B194
B195  B259  B262  B270  B274  B278  B280  B282  B312  B316  B346  B357  B542
B543  B544  B545  B600  B601  B603  B604  B613  B615  B618  B622  B801  B802
B803  B804  B805  B806  B808  B809  F030  F031  F033  F052  F055  F060  F061
F062  F103  F104  F142  F162  F163  F164  F187  F188  F189  F286  F303  F310
F311  F330  F331  F333  F334  F347  F355  F356  F534  F537  F611  F614  F621
F625  F626  F638  F775  F778  M107  M143  M266  M275  M276  M277  M279  M335
M336  M337  M606  M607  M612  M619  M791  S067  S068  S116  S117  S118  S119
S610  S628  S629  S631  S633  S635  S639  S640  S641  S642  S643
```

```
Enter mnemonic for parameter of interest : B600

   (At the X-AXIS prompt, you may type PRINT)

                ITEM
                ----
PLOT 1  X-AXIS: P002
PLOT 1. Y=B600    , HARMONIC # 3
PLOT 2. Y=B600    , HARMONIC #

                ITEM
                ----
PLOT 2  X-AXIS: RSHP
PLOT 2. Y=B600    , HARMONIC # 3
PLOT 3. Y=B600    , HARMONIC #

                ITEM
                ----
PLOT 3  X-AXIS:


Enter the flight(s), :counters (or DCS filename) : 100-200
```

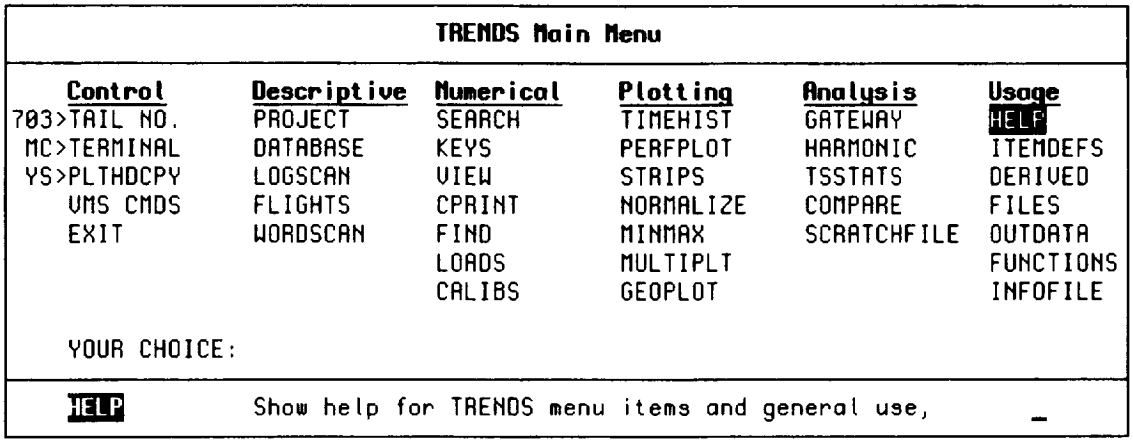


```
                HARMONIC ANALYSIS
                *****************

You may either:
  (1) plot pre-stored harmonics versus minmax stats, or
  (2) calculate and plot harmonics from time-history data.


     Please enter 1 or 2 or <cr> : 2

   Enter mnemonic: m143

   Enter one counter: 14480

M143    TIM :   188 PTS,   15.7 SAMP/SEC,  11.9 SEC DURATION, T0= 77143320

R018    :  2996 PTS,  251.0 SAMP/SEC,  11.9 SEC DURATION, T0= 77143320

  REVS TO PROCESS [ 112]   : 20

   STARTING REV [ 1]       : 3

    NO. OF HARMONICS [ 6] :
AVG. REVS/SEC =   9.508
    HARMONIC AMPLITUDE     PHASE
        0   74036.648
        1     187.714      77.567
        2     110.601      73.307
        3      63.845      69.998
        4      48.286      61.671
        5      38.228      54.972
        6      33.751      48.798

   Enter P to plot, <cr> for next counter : p
```



```
                    HARMONIC ANALYSIS
                    *****************

        You may either:
          (1) plot pre-stored harmonics versus minmax stats, or
          (2) calculate and plot harmonics from time-history data.


            Please enter 1 or 2 or <cr> : 1

                    HARMONIC DISPLAY
                    ****************

EXAMPLES of valid responses to prompts:

              X-AXIS: HARM                    (print out of harmonics)

       or     X-AXIS: P002,0,250,50           (PLOT of P002 vs harmonics of IC



 Enter mnemonic for parameter of interest : M143

    (At the X-AXIS prompt, you may type PRINT)

                ITEM
                ----
 PLOT 1  X-AXIS: PRINT

 Enter the flight(s), :counters (or DCS filename) : :10645,10646,10647

    3 COUNTERS.  FIRST =    10645, LAST =    10647

            3 COUNTERS.  FIRST =    10645, LAST =    10647

        CTR 10645  HARMONIC  AMPLITUDE   PHASE  M143
                       0   26522.34375
                       1     195.02228   178.1
                       2    3036.30615   -18.1
                       3     130.72978    34.1
                       4      73.12797   -34.0
                       5      16.10999  -139.4
                       6     276.44226   127.5

        CTR 10646  HARMONIC  AMPLITUDE   PHASE  M143
                       0   80851.77344
                       1    2898.49097    99.0
                       2     361.63794   -16.7
                       3     294.67429   -67.5
                       4      24.32754  -162.9
                       5      20.14590   150.4
                       6     683.39160    29.9

        CTR 10647  HARMONIC  AMPLITUDE   PHASE  M143
                       0  107760.00000
                       1    3331.47852   115.6
                       2    1338.23682   145.0
                       3    1576.37305    76.6
                       4     105.81961   142.5
                       5     204.36998   -81.1
                       6     358.09958  -149.7
```

HELP



DATABASE ACCESS OPTIONS
****

TAIL NO.	Change aircraft of interest
TERMINAL	Assign new terminal characteristics
PLTHDCPY	Change plot-hardcopy option
VMS CMDS	Execute VMS system commands from TRENDS
EXIT	Exit the program, return to the operating system
PROJECT	Display project and aircraft information
DATABASE	Show a brief summary of data in the base
LOGSCAN	Scan the flight log and search descriptions
FLIGHTS	Display some or all flight descriptions
WORDSCAN	Scan counter descriptions for words or strings
SEARCH	Search for a specific set of flight conditions
KEYS	Show value of primary condition keys for a flight
VIEW	View item statistics for specified counters
CPRINT	Print item statistics in your own custom format
FIND	Find counters with data for time-history items
LOADS	Show minmax/rev data and loads distribution
CALIBS	View calibration data by item and flight
TIMEHIST	Plot time-history or spectral data
PERFPLOT	Plot performance parameters 2X2, 3X3 or 4X4 per page
STRIPS	Plot time-history strip-charts for multiple counters
NORMALIZ	Plot normalized time-histories
MINMAX	Plot min/max-per-counter data (statistical summaries)
MULTIPLT	Plot families of min/max data
GEOPLOT	Display minmax statistics vs. sensor location
GATEWAY	Branch out of TRENDS to DATAMAP or a simulation
HARMONIC	Display n-per-rev harmonics vs. minmax items
TSSTATS	Compute and display time-slice statistics
COMPARE	Compare time histories across counters or databases
SCRATCHF	View and operate on scratch files
HELP	Show help for TRENDS menu items and general use,
ITEMDEFS	Show/search itemcodes and definitions
DERIVED	Show the derived pseudo-items
FILES	Scan user-created files
OUTDATA	Print time-history data to an ASCII file
FUNCTION	List/verify/edit the defined-function file
INFOFILE	Display and edit the contents of an infofile

```
                    DATABASE ACCESS OPTIONS
                    ***********************

    TPLOTS    List help for the TIMEHIST plotting options

    ALL       Copy narrative for all topics to file HELP.TRX

    HINTS     List general operational hints for use of TRENDS

    USERFILE  List the user-files used/produced by TRENDS

 Topic ? word
                                WORDSCAN
                                ********

Scans counter descriptions (pilot comments) for specified
character strings.  Saves results in SCAN.LIS.

Prompt                      Response              Result
------                      --------              ------

*1 Look for:               space or *      Accept every counter,
                                           proceed to prompt *2

                           AFT,LAT (eg)    Accept counters containing
                                           either AFT or LAT in the
                                           description, move to *2

                           AFT,LAT- (eg)   Accept all counters except
                                           those containing either
                                           AFT or LAT, move to *2

                           no entry        If scan has been successful,
                                           proceed to prompt *3, else
      (Hit RETURN to continue)_

                                           exit to main menu.

                           ?               Show help comments and keywords

*2 Enter flight(s)         175-177 (eg)    Scan all counters of flights
   or filename:                            175, 176 and 177, then
                                           repeat prompt *2.

                           HIACC (eg)      Scan counters contained
                                           in previously derived
                                           counterset HIACC, then
                                           repeat prompt *2.

                           :9175-9200 (eg) Scan counters 9175 through
                                           9200, then repeat *2

                           no entry        Repeat prompt *1.

                           ?               List existing derived
                                           counter-set files

*3 Save derived            Y               You will be asked for a
      (Hit RETURN to continue)_
```

counter-set?		filename, then program exits to main menu.
	N or no entry	Exit to main menu.

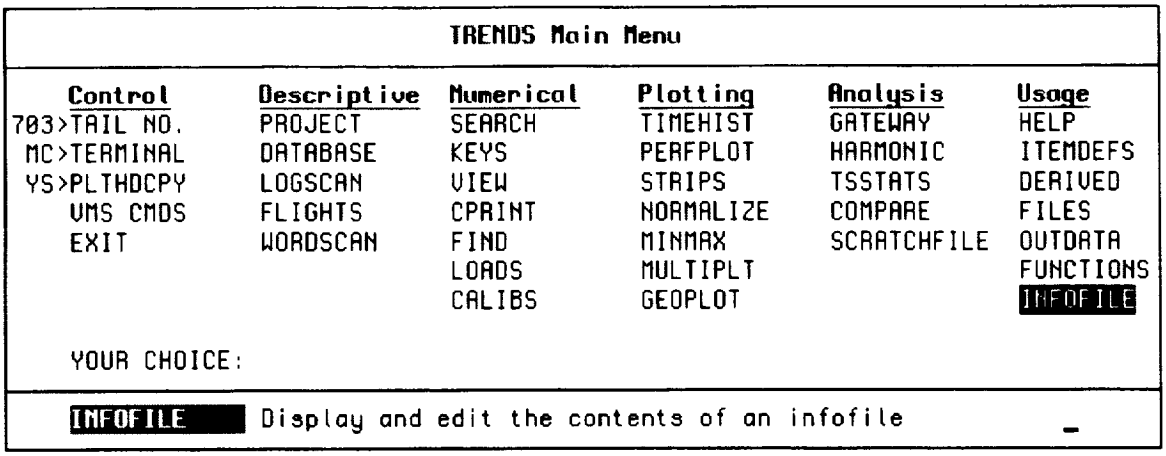
Interrupts - CTRL-C interrupts the scanning process to
1. enable abort, immediate exit to main menu and
2. show which itemcodes of a specified time-history group are available for a specified counter.

Post-interrupt Prompt	Response	Result
PIP #1 Enter item grp: (Hit RETURN to continue)_	HQ (eg)	Handling-quality items will

Post-interrupt Prompt	Response	Result
PIP #1 Enter item grp: (Hit RETURN to continue)	HQ (eg)	Handling-quality items will be shown. Proceed to PIP #2
	?	List item groups
	M or CTRL-C	Exit to main menu.
	no entry	Continue scanning where the scan was interrupted.
PIP #2 Enter a counter:	10259 (eg)	Show itemcodes available for this counter, then repeat PIP #2
	no entry	Repeat PIP #1

Topic ?

INFOFILE



Displays previously generated Infofiles. This item was incorporated into TRENDS to show the geometrical layout of groups of sensors, as described in an infofile. Infofiles are used in TRENDS' GEOPLOT and OUTDATA menu items to facilitate the use of grouped sensors. They are also used in cycle averaging to supply definition of rotor azimuth offsets and types. The infofiles are originally generated by flight-test or instrumentation engineers, since few users would know the layout of rotorcraft parameters. The user may wish to modify the INFOFILE in his/her directory to create a new group or to null out an item which is observed to have bad data in the database. Modifications must be done by use of the VMS DEC editor (EDT). The format of these files is best understood by example. The names of the groups also display a description of the parameter group. e.g. LBAB (Left Beam, Advanced Technology Blades). By specifying a group of like sensors as such, the user is relieved of the burden of looking up the individual itemcodes and typing them in as input of TRENDS. INFOFILE shows the user what the components and locations are for a given group.

An infofile contains one key-parameter group and an indefinite number of geometrical groups. The key parameter group is a list of key parameter names used in the particular vehicle database versus the corresponding generic names used in DATAMAP. Geometrical groups are lists of parameter names and their physical location (geometry, X, Y, Z(top/bottom)) of where each sensor is on the rotor, wing, fuselage, etc. Further insight into what infofiles are and what they can do for you may be found in Section V (5-26) and Appendix B (B-18).

Given below are examples of available groups in an Infofile, and the actual DATAMAP format of 2 geometrical groups called LBAB & RBAB that can be edited. Note, the DATAMAP format is not defined further in this document.

```
          AVAILABLE INFOFILE GROUPS
          *************************

LBAB  LEFT BEAM, ADVANCED TECHNOLOGY BLADES
RBAB  RIGHT BEAM, ADVANCED TECHNOLOGY BLADES
LCAB  LEFT CHORD, ADVANCED TECHNOLOGY BLADES
RCAB  RIGHT CHORD, ADVANCED TECHNOLOGY BLADES
LBSB  LEFT BEAM, STEEL BLADES
RBSB  RIGHT BEAM, STEEL BLADES
LCSB  LEFT CHORD, STEEL BLADES
RCSB  RIGHT CHORD, STEEL BLADES
S2MB  AIRSPEED, MAST TORQUE
S2M2 ITEMCODE PAIRS


    You may enter a "?" or such as:
         S2PA(2,ALL)  or S2PA(*,3)(TOP)  or S2PA(BOTTOM)
         or S2PA(2,3)  or NFBU  or  NFBU(4)

 ENTER AN INFOFILE GROUP: LBAB

         LBAB  LEFT BEAM, ADVANCED TECHNOLOGY BLADES

                        FRACTN OF RADIUS     (R/RADIUS)
                          1         2         3         4         5         6
                       0.06000   0.20600   0.30000   0.50000   0.69000   0.84000
ROW  1   0.00000        B114      B036      B046      B050      B040      B044
```

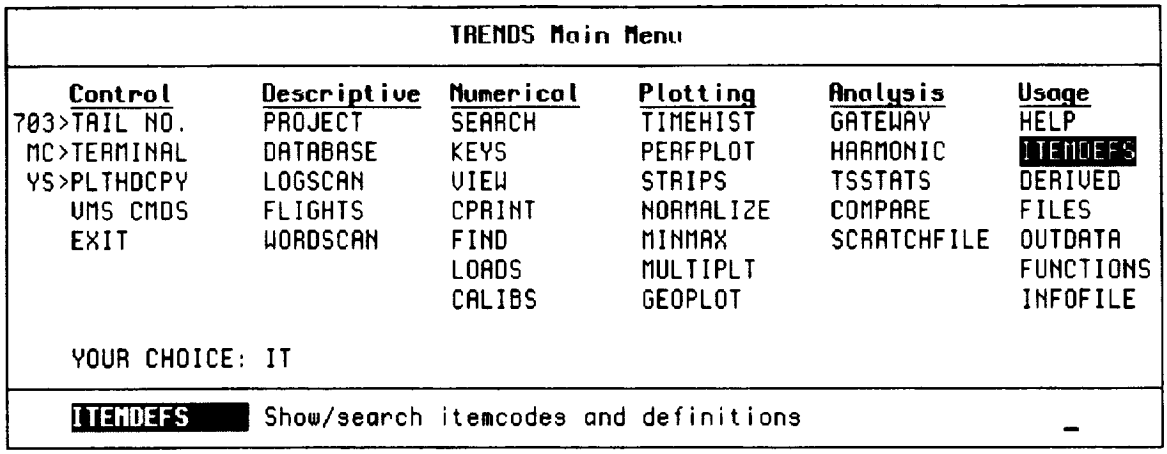
Infofile/Geometrical Parameter Group/DataMap Format

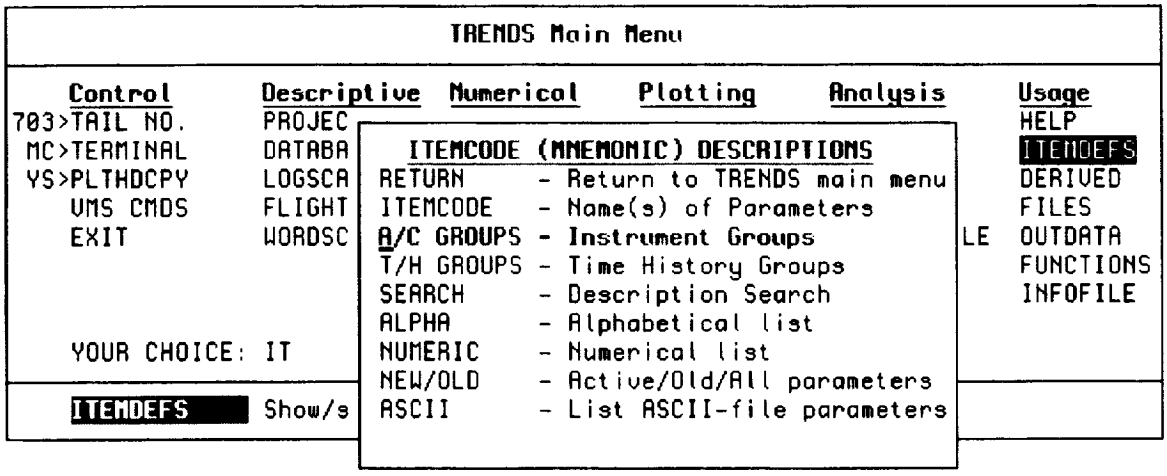
LBAB & RBAB Geometrical Groups

```
LBAB  LEFT BEAM, ADVANCED TECHNOLOGY BLADES
FRACTN OF RADIUS
R/RADIUS
BLADE ROOT
0.06,0.206,0.3,0.5,0.69,0.84//
JUNK//
B114/B036/B046/B050/B040/B044//
END
RBAB  RIGHT BEAM, ADVANCED TECHNOLOGY BLADES
FRACTN OF RADIUS
R/RADIUS
BLADE ROOT
0.06,0.206,0.3,0.5,0.69,0.84//
JUNK//
B112/B034/NULL/NULL/B038/B042//
END
```

ITEMDEFS

♦ GROUPS





When ITEMDEFS is selected, the several display options are shown. Selecting one of them (e.g. GROUPS) will give you another menu for more detailed searches to find the mnemonics, itemcodes, definitions, units and other item-specific information.

Select RETURN to return to the main TRENDS menu.

```
                    703 INSTRUMENTATION GROUPS
                          FLAPERON                  ROTOR MAST
AIRFRAME VIBRATION        FUEL SYSTEM               ROTOR PITCH LINK
CONTROL AIRFRAME ANGLES   GEAR                      ROTOR SWASH PLATE DR
CONTROL FORCE             GOVERNOR                  RUDDER
CONTROL POSITION          HORIZ                     SCAS
CONTROL ROTOR ANGLES      HYDRAULIC SYSTEM          SIDE-STICK CONTROLLER
CROWS LANDING RADAR       OIL SYSTEM                TEMPERATURES - SCANNER
DATA SYSTEM STATUS        PSEUDO ITEMS              TEST CONDITIONS
ECGB                      PYLON CONV. SPINDLE       TIP RIB STRESS
ELECTRICAL SYSTEM         PYLON DOWNSTOP            TIP RIB VIBRATORY
ELEVATOR                  PYLON VIB                 VERT
ENGINE                    ROTOR BLADE               WING
EXCITER                   ROTOR BOOST ACTUATOR      ALPHABETIC LISTING
FLAP                      ROTOR HUB SPINDLE         NUMERIC LISTING

                          TEST_
```

```
TEST CONDITIONS - Itemcodes currently active for flight  261
                                                  Fltr   Input
 Item          Description                Units    Freq  Rate/Dec   Group
T D008  ANGLE OF ATTACK                   DEG       3.0    31/2   TEST CONDITIONS
T D009  ROLL ATTITUDE - CABIN             DEG       3.0   125/8   TEST CONDITIONS
T D010  PITCH ATTITUDE - CABIN            DEG       3.0   125/8   TEST CONDITIONS
T D011  YAW ATTITUDE - CABIN              DEG       3.0   125/8   TEST CONDITIONS
T D161  RT PYLON CONVERSION POSITION      DEG       1.0    31/6   TEST CONDITIONS
T D186  LT PYLON CONVERSION POSITION      DEG       1.0    31/6   TEST CONDITIONS
T D327  ALTITUDE - RADAR ALTIMETER        FEET      1.0    31/6   TEST CONDITIONS
T P002  AIRSPEED - NOSE BOOM              KNOTS     1.0  125/25   TEST CONDITIONS
T P342  ALTITUDE - NOSE BOOM              FEET      1.0    31/6   TEST CONDITIONS
T T322  OAT (ROSEMONT)                    DEG C     1.0    31/6   TEST CONDITIONS
T V012  ROLL RATE - CABIN (INCOMPLETE)    D/SEC     3.0   125/8   TEST CONDITIONS
T V013  PITCH RATE -CABIN (INCOMPLETE)    D/SEC     3.0   125/8   TEST CONDITIONS
T V014  YAW RATE - CABIN (INCOMPLETE)     D/SEC     3.0   125/8   TEST CONDITIONS
T V015  ROLL RATE - SCAS                  D/SEC     3.0   125/8   TEST CONDITIONS
T V016  PITCH RATE - SCAS                 D/SEC     3.0   125/8   TEST CONDITIONS
T V017  YAW RATE - SCAS                   D/SEC     3.0   125/8   TEST CONDITIONS
```

Header	Column	Description
Column 1:	No Hdr.	"T" in this column designates that the itemcode for this flight contains timehistory data. e.g. D008 has timehistory data for flight 261.
Column 2:	Item	Parameter name (4 character Itemcode)
Column 3 & 4:	Descrip./Units	Sensor Description & Sensor Units
Column 5:	Filter Freq.	Sensor data has been filtered to "X" hertz. e.g. D009 filtered to 3.0 hertz
Column 6:	Rate/Dec	Sensor sample rate/Decimation rate Filtered data is curved fitted and then decimated
Column 7:	Group	Some rotorcraft databases are broken down into parameter groups which correspond to either A/C tests functions or physical areas which are instrumented. e.g. rotor blade

Selecting one of the groups (TEST shown), TRENDS will show you the data-item information for items in the selected group. Nothing is saved from the search except a hard-copy file of the information shown on the screen (ITEMDEFS.TRX703 for example). When you finish reading the results, a carriage return will take you back to the Groups sub-menu, from which another empty return will take you back to the ITEMDEFS menu.

```
  ITEMCODE (MNEMONIC) DESCRIPTIONS
RETURN    - Return to TRENDS main menu
ITEMCODE  - Name(s) of Parameters
GROUPS    - Parameter groups
SEARCH    - Description Search
ALPHA     - Alphabetical list
NUMERIC   - Numerical list
NEW/OLD   - Active/Old/All parameters
ASCII     - List ASCII-file parameters
```

ITEMCODE/MNEMONIC : A3

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
T	A300	C.G. LAT VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
T	A301	C.G. F/A VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
T	A302	PILOT SEAT LAT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
T	A304	COPILOT SEAT LAT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
	A340	RT CONV SPIND LAT VIRB	G'S		502/1	
T	A341	RT XMSN DOWNSTOP LAT VIBR	G'S		251/1	TIP RIB VIBRATORY
T	A350	RT XMSN LAT VIBR @ INLET	G'S		251/1	TIP RIB VIBRATORY
T	A352	C.G. VERT VIBR (SERVO)	G'S	3.0	31/2	AIRFRAME VIBRATION
T	A353	RT CONV SPINDLE LAT VIBR @ NUT	G'S		251/1	TIP RIB VIBRATORY
T	A380	PILOT SEAT F/A VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION

Under the ITEMCODE search option of ITEMDEFS, you may specify as much of the mnemonic or itemcode as you wish. Item names matching your specification will be shown. An empty response to the prompt will take you back to the ITEMDEFS sub-menu.

```
  ITEMCODE (MNEMONIC) DESCRIPTIONS
RETURN   - Return to TRENDS main menu
ITEMCODE - Name(s) of Parameters
GROUPS   - Parameter groups
SEARCH   - Description Search
ALPHA    - Alphabetical list
NUMERIC  - Numerical list
NEW/OLD  - Active/Old/All parameters
ASCII    - List ASCII-file parameters
```

```
  SEARCH FOR : FLAP_
                                                  Fltr  Input
  Item          Description              Units    Freq  Rate/Dec   Group
T  A057  RT RED BLADE FLAPPING ACCEL   G'S              251/1
T  B613  RT FLAP BM BD                 IN LB            125/1   FLAP
T  B615  RT FLAPERON BM BD             IN LB            251/1   FLAPERON
T  D309  PILOT FLAP LEVER POSITION     DEG       3.0     31/2   CONTROL POSITION
T  D617  FLAP POSITION                 DEG       3.0     31/2   CONTROL AIRFRAME A
T  D747  RT FLAPERON LVDT              %        10.0    125/4   EXCITER
T  D800  LT FLAPERON LVDT              %        10.0    125/4   EXCITER
T  E749  RT FLAPERON EXCITER SOLENOID  VOLTS    10.0     31/1   EXCITER
T  E751  LT FLAPERON EXCITER SOLENOID  VOLTS    10.0     31/1   EXCITER
   F614  RT FLAPERON CONTROL ARM FORCE LBS              502/1   FLAPERON
T  F621  LT FLAPERON CONTROL ARM FORCE LBS              251/1   FLAPERON
```

The SEARCH option of ITEMDEFS lets you search the description field for the character string you specify. Entering "flap" finds "flapping" and "flaperon" as well as "flap." An empty response to the prompt returns you to the previous sub-menu.

KEYS

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical      Plotting       Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS      FLIGHTS         CPRINT         NORMALIZE      COMPARE       FILES
    EXIT          WORDSCAN        FIND           MINMAX         SCRATCHFILE   OUTDATA
                                  LOADS          MULTIPLT                     FUNCTIONS
                                  CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE:

    KEYS          Show value of primary condition keys for a flight
```

KEYS
****

Show 6 key parameters for specified flights or counter-sets
You could tailor your own list of keys
by creating a KEYITEMS.703 file of 6 items.
You have none, so you get the system default list.

The keys are mean values of :

D186	LT PYLON CONVERSION POSITION		DEG
R338	RT ENGINE N2 RPM		%
D617	FLAP POSITION		DEG
P342	ALTITUDE - NOSE BOOM		FEET
P002	AIRSPEED - NOSE BOOM		KNOTS
M143	LT ROTOR MAST TORQUE	12	IN LB

Enter the flight(s), :counter(s) (or filename) : 255

N703 FLIGHT 255 21-AUG-91 GW = 14034. LBS CG = 299.

N703	D186 DEG	R338 %	D617 DEG	P342 FEET	P002 KNOTS	M143 IN LB	REV	
17918	91.63	89.90	42.58	-50.92	5.04	119842.55	163	LIFT OFF
17920	77.06	89.66	42.51	2094.14	81.65	108140.45	463	T/R HK "
17921	85.33	89.56	42.67	437.34	74.64	48930.55	357	APPROACH
17922	86.43	89.83	42.80	-3.77	37.82	59643.51	284	TO HOVER
17923	86.27	89.81	43.12	17.99	3.35	106132.40	331	HOVER VE
17924	88.87	89.59	43.19	-24.51	11.55	91772.77	281	TOUCHDOW

LOADS


```
                              TRENDS Main Menu

   Control          Descriptive      Numerical        Plotting         Analysis        Usage
703>TAIL NO.        PROJECT          SEARCH           TIMEHIST         GATEWAY         HELP
 MC>TERMINAL        DATABASE         KEYS             PERFPLOT         HARMONIC        ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW             STRIPS           TSSTATS         DERIVED
    VMS CMDS        FLIGHTS          CPRINT           NORMALIZE        COMPARE         FILES
    EXIT            WORDSCAN         FIND             MINMAX           SCRATCHFILE     OUTDATA
                                     LOADS            MULTIPLT                         FUNCTIONS
                                     CALIBS           GEOPLOT                          INFOFILE

    YOUR CHOICE:

    LOADS          Show minmax/rev data and loads distribution
```

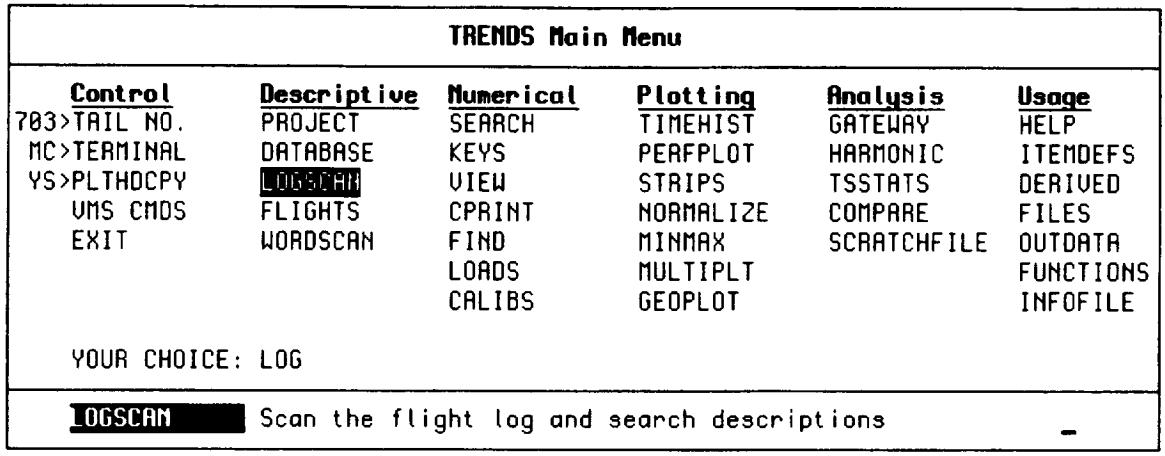
This menu item allows the user to look at statistical data in two formats, namely:

1. Min/Max/Rev data as a pseudo time history plot, where "0"= mean data value/rev.; "+"= Max data value/rev.; "-"= min data value/rev.
2. Min/Max data as a histogram where the parameter data is put into 32 bins equally spaced over the min/max data range for the parameter. The height of the histogrambar is proportional to the number of times the parameters value fell into that load bin range.

```
                          LOADS
                          *****
Shows minmax/rev data and loads distributions for
specified itemcodes and counters.

 ITEMCODE : ?

                       LOADS ITEMS AVAILABLE
                       *********************

A005  A019  A020  A150  A151  A152  A175  A176  A177  A300  A301  A302  A304
A340  A341  A350  A352  A353  A627  B108  B109  B112  B113  B114  B115  B120
B122  B123  B124  B125  B126  B130  B132  B133  B134  B137  B140  B141  B165
B166  B171  B172  B173  B174  B190  B191  B192  B193  B194  B195  B259  B262
B270  B274  B278  B280  B282  B312  B316  B346  B357  B542  B543  B544  B545
B600  B601  B603  B604  B613  B615  B618  B622  B801  B802  B803  B804  B805
B806  B808  B809  F030  F031  F033  F052  F055  F060  F061  F062  F103  F104
F142  F162  F163  F164  F187  F188  F189  F286  F303  F310  F311  F330  F331
F333  F334  F347  F355  F356  F534  F537  F611  F621  F625  F626  F638  F775
F778  M107  M143  M266  M275  M276  M277  M279  M335  M336  M337  M606  M607
M612  M619  M791  S067  S068  S116  S117  S118  S119  S610  S628  S629  S631
S633  S635  S639  S640  S641  S642  S643

 ITEMCODE : M143
```

```
                    M143  LT ROTOR MAST TORQUE    12          IN LB

                N703  FLT 185  CTR 10605: LIFT TO OGE MOST W/HANDS OFF
      130000.0 +-----------------------------+---------++------------------+
               I                                    +   +00+                I
               I                             ++++++ ++++ 00000000  +         I
  M143         I                  + +    000000+0000+000-00-0000+           I
               I                  ++0   +000000000+000 0  - -0000+++  +      I
   MIN,MAX     I                 + +00 +0-0--00-0-000  -     ---0000000     I
               I                 00 +0+0000  --0000--          ---000-      I
  vs. REVS     I               ++0000000 --   ---0  -             ---        I
               I               00000--00          0                         I
               I              +0--00000-          -                         I
       73000.0 +          +00-  -0 - -                                      +
               I          00--  --- -                                       I
               I         +0-     -                                          I
               I        +00                                                 I
               I       +00-                                                 I
               I       00-                                                  I
               I      00-                                                   I
               I      00                                                    I
               +   +00                                                      I
               000000                                                       I
       16000.0 +-----------------------------+-----------------------------+
                0.0    ROTOR  REVS          200.0                         400.0
Hit CR to continue

                N703  FLT 185  CTR 10605: LIFT TO OGE MOST W/HANDS OFF
       12900.0 +---------------000-----------+-----------------------------+
               I                 0                                          I
               I                                                            I
  M143         I                                                            I
               I                                                            I
  OSC LOAD     I                                  0                         I
               I               0   00           0                         I
  vs. REVS     I               0 0          0                              I
               I               0  000   0   0                              I
               I               00 0           0                            I
        7000.0 +            0 0     0 00   0  0                  0         +
               I      0     0 00  00    0      0                            I
               I         0 0    000 0   0  0 0000                          I
               I                 0    0000   0  00                         I
               I      0  0 000    00 0 00000 0      0     00 0 00 0         I
               I      000000000  000 00   0   000000  00000 00000000        I
               I    00 0 000      0  0   00 00  0    0 0 00   00  0         I
               0000000000 00  0      00 00  0 000000 00000000000 000        I
               I 0 00 0   00         000      0  00000 0  0 000  0 0         I
               0000 00                  0  0 0  0 000 000 000   0           I
       1100.0 0000--------------------0----+-----------0-----------------+
                0.0    ROTOR  REVS          200.0                         400.0

                HISTOGRAM OF SAMPLES PER LOAD RANGE (30 BINS)

                N703  FLT 185  CTR 10605: LIFT TO OGE MOST W/HANDS OFF
          58.0 +----**----------------------+-----------------------------+
               I    **                                                     I
               I    **                                                     I
  M143         I    **                                                     I
               I    **                                                     I
  SAMPLES      I    **                                                     I
               I    **                                                     I
  vs. LOAD     I    **                                                     I
               I    **  **    **                                          I
               I    ******  ****                                          I
          29.0 +    ******  ****                                          +
               I    ************                                          I
               I    ************                                          I
               I    **************                                        I
               I    ****************                                      I
               I  ******************                                      I
               I  ******************      **                            I
               I************************  **                            I
               I************************************                      I
               I*******************************************              **
           0.0 +*****__*****__**********__**__***************__**________****
              1100.0    LOAD  (IN LB )      7000.0                    12900.0
```

LOGSCAN



LOGSCAN provides the user with a one line flight description of all flights in the database. The most recent 15 flights are chronologically output for the users. The user may list all flights by using an "*" input for the "LOOK FOR" request in LOGSCAN. Note, also the user may search for flights by narrative description of the flights at the "LOOK FOR" prompt in LOGSCAN.

```
                                                                    FLT
                FLIGHT LOG FOR A/C 703                              HRS
  F 261     9/06/91   ACOUSTICS FLIGHT                        CROWS    :
  F 260     9/05/91   ACOUSTICS FLIGHT                        CROWS    :
  F 259     9/04/91   ACOUSTICS FLIGHT                        CROWS    :
  F 258     9/03/91   ACOUSTICS FLIGHT                        CROWS    :
  F 257     8/28/91   IPS CHECKOUT, Y03 FORMATION FLIGHT      CROWS    :
  F 256     8/26/91   IPS CHECKOUT, Y03 FORMATION FLIGHT      CROWS    :
  F 255     8/21/91   IPS CHECKOUT, Y03 FORMATION FLIGHT      MOFFET   :
  F 254     7/22/91   HELO MODE FLIGHT EVALUATION             ARC      0:48
  F 253     5/29/91   HELO AND TR MODE FLIGHT EVALUATION      ARC      0:36
  F 252     5/06/91   HELO, TR, AND AP MODE FLIGHT EVALUATION ARC      1:00
  F 251     3/14/91   HOVER AND LOW SPEED FLIGHT, HELO AND TR MODE ARC 0:54
  F 250     3/ 6/91   HOVER & LOW SPEED FLIGHT EVALUATION     ARC      0:36
  F 249     2/22/91   HOVER & LOW SPEED FLIGHT EVALUATION     ARC      0:24
  F 248     1/31/91   HOVER & LOW SPEED FLIGHT EVALUATION     ARC      0:06
  F 247    12/14/90   ENVELOPE EXPANSION                      ARC      1:30
   LOOK FOR : DOWNWASH
   LOOK FOR :
                                                                    FLT
                FLIGHT LOG FOR A/C 703                              HRS
  G 176A  05/03/83   DOWNWASH STUDY ON VTOL STAND              ARC      0:00
  G 176B  05/03/83   DOWNWASH STUDY ON VTOL STAND              ARC      0:00
  F 146A  04/20/83   DOWNWASH EFFECTS W FULL FLAP TEST MOD.    ARC      0:18
  F 146B  04/20/83   DOWNWASH EFFECTS W FULL FLAP TEST MOD.    ARC      0:06
  F 146C  04/20/83   DOWNWASH EFFECTS W FULL FLAP TEST MOD.    ARC      0:06
  F 146D  04/20/83   DOWNWASH EFFECTS W FULL FLAP TEST MOD.    ARC      0:06
  F 68B   06/10/80   ROTOR DOWNWASH,-TEST SETUP ABORT          .        0:06
  F 68D   06/10/80   ROTOR DOWNWASH - HOVER                    .        0:12

   LOOK FOR : F86
                                                                    FLT
                FLIGHT LOG FOR A/C 703                              HRS
  F 86A   01/19/81   TRACK/BAL- HOVER -> 70 DEG                DFRC     0:12
  F 86B   01/19/81   TRACK/BAL- HOVER -> 70 DEG                DFRC     0:02
```

LOGSCAN is used to search the flight descriptions for certain flight objectives. When first selected, LOGSCAN displays the most recent 15 flights, then prompts you for the search string.

MINMAX

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical      Plotting       Analysis      Usage
703>TAIL NO.        PROJECT          SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL        DATABASE         KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS        FLIGHTS          CPRINT         NORMALIZE      COMPARE       FILES
    EXIT            WORDSCAN         FIND           MINMAX         SCRATCHFILE   OUTDATA
                                     LOADS          MULTIPLT                     FUNCTIONS
                                     CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE:

    MINMAX          Plot min/max-per-counter data (statistical summaries)  _
```

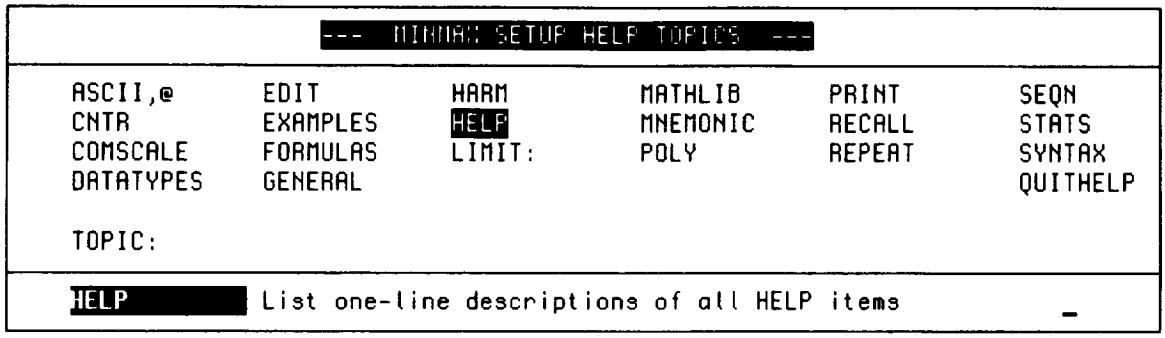
Plot min/max-per-counter data (statistical summaries). This item was one of the two major reasons TRENDS was initially developed, namely to allow the user to plot any or all statistical data in the database. This routine allows cross plotting of different statistical parameters. Note, Min/Max can also be used to plot User ASCII data files from a users database, if both parameter and data file are preceded by an @ sign. See "Topical Reference Section V, ASCII Input Files" for more information.

```
                        MIN/MAX DATA PLOTTING
                        *********************
EXAMPLES of valid responses to prompts:

              X-AXIS: CNTR                  (counter)
        or    X-AXIS: CNTR,5000,5500,100    (cntr. with scaling:strt,stp,inc
        or    X-AXIS: M143                  (ITEM CODE for X-axis,autoscale
        or    X-AXIS: ?                     (further INPUT INFORMATION)

              Y-CURVE 1: P002               (Y-axis, autoscale)
        or    Y-CURVE 2: POLY(P002,3)       (curve fit to P002 data points)
        or    Y-CURVE 2: D186,0,90,10       (cross plot of D186 & M143)


Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

                ITEM
                ----
 PLOT 1  X-AXIS: ?_
```

```
                    --- MINMAX: SETUP HELP TOPICS ---

    ASCII,@         EDIT            HARM            MATHLIB         PRINT           SEQN
    CNTR            EXAMPLES        HELP            MNEMONIC        RECALL          STATS
    COMSCALE        FORMULAS        LIMIT:          POLY            REPEAT          SYNTAX
    DATATYPES       GENERAL                                                         QUITHELP

    TOPIC:

    HELP            List one-line descriptions of all HELP items                    _
```

- *HELP (SETUP)*

MINMAX SETUP HELP Topics



ASCII,@	Read data from an ASCII user-file
CNTR	Specify counter number as plot abscissa
COMSCALE	Force a common scale for all curves of a plot
DATATYPES	Show the statistical datatypes
EDIT	Edit the plot setup
EXAMPLES	Examples of MINMAX plot-setup entries
FORMULAS	Explain the use of formulas or functions
GENERAL	General MINMAX usage discussion
HARM	PRINT rather than PLOT harmonics (in HARMONICS)
HELP	List one-line descriptions of all HELP items
LIMIT:	Look up and plot the pre-stored item limit (const)
MATHLIB	Show math library functions available for formulas
MNEMONIC	Search for parameter mnemonics or itemcodes
POLY	Polynomial regression syntax and examples
PRINT	Printing instead of plotting
RECALL	Recalling (and maybe editing) plot setups
REPEAT	Repeating a previously-entered line to save typing
SEQN	Using sequential point index as plot abscissa
STATS	Show the statistical datatypes
SYNTAX	Explain the plot specification syntax
QUITHELP	Return to the MINMAX dialogue (leave help)

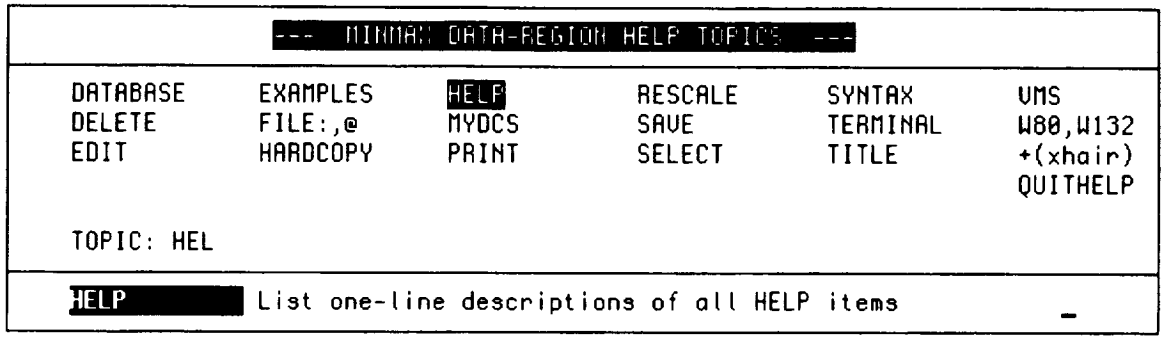
- ***HELP (DATA REGION)***

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical      Plotting       Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH         TIMEHIST       GATEWAY        HELP
 MC>TERMINAL        DATABASE         KEYS           PERFPLOT       HARMONIC       ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW           STRIPS         TSSTATS        DERIVED
    VMS CMDS        FLIGHTS          CPRINT         NORMALIZE      COMPARE        FILES
    EXIT            WORDSCAN         FIND           MINMAX         SCRATCHFILE    OUTDATA
                                     LOADS          MULTIPLT                      FUNCTIONS
                                     CALIBS         GEOPLOT                       INFOFILE

    YOUR CHOICE:

    MINMAX          Plot min/max-per-counter data (statistical summaries) _
```

```
                        MIN/MAX DATA PLOTTING
                        *********************
EXAMPLES of valid responses to prompts:

                X-AXIS: CNTR                    (counter)
        or      X-AXIS: CNTR,5000,5500,100      (cntr. with scaling:strt,stp,inc
        or      X-AXIS: M143                    (ITEM CODE for X-axis,autoscale
        or      X-AXIS: ?                       (further INPUT INFORMATION)

                Y-CURVE 1: P002                 (Y-axis, autoscale)
        or      Y-CURVE 2: POLY(P002,3)         (curve fit to P002 data points)
        or      Y-CURVE 2: D186,0,90,10         (cross plot of D186 & M143)


Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

                  ITEM
                  ----
 PLOT 1  X-AXIS: P002
     Y-CURVE 1 : M143
     Y-CURVE 2 :

                  ITEM
                  ----
 PLOT 2  X-AXIS:

 Enter the flight(s), :counters (or DCS filename) : ?_
```

```
                --- MINMAX DATA-REGION HELP TOPICS ---

   DATABASE        EXAMPLES        HELP            RESCALE         SYNTAX          VMS
   DELETE          FILE:,@         MYDCS           SAVE            TERMINAL        W80,W132
   EDIT            HARDCOPY        PRINT           SELECT          TITLE           +(xhair)
                                                                                   QUITHELP

   TOPIC: HEL

   HELP            List one-line descriptions of all HELP items                    _
```

MINMAX DATA-REGION HELP Topics



DATABASE	Look to see which flights/counters are in the base
DELETE	Deleting points on a plot using the cross-hairs
EDIT	Edit the plot setup
EXAMPLES	Display examples of valid data-region responses
FILE:,@	Show how to specify an ASCII input filename
HARDCOPY	Set or reset the plot-hardcopy option flag
HELP	List one-line descriptions of all HELP items
MYDCS	Show your existing derived counter sets (DCS)
PRINT	Turn on the PRINT (no plot) option
RESCALE	Rescale the plot for re-plotting without editing
SAVE	Save the current plot-page setup for later recall
SELECT	Selecting points of a plot using the cross-hairs
SYNTAX	Show the general syntax for data-region responses
TERMINAL	Change your terminal type
TITLE	Set your own plot titles (3 header lines)
VMS	Open the window to VMS within TRENDS
W80,W132	Change the screen width for printing
+(xhair)	Set or reset the cross-hair (pickling) option
QUITHELP	Return to the MINMAX data-region dialogue

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical      Plotting       Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH         TIMEHIST       GATEWAY        HELP
 MC>TERMINAL        DATABASE         KEYS           PERFPLOT       HARMONIC       ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW           STRIPS         TSSTATS        DERIVED
    VMS CMDS        FLIGHTS          CPRINT         NORMALIZE      COMPARE        FILES
    EXIT            WORDSCAN         FIND           MINMAX         SCRATCHFILE    OUTDATA
                                     LOADS          MULTIPLT                      FUNCTIONS
                                     CALIBS         GEOPLOT                       INFOFILE

    YOUR CHOICE:

    MINMAX          Plot min/max-per-counter data (statistical summaries) _
```

MIN/MAX DATA PLOTTING
****

EXAMPLES of valid responses to prompts:

```
              X-AXIS: CNTR                  (counter)
        or    X-AXIS: CNTR,5000,5500,100    (cntr. with scaling:strt,stp,inc
        or    X-AXIS: M143                  (ITEM CODE for X-axis,autoscale
        or    X-AXIS: ?                     (further INPUT INFORMATION)

              Y-CURVE 1: P002               (Y-axis, autoscale)
        or    Y-CURVE 2: POLY(P002,3)       (curve fit to P002 data points)
        or    Y-CURVE 2: D186,0,90,10       (cross plot of D186 & M143)
```

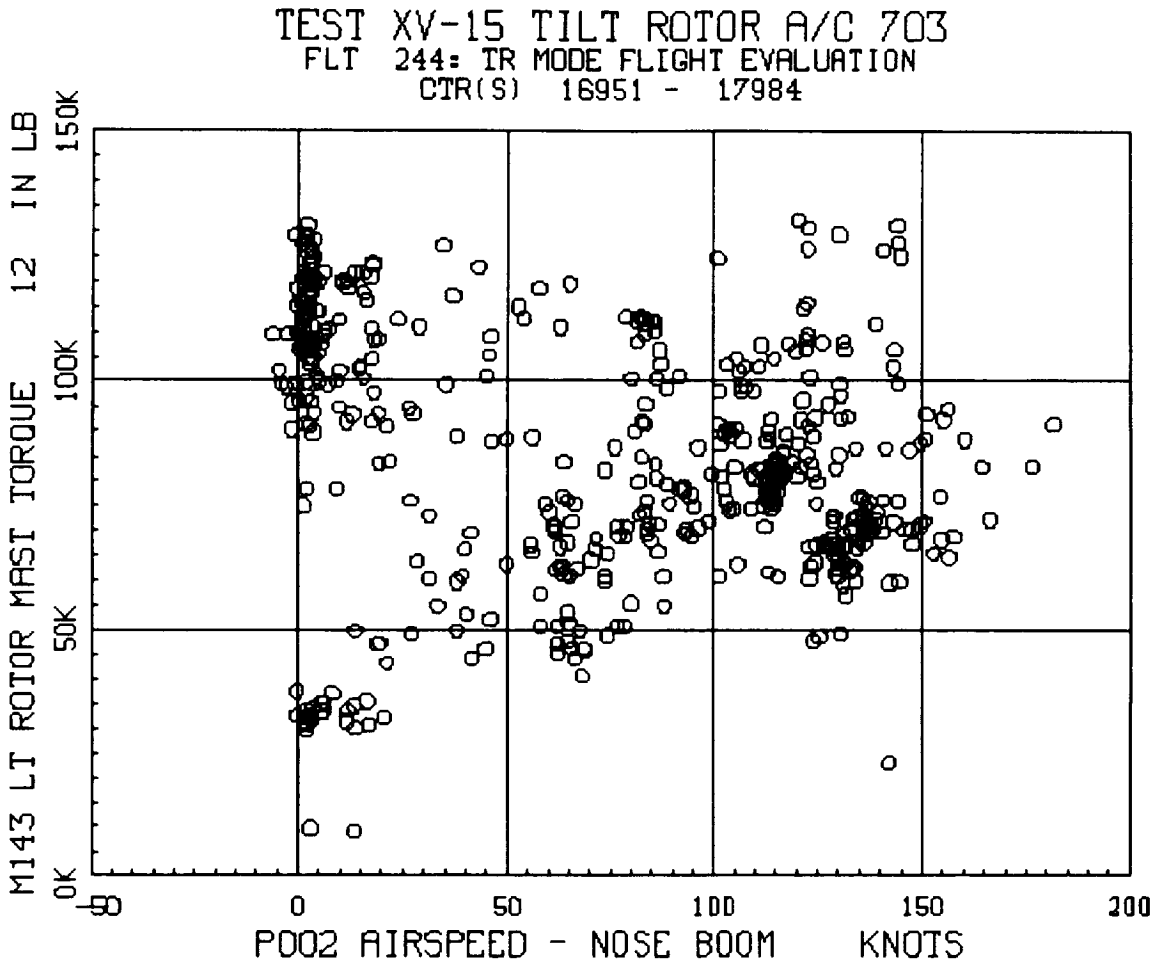
Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

```
                  ITEM
                  ----
PLOT 1  X-AXIS:  P002
    Y-CURVE 1 :  M143
    Y-CURVE 2 :
```

```
                  ITEM
                  ----
PLOT 2  X-AXIS:
```

Enter the flight(s), :counters (or DCS filename) : 244-256

♦ *PLOT EXAMPLE*



MIN/MAX DATA PLOTTING
****

EXAMPLES of valid responses to prompts:

```
          X-AXIS: CNTR                  (counter)
   or     X-AXIS: CNTR,5000,5500,100    (cntr. with scaling:strt,stp,inc
   or     X-AXIS: M143                  (ITEM CODE for X-axis,autoscale
   or     X-AXIS: ?                     (further INPUT INFORMATION)

          Y-CURVE 1: P002               (Y-axis, autoscale)
   or     Y-CURVE 2: POLY(P002,3)       (curve fit to P002 data points)
   or     Y-CURVE 2: D186,0,90,10       (cross plot of D186 & M143)
```

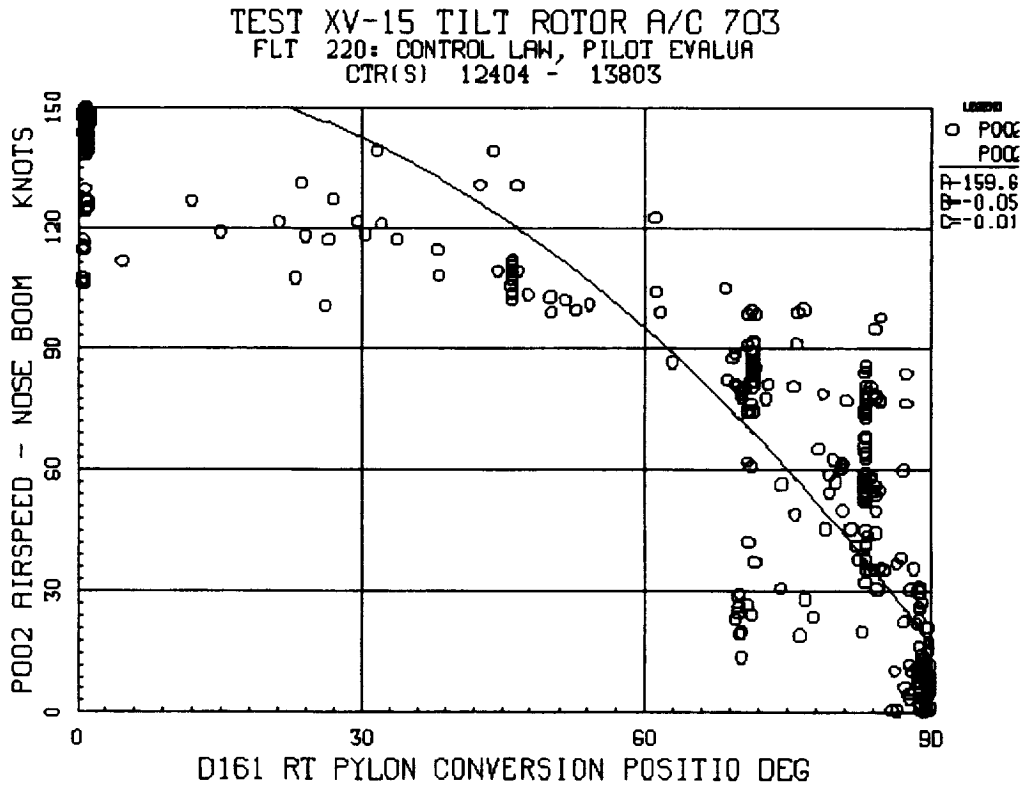
Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

```
                    ITEM
                    ----
PLOT 1  X-AXIS: d161,0,90,30
    Y-CURVE 1 : p002,0,150,30
    Y-CURVE 2 : POLY(P002,2)
    Y-CURVE 3 :

                    ITEM
                    ----
PLOT 2  X-AXIS:
```

Enter the flight(s), :counters (or DCS filename) : SAVE SETUP

OK. SETUP.PPG703 Saved

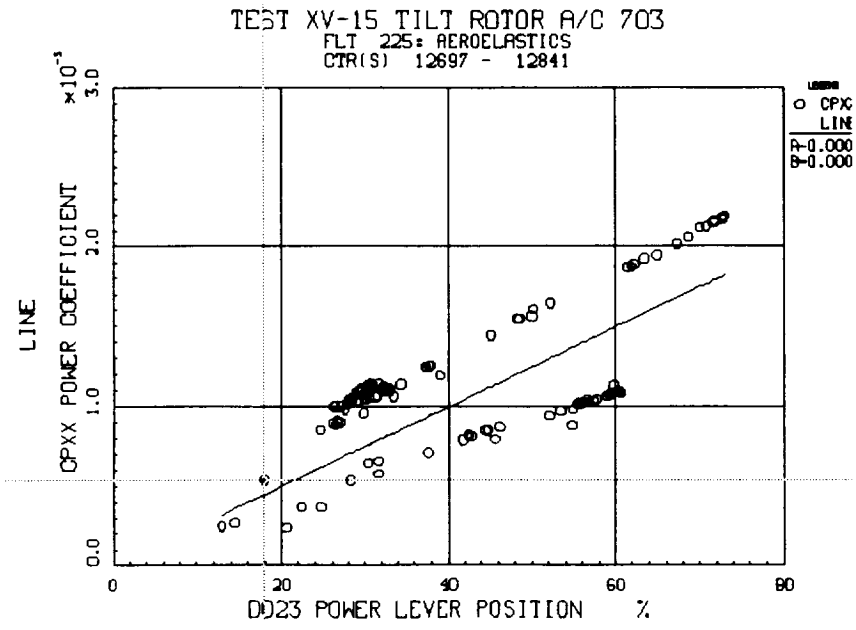
Enter the flight(s), :counters (or DCS filename) : 220-230



The MINMAX menu item is used for plotting statistical data for a range of counters. The following example illustrates its use.

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical      Plotting       Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS      FLIGHTS         CPRINT         NORMALIZE      COMPARE       FILES
    EXIT          WORDSCAN        FIND           MINMAX         SCRATCHFILE   OUTDATA
                                  LOADS          MULTIPLT                     FUNCTIONS
                                  CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE: MIN

    MINMAX        Plot min/max-per-counter data (statistical summaries)
```

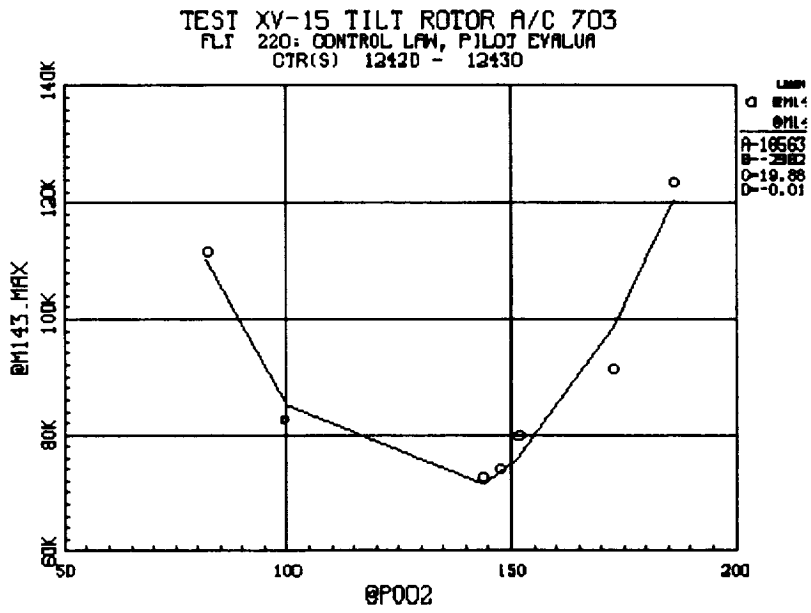
```
Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

                  ITEM
                  ----
 PLOT 1  X-AXIS: D023
     Y-CURVE 1 : CPXX
     Y-CURVE 2 : LINE=POLY(.002*D023/80,1)"
     Y-CURVE 3 :

                  ITEM
                  ----
 PLOT 2  X-AXIS:

 Enter the flight(s), :counters (or DCS filename) : *_

*** CROSS-HAIR CURSOR ON ***

                        !!!  ATTENTION  !!!
You can now DELETE points (pickle with D) or SELECT points (pickle with S)

DO YOU WANT TO STORE CROSS-HAIR DATA (Y/[NO] : Y
[DEFAULT] = POINTS.DAT , ENTER FILENAME OR <CR> : DELPTS.OUT

 Enter the flight(s), :counters (or DCS filename) : 225_
```



- ***PLOTTING FROM A USER ASCII INPUT FILE***

The following example of MINMAX plotting draws its data from a user ASCII input data file. The user generated ASCII input data file (ANGLES.STATS) format is given at the bottom of this page. This ASCII user file was generated by running menu-item TSSTATS. The contents of specific properly structured ASCII input files may be found from the MINMAX or TIMEHIST help menu (topic: ASCII,@)

```
                                ITEM
                                ----
PLOT 1  X-AXIS: edit

1   PLOT 1  X-AXIS: @P002
2       Y-CURVE 1 : @M143.MAX
3       Y-CURVE 2 : POLY(@M143.MAX,3)
4       Y-CURVE 3 :

5   PLOT 2  X-AXIS:

Enter the flight(s), :counters (or DCS filename) : @ANGLES.STATS:*_
```




```
        TRENDS Statistics Output File: ANGLES.STATS
             Title: title test
             Database:     703
             Generated:    16-JUL-92 16:30:18

{
        Mnemonic Description                          Units  I.C.
        P002     AIRSPEED - NOSE BOOM                 KNOTS  P002
        D009     ROLL ATTITUDE - CABIN                DEG    D009
        D010     PITCH ATTITUDE - CABIN               DEG    D010
        D011     YAW ATTITUDE - CABIN                 DEG    D011
        M107     RT ROTOR MAST TORQUE     12          IN LB  M107
        M143     LT ROTOR MAST TORQUE     12          IN LB  M143
}

Cntr:  12420  Flt:  220  (T/R H/K HANDS OFF            )  SLICE =  0.000 25.121

Mnem/Item     Average     Maximum     Minimum     Tmax      Tmin
P002           82.074      82.722      80.423     8.566     0.000
D009           -1.291      -0.969      -1.546    23.522    24.988
D010            5.412       5.754       4.964    24.861     3.570
D011           -1.120      -0.503      -1.553     0.000     7.394
M107      107900.586  110986.352  104694.680     1.721    22.821
M143      109163.445  111428.117  104589.555     6.821     0.000
```

MULTIPLT


```
                              TRENDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                 LOADS         MULTIPLT                    FUNCTIONS
                                 CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE:

   MULTIPLT      Plot families of min/max data                              -
```

MULTIPLT is similar to MINMAX with several important differences:

1. Data for only one item may be plotted on the Y-axis per plot.

2. Up to five different counter-groups (flights, derived counter sets, literal counter-groups (using :)) may be specified per plot, each group plotted with a different symbol to make families of curves.

