CORONAL DIAGNOSTIC SPECTROMETER
SoHO

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CDS ENGINEERING STUDIES

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1 General

1.1 Revisions

```
Version 0.0 : Draft for comment.
23/1/96
```

1.2 Distribution

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RAL  : MKC, CDP, RAH.
GSFC : WT, DZ.
MSSL : ERB.
```

1.3 Referenced Documents

1. CDS catalog definitions V0.24 (CDS SN2) 26/7/94

1.4 Summary and Purpose

This document describes how engineering studies are integrated into CDS operations and provides a user guide to the MK_ENG IDL tool.

2 Introduction

The science planning tools allow a time line of science studies to be set up which defines what CDS will be doing for a period of time. Science studies consist of a number of rasters using either the NIS or the GIS detectors at different positions on the sun obtained with the OPS. Each raster consists of a number of exposures at different positions obtained with the mirror and slit mechanisms. The science study time line and the definitions of the studies and rasters are contained within databases using the UIT database system (ref.1).

Each study in the science study time line may be explicitly time tagged or may be flagged to simply follow on sequentially from the previous study.

Each unique study has a study ID and a study variation number associated with it, which together with a number of parameters set up as it is put into the time line (such as position on the sun) serve to define it.

The science study time line is accessed by the routine CPT which translates it into tables of commands to the CDHS to implement the studies which are then loaded on board CDS and actuated through the deferred command store at the appropriate times.

CPT associates a number of tables with each study contained in files of the form series_nn.dt, raster_nn.dt, dexwin_nn.dt and vdswin_nn.dt. These correspond to the study commands, raster parameters, data extraction parameters and VDS window parameters respectively and have the same format used by the EGSE scripts CB5FILS, CB5FILR, CB5FILDE and CB5FILV.

In addition to the normal science operations there is a need for routine engineering operations which consist of things like QCM monitoring, detector calibration, pointing calibration *etc.* Some of these activities may be performed using normal science studies, however, others require purpose built sets of commands. The latter are termed engineering studies.

Engineering studies may be performed from command tables as for normal science studies or from the EGSE as scripts (script here implies a predetermined set of operations which may be, but is not necessarily, coded within a PERL script). The latter type of engineering study may be run only during real time contact periods whereas the former type may be run at any time.

Some attempt has been made to integrate engineering studies into the normal science planning software. Some parameters associated with the engineering study are stored in the same databases as used for normal science studies. These parameters provide sufficient information for the planning tools to allow selection of the engineering studies in the science time line in the same way as for science studies. However, because of the individual nature of each engineering study the bulk of the work in setting an engineering study up initially must be done manually.

3 MK_ENG IDL tool

MK_ENG inserts information about an engineering study into the planning databases so that the study is known about by the planning SW and can be included into the science plan. It also creates a file CDS_CP_ENG/engineering_nn.dt to contain the on-board (series) table commands associated with the study.

If the study is to be run as an onboard study then the commands must be inserted into this named file. If the study is to be run as an EGSE script there is still an onboard command table associated with it. In this case the command table just executes briefly and then finishes without doing anything. This allows even EGSE script studies to be recognized by the STM IDL process.

Engineering studies are labelled in the databases by a study ID of 0 and a particular study variation. The study variation is reflected in the filename created by MK_ENG. When CPT encounters an engineering study it copies the file into a series_mm.dt file and allocates it a CDHS ID. This is then loaded as normal along with the other science studies.

MK_ENG is called from the IDL command line with the following syntax :

```
> PRINT, mk_eng ( type, duration, description )

Inputs  : type        : Defines type of study : either 'SCRIPT' or 'SERIES'
          description : description of the engineering study.
          duration    : Float giving duration of the
                        engineering study in seconds.
```

```
Outputs : filename    : Returns the filename for the engineering study.

It has the function definition :

FUNCTION mk_eng, type, duration, description, ERRMSG=ERRMSG

Example :

