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1. Introduction

The three FIRST instruments have decided to use SCOS-2000 throughout the integration program as basis for the EGSE.

As SCOS-2000 is configured by a series of configuration files, together called the Mission Information Base (MIB) an adequate tool is required to generate and maintain the MIB.

Notice that the MIB always reflects the configuration of the system and as such evolves together with the integration state of the instrument.

We must distinguish the following items:

- the MIB, is a set of ASCII files.
- the database application that contains the tables. It is this application that should provide the integrity of the data.
- the MIB editor. This editor provides access to the tables by means of a series of forms. The editor links to the database that contains the tables.
- The data in the tables.

This report is an assessment of the SCOS-2000 database editor supplied by ESOC, also referred to as the *Integral MS Access editor*.

This report applies to the SCOS-2000 Database Editing Subsystem, version 2.0.

2. Reference documents

RD.1. FIRST/PLANCK Operations Interface Requirements Document SCI-PT-RS-7360 Draft 5

RD.2. Database Import ICD S2K-MCS-ICD-1-TOS-GCI

RD.3. MIB editor Requirements specification document SRON-U/HIFI-SP-2000-2.

RD.4. SCOS-2000 database editing subsystem

RD.5. SCOS-2000 Task parameter File ICD S2K-MCS-ICD-3-TOS-GCI

3. Report

3.1. Review of requirements

The evaluation of the editor follows the requirements as listed in RD.3.

The requirements are listed here in italics and the remarks that remain unchanged with respect to issue 1 of this report are also printed in italics.

My new remarks are marked with a change-bar.

I have also included the replies from Johnnie Houser, the editor's author. These replies are marked with JH. Where JH mentions :next release he refers to version 2.0.

3.1.1. Data content

Requirements:

RQ 3.1.1 *The database shall contain all data that is required to configure SCOS-2000*

RQ 3.1.2 *The database shall contain a table for each SCOS-2000 file*

***Remarks**:*

Remark #1. *The database-editor does not acknowledge table MCF for polynomial calibration curves. Even though the table does exist, no form is present to edit the data. Moreover, a polynomial curve can not be referred to from PCF-CURTX.*

Not severe, if an instrument team decides not to use polynomial calibration curves.

JH: Implemented for the next release. INTEGRAL does not use this table therefore the editor wasn't required for us. The way S2K handles this is as follows: If a telemetry parameter category is set to "N" and PCF_CURTX is not null then it first checks the CAF table for the reference. If not found then it checks the MCF for the reference. If found then the proper calculation is implemented. If not found then the db is inconsistent. A range of numbers should be preserved within the allowed range of 0 through 9999, for MCF references. They cannot be the same as those contained in the CAF table.

Solved: There is a MCF form

However the PCF/PLF form does not support MCF calibration

MCF has no primary key.

Remark #2. *The database editor does not encourage the user to enter any data in VDF. As an undocumented feature the date and time are entered in VDF when an export of the complete database is invoked. The order in which the records are exported is not properly defined.*

JH: The VDF entries are only used by the S2K system. The S2K operator has the capability to load a screen that shows the date, not the time, of the last remotely exported database. This table is populated automatically at export time and is transparent for database administration.

Having said this the local PC system date must be set to “DD/MM/YY” in order for this table to be populated correctly. Currently, if you select to export all the database tables at one time then the export will halt and return an error message if the system date is set other than that specified.

The interface with the VDF- table is improved with respect to the previous version.

Nevertheless the following remarks:

- The vdf-exporter does not work properly. It should add a record to the VDF-table for each export action and export the complete table. It does add the record, but this record is not exported. (The order export – add record is reversed)
- The text “the database was last imported on:” does not update after the update action.
- I wonder what provisions have been made to ensure that the record with cdf_name representing the most recent data is imported last.

In the VDF editor the browse-edit functions are reversed

The user can not edit the comment as the relevant record is created upon export.

The proper order is
- Export all tables
- edit VDF
- export VDF only

3.1.2. User interface

Requirements

RQ 3.2.1 *The database shall provide a datasheet for each table.*

JH: Implemented. The Access tool bar is now user defined and supports the selection of database tables in table view. This concept is in direct support of bulk database maintenance however it is felt to be very dangerous for large data set maintenance.

RQ 3.2.2 *The datasheets shall mark each column with the field-names listed in the MIB import ICD*

JH: Implemented. Function of Access with the above implementation.

RQ 3.2.3 *The datasheets shall use tiptexts to clarify the meaning of the columns.*

JH: This is not possible at table view level.