3. Lines are automatically drawn to connect (~) the points of each curve, with a prompt to permit entry of a smoothing factor by the user. The factor is used in cubic-spline smoothing of the curve-points. A small number results in the best straight-line fit while a large number will result in a cubic-spline curve which goes through all of the data points of the curve.

4. Each curve of a plot may be from a different database or ASCII file, so performances of different aircraft may be compared.

The intention of this function is to plot families of curves of the same variable with variations on some other item, expression or condition. The syntax for specifying the parametric variation is due for revision (improvement), but for now, the counter-groups may be saved in files from the results of running WORDSCAN (e.g., "CLIMB", "DESCENT", "H/K") or SEARCH (e.g., D186 < 5 deg, 5 < D186 < 85, D186 > 85 deg) before running MULTIPLT.

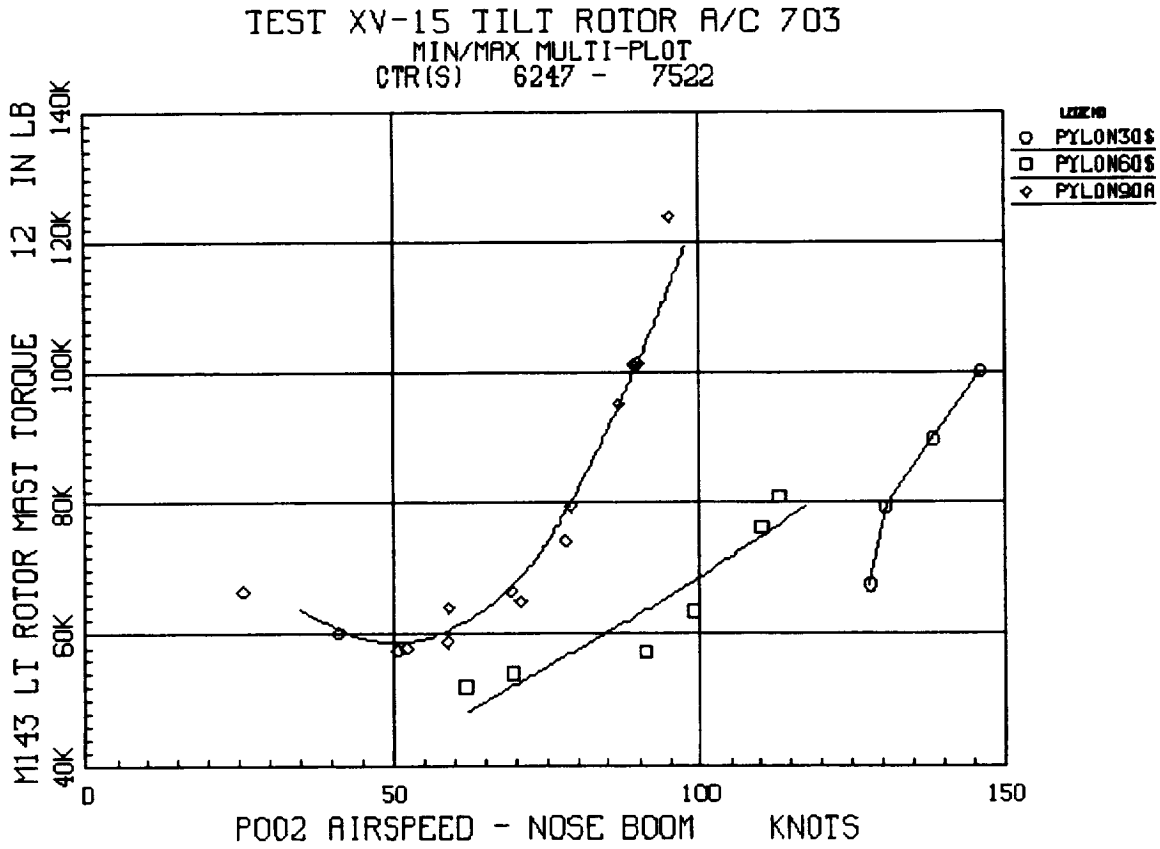
```
Multiple databases? (Y/[N]): N
```

NOTE:

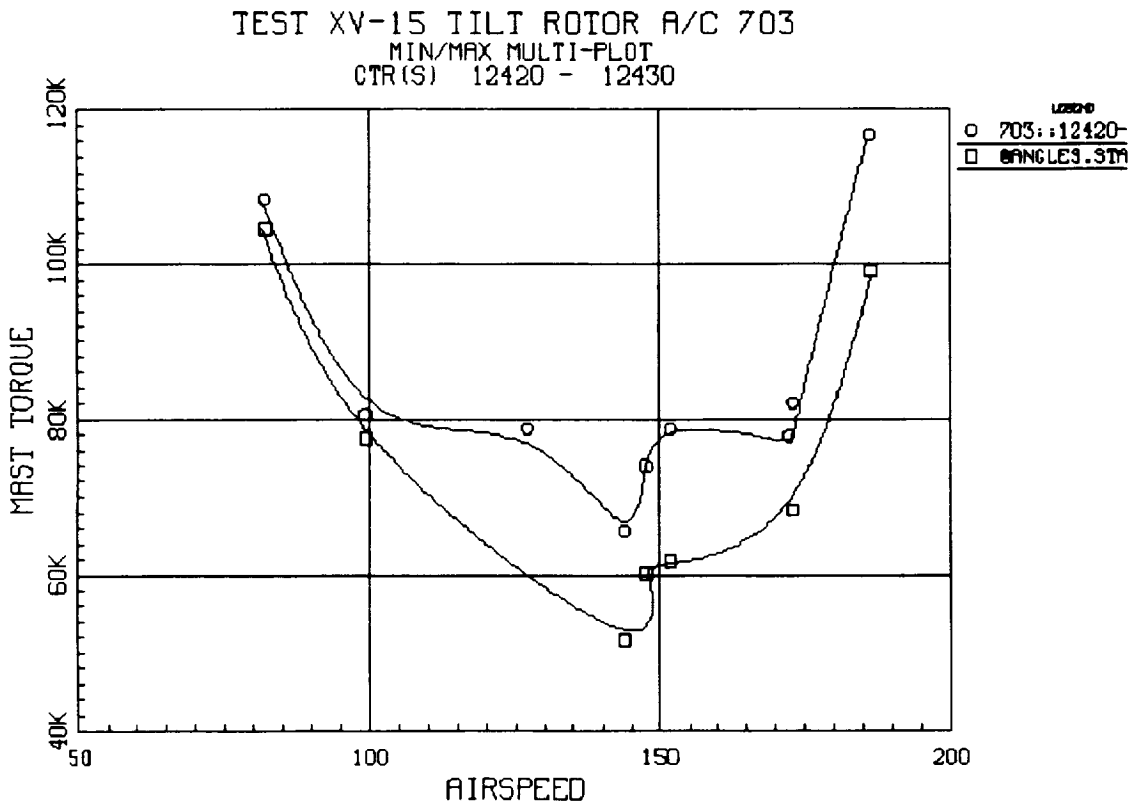
The example which follows is for three conditions in the 703 database, for various pylon angles. The second example compares two "databases", one of which is an ASCII input file of statistical data.

◆ *EXAMPLE #1*

```
Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

                ITEM
                ----
 PLOT 1  X-AXIS: P002
     Y-AXIS 1 : M143

                ITEM
                ----
 PLOT 2  X-AXIS:


 Enter flight, :counter(s) or DCS for family # 1 : PYLON30

PYLON30: No description supplied                    Saved: 26-SEP-1985 15:57
    6 COUNTERS.  FIRST =   6445, LAST =   8776


 Enter flight, :counter(s) or DCS for family # 2 : PYLON60

PYLON60: No description supplied                    Saved: 26-SEP-1985 15:54
    6 COUNTERS.  FIRST =   6769, LAST =   7546


 Enter flight, :counter(s) or DCS for family # 3 : PYLON90a

PYLON90A: Pylon 90 degrees & Airspeed above 26 kts Saved:  1-APR-1992 15:48
```



```
Multiple databases? (Y/[N]): Y

    Enter database #1 : 703

    Enter database #2 : @ANGLES.STATS

    Enter database #3 :

 OK.  The syntax for BOTH x-axis and y-axis prompts is:
        item703;@itemASC

Enter itemcode, CNTR, or (cr) when prompted
and, optionally, the scale min,max,inc.

                ITEM
                ----
 PLOT 1  X-AXIS: AIRSPEED=P002;@P002,50,200,50
     Y-AXIS 1 : MAST TORQUE=M107.MIN;@M143.MAX

                ITEM
                ----
 PLOT 2  X-AXIS: _

Enter fit, :ctrs or DCS for (703): :12420-12430

  11 COUNTERS.  FIRST =    12420, LAST =    12430

Enter counters or * for (@ANGLES.STATS): *

            OK.  ANGLES.STATS is open.

   7 COUNTERS.  FIRST =    12420, LAST =    12430

Entering zero (0) puts best curve through every point.
Negative number will not plot the smoothing curve.
The larger the number entered, the closer the curve will be to a straight line.
Default = 0.25

 Weighting factor for smoothing : .1_
```

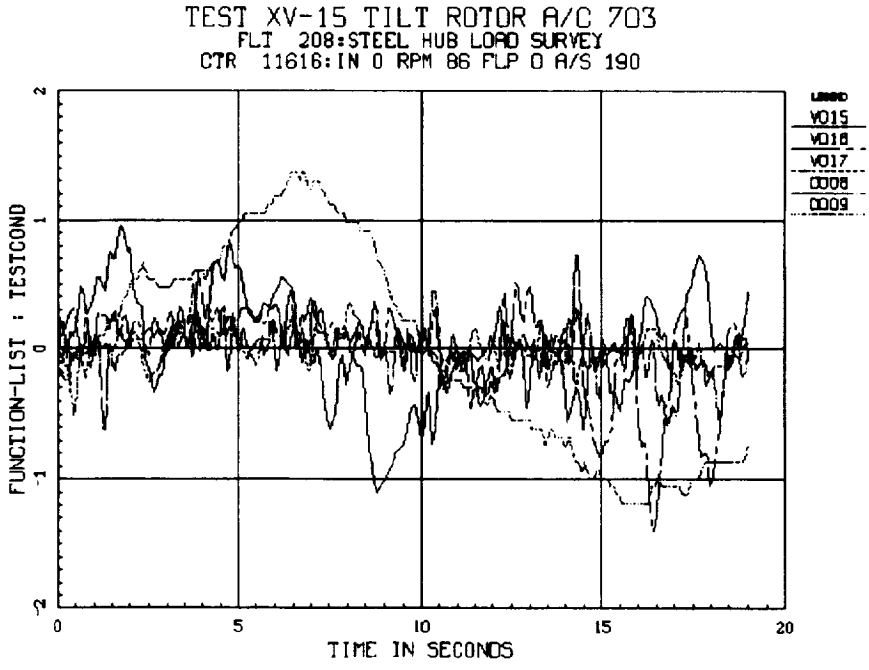


NORMALIZE

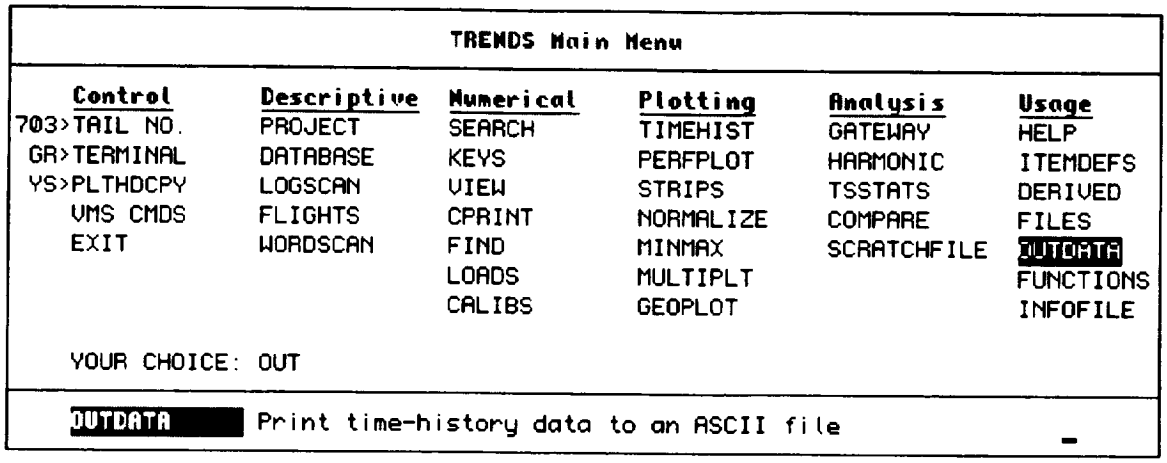
```
                              TRENDS Main Menu

   Control          Descriptive      Numerical      Plotting       Analysis      Usage
703>TAIL NO.        PROJECT          SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL        DATABASE         KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS        FLIGHTS          CPRINT         NORMALIZE      COMPARE       FILES
    EXIT            WORDSCAN         FIND           MINMAX         SCRATCHFILE   OUTDATA
                                     LOADS          MULTIPLT                     FUNCTIONS
                                     CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE:

    NORMALIZE  Plot normalized time-histories                                    _
```

This feature plots time-histories of several data-items together on the same plot with a common scale. The time-histories are automatically biased at their individual means (across the counter in question) before plotting. The items or expressions to be plotted are entered by means of a list-file with the extension .FNC<db> (for example, ACCESS.FNC703) which is prepared by the user with the VMS editor before running TRENDS. The user is then prompted for the name of the "function" file while running NORMALIZE. The file has one line for each item or expression to be plotted, with a maximum of eleven per plot.

```
                    MULTI-FUNCTION PLOTTING
                    ***********************

Enter function-list filename or ? : TESTCOND
   V015
   V016
   V017
   D008
   D009

Enter the counter number(s) : 11616
```



OUTDATA



OUTDATA provides a means for printing TRENDS time-history data to a file. OUTDATA ASCII files are readable by TIMEHIST (see TIMEHIST's help-item "ASCII,@" for how to request them). Because these files are readable, they are prototypes for other user-supplied time-history ASCII input files.

You will first be prompted for the counter of interest. Enter only one. Then you will be asked to name the file to which the data will be printed. Next, you will be asked to name the data items whose data you want to print. Enter them as a list of mnemonics or itemcodes separated by commas or spaces as in the following example.

```
Enter items...:  P002,M143,P342
```

Or, you may enter "LIST:" followed by the name of a file in which your items are listed.

```
OR     Enter items...:  LIST:MYLIST.ITEMS      (MYLIST=user file name)
```

Or, if you have and INFOFILE, you may request a predefined group of items from the infofile by prefacing the group name with the keyword "GROUP:" as follows.

```
      (Hit RETURN to continue)
OR     Enter items...: GROUP: ?                 to view available item groups
or     Enter items...: GROUP: NFBV              get all items in group NFBV
or     Enter items...: GROUP: NFBV(4)           get the 4th element of NFBV
or     Enter items...: GROUP: S2PA(2,3)         get element in row 3 of column 2
                                                (both elements of a double row)
or     Enter items...: GROUP: S2PA(*,3)(TOP)    get all of row 3, TOP only
or     Enter items...: GROUP: S2PA(BOTTOM)      get all bottom elements
```

The next prompt is for the time interval you want. This should be supplied as two numbers separated by a comma. Then you will be asked for sample rate. A value of 10 means 10 frames per second. In general, the time series for a group of data items will begin at slightly different times (time-skew) and be stored at different sample rates. OUTDATA will find the common time intersection and interpolate linearly between data samples to get the values for printing.

Warning: It should be noted that OUTDATA will interpolate all of the output data items to common output times. Because of time skew and different sampling rates, the output histories will not necessarily be identical to the individual inputs.

```
    Enter a counter number: 11616

       C703011616.208 is not cached, looking in the Jukebox


Volume ID E25B51E4, Volume 002A_DB703 is loaded in drive 0

 Writing C703011616.208 > mag disk
Job CACHEB (queue TRENDS_SPAWN$BAT, entry 539) started on TRENDS_SPAWN$BAT

  OK.  Now provide a name for the output file [OUT703.11616]:

              OK.  We will name it OUT703.11616

  Enter data items (or LIST:--; GROUP:--): P002,P342

Mnemonic Description                    Units  I.C.     ITIME    NPTS  Samp/Sec
P002     AIRSPEED - NOSE BOOM           KNOTS  P002  84473601      96     5.020
P342     ALTITUDE - NOSE BOOM           FEET   P342  84473601     100     5.229


  Enter more items (or LIST:--; GROUP:--): CR

       Your list of mnemonics/items has been written to ITEMS.SAV

                   The (max common) data duration (sec) is:   18.92

          Enter a print interval [0.0,   18.92] : 5,6

        Enter output rate in samples/sec [   5.2]: 5

                              Data have been written (     6 lines)

          Enter a counter number:

        Type the file now? (Y/[N]): y


        TRENDS Time-history Output File: OUT703.11616
             Title: title test
             Database:     703
             Counter:     11616 IN 0 RPM 86 FLP 0 A/S 190
             Generated:    16-JUL-92 15:15:41

{
Mnemonic Description                    Units  I.C.     ITIME    NPTS  Samp/Sec
P002     AIRSPEED - NOSE BOOM           KNOTS  P002  84473601      96     5.020
P342     ALTITUDE - NOSE BOOM           FEET   P342  84473601     100     5.229
}

             Print interval (sec):    5.00 to     6.00
             Output frame rate (/sec):    5.00
{
                 TIME          P002           P342
                 (SEC)         (KNOTS )       (FEET  )
                }
                5.0000  0.1910775E+03  0.6583566E+04
                5.2000  0.1909631E+03  0.6583566E+04
                5.4000  0.1910996E+03  0.6581862E+04
                5.6000  0.1911557E+03  0.6576392E+04
                5.8000  0.1910835E+03  0.6578753E+04
                6.0000  0.1910027E+03  0.6586256E+04

                              *** End of record ***
                    Hit RETURN to continue...
```

PERFPLOT

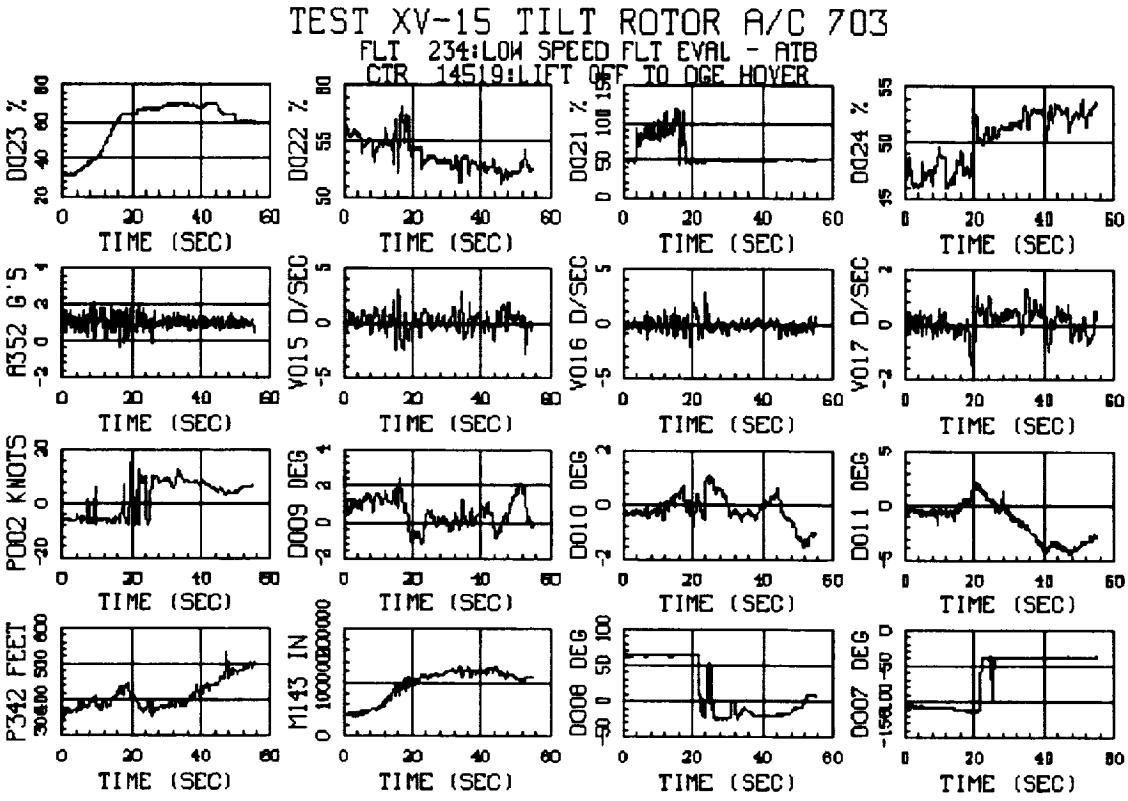

```
                              TRENDS Main Menu

   Control        Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 VS>PLTHDCPY      LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                 LOADS         MULTIPLT                    FUNCTIONS
                                 CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE: PER

   PERFPLOT      Plot performance parameters 2X2, 3X3 or 4X4 per page
```

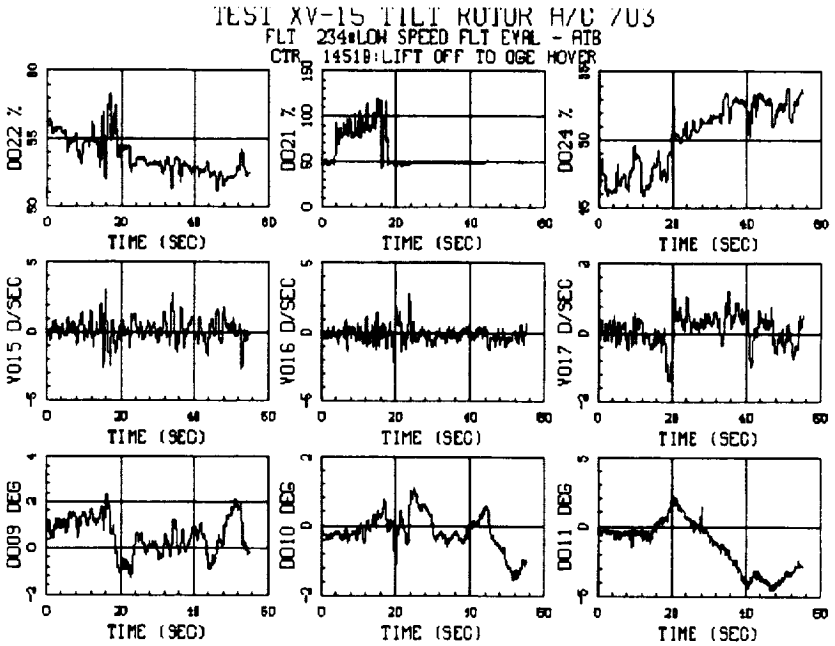
```
Plot setup file [PERF703] :CR

            ***** PERFORMANCE PLOTTING *****
                  -------- * ---------
4, 9 OR 16 PERFORMANCE PARAMETERS ARE PLOTTED ON A PAGE IN A
2X2, 3X3 OR 4X4 ARRAY.  THE PERFORMANCE PARAMETERS ARE:

    OPTION 1              OPTION 2                              OPTION 3
    --------              --------                              --------
 1       3        5        8       11       14       18       22       26
P002    P342     D022     D021     D024     D023     D022     D021     D024

 2       4        6        9       12       15       19       23       27
A352    M143     V015     V016     V017     A352     V015     V016     V017

                 7        10       13       16       20       24       28
                 D009     D010     D011     P002     D009     D010     D011

                                            17       21       25       29
                                            P342     M143     D008     D007

Enter option - 1 for 2x2; 2 for 3x3; 3 for 4x4 (or ED to edit): 3

Enter the counter number(s) : 14519
```

The PERFPLOT feature will let you specify and recall one of any number of custom setups you may have in your own directory. The default is a standard setup for the current database. The plot setup pulled in from the file may be changed, then saved or just plotted.

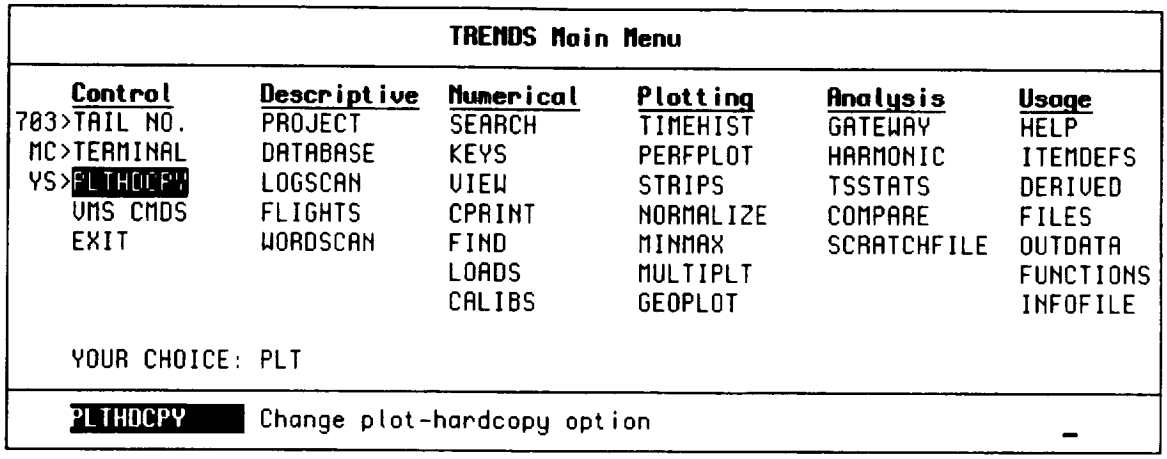
- *16 PLOTS*
- *9 PLOTS*

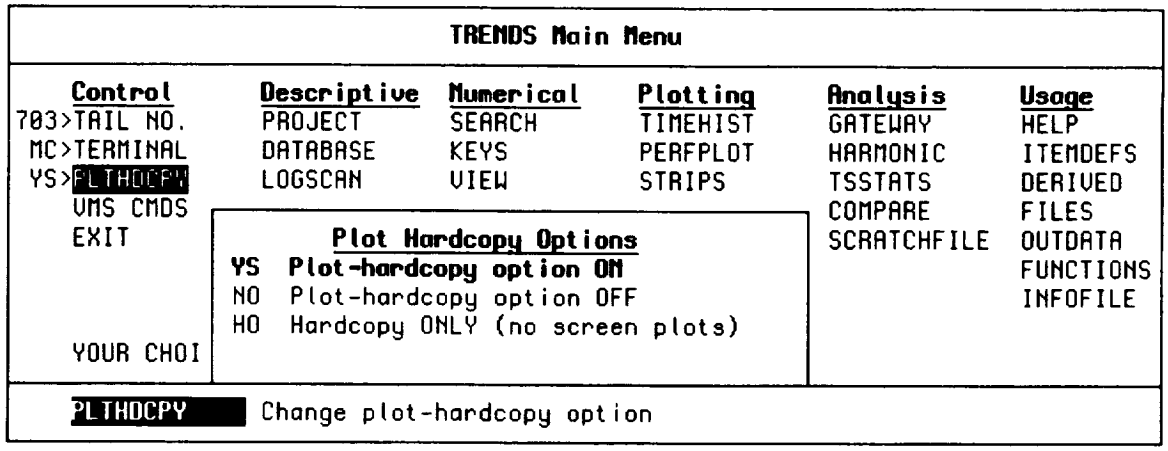
This item was incorporated into TRENDS in order to allow users to view 4, 9 and 16 parameter plots/page. The ease of setting up one's own parameter set and saving it is made user friendly. PERFPLOT gives the user a timehistory snapshot of his key parameters during the prime data time.





PLTHDCPY





If the YS option is selected under PLTHDCPY, TRENDS will show the plot on your terminal screen, then ask you if you want to save the plot. If your selection is NO, you will not be asked about saving the plot. If you select HO, your plots will not be shown on the screen, but will all be saved. In this case plots from an entire flight or DCS will be saved without any additional action by the user.

PROJECT

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical        Plotting         Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH           TIMEHIST         GATEWAY        HELP
 MC>TERMINAL        DATABASE         KEYS             PERFPLOT         HARMONIC       ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW             STRIPS           TSSTATS        DERIVED
   VMS CMDS         FLIGHTS          CPRINT           NORMALIZE        COMPARE        FILES
   EXIT             WORDSCAN         FIND             MINMAX           SCRATCHFILE    OUTDATA
                                     LOADS            MULTIPLT                        FUNCTIONS
                                     CALIBS           GEOPLOT                         INFOFILE

   YOUR CHOICE: PR

   PROJECT          Display project and aircraft information
```

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical        Plotting         Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH           TIMEHIST         GATEWAY        HELP
 MC>TERMINAL        DATABASE         KEYS             PERFPLOT         HARMONIC       ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW             STRIPS           TSSTATS        DERIVED
   VMS CMDS         FLIGHTS          CPRINT           NORMALIZE        COMPARE        FILES
   EXIT             WORDSCA                                                          OUTDATA
                                                                                     FUNCTIONS
                                                                                     INFOFILE

   YOUR CHOICE: PR

   PROJECT          Display

                    TEST XV-15 TILT ROTOR A/C 703

                    A/C Mods
                    XV15 Narrative
                    A/C Specs
                    A/C Weights
                    A/C Inertias
                    A/C dimensions
                    Show all data for 703
```

When PROJECT is selected, several sub-menus will be presented for you to find your way to project information of interest. The information shown in the menu is database-specific. The following example shows aircraft specifications and then narrows down to rotor specifications.

A/C Specs

ALL A/C Specs
A/C Specs, General
Rotor Specs
Wing Specs
Horizontal Tail Specs
Vertical Tail Specs

ROTORS (Steel Blades)

Diameter		25.0 ft
Blade airfoil specifications		
Centerline mast	(a=0.3)	NACA 64-935
Tip	(a=0.3)	NACA 64-208
Blade chord		1.17 ft
Blade twist (effective)		45 degrees
Disk loading		
Design gross weight		13.2 lbs/sq.ft.
Maximum gross weight		15.3 lbs/sq.ft.
Direction of rotation (inboard tip motion)		
Helicopter/airplane mode		aft/up
RPM and tip speed		
Helicopter/tilt-rotor mode		
Design operating		565 RPM (94%), 740 ft/sec
Operating overspeed		601 RPM (100%), 787 ft/sec
Hover test overspeed		625 RPM (104%), 818 ft/sec
Airplane mode		

Tip Speed

Variable rotor-tip speed control is provided to enable research on noise, performance, and hover downwash. The nominal design tip speeds are:

Condition	Tip speed (ft/s)	RPM
Hover/Helicopter mode	740	565
Cruise/Airplane mode	600	458
Hover Test Overspeed	818	625
Design Limit	865	661

SCRATCHFILE

```
                              TRENDS Main Menu

   Control        Descriptive     Numerical     Plotting      Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW          STRIPS        TSSTATS       DERIVED
   VMS CMDS       FLIGHTS         CPRINT        NORMALIZE     COMPARE       FILES
   EXIT           WORDSCAN        FIND          MINMAX        SCRATCHFILE   OUTDATA
                                  LOADS         MULTIPLT                    FUNCTIONS
                                  CALIBS        GEOPLOT                     INFOFILE

   YOUR CHOICE:

   SCRATCHFILE  View and operate on scratch files                            _
```

This item was incorporated into TRENDS to allow users to perform functions on DATAMAP-style scratch files (matrices of parameter data) and to transfer data between DATAMAP and TRENDS. Scratch files are temporary holding bins for storing raw data or results of analysis or derivations. There are four (4) logical scratch files available, each being a section of the physical file, PERMSCR.DAT, which should be located in the user's own operating directory. Each of the logical scratch files can store data in variable-dimension arrays of rows and columns as well as in "double-row" (e.g., top, bottom) arrays. Data can be retrieved by TRENDS or DATAMAP by specifying row and column, top or bottom from a given scratch file (section). Data from scratch files can be plotted in TIMEHIST, NORMALIZE, and COMPARE, as well as in DATAMAP (GATEWAY menu item). Further information about scratch files and their use may be found in the User's Guide section of this manual under DATAMAP or in USAAVRADCOM-TR-80-D-30A, the user's manual for DATAMAP written by Richard B. Philbrick, 1980.

NOTE:

Scratch files may be generated in DATAMAP or TRENDS by using an infofile as a template.

```
      This feature enables the viewing and manipulation of data in
scratch files.  The general syntax is

    { (ADD) destination=} (function() source (?) ())

Examples:

          SCF4                 Displays all of SCF4
          SCF4?                Displays more about SCF4
          SCF4(*,3)            Displays top and bottom of row 3
          ATPP(SCF4(1,*,TOP))  User's function ATPP of col 1, TOP
   SCF3 = ATPP(SCF4(1,*,TOP))  Stores result in SCF3(1,*,TOP) (Keep)
ADD SCF3 = ATPP(SCF4(1,*,TOP))  Adds result to SCF3
   SCF2 = CVF(SCF4(*,*),5,2)   Keeps filtered version of SCF4 in SCF2
   SCF3 = BF(SCF4(*,*),8)      Stores Butterworth version in SCF3
   SCF2 = POLY(SCF4(*,*),2)    Keeps quadratic fit of entire SCF4
   SCF1 = FFT(SCF4(*,*))       Keeps FFT spectra of SCF4 in SCF1

**********    INFO-FILE INPUT, SCRATCH OUTPUT    **********

      The standard form for building a scratch file from an info-file
      specification is, for example,

                  SCF2 = GROUP:S2PA(3,*,T)

      You may perform math operations and time-series functions just as
      you would for scratch-file inputs.  You may also use a character-
      string substitution.  For example,

       (entry 1)      X = GROUP:S2PA          (define X)
       (entry 2)      Y = X(T)                (X no longer usable)
       (entry 3)      SCF1 = CVF(SCREEN(1.3*DERIV(Y/1.1),150),5,1)
Enter your specification or ?:
```

```
Enter your specification or ?: Scf4

       CREATED AS: CYCLE AVERAGE:
GENERAL DATA LABL: MODEL BLADE CP'S, UH-60 DNW
       DOUBLEROW: BOTH
           UNITS: CP
   NO. OF COLUMNS:          10
   NUMBER OF ROWS:          23
ROW POS SCALE VAR: FRACTN OF CHORD
ROW POS SHORT VAR: X/CHORD
ROW POS TOPO FEAT: LEADING EDGE
COL POS SCALE VAR: FRACTN OF RADIUS
COL POS SHORT VAR: R/RADIUS
COL POS TOPO FEAT: BLADE ROOT
FIRST DIM SAMPINT:    0.16505283E-03
FIRST DATA RECORD:         216
ATTACHED PARAM ID:           0
LXAX FROM /PRCOM/:           1
      SHIP MODEL: DNW UH60
     SHIP NUMBER: BHD  00
SHIP GROSS WEIGHT:  13000.0
SHIP LONGITD. CG.:    300.3
TOP DBLE-ROW KYWD: CNP
BOT DBLE-ROW KYWD: CNP
 INDEP. VAR. TYPE:           1
   AZIMUTH OFFSET:    0.00000000E+00
TOP DBL-ROW LABEL: TOP SURFACE
BOT DBL-ROW LABEL: BOTTOM SURFACE
LUSQRD UNIT INDIC:           0
CROSS-PROC. LABEL:


 UNITS FOR 2ND DAT:

    ROW POSITIONS: -  FRACTN OF CHORD
  0.100E-01  0.200E-01  0.444E-01  0.492E-01  0.746E-01  0.787E-01
  0.107E+00  0.132E+00  0.157E+00  0.164E+00  0.203E+00  0.250E+00
  0.299E+00  0.393E+00  0.395E+00  0.544E+00  0.607E+00  0.701E+00
  0.790E+00  0.818E+00  0.937E+00  0.957E+00  0.963E+00

   COLUMN POSITIONS - FRACTN OF RADIUS
COL   POSITION      TINIT     TFINAL    COUNTER  REVS
        AZIMUTH/TIME        NPTS,1STVAL,LASTVAL=  2      0.000      0.042
        AIRSPEED            NPTS,1STVAL,LASTVAL=  2     41.185     41.185
        RPM                 NPTS,1STVAL,LASTVAL=  2   1420.000   1420.000
        STATIC PRESSURE     NPTS,1STVAL,LASTVAL=  2     14.431     14.431
        OUTSIDE AIR TEMP.   NPTS,1STVAL,LASTVAL=  2     11.000     11.000
  1  0.225E+00      0.000      0.042        827     1
  2  0.400E+00      0.000      0.042        827     1
  3  0.550E+00      0.000      0.042        827     1
  4  0.675E+00      0.000      0.042        827     1
  5  0.775E+00      0.000      0.042        827     1
  6  0.865E+00      0.000      0.042        827     1
  7  0.920E+00      0.000      0.042        827     1
  8  0.945E+00      0.000      0.042        827     1
  9  0.965E+00      0.000      0.042        827     1
 10  0.990E+00      0.000      0.042        827     1

-------------------------------------------------------------
```

SEARCH

```
                              TRENDS Main Menu

   Control       Descriptive    Numerical     Plotting      Analysis      Usage
703>TAIL NO.     PROJECT        SEARCH        TIMEHIST      GATEWAY       HELP
 MC>TERMINAL     DATABASE       KEYS          PERFPLOT      HARMONIC      ITEMDEFS
 YS>PLTHDCPY     LOGSCAN        VIEW          STRIPS        TSSTATS       DERIVED
    VMS CMDS     FLIGHTS        CPRINT        NORMALIZE     COMPARE       FILES
    EXIT         WORDSCAN       FIND          MINMAX        SCRATCHFILE   OUTDATA
                                LOADS         MULTIPLT                    FUNCTIONS
                                CALIBS        GEOPLOT                     INFOFILE

    YOUR CHOICE:

    SEARCH      Search for a specific set of flight conditions
```

See USER'S GUIDE SEARCH page 3-9 for more detail.

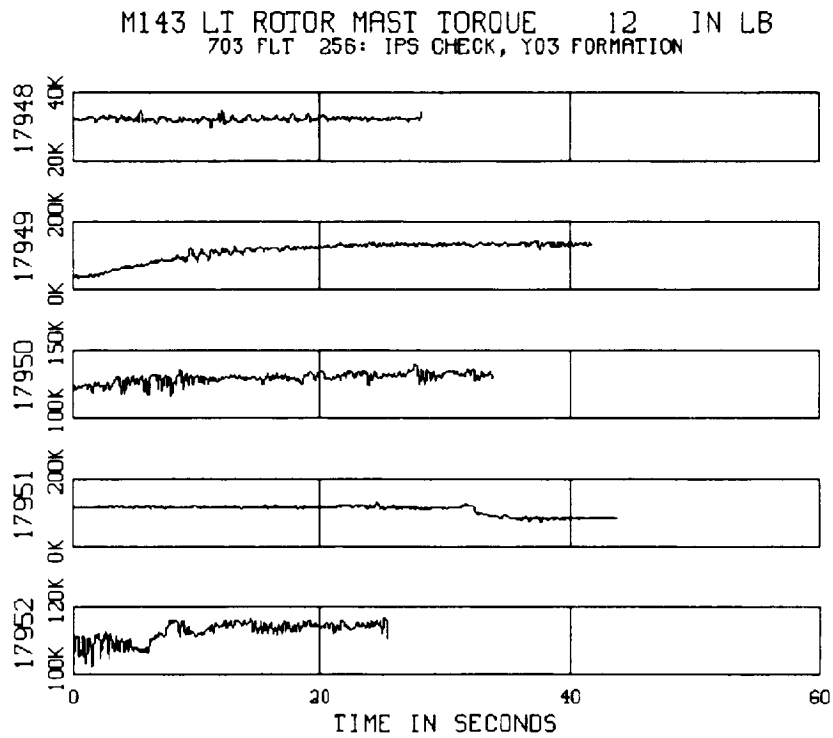
```
Searches the database for counters for which prescribed
conditions are satisfied.

Define the conditions -- first "itemcode",  then its acceptable bounds.
"ITEMCODE" may be a simple itemcode OR a derived/stored pseudo-item
OR a mathematical expression or defined function.
Enter "MASK" for condition mask or "KEYS" for standard keys.
Type "?" for a full explanation.  Have fun!

 ITEMCODE (or expression) : P342

           P342.AVS    ALTITUDE - NOSE BOOM              FEET


              Lower bound : 200

              Upper bound :

                                          CONDITION MASK :

ITEMCODE        LOWER        UPPER
P342.AVS        200.00    9999999.00        ALTITUDE - NOSE BOOM            FEET
     OK ? [Y] :
 Do you want to save this condition mask [N] ?

 Enter the flight number(s) : 255


              N703      FLIGHT  255      GW = 13000. LBS     CG = 300.0 IN.


    N703   P342.AVS
            FEET

17920        2094.1
17921         437.3
           --------
MAXIMUM      2094.1
MINIMUM       437.3
AVERAGE      1265.7
           --------

    N703   P342.AVS
            FEET
```

STRIPS


```
                              TRENDS Main Menu

   Control          Descriptive      Numerical        Plotting         Analysis       Usage
703>TAIL NO.        PROJECT          SEARCH           TIMEHIST         GATEWAY        HELP
 MC>TERMINAL        DATABASE         KEYS             PERFPLOT         HARMONIC       ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW             STRIPS           TSSTATS        DERIVED
   VMS CMDS         FLIGHTS          CPRINT           NORMALIZE        COMPARE        FILES
   EXIT             WORDSCAN         FIND             MINMAX           SCRATCHFILE    OUTDATA
                                     LOADS            MULTIPLT                        FUNCTIONS
                                     CALIBS           GEOPLOT                         INFOFILE

   YOUR CHOICE: ST

   STRIPS          Plot time-history strip-charts for multiple counters
```

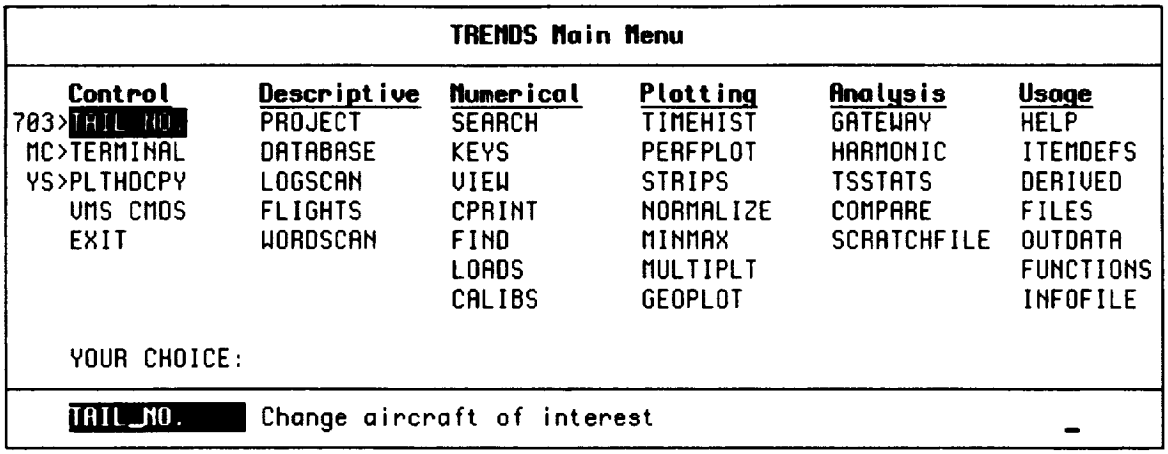
This item was incorporated into TRENDS in order to allow a user to easily look at a single parameter timehistory data plot for multiple counters in a format like strip chart recorders in the flight test control room. It is the key menu item to provide the user with output plots for multiple counters. Formulas are not handled and the abscissa is always time. Scales may be forced and intervals may be specified.

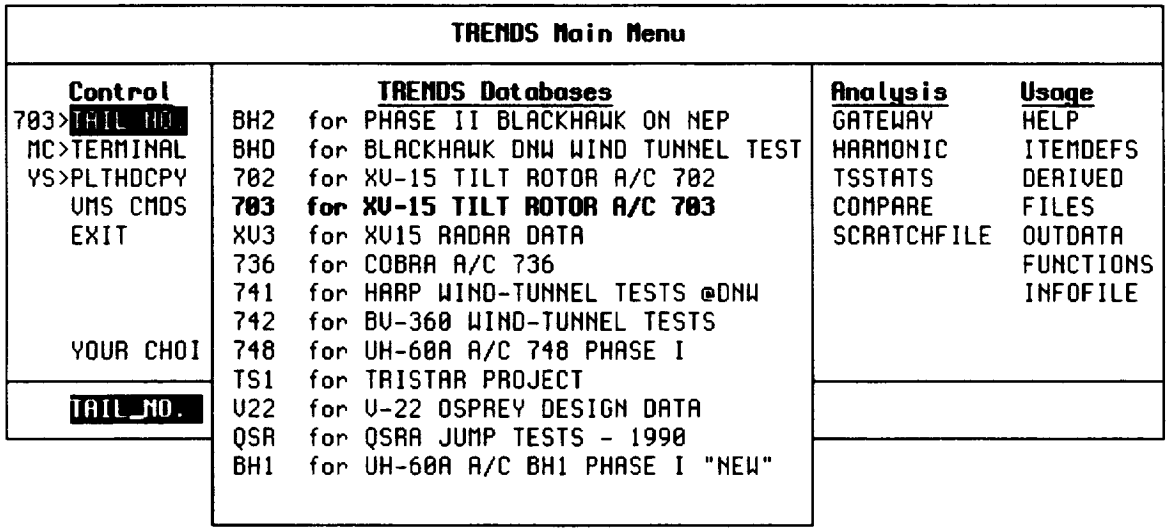
```
Enter itemcode or <CR> when prompted

    I.C. name : M143

Enter the counter(s), F"flight #", DCS filename : F256

  31 COUNTERS.  FIRST =    17948, LAST =    17984
   ***  Data acquired for counter   17948  ***
   ***  Data acquired for counter   17949  ***
   ***  Data acquired for counter   17950  ***
   ***  Data acquired for counter   17951  ***
   ***  Data acquired for counter   17952  ***
```



◆ *MULTIPLE COUNTER PLOT*

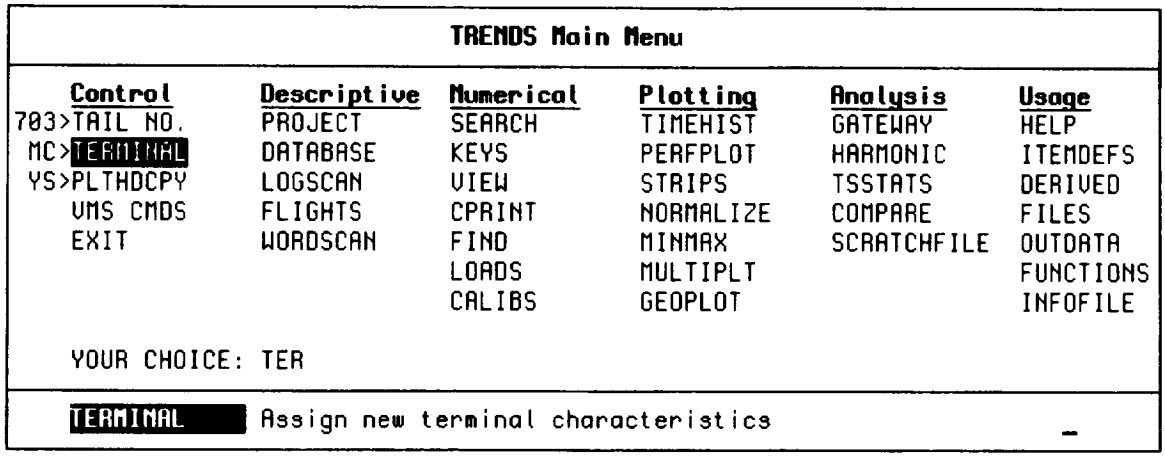
TAIL NO.



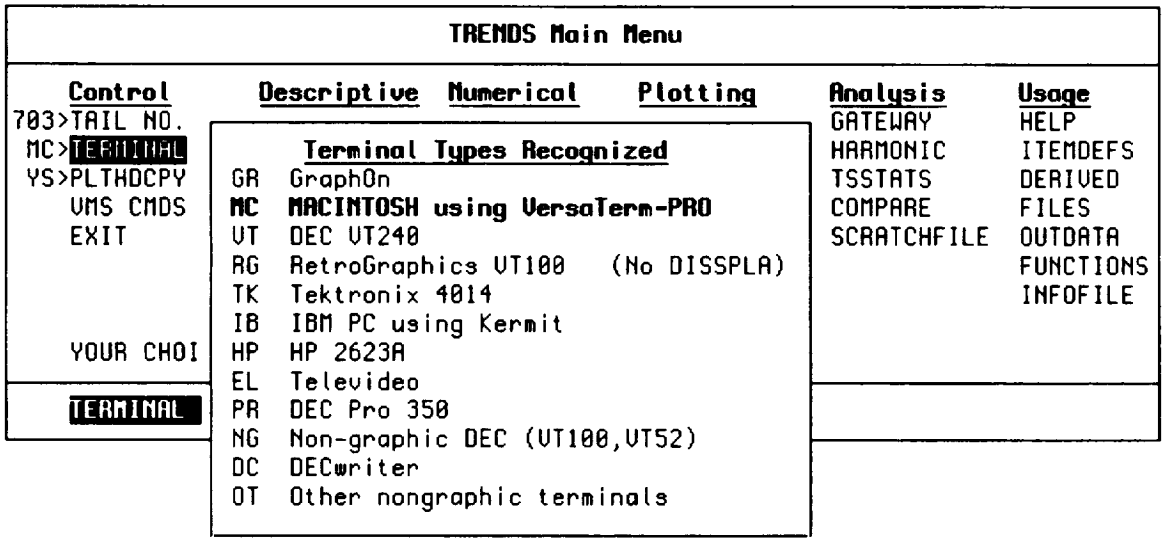


When TAIL_NO is selected, the available databases are shown in a sub-menu. Select one and TRENDS will change its pointers to reference the database you select. The available databases are specified by the TRENDS site manager, but you may add your own to the list by including appropriate pointers in your file USERBASE.PTR!

TERMINAL



Provides a way to tailor TRENDS to the terminal that you are using by allowing you to select your terminal type from this menu. It is important that this be done in order to properly have your screen switch from TEXT to graphics and back again AUTOMATICALLY. It should be noted that in the past the IBM PC is not as transparant as other systems when when switching between text and graphics and does require a special terminal emulator to achieve this flexibility.