> PRINT, mk_eng ( 'SCRIPT', 100.0, 'Test engineering series')
> /cs/data/plan/command/eng/engineering_14.dt
```

The type of table either 'SERIES' or 'SCRIPT' defines whether the table is to be run onboard or from the EGSE. The description will be displayed by the planning software. The duration is the time taken for the study to run which must be determined by experiment. This is the time allocated for the study by the planning tools.

4 Engineering study command table

These have filenames : CDS_CP_ENG/engineering_nn.dt, where the nn refers to the study variation allocated by MK_ENG. The command syntax within the file is that used by CB5FILS (see Appendix A for example).

The following rules should be observed when creating the engineering table :

1. The CDHS ID which forms the first parameter of a series/sequence table should be omitted. This will be added later by CPT.
2. The study should leave the mechanisms in their home positions (even if it does not use the mechanisms at all). This is the state assumed by CPT for the start of the next study following an engineering study. Series/sequence table 4 on-board is set up to return the instruments to their home positions so this can be called at the end of the engineering study. Unless the engineering study has deferred pointing it will start in the home position anyway.
3. The study should leave the GSETID parameters in their original settings. In practice this means that engineering studies that fiddle with the GSETID parameters must be run from the EGSE.
4. The engineering study should leave the CDS in the state defined by the WARM_START procedure. If the engineering study fiddles with anything that is regarded as part of the standard WARM_START state then it must set things right itself. This may be achieved by running WARM_START from the EGSE or series/sequence 4 from the CDHS (Note that series 4 is a subset of the WARM_START settings).
5. The engineering study should be less than 125 command words including the end sequence or jump sequence command.
6. The engineering study should only span one series/sequence table.

7. Any raster, data extraction or line list tables required by the engineering study must be loaded within the series/sequence table.

8. The study should only use raster table indices 0 and 1 with CDHS IDs 0xFFFF and 0xFFFE respectively for NIS and GIS studies.

9. The study should only use data extraction table indices 0 and 1 with CDHS IDs 0xFFFF and 0xFFFE respectively for NIS and GIS studies.

10. The study should only use VDS window table index 0 with CDHS ID 0XFFFF for NIS studies.

11. The engineering study should increment the sequence counter using CB5INCS.

Note that series 4 moves the mechanisms to home position from an unknown start position and so has a fairly long wait period for this to happen (about 6 minutes).

5 Planning software

The engineering studies are recognized by the planning software by their study ID of 0. The study title (from the title ID database) indicates whether the study is a CDHS table or an EGSE script. The study variation is used to select a particular engineering study.

The planning software should :

- Include engineering studies in the science plan using the duration0 field from the studyvar database as the duration of the study.
- Set up sci_details database entries for : date_obs, sci_obj, n_repeat_s=1, time_tagged=0 or 1, nrasters1=0.
- Set up study_details database entries for : usable='Y', flag_master=0, n_raster_def=0, sft='N', duration1=0.
- Ensure that the following study is time tagged.

An engineering study may have a deferred pointing associated with it in sci_details. In this case CPT will point to the deferred position at the start of the engineering study.

If the engineering study is not deferred then it will start at the home position.

At the end of the engineering study the mechanism will be in their home positions and the GSETID will be unchanged.

6 Appendix A : Example engineering study command table

This shows an NIS study coded in a table suitable for inclusion in an engineering study.

```
# NB no CDHS series/sequence ID
# Unless deferred will start at home position.

39            # Study ID=0 / Sequence Length calculated manually

CB5INCS 1          # Increment the Study counter (INCS)

CB5MIR 0x80        # Raster start at mirror posn. 0x80

CB5SLIT 0x0        # Raster start at slit posn. 0

CB5SIC             # Set Exposure Time Increment (CBVEXPTI) to 100 ms
CBVEXPTI 4
TERMINATE

CB5SIC              # Set Camera Operation Mode
CBVCAM 10 1 0 0 1   # HTR 10 lines, no binning, no htr, windowing, mode 1
TERMINATE

CB5FILR             # fill raster table :
                    # table length=12 => no.commands = 12+2+3=17
0x0                 # table index 0 = NIS
0x0                 # table location = start
0xFFFF              # Raster ID number = NIS
0x000C              # This table length (instrument dependent).
0x0230              # Data compression scheme, slit number, spectrometer
0x0001              # Number of runs of this raster
0x0101              # Number of mirror/slit locations used.
0x0000              # Size of mirror/slit steps (motor steps)
0x00C8              # Exposure time in units of 100ms
0xFFFF              # ID number of data extraction window list
                    # = FFFF Full Frame Readout
0x0000              # Data compression option
0xFFFF              # ID of VDS Hardware Window List.
0x0200              # Orientation, CDHS map and mode, HTR status, 4 nibbles.
0x0000              # Number of HTR cycles - not used.
0x0000
0x0000              # VDS on-chip binning: (byte,nibble,nibble)
                    #                      (off/on,xfac,yfac)
TERMINATE

CB5FILDE            # fill dexwin table :
                    # table length=4 => no.commands = 4+2+3=9
0x0                 # table index 0 = NIS
0x0                 # table location = start
0xFFFF              # Data Extraction List ID
0x0004              # Number of data lines.
```

```
0x0000              # Window 1   X start  0
0x0000              #          Y start  0
0x0400              #          X length 1024
0x0400              #          Y length 1024
TERMINATE

CB5FILV             # fill vdswin table :
                    # table length=7 => no.commands = 7+2+3=12
0x0                 # table index 0 = NIS
0x0                 # table location = start
0xFFFF              # VDS Hardware Window List ID
0x0007              # Number of data lines.
0x2206              # IMIF MLB header for VDS command
0x3001              # Set Number of Windows
0x3400              # Window 1   X start  0
0x3800              #          Y start  0
0x35FF              #          X length 512
0x39FF              #          Y length 512
0x3C00              # End of Windows
TERMINATE

CB5RUNR 0xFFFF     # Run Raster

CB5RUNS 4           # run warm_start sequence to reset CBVCAM parameters
```