RQ 3.2.4 *The datasheets shall show complete records on the monitor. (i.e. a record shall be visible completely without the need of using scroll-bars)*

The rationale of these requirements is that a user might want to see a spreadsheet-like overview of the data in the table.

JH: The editor forms / subforms are not designed for use of horizontal scroll bars. Vertical scroll bars are required on many subforms. For example on INTEGRAL we have many commands with greater than 200 parameter assigned to them.

RQ 3.2.5 *The database shall provide a set of forms that follow the data-structure of the MIB.*

JH: On some forms a few fields are not present because they are automatically populated at export time. For example, within the CSP subform of the command sequence editor the CSP_PTC, CSP_PFC and CSP_TYPE are not shown on the form. They are populated correctly at export time.

RQ 3.2.6 *Whenever the value of a field is limited to a set of values based on another table, the forms shall provide pulldown menus to select a value.*

JH: Implemented

RQ 3.2.7 *The forms shall use tiptexts to clarify the meaning of the columns*

JH: Implemented. All fields now support tiptexts. In addition if you click on any field within any form and press the F1 key you invoke a windows help file for that field only providing all relevant information for the field in question as specified in the S2K MIB ICD.

Remarks

~~*Remark #3.* *Requirements 3.2.1-3.2.4 are not implemented. The Database editor only provides forms through which the data can be viewed and edited.*~~

Remark #4. *Help functions and tip texts are present in most cases.*

3.1.3. Data checking

Requirements:

RQ 3.3.1 *When a field is marked as unique identifier of a record in a table, this unique key shall be enforced by the database.*

RQ 3.3.2 *When a relationship exists between to tables an update-cascade will enable edits of primary-key fields.*

JH: If I understand this correctly the function is implemented. For example if you add a new PCF record then the PLF and VPD key fields are automatically populated. However in the case of telemetry, telecommand and telecommand parameters and sequences and displays it is not possible to edit the key record if it is equal to a name field. If a record exists then you can only use the save as function to change the name field.

RQ 3.3.3 *When a relationship exists between to tables the absence of a delete-cascade will prevent unintended deletions.*

JH: Cascade deletes are supported where it is required. In all cases delete operations can only be conducted after passing through a warning message. If a

record is referenced by an external source then it cannot be deleted unless the reference is removed from the external source first.

RQ 3.3.4 *When a field can contain a limited set of values, validation rules shall enforce these limitations.*

JH: Implemented. It is not possible to enter data via the editor that is outside the range of the list.

RQ 3.3.5 *When a field is marked as mandatory in the MIB import ICD, the database shall enforce that a value is entered.*

JH: Current implementation. If a field is marked as “Required” in the table definition then the associated record cannot be saved until the required field is populated.

RQ 3.3.6 *When a default value is specified in the MIB import ICD (Default values used by SCOS-2000 for fields that are left blank in the tables) these default values shall be used as default values in the tables.*

JH: Required default values for fields, as specified in the S2K MIB ICD, are implemented within the table definition.

RQ 3.3.7 *Upon export, fields for which default values are specified shall not be left blank.*

JH: With the insertion of a new record the default values are set as specified in the table definition. However, there is no current check in the export routines to insure that these fields are populated in the event that it comes up missing. This can be considered for a future release of the editors.

RQ 3.3.8 *The database shall have a tool to check the data for a configurable set of errors. The kind of checks that is meant here are the checks that can only be performed when a complete data set is entered and that can not be performed by the consistency checks of the database itself.*

RQ 3.3.9 *The database editor shall maintain all fields that count the number of related fields in another table in those cases where these counters are meaningful for SCOS-2000*

RQ 3.3.10 *The database editor shall have a tool to update all fields that count the number of related fields in another table in those cases where these counters have no meaning for SCOS-2000.*

Remarks:

Remark #5. *The primary keys are implemented OK for what the unique fields are concerned.*

Remark #6. *The primary key is not OK in the situation of table PID. Here the first five fields should form a unique key, but the key is constructed from the first six fields. This may result in confusion.*

However, this might be better than the situation as defined in RD.2, section 3.3.2.4.1, where the first five fields should form a unique key provided that field #13 contains "Y". This inhibits a proper implementation of this key in a relational database. Probably not severe. It keeps the user awake.

JH: For INTEGRAL it was absolutely necessary to key on the first six fields based on the structure of the incoming satellite database from our manufacturer. Since the key fields influence the coding of the editors and consistency checker software then they must be maintained.