TIMEHIST

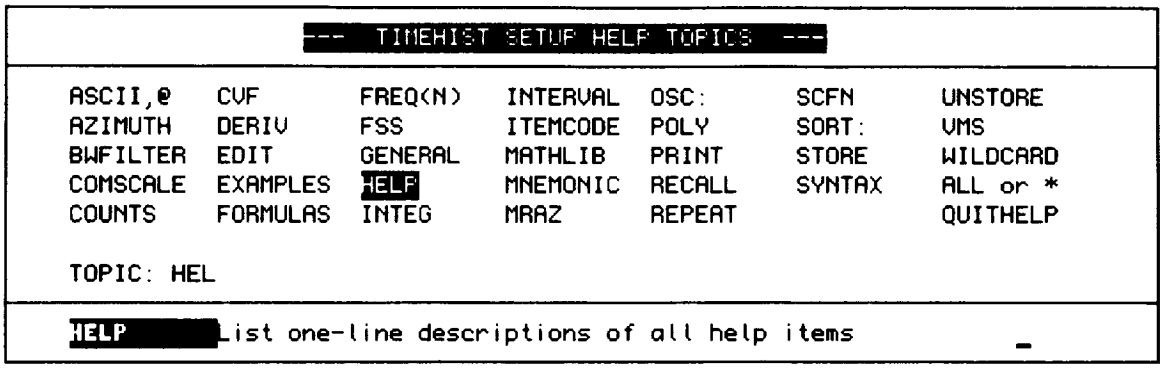
```
                              TRENDS Main Menu

   Control          Descriptive      Numerical      Plotting       Analysis      Usage
703>TAIL NO.        PROJECT          SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL        DATABASE         KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS        FLIGHTS          CPRINT         NORMALIZE      COMPARE       FILES
    EXIT            WORDSCAN         FIND           MINMAX         SCRATCHFILE   OUTDATA
                                     LOADS          MULTIPLT                     FUNCTIONS
                                     CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE: TI

    TIMEHIST    Plot time-history or spectral data                              -
```

This menu item is one of the most important ones in TRENDS, because it provides the user with the ability to plot time-history parameter data against time, another parameter, or to plot spectrals of data, etc. (see 3-18). Secondly, this plotting capability allows the user to apply virtually any function to the data in line with his user prompts or to use user defined functions out of the menu item FUNCTIONS file.

```
                        TIME-HISTORY PLOTTING
                        *********************
EXAMPLES of valid responses to prompts:

                X-AXIS: T                       (time on x-axis, auto scale)
        or      X-AXIS: T,0,20,5                (time, 0 to 20secs, inc=5)
        or      X-AXIS: M143                    (ITEM CODE for X-axis,autoscale)
        or      X-AXIS: MAA2(3),0,360,45        (Cycle-avg. 3 cycles vs azimuth)
        or      X-AXIS: FREQ,20,30,2            (SPECTRAL, with freq. scaling)
        or      X-AXIS: INT=5,8                 (Interval of time = 5 to 8 secs)
        or      X-AXIS: PRINT                   (DUMP TIME HISTORY FILE)
        or      X-AXIS: ?                       (HELP for more INPUT INFO)

                Y-CURVE 1: P002                 (Y-axis, autoscale)
        or      Y-CURVE 2: POLY(P002,3)         (curve fit to P002 data points)
        or      Y-CURVE 2: DIFF=M143-M107       (DIFF becomes plot label)
        or      Y-CURVE 3: RSIM                 (RSIM or FSIM=function Gen Input


Enter itemcode, TIME or (cr) when prompted
and, optionally, the scale min,max,inc.

                  ITEM
                  ----
 PLOT 1  X-AXIS:   ?
```

```
                    --- TIMEHIST SETUP HELP TOPICS ---

   ASCII,@    CVF        FREQ(N)    INTERVAL   POLY       SCFN       UNSTORE
   AZIMUTH    DERIV      FSS        MATHLIB    PRINT      SORT:      VMS
   BWFILTER   EDIT       GENERAL    MNEMONIC   RECALL     STORE      WILDCARD
   COMSCALE   EXAMPLES   HELP       MAA2       REPEAT     SYNTAX     ALL or *
   COUNTS     FORMULAS   INTEG      OSC:                             QUITHELP

   TOPIC:

   QUITHELP  Return to the TIMEHIST dialogue (leave help)                    -
```

Setup Help Topics



ASCII,@	Read data from an ASCII user-file
AZIMUTH	Using rotor azimuth & cycle averaging
BWFILTER	Butterworth filtering
COMSCALE	Force a common scale for all curves of a plot
COUNTS	Plot or print data in counts, not e.u.
CVF	Convolution filtering
DERIV	Derivatives
EDIT	Edit the plot setup
EXAMPLES	Examples of TIMEHIST plot-setup entries
FORMULAS	Explain the use of formulas or functions
FREQ(N)	Spectral analysis, versus Hz or per-rev
FSS	Fourier series synthesis of a time series
GENERAL	General TIMEHIST usage
HELP	List one-line descriptions of all help items
INTEG	Integrals
INTERVAL	Time interval specification
MATHLIB	Available math library functions for formulas
MNEMONIC	Search for data mnemonics or itemcodes
MRAZ	Main-rotor azimuth or cycle-averaging
OSC:	Plotting the oscillatory part of MMR data
POLY	Polynomial regression
PRINT	Printing instead of plotting
RECALL	Recalling (and maybe editing) plot setups
REPEAT	Repeating a previously-entered line to save typing
SCFN	Plotting DATAMAP-style scratch files
SORT:	Sort the data to be plotted by x-axis values
STORE	Store (save) away a curve by name for recall
SYNTAX	Plot specification syntax
UNSTORE	Clean up your STOREd curves
VMS	Open the window to VMS within TRENDS
WILDCARD	Specify items to be plotted, using *
ALL or *	Store all of the help to a file for printing
QUITHELP	Return to the TIMEHIST dialogue (leave help)

```
--- TIMEHIST SETUP HELP TOPICS ---

ASCII,@    CVF        FREQ(N)    INTERVAL   OSC:       SCFN       UNSTORE
AZIMUTH    DERIV      FSS        ITEMCODE   POLY       SORT:      VMS
BWFILTER   EDIT       GENERAL    MATHLIB    PRINT      STORE      WILDCARD
COMSCALE   EXAMPLES   HELP       MNEMONIC   RECALL     SYNTAX     ALL or *
COUNTS     FORMULAS   INTEG      MRAZ       REPEAT                QUITHELP

TOPIC: INT

INTEG          Integrals
```

EXAMPLE of INTEGration HELP if requested during setup:

```
                <<<  INTEG(x)  >>>
This integral is simply a weighted sum of sequential values of
the integrand, x, where the weight is the time-interval, dt.  The
initial (t=0) value of the integral is zero.  The integrand, x,
may be a mathematical expression (but not POLY(..) or INTEG) or a
simple itemcode.  INTEG may itself be used in a mathematical
expression, BUT must not appear twice on the same entry line.

    Valid examples:

      PLOT 1: X-AXIS:   TRYINT=7.3*INTEG(P002^2)/3.14
           Y-CURVE 1:   POLY(INTEG(D747),3)
           Y-CURVE 2:   INTEG(M143-M107)

    Invalid examples:

           Y-CURVE 1:   BAD1=INTEG(M143)-INTEG(M107)
           Y-CURVE 2:   BAD2=INTEG(INTEG(M143))

       (Hit RETURN to continue)_
```

TRENDS Main Menu

Control	Descriptive	Numerical	Plotting	Analysis	Usage
703>TAIL NO.	PROJECT	SEARCH	TIMEHIST	GATEWAY	HELP
MC>TERMINAL	DATABASE	KEYS	PERFPLOT	HARMONIC	ITEMDEFS
YS>PLTHDCPY	LOGSCAN	VIEW	STRIPS	TSSTATS	DERIVED
VMS CMDS	FLIGHTS	CPRINT	NORMALIZE	COMPARE	FILES
EXIT	WORDSCAN	FIND	MINMAX	SCRATCHFILE	OUTDATA
		LOADS	MULTIPLT		FUNCTIONS
		CALIBS	GEOPLOT		INFOFILE

YOUR CHOICE: TI

TIMEHIST Plot time-history or spectral data

TIME-HISTORY PLOTTING

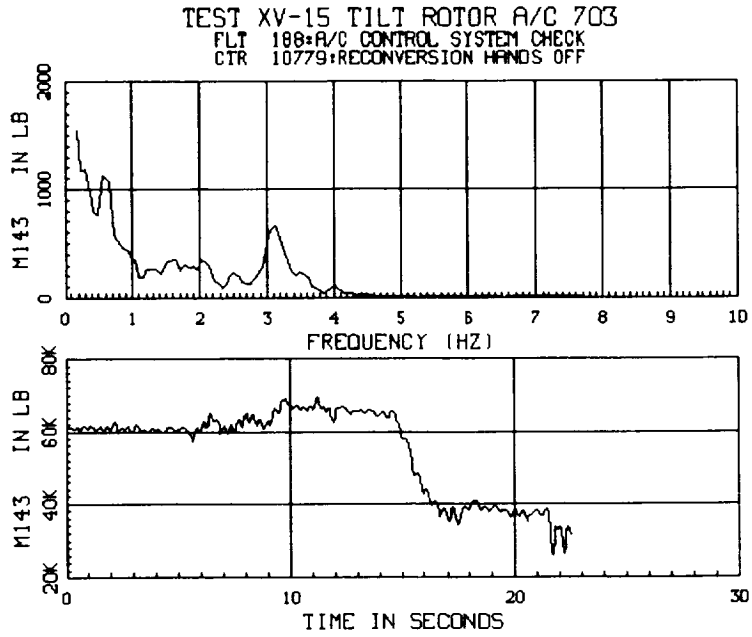
****

EXAMPLES of valid responses to prompts:

	X-AXIS: T	(time on x-axis, auto scale)
or	X-AXIS: T,0,20,5	(time, 0 to 20secs, inc=5)
or	X-AXIS: M143	(ITEM CODE for X-axis,autoscale)
or	X-AXIS: MRAZ(3),0,360,45	(Cycle-avg. 3 cycles vs azimuth)
or	X-AXIS: FREQ,20,30,2	(SPECTRAL, with freq. scaling)
or	X-AXIS: INT=5,8	(Interval of time = 5 to 8 secs)
or	X-AXIS: PRINT	(DUMP TIME HISTORY FILE)
or	X-AXIS: ?	(HELP for more INPUT INFO)
	Y-CURVE 1: P002	(Y-axis, autoscale)
or	Y-CURVE 2: POLY(P002,3)	(curve fit to P002 data points)
or	Y-CURVE 2: DIFF=M143-M107	(DIFF becomes plot label)
or	Y-CURVE 3: RSIM	(RSIM or FSIM=function Gen Input

Enter itemcode, TIME or (cr) when prompted
and, optionally, the scale min,max,inc.

```
                ITEM
                ----
PLOT 1  X-AXIS: FREQ,0,10,1
    Y-CURVE 1 : M143

                ITEM
                ----
PLOT 2  X-AXIS: T
    Y-CURVE 1 : M143
    Y-CURVE 2 :

                ITEM
                ----
PLOT 3  X-AXIS:

Enter the counter number(s) : 10779
```



Data-Region Help Topics

```
Enter the counter number(s) : ?
```

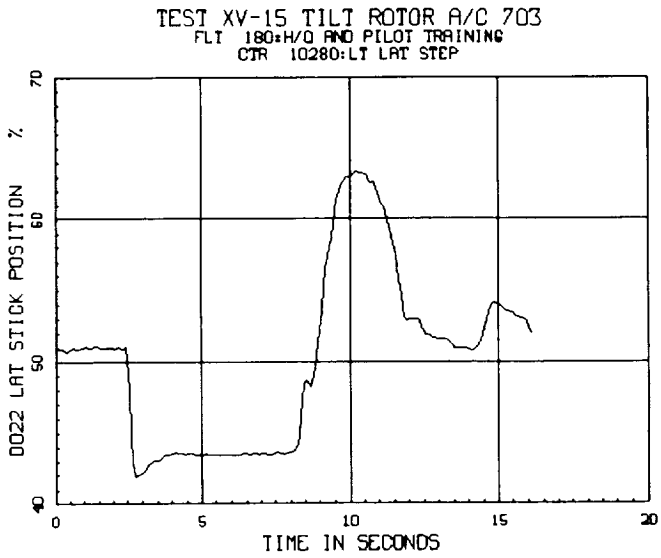
```
--- TIMEHIST DATA-REGION HELP TOPICS ---

APPEND    EDIT      HARDCOPY  MYDCS     SAVE      TITLE     W80,W132
CACHE     EXAMPLES  HELP      NOCACHE   SYNTAX    TSHIFT    +(xhair)
CACHED?   FILE:,@   INTERVAL  PRINT     TERMINAL  VMS       QUITHELP
DATABASE  FINDCTRS  JUKEBOX   RESCALE

TOPIC: HE

HELP          List one-line descriptions of all help items
```

TIMEHIST has two regions where the TRENDS user is given help. The first is SETUP HELP (see pg. 4-69) and the second is TIMEHIST DATA REGION (counter number(s):) HELP. Both of the SETUP & DATA REGION HELPs, are to provide the user with information on how to perform special functions which have been found to be useful.

```
APPEND        Append or concatenate several counters
CACHE         Reset the mode to normal caching after NOCACHE
CACHED?       Query the system to see which counters are cached
DATABASE      Look to see which flights/counters are in the base

EDIT          Edit the plot-page setup
EXAMPLES      Display examples of valid data-region responses
FILE:,@       Show how to specify ASCII input filename
FINDCTRS      Find counters with data for your items

HARDCOPY      Set or reset the plot-hardcopy option flag
HELP          List one-line descriptions of all help items
INTERVAL      Specify time slices for plotting or printing
JUKEBOX       Show current jukebox drive status

MYDCS         Show your existing derived counter sets
NOCACHE       Force TRENDS to read from the jukebox, no cache
PRINT         Turn on the PRINT (no plot) option
RESCALE       Rescale the plot for replotting without editing

SAVE          Save the current plot-page setup for later recall
SYNTAX        Show the general syntax for data-region responses
TERMINAL      Change your terminal type for TRENDS

TITLE         Set your own plot titles (3 header lines)
TSHIFT        Shift curves relative to each other in time
VMS           Open the window to VMS within TRENDS

W80,W132      Change the screen width for printing
+(xhair)      Set or reset the cross-hair (pickling) option
QUITHELP      Return to the TIMEHIST dialogue (leave help)
```

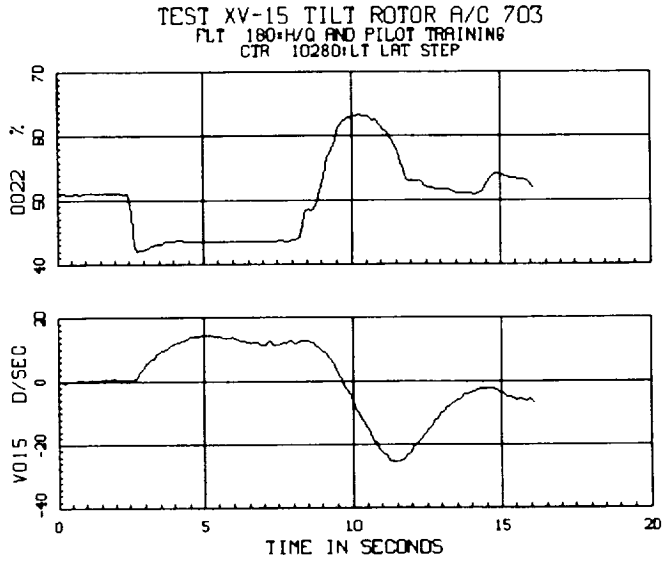
Enter itemcode, TIME or (cr) when prompted and, optionally, the scale min,max,inc.

```
                ITEM
                ----
PLOT 1  X-AXIS: T
    Y-CURVE 1 : D022
    Y-CURVE 2 :

                ITEM
                ----
PLOT 2  X-AXIS:

Enter the counter number(s) : 10280_
```



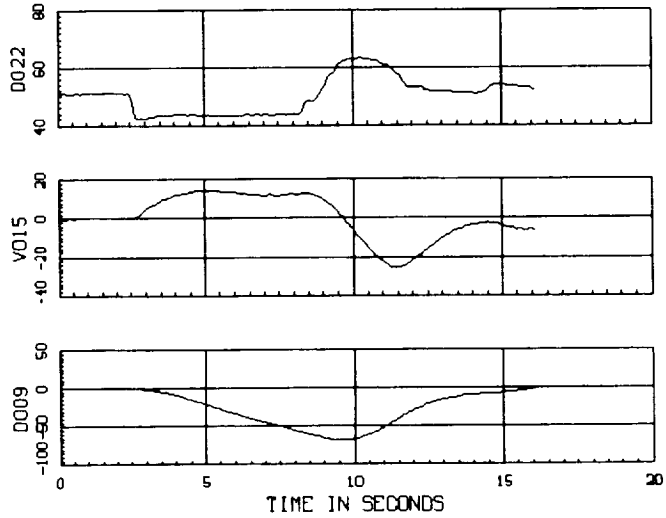
Enter itemcode, TIME or (cr) when prompted and, optionally, the scale min,max,inc.

```
                ITEM
                ----
PLOT 1  X-AXIS: T
    Y-CURVE 1 : D022
    Y-CURVE 2 :

                ITEM
                ----
PLOT 2  X-AXIS: T
    Y-CURVE 1 : V015
    Y-CURVE 2 :

                ITEM
                ----
PLOT 3  X-AXIS:

Enter the counter number(s) : 10280
```

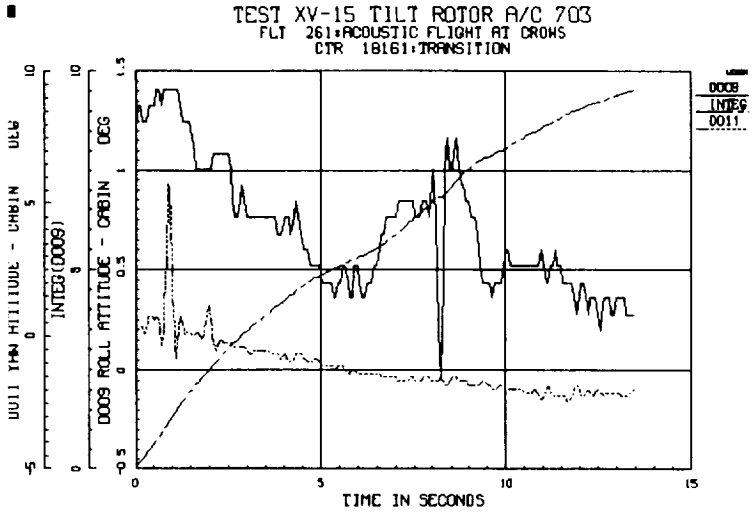


Enter itemcode, TIME or (cr) when prompted and, optionally, the scale min,max,inc.

```
                ITEM
                ----
PLOT 1  X-AXIS: T
    Y-CURVE 1 : D022
    Y-CURVE 2 :

                ITEM
                ----
PLOT 2  X-AXIS: T
    Y-CURVE 1 : V015
    Y-CURVE 2 :

                ITEM
                ----
PLOT 3  X-AXIS: T
    Y-CURVE 1 : D009
    Y-CURVE 2 :

Enter the counter number(s) : 10280
```

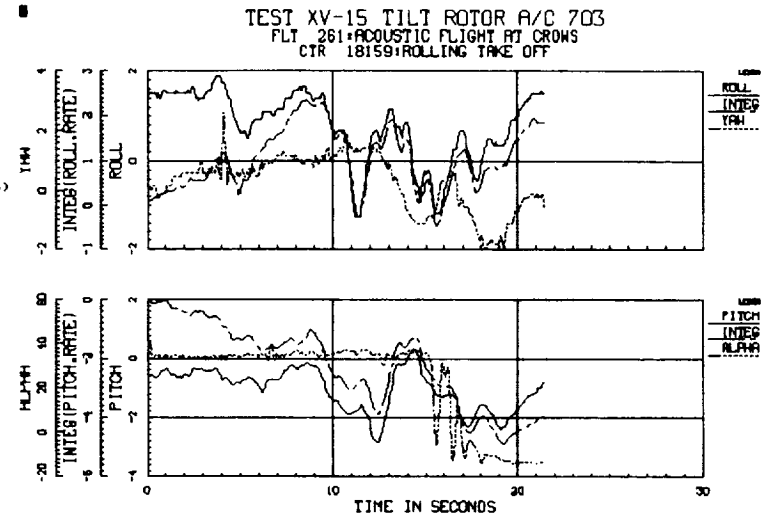


```
Enter itemcode, TIME or (cr) when prompted
and, optionally, the scale min,max,inc

                ITEM
                ----
PLOT 1  X-AXIS  T
    Y-CURVE 1   ROLL=D009
    Y-CURVE 2   INTEG(D009)
    Y-CURVE 3   D011

                ITEM
                ----
PLOT 2  X-AXIS

Enter the counter number(s)   18161_
```



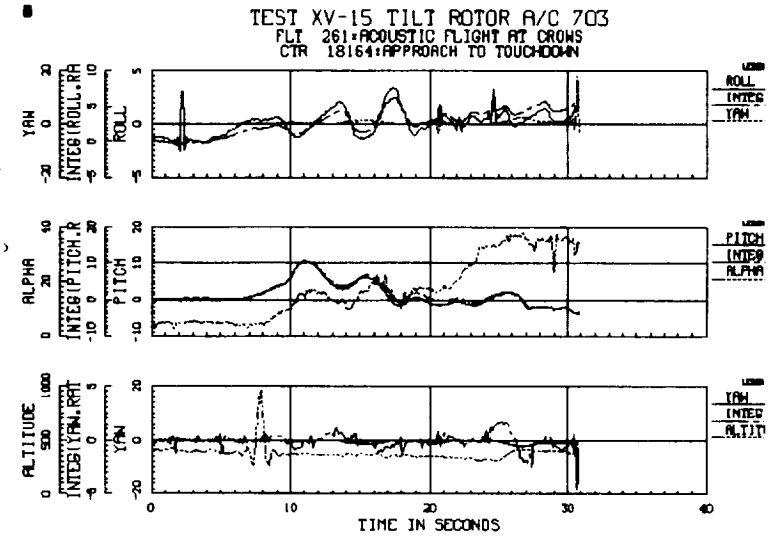
Note This setup was as a result of using Edit in TIMEHIST

```
 1   PLOT 1  X-AXIS  T
 2       Y-CURVE 1   ROLL=D009
 3       Y-CURVE 2   INTEG(ROLL_RATE)=INTEG(V015)
 4       Y-CURVE 3   YAW=-1*D011

 5   PLOT 2  X-AXIS  T
 6       Y-CURVE 1   PITCH=D010
 7       Y-CURVE 2   INTEG(PITCH_RATE)=INTEG(V016)
 8       Y-CURVE 3   ALPHA=D008

 9   PLOT 3  X-AXIS
10       Y-CURVE 1
11       Y-CURVE 2
12       Y-CURVE 3
```



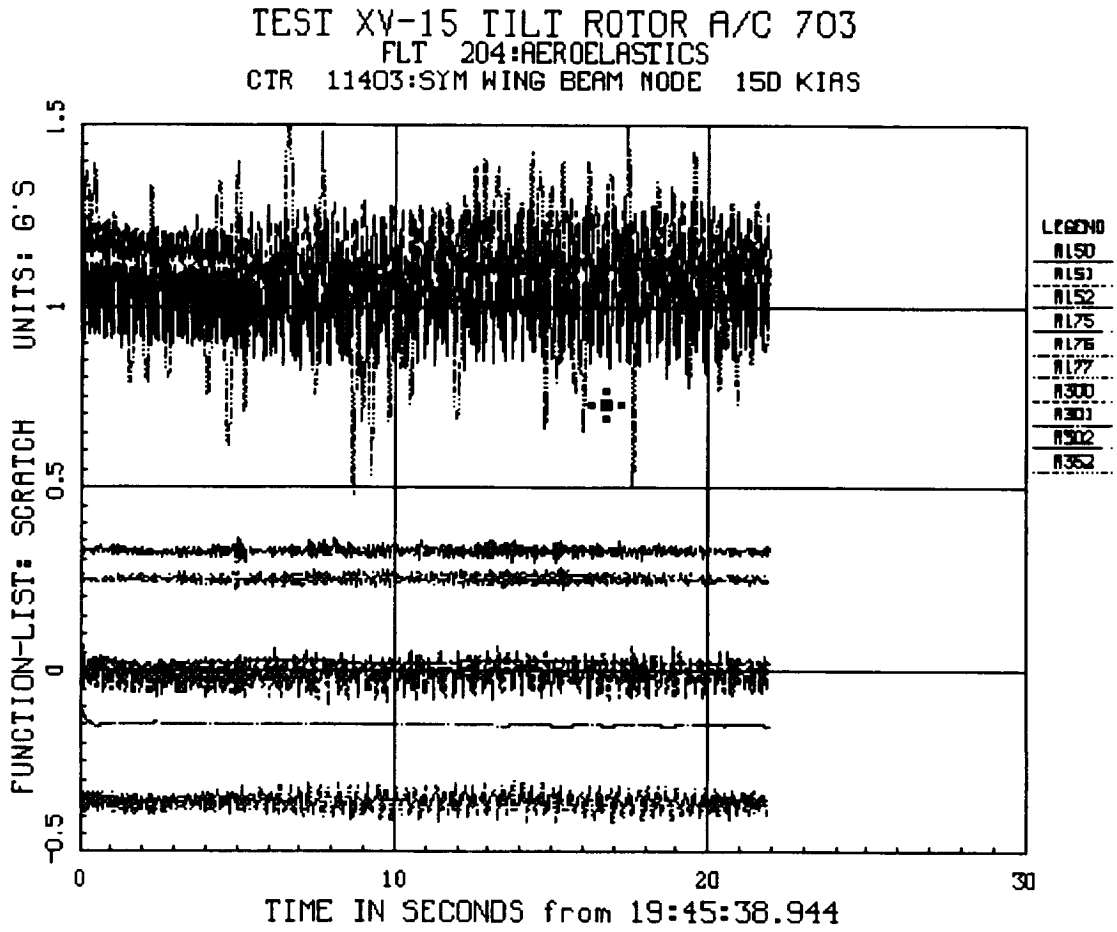
Note This setup was as a result of using Edit in TIMEHIST

```
                ITEM
                ----
PLOT 1  X-AXIS  edit

 1   PLOT 1  X-AXIS  T
 2       Y-CURVE 1   ROLL=D009
 3       Y-CURVE 2   INTEG(ROLL_RATE)=INTEG(V015)
 4       Y-CURVE 3   YAW=-1*D011

 5   PLOT 2  X-AXIS  T
 6       Y-CURVE 1   PITCH=D010
 7       Y-CURVE 2   INTEG(PITCH_RATE)=INTEG(V016)
 8       Y-CURVE 3   ALPHA=D008

 9   PLOT 3  X-AXIS  T
10       Y-CURVE 1   YAW=D011
11       Y-CURVE 2   INTEG(YAW_RATE)=V014
12       Y-CURVE 3   ALTITUDE=P342
```



Example of using TIMEHIST multicurves per plot option.

```
Enter itemcode, TIME or (cr) when prompted
and, optionally, the scale min,max,inc.

                ITEM
                ----
 PLOT 1  X-AXIS: T
     Y-CURVE 1 : A150
     Y-CURVE 2 : A151
     Y-CURVE 3 : A152

    <<<<  If you enter more than 3 curves, a common scale is assumed! >>>>
          You may plot up to 11 curves, but only one plot/page
          and EDIT/RECALL will not work (now).
     Y-CURVE 4 : A175

             OK. Multiple curves, common scale, one plot/page.
     Y-CURVE 5 : A176
     Y-CURVE 6 : A177
     Y-CURVE 7 : A300
     Y-CURVE 8 : A301
     Y-CURVE 9 : A302
     Y-CURVE10 : A352
     Y-CURVE11 :

         Your y-axis inputs are saved in SCRATCH.FNC703
         which you can recall in NORMALIZE

Enter the counter number(s) : 11403
```



Many of the special analytical features of TRENDS deal with time-history data and are, therefore, found in TIMEHIST (and related functions such as NORMALIZE and COMPARE). These analytical features are summarized briefly. More detailed discussions may be found in Section III Users' Guide (PLOTTING).

Calculus - DERIV & INTEG

The derivative is computed as the difference between two successive samples of the argument, x, divided by the inter-sample time increment, dt. The first (t=0) derivative value is set equal to the second (t=dt) value because of the lack of a previous x-value initially. DERIV has the same limitations in usage as INTEG has: it must not appear more than once in an entry line (because of a program shortcoming) and may not have POLY or CVF involved in an argument. The following are valid examples of the use of DERIV:

```
PLOT 1  X-AXIS:   SIN(D186)*DERIV(P002/P342)
     Y-CURVE 1:   POLY(DERIV(INTEG(M143-M107)),2),0,1000,50
     Y-CURVE 2:   INTEG(DERIV(M143-M107))/57.3,-5,5
```

The integral is simply a weighted sum of sequential values of the integrand, x, where the weight is the time-interval, dt. The initial (t=0) value of the integral is zero. The integrand, x, may be a mathematical expression (but not POLY(..) or INTEG) or a simple itemcode. INTEG may itself be used in a mathematical expression, BUT cannot appear twice on the same entry line.

Valid examples:

```
PLOT 1: X-AXIS:   TRYINT=7.3*INTEG(P002^2)/3.14
     Y-CURVE 1:   POLY(INTEG(D747),3)
     Y-CURVE 2:   INTEG(M143-M107)
```

Data Screening - Bad-Point Elimination

TIMEHIST provides an in-line function for screening out wild points in the data. The syntax of the function is:

SCREEN(IC,n)

where

IC = Itemcode/parameter name or expression
n = maximum absolute slope tolerance
(in engineering units) between any 2 points

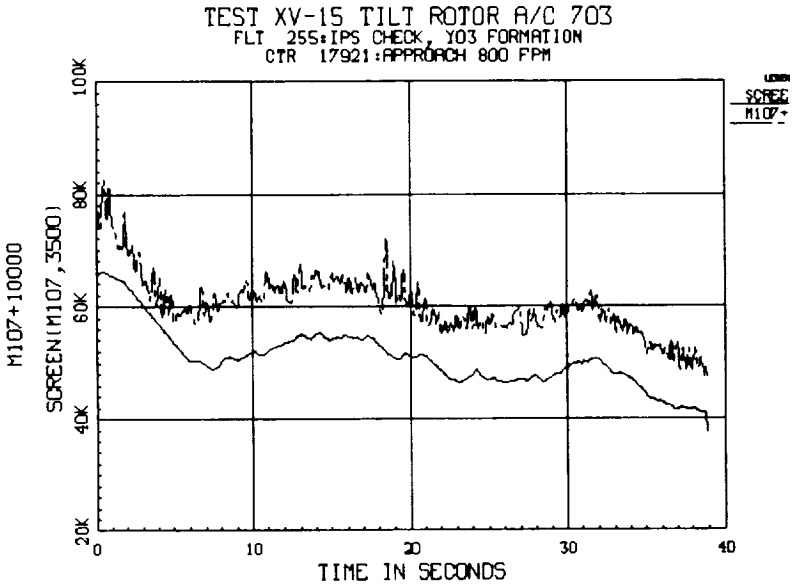
e.g. Screen(D009,5); (D009 = angle in degrees)
(n= 5 degrees/second)

When the inter-sample change exceeds the specified tolerance, the offending point is replaced by a point on the line between the previous "good" point and the next "good point". If the tolerance is set too low, as in the following example, SCREEN works like a filter.

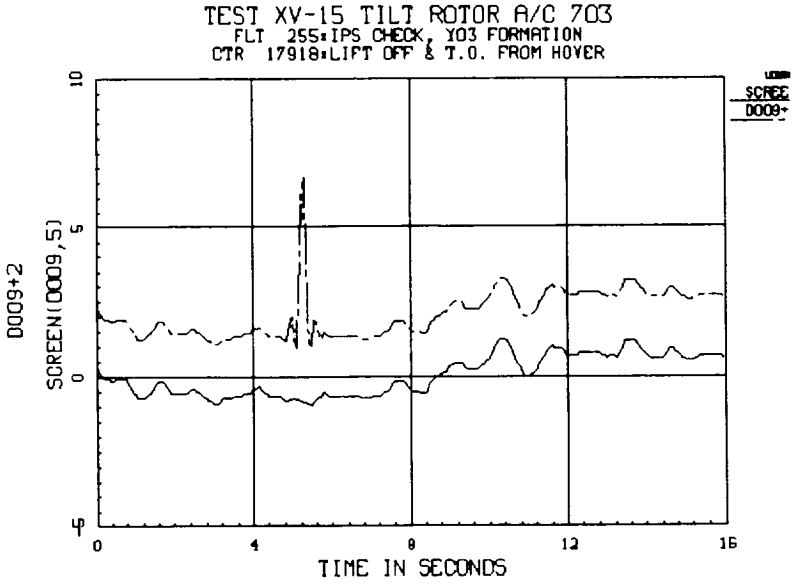
Screening Function

The following plots are examples of performing the SCREEN(IC,n) function on two parameters, M107 & D009. Note that screening of data is performed when the (n) slope tolerance is exceeded. In the following plots screening was performed when the slopes of M107 data exceeded 3500 inch-lbs/sec, while on D009 it was performed when 5 degrees/sec of change was encountered. It is recommended that one perform a derivative on the parameter prior to performing the screen function to obtain the screening limits.

```
                ITEM
                ----
PLOT 1  X-AXIS  edit

1   PLOT 1  X-AXIS  T
2       Y-CURVE 1   SCREEN(M107,3500)
3       Y-CURVE 2   M107+10000"
4       Y-CURVE 3

5   PLOT 2  X-AXIS
6       Y-CURVE 1
7       Y-CURVE 2
8       Y-CURVE 3

9   PLOT 3  X-AXIS
10      Y-CURVE 1
11      Y-CURVE 2
12      Y-CURVE 3
```




```
1   PLOT 1  X-AXIS  T,0,16,4
2       Y-CURVE 1   SCREEN(D009,5)
3       Y-CURVE 2   D009+2"
4       Y-CURVE 3

5   PLOT 2  X-AXIS
6       Y-CURVE 1
7       Y-CURVE 2
8       Y-CURVE 3

9   PLOT 3  X-AXIS
10      Y-CURVE 1
11      Y-CURVE 2
12      Y-CURVE 3
```



Cycle Averaging - MRAZ

The primary purpose of the cycle-averaging feature is to plot time-history data for cyclic items against rotor azimuth, rather than against time. Conditions usually vary somewhat from cycle to cycle, however, so data from several consecutive cycles (rotor revolutions) may be averaged together to smooth out differences. A cubic-spline algorithm and interpolation are implemented to provide smooth outputs at 256 evenly-spaced azimuth angles on each cycle.

The keyword which invokes this feature is MRAZ, entered in the expression field of an x-axis response. The default for number of cycles to "average" is one. If two or more cycles are to be averaged, the number of cycles is appended in parentheses (e.g., MRAZ(3)). You may override the automatic labeling and scaling, if desired.

Examples: PLOT 1 X-AXIS: NULABL=MRAZ, 0, 360, 90
PLOT 2 X-AXIS: MRAZ(10) (10 revs)

The azimuth offset (i.e., angle when the one-per-rev "blipper" goes high or angle reference resets) is set to a default value for all items for each database (e.g., 0 for 703, 82.63 for 748). The user may override this default if he/she has an INFOFILE.<db> file in the directory where TRENDS is being run. The initial group of the infofile must contain a line which defines MRAZ for the database. To override the default azimuth offset for the 703 database to be 45 degrees, this line would read:

MRAZ R018 45.0 /

If the number is missing, the database's default value is used. The rev reference can be an azimuth angle reference of a blipper if angle-encoder data are available. The instrumentation for the tilt rotor does not include a rotor azimuth encoder.

An individual item may be phase-shifted relative to the azimuth reference by encoding the shift (degrees) in square brackets.

Y-CURVE 1: M143[23]

Infofile groups may be phase-shifted by modifications to INFOFILE.<db>. Further shifts for individual items may be found in a database file called AZ.OFFSET.<db>. Such a file is found in the BH2 (UH-60) database, but not in 702 or 703.

Spectral Analysis - FREQ

When entered at the x-axis prompt, FREQ tells TIMEHIST to compute amplitude spectra (FFT) of the ordinates which follow. These are plotted versus frequency (in Hz). You may use FREQN to get the abscissa scaled in multiples of the main rotor frequency (n-per-rev) rather than in Hertz. FREQ and FREQN are flags to the program and not variables, so they cannot be used in mathematical expressions.

Example: PLOT 1 X-AXIS: MYLABL=FREQ,3,30,3
Y-CURVE 1: DIFFTORK=(M143-M107)/12

Filtering - CVF, BF, DCVF & DBF

TIMEHIST provides an in-line filtering of the argument, x, with cutoff frequency, co, and window-type, w, using the convolution-filter algorithm from DATAMAP. The argument, x, may be a mathematical expression or a simple itemcode. The cutoff frequency, co, is a literal number in Hertz. The window flag, w, is 1 or 2:

w = 1 Half-cosine window
w = 2 Hanning window.

CVF may NOT be used in mathematical expressions. The reason for this limitation is that CVF is a post-processing function (after all of the samples of its argument have been computed and stored). The following are valid examples:

```
PLOT 1  X-AXIS:  CVF(P342*12.,.2,1)
     Y-CURVE 1:  POLY(CVF(P342,1,2),3)
     Y-CURVE 2:  SMOOTH H (FT)=CVF(P342,5,1),2000,4000
     Y-CURVE 3:   POLY(CVF(DERIV(INTEG(M143-M107)),.5,2),3)
```

A third-order **Butterworth filter** operates on the argument, x, using a cut-off frequency, co, specified in Hertz. BF is a post-processing function like CVF, so it may not be part a formula, but can take a general expression in its argument and may be operated on by POLY.

```
Example:  Y-CURVE 1: BFTORKDIF = BF(M143-M107,0.5)
```

Derivatives of CVF AND BF:

```
PLOT 1  X-AXIS:  T
     Y-CURVE 1:  DCVF(P342)
     Y-CURVE 2:  DBF(P342)
```

May be specified, where DCVF is the derivative of the curve fitted Convolution filtered data set of parameter P342, and where DBF is the derivative of the curve-fitted Butterworth-filtered data set of parameter P342.

Storing Time Histories - STORE

The **STORE** command is used to name and store away curves (derived time histories) for later use. An example of this is

```
Y-CURVE 1:  STORE HDOT = CVF(DERIV(P342/60),1,1)
```

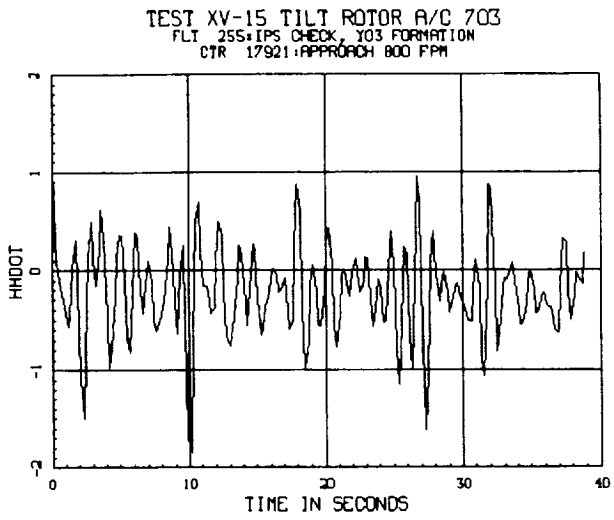
When this specification is evaluated over a data region, HDOT will be stored in your file SCRATCH.KEY for each counter in the data region. HDOT would be used as follows:

```
Y-CURVE 1:  HDNOISE = DERIV(P342/60) - HDOT
```

The STORED? command will show you the existing stored curves. UNSTORE provides a dialogue to help you clean up SCRATCH.KEY.

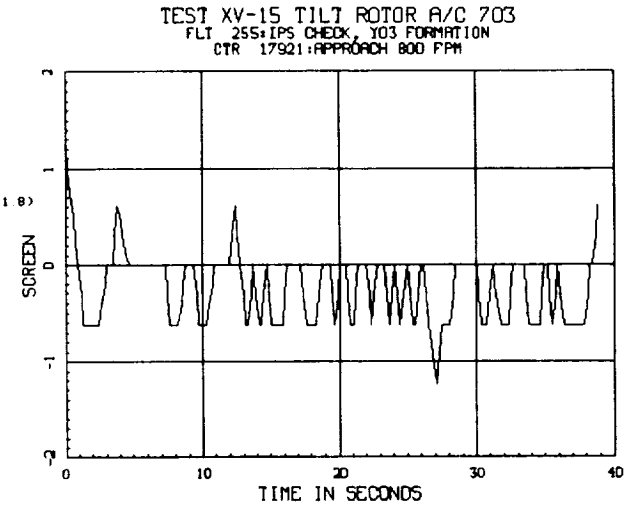
Example of stored function, CVF(IC,n1,n2)

```
                    ITEM
                    ----
PLOT 1  X-AXIS   T
    Y-CURVE 1    STORE HHDOT=CVF(DERIV(P342/60),1,1)
    Y-CURVE 2
                    ITEM
                    ----
PLOT 2  X-AXIS
```



Example of stored function, SCREEN(IC,n)

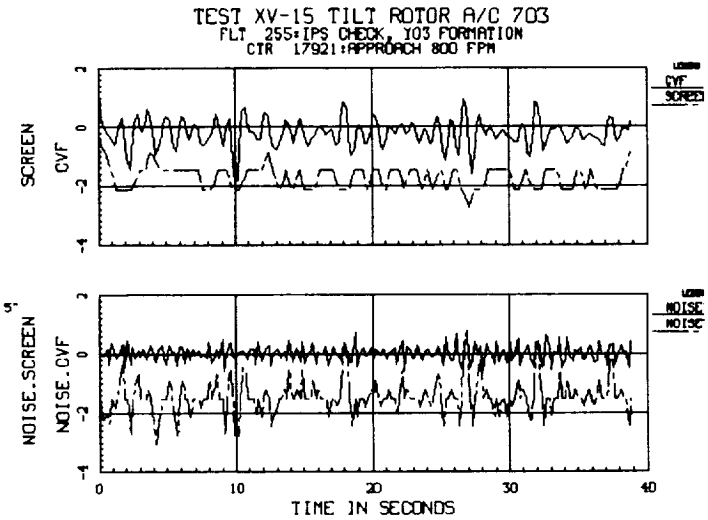
```
1   PLOT 1  X-AXIS: T
2       Y-CURVE 1   STORE SCREEN=SCREEN(DERIV(P342/60),1 8)
3       Y-CURVE 2
4       Y-CURVE 3
```



Example of CVF and SCREENed functions plotted

```
1   PLOT 1  X-AXIS  T
2       Y-CURVE 1   CVF=HHDOT
3       Y-CURVE 2   SCREEN=SCREEN-1.5"
4       Y-CURVE 3

5   PLOT 2  X-AXIS  T
6       Y-CURVE 1   NOISE_CVF=DERIV(P342/60)-HHDOT
7       Y-CURVE 2   NOISE_SCREEN=(DERIV(P342/60)-SCREEN)-1.5"
8       Y-CURVE 3
```

Example of differences of derivative of original function minus CVF function and SCREEN function.



Fourier Series Synthesis - FSS

TIMEHIST will synthesize a time series for the argument, X, in
FSS(X,n)
as a truncated Fourier Series of n terms. This is a post-processing function like CVF and BF, so it cannot be used in a formula, but X can be any valid mathematical expression.

Example: Y-CURVE 1: APPROX = FSS(0.5*F163.RAW,3) (see pg. 4-82)

Tabulating Time Histories - PRINT

The PRINT command may be entered at any X-AXIS prompt or at the prompt for data region. This command simply sets the print-flags, after which the X-AXIS prompt or data-region prompt will be repeated. The print-flags persist only for the current plot-page, but for as many counters as you wish to display. The CTRL-C can be used to interrupt printing and send control back to the data-region prompt. The PRINT command syntax includes six option switches which may be specified in any order, each set off with a slash (/) and with no imbedded blanks.

Options:

/O=filename	Output is written to "filename" (default .LIS)
/S=number n	Output only every "n-th" point (decimation)
/N	No screen-display while outputing to file
/E	Use scientific notation (E15.7)
/H	Display in hexadecimal after fixing data
/D=number n	Decimal places (F15.n, default=F15.5)

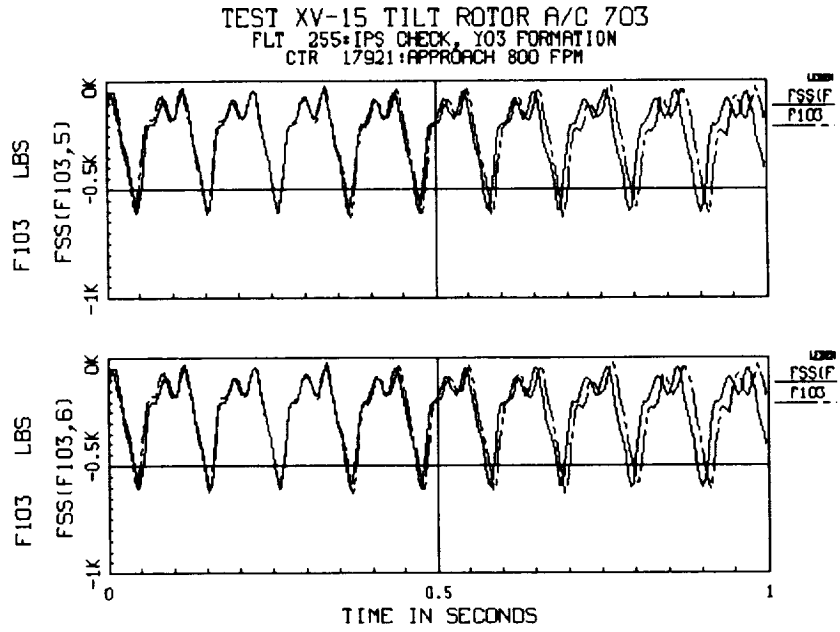
Valid examples:

PLOT 1 X-AXIS: PRINT
PLOT 2 X-AXIS: PRINT/N/S=2/OUT=POLYP342.DAT/E
Enter counter(s) etc.: PRINT/D=3

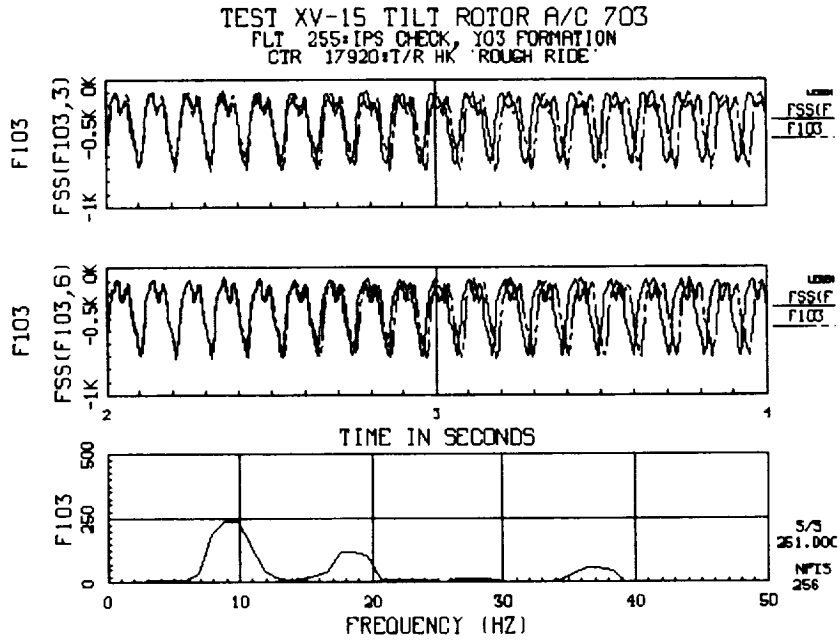
The output format is for an index plus eight (8) data columns (8F15.5 or 8E15.7) with a second optional line if you specify more than 8 data columns for printing

The following plots are examples of the FSS(X,n) Fourier Series Synthesis function. The FSS function will synthesize a time series to match an itemcode time history record.

```
1   PLOT 1  X-AXIS: T,0,1,0.5
2       Y-CURVE 1 : FSS(F103,5)
3       Y-CURVE 2 : F103"
4       Y-CURVE 3 :

5   PLOT 2  X-AXIS: T,0,1,0.5
6       Y-CURVE 1 : FSS(F103,6)
7       Y-CURVE 2 : F103"
8       Y-CURVE 3 :

9   PLOT 3  X-AXIS:
10      Y-CURVE 1 :
11      Y-CURVE 2 :
12      Y-CURVE 3 :
```




```
1   PLOT 1  X-AXIS: T,2,4,1
2       Y-CURVE 1 : FSS(F103,3)
3       Y-CURVE 2 : F103"
4       Y-CURVE 3 :

5   PLOT 2  X-AXIS: T,2,4,1
6       Y-CURVE 1 : FSS(F103,6)
7       Y-CURVE 2 : F103"
8       Y-CURVE 3 :

9   PLOT 3  X-AXIS: FREQ,0,50,10
10      Y-CURVE 1 : F103
11      Y-CURVE 2 :
12      Y-CURVE 3 :
```



Time Slicing - INTERVAL

The time interval of interest for plots may be specified by:

```
        INT = t1,t2              (initial, final time)
or      INT = filename (file of intervals by counter)
```

For frequency spectra for which only part of the available data is to be analyzed, this feature is quite useful. It is also useful in cross-plots of part of the data, in choosing the initial cycle for cycle averaging, or for homing in on a region of interest in the plot. The interval may be specified in the plot setup at an x-axis prompt. In that case, it persists for the current and later plots on the same page, but not for the next plot-page. Specified at the data-region prompt, it applies to the whole plot page. The following are valid examples.

```
PLOT 1  X-AXIS:  INT=3.4,5                (plot setup entry)
Enter counter(s) etc. : INT=3.4,5          (data-region entry)
Enter counter(s) etc. :  INT=SOMENAME.XXX
```

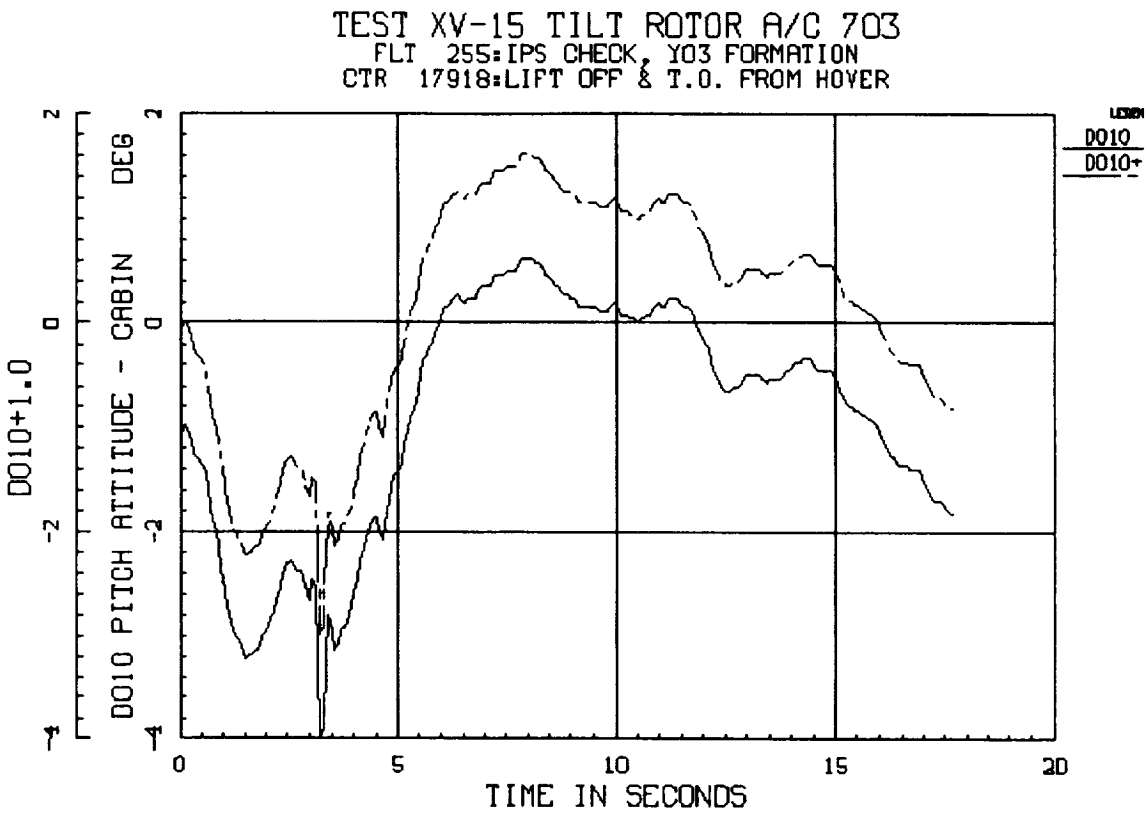
The format for the intervals file is simple: each line contains three numbers (1st=counter, 2nd=t1, 3rd=t2) starting in any column, separated by commas or spaces. The counter must be an integer, specified without a decimal point.

Time Shifting - TSHIFT

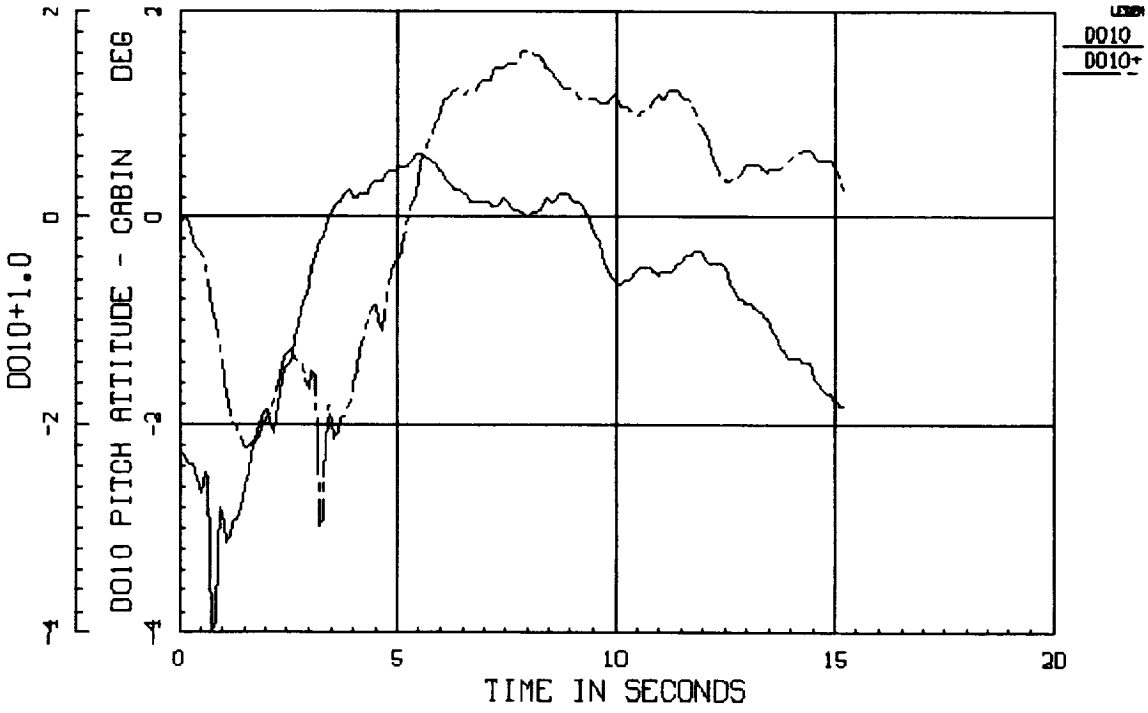
This feature lets you shift one curve left or right in time relative to another curve. For example:

```
Enter the counter number(s) : TSHIFT
Time shift for plot #1 [0.10] : .05
Time shift for plot #2 [0.00] :-.05
```

will cause the Y1 curve of plot #1 to be shifted to the left approximately 0.05 seconds relative to the abscissa (which need not be TIME) and to the Y2 curve, if there is one. The amount of shift actually used is not usually the exact value specified, but is rather at the resolution of the highest sampling rate of any of the variables involved in the plot. That is, the curves are not interpolated to satisfy the specified time-shift exactly. A negative time specification moves the abscissa and the Y2 curve (if any) to the left relative to the Y1 curve (i.e., the Y1 curve is shifted relatively right). The best way to understand this is to try it. Time-shifts are reset to zero when you set up a new plot page, but persist for changes of data region.




```
Enter the counter number(s) : tshift

Time shift for plot #1 [-1.50] : -2.5

Enter the counter number(s) : 17918
```



Wild-Card Specification

You may use the asterisk (*) in TIMEHIST to specify all or several of the stored time-history items to be plotted. Itemcodes which match your wild-card specification will be plotted with one, two or three plots per page, but not with more than one curve per plot. Any single-item (not wild-card) x axis may be specified, including MRAZ and FREQ, but no formulas are currently permitted on the wild-card items. The following are valid examples of the syntax.

```
Y-Curve 1: *
Y-Curve 2:                  (must be empty return -- only one curve/plot)
Y-Curve 1: P*
Y-Curve 1: P1*.RAW
```

If you want more than one plot per page, repeat the identical specification for each plot. TRENDS will cycle through the items. If you're into DATAMAP-style scratch files, you may use a syntax like:

```
Y-Curve 1: SCF3(*,4,BOT)
```

to plot all of the bottom 4th-row elements.

Scratch-file Use

TIMEHIST will recognize specification of a particular element of a DATAMAP-style scratch file in an ordinate (y-axis) definition. You must have the permanent scratch file, PERMSCR.DAT, in your directory. Within PERMSCR.DAT, there may be four (4) "scratch files," which are called SCF1, SCF2, SCF3, and SCF4. You can examine these out in the SCRATCHFILE feature in the main menu. The syntax is:

```
Y-CURVE 1: SCFn             (#col, #row, T or B)
```

for the top (T) or bottom (B) element of any row or column. The default is top (T) if you specify only row and column. Scratch-file elements may be used in any formula or as the argument for post-processes such as CVF or POLY. The counter in the scratch-file data is not used. If your specification does not involve database items, you may enter zero (0) as the counter number. You may also specify a row or column or both with wild cards (*), but in this case, the specification must be simple -- not an expression involving constants or database items.

Examples:

```
Y-CURVE 1:  SCF4(3,1,T)
Y-CURVE 2:  SCF4(3,2,B)"
Y-CURVE 1:  SCF4(*,3)       (all elements, row 3)
```

Signal Generation - RSIM & FSIM

TIMEHIST contains a limited signal-generation capability. To generate a raw time history, enter **RSIM** (raw) at the first Y-CURVE prompt (X may be time or FREQ). You will be prompted for

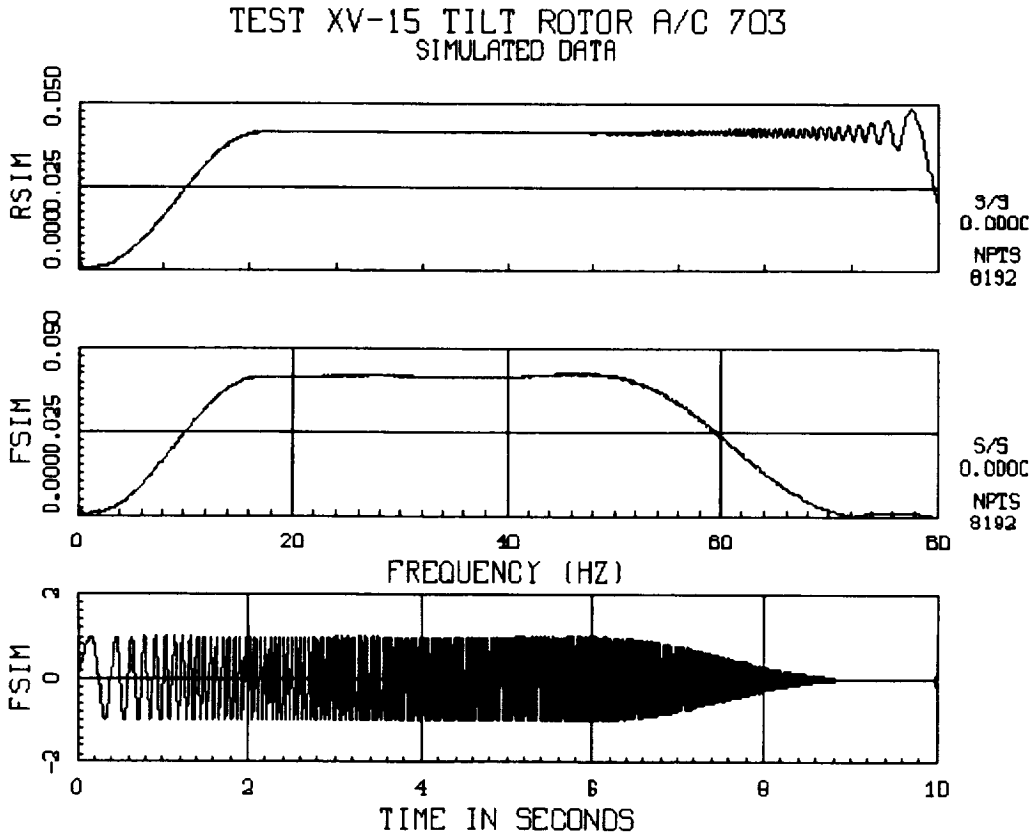
Starting frequency (Hz)
Ending frequency (Hz)
Time duration (sec)
Samples per second
Phase angle (deg)

If you use **FSIM** (filtered), you will also be asked for filter cutoff frequency and window type for the convolution filter. RSIM and FSIM cannot be used in any math expressions or in conjunction with database items. You will not be prompted for counter when RSIM or FSIM are used. The **default counter** for generated signals is 0. You may use **STORE** to save RSIM or FSIM, but remember that they will be stored as values for counter 0. You may recall STOREd data, but remember to specify the data region as zero. In order to plot a STOREd generated signal on the same plot with a based variable, use menu-item COMPARE.

(See the next page for examples.)

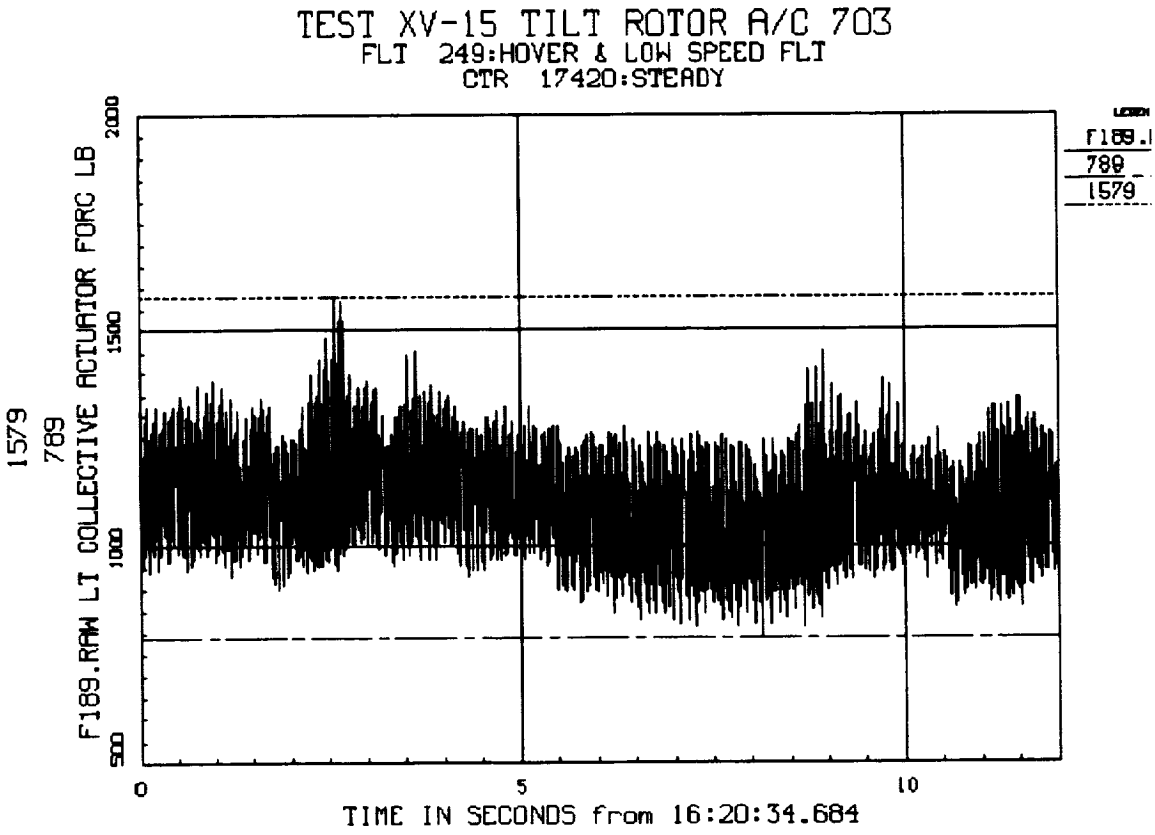
TIMEHIST has a sinusoidal function generator capability within it to allow the user to be able to compare flight data with that of simulated data that he/she can specify. RSIM will produce nonfiltered sinusoidal data, while FSIM produces filtered data.

```
 1   PLOT 1  X-AXIS: FREQ,0,80
 2       Y-CURVE 1 : RSIM
 3       Y-CURVE 2 :
 4       Y-CURVE 3 :

 5   PLOT 2  X-AXIS: FREQ,0,80,20
 6       Y-CURVE 1 : FSIM
 7       Y-CURVE 2 :
 8       Y-CURVE 3 :

 9   PLOT 3  X-AXIS: T,0,10,2
10       Y-CURVE 1 : FSIM
11       Y-CURVE 2 :
12       Y-CURVE 3 :

          Sinusoidal sweep simulation


Starting sweep frequency (HZ) : 1

Sweep time-interval (sec) : 10

Final sweep frequency (HZ) : 80

Data samples per second : 500

Initial phase angle (deg) : 0

Filter breakpoint frequency (HZ) : 50

Window (1 for half-cosine, 2 for Hanning) : 1
```



TIMEHIST allows the user to put up to two constant limits on a single parameter time history plot. Note, in the following TIMEHIST setup, the constant 789 has a (") suffix in order to use the original scaling of the F189.RAW parameter. The second limit, 1579, also requires a ditto mark (") to force the same scale as curve 2 (and hence, as curve 1).

```
Enter itemcode, TIME or (cr) when prompted
and, optionally, the scale min,max,inc.

                    ITEM
                    ----
PLOT 1  X-AXIS: T,0,12,5
    Y-CURVE 1 : F189.RAW
    Y-CURVE 2 : 789"
    Y-CURVE 3 : 1579"

                    ITEM
                    ----
PLOT 2  X-AXIS:

Enter the counter number(s) : 17420_
```



TSSTATS


```
                              TRENDS Main Menu

   Control        Descriptive    Numerical      Plotting       Analysis       Usage
703>TAIL NO.      PROJECT        SEARCH         TIMEHIST       GATEWAY        HELP
 MC>TERMINAL      DATABASE       KEYS           PERFPLOT       HARMONIC       ITEMDEFS
 YS>PLTHDCPY      LOGSCAN        VIEW           STRIPS         TSSTATS        DERIVED
   VMS CMDS       FLIGHTS        CPRINT         NORMALIZE      COMPARE        FILES
   EXIT           WORDSCAN       FIND           MINMAX         SCRATCHFILE    OUTDATA
                                 LOADS          MULTIPLT                      FUNCTIONS
                                 CALIBS         GEOPLOT                       INFOFILE

   YOUR CHOICE: TSST

   TSSTATS  Compute and display time-slice statistics
```

TSSTATS was incorportated into the TRENDS menu to allow the user to obtain parameter statistics for time periods less than an entire counter. Note, standard parameter statistics are available on a per counter time basis by selecting the VIEW & MIN/MAX Menu items Note, in the TSSTAT printouts, on page TSSTATS (2), the stored TRENDS statistics precede the TSSTAT's parameter statistics. The results can be written to an ASCII file which may in turn, be read in MINMAX or MULTIPLT for plotting. The format of these files is a prototype for user-supplied ASCII files of statistical input to TRENDS

```
                ****  TIME-SLICE STATISTICS  ****



   Write results to a file? (Y/[N]): y

  OK.  Now provide a name for the output file: CDemo

  Enter data item(s) or LIST:list-name: M143, A300, P342

        Mnemonic Description                    Units  I.C.
        M143     LT ROTOR MAST TORQUE    12    IN LB  M143
        A300     C.G. LAT VIBR                 G'S    A300
        P342     ALTITUDE - NOSE BOOM          FEET   P342

  Enter more data item(s) or LIST:list-name:

Your list of mnemonics/items has been written to ITEMS.SAV

 Enter counter(s) or DCS : 18159

18159  261  ROLLING TAKE OFF                  Duration =   21.434 sec.

Volume ID 40851CCE, Volume 006B_DB703 is loaded in drive 0

 Enter a time interval (t1:t2) : 10:15
```

```
Enter counter(s) or DCS : 18159

18159  261  ROLLING TAKE OFF                    Duration =   21.392 sec.

Enter a time interval (t1:t2) : 10:15

M143    TIM  HAS   337 PTS.   Time spanned =   21.418 sec from 13:30:12.873

              *******  STORED STATISTICS  (IN LB )  *******

COUNTER NO.     AVG STDY     AVG OSC      MAX OSC    ASSOC. STDY
   18159     89851.008     5423.164    14694.598   108219.313

              *******  M143     STATISTICS  (IN LB )  *******

# OF POINTS    AVERAGE       MAXIMUM       MINIMUM    STD. DEVIATION
     336     90316.930    139294.766     36480.777    30950.607
                       13:30:28.426 13:30:14.402

A300    TIM  HAS   108 PTS.   Time spanned =   21.315 sec from 13:30:12.873

              *******  STORED STATISTICS  (G'S   )  *******

COUNTER NO.     AVG STDY     AVG OSC      MAX OSC    ASSOC. STDY
   18159         -0.003       0.168        0.448       -0.012


P342    TIM  HAS   113 PTS.   Time spanned =   21.418 sec from 13:30:12.873

              *******  STORED STATISTICS  (FEET  )  *******

COUNTER NO.     AVG STDY     AVG OSC      MAX OSC    ASSOC. STDY
   18159       383.051       26.017      227.888      174.953

              *******  P342     STATISTICS  (FEET  )  *******

# OF POINTS    AVERAGE       MAXIMUM       MINIMUM    STD. DEVIATION
     112       387.136       431.327       338.748       24.709
                       13:30:20.713 13:30:13.829
```

VIEW


```
                              TRENDS Main Menu

   Control        Descriptive     Numerical      Plotting       Analysis      Usage
703>TAIL NO.      PROJECT         SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL      DATABASE        KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY      LOGSCAN         VIEW           STRIPS         TSSTATS       DERIVED
   VMS CMDS       FLIGHTS         CPRINT         NORMALIZE      COMPARE       FILES
   EXIT           WORDSCAN        FIND           MINMAX         SCRATCHFILE   OUTDATA
                                  LOADS          MULTIPLT                     FUNCTIONS
                                  CALIBS         GEOPLOT                      INFOFILE

   YOUR CHOICE: VI

   VIEW          View item statistics for specified counters
```

```
Enter Flight(s), :counter(s) or DCS name : 255
Enter Parameter name: M143
```

```
                                                        VIEW
                    A/C: 703  PLAN:    FLIGHT: 255   DATE: 21-AUG-91  WEIGHT:  14034
                              M143      (LT ROTOR MAST TORQUE    12    ) (IN LB )
 CTR  AVG STDY     AVG OSC    MAX OSC  ASSC STDY     MIN PK      MAX PK     FSCALE  REV

  FLIGHT: 255              M143      (LT ROTOR MAST TORQUE    12    ) (IN LB )
17918    119843.    6262.    14165.    109857.    88150.    142586.    97464.  163
17920    108140.   13248.    15229.    106376.    90277.    127986.    97464.  463
17921     48931.   11924.    40706.     10411.   -30296.     77901.    97464.  357
17922     59644.   16500.    23012.     67748.    17373.    115900.    97464.  284
17923    106132.    6746.    14020.     92694.    78674.    126342.    97464.  331
17924     91773.    7498.    23496.     89310.    36807.    138622.    97464.  281
Enter Parameter name : _
```

VIEW prints all of the statistics which are stored for a specified item over a specified data region (e.g., flight, DCS). The example above shows the seven (7) statistics which are stored for M143 (and for each item in the 703 database):

AVG STDY	(.AVS) Average-steady (DC) value
AVG OSC	(.AVO) Average-oscillatory (vibratory) value
MAX OSC	(.MAX) Maximum-oscillatory value over all revs
ASSC STDY	(.SMO) Associated-steady (steady at max oscillatory)
MIN PK	(.CMN) Minimum value during the counter
MAX PK	(.CMX) Maximum value during the counter
FSCALE	(.FSC) Full-scale E.U. value for max counts

By default, VIEW displays all of these statistics plus the number of revs and the counter description. This full field is wider than 80 columns, so your terminal may wrap or truncate the output. To widen the screen, enter W132 at the data-region prompt. This command has no effect for the Macintosh running under Versaterm Pro. The number of columns of statistics displayed by VIEW may be reduced by entering the number of statistics columns you want at the parameter prompt:

Enter Parameter name: 4 (print only first 4 statistics)

The number of decimal places used in the display is dependent upon the parameter being displayed, but the user may change it by following the parameter name by a comma and a number:

Enter Parameter name: M143,1 (print one decimal place)

TRENDS/VIEW enables specification of more than one parameter at a time, by means of the wild-card or GROUP conventions.

Enter Parameter name: *	(all parameters)
Enter Parameter name: M1*	(all parameters starting with M1)
Enter Parameter name: GROUP: MAST	(all parameters with "MAST" in the description or A/C group name)

♦ ***MULTIPLE-PARAMETER SPECIFICATION***

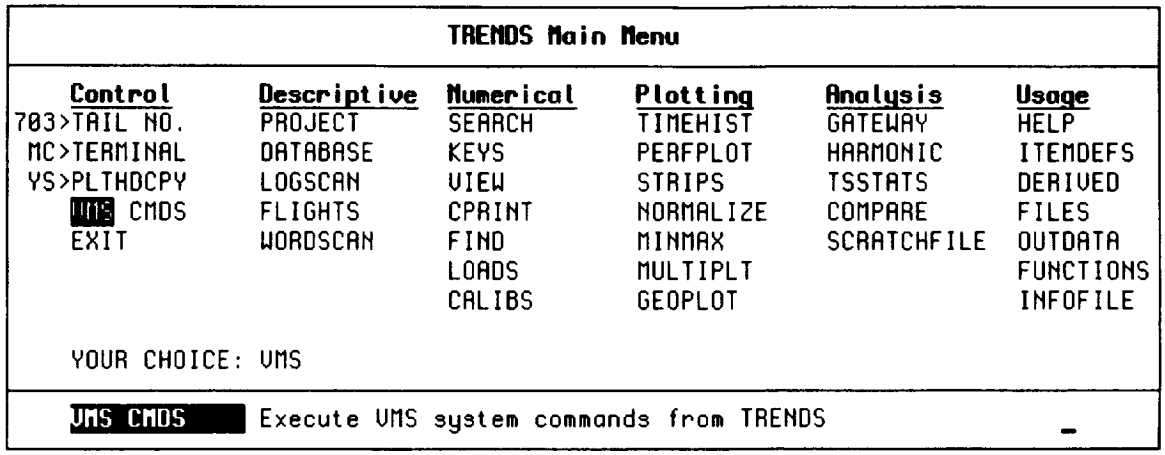
```
Enter Flight(s), :counter(s) or DCS name : F255
Enter Parameter name : M1*_
```

```
                                                    VIEW

                                    M143      <LT ROTOR MAST TORQUE          > <IN LB
 CTR  AVG STDY      AVG DSC     MAX DSC  PSSC STDY      MIN PK      MAX PK      FSCALE  REV

  FLIGHT: 255                  M107      <PT ROTOR MAST TORQUE    12    )  (IN LB >
17918    110334.       4852.     14108.     113580.      84812.     138794.      90822.  103
17920    109896.      10914.     15273.     108153.      91535.     131014.      96822.  463
17921     49039.      10425.     15465.      67906.      25827.      89563.      96822.  357
17922     80870.      13790.     20123.      80249.      23049.     115045.      90822.  284
17923    104453.       5408.     11815.     108057.      86537.     126400.      96822.  231
17924     87726.       5976.     18282.      80729.      41107.     141483.      96822.  281
  FLIGHT: 253                  M143      <LT ROTOR MAST TORQUE    12    )  (IN LB >
17918    119843.       6201.     14185.     108657.      88158.     142588.      97464.  103
17920    109140.      13240.     15229.     105376.      90277.     127996.      97464.  463
17921     46931.      11924.     40706.      10411.     -30296.      77901.      97464.  357
17922     58044.      16588.     23012.      67748.      17373.     115000.      97464.  284
17923    106132.       6746.     14020.      92604.      78674.     126942.      97464.  231
17924     91779.       7498.     25496.      89310.      56807.     130622.      97464.  281
Enter Parameter name : _
```

An item list may also be used to specify a group of parameter names to VIEW. The list file should contain a single itemcode or mnemonic on each line. The syntax for list entry is:

LIST: listname

VMS CMDS




```
This feature lets you enter system-level commands without leaving TRENDS.
Warning: CTRL-C will not stop anything and CTRL-Y will abort TRENDS!!

 Enter VMS command: $ _
```

NOTE:

Derived Counter Set (DCS) files made in TRENDS are not available via any VMS commands. One must use the "FILES" menu option to access or copy these files.

WORDSCAN

♦ *EXAMPLE*

```
                              TRENDS Main Menu

   Control          Descriptive      Numerical      Plotting       Analysis      Usage
703>TAIL NO.        PROJECT          SEARCH         TIMEHIST       GATEWAY       HELP
 MC>TERMINAL        DATABASE         KEYS           PERFPLOT       HARMONIC      ITEMDEFS
 YS>PLTHDCPY        LOGSCAN          VIEW           STRIPS         TSSTATS       DERIVED
    VMS CMDS        FLIGHTS          CPRINT         NORMALIZE      COMPARE       FILES
    EXIT            WORDSCAN         FIND           MINMAX         SCRATCHFILE   OUTDATA
                                     LOADS          MULTIPLT                     FUNCTIONS
                                     CALIBS         GEOPLOT                      INFOFILE

    YOUR CHOICE:

    WORDSCAN  Scan counter descriptions for words or strings
```

Select * (any comment) for flight 255

```
                                  WORDSCAN
  LOOK FOR : *
Enter flight(s), :counter(s) or DCS name : 255
                          Pilot Comments                Duration   T-H Data

FLT 255  CTR 17918  LIFT OFF & T.O. FROM HOVER          17.646   HQ,SPL
FLT 255  CTR 17920  T/R HK "ROUGH RIDE"                 50.254   HQ,SPL
FLT 255  CTR 17921  APPROACH 800 FPM                    38.819   HQ,SPL
FLT 255  CTR 17922  TO HOVER ECGB OVER                  30.807   HQ,SPL
FLT 255  CTR 17923  HOVER VERY SMOOTH STEADY           35.946   HQ,SPL
FLT 255  CTR 17924  TOUCHDOWN                          30.540   HQ,SPL
```

Or e.g. select any H/K points which occurred in flights 245 - 251

```
                                  WORDSCAN
  LOOK FOR : H/K
Enter flight(s), :counter(s) or DCS name : 245-251
                          Pilot Comments                Duration   T-H Data

FLT 245  CTR 17101  HELO H/K                           32.383   HQ,SPL

FLT 246  CTR 17136  HOVER H/K                          29.123   HQ,SPL
FLT 246  CTR 17169  STEADY HOVER H/K                   16.530   HQ,SPL
FLT 246  CTR 17210  HOVER H/K                          20.861   HQ,SPL

FLT 247  CTR 17261  TILTROTOR H/K                      27.410   HQ,SPL
FLT 247  CTR 17295  HELO H/K & GEAR DOWN               22.068   HQ,SPL
FLT 247  CTR 17307  TILTROTOR H/K                      18.602   HQ,SPL

FLT 248  CTR 17365  STEADY 94% HOVER H/K              16.801   HQ

FLT 250  CTR 17465  HOVER H/K STEADY OGE              24.455   HQ,SPL
FLT 250  CTR 17468  STEADY HELO H/K                   20.634   HQ,SPL

FLT 251  CTR 17533  HELO H/K                          20.438  SPL
FLT 251  CTR 17566  T/R H/K                           22.486   HQ,SPL
FLT 251  CTR 17570  HELO H/K                          18.952   HQ,SPL
```

This menu item enables the listing and searching of the test-point descriptions and the saving of the set of counters for which the search is successful. The primary prompts are:

LOOK FOR :	(* searches for anything) (<cr> returns to the main menu) (? shows all keywords) (SAS looks for SAS) (SAS,LEVEL looks for either one) (SAS&LEVEL looks for both) (SAS- looks for anything but SAS)
Enter flight (s),etc.:	(<cr> returns to LOOK FOR prompt) (9-39 searches flights 9 thru 39) (:1005-1106 searches counter range) (DESCENTS (eg.) searches the derived counter set DESCENTS) (SEL turns on the SELECT option) (DES turns off the SELECT option) (-1006 deletes counter 1006 from your current search success list) (other data-region options ok)

If the search is successful, WORDSCAN asks if you would like to save the derived counter set (counter numbers for which the search was successful) and, if so, prompts you for a name and a description for the derived counter set. The description is useful when you have a number of derived counter sets and want to remember why they were generated and what search they represent.

The SELECT option lets you confirm each counter before including it in your success-list ("keepers" for your derived counter set). DES de-selects the confirmation option and returns to automatic. DES may be entered at the confirmation prompt or at the data-region prompt.

The "negative counter" entry (e.g., -1006,1008) at the data-region prompt deletes selected counters from your current success-list. If, when viewing the entries in your success-list, you see a few entries you didn't want, this feature is useful.

(Examples- UH-60 Database 748)
$ LOOK FOR : SAS,HOV (look for SAS or HOV)
$ Enter flight(s), :counter(s) or DCS name : 9-20

```
                Pilot Comments        Duration   Tzero
FLT  11 CTR   7  HOVER,.08CTS,LEVEL SWEEP     50.210   6:47:01.656  T-H
FLT  11 CTR   8  HOVER,.08CTS,LEVEL SWEEP     53.199   6:59:52.418  T-H

                Pilot Comments        Duration   Tzero
FLT  17 CTR  12  10KIAS,.09CTS,SAS ON,LEVEL    5.155   7:24:57.793
```

$ Enter flight(s), :counter(s) or DCS name : <cr> (no more)
$ LOOK FOR : <cr> (look for no more strings)
$ Save the derived counter-set? (Y/N) [N] : <cr> (don't save)

Key words

A	A1=3.0	AP	B	BOX
A/C	A1=DEG	APP	BAC	BREAK
A/F	ABORT	APPRO	BACK	BRISK
A/P	ABOUT	APPROACH	BAD	BRUSH
A/R	ACCEL	APPROACH/LANDING	BAL	BUFFET
A/S	ACCEL/DECEL	APPROACHING	BALANCE	BUFFETING
A/S110	ACOUSTIC	AR	BALL	BUFFETT
A/S120	ADD	AROUND	BANK	BUMPY
A/S130	ADJ.	ARS	BASE	C/S
A/S145	AFT	AS	BC	CALL
A/S150	AIR	AS150	BEAM	CAMERA
A/S170	AIRBORNE	ASY	BEEP	CENTERED
A/S190	AIRPLANE	ASYM	BEFORE	CH
A/S70	ALL	AT	BEHIND	CHANGE
A1	ALT	ATT	BETTER	CHASE
A1-0	AMP	ATTEMPTED	BF	CHECK
A1-2.0	AMPL	ATTITUDE	BIAS	CHECKS
A1-4.0	AMPL=	AUT	BIGGER	CHNG
A1=0	AND	AUTO	BLIP	CHOCKS
A1=1.0	ANGLE	AUTOROTATION	BOTH	CHUGGING
A1=2.0	ANTENNA	AXIS	BOUNCING	CK

CKS	CROWS	DIR	EADY	FEELS
CLIMB	CYCLE	DISC.	ECGB	FFS
CLIMB/DESC	CYCLIC	DISCONNECT	ENABLE	FINAL
CLIMB/DESCENT	D/PAD	DISENG/REENGAGE	END	FIXED
CLIMBING	DATA	DISENGAGE	ENG	FLAIR/TOUCHDOWN
CLIMBOUT	DCS	DISENGAGED	ENG.	FLAP
CLMB	DCT	DIST.	ENGAGE	FLAPERON
COL	DECEL	DN	ENGAGED	FLAPS
COLL	DECEL/	DOUBLET	ENGAGEMENT	FLARE
COLL.	DECELERATE	DOWN	ENGINE	FLARE/TOUCHDOWN
COLLECTIVE	DECELL	DOWNSTOP	ENGS	FLARES
COMBINED	DECENT	DOWNWASH	ENTRY	FLIGHT
CONTINUOUS	DECREASE	DOWNWIND	EXCITATION	FLP
CONTROL	DEG	DRIFT	EXERCISE	FLP20
CONVERSION	DEG.	DROOPED	EXTENTION	FLP20/0
CONVERT	DEGREE	DROPPED	F	FLS
CONVERTING	DEGREES	DUAL	F/A	FLS/SCAS
COOL	DESCEND	DUTCH	F/F	FLT
COUNTER	DESCENDING	DWELL	FAILED	FLY
COUPLING	DESCENT	DWELL/DECAY	FAILURE	FLYBY
CROSSWIND	DIAL	DWN	FAST	FLYOVER

FOR	GLIDE	HD	HYSTERESIS	L/GEAR
FORCE	GLIDESLOPE	HDG	HYSTERSIS	LAL
FORWARD	GND	HEADING	HZ	LAND
FPM	GO	HELICOPTER	IDLE	LAND.
FR	GOING	HELIO	IGE	LANDING
FREQ	GOOD	HELO	IN	LAR
FREQ.	GOV	HI	IN/OUT	LARGE
FREQUENCY	GOV.	HIGH	INCH	LARGER
FROM	GOVERNOR	HIGHER	INCREASE	LAT
FT	GOVERNORS	HK	INPUT	LAT.
FT/MIN	GR	HNDS	INPUTS	LAT/DIR
FULL	GREEN	HOLD	INTO	LATCHED
FWD	H/K	HOOD	ITEMS	LATERAL
G.	H/O	HOV	JFC	LATERAL/DIRECTI
G/S	H/OFF	HOVER	KIAS	LDG
GBC	HALF	HP	KNOT	LEFT
GE	HAND	HP=10	KNOTS	LEV
GEAR	HANDS	HP=15	KT	LEVEL
GEARS	HANDSOFF	HP=5	KTS	LEVER
GEN	HARMONIC	HP=5000'	L	LIFT
GEN.	HARSH	HUB	L.G.	LIFTOFF

LIMIT	MANUAL	NICE	OSC.	POINT
LIMITS	MAST	NO	OUT	POS
LINE	MATCH	NO.	OVER	POWER
LIST	MAX	NOISE	OVERSHOT	POWER;
LITLE	MILD	NORM.	P	POWERLEVER
LITTLE	MIN	NORMAL	P&R	PRECISION
LOADS	MODE	NORTH	P&RSCAS	PRI
LONG	MODE150KIAS	NOSE	P.	PRIM.
LONGITUDINAL	MODE170KIAS	NOZZLE	PATTERN	PRIMARY
LOOKS	MOST	NR	PD	PRIME
LOOP	MOTOR	O.	PED	PSCAS
LOST	MPH	OAT	PED.	PSCAS/AR
LOW	MQ	OF	PEDAL	PSCASON
LT	MSL	OFF	PEDALS	PT
LT-RT	N.	OFF"	PEOPLE	PTCH&ROLL
LT.	N.G.	OFF/ON	PER	PULL
LT/RT	N2	OGE	PHOTO	PULLING
MAN	NG	ON	PILOTS	PULLUP/PUSHOVER
MANEU.	NGAGE	ON/FF	PITCH	PULSE
MANEUVER	NHOVER	ON/OFF	PITCHRATE	PUSH
MANEUVERS	NI	OSC	PITCHUP	PWR

PYLON	READY	RETURN	RPM86	SHUT
PYLONS;	REAR	REV	RPM98	SHUTDOWN
Q	REARWARD	REV.	RSCAS	SIDE
QM	REARWRD	REVERSAL	RT	SIDESLIP
QUICK	REC	REVERSE	RT.	SIDESTEP
R	REC.	REVERSIAL	RT/LT	SIDESTICK
R&P	RECONVERSION	RIDE	RUN	SIDEWARD
R&Y	RECONVERT	RIDE"	RWD	SIGNIFICANT
R&YSCASOFF	RECONVERTING	RIGHT	S	SINGLE
R.	RECORD	ROC	S.T.O.	SINK
R/D	RECOVER	ROD	S/A	SKITTISH
R/R	REDUCING	ROL	S/S	SLIP
RADALT	REENGAGE	ROLL	SAWTOOTH	SLO
RADAR	REG.	ROLL-ON	SCAS	SLOPE
RAISE	RELEASE	ROLL/REV	SCAS/P&R	SLOW
RAP	REPEAT	ROLLING	SEC	SLOWLY
RAPS	RESET	ROLLOUT	SEEMS	SMALL
RATE	RET	ROTATED	SELECTED	SMOOTH
RCD	RETRACT	ROTOR	SET	SOUTH
RE-ENGAGE	RETRACTION	ROUGH	SHAPING	SPEED
RE/VIB	RETRIM	RPM	SHOT	SPEED/POWER

SPLIT	STO	T/R	TRACK	VERT.CLIMB
SQUAT	STOL	T0	TRANS	VERTICAL
SQUIRRELY	STOP	TAIL	TRANSITION	VERY
SS	STP	TAKE	TRANSLATION	VIB
STABILITY	STRESS	TAKEOFF	TRANSLATIONS	VIBRATION
STABLE	STRUCTURAL	TAPE	TRIM	VMAX
STABLIZED	SURVEY	TAXI	TRIMED	VRY
STAEDY	SW	TD	TRN	VSTOL
STALL	SWEEP	TEST	TRYING	VT
STANDBY	SWEEPS	THEN	TUFT	VTOL
START	SWITCHED	THR.	TURBULENCE	W/
STATE	SYM	THROTTLE	TURN	W/BUFFET
STATIC	SYSTEM	TILT	TURN-30'	W/FLARE
STBY	SYSTEMS	TILTROTOR	TURNING	W/HANDS
STEADY	T	TO	TURNS	W/MIN
STEEP	T&B	TOPPING	TWIND	WHL
STEP	T.	TORQUE	UNLATCHED	WIND
STEPS	T.D.	TORSION	UP	WINDMILL
STICK	T.O.	TOUCH	UP/DOWN	WINDS
STILL	T/D	TOUCHDOWN	VERT	WING
STK	T/O	TR	VERT.	WITH

WM	XLATION	YAW	ZEROS
WORSE	XWIND	YAWING	

Section V: Topical Reference

Introduction

This section is a topical reference to TRENDS. Such topics as the rules for mathematical expressions apply to more than one menu item and are included in this section for general reference. Some of the information found in this section is repeated elsewhere in the manual.

The topics included in this section are:

General Comments for use of TRENDS

1. A simple carriage return (cr) will usually suffice in response to any prompt. "Yes" or "No" default responses will be shown in square brackets (e.g. [Y]) When the prompt is for logic control, a simple return will move you on to the next prompt, which may be forward through the available options or back up the logic-tree, depending on the function being exercised. In response to a request for filename, a simple return means "none, ask me again if I really wanted a file."

2. A question mark (?) in response to a prompt will usually result in display of some helpful information relative to the current prompt.

3. A control-C (CTRL-C) is treated as an interrupt of the current process and will (depending on the situation)

   a. return control to the main TRENDS menu
   b. repeat the previous prompt
   c. move onward to the next prompt
   d. interrupt for an auxiliary process and further program control before proceeding (as in WORDSCAN to list itemcodes of some type available for a specified counter)

   During plotting, a CTRL-C takes effect only after the plot-page has been completed.

4. A wild-card asterisk (*) may be used in HELP to mean "ALL topics" and in WORDSCAN to mean "LOOK FOR anything" in the counter descriptions. A wild card may also be used in TIMEHIST (*, P*.TIM), MINMAX (P*.OSC), and VIEW (*, B6*) to specify a set of data items. At a data-region prompt it means "the whole database."

5. At any prompt for flight or counter,
   W80 sets the screen to 80-character width
   W132 sets the screen to 132-character width
   VMS opens a window to the operating system.

Mathematical Expressions

TRENDS provides the user with a capability for combining the stored numerical data according to his own formulas for the purpose of searching or plotting. These formulas may be entered at prompt-time or stored as named "functions" and recalled by name (see menu-item FUNCTIONS). They may be applied to either minmax (scalar) data or to time-histories. The general form of the mathematical expressions understood by TRENDS is:

operand {operation operand} {operation ... operand}

where the operations are any of +, -, *, /, ^ (^ is exponentiation). The operands are either:

- itemcodes or mnemonics (with optional extensions),.....(M143 or M143, OSC)
- literal numbers (E-notation accepted),.....(2.3, −1.5E-5)
- names of previously defined formulas (functions), ...(AVGTORK)
- defined arithmetic functions of 1, 2, or 3 arguments.....(FTHET (X,Y,Z), See 5-5)
- names of STOREd time-series functions.....(M143FILT)
- individual scratch-file elements .....(SCF3(3,4,T))
- library functions with math-expression arguments,.....(SIN(2*D186))
- previously defined univariate table name table look-up
- TIME or MRAZ (for time-history plotting only, see TIMEHIST help)

Operational Hierarchy

TRENDS uses a Reverse Polish Notation implementation to evaluate formulas. The implementation has no operational hierarchy, but evaluates the expression string left-to-right, one character at a time. An operator (e.g., *, ^) works on whatever is in the "accumulator" unless told by parentheses to do otherwise, so parentheses should be used to clarify the input if there is any doubt. For example,

M143+M107/2 is equivalent to (M143+M107)/2

rather than to M143+(M107/2) as it would be in Fortran. All literal numbers are used as REAL*4 floating-point, whether or not the decimal point is specified.

It is important to note that the first field MUST be an OPERAND and NOT an operation. Therefore,

-M143	is invalid, while
-1*M143 or 0-M143	are valid expressions.

Valid Examples.

1.	M143.OSC	! itemcode with extension
2.	M143^2 + (M107^2)^.5	! RSS formula
3.	ATAN(SIN(D186)/COS(D186))-D161	! library functions
4.	RSHP * SQRT(SIGP^3)	! pseudo-items
5.	1.5 * VGAIN(.67*P002)	! table look-up
6.	LOG(RSSTORK)	! stored formula
7.	M143 * 1.E-5 * TIME	! E-notation, TIME
8.	0.05*INTEG(SCF3(3,4,T)*20)	! scratch file, integral
9.	FTHET(V015,V016,MRAZ/2)	! arithmetic function

Library Functions

The available library functions are REAL*4 functions of a single REAL*4 argument, X, which may itself be a mathematical expression.

SIN(X)	sine of angle X in degrees
COS(X)	cosine of angle X in degrees
TAN(X)	tangent of angle X in degrees
ASIN(X)	arcsine of X, returned in degrees (-90,90)
ACOS(X)	arccosine of X, returned in degrees (0,180)
ATAN(X)	arctangent of X, returned in degrees (-90,90)
SQRT(X)	square root of (absolute value of) X
EXP(X)	exponential of X
LOG(X)	logarithm (base 10) of (absolute value of) X
LOGE(X)	natural logarithm of (absolute value of) X
ABS(X)	absolute value of X
BIT10(X)	Boolean AND with 2048 (UH60 tail-rotor bit)
M360(X)	angle modulator puts X in range (0,360)

Univariate Table Look-up

Univariate table look-up is also available in TRENDS. Your table must be entered as a number of x,y pairs in your user-defined functions file, FUNCTIONS.<db>. If your table is called VGAIN, for example, you may use VGAIN(X) in any mathematical expression as an operand, where X may also be an expression. Linear interpolation is used between table-points when X lies within the table's independent-variable bounds. When X lies outside the bounds, the end-point y-value is returned.

Arithmetic Functions

Arithmetic functions (formulas) of 1, 2, or 3 arguments may be defined (in FUNCTIONS.<db>) and used in mathematical expressions. The prototype expressions might look like:

```
MYFUNC(X)   = 1 - X + (X^2)
RMS(X,Y)    = SQRT(X^2 + (Y^2))
FTHET(X,Y,Z) = X * COS(Z) - (Y*SIN(Z))
```

The arguments used in defining the prototype should not use any names which may be itemcodes or other user-function of library-function names. You may want to use such terms as X$ or Y$ for the prototype arguments. You may imbed a one-argument function in a multi-argument function, but not vice-versa. For example,

RMS(MYFUNC(M143),MYFUNC(M107)) is valid.

To use the arithmetic functions in TIMEHIST, SEARCH, MINMAX, etc., you would enter, for example,

FTHET(V016,V015,D186)

or

MYFUNC(V015)

or

RMS(V015,V016)

Menu Items

- ***FUNCTIONS***
- ***TIMEHIST***
- ***COMPARE***
- ***NORMALIZE***
- ***CPRINT***
- ***SEARCH***
- ***MINMAX***
- ***MULTIPLT***
- ***SCRATCHFILE***

Convolution Filter Algorithm (CVF)

CVF(x,co,w)

This feature provides an in-line filtering of the argument, x, with cutoff frequency, co, and window-type, w, using the convolution-filter algorithm from DATAMAP. The argument, x, may be a mathematical expression or a simple itemcode. The cutoff frequency, co, is a literal number in Hertz. The window flag, w, is 1 or 2:

w = 1 Half-cosine window
w = 2 Hanning window.

The window flag may be omitted. In this case the Hanning (w = 1) windows is used. CVF may be used as an argument ONLY of the POLY function and may NOT be used in mathematical expressions. The reason for this limitation is that CVF is a post-processing function (after all of the samples of its argument have been computed and stored) and POLY is a post-post-processing function (computed after the x-column values and POLY-argument-column values have been computed and stored.

Valid examples:

```
PLOT 1  X-AXIS: CVF(P342*12.,.2,1)
    Y-CURVE 1: POLY(CVF(P342,1,2),3)
    Y-CURVE 2: SMOOTH H (FT)=CVF(P342,5,1),2000,4000
    Y-CURVE 3: POLY(CVF(DERIV(INTEG(M143-M107)),.5,2),3)
    Y-CURVE 3: CVF(SCREEN(P342,400),.5)
```

Invalid examples:

```
    Y-CURVE 1: CVF(P342,1,2)/3.1416
    Y-CURVE 2: CVF(M143,5,1)-CVF(M107,5,1)
```

Menu Items

- ***TIMEHIST***
- ***COMPARE***
- ***NORMALIZE***

Derived Counter Sets

Successful searches in TRENDS identify sets of counters for which the search criteria were satisfied. Such a set is called a derived counter set or DCS. It is also sometimes called a pseudo-flight. The counter is the parameter which relates narrative, statistical data, and time histories in TRENDS. Therefore, a DCS which was derived from a search for "STEPS" (i.e., control input steps) in WORDSCAN can be used to initiate an airspeed-range search in SEARCH or to specify the data region for time-history plots in STRIPS or PERFPLOT.

The capability exists in WORDSCAN, SEARCH and elsewhere in TRENDS to save a DCS. The dialogue for saving is:

```
Save the derived counter set? (Y/[N]): Y
DCS name:    MYDCS
Description: ("STEP" counters in flts 200-220)
```

The DCS name you supply should have no more than 9 characters and no extension. TRENDS will check the name you supply so that you do not inadvertently overwrite a previously saved DCS and that the name is not to be confused with any of the admissible data-region command keywords, such as VMS or PRINT. You should always provide a meaningful description so that you can identify the DCS later from others you have saved. TRENDS will add the creation date and time to the information you supply when a DCS is saved.

The DCS is saved in your directory in a keyed-access, non-printable file, DCTRSETS.<db>, as a record whose character key is the DCS name. Thus you will not be able to print it directly. Menu-item FILES can be used to view or clean up your stored DCSs with commands such as:

```
DIR     *.DCS
TYPE    MYDCS.DCS
DEL     *.DCS
```

A single DCS name is acceptable in response to any data-region prompt in TRENDS. If you want to concatenate two or more DCSs, you can use WORDSCAN as follows:

```
LOOK FOR:  *
Enter flights etc.:    1STPART
Enter flights etc.:    2NDPART

Save DCS ?             Y
DCS name:              BOTHPARTS
```

Menu Items

- ***WORDSCAN***
- ***SEARCH***
- ***KEYS***
- ***CPRINT***
- ***FIND***
- ***TIMEHIST***
- ***MINMAX***
- ***LOADS***
- ***PERFPLOT***
- ***STRIPS***
- ***NORMALIZE***
- ***MINMAX***
- ***MULTIPLT***
- ***GEOPLOT***
- ***HARMONIC***
- ***TSSTATS***

Plot Specification Syntax

Menu Items

- ***TIMEHIST***
- ***COMPARE***
- ***MINMAX***
- ***MULTIPLT***

The setup prompts for each plot (1-3 per page) are of the form:

```
PLOT n X-AXIS:      (abscissa definition, n=1, 2, or 3)
    Y-CURVE 1:      (first curve, this plot)
    Y-CURVE 2:      (optional second curve, this plot)
    Y-CURVE 3:      (optional third curve, this plot)
```

You must provide a valid entry for the first two of these prompts, not just a carriage return <cr>, in order for a plot to be drawn. A null response, to the x-axis prompt terminates the setup dialogue. The syntax of your response is basically the same for abscissa and ordinates, although certain responses are invalid for one or the other (e.g., POLY cannot be used in an x-axis response and FREQ is not defined for a y-axis expression).

Responses to prompts for abscissa ("PLOT n X-AXIS :") or ordinate ("Y-CURVE 1 :") have the general form:

```
{label=}  expression  {,scale-min {,max {,increment}}} {"}
```

The label and forced scales are optional (as indicated by the curly brackets { } in the general form above).

Example:

```
AVG TORQUE (FT-LB) = (M143+M107)/24,-10000,10000,5000
      (label=)            (expression)  (min)  (max) (inc)
```

If scaling is not specified, the plots will be automatically scaled to fit the range of data. By default, a separate axis and scale will be drawn for each curve. If you wish to force a curve of any one plot to be drawn to the SAME scale, as the previous curve of that plot you may indicate this by ending your specification with quotation (ditto) marks.

```
Example-1:  PLOT 1 X-AXIS : TIME
            Y-CURVE 1 : ROLL (DEG) = D009
            Y-CURVE 2 : PITCH (DEG) = D010"
            Y-CURVE 3 : YAW (DEG) = D011
```

```
Example-2:  PLOT 1 X-AXIS : TIME
            Y-CURVE 1 : ROLL (DEG) = D009,0,360,30
            Y-CURVE 2 : PITCH (DEG) = D010"
            Y-CURVE 3 : YAW (DEG) = D011"
```

In example 1, a common scale will be found from the data for D009 and D010 and a separate scale will be found for D011. In example 2, the forced scale specified for D009 will be used for all three curves.

Repeat String (#)

TRENDS has a repeat-string capability which works in TIMEHIST or MINMAX to save you from having to enter the same long string more than once in the same plot.

```
PLOT 1 X-AXIS :    SQRT(A005.SPC^2+(A300.SPC^2))
Y-CURVE 1 :        SQUARE OFFSET=#X^2+.05
Y-CURVE 2 :        POLY(#,3)
```

In the above example, #X is replaced in Y-CURVE 1 by the expression specified for the x-axis. Then the # in the specification of Y CURVE 2 is replaced by the expression (not label or scales) from Y-CURVE 1. This feature works only within one plot. Expressions from PLOT 1 cannot be pulled in for PLOT 2, for example, with the exception that the x-axis specification from PLOT 1 can be duplicated on PLOT 2.

Polynomial Regression -- POLY(X,n)

TRENDS permits curve-fitting by up to third-order polynomials. Polynomial fits of ordinates data to the abscissa data (y=f(x)) may be obtained as "y-curves" by a response of the form

POLY(expression,order)

The expression obeys the rules described earlier for mathematical expressions. The order is a number between 0 and 3, inclusive.

Order	Fit	
0	Constant or mean,	y=A
1	Straight-line,	y=A + B*x
2	Quadratic,	y=A + B*x + C*x^2
3	Cubic,	y=A + B*x + C*x^2 + D*x^3

The response may specify axis label and scaling overrides, but may not use POLY in a mathematical expression. The domain of the fit is over the range of the x-axis scales. Default axis scales for the polynomial curve itself are those which would automatically bound the unfitted expression (i.e., automatic ordinate scales for "expression"). When POLY is specified, the coefficients of the fit (A,B,C,D values) are shown in the legend of the plot.

Example: Y-CURVE 2 : POLY(P342,3) (cubit fit of P342)

Commands

Certain commands can be entered at the plot-setup prompt to set option flags. After you have entered the command(s), you will be prompted again for plot-setup information.

?	Displays plot-setup help topics to be shown
PRINT	Sets the print option flags
INTERVAL	Sets time slice (TIMEHIST)
COUNTS	Data values will be unscaled (TIMEHIST)
EDIT	Edit or recall current or stored setup
RECALL	Recall prior setup
SAVE	Save the current setup

See page 3-33

The INTERVAL and COUNTS commands are meaningful only for TIMEHIST. Two other useful commands are entered only at the data-region prompt. These are TITLE and RESCALE. These commands result in some dialogue which will enable you to enter your preferences and override defaults.

Custom Title

This feature lets the user override one or all three of the title lines at the top of TRENDS plots. The default titles are application-dependent, but usually contain the aircraft tail number (database) and flight and counter descriptions. To override any of the title lines, enter TITLE at the prompt for flight or counter. For example,

Enter counter(s) etc.: TITLE

You will then be prompted as follows:

Enter the main (top) plot-title :
Enter upper sub-title :
Enter lower sub-title :

A simple carriage return (null entry) for any line gives the default auto-titling for that line. A space may be used to produce a blank line in the plot header. Your titles will persist (only) for the duration of your current session in TRENDS or until you change them.

Changing Scales – RESCALE

This plotting feature lets you re-scale your x- or y-axes in TIMEHIST or MINMAX after you have scaled them during the setup phase or TRENDS has scaled them automatically. To invoke the re-scale feature, enter RES at the data-region prompt You will then be shown the existing scales for each plot on the plot-page. You will then be allowed to enter new scales and increments for each abscissa and ordinate on the page. A simple carriage return to the prompt means "no change."

Example of RESCALE dialogue:

```
Current scale bounds for plot #1
X-axis:  Min =    0.00        Max =    15.00        Delta =    5.00
Y-axis 1:  Min = 94000.0      Max = 102000.00      Delta = 2000.00
Y-axis 2:  Min = 90000.0      Max = 105000.00      Delta = 5000.00

 New scale bounds for X-axis       (Syntax: Min,Max,Inc. or AUTO) : 5,10,1
 New scale bounds for Y-axis 1     (Syntax:Min,Max,Inc. or AUTO): AUTO
 New scale bounds for Y-axis 2     (Syntax:Min,Max,Inc. or AUTO):
```

As you see in the example, AUTO may be used to let TRENDS autoscale a curve which has previously been given forced scaling. NOTE: The re-scales will not be automatically saved as part of a SAVEd plot-page setup file for recall with EDIT. Scales may be included in the SAVEd files, but only if they are entered as part of the plot-page setup procedure or with external editing.

Editing and Saving Plot Setup

Menu Items

- ***TIMEHIST***
- ***COMPARE***
- ***MINMAX***
- ***MULTIPLT***

The EDIT feature allows you to change one or more lines of your plot-page specification without being required to re-enter the other previously entered lines. It also allows you to save and recall a plot-page specification file. The Plot Setup Editor has two formats, 1 & 2. Both TIMEHIST and MINMAX menu items use Format 1. In addition TIMEHIST can also support the Format 2 option. The Format 2 option is entered into by merely typing in a Y CURVE 4 entry during the initial setup. Note, the Format 2 option is not as robust as Format 1.

The plot-page setup dialogue in TIMEHIST consists of up to 12 response line prompts. In Format 1, one can have up to 3 plots per page with up to 3 curves per plot. In Format 2, one can have one plot per page with up to 11 curves per plot; however in Format 2 all curves are assumed to have the same units and will be given the same scale. Shown is an example of where only a portion of the possible plot options are used in both Formats.

Format 1	Format 2
Prompts	Prompts
(1) PLOT 1 X-AXIS: T, 10,20,2	(1) PLOT 1 X-AXIS:T, 10,20,2
(2) Y-CURVE 1: M143-M107	(2) Y-CURVE 1: A150
(3) Y-CURVE 2:	(3) Y-CURVE 2: A151
(4) Y-CURVE 3:	(4) Y-CURVE 3: A152
	<<<<< If you enter more than 3 curves ....etc...
	you may plot up to 11 curves, ...etc/
(5) PLOT 2 X-AXIS P002:	(5) Y-CURVE 4: A175
	OK. Multiple curves, common .... etc.
(6) Y-CURVE 1: M143-M107	(6) Y-CURVE 5: A176
(7) Y-CURVE 2:	(7) Y-CURVE 6: A177
(8) Y-CURVE 3:	(8) Y-CURVE 7: A300
(9) PLOT 3 X-AXIS:	(9) Y-CURVE 7: A300
(10) Y-CURVE 1:	(10) Y-CURVE 9: A302
(11) Y-CURVE 2:	(11) Y-CURVE 10: A352
(12) Y-CURVE 3:	(12) Y-CURVE 11:

TIMEHIST and/or MINMAX plot setup prompts do not require you to respond to all lines, but the potential exists. When you have completed the specification, you will be prompted for data region:

Enter the counter numbers:	(TIMEHIST)
Enter the flight numbers:	(MINMAX)

With the EDIT feature, you may review or modify your plot-page entries at this point. To do so, enter

EDIT	To pull up the current plot-page for editing
EDIT ?	To show names of saved plot-pages in your directory
EDIT filename	To recall a saved plot-page for editing or re-use
SAVE filename	To store away the current plot-page setup as a file in your directory

RECALL

RECALL may be substituted for EDIT, if you prefer. EDIT or RECALL may be used at any of the X-AXIS prompts as well as at the data-region prompt. When in the EDIT mode, you will be shown the 12 lines of your plot-page setup.

Example of Plot Setup Editor using the Format 1 option.

The Editor is entered into after one types in "EDIT" at the following prompt. Notice the instructions at the bottom of the Plot Setup Edit Box in how to operate within it.

Enter the counter number(s): EDIT

```
                Plot Setup EDITOR
Plot 1 - x:  TIME,10,20,2
 Y-curve 1:  M143-M107
 Y-curve 2:
 Y-curve 3:

Plot 2 - x:  P002
 Y-curve 1:  M143-M107
 Y-curve 2:
 Y-curve 3:

Plot 3 - x:
 Y-curve 1:
 Y-curve 2:
 Y-curve 3:

    INSERT: just type                MOVE CURSOR: use the arrow keys
    DELETE: del a char to the left   CR/ENTER:    exit screen editor
    BSPACE: del a char to the right  CNTR_C:      abort edit
```

Edit the Plot setup box

Now notice the modification to the plot set up below, namely: Y-curve 2 in plot 1, and "X" in plot 2. By using the arrow keys to locate where the new text is to go and then simply by typing it in, one is able to edit the setup. Note, at the counter prompt the setup can be saved by simply typing "SAVE (file name). Plot-page files are printable and may be created or modified through use of the VMS system editor. They are identified by the PPG* extension, where * = the database number. e.g. 703.

```
                Plot Setup EDITOR
Plot 1 - x:  TIME,10,20,2
 Y-curve 1:  M143-M107
 Y-curve 2:  POLY(M143-M107,3)
 Y-curve 3:

Plot 2 - x:  P342
 Y-curve 1:  M143-M107
 Y-curve 2:
 Y-curve 3:

Plot 3 - x:
 Y-curve 1:
 Y-curve 2:
 Y-curve 3:

    INSERT: just type                MOVE CURSOR: use the arrow keys
    DELETE: del a char to the left   CR/ENTER:    exit screen editor
    BSPACE: del a char to the right  CNTR_C:      abort edit
```

Examples of saving or recalling plot file setups:

Enter the counter number(s): SAVE (filename prompt follows)
Enter the counter number(s): SAVE TORK

Menu Items

- *TIMEHIST*
- *COMPARE*
- *MINMAX*
- *MULTIPLT*

Menu Items

- ***TIMEHIST***
- ***COMPARE***
- ***MINMAX***
- ***MULTIPLT***

Example of TIMEHIST multicurves/plot edit option

Plot Setup EDITOR

Plot 1 - x:	TIME
Y-curve 1:	A150
Y-curve 2:	A151
Y-curve 3:	A152
Y-curve 4:	A175
Y-curve 5:	A176
Y-curve 6:	A177
Y-curve 7:	A300
Y-curve 8:	A301
Y-curve 9:	A302
Y-curve 10:	A352
Y-curve 11:	

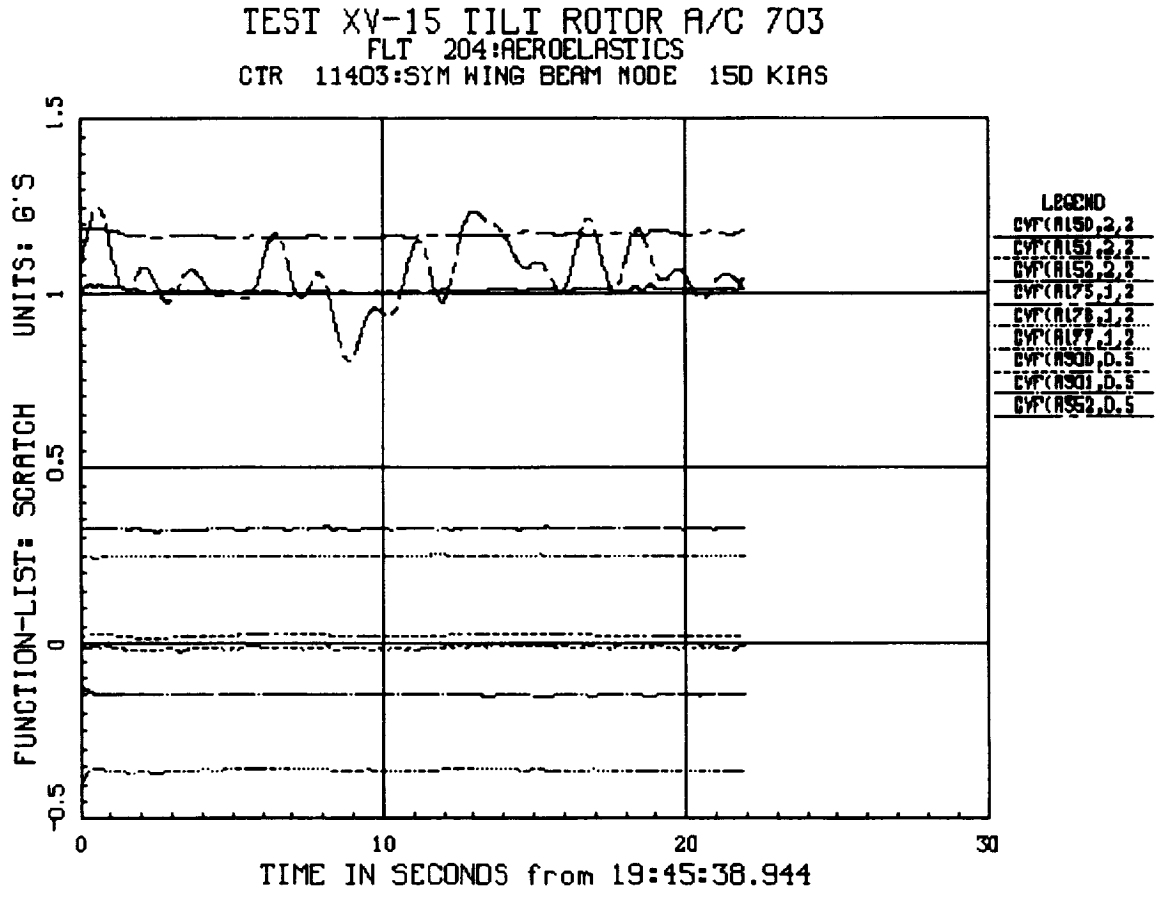
INSERT: just type — MOVE CURSOR: use the arrow keys
DELETE: del a char to the left — CR/ENTER: exit screen editor
BSPACE: del a char to the right — CNTR_C: abort edit

Now editing the original plot setup. See 5-12 for more edit info

Plot Setup EDITOR

Plot 1 - x:	TIME
Y-curve 1:	CVF(A150,2,2)
Y-curve 2:	CVF(A151,2,2)
Y-curve 3:	CVF(A152,2,2)
Y-curve 4:	CVF(A175,1,2)
Y-curve 5:	CVF(A176,1,2)
Y-curve 6:	CVF(A177,1,2)
Y-curve 7:	CVF(A300,0.5,2)
Y-curve 8:	CVF(A301,0.5,2)
Y-curve 9:	CVF(A302,3,2)
Y-curve 10:	CVF(A352,3,2)
Y-curve 11:	

INSERT: just type — MOVE CURSOR: use the arrow keys
DELETE: del a char to the left — CR/ENTER: exit screen editor
BSPACE: del a char to the right — CNTR_C: abort edit



Data Region Syntax and Commands

Data-region prompts are of two different types: flight type and counter type. Those applications which are concerned with a range of counters and statistical (e.g., SEARCH, MINMAX) or narrative data (e.g., WORDSCAN, FLIGHTS) give the flight-type prompt. Numbers entered in response are interpreted as flights. A list of specific counters must be identified by a leading semicolon (:). Those applications which deal with time-history data (e.g., TIMEHIST, PERFPLOT) give the counter-type prompt and expect any unqualified numerical response to be counter number(s). Flight numbers may be entered, but they must be preceded by F. The user should observe the prompt.

The data-region prompt in MINMAX and SEARCH is:

Enter flight(s), :counter(s) or DCS filename :

Your response is either (1) one or more flights, (2) one or more counter numbers preceded by a semicolon, (3) one derived counter set (DCS), or (4) one of several command or control options. Examples of the first three are:

Enter flight(s), etc :	180,182-185,216	(flights)
	:11208-11400,12210	(counters)
	HELIMODE	(DCS)

The data-region prompt in TIMEHIST is

Enter counter(s), "F"flights(s) or DCS filename :

Your response is either (1) one or more counters, (2) one or more flight numbers preceded by F, (3) one derived counter set (DCS), or (4) one of several commands or control options. Examples of the first three are:

Enter counter(s), etc.:	11208-11400,12210	(counters)
	F180,182-186,216	(flights)
	HELIMODE	(DCS)

To access XV15 hangar or ground runs, use H or G instead of F in the flights example. Responses cannot be mixed (i.e., counters with flights) and only one DCS can be used at one data-region entry. The prompt will be repeated after your plots are made, so you will get another chance to add data regions, maybe in another form. The numbers do not have to be in ascending order. The hyphen (-) in the example means "inclusive," as in "flights 182 through 186, inclusive."

Repeating the Data Region

Once a data region has been entered for MINMAX or TIMEHIST in a TRENDS session, you may recall it by entering ditto (") at the next data-region prompt. This works whether you entered flights, counters, or a DCS and is not affected by intervening plot-setup entries, editing, or command/control entries. Only the most recent data region can be recalled.