Remark #7. *Most cascades have the delete option on. They are properly documented in RD.4*

Remark #8. ~~*Validation rules are not implemented. For example, if the RAWFMT field should only contain U, I or R the field may contain any value*~~.

Validation rules are enforced.

Remark #9. *Mandatory fields are enforced and default values are used.*

Remark #10. *Empty fields with default values are exported empty.*

JH: To be investigated and possibly fixed for the next release. For INTEGRAL this has never been the case. Unless the field's data is removed after the default value was set. I'll check this and find a solution.

Remark #11. ~~*Queries to spot errors are not implemented. This is not severe, but it might be nice-to-have. Anyway, these tools will pop up by the time the database is refused for obscure reasons*~~.

JH: The original baseline for INTEGRAL was to have all consistency checking done with a dedicated application outside of the editors. It will be delivered with the next release. To add to this subject a little the INTEGRAL database is rather large in turns of records and populated fields. The later being greater than 870,000. Since the code behind the editors is greater than 1300 pages then additional overhead would certainly deteriorate the performance of the application as far as the INTEGRAL database is concerned.

Having said this the editor is designed to force correctness in most cases. Having conducted massive database maintenance in the last several months myself I have never entered an incorrect record.

The editor has a consistency checker. This really is an impressive tool, easy to use with clear indications of the spotted errors.

A useful extension might be if one individual check could be repeated. The user has performed the checks, he has removed a particular error and wants the consistency checker to confirm this. Rather than going through all the tests, he only would like to carry out the indicated test.

Remark #12. *The maintenance of counters seems to be a difficult area. You may wonder why these fields are in the database in the first place. It is hardly possible to get a 100% waterproof editor of a master-detail relationship where the master-table contains the number of details. In RD.2 their presence is justified with "to enable consistency checking". (If they would not exist you could not tell if they were consistent.) Moreover, they are hatched out in most cases as SCOS-2000 would not use them.*

Back to the editor: In some cases the user is prompted to indicate if he wants to have the counters updated, at the expense of several minutes waiting time. In my humble opinion, the editor should always guarantee the correctness of the output data, disregarding the operator's lack of time.

JH: Agreed. The presents of these counters within the database are in most cases useless and certainly do not have any useful function other than for administrative purposes. S2K currently does not use any of them.

Another reason to keep wrong data out of the ASCII files is the following observation:

Remark #13. *CSF_NFPARS is a counter that is hatched as irrelevant for SCOS-2000 in RD.2. However, in RD.5 it is stated that the number of parameters in a task parameter file will be checked against CSF_NFPARS.*

Remark #14. *Undocumented feature: when a parameter code (PTC,PFC)=(5,2) is entered in the table, the output contains (5,3). Only severe if you don't like surprises.*

JH: INTEGRAL mission database related activity. I will remove this processing for the next release of the editor application.

3.1.4. Groups of data

Requirements

RQ 3.4.1 *The database shall have an organised way to collect groups of data that as a group correspond to a subsystem of the instrument.*

RQ 3.4.2 *The data that belongs to a subsystem can be entered to the database without detailed knowledge of SCOS-2000.*

RQ 3.4.3 *A report can be made of the data that belongs to one subsystem.*

RQ 3.4.4 *The database-content can be changed according to a change in instrument configuration.*

Remarks

Remark #15. *This requirements anticipate that data shall be supplied by subsystems engineers who have nothing to do with SCOS-2000. They should only be asked to supply data that is related to their subsystem, not to SCOS-2000. The only organised way to enter data is by typing forms.*

Remark #16. *An untrained operator cannot enter or edit data.*

JH: I agree. In ESOC it is not possible for anyone to edit satellite databases unless they are a fully qualified database administrator with a vast amount of control system and spacecraft hardware/operational experience.

Remark #17. *Report facility is poor.*

JH: It has been improved for the new release and will be improved more for future releases

I would like to see the following reports:
- CCF with CDF
- CPC
- The (de) calibration sets (these are present)
- PID-PLF
- PID-VPD

Moreover the forms should contain the Database version VDF data in the header. Refer to Annex A for form-proposals.

3.1.5. Tools

Requirements:

RQ 3.5.1 *The database shall have a tool to import a set of SCOS-2000 files*

JH: Implemented. This is not a selective import however. The user has the opportunity to import a single table, a set of tables or the complete database.

RQ 3.5.2 *The database shall have a tool to append a set of SCOS-2000 files*

RQ 3.5.3 *The database shall have a tool to output a set of SCOS-2000 files*

RQ 3.5.4 *The database shall have a tool to delete the data from the tables*

JH: Implemented. The user now has the capability to delete a single database table.