NOTE:

Two or more counters may be appended in TIMEHIST. See APPEND on page 3-40 for details.

Menu Items

- *TIMEHIST*
- *MINMAX*
- *COMPARE*
- *MULTIPLT*
- *NORMALIZE*
- *WORDSCAN*
- *SEARCH*
- *KEYS*
- *VIEW*
- *CPRINT*
- *FIND*
- *LOADS*
- *PERFPLOT*
- *STRIPS*
- *GEOPLOT*
- *HARMONIC*
- *TSSTATS*
- *FLIGHTS*

Command/Control Options

Entered at the data-region prompt let you change such things as time intervals, hard-copy flags, titles, etc. Following treatment of the entered option, the "Enter counter(s)" prompt will be repeated. Only the first 3 characters of the options need be entered. The following options are available.

PRINT	Turns on print flag with optional switches
+ (cross-hair)	Toggles the cross-hair feature on/off
INTERVAL	Sets time interval for plots or analyses
TITLE	Enables override of default plot titles
TSHIFT	Shifts curves relative to each other in time
RESCALE	Enables overrides of current plot scales
VMS	Lets you issue VMS operating system commands
FILE: or @	Specifies and opens ASCII file for reading data
PLTHDCPY	Lets you change the plot-hardcopy option
TERMINAL	Enables changing of terminal type
W80 or W132	Sets screen with to 80 or 132 characters
EDIT {file}	Recalls plot setup for editing
SAVE {file}	Saves current plot setup
?	Obtains in-line help menu

See page 3-33

Examples:

Enter counter(s), etc.	:INT=3,5	(time slicing)
Enter flight(s), etc.	:TITLE	(custom plot titles)
Enter flight(s), etc.	:SAVE ACCELS	(plot setup)

Some of the options are application-specific. TIMEHIST recognizes ENSEMBLE to set the mode to plot all of the requested counters' data (curves) on the same plot. This works properly only for a single plot per page, and the default returns to one plot page per counter after the ensemble plot so that ENSEMBLE must be re-entered if it is desired for any new plot. COMPARE recognizes SYNCH at the data-region prompt if two curves are to be synchronized with their start times. Otherwise, start times are ignored and assumed zero for both curves, unlike TIMEHIST. COMPARE also recognizes DIFF at the data-region prompt. This causes COMPARE to plot the average and difference of the two curves rather than the curves themselves.

Cross-Hair (+) Measurements of Plot-points

This feature lets the user measure and (optionally) record x,y points in a plot by positioning cross-hairs and marking the points. The feature is available with any of the plotting applications in TRENDS except STRIPS and PERFPLOT. Your setup must have:

1. only one plot (i.e., one x,y grid) per page and
2. only one y-scale (multiple curves at the same scale are OK)

To invoke the cross-hair feature, type a "+" at the prompt for data region (i.e., flight or counter). If your plot configuration is valid, you will see:

*** CROSS-HAIR CURSOR ON ***

You can now DELETE points (D) or SELECT points (D)

DO YOU WANT TO STORE CROSS-HAIR DATA? (Y/[NO]) :

If your answer to the question is Y, you will be asked for a filename in which to record the registered points. The default filename is POINTS.DAT and the default extension is DAT. The + works as a toggle to turn off the cross-hair mode and close the file. Otherwise, the cross-hair mode stays on until you return to the main TRENDS menu and new measurements will be added to your recording file.

When the plot comes up on your screen, cross-hairs will appear. The cross-hairs differ in appearance between terminal types. Movement of the cross-hairs is controlled by the cursor arrows on Graphons, VT-240s and retrographic VT-100s. Movement is controlled by thumb-wheels on Tektronix terminals and with the mouse on a MacIntosh.

Points are pickled (marked or registered) by striking any letter or number key or space except Q (without "Return") or by using the button on the mouse. A Q removes the cross-hair from the screen and ends the marking mode for the current plot. A return then clears the screen for the next plot. Don't hit the Return when marking points, because it registers as a point, but with the wrong coordinates. As each point is marked, its coordinates are displayed at the bottom of the plot (not on the hard copy) and (optionally) written to the recording file.

Menu Items

- ***TIMEHIST***
- ***MINMAX***
- ***NORMALIZE***
- ***COMPARE***
- ***MULTIPLT***
- ***GEOPLOT***
- ***HARMONICS (STORED)***

Menu Items

- *TIMEHIST*
- *MINMAX*
- *NORMALIZE*
- *COMPARE*
- *MULTIPLT*
- *GEOPLOT*
- *HARMONICS (STORED)*

The screen area for displaying the coordinates holds only six coordinate pairs. When a seventh point is marked, the screen is cleared and the plot is redrawn before displaying the seventh point. This artifice is necessary because we have not figured out a way to clear only part of the screen while in the graphical mode under DISSPLA.

The optional recording file is formatted in ASCII characters, so you may type or print it. It contains the plot headers and abscissa/ordinate specifications as well as the recorded coordinates.

Cross-hair marking has been used with TIMEHIST to linearize control position (D021, D022, D023, D024) time histories from flight test in order to feed them into the tilt-rotor simulation, GTRSIM. When these linearized control position histories are used in the simulation, they produce responses which can be compared with recorded flight responses to validate the simulation. If the letter L is used to pickle points , a straight line will connect the L-pickled points on the screen but not on hardcopy.

Deleting or Selecting Points

If you are in MINMAX and the letter keys C, S, or D are used to pickle, then TRENDS can identify, select, or delete points. In this case, TRENDS will look for the plotted point which is closest to where you pickled, put the "+" at that point and display the coordinates of that point, rather than the cross-hair's location. The counter number of the point will also be displayed. This feature is useful in identifying particular points in a plot when you notice something interesting about them, but don't know the counter number associated with the points. If you simply want to identify the counter for some point, use C to pickle. If you use D to pickle, the points' counters will be saved as a set to be deleted from the full plotted set. After the plot has cleared, MINMAX will give you an opportunity to save the undeleted points as a derived counter set (DCS). If you use S to pickle, these "selected" points' counters will be temporarily stored as a set which will be able to save as a DCS. Whether you save the selected or undeleted points as DCSs or not, MINMAX will give you an opportunity to plot them before returning control to the data-region prompt.

Output Files

User Generated by Using TRENDS

Several different types of files will be produced in the user's directory during a TRENDS session. Some of these are editable and printable ASCII files; others are not. The editable files will be indicated by (A) for ASCII. Lower-case parts of file names are generic, capitals are specific. The notation <db> stands for current database: e.g. 703.

AIRCRAFT.DEF	(A)	Contains your default database and plot-hardcopy indicators.
CONDITION.<db>		Keyed-access condition mask from SEARCH.
DCTRSETS.<db>		Contains all derived counter sets for <db>. May be viewed in FILES.
FORxxx.DAT	(A)	Debug and scratch files which should be purged and/or deleted by the user
FUNCTIONS.<db>	(A)	Definitions of user's named formulas and lookup tables
ITEMS.ASC	(A)	Logfile created when inspecting user's ASCII input files within ITEMDEFS
ITEMS.SAV	(A)	List of data items created/usable in OUTDATA to minimize retyping
MYDIR.DAT	(A)	File containing your current directory name.
OUT<db>.<cntr> (or supplied name)	(A)	Tabulated time-histories produced by OUTDATA.
PERF<db>.PPF<db>	(A)	Layout file created/used in PERFPLOT
POINTER.RUN	(A)	Pointer file for TRENDS, may include your pointers to a private database.
POINTS.DAT (or supplied name)	(A)	Contains the list of coordinates marked with cross-hairs on a plot plus self-documentation (labels, etc.)

Menu Items

- ***TAIL NO.***
- ***TERMINAL***
- ***SEARCH***
- ***TIMEHIST***
- ***PERFPLOT***
- ***ITEMDEFS***
- ***DERIVED***
- ***FILES***
- ***OUTDATA***
- ***FUNCTIONS***

SCRATCH.KEY		Keyed-access for time-history data from STORE command in TIMEHIST
SEARCH.MSK	(A)	Editable version of the most recent condition mask from SEARCH.
TERM.DAT	(A)	Contains your terminal-type indicator.
TSSTATS.DAT	(A)	Structured output file from TSSTATS, prototype for ASCII statistical input file
USERFILES.DAT	(A)	Directory of certain TRENDS files generated when you call TRENDS.
USERFILES.IND		Keyed-access version of USERFILES.DAT
<db>DFLT.USR	(A)	Default pointer file required by DATAMAP.
filename.FMT<db>	(A)	Layout file created by MAKE in CPRINT.

Menu Items

- ***SEARCH***
- ***TSTATS***
- ***INFOFILE***
- ***SCRATCH***

menu-item.TRX<db>	(A)	Log-file (e.g., WORDSCAN.TRX703) which echoes your session inputs and TRENDS' responses. Each entry from the menu creates a new version.

****TRX Files***

- ***PROJECT***
- ***DATABASE***
- ***LOGSCAN***
- ***FLIGHT***
- ***WORDSCAN***
- ***SEARCH***
- ***KEYS***
- ***VIEW***
- ***FIND***
- ***CALIBS***
- ***ITEMDEFS***

ASCII Input Files

(User Generated Outside of TRENDS)

TRENDS will accept ASCII input files containing time-history or statistical (and parametric) data, provided that these files have the appropriate structure. Prototypes for these structures are produced in the outputs of OUTDATA (time history) and TSSTATS (statistical).

TIMEHIST accepts the time-history type of file, while MINMAX or MULTIPLT accept the statistical files. During plot setup, data items which come from a formatted input file must be prefaced by "@" to distinguish them from database itemcodes or function names. The input would look like:

Y-CURVE 1: ASCITEM = @BB18 * 1.68

ASCII-file input data items may be used with constants or other like data items in formulas, but not in combination with database items. No checking is done by TRENDS during plot setup to confirm that such data items are actually named in a proper file, but the ASCII,@ category in the help menu will display the contents of a named file.

The data-region response in TIMEHIST is:

1. Enter counter(s), etc.: @TWOCTRS.703
2. Enter counter(s), etc.: 11616, 14480
3. Enter counter(s), etc.: @TWOCTRS.703:11616,14480

The first of these responses simply names the file, thus enabling the second response. The third response names the file and the counters all at the same time.

The data-region response in MINMAX is

1. Enter flight(s), etc.: @OUT703.STATS
2. Enter flight(s), etc.: :12425-12429
3. Enter flight(s), etc.: @OUT703.STATS:12425-12429
4. Enter flight(s), etc.: @OUT703.STATS:*

The first three examples are similar to those for TIMEHIST. The fourth shows the use of the wild card. Do not try to use the first response and the wild-card response on separate lines.

The data-region dialogue is still different in MULTIPLT, where one must answer "Y" to the prompt:

Multiple Databases?

To use an ASCII input file, you would then respond with the filename as follows.

Enter database #1 : @OUT703.STATS

Later you will be prompted to

Enter counters or * for (@OUT703.STATS):

and you may use the wild card or answer with any subset of the counters contained in the file.

Structure

The prototype for the time-history input file is found in the files produced by menu-item OUTDATA, so it is recommended that the user produce one of these and study it if he or she intends to write such a file with an editor or another program (an example follows later). The file is divided logically into sections:

1. file header lines (several file-documenting lines, some with keywords)
2. item descriptions lines (one line for each data column to follow)
3. frame rate line and column headers
4. data lines
5. "END OF RECORD" line

The keywords recognized in the file-header lines are TITLE: and COUNTER: (not case-sensitive), which are followed by text strings used only for labeling plots. The end of the header-line section is indicated by a left curly bracket ({). The item-description lines must have a header which includes strings DESCRIP, UNITS, and I.C. to determine starting columns for subsequent descriptive data. The mnemonic must start in column 2 and may be 8 characters in length. The item-description segment is terminated by a right curly bracket (}). The frame-rate line must contain "FRAME RATE" followed by a colon and a number. A right curly bracket (}) indicates "start of data" and the "END OF RECORD" line terminates the data.

The prototype for statistical ASCII input files is produced by TSSTATS. The file segments are:

1. file header lines, terminated by a line containing "mnemonic"
   (the only recognized keyword is "Title")

2. item description lines, headed by the "mnemonic" line
   (one line for each data item or parameter)
   (list is terminated by a line containing "}")

3. data blocks, one for each counter
   (first line of block has "Cntr:" followed by number)
   (one line for each data item: name + 1-3 numbers)

4. "END OF RECORD" line (optional)

As with the time-history ASCII files, the mnemonics, descriptions, units, and itemcodes in the item-description segment must be aligned under their appropriate and properly-spelled column headings. Supplied counter descriptions must be enclosed in parentheses on the "Cntr:" line of a data block. Data-block lines for each item must contain the name and at least one number. The first number is assumed by TRENDS to be the average (mean). The second and third numbers, if included, are assumed to be the maximum and minimum, respectively. The column header lines in data blocks are read as commentary only.

Examples

```
          TRENDS Time-history Output File: OUT703.11616
               Title: title test
               Database:     703
               Counter:     11616 IN 0 RPM 86 FLP 0 A/S 190
               Generated:    16-JUL-92 15:15:41

{
Mnemonic Description                    Units  I.C.      ITIME     NPTS  Samp/Sec
P002     AIRSPEED - NOSE BOOM           KNOTS  P002   84473601      96      5.020
P342     ALTITUDE - NOSE BOOM           FEET   P342   84473601     100      5.229
}

               Print interval (sec):    5.00 to     6.00
               Output frame rate (/sec):    5.00
{
    TIME         P002           P342
    (SEC)        (KNOTS )       (FEET  )
}
   5.0000  0.1910775E+03  0.6583566E+04
   5.2000  0.1909631E+03  0.6583566E+04
   5.4000  0.1910996E+03  0.6581862E+04
   5.6000  0.1911557E+03  0.6576392E+04
   5.8000  0.1910835E+03  0.6578753E+04
   6.0000  0.1910027E+03  0.6586256E+04

                  ***  End of record  ***
NEP$




          TRENDS Statistics Output File: ANGLES.STATS
               Title: title test
               Database:     703
               Generated:    16-JUL-92 16:30:18

  {
          Mnemonic Description                    Units  I.C.
          P002     AIRSPEED - NOSE BOOM           KNOTS  P002
          D009     ROLL ATTITUDE - CABIN          DEG    D009
          D010     PITCH ATTITUDE - CABIN         DEG    D010
          D011     YAW ATTITUDE - CABIN           DEG    D011
          M107     RT ROTOR MAST TORQUE    12     IN LB  M107
          M143     LT ROTOR MAST TORQUE    12     IN LB  M143
  }

  Cntr:  12420  Flt:  220  (T/R H/K HANDS OFF          )  SLICE =  0.000 25.121

  Mnem/Item    Average     Maximum     Minimum     Tmax        Tmin
  P002          82.074      82.722      80.423      8.566       0.000
  D009          -1.291      -0.969      -1.546     23.522      24.988
  D010           5.412       5.754       4.964     24.861       3.570
  D011          -1.120      -0.503      -1.553      0.000       7.394
  M107     107900.586  110986.352  104694.680      1.721      22.821
  M143     109163.445  111428.117  104589.555      6.821       0.000

  Cntr:  12422  Flt:  220  (CONVERSION HANDS OFF        )  SLICE =  1.000  5.000

  Mnem/Item    Average     Maximum     Minimum     Tmax        Tmin
  P002          99.519      99.969      99.034      0.000       3.386
  D009          -0.192       0.056      -0.457      1.530       2.614
  D010          -0.936      -0.845      -1.003      0.510       0.319
  D011          -0.930      -0.653      -1.253      0.127       3.187
  M107      80275.445   84367.727   78414.836      1.530       2.359
```

Private Databases

About 10 databases are maintained as "standard" databases (e.g. BH2, 703, etc.)to be accessed by the TRENDS user community. On occasion, someone may have a "private" database, written in the appropriate format, and want to use the plotting and analysis features of TRENDS. In order to access such a database, the user must have a file called

USERBASE.PTR

in his/her directory prior to invoking TRENDS. This file will be appended to the pointer-file for the standard databases by TRENDS. An example of the contents of the USERBASE.PTR file is

```
!            C81 DATABASE
BC1%DRIVER    %ACCESS0:[ACCESS]                DRIVER:where program is
BC1%DOC       %ACCESS0:[ACCESS]                DOC:where help-files are
BC1%DATA      %LEW0:[ABC.C81DATA]              DATA:where root database is
BC1%TIM       %LEW0:[ABC.C81DATA]              TIM:where T-H files are
BC1%PLTTTL    %BOBS LOCAL C81 DATABASE         PLTTL:default plot title
BC1%NODE      %NEP                             NODE:computer designation
                                               C3 Chars
!            CAMRAD 123 DATABASE
123 %DRIVER   %ACCESS0:[ACCESS]
123 %DOC      %ACCESS0:[ACCESS]
123 %DATA     %LEW0:[HARRY]
123 %TIM      %LEW0:[HARRY.CAMRADJA]
123 %PLTTTL   %CAMRAD 123 SIMULATION DATABASE
123 %NODE     %NEP
```

This pointer file defines paths to two private databases, BC1 and 123. It also defines plot titles (PLTTTL) which are used in the TAIL NO. menu to briefly identify the database. The database names have to be three characters long.

NOTE:

The drive names and directories in the above example are fictitious. If you want to define a private database and need more information, contact the TRENDS manager.

INFOFILEs & SCRATCH FILEs

Menu Items

- ***GEOPLOT***
- ***OUTDATA***
- ***SCRATCH FILE***
- ***TIMEHIST***
- ***INFOFILE***
- ***VIEW***
- ***NORMALIZE***
- ***COMPARE***

DATAMAP-style infofiles and scratch files are concerned with array processing, rather than focusing on individual data items. An infofile contains named "geometrical group" layouts, including coordinates. The groups may be one-dimensional or two-dimensional. At this time, TRENDS treats infofiles only in OUTDATA and in GEOPLOT. TRENDS requires that your file be named:

INFOFILE.<db>

and be located in the directory in which you are running TRENDS. While infofiles are primarily layouts, scratch files are actually local databases containing time-history and other data. TRENDS requires that you have an initialized scratch file named:

PERMSCR.DAT

in the directory where you are operating. This file is divided into four equal-sized parts, called SCF1, SCF2, SCF3, and SCF4. TRENDS can show and/or operate on these parts in SCRATCHFILE and can plot them in TIMEHIST. Scratch files can be generated in DATAMAP or TRENDS from the database using an Infofile template.

GEOPLOT and OUTDATA let you specify geometric groups from your infofile as part of the data-item setup phase. If you want to see which groups your infofile contains, enter "GROUP?"

In OUTDATA	Enter data item(s) etc.:	GROUP?
In GEOPLOT	Please enter GROUP:xxxx :	GROUP?

To specify group LBAB,

In OUTDATA	Enter data item(s) etc.:	GROUP:LBAB

Two-dimensional groups are identified by names starting with "S2." The first dimension is column and the second is row, so:

GROUP:S2PA(3,*)

selects the entire 3rd column of group S2PA. For wings and rotors, the column dimension is usually chosen as the span and the row dimension as the chord, so the above example selects the group of sensors at all chord locations of the 3rd span station.

GROUP:S2PA(3,*,T) (selects top items only)

Geometrical groups often have two subgroups: top-bottom, leading-trailing, left-right, etc. If not specifically mentioned, TRENDS assumes you want both subgroups; if you want only one, append your choice in parentheses.

GROUP:S2PA(*,*)(LEFT)

Your specification of subgroup must match, so "TOP" would not select "LEADING" from a leading-trailing choice, for example. You do not have to type the entire subgroup name, but only enough to match a choice.

Jukebox Operations

Most of the time-history data files are stored on laser-optical (WORM) disks in a four-drive, 134-shelf jukebox. TRENDS controls this jukebox for the user, so that requested files are located and read in a process that appears as though they were stored on a fixed magnetic disk farm. A caching algorithm is implemented to pull time-history files from the laser-optical disk as they are requested and to copy them onto a magnetic cache disk for subsequent access (for a short period of time). This caching speeds up subsequent access to the file and lessens contention for the jukebox resources (drives, robotic picker, flip side of optical disks).

When time history data are requested for any counter, TRENDS looks at a "cache map" to see where the file is located. If it is not cached or on some other magnetic disk, the user sees:

<filename> is not cached. Looking in the jukebox.

TRENDS will locate the right optical disk (platter) and shelf and issue commands to the jukebox to load the platter into one of the four drives, then issue the command to mount the disk for the VMS system. As the file is being opened for reading, a batch job is spawned to copy the file to the cache disk and to update the cache map. Then the time-history data for the requested data item are read into TRENDS from the optical disk for plotting or analysis. All of this takes place automatically and requires no special input from the user. The user has a few commands at his/her disposal in TIMEHIST at the prompt for counter:

NOCACHE Tells TRENDS not to read from cache and not to copy to cache. CACHE restores the normal operation.

CACHED? Displays those files currently cached for the current database.

JKA? Displays the drives' status and loaded/mounted platters.

Menu Items

- ***COMPARE***
- ***OUTDATA***
- ***NORMALIZE***
- ***PERFPLOT***
- ***STRIPS***
- ***TIMEHIST***
- ***TSSTATS***
- ***HARMONIC***
- ***SCRATCHFILE***

Parameter Statistics & Data Types

The TRENDS database includes several different types of scalar data, as follows:

1. MINMAX-per-counter, derived statistical values of recorded parameters/itemcodes
2. Derived pseudo-items, named formulas which use itemcode.AVS data types
3. Harmonics, derived harmonic amplitudes and phases of parameters/itemcodes
4. Rates, mean slopes of itemcodes.AVS selected parameters

1. **MINMAX Statistical Data Types:** The most common statistics/datatypes are as follows:

*itemcode.**AVS**	average steady value for all prime-data revs in the counter. itemcode.AVS = (max + min)/2
itemcode.**OSC**	average oscillatory value over all of the prime-data revs in the counter. itemcode.OSC = (max - min)/2
itemcode.**MAX**	maximum (over all revs in the counter) of the oscillatory component
itemcode.**SMO**	steady value on the rev in which the maximum oscillatory value occurred
itemcode.**CMN**	minimum, the algebraic minimum of all samples of the item during the counter
itemcode.**CMX**	maximum, the algebraic maximum of all samples of the item during the counter
itemcode.**FSC**	full-scale engineering value associated with 126 counts
itemcode.**HMn**	n-th harmonic amplitude (where n lies between 0 and 6, inclusive
***NOTE:** -------->	itemcode = itemcode.AVS, is the DEFAULT value used in the database

2. **Derived Parameters/Pseudo-Items:** A number of derived parameters called pseudo-items are standardly calculated from the average-steady values of recorded items and stored for retrieval in TRENDS. e.g. RSHP (rotor shaft horsepower), HDFT (density altitude), etc. See page 6-25 for a complete list

3. **Harmonics:** Harmonic amplitudes and phase angles are pre-computed and stored for all items in the spectral (SPC) time-history group. The amplitudes (7) are accessible to the user for searching (in SEARCH), plotting (using HARMONIC or MINMAX) or listing (through the PRINT or HARM options in HARMONIC). They may be used in user-defined mathematical expressions in either SEARCH or MINMAX. The phases (6) are presently accessible only for listing, using the PRINT or HARM options within the HARMONIC capability. The amplitudes are specified in searching or plotting applications by use of the "HMn" extension:

itemcode.**HM0**	Zero-th harmonic (mean)
itemcode.**HM1**	First harmonic (one-per-rev) amplitude
etc.	

4. **Computed rates:** The mean slope or first time-derivative or rate is standardly computed (along with some other measures) and stored for a group of performance items. These items are:

Item	Rate Itemcode	Description
P342.AVS	HDOT	Climb rate
P002.AVS	IASD	Airspeed rate
D186.AVS	PCAD	Pylon conversion angle rate
E719.AVS	GOVD	Govenor LVDT rate
etc.	See Pages 3-11 & 6-25	

Section VI: Parameter Lists (Database 703)

XV-15 Tiltrotor (N703) Alphabetical Listing

Itemcodes currently active for flight 261

*T denotes available time history data

NOTE:

Alphabetical and Numerical lists do not include Derived Parameter group.

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	A005	C.G. VERT VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
*T	A019	PILOT SEAT VERT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	A020	COPILOT SEAT VERT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	A056	RT RED BLADE LEAD/LAG ACCEL	G'S		251/1	
*T	A057	RT RED BLADE FLAPPING ACCEL	G'S		251/1	
*T	A150	RT PYLON NORM ACCEL (F/A)	G'S	10.0	251/1	PYLON VIB
*T	A151	RT PYLON LAT ACCEL	G'S	10.0	251/1	PYLON VIB
*T	A152	RT PYLON AXIAL ACCEL (VERT)	G'S	10.0	251/1	PYLON VIB
*T	A175	LT PYLON NORM ACCEL (F/A)	G'S	10.0	251/1	PYLON VIB
*T	A176	LT PYLON LAT ACCEL	G'S	10.0	251/1	PYLON VIB
*T	A177	LT PYLON AXIAL ACCEL (VERT)	G'S	10.0	251/1	PYLON VI
*T	A300	C.G. LAT VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
*T	A301	C.G. F/A VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
*T	A302	PILOT SEAT LAT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	A304	COPILOT SEAT LAT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	A341	RT XMSN DOWNSTOP LAT VIBR	G'S		251/1	TIP RIB VIBRATORY
*T	A350	RT XMSN LAT VIBR @ INLET	G'S		251/1	TIP RIB VIBRATORY
*T	A352	C.G. VERT VIBR (SERVO)	G'S	3.0	31/2	AIRFRAME VIBRATION
*T	A353	RT CONV SPINDLE LAT VIBR @ NUT	G'S		251/1	TIP RIB VIBRATORY
*T	A380	PILOT SEAT F/A VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	A627	RT PYLON DOWNSTOP LAT VIBR	G'S		251/1	TIP RIB VIBRATORY
*T	ATTL	LASER AZIMUTH	DEG			CROWS LANDING RADAR
*T	ATTR	TTR AZIMUTH	DEG			CROWS LANDING RADAR
*T	B034	RT RED ATB BM BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B035	RT RED ATB CHD BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B036	LT RED ATB BM BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B037	LT RED ATB CHD BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B038	RT RED ATB BM BD 103.5	IN LB		251/1	ROTOR BLADE
	B039	RT RED ATB CHD BD 103.5	IN LB		251/1	ROTOR BLADE
*T	B040	LT RED ATB BM BD 103.5	IN LB		251/1	ROTOR BLADE
*T	B041	LT RED ATB CHD BD 103.5	IN LB		251/1	ROTOR BLADE
*T	B043	RT RED ATB CHD BD 126	IN LB		251/1	ROTOR BLADE
*T	B044	LT RED ATB BM BD 126	IN LB		251/1	ROTOR BLADE
*T	B045	LT RED ATB CHD BD 126	IN LB		251/1	ROTOR BLADE
*T	B046	LT RED ATB BM BD 45	IN LB		125/1	ROTOR BLADE
*T	B047	LT RED ATB CHD BD 45	IN LB		125/1	ROTOR BLADE
*T	B050	LT RED ATB BM BD 75	IN LB		125/1	ROTOR BLADE
*T	B051	LT RED ATB CHD BD 75	IN LB		125/1	ROTOR BLADE

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	B108	RT ROTOR MAST PARA BD 13.2	IN LB		251/1	ROTOR MAST
*T	B109	RT ROTOR MAST PERP BD 13.2	IN LB		251/1	ROTOR MAST
*T	B112	RT HUB SPINDLE BM BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B113	RT HUB SPINDLE CHD BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B114	LT HUB SPINDLE BM BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B115	LT HUB SPINDLE CHD BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B140	LT ROTOR MAST PARA BD 13.2	IN LB		251/1	ROTOR MAST
	B141	LT ROTOR MAST PERP BD 13.2	IN LB		251/1	ROTOR MAST
*T	B165	RT PYLON CONV SPINDLE BM BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T	B166	RT PYLON CONV SPINDLE CHD BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T	B171	RT HUB SPINDLE BM BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B172	RT HUB SPINDLE CHD BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B173	RT HUB SPINDLE BM BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B174	RT HUB SPINDLE CHD BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B190	LT PYLON CONV SPINDLE BM BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T	B191	LT PYLON CONV SPINDLE CHD BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T	B192	LT HUB SPINDLE BM BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B193	LT HUB SPINDLE CHD BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B194	LT HUB SPINDLE BM BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B195	LT HUB SPINDLE CHD BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B258	RT VERT STAB SPAR BM 113	IN LB		251/1	
*T	B259	LT HORIZ STAB SPAR BM BD 8	IN LB		125/1	HORIZ
*T	B262	RT HORIZ STAB SPAR BM BD 8	IN LB		125/1	HORIZ
*T	B263	RT HORIZ STAB SPAR CHD BD 7.7	IN LB		251/1	
*T	B264	RT HOR STAB SPAR BM BD 65	IN LB		251/1	
*T	B270	RT VERT STAB BM BD 110	IN LB		125/1	VERT
*T	B274	RT ELEVATOR CONTROL ARM BM BD	IN LB		251/1	ELEVATOR
*T	B278	RT RUDDER CONTROL ARM BM BD	IN LB		125/1	RUDDER
*T	B280	LT RUDDER CONTROL ARM BM BD	IN LB		125/1	RUDDER
*T	B316	RT MN LD GR OLEO STRUT LAT BD	IN LB		125/1	GEAR
*T	B542	LT ENGINE COUPLING G/B PITCH B	IN LB		251/1	ECGB
*T	B543	LT ENGINE COUPLING G/B YAW BD	IN LB	10.0	251/1	ECGB
*T	B544	RT ENGINE COUPLING G/B PITCH B	IN LB		251/1	ECGB
*T	B545	RT ENGINE COUPLING G/B YAW BD	IN LB	10.0	251/1	ECGB
*T	B600	RT WING SPAR BM BD 22	IN LB	10.0	125/1	WING
*T	B601	LT WING SPAR BM BD 22	IN LB	10.0	125/1	WING
*T	B603	RT WING SPAR CHD BD 22	IN LB	10.0	125/1	WING
*T	B604	LT WING SPAR CHD BD 22	IN LB	10.0	125/1	WING
*T	B613	RT FLAP BM BD	IN LB		125/1	FLAP
*T	B615	RT FLAPERON BM BD	IN LB		251/1	FLAPERON
	B802	RT HUB SPINDLE BENDING (RED) 9	IN-LB			
	B803	LT HUB SPINDLE BENDING (RED) 9	IN-LB			
	B805	RT HUB SPINDLE BENDING (WHT) 9	IN-LB			
	B806	RT HUB SPINDLE BENDING (GRN) 9	IN-LB		502/1	
	B807	LT HUB SPINDLE BENDING @ 9 WH	IN-LB			
	B808	LT HUB SPINDLE BENDING (GRN) 9	IN-LB			
	CDUR	COUNTER DURATION	SECOND			PSEUDO ITEMS
	CPXX	POWER COEFFICIENT				PSEUDO ITEMS
	CRPM	COMPUTED RPM	RPM			PSEUDO ITEMS
	CTXX	THRUST COEFFICIENT				PSEUDO ITEMS
*T	D007	ANGLE OF SIDESLIP	DEG	3.0	31/2	TEST CONDITIONS
*T	D008	ANGLE OF ATTACK	DEG	3.0	31/2	TEST CONDITIONS
*T	D009	ROLL ATTITUDE - CABIN	DEG	3.0	125/8	TEST CONDITIONS
*T	D010	PITCH ATTITUDE - CABIN	DEG	3.0	125/8	TEST CONDITIONS

Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T D011	YAW ATTITUDE - CABIN	DEG	3.0	125/8	TEST CONDITIONS
*T D021	F/A STICK POSITION	%	3.0	125/8	ONTROL POSITION
*T D022	LAT STICK POSITION	%	3.0	125/8	CONTROL POSITION
*T D023	POWER LEVER POSITION	%	3.0	31/2	CONTROL POSITION
*TD024	PEDAL POSITION	%	3.0	125/8	CONTROL POSITION
*TD025	FFS F/A CYCLIC STICK POSITION	%	3.0	31/2	CONTROL POSITION
*T D026	FFS LAT STICK POSITION	%	3.0	31/2	CONTROL POSITION
*T D027	FFS RUDDER PEDAL POSITION	%	3.0	31/2	CONTROL POSITION
*T D156	RT PYLON HUB SPRING F/A POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T D157	RT PYLON HUB SPRING LAT POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T D158	RT PYLON COLL. ACTUATOR POS	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D159	RT PYLON S/PLATE F/A POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D160	RT PYLON S/PLATE LAT POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D161	RT PYLON CONVERSION POSITION	DEG	1.0	31/6	TEST CONDITIONS
*T D181	LT PYLON HUB SPRING F/A POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T D182	LT PYLON HUB SPRING LAT POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T D183	LT PYLON COLL. ACTUATOR POS	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D184	LT PYLON S/PLATE F/A POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D185	LT PYLON S/PLATE LAT POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D186	LT PYLON CONVERSION POSITION	DEG	1.0	31/6	TEST CONDITIONS
*T D238	RT HUB SPRING F/A POSITION	DEG		251/1	BOX C
*T D239	RT HUB SPRING LAT POSITION	DEG		251/1	BOX C
*T D240	RT COLL ACTUATOR POSITION	DEG		251/1	BOX C
*T D241	RT SWASHPLATE F/A POSITION	DEG		251/1	BOX C
*T D250	LT HUB SPRING F/A POSITION	DEG		251/1	BOX C
*T D251	LT HUB SPRING LAT POSITION	DEG		251/1	BOX C
*T D252	LT COLL ACTUATOR POSITION	DEG		251/1	BOX C
*T D253	LT SWASHPLATE F/A POSITION	DEG		251/1	BOX C
*T D281	ELEVATOR POSITION	DEG	3.0	31/2	CONTROL AIRFRAME ANGLES
*T D284	RUDDER POSITION	DEG	3.0	31/2	CONTROL AIRFRAME ANGLES
*T D305	RT MAIN LDG GEAR OLEO EXT POS	IN	1.0	125/25	GEAR
*T D306	F/A SCAS ACTUATOR POSITION	IN	6.0	125/4	SCAS
*T D307	LATERAL SCAS ACTUATOR POSITION	IN	6.0	125/4	SCAS
*T D308	DIRECTIONAL SCAS ACTUATOR POS	IN	6.0	125/4	SCAS
*T D309	PILOT FLAP LEVER POSITION	DEG	3.0	31/2	CONTROL POSITION
*T D314	LT MAIN LDG GEAR ACT. POS	IN	1.0	31/6	GEAR
*T D315	LT MAIN LDG GEAR OLEO EXT POS	IN	1.0	31/6	GEAR
*T D317	RT MAIN LDG GEAR ACT. POS	IN	1.0	125/25	GEAR
*T D318	DIFF.CYCLIC WASHOUT ACT. POS	IN	3.0	31/2	CONTROL POSITION
*T D327	ALTITUDE - RADAR ALTIMETER	FEET	1.0	31/6	TEST CONDITIONS
*T D348	NOSE LDG GEAR ACT. POS	IN		125/1	GEAR
*T D349	NOSE LDG GEAR OLEO EXT POS	IN	1.0	125/25	GEAR
*T D360	TEMPERATURE SCANNER ENCODER	TEMPS	31/1		PYLON TEMP/PRESSURE
*T D509	RT THROTTLE POSITION	DEG	3.0	31/2	CONTROL POSITION
*T D510	LT THROTTLE POSITION	DEG	3.0	31/2	CONTROL POSITION
*T D511	SCANIVALVE POSITION ENCODER	SCAN		31/1	PYLON TEMP/PRESSURE
*T D617	FLAP POSITION	DEG	3.0	31/2	CONTROL AIRFRAME ANGLES
*T D645	RT WING AILERON POSITION	DEG	3.0	125/8	CONTROL AIRFRAME ANGLES
*T D646	LT WING AILERON POSITION	DEG	3.0	125/8	CONTROL AIRFRAME ANGLES
*TD746	RT COLLECTIVE LVDT	%	10.0	125/4	EXCITER
*T D747	RT FLAPERON LVDT	%	10.0	125/4	EXCITER
*T D799	LT COLLECTIVE LVDT	%	10.0	125/4	EXCITER
*T D800	LT FLAPERON LVDT	%	10.0	125/4	EXCITER
DNLD	DOWNLOAD COEFFICIENT				PSEUDO ITEMS

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
	E072	RR-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E073	RR-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E074	LR-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E075	LR-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E154	RT PYLON DC GEN VOLTS	VOLTS		125	ELECTRICAL SYSTEM
	E155	RT PYLON DC GEN AMPS	AMPS		251	ELECTRICAL SYSTEM
	E179	LT PYLON DC GEN VOLTS	VOLTS		125	ELECTRICAL SYSTEM
	E180	LT PYLON DC GEN AMPS	AMPS		125	ELECTRICAL SYSTEM
	E196	RP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E197	RP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E198	LP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E199	LP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E298	EMP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E299	EMP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E369	CP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E370	CP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E371	CP-3 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E372	N-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E373	CA1-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E374	RMG-1 VOLTAGE SENSE	VOLTS		125	DATA SYSTEM STATUS
	E375	LMG-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E647	RW-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E648	RW-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E649	LW-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E700	GPA GAIN-4			31	DATA SYSTEM STATUS
	E701	GPA GAIN-16			31	DATA SYSTEM STATUS
	E705	GPA GAIN-512			31	DATA SYSTEM STATUS
	E706	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E707	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E708	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E709	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E710	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E711	HIGH LEVEL CAL			31	DATA SYSTEM STATUS
	E712	POWER SUPPLY BYTE			31	DATA SYSTEM STATUS
*T	E717	PRIMARY GOV SERVO VALVE	AMPS	3.0	31/2	GOVERNOR
*T	E718	PRIMARY GOV RPM ERROR	%	10.0	125/4	GOVERNOR
*T	E719	PRIMARY GOV #1 LVDT	%	3.0	125/8	GOVERNOR
*T	E720	PRIMARY GOV ACT. VELOCITY	D/SEC	3.0	31/2	GOVERNOR
*T	E721	PRIMARY GOV COMMAND RPM	%	3.0	31/2	GOVERNOR
*T	E722	PRIMARY MONITOR COMMAND RPM	%	3.0	31/2	GOVERNOR
*T	E723	PRIMARY MONITOR RPM ERROR	%	10.0	125/4	GOVERNOR
*T	E724	STANDBY GOVERNOR RPM ERROR	%	10.0	31/1	GOVERNOR
	E725	GPA GAIN-4			31	DATA SYSTEM STATUS
	E726	GPA GAIN-16			31	DATA SYSTEM STATUS
	E727	GPA GAIN-64			31	DATA SYSTEM STATUS
	E730	GPA GAIN-512			31	DATA SYSTEM STATUS
	E731	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E732	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E733	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E734	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E735	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E736	HIGH LEVEL CAL			31	DATA SYSTEM STATUS
	E737	POWER SUPPLY BYTE			31	DATA SYSTEM STATUS
*T	E748	RT COLLECTIVE EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	E749	RT FLAPERON EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
*T	E750	LT COLLECTIVE EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
*T	E751	LT FLAPERON EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
	ETIM	ELAPSED TIME SINCE ENGINES ON	MINUTE			PSEUDO ITEMS
*T	ETTL	LASER ELEVATION	FT			CRWS LANDING RADAR
*T	ETTR	TTR ELEVATION	DEG			CROWS LANDING RADAR
*T	F030	FFS F/A CYCLIC STICK FORCE	LBS	3.0	31/2	CONTROL FORCE
*T	F031	FFS LATERAL STICK FORCE	LBS	3.0	31/2	CONTROL FORCE
*T	F033	FFS RUDDER PEDAL FORCE	LBS	3.0	31/2	CONTROL FORCE
*T	F052	RT SWASH PLATE DRIVER FORCE	LBS		251/1	ROTOR SWASH PLATE DR
*T	F055	RT PITCH LINK (GRN) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	F060	LT PITCH LINK (RED) AX. FORCE	LBS	10.0	251/1	ROTOR PITCH LINK
*T	F061	LT PITCH LINK (WHT) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	F062	LT PITCH LINK (GRN) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	F103	RT PITCH LINK (RED) AX. FORCE	LBS	10.0	251/1	ROTOR PITCH LINK
*T	F104	RT PITCH LINK (WHT) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	F142	LT SWASH PLATE DRIVER FORCE	LBS		251/1	ROTOR SWASH PLATE DR
*T	F162	RT F/A CYCLIC ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F163	RT LAT STICK ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F164	RT COLLECTIVE ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F187	LT F/A CYCLIC ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F188	LT LAT STICK ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F189	LT COLLECTIVE ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F224	LT RED PITCH HSNG UP FWD LUG	LBS		251/1	
*T	F225	LT RED PITCH HSNG UP AFT LUG	LBS		251/1	
*T	F228	RT RED PITCH HSNG UP FWD LUG	LBS		251/1	
*T	F229	RT RED PITCH HSNG UP AFT LUG	LBS		251/1	
*T	F230	RT RED PITCH HSNG LWR FWD LUG	LBS		251/1	
*T	F231	RT RED PITCH HSNG LWR AFT LUG	LBS		251/1	
*T	F286	HOR STAB INCIDENCE LINK AX. FO	LBS		251/1	HORIZ
*T	F303	RT MN LD GR DRAG STRUT AX FOR	LBS		125/1	GEAR
*T	F534	LT ENGINE STRUT AXIAL FORCE	LBS		125/1	ENGINE
*T	F537	RT ENGINE STRUT AXIAL FORCE	LBS		125/1	ENGINE
*T	F611	RT PYLON CONV ACT AXIAL FORCE	LBS		251/1	PYLON CONV. SPINDLE
	F614	RT FLAPERON CONTROL ARM FORCE	LBS		502/1	FLAPERON
*T	F621	LT FLAPERON CONTROL ARM FORCE	LBS		251/1	FLAPERON
*T	F625	LT PYLON DOWNSTOP VERT FORCE	LBS		251/1	PYLON DOWNSTOP
*T	F626	RT PYLON DOWNSTOP VERT FORCE	LBS		251/1	PYLON DOWNSTOP
*T	F638	LT PYLON CONV ACT AXIAL FORCE	LBS		251/1	PYLON CONV. SPINDLE
	GWT0	RAMP GROSS WEIGHT	LBS			PSEUDO ITEMS
	GWT1	GROSS WEIGHT, FUEL WT METHOD	LBS			PSEUDO ITEMS
	GWT2	GROSS WEIGHT, FUEL FLOW METHOD	LBS			PSEUDO ITEMS
	HDFT	DENSITY ALTITUDE	FEET			PSEUDO ITEMS
	KCAS	CALIBRATED AIRSPEED	KNOTS			PSEUDO ITEMS
	KTAS	TRUE AIRSPEED	KNOTS			PSEUDO ITEMS
	M048	LT RED ATB TORSION 45	IN LB		125/1	ROTOR BLADE
*T	M049	LT RED ATB TORSION 75	IN LB		125/1	ROTOR BLADE
*T	M107	RT ROTOR MAST TORQUE 12	IN LB	3.0	251/16	ROTOR MAST
*T	M143	LT ROTOR MAST TORQUE 12	IN LB	3.0	251/16	ROTOR MAST
*T	M266	RT HOR STAB SPAR TORQUE 8	IN LB		125/1	HORIZ
*T	M275	RT ELEV DRIVE TUBE TORQUE	IN LB		251/1	ELEVATOR
*T	M277	LT RUDDER DRIVE TUBE TORQUE	IN LB		125/1	RUDDER
*T	M279	LT ELEV DRIVE TUBE TORQUE	IN LB		251/1	ELEVATOR
*T	M336	LT ENGINE TORQUE	%		125/1	ENGINE

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	M337	INTERCONNECT SHAFT TORQUE	%	3.0	125/8	ENGINE
*T	M606	RT WING SPAR TORQUE 22	IN LB	10.0	125/1	WING
*T	M607	LT WING SPAR TORQUE 22	IN LB	10.0	125/1	WING
	OATC	CORRECTED TEMPERATURE	DEG C			PSEUDO ITEMS
*T	P002	AIRSPEED - NOSE BOOM	KNOTS	1.0	125/25	TEST CONDITIONS
	P149	PC3 HYDRAULIC PRESSURE	PSI		125	HYDRAULIC SYSTEM
	P153	PC2 HYDRAULIC PRESSURE	PSI		125	HYDRAULIC SYSTEM
	P178	PC1 HYDRAULIC PRESSURE	PSI		125	HYDRAULIC SYSTEM
	P1WX	ADJUSTED HORSEPOWER	HP			PSEUDO ITEMS
	P323	RT ENGINE OIL PRESSURE	PSI		251	OIL SYSTEM
	P324	LT ENGINE OIL PRESSURE	PSI		251	OIL SYSTEM
	P325	RT XMSN OIL PRESSURE	PSI		251	OIL SYSTEM
	P326	LT XMSN OIL PRESSURE	PSI		125	OIL SYSTEM
*T	P342	ALTITUDE - NOSE BOOM	FEET	1.0	31/6	TEST CONDITIONS
	P901	FUSELAGE	PSIA		125	WING PRESSURE
	P902	FUSELAGE	PSIA		125	WING PRESSURE
	P903	FUSELAGE	PSIA		125	WING PRESSURE
	P904	FUSELAGE	PSIA		125	WING PRESSURE
	P905	FUSELAGE	PSIA		125	WING PRESSURE
	P906	FUSELAGE	PSIA		125	WING PRESSURE
	P907	FUSELAGE	PSIA		125	WING PRESSURE
*T	Q018	ROTOR BLIPPER BOX A	--		251/1	ROTOR BLADE
*T	QQ18	ROTOR BLIPPER BOX C	--		251/1	ROTOR BLADE
*T	R018	ROTOR AZIMUTH BLIPPER			251/1	ROTOR BLADE
*T	R106	ROTOR RPM	%	3.0	125/4	ENGINE
	R320	RT FUEL TANK QUANTITY	LBS		31	FUEL SYSTEM
	R321	LT FUEL TANK QUANTITY	LBS		31	FUEL SYSTEM
*T	R328	RT ENGINE FUEL FLOW RATE	LB/HR	1.0	125/25	ENGINE
*T	R329	LT ENGINE FUEL FLOW RATE	LB/HR	1.0	125/25	ENGINE
*T	R338	RT ENGINE N2 RPM	%	6.0	125/4	ENGINE
*T	R339	LT ENGINE N2 RPM	%	6.0	125/4	ENGINE
*T	R503	RT ENGINE N1 RPM	%	3.0	125/8	ENGINE
*T	R515	LT ENGINE N1 RPM	%	3.0	125/8	ENGINE
	RHPN	NORMALIZED HP (RSHP/SIGP)	HP			PSEUDO ITEMS
	RSHP	ROTOR SHAFT HORSEPOWER	HP			PSEUDO ITEMS
*T	RTTL	LASER RANGE	FEET			CROWS LANDING RADAR
*T	RTTR	TTR RANGE	FEET			CROWS LANDING RADAR
	S067	RT PYLON DOWNSTOP STRIKER STR	PSI		251/1	PYLON DOWNSTOP
	S068	LT PYLON DOWNSTOP STRIKER STR	PSI		251	PYLON DOWNSTOP
	S116	RT PY DOWNSTOP AFT (XMSN CASE)	PSI		251/1	PYLON DOWNSTOP
	S117	RT PY DOWNSTOP FWD (XMSN CASE)	PSI		251/1	PYLON DOWNSTOP
	S118	LT PY DOWNSTOP AFT (XMSN CASE)	PSI		125/1	PYLON DOWNSTOP
	S119	LT PY DOWNSTOP FWD (XMSN CASE)	PSI		125/1	PYLON DOWNSTOP
*T	S631	RT WING FRONT SPAR LO SHEAR 6	PSI		125/1	WING
*T	S633	RT WING REAR SPAR LO SHEAR 6	PSI		125/1	WING
	S635	RT WING FRONT SPAR LO SHEAR 14	PSI		251/1	WING
*T	S642	INBD SPINDLE RIB UP ARM INBD	PSI		251/1	TIP RIB STRESS
*T	S643	INBD SPINDLE RIB UP ARM OTBD	PSI		125/1	TIP RIB STRESS
	SIGP	DENSITY RATIO				PSEUDO ITEMS
*T	T322	OAT (ROSEMONT)	DEG C	1.0	31/6	TEST CONDITIONS
	TCGO	TEMP CENTER GEARBOX OIL	DEG F			TEMPERATURES - SCANNER
	TDAY	COUNTER START TIME OF DAY	MINUTE			PSEUDO ITEMS
	TL04	TEMP LT ENGINE OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TL05	TEMP LT ENG OIL #2 SCAVENG PUM	DEG F			TEMPERATURES - SCANNER

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
	TL06	TEMP LT XMSN OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TL07	TEMP LT XMSN OIL OUT OF COOLER	DEG F			TEMPERATURES - SCANNER
	TL08	TEMP LT HUB SPRING BEARING	DEG F			TEMPERATURES - SCANNER
	TL09	TEMP LT CONV. SPINDLE BEARING	DEG F			TEMPERATURES - SCANNER
	TL10	TEMP LT DRIVE SHAFT OB BEARING	DEG F			TEMPERATURES - SCANNER
	TL11	TEMP LT DRIVE SHAFT IB BEARING	DEG F			TEMPERATURES - SCANNER
	TLTI	TEMP LT T7 TURBINE INLET	DEG F			TEMPERATURES - SCANNER
	TOCG	C.G. FOR RAMP GW	INCHES			PSEUDO ITEMS
	TR04	TEMP RT ENGINE OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TR05	TEMP RT ENG OIL #2 SCAVENG PUM	DEG F			TEMPERATURES - SCANNER
	TR06	TEMP RT XMSN OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TR07	TEMP RT XMSN OIL OUT OF COOLER	DEG F			TEMPERATURES - SCANNER
	TR08	TEMP RT HUB SPRING BEARING	DEG F			TEMPERATURES - SCANNER
	TR09	TEMP RT CONV. SPINDLE BEARING	DEG F			TEMPERATURES - SCANNER
	TR10	TEMP RT DRIVE SHAFT OB BEARING	DEG F			TEMPERATURES - SCANNER
	TR11	TEMP RT DRIVE SHAFT IB BEARING	DEG F			TEMPERATURES - SCANNER
	TRTI	TEMP RT T7 TURBINE INLET	DEG F			TEMPERATURES - SCANNER
	TRWF	TEMP OAT TOP RIGHT WING	DEG F			TEMPERATURES - SCANNER
*T	V012	ROLL RATE - CABIN (INCOMPLETE)	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V013	PITCH RATE -CABIN (INCOMPLETE)	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V014	YAW RATE - CABIN (INCOMPLETE)	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V015	ROLL RATE - SCAS	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V016	PITCH RATE - SCAS	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V017	YAW RATE - SCAS	D/SEC	3.0	125/8	TEST CONDITIONS
	X365	RECORD NUMBER			31	DATA SYSTEM STATUS
	X366	RECORD NUMBER			31	DATA SYSTEM STATUS
*T	XTTL	X LASER POSITION				CROWS LANDING RADAR
*T	XTTR	X POSITION FROM TTR RADAR	FEET		62/1	CROWS LANDING RADAR
*T	XTTV	X VELOCITY FROM TTR RADAR	FT/SEC		62/1	CROWS LANDING RADAR
*T	YTTL	Y LASER POSITION				CROWS LANDING RADAR
*T	YTTR	Y POSITION FROM TTR RADAR	FEET		62/1	CROWS LANDING RADAR
*T	YTTV	Y VELOCITY FROM TTR RADAR	FT/SEC		62/1	CROWS LANDING RADAR
*T	ZTTL	Z LASER POSTION				CROWS LANDING RADAR
*T	ZTTR	Z POSITION FROM TTR RADAR	FEET		62/1	CROWS LANDING RADAR
*T	ZTTV	Z VELOCITY FROM TTR RADAR	FT/SEC		62/1	CROWS LANDING RADAR

Numerical Listing

Itemcodes currently active for flight 261

*T denotes available time tistory data

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	P002	AIRSPEED - NOSE BOOM	KNOTS	1.0	125/25	TEST CONDITIONS
*T	P002	AIRSPEED - NOSE BOOM	KNOTS	1.0	125/25	TESTCONDITIONS
*T	A005	C.G. VERT VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
*T	D007	ANGLE OF SIDESLIP	DEG	3.0	31/2	TEST CONDITIONS
*T	D008	ANGLE OF ATTACK	DEG	3.0	31/2	TEST CONDITIONS
*T	D009	ROLL ATTITUDE - CABIN	DEG	3.0	125/8	TEST CONDITIONS
*T	D010	PITCH ATTITUDE - CABIN	DEG	3.0	125/8	TEST CONDITIONS
*T	D011	YAW ATTITUDE - CABIN	DEG	3.0	125/8	TEST CONDITIONS
*T	V012	ROLL RATE - CABIN (INCOMPLETE)	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V013	PITCH RATE -CABIN (INCOMPLETE)	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V014	YAW RATE - CABIN (INCOMPLETE)	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V015	ROLL RATE - SCAS	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V016	PITCH RATE - SCAS	D/SEC	3.0	125/8	TEST CONDITIONS
*T	V017	YAW RATE - SCAS	D/SEC	3.0	125/8	TEST CONDITIONS
*T	Q018	ROTOR BLIPPER BOX A	--		251/1	ROTOR BLADE
*T	R018	ROTOR AZIMUTH BLIPPER			251/1	ROTOR BLADE
*T	A019	PILOT SEAT VERT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	A020	COPILOT SEAT VERT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	D021	F/A STICK POSITION	%	3.0	125/8	CONTROL POSITION
*T	D022	LAT STICK POSITION	%	3.0	125/8	CONTROL POSITION
*T	D023	POWER LEVER POSITION	%	3.0	31/2	CONTROL POSITION
*T	D024	PEDAL POSITION	%	3.0	125/8	CONTROL POSITION
*T	D025	FFS F/A CYCLIC STICK POSITION	%	3.0	31/2	CONTROL POSITION
*T	D026	FFS LAT STICK POSITION	%	3.0	31/2	CONTROL POSITION
*T	D027	FFS RUDDER PEDAL POSITION	%	3.0	31/2	CONTROL POSITION
*T	F030	FFS F/A CYCLIC STICK FORCE	LBS	3.0	31/2	CONTROL FORCE
*T	F031	FFS LATERAL STICK FORCE	LBS	3.0	31/2	CONTROL FORCE
*T	F033	FFS RUDDER PEDAL FORCE	LBS	3.0	31/2	CONTROL FORCE
*T	B034	RT RED ATB BM BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B035	RT RED ATB CHD BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B036	LT RED ATB BM BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B037	LT RED ATB CHD BD 30.9	IN LB		251/1	ROTOR BLADE
*T	B038	RT RED ATB BM BD 103.5	IN LB		251/1	ROTOR BLADE
	B039	RT RED ATB CHD BD 103.5	IN LB		251/1	ROTOR BLADE
*T	B040	LT RED ATB BM BD 103.5	IN LB		251/1	ROTOR BLADE
*T	B041	LT RED ATB CHD BD 103.5	IN LB		251/1	ROTOR BLADE
*T	B042	RT RED ATB BM BD 126	IN LB		251/1	ROTOR BLADE
*T	B043	RT RED ATB CHD BD 126	IN LB		251/1	ROTOR BLADE
*T	B044	LT RED ATB BM BD 126	IN LB		251/1	ROTOR BLADE
*T	B045	LT RED ATB CHD BD 126	IN LB		251/1	ROTOR BLADE
*T	B046	LT RED ATB BM BD 45	IN LB		125/1	ROTOR BLADE
*T	B047	LT RED ATB CHD BD 45	IN LB		125/1	ROTOR BLADE
	M048	LT RED ATB TORSION 45	IN LB		125/1	ROTOR BLADE
*T	M049	LT RED ATB TORSION 75	IN LB		125/1	ROTOR BLADE
*T	B050	LT RED ATB BM BD 75	IN LB		125/1	ROTOR BLADE
*T	B051	LT RED ATB CHD BD 75	IN LB		125/1	ROTOR BLADE

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	F052	RT SWASH PLATE DRIVER FORCE	LBS		251/1	ROTOR SWASH PLATE DR
*T	F055	RT PITCH LINK (GRN) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	A056	RT RED BLADE LEAD/LAG ACCEL	G'S		251/1	
*T	A057	RT RED BLADE FLAPPING ACCEL	G'S		251/1	
*T	F060	LT PITCH LINK (RED) AX. FORCE	LBS	10.0	251/1	ROTOR PITCH LINK
*T	F061	LT PITCH LINK (WHT) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	F062	LT PITCH LINK (GRN) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
	S067	RT PYLON DOWNSTOP STRIKER STR	PSI		251/1	PYLON DOWNSTOP
	S068	LT PYLON DOWNSTOP STRIKER STR	PSI		251	PYLON DOWNSTOP
	E072	RR-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E073	RR-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E074	LR-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E075	LR-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
*T	F103	RT PITCH LINK (RED) AX. FORCE	LBS	10.0	251/1	ROTOR PITCH LINK
*T	F104	RT PITCH LINK (WHT) AX. FORCE	LBS		251/1	ROTOR PITCH LINK
*T	R106	ROTOR RPM	%	3.0	125/4	ENGINE
*T	M107	RT ROTOR MAST TORQUE 12	IN LB	3.0	251/16	ROTOR MAST
*T	B108	RT ROTOR MAST PARA BD 13.2	IN LB		251/1	ROTOR MAST
*T	B109	RT ROTOR MAST PERP BD 13.2	IN LB		251/1	ROTOR MAST
*T	B112	RT HUB SPINDLE BM BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B113	RT HUB SPINDLE CHD BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B114	LT HUB SPINDLE BM BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
*T	B115	LT HUB SPINDLE CHD BD (RED) 9	IN LB	10.0	251/1	ROTOR HUB SPINDLE
	S116	RT PY DOWNSTOP AFT (XMSN CASE)	PSI		251/1	PYLON DOWNSTOP
	S117	RT PY DOWNSTOP FWD (XMSN CASE)	PSI		251/1	PYLON DOWNSTOP
	S118	LT PY DOWNSTOP AFT (XMSN CASE)	PSI		125/1	PYLON DOWNSTOP
	S119	LT PY DOWNSTOP FWD (XMSN CASE)	PSI		125/1	PYLON DOWNSTOP
*T	B140	LT ROTOR MAST PARA BD 13.2	IN LB		251/1	ROTOR MAST
	B141	LT ROTOR MAST PERP BD 13.2	IN LB		251/1	ROTOR MAST
*T	F142	LT SWASH PLATE DRIVER FORCE	LBS		251/1	ROTOR SWASH PLATE DR
*T	M143	LT ROTOR MAST TORQUE 12	IN LB	3.0	251/16	ROTOR MAST
	P149	PC3 HYDRAULIC PRESSURE	PSI		125	HYDRAULIC SYSTEM
*T	A150	RT PYLON NORM ACCEL (F/A)	G'S	10.0	251/1	PYLON VIB
*T	A151	RT PYLON LAT ACCEL	G'S	10.0	251/1	PYLON VIB
*T	A152	RT PYLON AXIAL ACCEL (VERT)	G'S	10.0	251/1	PYLON VIB
	P153	PC2 HYDRAULIC PRESSURE	PSI		125	HYDRAULIC SYSTEM
	E154	RT PYLON DC GEN VOLTS	VOLTS		125	ELECTRICAL SYSTEM
	E155	RT PYLON DC GEN AMPS	AMPS		251	ELECTRICAL SYSTEM
*T	D156	RT PYLON HUB SPRING F/A POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T	D157	RT PYLON HUB SPRING LAT POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T	D158	RT PYLON COLL. ACTUATOR POS	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T	D159	RT PYLON S/PLATE F/A POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T	D160	RT PYLON S/PLATE LAT POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T	D161	RT PYLON CONVERSION POSITION	DEG	1.0	31/6	TEST CONDITIONS
*T	F162	RT F/A CYCLIC ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F163	RT LAT STICK ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T	F164	RT COLLECTIVE ACTUATOR FORCE	LBS	3.0 2	51/16	ROTOR BOOST ACTUATOR
*T	B165	RT PYLON CONV SPINDLE BM BD	IN LB	10.0 1	25/1	PYLON CONV. SPINDLE
*T	B166	RT PYLON CONV SPINDLE CHD BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T	B171	RT HUB SPINDLE BM BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B172	RT HUB SPINDLE CHD BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B173	RT HUB SPINDLE BM BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	B174	RT HUB SPINDLE CHD BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T	A175	LT PYLON NORM ACCEL (F/A)	G'S	10.0	251/1	PYLON VIB

Item	Description	Units	Freq	Fltr Rate/Dec	Input Group
*TA176	LT PYLON LAT ACCEL	G'S	10.0	251/1	PYLON VIB
*T A177	LT PYLON AXIAL ACCEL (VERT)	G'S	10.0	251/1	PYLON VIB
P178	PC1 HYDRAULIC PRESSURE	PSI		125	HYDRAULIC SYSTEM
E179	LT PYLON DC GEN VOLTS	VOLTS		125	ELECTRICAL SYSTEM
E180	LT PYLON DC GEN AMPS	AMPS		125	ELECTRICAL SYSTEM
*T D181	LT PYLON HUB SPRING F/A POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T D182	LT PYLON HUB SPRING LAT POS	DEG	3.0	31/2	CONTROL ROTOR ANGLES
*T D183	LT PYLON COLL. ACTUATOR POS	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D184	LT PYLON S/PLATE F/A POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D185	LT PYLON S/PLATE LAT POSITION	DEG	3.0	125/8	CONTROL ROTOR ANGLES
*T D186	LT PYLON CONVERSION POSITION	DEG	1.0	31/6	TEST CONDITIONS
*T F187	LT F/A CYCLIC ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T F188	LT LAT STICK ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T F189	LT COLLECTIVE ACTUATOR FORCE	LBS	3.0	251/16	ROTOR BOOST ACTUATOR
*T B190	LT PYLON CONV SPINDLE BM BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T B191	LT PYLON CONV SPINDLE CHD BD	IN LB	10.0	125/1	PYLON CONV. SPINDLE
*T B192	LT HUB SPINDLE BM BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T B193	LT HUB SPINDLE CHD BD (WHT) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T B194	LT HUB SPINDLE BM BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
*T B195	LT HUB SPINDLE CHD BD (GRN) 9	IN LB		251/1	ROTOR HUB SPINDLE
E196	RP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
E197	RP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
E198	LP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
E199	LP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
P1WX	ADJUSTED HORSEPOWER	HP			PSEUDO ITEMS
*T F224	LT RED PITCH HSNG UP FWD LUG	LBS		251/1	
*T F225	LT RED PITCH HSNG UP AFT LUG	LBS		251/1	
*T F228	RT RED PITCH HSNG UP FWD LUG	LBS		251/1	
*T F229	RT RED PITCH HSNG UP AFT LUG	LBS		251/1	
*T F230	RT RED PITCH HSNG LWR FWD LUG	LBS		251/1	
*T F231	RT RED PITCH HSNG LWR AFT LUG	LBS		251/1	
*T D238	RT HUB SPRING F/A POSITION	DEG		251/1	BOX C
*T D239	RT HUB SPRING LAT POSITION	DEG		251/1	BOX C
*T D240	RT COLL ACTUATOR POSITION	DEG		251/1	BOX C
*T D241	RT SWASHPLATE F/A POSITION	DEG		251/1	BOX C
*T D250	LT HUB SPRING F/A POSITION	DEG		251/1	BOX C
*T D251	LT HUB SPRING LAT POSITION	DEG		251/1	BOX C
*T D252	LT COLL ACTUATOR POSITION	DEG		251/1	BOX C
*T D253	LT SWASHPLATE F/A POSITION	DEG		251/1	BOX C
*T B258	RT VERT STAB SPAR BM 113	IN LB		251/1	
*T B259	LT HORIZ STAB SPAR BM BD 8	IN LB		125/1	HORIZ
*T B262	RT HORIZ STAB SPAR BM BD 8	IN LB		125/1	HORIZ
*T B263	RT HORIZ STAB SPAR CHD BD 7.7	IN LB		251/1	
*T B264	RT HOR STAB SPAR BM BD 65	IN LB		251/1	
*T M266	RT HOR STAB SPAR TORQUE 8	IN LB		125/1	HORIZ
*T B270	RT VERT STAB BM BD 110	IN LB		125/1	VERT
*T B274	RT ELEVATOR CONTROL ARM BM BD	IN LB		251/1	ELEVATOR
*T M275	RT ELEV DRIVE TUBE TORQUE	IN LB		251/1	ELEVATOR
*T M277	LT RUDDER DRIVE TUBE TORQUE	IN LB		125/1	RUDDER
*T B278	RT RUDDER CONTROL ARM BM BD	IN LB		125/1	RUDDER
*T M279	LT ELEV DRIVE TUBE TORQUE	IN LB		251/1	ELEVATOR
*T B280	LT RUDDER CONTROL ARM BM BD	IN LB		125/1	RUDDER
*T D281	ELEVATOR POSITION	DEG	3.0	31/2	CONTROL AIRFRAME ANGLES
*T D284	RUDDER POSITION	DEG	3.0	31/2	CONTROL AIRFRAME ANGLES

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*TF286		HOR STAB INCIDENCE LINK AX. FOL	BS		251/1	HORIZ
	E298	EMP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E299	EMP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
*T	A300	C.G. LAT VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
*T	A301	C.G. F/A VIBR	G'S	0.5	125/25	AIRFRAME VIBRATION
*T	A302	PILOT SEAT LAT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	F303	RT MN LD GR DRAG STRUT AX FOR	LBS		125/1	GEAR
*T	A304	COPILOT SEAT LAT VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	D305	RT MAIN LDG GEAR OLEO EXT POS	INCHES	1.0	125/25	GEAR
*T	D306	F/A SCAS ACTUATOR POSITION	INCHES	6.0	125/4	SCAS
*T	D307	LATERAL SCAS ACTUATOR POSITION	INCHES	6.0	125/4	SCAS
*T	D308	DIRECTIONAL SCAS ACTUATOR POS	INCHES	6.0	125/4	SCAS
*T	D309	PILOT FLAP LEVER POSITION	DEG	3.0	31/2	CONTROL POSITION
*T	D314	LT MAIN LDG GEAR ACT. POS	INCHES	1.0	31/6	GEAR
*T	D315	LT MAIN LDG GEAR OLEO EXT POS	INCHES	1.0	31/6	GEAR
*T	B316	RT MN LD GR OLEO STRUT LAT BD	IN LB		125/1	GEAR
*T	D317	RT MAIN LDG GEAR ACT. POS	NCHES	1.0	125/25	GEAR
*T	D318	DIFF.CYCLIC WASHOUT ACT. POS	NCHES	3.0	31/2	CONTROL POSITION
	R320	RT FUEL TANK QUANTITY	LBS		31	FUEL SYSTEM
	R321	LT FUEL TANK QUANTITY	LBS		31	FUEL SYSTEM
*T	T322	OAT (ROSEMONT)	DEG C	1.0	31/6	TEST CONDITIONS
	P323	RT ENGINE OIL PRESSURE	PSI		251	OIL SYSTEM
	P324	LT ENGINE OIL PRESSURE	PSI		251	OIL SYSTEM
	P325	RT XMSN OIL PRESSURE	PSI		251	OIL SYSTEM
	P326	LT XMSN OIL PRESSURE	PSI		125	OIL SYSTEM
*T	D327	ALTITUDE - RADAR ALTIMETER	FEET	1.0	31/6	TEST CONDITIONS
*T	R328	RT ENGINE FUEL FLOW RATE	LB/HR	1.0	125/25	ENGINE
*T	R329	LT ENGINE FUEL FLOW RATE	LB/HR	1.0	125/25	ENGINE
*T	M336	LT ENGINE TORQUE	%		125/1	ENGINE
*T	M337	INTERCONNECT SHAFT TORQUE	%	3.0	125/8	ENGINE
*T	R338	RT ENGINE N2 RPM	%	6.0	125/4	ENGINE
*T	R339	LT ENGINE N2 RPM	%	6.0	125/4	ENGINE
*T	A341	RT XMSN DOWNSTOP LAT VIBR	G'S		251/1	TIP RIB VIBRATORY
*T	P342	ALTITUDE - NOSE BOOM	FEET	1.0	31/6	TEST CONDITIONS
*T	D348	NOSE LDG GEAR ACT. POS	INCHES		125/1	GEAR
*T	D349	NOSE LDG GEAR OLEO EXT POS	INCHES	1.0	125/25	GEAR
*T	A350	RT XMSN LAT VIBR @ INLET	G'S		251/1	TIP RIB VIBRATORY
*T	A352	C.G. VERT VIBR (SERVO)	G'S	3.0	31/2	AIRFRAME VIBRATION
*T	A353	RT CONV SPINDLE LAT VIBR @ NUT	G'S		251/1	TIP RIB VIBRATORY
*T	D360	TEMPERATURE SCANNER ENCODER	TEMPS		31/1	PYLON TEMP/PRESSURE
	X365	RECORD NUMBER			31	DATA SYSTEM STATUS
	X366	RECORD NUMBER			31	DATA SYSTEM STATUS
	E369	CP-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E370	CP-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E371	CP-3 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E372	N-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E373	CA1-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E374	RMG-1 VOLTAGE SENSE	VOLTS		125	DATA SYSTEM STATUS
	E375	LMG-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
*T	A380	PILOT SEAT F/A VIBR	G'S	0.5	251/50	AIRFRAME VIBRATION
*T	R503	RT ENGINE N1 RPM	%	3.0	125/8	ENGINE
*T	D509	RT THROTTLE POSITION	DEG	3.0	31/2	CONTROL POSITION
*T	D510	LT THROTTLE POSITION	DEG	3.0	31/2	CONTROL POSITION
*T	D511	SCANIVALVE POSITION ENCODER	SCAN		31/1	PYLON TEMP/PRESSURE

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
*T	R515	LT ENGINE N1 RPM	%	3.0	125/8	ENGINE
*T	F534	LT ENGINE STRUT AXIAL FORCE	LBS		125/1	ENGINE
*T	F537	RT ENGINE STRUT AXIAL FORCE	LBS		125/1	ENGINE
*T	B542	LT ENGINE COUPLING G/B PITCH B	IN LB		251/1	ECGB
*T	B543	LT ENGINE COUPLING G/B YAW BD	IN LB	10.0	251/1	ECGB
*T	B544	RT ENGINE COUPLING G/B PITCH B	IN LB		251/1	ECGB
*T	B545	RT ENGINE COUPLING G/B YAW BD	IN LB	10.0	251/1	ECGB
*T	B600	RT WING SPAR BM BD 22	IN LB	10.0	125/1	WING
*T	B601	LT WING SPAR BM BD 22	IN LB	10.0	125/1	WING
*T	B603	RT WING SPAR CHD BD 22	IN LB	10.0	125/1	WING
*T	B604	LT WING SPAR CHD BD 22	IN LB	10.0	125/1	WING
*T	M606	RT WING SPAR TORQUE 22	IN LB	10.0	125/1	WING
*T	M607	LT WING SPAR TORQUE 22	IN LB	10.0	125/1	WING
*T	F611	RT PYLON CONV ACT AXIAL FORCE	LBS		251/1	PYLON CONV. SPINDLE
*T	B613	RT FLAP BM BD	IN LB		125/1	FLAP
	F614	RT FLAPERON CONTROL ARM FORCE	LBS		502/1	FLAPERON
*T	B615	RT FLAPERON BM BD	IN LB		251/1	FLAPERON
*T	D617	FLAP POSITION	DEG	3.0	31/2	CONTROL AIRFRAME ANGLES
*T	F621	LT FLAPERON CONTROL ARM FORCE	LBS		251/1	FLAPERON
*T	F625	LT PYLON DOWNSTOP VERT FORCE	LBS		251/1	PYLON DOWNSTOP
*T	F626	RT PYLON DOWNSTOP VERT FORCE	LBS		251/1	PYLON DOWNSTOP
*T	A627	RT PYLON DOWNSTOP LAT VIBR	G'S		251/1	TIP RIB VIBRATORY
*T	S631	RT WING FRONT SPAR LO SHEAR 6	PSI		125/1	WING
*T	S633	RT WING REAR SPAR LO SHEAR 6	PSI		125/1	WING
	S635	RT WING FRONT SPAR LO SHEAR 14	PSI		251/1	WING
*T	F638	LT PYLON CONV ACT AXIAL FORCE	LBS		251/1	PYLON CONV. SPINDLE
*T	S642	INBD SPINDLE RIB UP ARM INBD	PSI		251/1	TIP RIB STRESS
*T	S643	INBD SPINDLE RIB UP ARM OTBD	PSI		125/1	TIP RIB STRESS
*T	D645	RT WING AILERON POSITION	DEG	3.0	125/8	CONTROL AIRFRAME ANGLES
*T	D646	LT WING AILERON POSITION	DEG	3.0	125/8	CONTROL AIRFRAME ANGLES
	E647	RW-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E648	RW-2 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E649	LW-1 VOLTAGE SENSE	VOLTS		31	DATA SYSTEM STATUS
	E700	GPA GAIN-4			31	DATA SYSTEM STATUS
	E701	GPA GAIN-16			31	DATA SYSTEM STATUS
	E705	GPA GAIN-512			31	DATA SYSTEM STATUS
	E706	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E707	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E708	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E709	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E710	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E711	HIGH LEVEL CAL			31	DATA SYSTEM STATUS
	E712	POWER SUPPLY BYTE			31	DATA SYSTEM STATUS
*T	E717	PRIMARY GOV SERVO VALVE	MAMPS	3.0	31/2	GOVERNOR
*T	E718	PRIMARY GOV RPM ERROR	%	10.0	125/4	GOVERNOR
*T	E719	PRIMARY GOV #1 LVDT	%	3.0	125/8	GOVERNOR
*T	E720	PRIMARY GOV ACT. VELOCITY	D/SEC	3.0	31/2	GOVERNOR
*T	E721	PRIMARY GOV COMMAND RPM	%	3.0	31/2	GOVERNOR
*T	E722	PRIMARY MONITOR COMMAND RPM	%	3.0	31/2	GOVERNOR
*T	E723	PRIMARY MONITOR RPM ERROR	%	10.0	125/4	GOVERNOR
*T	E724	STANDBY GOVERNOR RPM ERROR	%	10.0	31/1	GOVERNOR
	E725	GPA GAIN-4			31	DATA SYSTEM STATUS
	E726	GPA GAIN-16			31	DATA SYSTEM STATUS
	E727	GPA GAIN-64			31	DATA SYSTEM STATUS

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
	E730	GPA GAIN-512			31	DATA SYSTEM STATUS
	E731	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E732	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E733	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E734	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E735	LOW LEVEL CAL			31	DATA SYSTEM STATUS
	E736	HIGH LEVEL CAL			31	DATA SYSTEM STATUS
	E737	POWER SUPPLY BYTE			31	DATA SYSTEM STATUS
*T	D746	RT COLLECTIVE LVDT	%	10.0	125/4	EXCITER
*T	D747	RT FLAPERON LVDT	%	10.0	125/4	EXCITER
*T	E748	RT COLLECTIVE EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
*T	E749	RT FLAPERON EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
*T	E750	LT COLLECTIVE EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
*T	E751	LT FLAPERON EXCITER SOLENOID	VOLTS	10.0	31/1	EXCITER
*T	D799	LT COLLECTIVE LVDT	%	10.0	125/4	EXCITER
*T	D800	LT FLAPERON LVDT	%	10.0	125/4	EXCITER
	B802	RT HUB SPINDLE BENDING (RED) 9	IN-LB			
	B803	LT HUB SPINDLE BENDING (RED) 9	IN-LB			
	B805	RT HUB SPINDLE BENDING (WHT) 9	IN-LB			
	B806	RT HUB SPINDLE BENDING (GRN) 9	IN-LB		502/1	
	B807	LT HUB SPINDLE BENDING @ 9 WH	IN-LB			
	B808	LT HUB SPINDLE BENDING (GRN) 9	IN-LB			
	P901	RAKE PRESSURE #1 4" OUT	PSF		125	WING PRESSURE
	P902	RAKE PRESSURE #2 8" OUT	PSF		125	WING PRESSURE
	P903	RAKE PRESSURE #3 12" OUT	PSF		125	WING PRESSURE
	P904	RAKE STATIC PRESSURE	PSF		125	WING PRESSURE
	P905	RAKE PRESSURE #4 16" OUT	PSF		125	WING PRESSURE
	P906	RAKE PRESSURE #5 20" OUT	PSF		125	WING PRESSURE
	P907	RAKE PRESSURE #6 24" OUT	PSF		125	WING PRESSURE
	OATC	CORRECTED TEMPERATURE	DEG C			PSEUDO ITEMS
	KCAS	CALIBRATED AIRSPEED	KNOTS			PSEUDO ITEMS
	TCGO	TEMP CENTER GEARBOX OIL	DEG F			TEMPERATURES - SCANNER
	TDAY	COUNTER MID TIME POINT	MINUTE			PSEUDO ITEMS
	HDFT	DENSITY ALTITUDE	FEET			PSEUDO ITEMS
	CDUR	COUNTER DURATION	SECOND			PSEUDO ITEMS
	RHPN	NORMALIZED HP (RSHP/SIGP)	HP			PSEUDO ITEMS
	SIGP	DENSITY RATIO				PSEUDO ITEMS
	AILD	RT AILERON RATE (SLOPE D645)	DEG/S			PSEUDO ITEMS
	TL04	TEMP LT ENGINE OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TL05	TEMP LT ENG OIL #2 SCAVENG PUM	DEG F			TEMPERATURES - SCANNER
	TL06	TEMP LT XMSN OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TL07	TEMP LT XMSN OIL OUT OF COOLER	DEG F			TEMPERATURES - SCANNER
	TL08	TEMP LT HUB SPRING BEARING	DEG F			TEMPERATURES - SCANNER
	TL09	TEMP LT CONV. SPINDLE BEARING	DEG F			TEMPERATURES - SCANNER
	TL10	TEMP LT DRIVE SHAFT OB BEARING	DEG F			TEMPERATURES - SCANNER
	TL11	TEMP LT DRIVE SHAFT IB BEARING	DEG F			TEMPERATURES - SCANNER
	ALFD	ANGLE OF ATTACK (D008) RATE	DEG/S			PSEUDO ITEMS
	TLTI	TEMP LT T7 TURBINE INLET	DEG F			TEMPERATURES - SCANNER
	DNLD	DOWNLOAD COEFFICIENT				PSEUDO ITEMS
	TOCG	C.G. FOR RAMP GW	INCHES			PSEUDO ITEMS
	CPXX	POWER COEFFICIENT				PSEUDO ITEMS
*T	QQ18	ROTOR BLIPPER BOX C	--		251/1	ROTOR BLADE
	TR04	TEMP RT ENGINE OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TR05	TEMP RT ENG OIL #2 SCAVENG PUM	DEG F			TEMPERATURES - SCANNER

	Item	Description	Units	Fltr Freq	Input Rate/Dec	Group
	TR06	TEMP RT XMSN OIL INTO COOLER	DEG F			TEMPERATURES - SCANNER
	TR07	TEMP RT XMSN OIL OUT OF COOLER	DEG F			TEMPERATURES - SCANNER
	TR08	TEMP RT HUB SPRING BEARING	DEG F			TEMPERATURES - SCANNER
	TR09	TEMP RT CONV. SPINDLE BEARING	DEG F			TEMPERATURES - SCANNER
	TR10	TEMP RT DRIVE SHAFT OB BEARING	DEG F			TEMPERATURES - SCANNER
	TR11	TEMP RT DRIVE SHAFT IB BEARING	DEG F			TEMPERATURES - SCANNER
	CRPM	COMPUTED RPM	RPM			PSEUDO ITEMS
	TRTI	TEMP RT T7 TURBINE INLET	DEG F			TEMPERATURES - SCANNER
	TRWF	TEMP OAT TOP RIGHT WING	DEG F			TEMPERATURES - SCANNER
	RSHP	ROTOR SHAFT HORSEPOWER	HP			PSEUDO ITEMS
	KTAS	TRUE AIRSPEED	KNOTS			PSEUDO ITEMS
	ETIM	ELAPSED TIME SINCE ENGINES ON	MINUTE			PSEUDO ITEMS
*T	ATTL	LASER AZIMUTH	DEG			CROWS LANDING RADAR
*T	ETTL	LASER ELEVATION	DEG			CROWS LANDING RADAR
*T	RTTL	LASER RANGE	FEET			CROWS LANDING RADAR
*T	XTTL	X LASER POSITION				CROWS LANDING RADAR
*T	YTTL	Y LASER POSITION				CROWS LANDING RADAR
*T	ZTTL	Z LASER POSTION				CROWS LANDING RADAR
*T	ATTR	TTR AZIMUTH	DEG			CROWS LANDING RADAR
*T	ETTR	TTR ELEVATION	DEG			CROWS LANDING RADAR
*T	RTTR	TTR RANGE	FEET			CROWS LANDING RADAR
*T	XTTR	X POSITION FROM TTR RADAR	FEET		62/1	CROWS LANDING RADAR
*T	YTTR	Y POSITION FROM TTR RADAR	FEET		62/1	CROWS LANDING RADAR
*T	ZTTR	Z POSITION FROM TTR RADAR	FEET		62/1	CROWS LANDING RADAR
*T	XTTV	X VELOCITY FROM TTR RADAR	FT/SEC		62/1	CROWS LANDING RADAR
*T	YTTV	Y VELOCITY FROM TTR RADAR	FT/SEC		62/	CROWS LANDING RADAR
*T	ZTTV	Z VELOCITY FROM TTR RADAR	FT/SEC		62/1	CROWS LANDING RADAR
	CTXX	THRUST COEFFICIENT				PSEUDO ITEMS
	GWJW	GROSS WT USING ADJ FUEL WEIGHT	LBS			PSEUDO ITEMS
	GWT0	RAMP GROSS WEIGHT	LBS			PSEUDO ITEMS
	GWT1	GROSS WEIGHT, FUEL WT METHOD	LBS			PSEUDO ITEMS
	GWT2	GROSS WEIGHT, FUEL FLOW METHOD	LBS			PSEUDO ITEMS

Instrumentation Groups XV15 (N703) Tilt Rotor

*T denotes available time tistory data

	FUEL SYSTEM	ROTOR MAST
AIRFRAME VIBRATION	GEAR	ROTOR PITCH LINK
CONTROL AIRFRAME ANGLES	GOVERNOR	ROTOR SWASH PLATE DR
CONTROL FORCE	HORIZ	RUDDER
CONTROL POSITION	HYDRAULIC SYSTEM	SCAS
CONTROL ROTOR ANGLES	OIL SYSTEM	SIDE-STICK CONTROLLER
DATA SYSTEM STATUS	**PSEUDO ITEMS (DERIVED)**	TEMP- SCANNER
ECGB	PYLON CONV. SPINDLE	TEST CONDITIONS
ELECTRICAL SYSTEM	PYLON DOWNSTOP	TIP RIB STRESS
ELEVATOR	PYLON VIB	TIP RIB VIBRATORY
ENGINE	RADAR	VERT
EXCITER	ROTOR BLADE	WING
FLAP	ROTOR BOOST ACTUATOR	ALHABETIC LISTING
FLAPERON	ROTOR HUB SPINDLE	NUMERIC LISTING

AIRFRAME VIBRATION - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	A005	C.G. VERT VIBR	G'S	.5	251/5125
*T	A019	PILOT SEAT VERT VIBR	G'S	0.5	251/50
*T	A020	COPILOT SEAT VERT VIBR	G'S	0.5	251/50
*T	A300	C.G. LAT VIBR	G'S	0.5	125/25
*T	A301	C.G. F/A VIBR	G'S	0.5	125/25
*T	A302	PILOT SEAT LAT VIBR	G'S	.5	51/50
*T	A304	COPILOT SEAT LAT VIBR	G'S	.5	51/50
*T	A352	C.G. VERT VIBR (SERVO)	G'S	3.0	1/2
*T	A380	PILOT SEAT F/A VIBR	G'S	0.5	51/50

CONTROL AIRFRAME ANGLES - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	D281	ELEVATOR POSITION	DEG	3.0	31/2
*T	D284	RUDDER POSITION	DEG	3.0	31/2
*T	D617	FLAP POSITION	DEG	3.0	31/2
*T	D645	RT WING AILERON POSITION	DEG	3.0	125/8
*T	D646	LT WING AILERON POSITION	DEG	3.0	125/8

CONTROL FORCE - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	F030	FFS F/A CYCLIC STICK FORCE	LBS	3.0	31/2
*T	F031	FFS LATERAL STICK FORCE	LBS	3.0	31/2
*T	F033	FFS RUDDER PEDAL FORCE	LBS	3.0	31/2

CONTROL POSITION - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
	D021	F/A STICK POSITION	%	3.0	125/8
*T	D022	LAT STICK POSITION	%	3.0	125/8
*T	D023	POWER LEVER POSITION	%	3.0	31/2
*T	D024	PEDAL POSITION	%	3.0	125/8
*T	D025	FFS F/A CYCLIC STK. POSITION	%	3.0	31/2
*T	D026	FFS LAT STICK POSITION	%	3.0	31/2
*T	D027	FFS RUDDER PEDAL POSITION	%	3.0	31/2
*T	D309	PILOT FLAP LEVER POSITION	DEG	3.0	31/2
*T	D318	DIFF.CYCLIC WASHOUT ACT. POS	IN	3.0	31/2
*T	D509	RT THROTTLE POSITION	DEG	3.0	31/2
*T	D510	LT THROTTLE POSITION	DEG	3.0	31/2

CONTROL ROTOR ANGLES - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	D156	RT PYLON HUB SPRING F/A POS	DEG	3.0	31/2
*T	D157	RT PYLON HUB SPRING LAT POS	DEG	3.0	31/2
*T	D158	RT PYLON COLL. ACTUATOR POS	DEG	3.0	125/8
*T	D159	RT PYLON S/PLATE F/A POSITION	DEG	3.0	125/8
*T	D160	RT PYLON S/PLATE LAT POSITION	DEG	3.0	125/8
*T	D181	LT PYLON HUB SPRING F/A POS	DEG	3.0	31/2
*T	D182	LT PYLON HUB SPRING LAT POS	DEG	3.0	31/2
*T	D183	LT PYLON COLL. ACTUATOR POS	DEG	3.0	125/8
*T	D184	LT PYLON S/PLATE F/A POSITION	DEG	3.0	125/8
*T	D185	LT PYLON S/PLATE LAT POSITION	DEG	3.0	125/8

DATA SYSTEM STATUS - Itemcodes currently active for flight 261

Item	Description	Units	Filter Freq	Input Rate/Dec
E072	RR-1 VOLTAGE SENSE	VOLTS	31	
E073	RR-2 VOLTAGE SENSE	VOLTS	31	
E074	LR-1 VOLTAGE SENSE	VOLTS	31	
E075	LR-2 VOLTAGE SENSE	VOLTS	31	
E196	RP-1 VOLTAGE SENSE	VOLTS	31	
E197	RP-2 VOLTAGE SENSE	VOLTS	31	
E198	LP-1 VOLTAGE SENSE	VOLTS	31	
E199	LP-2 VOLTAGE SENSE	VOLTS	31	
E298	EMP-1 VOLTAGE SENSE	VOLTS	31	
E299	EMP-2 VOLTAGE SENSE	VOLTS	31	
E369	CP-1 VOLTAGE SENSE	VOLTS	31	
E370	CP-2 VOLTAGE SENSE	VOLTS	31	
E371	CP-3 VOLTAGE SENSE	VOLTS	31	
E372	N-1 VOLTAGE SENSE	VOLTS	31	
E373	CA1-1 VOLTAGE SENSE	VOLTS	31	
E374	RMG-1 VOLTAGE SENSE	VOLTS	125	
E375	LMG-1 VOLTAGE SENSE	VOLTS	31	
E647	RW-1 VOLTAGE SENSE	VOLTS	31	
E648	RW-2 VOLTAGE SENSE	VOLTS	31	
E649	LW-1 VOLTAGE SENSE	VOLTS	31	
E700	GPA GAIN-4		31	
E701	GPA GAIN-16		31	
E705	GPA GAIN-512		31	
E706	LOW LEVEL CAL		31	
E707	LOW LEVEL CAL		31	
E708	LOW LEVEL CAL		31	

	Item	Description	Units	Filter Freq	Input Rate/Dec
	E709	LOW LEVEL CAL		31	
	E710	LOW LEVEL CAL		31	
	E711	HIGH LEVEL CAL		31	
	E712	POWER SUPPLY BYTE		31	
	E725	GPA GAIN-4		31	
	E726	GPA GAIN-16		31	
	E727	GPA GAIN-64		31	
	E730	GPA GAIN-512		31	
	E731	LOW LEVEL CAL		31	
	E732	LOW LEVEL CAL		31	
	E733	LOW LEVEL CAL		31	
	E734	LOW LEVEL CAL		31	
	E735	LOW LEVEL CAL		31	
	E736	HIGH LEVEL CAL		31	
	E737	POWER SUPPLY BYTE		31	
	X365	RECORD NUMBER		31	
	X366	RECORD NUMBER		31	

ECGB - Itemcodes currently active for flight 26

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B542	LT ENG. COUPLING G/B PITCH B	IN LB		251/1
*T	B543	LT ENGINE COUPLING G/B YAW BD	IN LB	10.0	251/1
*T	B544	RT ENGINE COUPLING G/B PITCH B	IN LB		251/1
*T	B545	RT ENGINE COUPLING G/B YAW BD	IN LB	10.0	251/1

ELECTRICAL SYSTEM - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
	E154	RT PYLON DC GEN VOLTS	VOLTS		125
	E155	RT PYLON DC GEN AMPS	AMPS		251
	E179	LT PYLON DC GEN VOLTS	VOLTS		125
	E180	LT PYLON DC GEN AMPS	AMPS		125

ELEVATOR - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B274	RT ELEVATOR CONTROL ARM BM BD		IN LB	251/1
*T	M275	RT ELEV DRIVE TUBE TORQUE	IN LB		251/1
*T	M279	LT ELEV DRIVE TUBE TORQUE	IN LB		251/1

ENGINE - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	F534	LT ENGINE STRUT AXIAL FORCE	LBS		125/1 ENGINE
*T	F537	RT ENGINE STRUT AXIAL FORCE	LBS		125/1
*T	M336	LT ENGINE TORQUE	%		125/1
*T	M337	INTERCONNECT SHAFT TORQUE	%	3.0	125/8
*T	R106	ROTOR RPM	%	3.0	125/4
*T	R328	RT ENGINE FUEL FLOW RATE	LB/HR	1.0	125/25
*T	R329	LT ENGINE FUEL FLOW RATE	LB/HR	1.0	125/25
*T	R338	RT ENGINE N2 RPM	%	6.0	125/4
*T	R339	LT ENGINE N2 RPM	%	6.0	125/4
*T	R503	RT ENGINE N1 RPM	%	3.0	125/8
*T	R515	LT ENGINE N1 RPM	%	3.0	125/8

EXCITER - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	D746	RT COLLECTIVE LVDT	%	10.0	125/4
*T	D747	RT FLAPERON LVDT	%	10.0	125/4
*T	D799	LT COLLECTIVE LVDT	%	10.0	125/4
*T	D800	LT FLAPERON LVDT	%	10.0	125/4
*T	E748	RT COLLECTIVE EXCITER SOLENOID	VOLTS	10.0	31/1
*T	E749	RT FLAPERON EXCITER SOLENOID	VOLTS	10.0	31/1
*T	E750	LT COLLECTIVE EXCITER SOLENOID	VOLTS	10.0	31/1
*T	E751	LT FLAPERON EXCITER SOLENOID	VOLTS	10.0	31/1

FLAP - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B613	RT FLAP BM BD	IN LB		125/1

FLAPERON - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B615	RT FLAPERON BM BD	IN LB		251/1
	F614	RT FLAPERON CONTROL ARM FORCE	LBS	502/1	
*T	F621	LT FLAPERON CONTROL ARM FORCE	LBS	251/1	

FUEL SYSTEM - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
	R320	RT FUEL TANK QUANTITY	LBS	31	
	R321	LT FUEL TANK QUANTITY	LBS	31	

GEAR - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B316	RT MN LD GR OLEO STRUT LAT BD	IN LB		125/1
*T	D305	RT MAIN LDG GEAR OLEO EXT POS	IN	1.0	125/25
*T	D314	LT MAIN LDG GEAR ACT. POS	IN	1.0	31/6
*T	D315	LT MAIN LDG GEAR OLEO EXT POS	IN	1.0	31/6
*T	D317	RT MAIN LDG GEAR ACT. POS	IN	1.0	125/25
*T	D348	NOSE LDG GEAR ACT. POS	IN		125/1
*T	D349	NOSE LDG GEAR OLEO EXT POS	IN	1.0	125/25
*T	F303	RT MN LD GR DRAG STRUT AX FOR	LBS		125/1

GOVERNOR - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	E717	PRIMARY GOV SERVO VALVE	MAMPS	3.0	31/2
*T	E718	PRIMARY GOV RPM ERROR	%	10.0	125/4
*T	E719	PRIMARY GOV #1 LVDT	%	3.0	125/8
*T	E720	PRIMARY GOV ACT. VELOCITY	D/SEC	3.0	31/2
*T	E721	PRIMARY GOV COMMAND RPM	%	3.0	31/2
*T	E722	PRIMARY MONITOR COMMAND RPM	%	3.0	31/2
*T	E723	PRIMARY MONITOR RPM ERROR	%	10.0	125/4
*T	E724	STANDBY GOVERNOR RPM ERROR	%	10.0	31/1

HORIZ - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B259	LT HORIZ STAB SPAR BM BD 8	IN LB		125/1
*T	B262	RT HORIZ STAB SPAR BM BD 8	IN LB		125/1
*T	F286	HOR STAB INCIDENCE LINK AX. FO	LBS		251/1
*T	M266	RT HOR STAB SPAR TORQUE 8	IN LB		125/1

HYDRAULIC SYSTEM - Itemcodes currently active for flight 261

Item	Description	Units	Filter Freq	Input Rate/Dec
P149	PC3 HYDRAULIC PRESSURE	PSI		125
P153	PC2 HYDRAULIC PRESSURE	PSI		125
P178	PC1 HYDRAULIC PRESSURE	PSI		125

OIL SYSTEM - Itemcodes currently active for flight 261

Item	Description	Units	Filter Freq	Input Rate/Dec
P323	RT ENGINE OIL PRESSURE	PSI		251
P324	LT ENGINE OIL PRESSURE	PSI		251
P325	RT XMSN OIL PRESSURE	PSI		251
P326	LT XMSN OIL PRESSURE	PSI		125

Derived PSEUDO ITEMS - Itemcodes currently active for flight 261

The following derived pseudo-items are available in minmax/counter, average-steady form.

Item	Description	Units	Filter Freq	Input Rate/Dec
AILD	RT AILERON RATE (SLOPE D645)		DEG/S	AILD
ALFD	ANGLE OF ATTACK (D008) RATE		DEG/S	ALFD
BETD	SIDESLIP RATE (SLOPE D007)		DEG/S	BETD
CDUR	COUNTER DURATION		SECOND	CDUR
CPXX	POWER COEFFICIENT			CPXX
CRPM	COMPUTED RPM		RPM	CRPM
CTXX	THRUST COEFFICIENT			CTXX
DNLD	DOWNLOAD COEFFICIENT			DNLD
ETIM	ELAPSED TIME SINCE ENGINES ON		MINUTE	ETIM
FLPD	FLAP ANGLE RATE (SLOPE D617)		DEG/S	FLPD
GOVD	GOV. LVDT RATE (SLOPE E719)		%/S	GOVD
GWJW	GROSS WT USING ADJ FUEL WEIGHT		LBS	GWJW
GWT0	RAMP GROSS WEIGHT		LBS	GWT0
GWT1	GROSS WEIGHT, FUEL WT METHOD		LBS	GWT1
GWT2	GROSS WEIGHT, FUEL FLOW METHOD		LBS	GWT2
HDFT	DENSITY ALTITUDE		FEET	HDFT
HDOT	CLIMB/DESCENT RATE(SLOPE P342)		FT/SEC	HDOT
IASD	AIRSPEED RATE (SLOPE P002)		KNOT/S	IASD
KCAS	CALIBRATED AIRSPEED		KNOTS	KCAS
KTAS	TRUE AIRSPEED		KNOTS	KTAS
OATC	CORRECTED TEMPERATURE		DEG C	OATC
P1WX	ADJUSTED HORSEPOWER		HP	P1WX
PCAD	PYLON CONVERSION RATE		DEG/S	PCAD
PHID	ROLL ANGLE RATE (SLOPE D009)		DEG/S	PHID
RHPN	NORMALIZED HP (RSHP/SIGP)		HP	RHPN
RSHP	ROTOR SHAFT HORSEPOWER		HP	RSHP
SIGP	DENSITY RATIO			SIGP
TDAY	COUNTER START TIME OF DAY		MINUTE	TDAY
THTD	PITCH ANGLE RATE (SLOPE D010)		DEG/S	THTD
TOCG	C.G. FOR RAMP GW		INCHES	TOCG

PYLON CONV. SPINDLE - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B165	RT PYLON CONV SPINDLE BM BD	IN LB	10.0	125/1
*T	B166	RT PYLON CONV SPINDLE CHD BD	IN LB	10.0	125/1
*T	B190	LT PYLON CONV SPINDLE BM BD	IN LB	10.0	125/1
*T	B191	LT PYLON CONV SPINDLE CHD BD	IN LB	10.0	125/1
*T	F611	RT PYLON CONV ACT AXIAL FORCE	LBS		251/1
*T	F638	LT PYLON CONV ACT AXIAL FORCE	LBS		251/1

PYLON DOWNSTOP - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	F625	LT PYLON DOWNSTOP VERT FORCE	LBS		251/1
*T	F626	RT PYLON DOWNSTOP VERT FORCE	LBS		251/1
	S067	RT PYLON DOWNSTOP STRIKER STR	PSI		251/1
	S068	LT PYLON DOWNSTOP STRIKER STR	PSI		251/1
	S116	RT PY DOWNSTOP AFT (XMSN CASE)	PSI		251/1
	S117	RT PY DOWNSTOP FWD (XMSN CASE)	PSI		251/1
	S118	LT PY DOWNSTOP AFT (XMSN CASE)	PSI		125/1
	S119	LT PY DOWNSTOP FWD (XMSN CASE)	PSI		125/1

PYLON VIB - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	A150	RT PYLON NORM ACCEL (F/A)	G'S	10.0	251/1
*T	A151	RT PYLON LAT ACCEL	G'S	10.0	251/1
*T	A152	RT PYLON AXIAL ACCEL (VERT)	G'S	10.0	251/1
*T	A175	LT PYLON NORM ACCEL (F/A)	G'S	10.0	251/1
*T	A176	LT PYLON LAT ACCEL	G'S	10.0	251/1
*T	A177	LT PYLON AXIAL ACCEL (VERT)	G'S	10.0	251/1

CROWS LANDING RADAR - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	ATTL	LASER AZIMUTH	DEG		
*T	ATTR	TTR AZIMUTH	DEG		
*T	ETTL	LASER ELEVATION	FT		
*T	ETTR	TTR ELEVATION	DEG		
*T	RTTL	LASER RANGE	FEET		
*T	RTTR	TTR RANGE	FEET		
*T	XTTL	X LASER POSITION			
*T	XTTR	X POSITION FROM TTR RADAR	FEET		62/1
*T	XTTV	X VELOCITY FROM TTR RADAR	FT/SEC		62/1
*T	YTTL	Y LASER POSITION			
*T	YTTR	Y POSITION FROM TTR RADAR	FEET		62/1
*T	YTTV	Y VELOCITY FROM TTR RADAR	FT/SEC		62/1
*T	ZTTL	Z LASER POSTION			
*T	ZTTR	Z POSITION FROM TTR RADAR	FEET		62/1
*T	ZTTV	Z VELOCITY FROM TTR RADAR	FT/SEC		62/1

ROTOR BLADE - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B034	RT RED ATB BM BD 30.9	IN LB		251/1
*T	B035	RT RED ATB CHD BD 30.9	IN LB		251/1
*T	B036	LT RED ATB BM BD 30.9	IN LB		251/1
*T	B037	LT RED ATB CHD BD 30.9	IN LB		251/1
*T	B038	RT RED ATB BM BD 103.5	IN LB		251/1
	B039	RT RED ATB CHD BD 103.5	IN LB		251/1
*T	B040	LT RED ATB BM BD 103.5	IN LB		251/1
*T	B041	LT RED ATB CHD BD 103.5	IN LB		251/1
*T	B042	RT RED ATB BM BD 126	IN LB		251/1
*T	B043	RT RED ATB CHD BD 126	IN LB		251/1
*T	B044	LT RED ATB BM BD 126	IN LB		251/1
	Item	**Description**	**Units**	**Filter Freq**	**Input Rate/Dec**
*T	B045	LT RED ATB CHD BD 126	IN LB		251/1
*T	B046	LT RED ATB BM BD 45	IN LB		125/1
*T	B047	LT RED ATB CHD BD 45	IN LB		125/1
*T	B050	LT RED ATB BM BD 75	IN LB		125/1
*T	B051	LT RED ATB CHD BD 75	IN LB		125/1
	M048	LT RED ATB TORSION 45	IN LB		125/1
*T	M049	LT RED ATB TORSION 75	IN LB		125/1
*T	Q018	ROTOR BLIPPER BOX A		--	251/1
*T	QQ18	ROTOR BLIPPER BOX C		--	251/1
*T	R018	ROTOR AZIMUTH BLIPPER			251/1

ROTOR BOOST ACTUATOR - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	F162	RT F/A CYCLIC ACTUATOR FORCE	LBS	3.0	251/16
*T	F163	RT LAT STICK ACTUATOR FORCE	LBS	3.0	251/16
*T	F164	RT COLLECTIVE ACTUATOR FORCE	LBS	3.0	251/16
*T	F187	LT F/A CYCLIC ACTUATOR FORCE	LBS	3.0	251/16
*T	F188	LT LAT STICK ACTUATOR FORCE	LBS	3.0	251/16
*T	F189	LT COLLECTIVE ACTUATOR FORCE	LBS	3.0	251/16

ROTOR HUB SPINDLE - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B112	RT HUB SPINDLE BM BD (RED) 9	IN LB	10.0	251/1
*T	B113	RT HUB SPINDLE CHD BD (RED) 9	IN LB	10.0	251/1
*T	B114	LT HUB SPINDLE BM BD (RED) 9 I	IN LB	10.0	251/1
*T	B115	LT HUB SPINDLE CHD BD (RED) 9	IN LB	10.0	251/1
*T	B171	RT HUB SPINDLE BM BD (WHT) 9	IN LB		251/1
*T	B172	RT HUB SPINDLE CHD BD (WHT) 9	IN LB		251/1
*T	B173	RT HUB SPINDLE BM BD (GRN) 9	IN LB		251/1
*T	B174	RT HUB SPINDLE CHD BD (GRN) 9	IN LB		251/1
*T	B192	LT HUB SPINDLE BM BD (WHT) 9	IN LB		251/1
*T	B193	LT HUB SPINDLE CHD BD (WHT) 9	IN LB		251/1
*T	B194	LT HUB SPINDLE BM BD (GRN) 9	IN LB		251/1
*T	B195	LT HUB SPINDLE CHD BD (GRN) 9	IN LB		251/1

ROTOR MAST - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B108	RT ROTOR MAST PARA BD 13.2	IN LB		251/1
*T	B109	RT ROTOR MAST PERP BD 13.2	IN LB		251/1
*T	B140	LT ROTOR MAST PARA BD 13.2	IN LB		251/1
	B141	LT ROTOR MAST PERP BD 13.2	IN LB		251/1
*T	M107	RT ROTOR MAST TORQUE 12	IN LB	3.0	251/16
*T	M143	LT ROTOR MAST TORQUE 12	IN LB	3.0	251/16

ROTOR PITCH LINK - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	F055	RT PITCH LINK (GRN) AX. FORCE	LBS		251/1
*T	F060	LT PITCH LINK (RED) AX. FORCE	LBS	10.0	251/1
*T	F061	LT PITCH LINK (WHT) AX. FORCE	LBS		251/1
*T	F062	LT PITCH LINK (GRN) AX. FORCE	LBS		251/1
*T	F103	RT PITCH LINK (RED) AX. FORCE	LBS	10.0	251/1
*T	F104	RT PITCH LINK (WHT) AX. FORCE	LBS		251/1

ROTOR SWASH PLATE DR - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	F052	RT SWASH PLATE DRIVER FORCE	BS	251/1	
*T	F142	LT SWASH PLATE DRIVER FORCE	LBS	251/1	

RUDDER - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B278	RT RUDDER CONTROL ARM BM BD	IN LB		125/1
*T	B280	LT RUDDER CONTROL ARM BM BD	IN LB		125/1
*T	M277	LT RUDDER DRIVE TUBE TORQUE	IN LB		125/1

SCAS - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	D306	F/A SCAS ACTUATOR POSITION	IN	6.0	125/4
*T	D307	LATERAL SCAS ACTUATOR POSITION	IN	6.0	125/4
*T	D308	DIRECTIONAL SCAS ACTUATOR POS	IN	6.0	125/4

SIDE-STICK CONTROLLER - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec

TEMPERATURES - SCANNER - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
	TCGO	TEMP CENTER GEARBOX OIL	DEG F		
	TL04	TEMP LT ENGINE OIL INTO COOLER	DEG F		
	TL05	TEMP LT ENG OIL #2 SCAVENG PUM	DEG F		
	TL06	TEMP LT XMSN OIL INTO COOLER	DEG F		
	TL07	TEMP LT XMSN OIL OUT OF COOLER	DEG F		

Item	Description	Units	Filter Freq	Input Rate/Dec
TL08	TEMP LT HUB SPRING BEARING	DEG F		
TL09	TEMP LT CONV. SPINDLE BEARING	DEG F		
TL10	TEMP LT DRIVE SHAFT OB BEARING	DEG F		
TL11	TEMP LT DRIVE SHAFT IB BEARING	DEG F		
TLTI	TEMP LT T7 TURBINE INLET	DEG F		
TR04	TEMP RT ENGINE OIL INTO COOLER	DEG F		
TR05	TEMP RT ENG OIL #2 SCAVENG PUM	DEG F		
TR06	TEMP RT XMSN OIL INTO COOLER	DEG F		
TR07	TEMP RT XMSN OIL OUT OF COOLER	DEG F		
TR08	TEMP RT HUB SPRING BEARING	DEG F		
TR09	TEMP RT CONV. SPINDLE BEARING	DEG F		

Item	Description	Units	Filter Freq	Input Rate/Dec
TR10	TEMP RT DRIVE SHAFT OB BEARING	DEG F		
TR11	TEMP RT DRIVE SHAFT IB BEARING	DEG F		
TRTI	TEMP RT T7 TURBINE INLET	DEG F		
TRWF	TEMP OAT TOP RIGHT WING	DEG F		

TEST CONDITIONS - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	D007	ANGLE OF SIDESLIP	DEG	3.0	31/2
*T	D008	ANGLE OF ATTACK	DEG	3.0	31/2
*T	D009	ROLL ATTITUDE - CABIN	DEG	3.0	125/8
*T	D010	PITCH ATTITUDE - CABIN	DEG	3.0	125/8
*T	D011	YAW ATTITUDE - CABIN	DEG	3.0	125/8
*T	D161	RT PYLON CON. POSITION	DEG	1.0	31/6
*T	D186	LT PYLON CONV. POSITION	DEG	1.0	31/6
*T	D327	ALTITUDE - RADAR ALTIMETER	FEET	1.0	31/6
*T	P002	AIRSPEED - NOSE BOOM	KNOTS	1.0	125/25
*T	P342	ALTITUDE - NOSE BOOM	FEET	1.0	31/6
*T	T322	OAT (ROSEMONT)	DEG C	1.0	31/6
*T	V012	ROLL RATE - CABIN (INCMLT)	D/SEC	3.0	125/8
*T	V013	PITCH RATE -CABIN (INCMPLT)	D/SEC	3.0	125/8
*T	V014	YAW RATE - CABIN (INCMPLT)	D/SEC	3.0	125/8
*T	V015	ROLL RATE - SCAS	D/SEC	3.0	125/8
*T	V016	PITCH RATE - SCAS	D/SEC	3.0	125/8
*T	V017	YAW RATE - SCAS	D/SEC	3.0	125/8

TIP RIB STRESS - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	S642	INBD SPINDLE RIB UP ARM INBD	PSI		251/1
*T	S643	INBD SPINDLE RIB UP ARM OTBD	PSI		125/1

TIP RIB VIBRATORY - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	A341	RT XMSN DOWNSTOP LAT VIBR	G'S		251/1
*T	A350	RT XMSN LAT VIBR @ INLET	G'S		251/1
*T	A353	RT CONV SPINDLE LAT VIBR @ NUT	G'S		251/1
*T	A627	RT PYLON DOWNSTOP LAT VIBR	G'S		251/1

VERT - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B270	RT VERT STAB BM BD 110	IN LB		125/1

WING - Itemcodes currently active for flight 261

	Item	Description	Units	Filter Freq	Input Rate/Dec
*T	B600	RT WING SPAR BM BD 22	IN LB	10.0	125/1
*T	B601	LT WING SPAR BM BD 22	IN LB	10.0	125/1
*T	B603	RT WING SPAR CHD BD 22	IN LB	10.0	125/1
*T	B604	LT WING SPAR CHD BD22	IN LB	10.0	125/1
*T	M606	RT WING SPAR TORQUE22	IN LB	10.0	125/1
*T	M607	LT WING SPAR TORQUE22	IN LB	10.0	125/1
*T	S631	RT WING FRONT SPAR LO SHEAR 6	PSI		125/1
*T	S633	RT WING REAR SPAR LO SHEAR6	PSI		125/1
	S635	RT WING FRONT SPAR LO SHEAR 14	PSI		251/1

Derived Pseudo Items

Itemcodes currently active for flight 261

The following derived pseudo-items are available in minmax/counter, average-steady form.

Item	Description	Units	Filter Freq	Input Rate/Dec
AILD	RT AILERON RATE (SLOPE D645)		DEG/S	AILD
ALFD	ANGLE OF ATTACK (D008) RATE		DEG/S	ALFD
BETD	SIDESLIP RATE (SLOPE D007)		DEG/S	BETD
CDUR	COUNTER DURATION		SECOND	CDUR
CPXX	POWER COEFFICIENT			CPXX
CRPM	COMPUTED RPM		RPM	CRPM
CTXX	THRUST COEFFICIENT			CTXX
DNLD	DOWNLOAD COEFFICIENT			DNLD
ETIM	ELAPSED TIME SINCE ENGINES ON		MINUTE	ETIM
FLPD	FLAP ANGLE RATE (SLOPE D617)		DEG/S	FLPD
GOVD	GOV. LVDT RATE (SLOPE E719)		%/S	GOVD
GWJW	GROSS WT USING ADJ FUEL WEIGHT		LBS	GWJW
GWT0	RAMP GROSS WEIGHT		LBS	GWT0
GWT1	GROSS WEIGHT, FUEL WT METHOD		LBS	GWT1
GWT2	GROSS WEIGHT, FUEL FLOW METHOD		LBS	GWT2
HDFT	DENSITY ALTITUDE		FEET	HDFT
HDOT	CLIMB/DESCENT RATE(SLOPE P342)		FT/SEC	HDOT
IASD	AIRSPEED RATE (SLOPE P002)		KNOT/S	IASD
KCAS	CALIBRATED AIRSPEED		KNOTS	KCAS
KTAS	TRUE AIRSPEED		KNOTS	KTAS
OATC	CORRECTED TEMPERATURE		DEG C	OATC
P1WX	ADJUSTED HORSEPOWER		HP	P1WX
PCAD	PYLON CONVERSION RATE		DEG/S	PCAD
PHID	ROLL ANGLE RATE (SLOPE D009)		DEG/S	PHID
RHPN	NORMALIZED HP (RSHP/SIGP)		HP	RHPN
RSHP	ROTOR SHAFT HORSEPOWER		HP	RSHP
SIGP	DENSITY RATIO			SIGP
TDAY	COUNTER START TIME OF DAY		MINUTE	TDAY
THTD	PITCH ANGLE RATE (SLOPE D010)		DEG/S	THTD
TOCG	C.G. FOR RAMP GW		INCHES	TOCG

Section VII – GTRSIM

Simulation Using GTRSIM

The Generic Tilt-Rotor Simulation (GTRSIM) at NASA/Ames Research Center (ARC) is a revised version of a program (IFHC80) which was developed by Bell Helicopter Textron (BHT) for design and analysis of tilt-rotor aircraft. GTRSIM was developed at ARC by Systems Technology, Inc. (STI) under NASA contract. Its features include:

1. Two distinct rotors represented by algebraic equations,
2. Aerodynamic tables and equations for each component of the airframe (fuselage, wing, pylon, horizontaland vertical stabilizers, control surfaces and wake effects),
3. The entire control system, including phasing and mixing,
4. The engine, drive system and controls,
5. Rotor collective governor,
6. Stability and control augmentation system (SCAS),
7. Landing gear aerodynamics.

GTRSIM can be accessed through TRENDS. Typing SIMULATE from the TRENDS GATEWAY menu item initiates a guided procedure for helping you to set up input for a run, execute GTRSIM and display results of the run. Complete instructions for GTRSIM's use are very well documented in NASA Contractor Report CR-166535, "Generic Tilt-Rotor Simulation (GTRSIM) User's and Programmer's Guide, Volume 1: User's Guide," by G.D. Hanson and S.W. Ferguson of STI. GTRSIM's input and output procedures have been somewhat modified from those found in the User's Guide to assist the TRENDS user to set up runs and execute interactively. The TRENDS interface is a command procedure which presents the following menu.

GENERIC TILT-ROTOR SIMULATION

The simulation options are:

MC Modify model configuration parameters
PI Prepare input for the simulation
RS Run the simulation program, GTRSIM
TS Tabulate (print out) sweep results
PS Plot the sweep results
PM Plot maneuver (time-history) results
EX Exit to TRENDS/ACCESS program

Which option?:

The user selects one of the available options by typing the two-letter option code. When the selected option has been executed, control returns to the above menu unless, of course, the EX option was selected. A common order for selecting the options would be in the order shown above. Program inputs are categorized into two types for the TRENDS interface:

1. Configuration parameters, and
2. Case parameters.

The configuration parameters are modified through the MC option, while case parameters are modified through the PI option. A third input type, aerodynamic table data, is not currently modifiable through the TRENDS interface. The RS option executes GTRSIM from input files produced during the MC and PI options and produces output files in your directory. Some of these output files are scanned during the TS, PS and PM option steps to produce tabular and graphical display of the results.

Options

Option MC: Modify Configuration

When the MC option is selected, you will see

Step 1: View/Change Model Configuration Parameters
(See Appendix A of User's Guide, CR-166535)

TILT-ROTOR MODEL CONFIGURATION GROUPS

CONTROL SYSTEM	FLIGHT CONFIGURATION	FUSELAGE
HORIZONTAL STABILIZER	IGE MOMENT	LNDG GEAR
OTHER TABLES	POWER MANAGEMENT	ROTOR
SCAS - PITCH SIGNAL	SCAS - ROLL SIGNAL	SCAS-YAW
SIGNAL	VERTICAL STABILIZER	WING PYLON

$ See parameters in which group :

If you respond with CON, for example, you will be shown

CONTROL SYSTEM

XLNTR	LONG. CYC. FORCE NEUTRAL	INCHES	4.8000
XLTTR	LAT CYC. FORCE NEUTRAL	INCHES	4.8000
XPDTR	PEDALS FORCE NEUTRAL	INCHES	2.5000
XLNN	LONG. CYCLIC NEUTRAL	INCHES	4.8000
XLTN	LAT. CYC. NEUTRAL POSIT,	INCHES	4.8000
XPDN	PEDALS NEUTRAL POSITION	INCHES	2.5000
DEDXLN	D(ELEVATOR)/D(XLN)	DEG/IN	4.1600
DADXLT	D(AILERON)/D(XLT)	DEG/IN	3.9300
DRDXPD	D(RUDDER)/D(XPD)	DEG/IN	8.0000
A1SWCH	A1 CONTROLLER SWITCH	-ND-	0.00000E+00
DCYCN2	DIFERENTIAL CYCLIC CONST	-ND-	1.0000
DCYCN3	DIFERENTIAL CYCLIC CONS	-ND-	1.0000
DCYCN4	DIFERENTIAL CYCLIC CONST	-ND-	1.0000
F4	CONST. IN FFS EQU.	LB/IN	0.00000E+00
DB1	B1 RIGGING OFFSET CONSTAN	DEG	1.5000
LTRNJ	LATERAL CONTROL RANGE	INCHES	9.6000
LNRNJ	LONGIT. CONTROL RANGE	INCHES	9.6000
PDRNJ	PEDAL CONTROL RANGE	INCHES	5.0000
COLRNJ	POWER LEVER CONTROI RANGE	IN	10.000
PBMMAX	MAX. FWD MAST TILT ANGLE	DEG	90.000
PBMMIN	MAX. AFT MAST TILT ANGLE	DEG	-5.0000

$ See parameters in which group :

An asterisk (*) selects all groups. Proceed with a null entry. Now you will have the chance to change the values of math-model configuration parameters (in your file CONFIG.KEY). Your first prompt will be by parameter name -- you will see all parameters whose names contain the letters you enter. For each parameter, you will have the opportunity to change the value shown. A simple carriage return retains the existing value. When you have finished the list, you will again be prompted for name. Enter another name or, to escape the prompt, a simple return. You may use "*", "?", "LIST" or "ALIST" if you want. Next, you will be asked for parameter description (this feature is just in case you don't remember the name) and you may follow the same procedure for changing values and for escaping the prompt. LIST, ALIST and "*" are not recognized at the description prompt. Your CONFIG.KEY file is the configuration input to GTRSIM when you run from TRENDS.