RQ 3.5.5 *The database shall have a tool to enter series of parameter-value-sets in an intuitive way.*

Remarks:

Remark #18. *The only tool implemented is the output tool. The others are missing. In my opinion a proper import tool is very important. Depending in whether or not an instrument team decides to use parameter values sets (what may be very efficient) a better tool to handle these tables is required.*

The editor has a Reload function. Although the manual envisages a restricted functionality for this function I think it may be very useful to group the MIB data into several smaller MIBs.

We should keep in mind that when more than one table is imported the existing records are replaced, rather than appended.

The importer can not import records that violate keys or validation rules. In these case the error-message is poor. “You tried to import 1000 records. Two of them failed. Please guess which records failed and what was wrong with them.

3.2. Appearance and user interface

The assessment of the user-interface is mostly a matter of taste. I can make the following observations:

The user interface has improved with respect to the previous version. An important improvement is the better navigation between the user-forms.

Remark #19. *The user manual (RD.4) recommends to use at least a 17-inch monitor with 1024*768 display resolution on small font size. The penalty of using a normal fontsize is that part of the forms do not fit on the display. The result of using small fontsize is a severe headache.*

The solution is to use a 19-inch monitor.

Remark #20. *The Database editor does not comply with the normal MS-Windows look and feel. The S2K-logo is used as major navigation button, option-buttons are used as action buttons, etcetera. Again matter of taste, you learn to live with it.*

Remark #21. *The editor is designed with the goal to squeeze all the data in the database onto the monitor screen. It shows no empathy at all with the user: what could a user possibly want to see?*

And: why, if the monitor-area is so small, there is always a far too big part reserved for these ugly large buttons EDIT-ADD-DELETE Etcetera, and why is there so much unused are between the fields.

3.3. Miscellaneous observations

3.3.1. The use of hexadecimal values in numerical calibration curves

Remark #22. *MIB editor does not support hexadecimal values in numerical calibration curves.*

The numerical calibration curves may be expressed in octal, decimal or hexadecimal values. In table CAF a curve is specified as OCT, DEC or HEX.

JH: I agree. INTEGRAL does not use anything other than decimal for these values. Having said this the tables do support all specified types. The fields are of type character with a width of 17. I can easily change the form for the next release in order to suit your needs. One need not prefix a value to indicate that it is hex. The radix takes care of this. Please note that the graphics window will be lost.

This is indicated in the manual.

This is not severe if an instrument-team decides not to use hexadecimal values.

3.3.2. Use of units with engineering calibration

Remark #23. *SCOS-2000 allows to specify an engineering unit for a parameter and to specify an engineering unit for a calibration curve.*

These errors will be caught by the consistency checker

3.3.3. Non-conformances with RD.2

Remark #24. ~~*The field OCP-RLCHK of table OCP is limited to six characters (should be 8 chars).*~~ The fields ocp_lvalu and ocp_hvalu should have length 14 not 10.

Remark #25. The fields: cvs_spid, pcf_pid, pid_pi2_val, pid_spid, pid_tpsd, tpcf_spid,plf_spid and vpd_tpsd are not capable of containing 10-digits numbers

Remark #26. The following fields should not be mandatory:

- css_mandisp
- gpf_upun
- spf_upun

3.3.4. Name of the editor

~~Remark #27. The editor appears with three names:~~

3.3.5. Report forms

Remark #28. The Variable Packet Definition Selection Form opens after: VPD-editor > Report> preview selected. The selection list should only display *unique* records, preferably in numerical order.

Remark #29. The multiple selection form PLF has a wrong header-text.

Remark #30. The PID report has no output order.

4. Conclusions

1. Version 2 has improved greatly with respect to the previous version. This is also true for the User manual.

2. The SCOS-2000 database editor is a good tool to work with.

3. The changes implemented in the current version should be encouraging for users to feed back their experiences and comments. The feedback is appreciated and leads certainly to a better product.