If you respond to the prompt for name with a question mark (?), you will obtain the following help.

PARAMETER NAME:

This prompt is asking you to supply the name of a simulation parameter (or part of the name) from any configuration group. The program will then show you the current value of the parameter so you can accept it with a simple return or enter a new value.

The numerical values you enter to change configuration parameters should contain decimal points for floating-point parameters, but no decimal points for integers (switches). Scientific notation is not acceptable for input.

For all parameters (one at a time), you may use an asterisk (*). For a listing of all parameters (with the opportunity to change values) by group, type LIST. For an alphabetical listing, type ALIST.

PARAMETER DESCRIPTION:

This prompt is asking you to supply part of the parameter's description instead of the parameter name (mnemonic). The program will then prompt you for a value just like it does for a mnemonic response. LIST, ALIST and '*' are not recognized here.

When your changes have been completed, you will be asked:

$ Do you want to compare your current configuration file with another ? (Y/N)

A negative response will return you to the GTRSIM/TRENDS interface menu. A positive response will cause your current configuration file, CONFIG.KEY, to be compared item-by-item with the master configuration file or with another file which you specify. All differences in parameter values will be displayed for you before control is returned to the interface menu.

Option PI: Prepare Input

When the PI option is selected, you will have the chance to interactively prepare a case input file which will later be used as input to GTRSIM. You will first see:

Step 2: Prepare the Simulation Input File
(Read Sec. 2.3 and pages A2,A23-28 of User's Guide)

$ Provide a filename [SIMINP] :

The default (empty response) filename is SIMINP.DAT. You may supply another name, with or without extension. If you do not supply the extension, ".DAT" will be appended. The next part of the dialogue is to specify four lines of header information for labeling the output from GTRSIM. Default headers are shown to you.

Default title : XV-15 TILT ROTOR DIGITAL FLIGHT SIMULATION
$ Enter :

Default title : G.W. = 12546 LBS, 299.9 AFT C.G.
$ Enter :

Default title : FLAPS 0/0, GEAR UP, 6-27-83
$ Enter :

Default title : TRIM SWEEP: GROSS WEIGHT AND AIRSPEED
$ Enter :

The next prompt lets you choose whether you want a trim-sweep (TRMS) case or a maneuver simulation (MANS) case. You may have any number of these cases in a run.

$ Enter run option (TRMS or MANS) :

If you enter TRMS, you will be shown the list of sweep variables and will enter a dialogue to help you set up the trim-sweep case.

Trim-Sweep Dialogue

SWEEP VARIABLES

1	U	VELOCITY ALONG X-GND AXIS	KNOTS
2	V	VELOCITY ALONG Y-GND AXIS	KNOTS
3	W	VELOCITY ALONG Z-GND AXIS	KNOTS
4	BETAD	MAST TILT ANGLE	DEG
5	NZ	G-LEVEL FOR COORD. TURN	-ND-
6	OMEGR0	CENTER ROTOR RPM	RPM
7	SLCG0	A/C C.G. S.L. @BETAD=0	IN
8	VT	TOTAL VELOCITY	KNOTS
9	WLCG0	A/C C.G. W.L. @BETAD=0	IN
10	GW	A/C GROSS WEIGHT	LBS
11	RODESC	RATE OF DESCENT (+ DOWN)	FT/MIN

(Sample responses are shown in the following dialogue)

$ Primary (outer-loop) variable name : GW

$ Starting value (in LBS) : 12546

$ Increment (in LBS) : 100

$ Number of steps : 2

$ Secondary (inner-loop) variable name : U

$ Starting value (in KNOTS) : 140

$ Displacement with primary (in KNOTS) : 0

$ Increment (in KNOTS) : 20

$ Number of steps : 4

This trim-sweep case has been written to SIMINP.DAT

You will again be prompted for run-option.
$ Enter run option (TRMS or MANS) :

If you enter MANS, you will enter a dialogue for specification of parameters which define the maneuver case.

Maneuver Input Dialogue

$ Maneuver run duration (max 8 sec), sec : 8

$ Time control-step occurs, sec : 2

$ Output time-increment, sec : .25

$ Longitudinal stick step size, inches : .5

$ Lateral stick step size, inches : 0

$ Pedal step size, inches : 0

$ Collective step size, inches : 0

$ Time at which wind-gust begins, sec : 6

$ Duration of the wind-gust, sec : .5

$ Change in U ground velocity from wind gust, ft/sec : 10

$ Change in V ground velocity from wind gust, ft/sec : 0

$ Change in W ground velocity from wind gust, ft/sec : 0

This maneuver case has been written to SIMINP.DAT

$ Enter run option (TRMS or MANS) :

If you answer this run-option prompted with a null response, the dialogue for setting up the input file will be terminated and you will be shown the complete input file produced from your dialogue. Control will then return to the GTRSIM interface menu.

```
          XV-15 TILT ROTOR DIGITAL FLIGHT SIMULATION
          G.W. = 12546 LBS, 299.9 AFT C.G.
          FLAPS  0/0,  GEAR UP,  6-27-83
                TRIM SWEEP: GROSS WT AND AIRSPEED
END OF DATA
TRMS       ==> TRIM SWEEP
      10  IVAR1    PRIMARY VARIABLE = GW
  12546.00  SI      STARTING VALUE, LBS
    100.00  DI      INCREMENT, LBS
       2  NI       NUMBER OF STEPS
       1  IVAR2    SECONDARY VARIABLE = U
    140.00  SI      STARTING VALUE, KNOTS
      0.00  A2      OFFSET, KNOTS
     20.00  DI      INCREMENT, KNOTS
       4  NI       NUMBER OF STEPS
 &CHANGE
 &END
MANS       ==> MANEUVER AFTER TRIMMING
     8.00  RTIME    MANEUVER RUN TIME (MAX=8), SEC
     2.00  PTIME    TIME CONTROLS MOVE, SEC
     0.25  PRTDEL   PRINT TIME INCREMENT, SEC
        1  IOUTI    OUTPUT CODE (NOT USED), -ND-
        1  IOUTI    OUTPUT CODE (NOT USED), -ND-
        1  IOUTI    OUTPUT CODE (NOT USED), -ND-
     0.50  DXLN     DELTA CHANGE LONGITUDINAL STICK, IN
     0.00  DXLT     DELTA CHANGE LATERAL STICK, IN
     0.00  DXPD     DELTA CHANGE PEDALS, IN
     0.00  DXCOL    DELTA CHANGE COLLECTIVE, IN
     6.00  GSTIN    TIME GUST ENCOUNTERED, SEC
     6.50  GSTOUT   TIME GUST STOPS, SEC
    10.00  DUGND    DELTA CHANGE UGND VEL., FT/SEC
     0.00  DVGND    DELTA CHANGE VGND VEL., FT/SEC
     0.00  DWGND    DELTA CHANGE WGND VEL., FT/SEC
&CHANGE
&END
END OF RUN
```

Option RS: Run the Simulation

The RS option enables execution of GTRSIM with the input files (CONFIG.KEY and either SIMINP.DAT or another case-input file). You will be shown

Step 3: Run the Tilt-Rotor Simulation Program

and then prompted:

INPUT DATA FILE (Def: SIMINP) :

A null entry defaults to use of SIMINP.DAT as the case-input file. As GTRSIM begins executing, it reads the configuration parameters and displays

READING DATA FOR GROUP : CONTROL SYSTEM

(etc.)

The case-header information from your case-input file is next displayed, followed by a display of the names of each of the approximately 300 aerodynamic tables. If your case includes the trim-sweep case described earlier, you will see

```
CASE/COUNTER 111  GW = 12546.00,  U =  140.00
CASE/COUNTER 112  GW = 12546.00,  U =  160.00
CASE/COUNTER 113  GW = 12546.00,  U =  180.00
CASE/COUNTER 114  GW = 12546.00,  U =  200.00
CASE/COUNTER 121  GW = 12646.00,  U =  140.00
CASE/COUNTER 122  GW = 12646.00,  U =  160.00
CASE/COUNTER 123  GW = 12646.00,  U =  180.00
CASE/COUNTER 124  GW = 12646.00,  U =  200.00

CASE COMPLETED
```

When all cases have executed, control will be returned to the menu.

Option TS: Tabulate Sweep Results

This option lets you tabulate derived values of selected parameters for all of the points of the trim sweep. It also lets you display a block output of many parameters at any one trim point. GTRSIM stores values of 123 derived variables for each trim point in a keyed-access binary (not printable) file in your directory. A new version of this file, TRSOUT.SIM is created each time your GTRSIM run contains a trim-sweep case. You will be prompted:

Simulation filename :

The default filename for a null response is TRSOUT.SIM, but you may have kept an earlier version and wish to name it instead. The file contains the header information from the run as well as the run date/time and the sweep variables with their values. These are all displayed prior to the message

You can tabulate up to 9 output parameters from the trim sweep.
Type "?" to see the list.

and the prompt

Parameter for column 1 :

If you enter a "?" you will see

Simulation Output Parameters

1 A0L	2 A0R	3 A1L	4 A1R	5 ALPFD	6 AMBTMP
7 B1L	8 B1R	9 BETAD	10 BETFD	11 BLCG	12 CDALPH
13 CDFACT	14 CDL	15 CDLIM	16 CDMACH	17 CDR	18 CDRISL
19 CDRISR	20 CPL	21 CPR	22 CTELL	23 CTELR	24 CTL
25 CTR	26 DELA	27 DELE	28 DELR	29 DELSTD	30 DENALT
31 EASTG	32 FAFLPL	33 FAFLPR	34 FLAPS	35 G-LEVL	36 GAMMAD
37 GW	38 HEIGHT	39 HL	40 HPENG	41 HPEREQ	42 HPL
43 HPR	44 HR	45 IXX	46 IXZ	47 IYY	48 IZZ
49 JTL	50 JTR	51 LAMDAL	52 LAMDAR	53 LTFLPL	54 LTFLPR
55 MUL	56 MUR	57 NORTHG	58 OAT	59 OMEGAL	60 OMEGAR
61 P	62 PITCH	63 PITCHD	64 PRPEFL	65 PRPEFR	66 PRSALT
67 PTCHDD	68 Q	69 QF	70 QL	71 QR	72 R
73 RHO	74 RODESC	75 ROLL	76 ROLLD	77 ROLLDD	78 RPM
79 SD	80 SIGMAP	81 SLCG	82 THOLG	83 THORG	84 THETOL
85 THETOR	86 THETD	87 THETES	88 TIPMNL	89 TIPMNR	90 TIPVL

91 TIPVR	92 TL	93 TR	94 U	95 UGND	96 V
97 VGND	98 VKCAS	99 VT	100 W	101 WGND	102 WIL
103 WIR	104 WLCG	105 XCOL	106 XCOL %	107 XGNDD	108 XGNDDD
109 XLN	110 XLN %	111 XLT	112 XLT %	113 XPD	114 XPD %
115 YAW	116 YAWD	117 YAWDD	118 YGNDDD	119 YGNDD	120 YL
121 YR	122 ZGNDD	123 ZGNDDD			

If you enter the name of one of the output parameters, you will be shown its description and units, then prompted for another. This process terminates with a null response to the prompt for parameter. Had you entered VT, HPENG and HPR, you would see

1	VT	TOTAL VELOCITY	KNOTS
2	HPENG	ENGINE HORSEPOWER	HP
3	HPR	HORSEPOWER RIGHT ROTOR	HP

CNTR	TRIM-SWEEP VARIABLES	VT KNOTS	HPENG HP	HPR HP
111	GW = 12546.00, U = 140.00	140.00	445.96	404.76
112	GW = 12546.00, U = 160.00	160.00	470.60	427.68
113	GW = 12546.00, U = 180.00	180.00	540.93	493.09
114	GW = 12546.00, U = 200.00	200.00	626.49	572.66
121	GW = 12646.00, U = 140.00	140.00	448.96	407.51
122	GW = 12646.00, U = 160.00	160.00	473.25	430.15
123	GW = 12646.00, U = 180.00	180.00	543.30	495.30
124	GW = 12646.00, U = 200.00	200.00	628.20	574.25

After the trim-sweep tabulation, you will again be prompted for a list of parameters. If your first response is null, you will be asked

SNAPSHOT OF WHAT COUNTER:

If you respond with one of the available counter numbers (e.g., 123), you will see the block-print for that counter (trim point). A null response will return control to the GTRSIM interface menu.

Appendix A – UH-60

Difference From XV-15

Most of the examples in this User's Manual are taken from the XV-15 (703) database. While we have tried to make TRENDS generic, there are some differences between databases that require database-specific explanations or clarification. The XV-15 703 database is, by far, the oldest of the TRENDS databases at ARC and, consequently, the most general. Some of the database characteristics, such as .SPC time-history datatypes and specially-numbered hangar runs, are not found in the other databases. The UH-60 databases, 748, BH1, and BH2, are the next-largest and next in generality. This appendix explains some of the differences between the 703 database and the UH-60 databases.

1. **Minmax statistics:** The scalar measures (or minmax statistics) for the UH-60 databases differ from those for the XV-15. Thus, the format in VIEW is different and the extensions the user supplies in SEARCH or MINMAX/MULTIPLT for non-default statistics are different. The measures and extensions for UH-60 statistics are:

itemcode.AVG	arithmetic mean (default for no extension) of all time-history data points in the counter
itemcode.MAX	maximum of all time-history data points (equivalent of itemcode.CMX for XV-15)
itemcode.MIN	minimum of all time-history data points (equivalent of itemcode.CMN for XV-15)
itemcode.SD	standard deviation about the mean
itemcode.AVS	average-steady over all revs (same as XV-15)
itemcode.AVO	average-oscillatory (same as .OSC in XV-15)
itemcode.MX	max-oscillatory (same as .MAX in XV-15)
itemcode.SM	steady at max-oscillatory (same as XV-15)
itemcode.V95	95th-percentile vibratory -- the oscillatory value below which 95% of the revs fall

It should be noted that the default minmax statistic (when you don't supply an extension in SEARCH, MINMAX, or MULTIPLT) is the mean for UH-60, while it is the average-steady value for XV-15. The two are usually similar.

2. **Pseudo-items:** The derived "pseudo-items" differ from database to database. The UH-60 databases have time-history pseudo-items stored, while the XV-15 databases have only minmax (scalar) pseudo-items. A complete list of the pseudo-items can be found by using the DERIVED feature in the TRENDS menu.

3. **Harmonics:** Harmonic amplitudes and phases are computed and stored for selected items for both types of database, but fifteen (15) harmonics are stored for UH-60, while only six (6) are stored for XV-15. The list of selected items is available in FIND and/or HARMONICS by entering a question mark (?) at the prompt for item.

4. **Rates:** No rates are pre-computed and stored as scalars for UH-60 as they are for XV-15.

UH-60 Parameter Lists

ML Mnemonic-ordered list

Itemcodes currently active for flight 67

*T denotes available time history data

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
*T ABCLOCK	AIRBORNE CLOCK (T SINCE PRIME)	MSEC	TIAB		836/1
*T AC23	Co Pilot Vert Accel	g's	AC23	VP	418/1
*T AC24	Co Pilot Lat Accel	g's	AC24	VP	418/1
*T AC51	Fwd Cockpit Floor Vert	g's	AC51	VP	418/1
*T AC52	Fwd Cockpit Floor Lat	g's	AC52	VP	418/1
*T AC53	Pilot Vert Accel	g's	AC53	VP	418/1
*T AC54	Pilot Lat Accel	g's	AC54	VP	418/1
*T AC99	Pilot Long Accel	g's	AC99	VP	418/1
*T AE30	Accel Edgewise 30%R	g's	AE30	RA	357/1
*T AE50	Accel Edgewise 50%R	g's	AE50	RA	714/1
*T AE70	Accel Edgewise 70%R	g's	AE70	RA	714/1
*T AE90	Accel Edgewise 90%R	g's	AE90	RA	357/1
*T AF21	Fwd Cabin L Ver Ac	g's	AF21	VP	418/1
*T AF25	Aft Cabin L Ver Ac	g's	AF25	VP	418/1
*T AF51	Fwd Cabin R Ver Ac	g's	AF51	VP	418/1
*T AF52	Fwd Cabin R Lat Ac	g's	AF52	VP	418/1
*T AF53	Mid Cabin Right Vert	g's	AF53	VP	418/1
*T AF54	Mid Cabin Right Lat	g's	AF54	VP	418/1
*T AF55	Aft Cabin R Ver Ac	g's	AF55	VP	418/1
*T AF56	Aft Cabin R Lat Ac	g's	AF56	VP	418/1
*T AF57	FS 443 Vert	g's	AF57	VP	418/1
*T AF58	FS 443 Lat	g's	AF58	VP	418/1
*T AH01	Bifilar Accel 1	g's	AH01	RA	714/1
*T AH02	Bifilar Accel 2	g's	AH02	RA	357/1
*T AH03	Bifilar Accel 3	g's	AH03	RA	357/1
*T AH04	Bifilar Accel 4	g's	AH04	RA	357/1
*T AH0V	RDAS Outboard Accel Z	g's	AH0V	RA	2142/1
*T AH0X	Hub Accel X	g's	AH0X	RA	714/1
*T AH0Y	Hub Accel Y	g's	AH0Y	RA	357/1
*T AH0Z	Hub Accel Z	g's	AH0Z	RA	357/1
*T AH11	Hub Arm Accel 1	g's	AH11	RA	357/1
*T AH12	Hub Arm Accel 2	g's	AH12	RA	357/1
*T AH13	Hub Arm Accel 3	g's	AH13	RA	357/1
*T AH14	Hub Arm Accel 4	g's	AH14	RA	357/1
*T ALPHA	Angle of Attack	deg	DAA0	AP	209/1
*T AMF2	Mid Accel Flap 2	g's	AMF2	RA	714/1
*T AMF3	Mid Accel Flap 3	g's	AMF3	RA	357/1
*T AMF4	Mid Accel Flap 4	g's	AMF4	RA	2142/1
*T AMF5	Mid Accel Flap 5	g's	AMF5	RA	2142/1
*T AMU	Advance Ratio	-nd-	V0MU	DP	31/1
*T AN30	Accel Norm Fwd 30%R	g's	AN30	RA	714/1
*T AN31	Accel Norm Aft 30%R	g's	AN31	RA	357/1
*T AN50	Accel Norm Fwd 50%R	g's	AN50	RA	357/1
*T AN51	Accel Norm Aft 50%R	g's	AN51	RA	357/1

	Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
*T	AN70	Accel Norm Fwd 70%R	g's	AN70	RA	714/1
*T	AN71	Accel Norm Aft 70%R	g's	AN71	RA	714/1
*T	AN90	Accel Norm Fwd 90%R	g's	AN90	RA	357/1
*T	AN91	Accel Norm Aft 90%R	g's	AN91	RA	357/1
*T	ARF1	Root Accel Flap 1	g's	ARF1	RA	357/1
*T	ARF2	Root Accel Flap 2	g's	ARF2	RA	357/1
*T	ARF3	Root Accel Flap 3	g's	ARF3	RA	357/1
*T	ARF4	Root Accel Flap 4	g's	ARF4	RA	2142/1
*T	AT01	Mid Tail Cone Vert	g's	AT01	VP	418/1
*T	AT02	Mid Tail Cone Lat	g's	AT02	VP	418/1
*T	AT03	Int. Gear Box Vert	g's	AT03	VP	418/1
*T	AT07	Vert Tail Ver Ac	g's	AT07	VP	418/1
*T	AT08	Vert Tail Lat Ac	g's	AT08	VP	418/1
*T	AT25	Horz Tip L Vert	g's	AT25	VP	418/1
*T	AT55	Horz Tip R Vert	g's	AT55	VP	418/1
*T	ATF2	Tip Accel Flap 2	g's	ATF2	RA	2142/1
*T	ATF3	Tip Accel Flap 3	g's	ATF3	RA	714/1
*T	ATF4	Tip Accel Flap 4	g's	ATF4	RA	2142/1
*T	ATF5	Tip Accel Flap 5	g's	ATF5	RA	2142/1
*T	AX21	Lt Fwd Trans.Beam Vert	g's	AX21	VP	418/1
*T	AX23	Lt Aft Trns.Beam Vert	g's	AX23	VP	418/1
*T	AX51	RT Fwd Trns.Beam Vert	g's	AX51	VP	418/1
*T	AX52	RT Fwd Trns.Beam Lat	g's	AX52	VP	418/1
*T	AX53	RT Aft Trns.Beam Vert	g's	AX53	VP	418/1
*T	AX54	Rt Aft Trns.Beam Lat	g's	AX54	VP	418/1
*T	AXCG	Lin Accel Cg-Long	g's	DL00	TC	209/1
*T	AXCGC	AXCG Corrected to true CG	ft/s2	DL0C	DP	125/1
*T	AYCG	Lin Accel Cg-Lat	g's	DL01	TC	209/1
*T	AYCGC	AYCG Corrected to true CG	ft/s2	DL1C	DP	125/1
*T	AYCGSENS	Sensitive Lat Accel	g's	DL11	AP	209/1
*T	AZCG	Lin Accel Cg-Normal	g's	DL02	TC	209/1
*T	AZCGC	AZCG Corrected to true CG	ft/s2	DL2C	DP	125/1
*T	BE01	MR Root E Bending	in-lb	BE01	BL	357/1
*T	BE50	MR EB 50% R	in-lb	BE50	BL	357/1
*T	BETA	Angle of SD/SLP	deg	DSS0	AP	209/1
*T	BL19	Spare channel	none	BL19		209/1
*T	BN01	MR Root N Bending	in-lb	BN01	BL	357/1
*T	BN70	MR NB 70% R	in-lb	BN70	BL	357/1
*T	BP10	MR Pushrod Load (1)	lb	BP10	RP	357/1
*T	BP20	MR Pushrod Load (2)	lb	BP20	RP	714/1
*T	BP30	MR Pushrod Load (3)	lb	BP30	RP	357/1
*T	BP40	MR Pushrod Load (4)	lb	BP40	RP	357/1
*T	BR60	MR BR 60% R	psi	BR60	BL	357/1
*T	CART	Ballast Cart Pos	in	CART	AP	209/1
*T	CH91	System Health Monitor		CH91		209/1
*T	CH92	System Health Monitor		CH92		209/1
*T	COLLSTK	Control Pos Coll	%	D103	AP	209/1
*T	COUNT10	Run Counter	Counts			357/1
*T	COUNTER1	Run Counter	Counts			357/1
*T	COUNTER2	Run Counter	Counts			357/1
*T	COUNTER3	Run Counter	Counts			357/1
*T	COUNTER4	Run Counter	Counts			357/1
*T	COUNTER5	Run Counter	Counts			357/1
*T	COUNTER6	Run Counter	Counts			357/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
*T COUNTER7	Run Counter	Counts			357/1
*T COUNTER8	Run Counter	Counts			357/1
*T COUNTER9	Run Counter	Counts			357/1
*T CP	Coefficient of Power	-nd-	CP00	DP	31/1
*T CT	Coefficient of Thrust	-nd-	CT00	DP	31/1
*T DELTAB	Boom amb air press rat (drv)	-nd-	DLTA	DP	31/1
*T DMIXA	Mix in Pos Lat	%	DM01	AP	209/1
*T DMIXE	Mix in Pos Long	%	DM00	AP	209/1
*T DMIXR	Mix in Pos Dir	%	DM02	AP	209/1
*T EG01	#1 Engine Gas Gen Spd	%	EG01	EP	209/1
*T EG02	#2 Engine Gas Gen Spd	%	EG02	EP	209/1
*T EP01	#1 Eng Power Turb Spd	%	EP01	EP	209/1
*T EP02	#2 Eng Power Turb Spd	%	EP02	EP	209/1
*T FCTS1	Eng1 Fuel Tot	1 gal	EF01	EP	209/1
*T FCTS2	Eng2 Fuel Tot	1 gal	EF02	EP	209/1
*T FCTSAPU	APU Fuel Total	1 gal	EF03	EP	209/1
*T FLAP1	Corrected Blade 1 Flap	deg	FLP1	DP	357/1
*T FLAP2	Corrected Blade 2 Flap	deg	FLP2	DP	357/1
*T FLAP3	Corrected Blade 3 Flap	deg	FLP3	DP	357/1
*T FLAP4	Corrected Blade 4 Flap	deg	FLP4	DP	357/1
*T FUELTMP1	Eng1 Fuel Temp	deg-C	EF07	EP	209/1
*T FUELTMP2	Eng2 Fuel Temp	deg-C	EF08	EP	209/1
*T H001	Altitude (boom)	inHg	H001	TC	209/1
*T H002	Altitude (ship)	inHg	H002	TC	209/1
*T HDB	Boom density altitude	(drv) ft	HDB0	DP	31/1
*T HEADING	Heading	deg	DA02	TC	209/1
*T HPB	Pressure Altitude (Boom)	feet	HPB0	DP	31/1
*T HPS	Pressure Altitude (Ship)	feet	HPS0	DP	31/1
*T IMON	Current Monitor	Amps	IMON		209/1
*T ATSTK	Control Pos Lat	%	D101	TC	209/1
*T LEADLAG1	Corrected Blade 1 Leadlag	deg	LAG1	DP	357/1
*T LEADLAG2	Corrected Blade 2 Leadlag	deg	LAG2	DP	357/1
*T LEADLAG3	Corrected Blade 3 Leadlag	deg	LAG3	DP	357/1
*T LEADLAG4	Corrected Blade 4 Leadlag	deg	LAG4	DP	357/1
*T LONGSTK	Control Pos Long	%	D100	TC	209/1
*T LSSX	LowairX (LASSIE)	kts	VX03	TC	209/1
*T LSSXC	Calibrated Lassie X True	Knots	VX3C	DP	31/1
*T LSSY	LowairY (LASSIE)	kts	VY03	TC	209/1
*T LSSYC	Calibrated Lassie Y True	Knots	VY3C	DP	31/1
*T LSSZ	LowairZ (LASSIE)	ft/min	VZ03	TC	209/1
*T MGT1	Turb1 Exh Temp	deg-C	ET01	EP	209/1
*T MGT2	Turb2 Exh Temp	deg-C	ET02	EP	209/1
*T MR10	MR Link Load Fwd Sens	lb	MR10		836/1
*T MR11	MR Link Load Lat Sens	lb	MR11		836/1
*T MR13	MR Link Load Aft Sens	lb	MR13		836/1
*T MR14	MR Sta Scissors Sens	lb	MR14		836/1
*T MRALSS	MR Link Load Aft	lb	MR03	RP	836/1
*T MRFLAP1	MR Flapping (1)	deg	BH11	RP	357/1
*T MRFLAP2	MR Flapping (2)	deg	BH21	RP	357/1
*T MRFLAP3	MR Flapping (3)	deg	BH31	RP	714/1
*T MRFLAP4	MR Flapping (4)	deg	BH41	RP	357/1
*T MRFLSS	MR Link Load Fwd	lb	MR00	RP	836/1
*T MRLAG1	MR Lead-Lag (1)	deg	BH10	RP	357/1
*T MRLAG2	MR Lead-Lag (2)	deg	BH20	RP	357/1

	Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
*T	MRLAG3	MR Lead-Lag (3)	deg	BH30	RP	714/1
*T	MRLAG4	MR Lead-Lag (4)	deg	BH40	RP	357/1
*T	MRLSS	MR Link Load Lat	lb	MR01	RP	836/1
*T	MRPITCH1	MR Pitch (1)	deg	BH12	RP	357/1
*T	MRPITCH2	MR Pitch (2)	deg	BH22	RP	357/1
*T	MRPITCH3	MR Pitch (3)	deg	BH32	RP	357/1
*T	MRPITCH4	MR Pitch (4)	deg	BH42	RP	357/1
*T	MRSTASC	MR Sta scissors	lb	MR04	RP	836/1
*T	MRTRAZI	MR/TR 1/rev	Event	MRTR	RP	836/1
*T	MTIP	Advancing Tip Mach Number	Mach	VTIP	DP	31/1
*T	MUXTIM01	MUX CLOCK stream 1 (mod 3 sec)	SECE-4	TM01		2142/1
*T	MUXTIM02	MUX CLOCK stream 2 (mod 3 sec)	SECE-4	TM02		2142/1
*T	MUXTIM03	MUX CLOCK stream 3 (mod 3 sec)	SECE-4	TM03		2142/1
*T	MUXTIM04	MUX CLOCK stream 4 (mod 3 sec)	SECE-4	TM04		2142/1
*T	MUXTIM05	MUX CLOCK stream 5 (mod 3 sec)	SECE-4	TM05		2142/1
*T	MUXTIM06	MUX CLOCK stream 6 (mod 3 sec)	SECE-4	TM06		2142/1
*T	MUXTIM07	MUX CLOCK stream 7 (mod 3 sec)	SECE-4	TM07		2142/1
*T	MUXTIM08	MUX CLOCK stream 8 (mod 3 sec)	SECE-4	TM08		2142/1
*T	MUXTIM09	MUX CLOCK stream 9 (mod 3 sec)	SECE-4	TM09		2142/1
*T	MUXTIM10	MUX CLOCK stream 10 mod 3 sec	SECE-4	M10		2142/1
*T	MUXTIME	MUX CLOCK (T SINCE PRIME)	MSEC	TIMX		2142/1
*T	PEDAL	Control Pos Dir	%	D102	TC	209/1
*T	PITCHATT	Attitude Pitch	deg	DA00	TC	209/1
*T	PITCHC1	Corrected Blade 1 Pitch	deg	PTC1	DP	357/1
*T	PITCHC2	Corrected Blade 2 Pitch	deg	PTC2	DP	357/1
*T	PITCHC3	Corrected Blade 3 Pitch	deg	PTC3	DP	357/1
*T	PITCHC4	Corrected Blade 4 Pitch	deg	PTC4	DP	357/1
*T	PSAFT	Prim Servo Pos Aft	%	DP03	AP	209/1
*T	PSFWD	Prim Servo Pos For	%	DP00	AP	209/1
*T	PSLAT	Prim Servo Pos Lat	%	DP01	AP	209/1
*T	PTCHACC	Pitch Accel	d/s2	DAC0	TC	209/1
*T	PTCHRATE	Angular Rate Pitch	d/s	DR00	TC	209/1
*T	QEIC1	Eng1 Shaft Q	ft-lb	EQ01	EP	209/1
*T	QEIC2	Eng2 Shaft Q	ft-lb	EQ02	EP	209/1
*T	QTR2	TR Shaft Q	in-lb	RQ20	AP	836/1
*T	QTR3	TR Shaft Q	in-lb	RQ21	AP	836/1
*T	RADALT	Altitude (Radar)	ft	H003	TC	209/1
*T	RDASE0	Main Frame Sync Errors	Status			836/1
*T	RDASE1	TLZR 1-3 Col	Errors			209/1
*T	RDASE2	TLZR 4 Col (MSD)	Errors			209/1
*T	RECNO	Record No.		RECN		836/1
*T	RL01	Damper Load 1	lb's	RL01	RP	357/1
*T	RL02	Damper Load 2	lb's	RL02	RP	357/1
*T	RL03	Damper Load 3	lb's	RL03	RP	357/1
*T	RL04	Damper Load 4	lb's	RL04	RP	357/1
*T	ROLLACC	Roll Accel	d/s2	DAC1	TC	209/1
*T	ROLLATT	Attitude Roll	deg	DA01	TC	209/1
*T	ROLLRATE	Angular Rate Roll	d/s	DR01	TC	209/1
*T	ROTOR1	Rotor Position	deg	MRZ1	RP	2142/1
*T	ROTOR10	Rotor Position	deg	MRZ0	RP	2142/1
*T	ROTOR2	Rotor Position	deg	MRZ2	RP	2142/1
*T	ROTOR3	Rotor Position	deg	MRZ3	RP	2142/1
*T	ROTOR4	Rotor Position	deg	MRZ4	RP	2142/1
*T	ROTOR5	Rotor Position	deg	MRZ5	RP	2142/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
*T ROTOR6	Rotor Position	deg	MRZ6	RP	2142/1
*T ROTOR7	Rotor Position	deg	MRZ7	RP	2142/1
*T ROTOR8	Rotor Position	deg	MRZ8	RP	2142/1
*T ROTOR9	Rotor Position	deg	MRZ9	RP	2142/1
*T RP01	Damper Position		RP01	RP	714/1
*T RPMMR	Rotor Speed	rpm	VR04	TC	209/1
*T RQ10	MR Torque	ft-lb	RQ10	RP	357/1
*T RQ11	MR Shaft Bending	in-lb	RQ11	RP	357/1
*T RQ12	MR Shaft Upper Bending	in-lbs	RQ12	RP	714/1
*T SASA	SAS Out Pos Lat	%	DS01	AP	209/1
*T SASE	SAS Out Pos Long	%	DS00	AP	209/1
*T SASR	SAS Out Pos Dir	%	DS02	AP	209/1
*T SE01	Edgewise Bending Root	in-lb	SE01	BL	714/1
*T SE20	Edgewise Bending 20%R	in-lb	SE20	BL	714/1
*T SE30	Edgewise Bending 30%R	in-lb	SE30	BL	714/1
*T SE40	Edgewise Bending 40%R	in-lb	SE40	BL	714/1
*T SE50	Edgewise Bending 50%R	in-lb	SE50	BL	357/1
*T SE60	Edgewise Bending 60%R	in-lb	SE60	BL	357/1
*T SE70	Edgewise Bending 70%R	in-lb	SE70	BL	357/1
*T SE80	Edgewise Bending 80%R	in-lb	SE80	BL	714/1
*T SFID	Sub frame ID		SF11		836/1
*T SFID1	Sub frame ID - Stream 1		SF01		2142/1
*T SFID10	Sub frame ID - Stream 10		SF10		2142/1
*T SFID2	Sub frame ID - Stream 2		SF02		2142/1
*T SFID3	Sub frame ID - Stream 3		SF03		2142/1
*T SFID4	Sub frame ID - Stream 4		SF04		2142/1
*T SFID5	Sub frame ID - Stream 5		SF05		2142/1
*T SFID6	Sub frame ID - Stream 6		SF06		2142/1
*T SFID7	Sub frame ID - Stream 7		SF07		2142/1
*T SFID8	Sub frame ID - Stream 8		SF08		2142/1
*T SFID9	Sub frame ID - Stream 9		SF09		2142/1
*T SHP1	Shaft HP Engine 1	Hp	SHP1	DP	125/1
*T SHP2	Shaft HP Engine 2	Hp	SHP	DP	125/1
*T SHPMR	Main Rotor Shaft HP	Hp	MRHP	DP	125/1
*T SHPT	Combined Engine Shaft HP	Hp	ESHP	DP	125/1
*T SHPTR	Tail Rotor Shaft HP	Hp	TRHP	DP	125/1
*T SIGMAB	Boom air density ratio (drv)	-nd-	SGMA	DP	31/1
*T SN01	Normal Bending Root	in-lb	SN01	BL	357/1
*T SN20	Normal Bending 20%R	in-lb	SN20	BL	357/1
*T SN30	Normal Bending 30%R	in-lb	SN30	BL	714/1
*T SN40	Normal Bending 40%R	in-lb	SN40	BL	714/1
*T SN50	Normal Bending 50%R	in-lb	SN50	BL	357/1
*T SN60	Normal Bending 60%R	in-lb	SN60	BL	357/1
*T SN70	Normal Bending 70%R	in-lb	SN70	BL	357/1
*T SN80	Normal Bending 80%R	in-lb	SN80	BL	714/1
*T SN90	Normal Bending 90%R	in-lb	SN90	BL	357/1
*T ST30	Torsional Bending 30%R	in-lb	ST30	BL	714/1
*T ST50	Torsional Bending 50%R	in-lb	ST50	BL	714/1
*T ST70	Torsional Bending 70%R	in-lb	ST70	BL	714/1
*T ST90	Torsional Bending 90%R	in-lb	ST90	BL	714/1
*T STABLR	Stab Position	deg	D003	AP	209/1
*T T100	OAT	deg-C	T100	TC	209/1
*T THETA	Air temperature ratio(drv)	-nd-	THTA	DP	31/1
*T TRIP	TR Imprest Pitch	deg	R021	AP	209/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
*TUBODYBC	Boom long velocity /cg(drv)	ft/s	VXCG	DP	31/1
*T V001	Airspeed (boom)	inHg	V001	TC	209/1
*T V002	Airspeed (ship)	inHg	V002	TC	209/1
*T VBODYBC	Boom lat velocity /cg(drv)	ft/s	VYCG	DP	31/1
*T VCALB	Boom calibrated airsp.(drv)	kt	VCAB	DP	31/1
*T VCALS	Ship calibrated airsp.(drv)	kt	VCAS	DP	31/1
*T VICB	Indicated Boom Airspeed (corr)	kt	VICB	DP	31/1
*T VR05DRPM	DIGITAL RPM	RPM	VR05	TC	209/1
*T VT	True Boom/Lassie Airspeed	kt	VTRU	DP	31/1
*T VTB	Boom true airspeed	(drv) kt	VTAS	DP	31/1
*T WBODYBC	Boom vert velocity /cg(drv)	ft/s	VZCG	DP	31/1
*T WFVOL1	Eng1 Fuel Rate	g/hr	EF05	EP	209/1
*T WFVOL2	Eng2 Fuel Rate	g/hr	EF06	EP	209/1
*T X2A6	Spare RDAS Channel	none	X2A6		357/1
*T X2A7	Spare RDAS Channel	none	X2A7		357/1
*T YAWACC	Yaw Accel	d/s2	DAC2	TC	209/1
*T YAWRATE	Angular Rate Yaw	d/s	DR02	TC	209/1

UH-60 Pressure Sensors – RDAS System

NOTE:

All pressure sensors listed here generate time-history data.

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
DELTAB	Boom amb air press rat (drv)	-nd-	DLTA	DP	31/1
HPB	Pressure Altitude (Boom)	feet	HPB0	DP	31/1
HPS	Pressure Altitude (Ship)	feet	HPS	DP	31/1
P101	Pres 1.0%Chrd 22.5%R Top	psia	P101	PM	2142/1
P103	Pres 4.9%Chrd 22.5%R Top	psia	P103	PM	2142/1
P105	Pres 10.7%Chrd 22.5%R Top	psia	P105	PM	2142/1
P106	Pres 16.4%Chrd 22.5%R Top	psia	P106	PM	2142/1
P107	Pres 20.3%Chrd 22.5%R Top	psia	P107	PM	2142/1
P108	Pres 25.0%Chrd 22.5%R Top	psia	P108	PM	2142/1
P110	Pres 39.5%Chrd 22.5%R Top	psia	P110	PM	2142/1
P113	Pres 60.7%Chrd 22.5%R Top	psia	P113	PM	2142/1
P114	Pres 81.8%Chrd 22.5%R Top	psia	P114	PM	2142/1
P115	Pres 96.3%Chrd 22.5%R Top	psia	P115	PM	2142/1
P151	Pres 1.0%Chrd 22.5%R Bot	psia	P151	PM	2142/1
P153	Pres 4.9%Chrd 22.5%R Bot	psia	P153	PM	2142/1
P155	Pres 10.7%Chrd 22.5%R Bot	psia	P155	PM	2142/1
P156	Pres 16.4%Chrd 22.5%R Bot	psia	P156	PM	2142/1
P157	Pres 20.3%Chrd 22.5%R Bot	psia	P157	PM	2142/1
P158	Pres 25.0%Chrd 22.5%R Bot	psia	P158	PM	2142/1
P160	Pres 39.5%Chrd 22.5%R Bot	psia	P160	PM	2142/1
P163	Pres 60.7%Chrd 22.5%R Bot	psia	P163	PM	2142/1
P164	Pres 81.8%Chrd 22.5%R Bot	psia	P164	PM	2142/1
P165	Pres 96.3%Chrd 22.5%R Bot	psia	P165	PM	2142/1
P201	Pres 1.0%Chrd 44.0%R Top	psia	P201	PM	2142/1
P203	Pres 4.9%Chrd 44.0%R Top	psia	P203	PM	2142/1
P205	Pres 10.7%Chrd 44.0%R Top	psia	P205	PM	2142/1
P206	Pres 16.4%Chrd 44.0%R Top	psia	P206	PM	2142/1
P207	Pres 20.3%Chrd 44.0%R Top	psia	P207	PM	2142/1
P208	Pres 25.0%Chrd 44.0%R Top	psia	P208	PM	2142/1
P210	Pres 39.5%Chrd 44.0%R Top	psia	P210	PM	2142/1
P213	Pres 60.7%Chrd 44.0%R Top	psia	P213	PM	2142/1
P214	Pres 81.8%Chrd 44.0%R Top	psia	P214	PM	2142/1
P215	Pres 96.3%Chrd 44.0%R Top	psia	P215	PM	2142/1
P251	Pres 1.0%Chrd 44.0%R Bot	psia	P251	PM	2142/1
P253	Pres 4.9%Chrd 44.0%R Bot	psia	P253	PM	2142/1
P255	Pres 10.7%Chrd 44.0%R Bot	psia	P255	PM	2142/1
P256	Pres 16.4%Chrd 44.0%R Bot	psia	P256	PM	2142/1
P257	Pres 20.3%Chrd 44.0%R Bot	psia	P257	PM	2142/1
P258	Pres 25.0%Chrd 44.0%R Bot	psia	P258	PM	2142/1
P260	Pres 39.5%Chrd 44.0%R Bot	psia	P260	PM	2142/1
P263	Pres 60.7%Chrd 44.0%R Bot	psia	P263	PM	2142/1
P264	Pres 81.8%Chrd 44.0%R Bot	psia	P264	PM	2142/1
P265	Pres 96.3% hrd 44.0%R Bot	psia	P265	PM	2142/1
P301	Pres 1.0%Chrd 55.0%R Top	psia	P301	PM	2142/1
P303	Pres 4.9%Chrd 55.0%R Top	psia	P303	PM	2142/1
P305	Pres 10.7%Chrd 55.0%R Top	psia	P305	PM	2142/1
P306	Pres 16.4%Chrd 55.0%R Top	psia	P306	PM	2142/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
P307	Pres 20.3%Chrd 55.0%R Top	psia	P307	PM	2142/1
P308	Pres 25.0%Chrd 55.0%R Top	psia	P308	PM	2142/1
P310	Pres 39.5%Chrd 55.0%R Top	psia	P310	PM	2142/1
P313	Pres 60.7%Chrd 55.0%R Top	psia	P313	PM	2142/1
P314	Pres 81.8%Chrd 55.0%R Top	psia	P314	PM	2142/1
P315	Pres 96.3%Chrd 55.0%R Top	psia	P315	PM	2142/1
P351	Pres 1.0%Chrd 55.0%R Bot	psia	P351	PM	2142/1
P353	Pres 4.9%Chrd 55.0%R Bot	psia	P353	PM	2142/1
P355	Pres 10.7%Chrd 55.0%R Bot	psia	P355	PM	2142/1
P356	Pres 16.4%Chrd 55.0%R Bot	psia	P356	PM	2142/1
P357	Pres 20.3%Chrd 55.0%R Bot	psia	P357	PM	2142/1
P358	Pres 25.0%Chrd 55.0%R Bot	psia	P358	PM	2142/1
P360	Pres 39.5%Chrd 55.0%R Bot	psia	P360	PM	2142/1
P363	Pres 60.7%Chrd 55.0%R Bot	psia	P363	PM	2142/1
P364	Pres 81.8%Chrd 55.0%R Bot	psia	P364	PM	2142/1
P365	Pres 96.3%Chrd 55.0%R Bot	psia	P365	PM	2142/1
P401	Pres 1.0%Chrd 67.5%R Top	psia	P401	PM	2142/1
P403	Pres 4.9%Chrd 67.5%R Top	psia	P403	PM	2142/1
P405	Pres 10.7%Chrd 67.5%R Top	psia	P405	PM	2142/1
P406	Pres 16.4%Chrd 67.5%R Top	psia	P406	PM	2142/1
P407	Pres 20.3%Chrd 67.5%R Top	psia	P407	PM	2142/1
P408	Pres 25.0%Chrd 67.5%R Top	psia	P408	PM	2142/1
P410	Pres 39.5%Chrd 67.5%R Top	psia	P410	PM	2142/1
P413	Pres 60.7%Chrd 67.5%R Top	psia	P413	PM	2142/1
P414	Pres 81.8%Chrd 67.5%R Top	psia	P414	PM	2142/1
P415	Pres 96.3%Chrd 67.5%R Top	psia	P415	PM	2142/1
P421	Pres 1.0%Chrd 70.8%R Top	psia	P421	PM	2142/1
P423	Pres 4.9%Chrd70.8%R Top	psia	P423	PM	2142/1
P431	Pres 1.0%Chrd 74.1%R Top	psia	P431	PM	2142/1
P433	Pres 4.9%Chrd 74.1%R Top	psia	P433	PM	2142/1
P451	Pres 1.0%Chrd 67.5%R Bot	psia	P451	PM	2142/1
P453	Pres 4.9%Chrd 67.5%R Bot	psia	P453	PM	2142/1
P455	Pres 10.7%Chrd 67.5%R Bot	psia	P455	PM	2142/1
P456	Pres 16.4%Chrd 67.5%R Bot	psia	P456	PM	2142/1
P457	Pres 20.3%Chrd 67.5%R Bot	psia	P457	PM	2142/1
P458	Pres 25.0%Chrd 67.5%R Bot	psia	P458	PM	2142/1
P460	Pres 39.5%Chrd 67.5%R Bot	psia	P460	PM	2142/1
P463	Pres 60.7%Chrd 67.5%R Bot	psia	P463	PM	2142/1
P464	Pres 81.8%Chrd 67.5%R Bot	psia	P464	PM	2142/1
P465	Pres 96.3%Chrd 67.5%R Bot	psia	P465	PM	2142/1
P473	Pres 4.9%Chrd 70.8%R Bot	psia	P473	PM	2142/1
P483	Pres 4.9%Chrd 74.1%R Bot	psia	P483	PM	2142/1
P501	Pres 1.0%Chrd 77.5%R Top	psia	P501	PM	2142/1
P502	Pres 3.0%Chrd 77.5%R Top	psia	P502	PM	2142/1
P503	Pres 4.9%Chrd 77.5%R Top	psia	P503	PM	2142/1
P504	Pres 8.0%Chrd 77.5%R Top	psia	P504	PM	2142/1
P505	Pres 10.7%Chrd 77.5%R Top	psia	P505	PM	2142/1
P506	Pres 16.4%Chrd 77.5%R Top	psia	P506	PM	2142/1
P507	Pres 20.3%Chrd 77.5%R Top	psia	P507	PM	2142/1
P508	Pres 25.0%Chrd 77.5%R Top	psia	P508	PM	2142/1
P510	Pres 25.0%Chrd 77.5%R Top	psia	P510	PM	2142/1
P513	Pres 60.7%Chrd 77.5%R Top	psia	P513	PM	2142/1
P514	Pres 81.8%Chrd 77.5%R Top	psia	P514	PM	2142/1
P515	Pres 96.3%Chrd 77.5%R Top	psia	P515	PM	2142/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
P521	Pres1.0%Chrd 80.5%R Top	psia	P521	PM	2142/1
P523	Pres 4.9%Chrd 80.5%R Top	psia	P523	PM	2142/1
P531	Pres 1.0%Chrd 83.5%R Top	psia	P531	PM	2142/1
P533	Pres 4.9%Chrd 83.5%R Top	psia	P533	PM	2142/1
P551	Pres 1.0%Chrd 77.5%R Bot	psia	P551	PM	2142/1
P552	Pres 3.0%C hrd 77.5%R Bot	psia	P552	PM	2142/1
P553	Pres 4.9%Chrd 77.5%R Bot	psia	P553	PM	2142/1
P554	Pres 8.0%Chrd 77.5%R Bot	psia	P554	PM	2142/1
P555	Pres 10.7%Chrd 77.5%R Bot	psia	P555	PM	2142/1
P556	Pres 16.4%Chrd 77.5%R Bot	psia	P556	PM	2142/1
P557	Pres 20.3%Chrd 77.5%R Bot	psia	P557	PM	2142/1
P558	Pres 25.0%Chrd 77.5%R Bot	psia	P558	PM	2142/1
P560	Pres 60.7%Chr77.5.0%R Top	psia	P560	PM	2142/1
P563	Pres 60.7%Chrd 77.5%R Bot	psia	P563	PM	2142/1
P564	Pres 81.8%Chrd 77.5%R Bot	psia	P564	PM	2142/1
P565	Pres 96.3%Chrd 77.5%R Bot	psia	P565	PM	2142/1
P573	Pres 4.9%Chrd 80.5%R Bot	psia	P573	PM	2142/1
P583	Pres 4.9%Chrd 83.5%R Bot	psia	P583	PM	2142/1
P601	Pres 1.0%Chrd 86.5%R Top	psia	P601	PM	2142/1
P602	Pres 3.0%Chrd 86.5%R Top	psia	P602	PM	2142/1
P603	Pres 4.9%Chrd 86.5%R Top	psia	P603	PM	2142/1
P604	Pres 8.0%Chrd 86.5%R Top	psia	P604	PM	2142/1
P605	Pres 10.7%Chrd 86.5%R Top	psia	P605	PM	2142/1
P606	Pres 16.4%Chrd 86.5%R Top	psia	P606	PM	2142/1
P607	Pres 20.3%Chrd 86.5%R Top	psia	P607	PM	2142/1
P608	Pres 25.0%Chrd 86.5%R Top	psia	P608	PM	2142/1
P609	Pres 32.0%Chrd 86.5%R Top	psia	P609	PM	2142/1
P610	Pres 39.5%Chrd 86.5%R Top	psia	P610	PM	2142/1
P611	Pres 46.0%Chrd 86.5%R Top	psia	P611	PM	2142/1
P612	Pres 53.0%Chrd 86.5%R Top	psia	P612	PM	2142/1
P613	Pres 60.7%Chrd 86.5%R Top	psia	P613	PM	2142/1
P614	Pres 81.8%Chrd 86.5%R Top	psia	P614	PM	2142/1
P615	Pres 96.3%Chrd 86.5%R Top	psia	P615	PM	2142/1
P621	Pres 1.0%Chrd 89.1%R Top	psia	P621	PM	2142/1
P623	Pres 4.9%Chrd 89.1%R Top	psia	P623	PM	2142/1
P651	Pres 1.0%Chrd 86.5%R Bot	psia	P651	PM	2142/1
P652	Pres 3.0%Chrd 86.5%R Bot	psia	P652	PM	2142/1
P653	Pres 4.9%Chrd 86.5%R Bot	psia	P653	PM	2142/1
P654	Pres 8.0%Chrd 86.5%R Bot	psia	P654	PM	2142/1
P655	Pres 10.7%Chrd 86.5%R Bot	psia	P655	PM	2142/1
P656	Pres 16.4%Chrd 86.5%R Bot	psia	P656	PM	2142/1
P657	Pres 20.3%Chrd 86.5%R Bot	psia	P657	PM	2142/1
P658	Pres 25.0%Chrd 86.5%R Bot	psia	P658	PM	2142/1
P659	Pres 32.0%Chrd 86.5%R Bot	psia	P659	PM	2142/1
P660	Pres 39.5%Chrd 86.5%R Bot	psia	P660	PM	2142/1
P663	Pres 60.7%Chrd 86.5%R Bot	psia	P663	PM	2142/1
P664	Pres 81.8%Chrd 86.5%R Bot	psia	P664	PM	2142/1
P665	Pres 96.3%Chrd 86.5%R Bot	psia	P665	PM	2142/1
P673	Pres 4.9%Chrd 89.1%R Bot	psia	P673	PM	2142/1
P701	Pres 1.0%Chrd 92.0%R Top	psia	P701	PM	2142/1
P702	Pres 3.0%Chrd 92.0%R Top	psia	P702	PM	2142/1
P703	Pres 4.7%Chrd 92.0%R Top	psia	P703	PM	2142/1
P704	Pres 8.0%Chrd 92.0%R Top	psia	P704	PM	2142/1
P705	Pres 10.7%Chrd 92.0%R Top	psia	P705	PM	2142/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
P706	Pres 16.4%Chrd 92.0%R Top	psia	P706	PM	2142/1
P707	Pres 20.3%Chrd 92.0%R Top	psia	P707	PM	2142/1
P708	Pres 25.0%Chrd 92.0%R Top	psia	P708	PM	2142/1
P709	Pres 32.0%Chrd 92.0%R Top	psia	P709	PM	2142/1
P710	Pres 39.5%Chrd 92.0%R Top	psia	P710	PM	2142/1
P711	Pres 46.0%Chrd 92.0%R Top	psia	P711	PM	2142/1
P712	Pres 53.0%Chrd 92.0%R Top	psia	P712	PM	2142/1
P713	Pres 60.7%Chrd 92.0%R Top	psia	P713	PM	2142/1
P714	Pres 81.8%Chrd 92.0%R Top	psia	P714	PM	2142/1
P715	Pres 96.3%Chrd 92.0%R Top	psia	P715	PM	2142/1
P721	Pres 1.0%Chrd 94.3%R Top	psia	P721	PM	2142/1
P723	Pres 4.9%Chrd 94.3%R Top	psia	P723	PM	2142/1
P751	Pres 1.0%Chrd 92.0%R Bot	psia	P751	PM	2142/1
P752	Pres 3.0%Chrd 92.0%R Bot	psia	P752	PM	2142/1
P753	Pres 4.9%Chrd 92.0%R Bot	psia	P753	PM	2142/1
P754	Pres 8.0%Chrd 92.0%R Bot	psia	P754	PM	2142/1
P755	Pres 10.7%Chrd 92.0%R Bot	psia	P755	PM	2142/1
P756	Pres 16.4%Chrd 92.0%R Bot	psia	P756	PM	2142/1
P757	Pres 20.3%Chrd 92.0%R Bot	psia	P757	PM	2142/1
P758	Pres 25.0%Chrd 92.0%R Bot	psia	P758	PM	2142/1
P759	Pres 32.0%Chrd 92.0%R Bot	psia	P759	PM	2142/1
P760	Pres 39.5%Chrd 92.0%R Bot	psia	P760	PM	2142/1
P761	Pres 46.0%Chrd 92.0%R Bot	psia	P761	PM	2142/1
P763	Pres 60.7%Chrd 92.0%R Bot	psia	P763	PM	2142/1
P764	Pres 81.8%Chrd 92.0%R Bot	psia	P764	PM	2142/1
P765	Pres 96.3%Chrd 92.0%R Bot	psia	P765	PM	2142/1
P773	Pres 4.9%Chrd 94.3%R Bot	psia	P773	PM	2142/1
P801	Pres 1.0%Chrd 96.5%R Top	psia	P801	PM	2142/1
P802	Pres 3.0%Chrd 96.5%R Top	psia	P802	PM	2142/1
P803	Pres 4.7%Chrd 96.5%R Top	psia	P803	PM	2142/1
P804	Pres 8.0%Chrd 96.5%R Top	psia	P804	PM	2142/1
P805	Pres 10.7%Chrd 96.5%R Top	psia	P805	PM	2142/1
P806	Pres 16.4%Chrd 96.5%R Top	psia	P806	PM	2142/1
P807	Pres 20.3%Chrd 96.5%R Top	psia	P807	PM	2142/1
P808	Pres 25.0%Chrd 96.5%R Top	psia	P808	PM	2142/1
P809	Pres 32.0%Chrd 96.5%R Top	psia	P809	PM	2142/1
P810	Pres 39.5%Chrd 96.5%R Top	psia	P810	PM	2142/1
P811	Pres 46.0%Chrd 96.5%R Top	psia	P811	PM	2142/1
P812	Pres 53.0%Chrd 96.5%R Top	psia	P812	PM	2142/1
P813	Pres 60.7%Chrd 96.5%R Top	psia	P813	PM	2142/1
P814	Pres 81.8%Chrd 96.5%R Top	psia	P814	PM	2142/1
P815	Pres 96.3%Chrd 96.5%R Top	psia	P815	PM	2142/1
P821	Pres 1.0%Chrd 97.5%R Top	psia	P821	PM	2142/1
P823	Pres 4.9%Chrd 97.5%R Top	psia	P823	PM	2142/1
P851	Pres 1.0%Chrd 96.5%R Bot	psia	P851	PM	2142/1
P852	Pres 3.0%Chrd 96.5%R Bot	psia	P852	PM	2142/1
P853	Pres 4.9%Chrd 96.5%R Bot	psia	P853	PM	2142/1
P854	Pres 8.0%Chrd 96.5%R Bot	psia	P854	PM	2142/1
P855	Pres 10.7%Chrd 96.5%R Bot	psia	P855	PM	2142/1
P856	Pres 16.4%Chrd 96.5%R Bot	psia	P856	PM	2142/1
P857	Pres 20.3%Chrd 96.5%R Bot	psia	P857	PM	2142/1
P858	Pres 25.0%Chrd 96.5%R Bot	psia	P858	PM	2142/1
P859	Pres 32.0%Chrd 96.5%R Bot	psia	P859	PM	2142/1
P860	Pres 39.5%Chrd 96.5%R Bot	psia	P860	PM	2142/1

Mnemonic	Description	Units	Item Code	Grp	Input Rate/Dec
P861	Pres 46.0%Chrd 96.5%R Bot	psia	P861	PM	2142/1
P862	Pres 53.0%Chrd 96.5%R Bot	psia	P862	PM	2142/1
P863	Pres 60.7%Chrd 96.5%R Bot	psia	P863	PM	2142/1
P864	Pres 81.8%Chrd 96.5%R Bot	psia	P864	PM	2142/1
P865	Pres 96.3%Chrd 96.5%R Bot	psia	P865	PM	2142/1
P873	Pres 4.9%Chrd 97.5%R Bot	psia	P873	PM	2142/1
P901	Pres 1.0%Chrd 99.0%R Top	psia	P901	PM	2142/1
P902	Pres 3.0%Chrd 99.0%R Top	psia	P902	PM	2142/1
P903	Pres 4.9%Chrd 99.0%R Top	psia	P903	PM	2142/1
P904	Pres 8.0%Chrd 99.0%R Top	psia	P904	PM	2142/1
P905	Pres 10.7%Chrd 99.0%R Top	psia	P905	PM	2142/1
P906	Pres 16.4%Chrd 99.0%R Top	psia	P906	PM	2142/1
P907	Pres 20.3%Chrd 99.0%R Top	psia	P907	PM	2142/1
P908	Pres 25.0%Chrd 99.0%R Top	psia	P908	PM	2142/1
P909	Pres 32.0%Chrd 99.0%R Top	psia	P909	PM	2142/1
P910	Pres 39.5%Chrd 99.0%R Top	psia	P910	PM	2142/1
P911	Pres 46.0%Chrd 99.0%R Top	psia	P911	PM	2142/1
P912	Pres 53.0%Chrd 99.0%R Top	psia	P912	PM	2142/1
P913	Pres 60.7%Chrd 99.0%R Top	psia	P913	PM	2142/1
P914	Pres 81.8%Chrd 99.0%R Top	psia	P914	PM	2142/1
P915	Pres 96.3%Chrd 99.0%R Top	psia	P915	PM	2142/1
P951	Pres 1.0%Chrd 99.0%R Bot	psia	P951	PM	2142/1
P952	Pres 3.0%Chrd 99.0%R Bot	psia	P952	PM	2142/1
P953	Pres 4.9%Chrd 99.0%R Bot	psia	P953	PM	2142/1
P954	Pres 8.0%Chrd 99.0%R Bot	psia	P954	PM	2142/1
P955	Pres 10.7%Chrd 99.0%R Bot	psia	P955	PM	2142/1
P956	Pres 16.4%Chrd 99.0%R Bot	psia	P956	PM	2142/1
P957	Pres 20.3%Chrd 99.0%R Bot	psia	P957	PM	2142/1
P958	Pres 25.0%Chrd 99.0%R Bot	psia	P958	PM	2142/1
P959	Pres 32.0%Chrd 99.0%R Bot	psia	P959	PM	2142/1
P960	Pres 39.5%Chrd 99.0%R Bot	psia	P960	PM	2142/1
P961	Pres 46.0%Chrd 99.0%R Bot	psia	P961	PM	2142/1
P962	Pres 53.0%Chrd 99.0%R Bot	psia	P962	PM	2142/1
P963	Pres 60.7%Chrd 99.0%R Bot	psia	P963	PM	2142/1
P964	Pres 81.8%Chrd 99.0%R Bot	psia	P964	PM	2142/1
P965	Pres 96.3%Chrd 99.0%R Bot	psia	P965	PM	2142/1
TRIP	TR Imprest Pitch	deg	R021	AP	209/1

UH-60 Derived Parameters

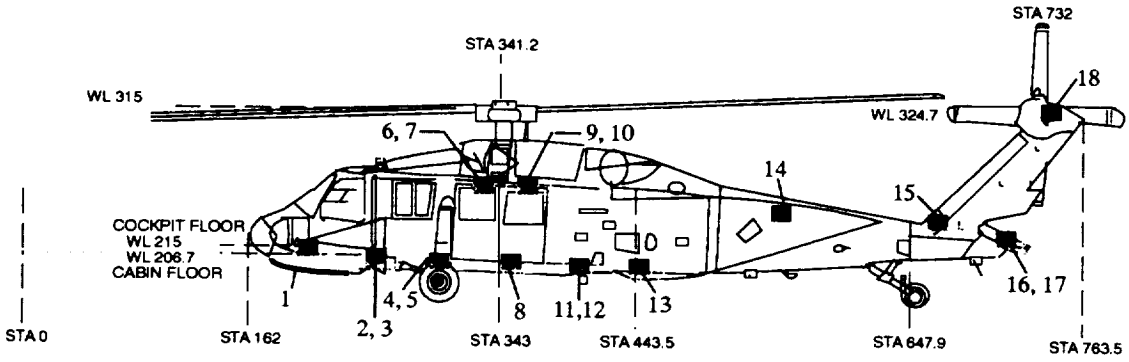
* The following derived pseudo-items with *T have time-history data in TRENDS. All have parameter statistics.

*T	AMU	Advance Ratio	-nd-	V0MU
*T	AXCGC	AXCG Corrected to true CG	ft/s2	DL0C
*T	AYCGC	AYCG Corrected to true CG	ft/s2	DL1C
*T	AZCGC	AZCG Corrected to true CG	ft/s2	DL2C
*T	CP	Coefficient of Power	-nd-	CP00
*T	CT	Coefficient of Thrust	-nd-	CT00
*T	CTTR	THRUST COEFF. - TAIL ROTOR	NONE	CTTR
*T	DELSTAB	STABILATOR ANGLE DIFF/IDEAL	DEGS	DSTB
	DELTAB	Boom amb air press rat (drv)	-nd-	DLTA
*T	EQ1C	Corrected Shaft Torque Engine1	ft-lb	EQ1C
*T	EQ2C	Corrected Shaft Torque Engine2	ft-lb	EQ2C
*T	FLAP1	Corrected Blade 1 Flap	deg	FLP1
*T	FLAP2	Corrected Blade 2 Flap	deg	FLP2
*T	FLAP3	Corrected Blade 3 Flap	deg	FLP3
*T	FLAP4	Corrected Blade 4 Flap	deg	FLP4
	FSCG	Fuselage Station C. G.	inches	FSCG
*T	GW	Aircraft gross weight (drv)	lb	FSGW
*T	H3DP	Static Pressure	Psia	H3DP
	HDB	Boom density altitude (drv)	ft	HDB0
	HDG_TRU	True Heading	Deg	DA12
	HPB	Pressure Altitude (Boom)	feet	HPB0
	HPS	Pressure Altitude (Ship)	feet	HPS0
*T	LEADLAG1	Corrected Blade 1 Leadlag	deg	LAG1
*T	LEADLAG2	Corrected Blade 2 Leadlag	deg	LAG2
*T	LEADLAG3	Corrected Blade 3 Leadlag	deg	LAG3
*T	LEADLAG4	Corrected Blade 4 Leadlag	deg	LAG4
*T	LSSXC	Calibrated Lassie X True	Knots	VX3C
*T	LSSYC	Calibrated Lassie Y True	Knots	VY3C
*T	MQIN	Main Rotor Shaft Torque	In-Lb	MQIN
*T	MTIP	Advancing Tip Mach Number	Mach	VTIP
*T	PITCHC1	Corrected Blade 1 Pitch	deg	PTC1
*T	PITCHC2	Corrected Blade 2 Pitch	deg	PTC2
*T	PITCHC3	Corrected Blade 3 Pitch	deg	PTC3
*T	PITCHC4	Corrected Blade 4 Pitch	deg	PTC4
*T	QTRA	Tail Rotor Torque A	ft-lb	QTRA
*T	QTRB	Tail Rotor Torque B	ft-lb	QTRB
	SHP1	Shaft HP Engine 1	Hp	SHP1
	SHP2	Shaft HP Engine 2	Hp	SHP2
	SHPLOSS	SHAFT HP LOSS	HP	SHPL
	SHPMR	Main Rotor Shaft HP	Hp	MRHP
	SHPROTOR	TOTAL MAIN AND TAIL SHP	HP	SHPR
	SHPT	Combined Engine Shaft HP	Hp	ESHP
	SHPTR	Tail Rotor Shaft HP	Hp	TRHP
	SIGMAB	Boom air density ratio (drv)	-nd-	SGMA
	THETA	Air temperature ratio (drv)	-nd-	THTA
	TIMD	Time of Day for Counter Start	sec	TIMD

*T	UBODYBC	Boom long velocity /cg (drv)	ft/s	VXCG
*T	VBODYBC	Boom lat velocity /cg (drv)	ft/s	VYCG
*T	VCALB	Boom calibrated airsp.(drv)	kt	VCAB
*T	VCALS	Ship calibrated airsp. (drv)	kt	VCAS
*T	VICB	Indicated Boom Airspeed (corr)	kt	VICB
*T	VT	True Boom/Lassie Airspeed	kt	VTRU
*T	VTB	Boom true airspeed (drv)	kt	VTAS
*T	VTS	TRUE AIRSPEED (SHIP)	KNOTS	VTSX
*T	WBODYBC	Boom vert velocity /cg (drv)	ft/s	VZCG

UH-60 Fuselage Accelerometer Block Locations

Block	Description	Mnemonic	Station	Buttline	Waterline
1	Cockpit Floor, Forward	AC51, AC52	198.0	35.0	215.0
2	Co-Pilot Floor	AC23, AC24	253.0	-31.0	206.7
3	Pilot Floor	AC53, AC54, AC99	253.0	31.0	206.7
4	Left Cabin, Forward	AF21	295.0	-35.5	206.7
5	Right Cabin, Forward	AF51, AF52	295.0	35.5	206.7
6	Left XSSM Beam, Forward	AX21	332.0	-17.5	260.7
7	Right XSSM Beam, Forward	AX51, AX52	332.0	17.5	260.7
8	Mid Cabin, Right	AF53, AF54	350.0	31.0	206.7
9	Left XSSM Beam, Aft	AX23	356.0	-17.5	260.7
10	Right XSSM Beam, Aft	AX53, AX54	357.0	17.5	260.7
11	Left Cabin, Aft	AF25	398.0	-35.5	206.7
12	Right Cabin, Aft	AF55, AF56	398.0	35.5	206.7
13	Station 443.5 Floor	AF57, AF58	443.5	28.0	206.7
14	Mid Tail Cone	AT01, AT02	545.0	00.0	250.0
15	Intermediate Gear Box	AT03	655.5	00.0	239.0
16	Left Stabilator Tip	AT25	702.0	-80.0	247.0
17	Right Stabilator Tip	AT55	702.0	80.0	247.0
18	Vertical Tail	AT07, AT08	732.0	00.0	325.0



Appendix B – DATAMAP

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Overview

DATAMAP was a program originally written, by the Bell Helicopter Textron Corporation under a government contract to support rotor airloads analysis. However, for the past 10 years NASA Ames has been improving and embellishing it. One of the significant improvements to DATAMAP was to allow it to access the archival database in TRENDS. NOTE, TRENDS is only a gateway to DATAMAP; hence, the user will find an entirely different syntax used in it than is found in TRENDS. Some redundancy in DATAMAP capabilities will be noted with those of TRENDS. DATAMAP consists of many analysis and derivation routines and a variety of plotting routines, many designed specifically for rotorcraft applications.

Capabilities

Analysis	Derivation
Amplitude Spectrum	Pressure Coefficient
Harmonic Analysis	Normal Force Coefficient
Digital Filtering	Chordwise Force Coefficient
Moving Block Damping	Pitching Moment Coefficient
Acoustic Analysis	Blade Normal Force
Numerical Integration	Blade Chordwise Force
Numerical Differentiation	Blade Pitching Moment
Stochastic Process Analysis	Long. & Lat. Blade Flapping
Frequency Response	Long. & Lat. Blade Feathering
Coherence Function	Blade Collective Angle
Auto/Cross Spectral Density	Local Mach Number
Auto/Cross Correlation	Density Altitude
Statistical Analysis	Shaft Torque Coefficient
Mean	Shaft Horsepower
Variance	Rotor Speed
Standard Deviation	Rotor Azimuth
Chi-Square Normal Dist Test	True Airspeed
Min/Max Analysis	
Spike Deletion from data	
Linear Adjustment to data	

This appendix is designed to serve as an introduction to the syntax and capabilities of the DATAMAP analysis program. In addition to the analysis and derivation routines summarized above, a set of DATAMAP support capabilities are also incorporated into DATAMAP which allow the user to modify the basic default operating setups. DATAMAP can be run either as an interactive or a batch job. The batch job requires a command file that contains the instructions for the desired operations.

Command Step Summary

DATAMAP uses an entirely different interface than does TRENDS. Where TRENDS is essentially a prompt driven program, DATAMAP uses a command step approach. The command step is composed of a minimum of two substeps, and a maximum of four substeps, each substep is terminated with a '/'. The organization of the command step, as shown below, always begins with the specification substep, and always contains at least one more substep. The action, input, and disposition substeps are included based on which specification option is selected. To assist the user in forming proper command steps, DATAMAP includes a HELP feature which lists the required entries at each substep and the options that are available. For detailed explanations of the options the user is referred to the DATAMAP Users manual (ref. 1 & 2).

The DATAMAP user interface includes the use of entry default values. Some entries start out with stored default values, others obtain their default values from the previous user input. To use a default value, double commas are inserted in the command stream or if the rest of the substep is to be defaulted a '/' is input, which not only defaults the rest of the entries but also signals the end of that substep.

Specification / Action / Input / Disposition/

- The Specification substep is used to select one of the eleven types of operations that is to be performed with the current command step.
- The Action substep is used to further define the operation by providing additional details as to the nature of the intended operation.
- The Input substep is used to define where the data is to be found and which subset of the data is to be used.
- The Disposition substep is used to describe what is done with the results of the current command step.

Among the differences between TRENDS and DATAMAP are the following:

- DATAMAP requires that all inputs be entered as UPPER case.
- All sensors are referred to by their Item Code labels and not their mnemonics.
- DATAMAP uses the latest input values as replacements for standard default values at most entry locations.
- DATAMAP requires a minimum of 4 characters to be entered for each of the commands, e.g. DISP or DISPLAY are equivalent.

TRENDS and DATAMAP share two important features that allow the results of each program to be used in the other, these are the Info File and the Scratch File. These two files provide important capabilities that facilitate both TRENDS and DATAMAP being able to support multiple independent databases.

Info Files Overview

The Info File allows the user to specify the definition of several key sensors and allows the physical location of related sensors to be defined. Multiple independent databases by their nature do not have a common sensor labeling scheme. Yet there exist a set of sensors that are commonly needed in the computation of rotorcraft related parameters, for example:

- Main Rotor azimuth encoder
- Rigid blade motion (flapping, feathering, lead-lag)
- Rotor torque
- Airspeed
- Static pressure
- Ambient temperature

The Initial Group of the Info File allows the user to equate the Item Code names for a database for these measurements with the generic names used internal to the programs. Certain of these measurement equivalences include numerical adjustments.

The main rotor azimuth blipper that is equated to the generic MRAZ label may have a phase offset such that when the blipper is triggered, the reference blade is at some non-zero location. This information then is included in the Initial Group. Not all databases include a once-per-rev blipper, some include a sensor that measures the azimuth in degrees. The Info File accommodated this with the generic MDEG label. MDEG is a backup source for the primary MRAZ.

Blade motion equivalences also can be followed by azimuthal offsets. True Airspeed equivalence can include a look up table converting indicated airspeed to calibrated airspeed.

The Initial Group is followed by a series of Geometric Groups, which contain related sets of sensor item codes that are organized by their physical location, and are given four character group names. The contents of the group can then be called for use by the group name.

The purpose of the Geometric Groups are to ease the access to large groups of sensors that are related by physical location. These groups alleviate the need to repeatedly specify a long list of sensor names and their associated locations. Instead the user merely specifies the group name that associates the desired sensors and then specifies any subset of that group by the array location of the desired sensor sub-set. Each group name has associated with it at least one row of several columns. It also has the potential for pairing sensors by "Double-Row" elements such as the blade upper and lower surfaces instrumented with pressure transducers. A sample Info file is presented at the end of this Appendix.

Each database maintained within the TRENDS/DATAMAP database has an Info File assembled for the user community. If additional groups are desired, the default Info File can be copied to the users account, edited to suit, named INFOFILE.<db#>. The users own <db#>DFLT.USR (e.g. 703DFLT.USR) must then be edited to point to the new location of the modified Info File.

Scratch Files

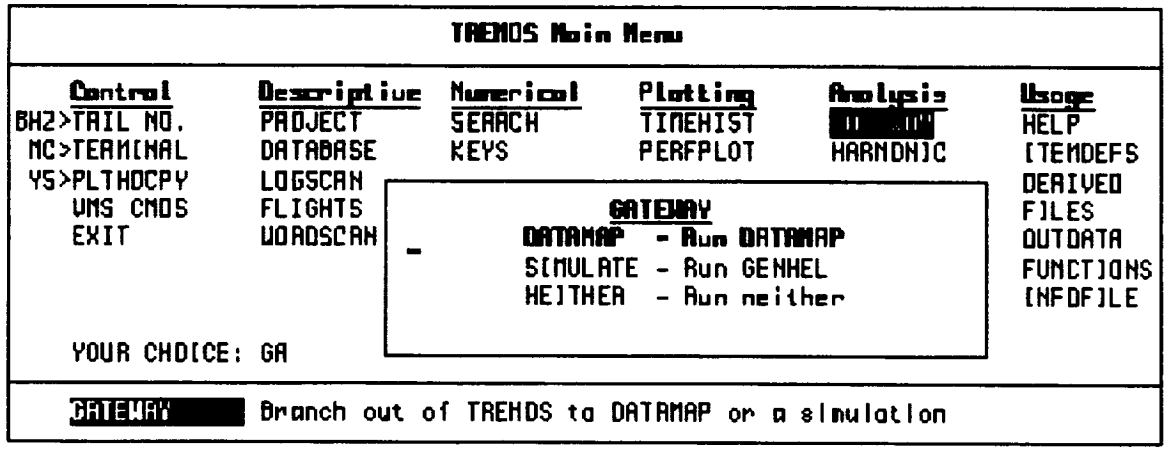
Scratch Files are temporary holding bins for storing raw data or results of analysis or derivations. There are four available scratch files that comprise the file PERMSCR.DAT. Each user should have his own such file as these cannot be shared with other users. TRENDS has a single central file for those users who do not have their own.

Scratch Files are designed to work in conjunction with Info Files. They are structured to be able to store time history data in subsets that are assigned row and column locations, as well as "Double Row" element designations. While they are designed for use with Info Files, that is not a prerequisite. It is possible to compile the contents of a scratch file by adding columns of data one at a time. If the data stored in the scratch file was processed using an Info File group, then the physical location information will also be stored in the scratch file for proper automatic labeling of plotted and printed output.

The Scratch File is the only means available for transferring results back and forth between TRENDS and DATAMAP. As an example, data can be operated on by a DATAMAP derivation, then stored in one of the four scratch files. TRENDS then can read the contents of the scratch file and apply the data to a user defined function, storing the results in another scratch file. DATAMAP can then access the contents of this scratch file for use with the multiple curve plotting capability to present the final results.

Example Session DATAMAP

An example DATAMAP session is presented that includes a sequence of Command steps to illustrate how results are obtained with DATAMAP.
NOTE: The DATAMAP examples given here are for the Blackhawk databases, BH2 & 748; hence the parameters names used are for Black Hawk flight program and not the Tiltrotor.



Starting with the TRENDS main menu, if DATAMAP is selected the user is offered five operational possibilities. This example is for an interactive session and so option 1) is selected

```
 ---------- DATAMAP COMMAND PROCEDURE ------------
TYPE "RESTART" IN RESPONSE TO ANY "Data:" PROMPT
IN ORDER TO RETURN TO THIS POINT IN THE PROCEDURE.
ENTER NUMBER TO SELECT DESIRED OPERATION:
    1 = RUN PROCESSING PROGRAM INTERACTIVELY
    2 = RUN PROCESSING PROGRAM IN BATCH
    3 = TRANSFER BHT-GCD FORMAT DATA TO MASTER FILE
    4 = TRANSFER DTF FORMAT DATA TO MASTER FILE
    5 = EXIT
```

1

Next the operating mode is set from among three choices, for this session we need interactive graphics or option 3).

3

```
            NASA ARC
ENTER OPERATING MODE:
  1 = BATCH
  2 = INTERACTIVE (NO PLOTS)
  3 = INTERACTIVE GRAPHICS (TEKTRONIX NEEDED)
```

Next a list of run settings is presented. Normally there is no need to modify any of these and a YES or Y is the response. If the user does want to change a setting, the appropriate keyword in the right column is typed. The options most often selected for change are MAIN/TAIL, GRID/NOGRID, TICS/NOTICS, A-C#, and TYPE. The first keywords select either main or tail rotor as the source of azimuth orientation, the next two determine the look of plots, the next selects the aircraft database, the last determines which type of data files DATAMAP will attempt to access.

The partition name is next prompted for. A partition is a set of data that is stored in a subdirectory. To see the available answers to this prompt, type MENU.

```
    RUN SETTINGS:                                    KEYWORD
TERMINAL DATA RATE 960 CHARACTERS/SECOND              'LINE'
ROTOR MODE 'MAIN'                                  'MAIN','TAIL'
PLOT GRID MODE  'GRID'                            'GRID','NOGRID'
PLOT TICS MODE 'NOTICS'                           'TICS','NOTICS'
PLOT FRAME WIDTH 12.00 INCHES                         'PWID'
OPERATOR PEN PLACEMENT IN 'X' -1.50 INCHES            'PENX'
OPERATOR PEN PLACEMENT IN 'Y'  0.50 INCHES            'PENY'
PRINT BLOCKS OF 5 LINES/BLOCK   6/PAGE                'BLOCKS'
SCRATCH FILES SIZE (EACH)  900 RECORDS             'FILESIZE'
SCRATCH FILES ARE PERMANENT                        'TEMP','PERM'
CPU SECONDS TO TRIGGER WARNING900.00                  'WARN'
STEP EXECUTION TIMES WILL NOT BE PRINTED          'STEP','NOSTEP'
DEFAULT TAIL #          703                           'A-C#'
DEFAULT DATA TYPE: TIM                                'TYPE'

ENTER 'YES' TO ACCEPT THESE VALUES OR
A KEYWORD TO MODIFY A SETTING.
```

YES

```
 ENTER PARTITION NAME
MENU
MENU

Partition Directories available:
   SD
 ENTER PARTITION NAME
SD
SD

 NEW STEP.
```

DATAMAP next provides the prompt 'NEW STEP', which indicates that it is ready for instructions from the user for the current session.

Each new step example given here is numbered to facilitate aligning the step commands with the explanation of each step. When DATAMAP is run the line numbers are not present, however at the completion of each command step DATAMAP provides the prompt 'NEW STEP'. The explanations and resultant tables and figures follow the example command step inputs.

The Command Sequence examples provided are arranged in the following five sets:

1-7) Tools for establishing what data is available for use, in terms of counters, sensors, geographical groups from the Info File, and scratch file contents. The second example is used to end the current step and returns the user to the NEW STEP prompt.

8-22) A representative sequence of command steps that are used to calculate and display the pressure coefficients at a particular location on the rotor blade. The examples include filtering the data, computing and displaying a spectral analysis of the data, deriving and plotting the pressure coefficients, and displaying the averaged pressure data for the top surface with an X-Y plot and the bottom surface with a contour plot.

23-25) A representative sequence of command steps that are used to calculate and display blade loads from multiple counters, and use the auto scaling feature during plotting.

26-28) Allow the user to change the data that is available to DATAMAP without the need to first exit the program.

29) Ends the current session and sends the user back to the introductory selection list.

Example Commands

Specification/Action/Input/Disposition/

1) HELP
2) CANCEL
3) MENU/DATA/
4) MENU/SCRATCH/
5) MENU/counter number/
6) MENU/INFO/
7) MENU/INFO GROUP S2PA/

8) SET/COPY/
9) COMMENT/EXAMPLE OF USER SPECIFIED PLOT LABEL/
10) ANAL/FILT BAND 90 0 4/GROUP S2PA BOTH 5 ALL 5607 0 2/KEEP SCF1/
11) ANAL/SPEC 90 COS/SCF1 ALL 4 ALL TOP/PLOT FREQ CLOSE LOG/
12) SET/CONNECT/
13) ANAL/AVER/SCF1 ALL ALL ALL BOTH/KEEP SCF2/DATAMAP
14) DERI/CP 318/SCF2 ALL ALL 1 BOTH/KEEP SCF3/
15) DISP/SCF3 90 MRAZ ALL 1 TOP/MPLOT ROW/
16) DISP/SCF3 90 MRAZ ALL 1 BOTT/APLOT ROW/
17) UTIL/COPY/
18) SET/LINE/
19) SET/NOGRID/
20) SET/TICS/
21) DISP/SCF2 ALL ALL ALL TOP/MPLOT MRAZ/
22) DISP/SCF2 ,,,, BOTT/CONT RECT MRAZ ROW/

23) ANAL/AVER/BN50 1705 0 15/KEEP SCF4/
24) ANAL/AVER/BN50 1706 0 15/ADD SCF4/
25) DISP/SCF4/MPLOT MRAZ CURS/

26) UTIL/TYPE/ {RAW, TIM, or SPC }/
27) UTIL/JGET/counter number/
28) UTIL/ROOT/device mane and directory name/

29) TERM/

Each of the entries in the command step examples above are discussed in detail here.

Example 1 – invokes the HELP feature in DATAMAP. The result, shown in Table 1, lists the input options available at that substep. When the current substep is completed, the help feature is disenabled and must be reinvoked if desired for the new substep. This feature can also be invoked by typing a '?'.

Example 2 – presents a command that can be used at any point in a command step to reset back to the NEW STEP prompt. It operates without the need of a '/'.

Example 3 – requests DATAMAP to display the data that is available on the magnetic disk for immediate access. It provides a list, shown in Table 1, of all data resident on the disk, including data that is of another tail number and hence not actually assessable to the user on the current setting.

Example 4 – provides the user with a summary, shown in Table 2, of the contents of the four scratch files. This is particularly useful
when long multiple steps are being used where the proper management of resources and data content are important.

Example 5 – lists all of the sensors, shown in Table 3, that are available for use with the requested counter number.

Example 6 – lists the summary contents of the info file, shown in table 4.

Example 7 – displays the geometric locations of the sensors contained in the geometric group S2PA. The output is presented in Table 5.

Example 8 – stores the plot information such that after the user has viewed the plot, he may create a hard copy, see example 17).

Example 9 – customizes the plot labeling for the succeeding generated plots. The custom label is included in Figure 1. There are some restrictions on the content of this label that DATAMAP will be only to happy to point out to the user.

Example 10 – analyze the data by filtering it with a bandpass of 90 hertz upper frequency and lower of 0 hertz, with a 4 pole Chebyshev filter. The Chebyshev was accepted as a default value with the '/'. The sensors of interest are contained in group S2PA, of those sensors both blade surfaces are requested at the fifth radial station and all chord locations, the data from counter 5607 is to start at 0 seconds and continue for 2 seconds. The results are to be stored in scratch file 1.

Example 11 – performs a spectral analysis out to 90 hertz using a cosine window function. The input data is stored in scratch file 1, and all available points are to be used, of the 4th chordwise sensor at all radial stations present on the top surface. The results are to be displayed, shown in Figure 1, on an X-Y plot with frequency as the x axis, no cursor is wanted and the Y axis is to be a log scale.

Example 12 – sets the default parameter such that a curve will connect the symbols that are plotted at the data points. The entry LINE would connect the data points with a curve without symbols (and is the default setting), or SYMBOL can be used which will produce only symbols without the curve.

Example 13 – performs an analysis of data to compute a cycle average of the contents of scratch file 1 for all time available at all chordwise and radial locations and for both surfaces. The results are to be kept in scratch file 2. The term 'cycle average' as used here signifies that data from multiple rotor revolutions are averaged according to their azimuthal location. The result is a single rotor revolution that is an average of all the individual revolutions.

Example 14 – derives values of pressure coefficient and that the rotor has a 318 inch rotor radius. The data will be found in scratch file 2, and is to include all time, all chordwise values of the 5th radial array on both surfaces. The results are to be stored in scratch file 3. The 5th radial array was stored in the 1st column of scratch file 2, back in example 10). The entries in the substeps refer to the column and row element of the scratch file array, not directly to the radial or chord locations respectively. This can be seen by referring to Tables 2. It can be seen there that SCF1, SCF2, and SCF3 all have .775 r/R as the only column entry.

Example 15 – produce a display using data from scratch file 3. The data at 90 degrees of main rotor azimuth all chordwise sensors and the first radial station available for the top surface is to be plotted versus the row element (chord) such that additional curves may be added. The result is shown in Figure 2a.

Example 16 – further instructs the program to repeat the operation of example 14 using the bottom surface data this time, and add the results to the plot generated in example 14, shown in Figure 2b.

Example 17 – produce a hard copy of the preceding plot.

Example 18 – plot with a line only.

Example 19 – tells the program that there are to be no grid marks on future plots.

Example 20 – tics marks are to be inserted between the major marks of both axis for future plots.

Example 21 – display the contents of scratch file 2 for all time, all chordwise values for the first radial array top surface only. The display, shown in Figure 3 will be a multi curve X-Y plot with main rotor azimuth as the X axis.

Example 22 – display the contents of scratch file 2 for all time, all chords, all radii, for the bottom surface. The entries for time, row, and column have been defaulted to the previous values of ALL from example 21 by the use of the four commas. A pair of commas defaults the first ALL, the third comma forms a pair with the second comma defaulting the second ALL, etc. The display will be a contour plot of rectangular planform with main rotor azimuth as the X axis and chord and the Y axis, and is shown in Figure 4.

NOTE:

The next examples use the 748 database

Example 23 – cycle average the data for sensor BN50 and counter 1705 starting at 0 seconds and including 15 revolutions, and storing the result in scratch file 4.

Example 24 – repeat the actions of example 23 but with data from counter 1706, and add the result to the data already stored in scratch file 4.

Example 25 – display the contents of scratch file 4 as a multiple curve X-Y plot, shown in Figure 5, and the cursor is to be turned on. The cursor is controlled with the arrow keys of the keyboard. To have the numerical location of the cursor printed on screen, any key on the keyboard can be pressed. All keys except. 'C' automatically advance to the next curve after printing the cross hair coordinates. The 'C' key allows the user to get multiple readings without progressing on to the next curve. The numerical value of the location are printed in the upper left hand corner of the screen. In order to produce the example plot, example 24 was repeated for counters 1707, 1708, and 1709.

Example 26 – changes the data file type that is to be accessed. The default type is TIM, the other allowable types for DATAMAP are RAW and SPC. See section User Guide III for further discussion of the characteristics of these data types.

Example 27 – retrieves data from the Jukebox data storage device and store it on the interactive magnetic disk for interactive access with DATAMAP. This command frequently follows the use of MENU/DATA/.

Example 28 – changes the root location of the databases. If the user knows that a set of data reside on a second disk drive in a certain directory, this info is extended with this command. The user then has the option of using new MAP and FLIGHT files, specifying which 'partition' (specific subdirectory that holds data of interest, there may be several) to use, the 'tail number' (test source of data e.g., 703, 748, or BH2) and which Info File is appropriate. These choices are all presented in a question and answer session prompted by the UTIL/ROOT.

Example 29 – tell DATAMAP that the user desires to terminate the current session and return to the initial session setup option list. If the user is thru using DATAMAP, option 5 should be entered, which returns the user to the main TRENDS menu.

DATAMAP Tables

♦ *EXAMPLE SESSION*

Table 1

```
 NEW STEP:
HELP
 ENTER:- (1) OPTIONS: ANALYZE,DERIVE,DISPLAY,BUILD,
           EDIT,NOEDIT,EXECUTE,MENU,TERMINATE,SAVE,
           COMMENT,SET,UTILITY -NO DEFAULT
 -----MORE ENTRIES MAY FOLLOW IN SUBSTEP-----
MENU/DATA/
Data for Partition:
CACHE@:[ODSCACHE SD]
   COUNTER  TAIL#  FLT#
       848   702    113
      8997   703    152
      8998   703    152
      9436   703    163
      9796   703    169
     10058   703    178
     10059   703    178
     10193   703    179
     10194   703    179
     10195   703    179
     10274   703    188
     10278   703    188
     10279   703    188
     10280   703    188
     10755   703    188
     10779   703    188
     11403   703    204
     11404   703    204
     11405   703    204
     11406   703    204
Enter <X> to Stop, <Return> for More
```

Table 2

```
 NEW STEP
 MENU/SCRATCH/


  SCF1

  TIME HISTORY:
  UH-60A BLADE PRESSURES, CHORDWISE ARRAY
  DOUBLEROW - BOTH          COUNTER -   5607
  1ST DIMENSION -     TIME (SECONDS)       4286 POINTS     2.000 SECONDS
  2ND DIMENSION (ROW POSITION) - FRACTN OF CHORD
      0.100E-01  0.300E-01  0.490E-01  0.800E-01  0.107E+00  0.164E+00
      0.203E+00  0.250E+00  0.320E+00  0.395E+00  0.460E+00  0.530E+00
      0.607E+00  0.818E+00  0.963E+00
  3RD DIMENSION (COLUMN POSITION) - FRACTN OF RADIUS
      0.775E+00


  SCF2

  CYCLE AVERAGE:
  UH-60A BLADE PRESSURES, CHORDWISE ARRAY
  DOUBLEROW - BOTH          COUNTER -   5607
  1ST DIMENSION -     TIME (SECONDS)        256 POINTS     0.233 SECONDS
  2ND DIMENSION (ROW POSITION) - FRACTN OF CHORD
      0.100E-01  0.300E-01  0.490E-01  0.800E-01  0.107E+00  0.164E+00
      0.203E+00  0.250E+00  0.320E+00  0.395E+00  0.460E+00  0.530E+00
      0.607E+00  0.818E+00  0.963E+00
  3RD DIMENSION (COLUMN POSITION) - FRACTN OF RADIUS
      0.775E+00


  SCF3

  DERIVED PARAMETER
  BLADE STATIC PRESSURE COEFF
  DOUBLEROW - BOTH          COUNTER -   5607
  1ST DIMENSION -     TIME (SECONDS)        256 POINTS     0.233 SECONDS
  2ND DIMENSION (ROW POSITION) - FRACTN OF CHORD
      0.100E-01  0.300E-01  0.490E-01  0.800E-01  0.107E+00  0.164E+00
      0.203E+00  0.250E+00  0.320E+00  0.395E+00  0.460E+00  0.530E+00
      0.607E+00  0.818E+00  0.963E+00
  3RD DIMENSION (COLUMN POSITION) - FRACTN OF RADIUS
      0.775E+00


  SCF4

  CYCLE AVERAGE:
  MR normal bending 50% radius
  DOUBLEROW - TOP           COUNTER - MULTIPLE
  1ST DIMENSION -     TIME (SECONDS)        256 POINTS     0.233 SECONDS
  3RD DIMENSION (COLUMN POSITION) - COLUMN POSITION
      0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00
```

Table 3

```
 NEW STEP
MENU/5607/
 ITEM CODE LIST FOR COUNTER   5607 PARTITION: SD       TAIL #: BH2 FLIGHT #  056
   ITEM  SEC  FILT  OFF  RATE  TYPE        ITEM  SEC  FILT  OFF  RATE  TYPE
   TIAB 20.0  -1   0.0   500  TIM         AC23 20.0  -1   0.0   500  TIM
   AC24 20.0  -1   0.0   500  TIM         AC51 40.0  -1   0.0     0  TIM
   AC52 40.0  -1   0.0     0  TIM         AC53 20.0  -1   0.0   500  TIM
   AC54 20.0  -1   0.0   500  TIM         AC99 20.0  -1   0.0   500  TIM
   AE30 20.0  -1   0.0   357  TIM         AE50 20.0  -1   0.0   714  TIM
   AE70 20.0  -1   0.0   357  TIM         AE90 20.0  -1   0.0   357  TIM
   AF21 20.0  -1   0.0   500  TIM         AF25 20.0  -1   0.0   500  TIM
   AF51 40.0  -1   0.0     0  TIM         AF52 40.0  -1   0.0     0  TIM
   AF53 20.0  -1   0.0   500  TIM         AF54 20.0  -1   0.0   500  TIM
   AF55 20.0  -1   0.0   500  TIM         AF56 20.0  -1   0.0   500  TIM
   AF57 20.0  -1   0.0   500  TIM         AF58 20.0  -1   0.0   500  TIM
   AH01 20.0  -1   0.0   357  TIM         AH02 20.0  -1   0.0   357  TIM
   AH03 20.0  -1   0.0   357  TIM         AH04 20.0  -1   0.0   357  TIM
   AH0X 40.0  -1   0.0     0  TIM         AH0Y 20.0  -1   0.0   357  TIM
   AH0Z 20.0  -1   0.0   357  TIM         AH11 20.0  -1   0.0   357  TIM
   AH12 20.0  -1   0.0   357  TIM         AH13 40.0  -1   0.0     0  TIM
   DAA0 20.0  -1   0.0    31  TIM         AMF1 20.0  -1   0.0  2143  TIM
   AMF2 20.0  -1   0.0   357  TIM         AMF4 20.0  -1   0.0  2143  TIM
   V0MU 19.9  -1   0.0    31  TIM         AN30 20.0  -1   0.0   714  TIM
   AN31 20.0  -1   0.0   357  TIM         AN50 20.0  -1   0.0   357  TIM
  ENTER <C> TO CONTINUE, <X> TO STOP:
X
```

Table 4

```
INITIAL GROUP:
 MDEG MAZ1 0.0, AZB1 0.0/
 TASK UTRU U000/
 OATM T100/
 STAT H001/
 MTOR RQ10 RQ00/
 MFLP BH01 82.63 BH00 0 0 BH89 90.0/
 MFTH BH02 82.63 BH81 0.0/
 END

NAMES AND DESC. OF SUBSEQUENT GROUPS IN FILE:
 NBRB BLADE REAR BENDING, UH-60/1
 NBEB BLADE EDGEWISE BENDING, UH-60/1
 NBNB BLADE NORMAL BENDING, UH-60/1
 S2VZ  VERTICAL FUSELAGE VIBRATION, UH-60/1
 S2VY  LATERAL FUSELAGE VIBRATION, UH-60/1
 S2VX  LONGITUDINAL FUSELAGE VIBRATION, UH-60/1
 FZVR  RIGHT VERTICAL FUSELAGE VIBRATION
 FZVL  LEFT VERTICAL FUSELAGE VIBRATION
 FYVR  RIGHT LATERAL FUSELAGE VIBRATION
 S2PA  UH-60A BLADE PRESSURES, CHORDWISE ARRAY
 S2RP  UH-60A BLADE PRESSURES, RADIAL ARRAY
 SNGB  BLADE NORMAL BENDING
 SEGB  BLADE EDGWISE BENDING
 STGB  BLADE TORSION
 AMBF  BLADE NORMAL ACCEL, FORE
 AEBB  BLADE EDGEWISE ACCEL
 ANBA  BLADE NORMAL ACCEL, AFT
 S2AN  ALL NORMAL BLADE ACCELS
 S2TM  BLADE TEMPRATURE ARRAY
 BBM1  BEAM BENDING MOMENTS
```

Table 5

```
MENU/INFO GROUP S2PA/
Info Menu for Group: S2PA    Rows: 15   Columns:  9    Keyword(s)  BLAP   BLAM
  Column is FRACTN OF RADIUS in R/RADIUS    Row is FRACTN OF CHORD  in X/CHORD
              1     2     3     4     5     6     7     8     9
            0.25  0.44  0.55  0.68  0.77  0.87  0.92  0.97  0.99
           ===================================================
 1  0.01 | P101  P201  P301  P401  P501  P601  P701  P801  P901  |
         | P151  P251  P351  P451  P551  P651  P751  P851  P951  |
 2  0.03 | NULL  NULL  NULL  NULL  P502  P602  P702  P802  P902  |
         | NULL  NULL  NULL  NULL  P552  P652  P752  P852  P952  |
 3  0.05 | P103  P203  P303  P403  P503  P603  P703  P803  P903  |
         | P153  P253  P353  P453  P553  P653  P753  P853  P953  |
 4  0.08 | NULL  NULL  NULL  NULL  P504  P604  P704  P804  P904  |
         | NULL  NULL  NULL  NULL  P554  P654  P754  P854  P954  |
 5  0.11 | P105  P205  P305  P405  P505  P605  P705  P805  P905  |
         | P155  P255  P355  P455  P555  P655  P755  P855  P955  |
 6  0.16 | P106  P206  P306  P406  P506  P606  P706  P806  P906  |
         | P156  P256  P356  P456  P556  P656  P756  P856  P956  |
 7  0.20 | P107  P207  P307  P407  P507  P607  P707  P807  P907  |
         | P157  P257  P357  P457  P557  P657  P757  P857  P957  |
 8  0.25 | P108  P208  P308  P408  P508  P608  P708  P808  P908  |
         | P158  P258  P358  P458  P558  P658  P758  P858  P958  |
         :     :     :     :     :     :     :     :     :
ENTER  <D>OWN, OR <Q>UIT D
Info Menu for Group: S2PA    Rows: 15   Columns:  9    Keyword(s)  BLAP   BLAM
  Column is FRACTN OF RADIUS in R/RADIUS    Row is FRACTN OF CHORD  in X/CHORD
              1     2     3     4     5     6     7     8     9
            0.25  0.44  0.55  0.68  0.77  0.87  0.92  0.97  0.99
            :     :     :     :     :     :     :     :     :
 8  0.25 | P108  P208  P308  P408  P508  P608  P708  P808  P908  |
         | P158  P258  P358  P458  P558  P658  P758  P858  P958  |
```

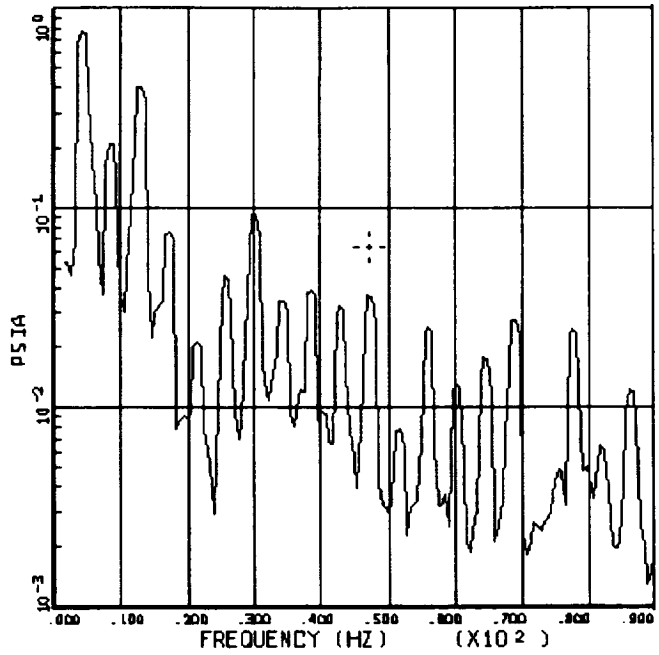


Figure 1

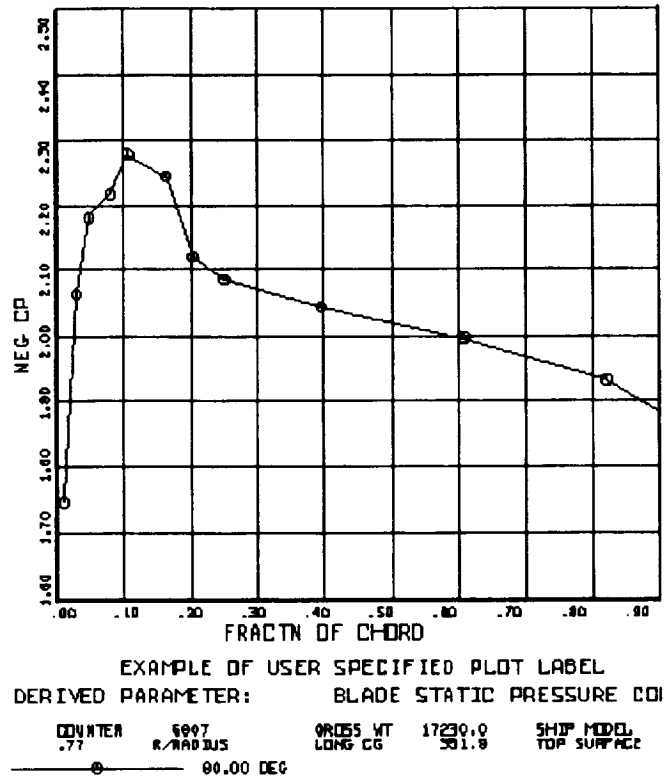


Figure 2a

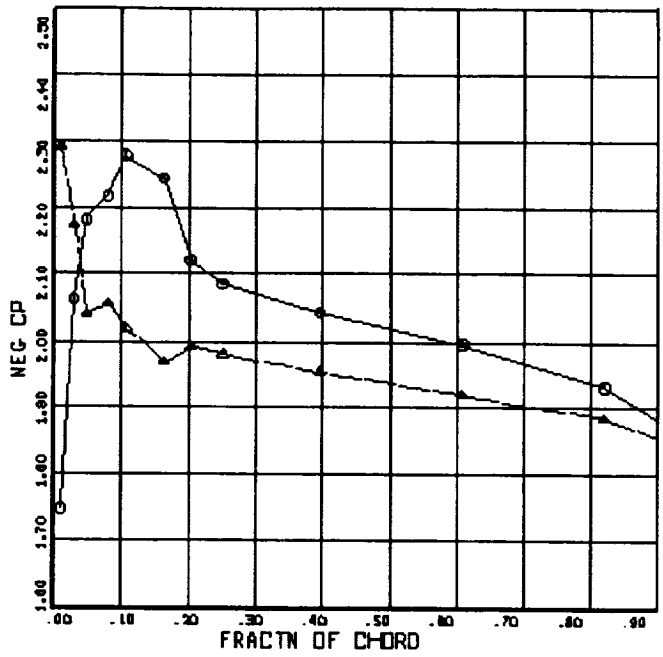


Figure 2b

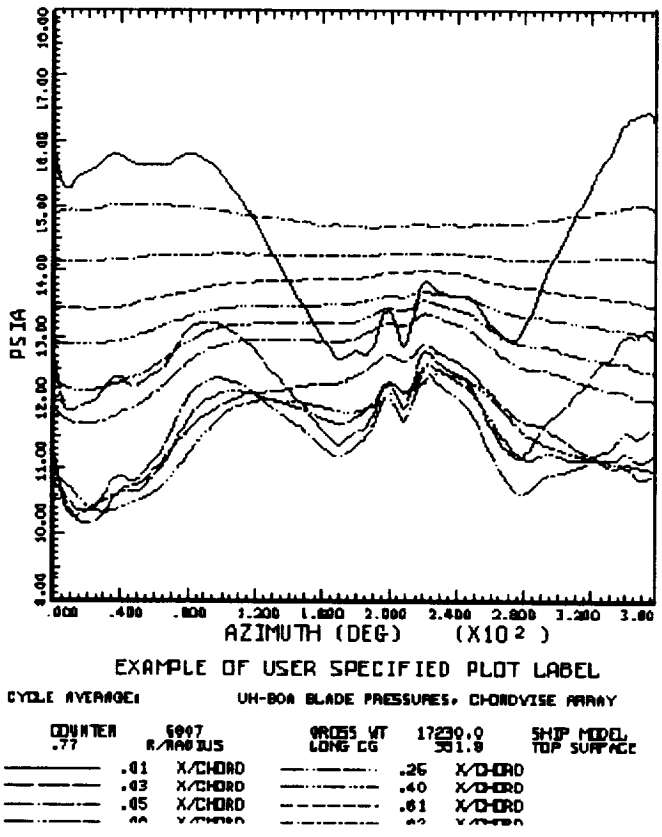
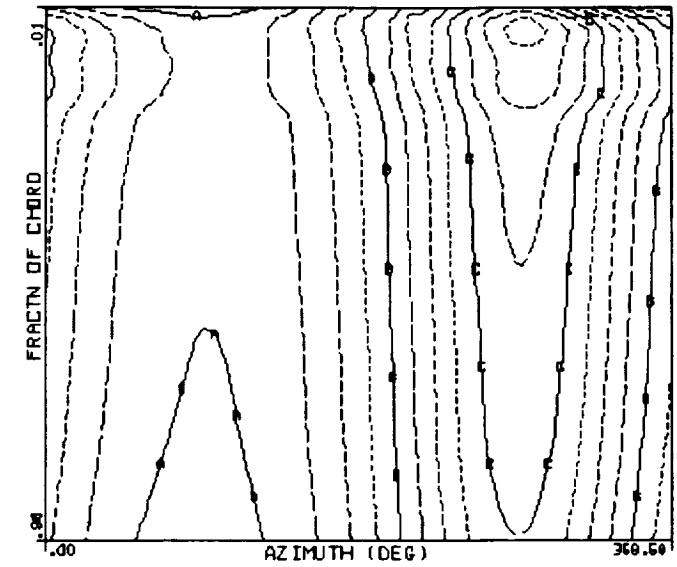


Figure 3



DERIVED PARAMETER: BLADE STATIC PRESSURE COEF

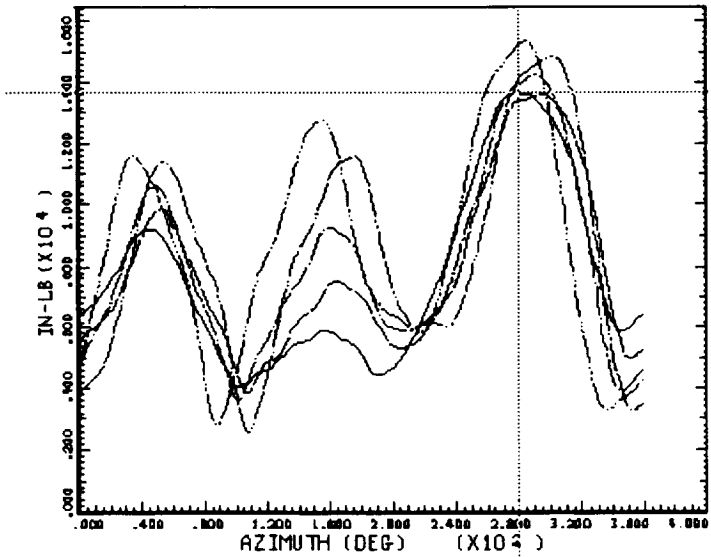
COUNTER .77 5807 R/RADIUS CROSS WT 17290 LONG CG 361 SHIP MODEL UH60 TOP SURFACE

CONTOUR LEVEL VALUES IN NEG CP

a 2.0
b 3.6
c 5.2

DATAMAP (VERS 5.7 - 08/20/91) NASA ARC 20APR'92

Figure 4



CYCLE AVERAGE: MN NORMAL BENDING 60% RADIUS

COUNTER .00 MULTIPLE CROSS WT LONG CG 0.0 SHIP MODEL SHIP ID UH-60 710

.00
.00
.00
.00
.00

DATAMAP (VERS 5.7 - 08/20/91) NASA ARC 15APR'92

Figure 5

Info File Example

The data analysis computer programs DATAMAP and TRENDS use information that is stored in the Info File to facilitate computation and display of related data sets. The file contains an Initial Group followed by related sets of sensor item codes that are organized by their physical location, and are given four character geometric group names. An Info File contains information relative to a single aircraft only, although information relative to analytical mathematical models is often included, so that during correlation work between test and analysis the same Info File can be used.

The Initial Group is a list of generic labels and the item codes that are equated to them for the database assigned to that Info File. The generic labels are what the computer codes use internally in computations. The Initial Group allows each database to use sensor naming conventions that are independent of any other database while being consistent within that database. The generic labels included in the Initial Group are presented here with their descriptions.

MRAZ - Main rotor azimuth contactor pulse
TRAZ - Tail rotor azimuth contactor pulse
MDEG - Main rotor azimuth encoder in degrees
TDEG - Tail rotor azimuth encoder in degrees
TIAS - Indicated airspeed in knots squared
TASK - True airspeed in knots
OATM - Static temperature in degrees C
STAT - Static pressure in psia
MTOR - Main rotor torque in in-lb
MFLP - Blade flapping in degrees
MFTH - Blade feathering in degrees

Correction factors often follow these equivalences. This value would follow the item code in the Initial Group separated by a space. For example, the main rotor azimuth contactor may be offset from true zero by some positive number of degrees. Another example is the position corrections to convert from indicated to corrected airspeed follow the item code for TIAS as pairs of numbers, where the first number is the indicated value, the second is the corrected value.

If there are several item codes that were used during the test to measure the same parameter, they are entered sequentially on the same line separated by commas.

The geometric groups follow the Initial Group and each can be a one-, two-, or three-dimensional array. The third dimension is limited to only two values. Each group name is followed by a description of that sensor set. This description is included on any plot produced using this group name. The next line identifies the azimuthal offset of that sensor group with the main rotor once-per-rev contactor. The next two lines are the labels applied to the first two dimensions of the sensor array. These are followed by the physical locations of the sensors and the orientation of the first entries, for the first-array dimension. If this is a two- or three-dimension array the information for the second-array dimension follows. Next is a four character code unique to the type of sensors included in the group. If the group is a three-dimensional array these codes are followed by the orientation of the third dimension. The item codes that comprise the group are listed last.

The item codes are presented in the reverse order just discussed; that is, the third dimension is varied first, the after a slash the second dimension is incremented and the third dimension is again varied. When the second dimension has been completely varied a double slash denotes that the first dimension is incremented. The other two dimensions are then varied as before. There are occasions when there are no sensors at a given row column location in the matrix. These are filled with a NULL entry. Each group information section is terminated with the word END.

An example Info File is presented below that includes information from the Black Hawk airloads research aircraft as well as values from a comprehensive analytical prediction program. In the Initial Group, the first entries are the item codes from the aircraft, the second entries are from the analytical code. The geometric groups presented are FZVR, S2PA, SNGB, and BBM1. FZVR, SNGB, and BBM1 are examples of one dimensional arrays, S2PA is an example of a three dimensional array, with column being blade radius, row being chord location, and the 'Double-row' elements being the blade upper and lower surfaces. Due to the size of the item code matrix the entire listing is not shown. SNGB and BBM1 are equivalent groups for the aircraft and analytical predictions respectively.

A more thorough explanation of the structure of the Info File can be found in Reference 1.

Example of Info File

```
MRAZ MRTR 82.63/
MDEG MRZ1 75.0, AZ81 0.0/
TASK VTRU V800/
OATM T100/
STAT H001/
MTOR RQ10 RQ80/
MFLP FLAP 82.63 BH80 0.0/
MFTH PTCH 82.63 BH81 0.0/
END
FZVR RIGHT VERTICAL FUSELAGE VIBRATION
FUSELAGE STATION
INCHES
FORWARD
203.5,253.0,327.0,327.0,350.0,360.0,398.0,443.5,
545.0,658.0,702.2,732.0//
FAZ2//
AC51/AC53/AF51/AF53/AX53/AF55/AF57/AT01/
AT03/NULL/AT51//
END
S2PA UH-60A BLADE PRESSURES, CHORDWISE ARRAY
FRACTN OF RADIUS
R/RADIUS
BLADE ROOT
.25,.44,.55,.675,.775,.865,.92,.965,.99//
FRACTN OF CHORD
X/CHORD
LEADING EDGE
.01,.03,.049,.08,.107,.164,.203,.25,.32,.395,.460,.530,
.607,.818,.963//
BLAP,BLAM//
TOP SURFACE
BOTTOM SURFACE
P101,0.0153,P151,-0.0125/P201,0.0153,P251,-0.0125/
P301,0.0057,P351,-0.0302/P401,00057,P451,-0.0302/
P501,0.0057,P551,-00302/P601,0.0152,P651,-0.0125/
P701,0.0153,P751,-0.0125/P801,0.0153,P851,-0.0125/
P901,0.0153,P951,-0.0125//
NULL,0.0285,NULL,-0.0218/NULL,0.0285,NULL,-0.0218/
```

```
NULL,0.0232,NULL,-0.0340/NULL,0.0232,NULL,-0.0340/
P502,0.0232,P552,-0.0340/P602,0.0285,P652,-0.0218/
P702,0.0285,P752,-0.0218/P802,0.0285,P852,-0.0218/
P902,0.0285,P952,-0.0218//
P103,0.0357,P153,-0.0270/P203,0.0357,P253,-0.0270/
P303,0.0324,P353,-0.0356/P403,0.0324,P453,-0.0356/
P503,0.0324,P553,-0.0356/P603,0.0357,P653,-0.0270/
P703, .....
.....
END
SNGB  BLADE NORMAL BENDING
AZIMUTH 180.0
FRACTN OF RADIUS
R/RADIUS
BLADE ROOT
.1127,.2,.3,.4,.5,.6,.7,.8,.9//
FAZ2//
SNO1/SN20/SN30/SN40/SN50/SN60/SN70/SN80/SN90//
END
BBM1  BEAM BENDING MOMENTS
FRACTN OF RADIUS
R/RADIUS
BLADE ROOT
0.000,0.046,0.070,0.110,0.140,0.180,0.230,0.350,0.500,
0.620,0.680,0.710,0.750,0.820,0.850,0.870,0.890,0.930,
0.960,0.980,1.000//
BBM1//
BB00/BB01/BB02/BB03/BB04/BB05/BB06/BB07/BB08/
BB09/BB10/BB11/BB12/BB13/BB14/BB15/BB16/BB17/
BB18/BB19/BB20//
END
```

References

1) Philbrick, R.B.: The Data from Areomechanics Test and Analytics.- Management and Analysis Package, Volume One-Users Manual, Bell Helicopter Textron, USAAVRADCOM-TR-80-D-30A, Dec 1980

2) Watts, M.E., Dejpour, S.R.: DATAMAP Upgrade Version 4.0. NASA TM-100993, NASA Ames, March 1989

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13. ABSTRACT ***(Maximum 200 words)***

This report is designed to be a user's guide and reference manual for users intending to access rotorcraft test data via TRENDS, the relational database system which was developed as a tool for the aeronautical engineer with no programming background. This report has been written to assist novice and experienced TRENDS users. TRENDS is a complete system for retrieving, searching and analyzing both numerical and narrative data, and for displaying time history and statistical data in graphical and numerical formats. This manual provides a "Guided Tour" and a "User's Guide" for the new and intermediate-skilled users. Examples for the use of each menu item within TRENDS is provided in the Menu Reference section of the manual, including full coverage for TIMEHIST, one of the key tools. This manual is written around the XV-15 Tilt Rotor database, but does include an appendix on the UH-60 Blackhawk database.

This User's Guide and Reference Manual establishes a referable source for the research community and augments NASA TM -101025, TRENDS: The Aeronautical Post-Test, Database Management System, Jan. 1990 written by the same authors.

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