Numerical calibrations

Database version: 22/02/01 Page 1 of 1

Linked to: C:\S2Kdbs\Data\ExampleDatabase\Working

Date: Apr 12, 2001 Tables: CAF and CAF

caf_number	**222**	MRU: BAT temperature	
Eng. format	R	caf_radix	D
Raw format	U	caf_unit	degC

x-values	y-values
0	50
39	37
103	21
152	10
198	-1
229	-10
255	-20

Command parameter characteristics

Database version: 22/02/01 Page 1 of 1

Linked to: C:\S2Kdbs\Data\ExampleDatabase\Working

Date: Apr 12, 2001 Tables: CPC

Name	**A0001**	Description	DATA 1 UMW		
PTC	3	Unit		PAF	
PFC	12	Categ	N	Inter	R
Disp	U	Range	1	Default	0
Radix	H	CCA			

Command definitions

Database version: 22/02/01

Linked to: C:\S2Kdbs\Data\ExampleDatabase\Working

Date: Apr 12, 2001 Tables: CCF, CVP, PTV and CDF

Name **A1021** PERIOD MEM DWLD
Set Periodic Memory Download Parameters TC

Command type		APID	640	Subsystem	1
Critical	N	ccf_plan	N	High priority	N
Packet-ID	STANDARD	Executable	Y	MAP-ID	0
Type	5	Interlock scope	L	Default par. set	
Sub-type	3	Interlock stage	C	Red'nt APID	

Applicable verification stages: 9999

Command elements:

Bit offset	Parameter name	type	Description	Length	Group size	Inter	Def value	MTID
0		A		8		R	13	
8		A		8		R	0	
16	A0303	E		16		D		
32	A0304	E		16		D		
48	A0305	E		16		D		
64	A0306	E		16		D		
80	A0307	E		16		D		
96	A0308	E		16		D		
112	A0309	E		16		D		
128	A0310	E		16		D		
144	A0311	E		16		D		
160	A0312	E		16		D		
176	A0313	E		16		D		
192	A0314	E		16		D		
208	A0315	E		16		D		
224	A0316	E		16		D		
240	A0317	E		16		D		
256	A0318	E		16		D		
272	A0319	E		16		D		
288	A0320	E		16		D		
304	A0321	E		16		D		
320	A0322	E		16		D		
336	A0323	E		16		D		
352	A0324	E		16		D		
368	A0325	E		16		D		
384	A0326	E		16		D		
400	A0327	E		16		D		
416	A0328	E		16		D		
432	A0329	E		16		D		
448	A0330	E		16		D		
464	A0331	E		16		D		
480	A0332	E		16		D		
496	A0333	E		16		D		
512	A0334	E		16		D		

Fixed packets

Database version: 22/02/01

Linked to: C:\S2Kdbs\Data\ExampleDatabase\Working

Date: Apr 12, 2001

pid_spid	**79**	1st identifier	0	TPSD	-1
type	26	2nd identifier	0	DFHsize	10
sub-type	26	description	TC SPACON	time flag	N
APID	52	unit		gen. interval	

Position		Parameter					Occurences		
byte	bit	name	description	ptc	pfc	number	lag (bits)	time-offset	delay
0	0	MAP_ID	SELECTED MAP ID	3	4	1	0	0	1
1	0	VC_ID	SELECTED VC ID	3	4	1	0	0	1
2	0	TCE_BUF	TCE BUFFER	3	4	1	0	0	1
3	0	UPL_MOD	TRANS MODE	3	4	1	0	0	1
4	0	STAT_PTV	STATIC PTV	3	0	1	0	0	1
4	4	DYN_PTV	DYNAMIC PTV	3	0	1	0	0	1
5	0	CEV	CEV STATUS	3	0	1	0	0	1

Variable packets

Database version: 22/02/01

Linked to: C:\S2Kdbs\Data\ExampleDatabase\Working

Date: Apr 12, 2001

pid_spid	**97**	1st identifier	33	TPSD	**1001**
type	97	2nd identifier	0	DFHsize	10
sub-type	0	description	ACC MODE	time flag	N
APID	640	unit		gen. interval	

	Parameter					Attributes				Display options					
Pos	name	description	ptc	pfc	A	B	C	D	Description	A	B	C	D	E
0	A5768	BODY FILLER 6	3	2	0	0	N	N		21	L	Y	2	N
6	A5763	MESS CLASS	2	2	0	0	N	N		21	L	Y	2	N
8	A5764	MESS ID	2	8	0	0	N	N		21	L	Y	2	N
16	A5767	BODY FILLER 3	2	3	0	0	N	N		21	L	Y	2	N
19	A5770	MODE COMMANDED	2	5	0	0	N	N		21	L	Y	2	N
24	A5766	BODY FILLER 4	3	0	0	0	N	N		21	L	Y	2	N
28	A5771	OEM ACTUAL MODE	2	4	0	0	N	N		21	L	Y	2	N
32	A5772	BODY FILLER 16	3	12	0	0	N	N		21	L	Y	2	N