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FIRST PROJECT TELEFAX

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Date : 21 May 1996 Page: 1 of 1
Ref. : PT-02407 + att.: 9+1

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To : FIRST Science Operations Definition Group :

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Cc. : ESTEC -- J.A. Steinz (PI), B. Taylor (SA),
ESOC -- A.F. Smith (MOD)

Subject : **FINAL Minutes of the 2nd FSODG**

Please find attached the final minutes of the 2nd FSODG meeting. I have updated them according to the comments received. W.r.t. housing of the FIRST archive (in scenario #2) I find Andy's arguments thoroughly convincing (his Profs note of 21.05.96 is attached) and have therefore updated the minutes as he suggested despite Otto's misgivings. Updates to the minutes, w.r.t. the draft, are indicated by a vertical bar in the margin.

As far as AI's #2/4, 2/7 and 2/8 are concerned, it should be clear that "costing" can only be very preliminary and at best indicative of the relative merits of both scenarios. The "numbers" should not be circulated outside the group otherwise we run the risk of seeing them turned quickly into "hard" figures.

Regards,

P. Estaria

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MINUTES OF THE SECOND FSODG MEETING

The second meeting of the FIRST Science Operations Definition Group (FSODG) was held in ESTEC on May 9-10, 1996. All members were present.

AGENDA

The agenda (attachment 1) was adopted.

1. APPROVAL OF MINUTES OF FIRST MEETING

- It was clarified that the figure of 65 MAUs indicated in paragraph 2 (p. 2) of the minutes was roughly the overall cost (95' E.C.) of ISO Science Operations **including** a Post-Operational and an Archive phases. The only valid reference (indicative only) for FSODG work is the figure of 32-33 MAUs.

- The concepts of Ground Station(s) coverage and on board storage of instrument commands were re-addressed. It was concluded that:

  - command storing can be done at two levels: instrument buffering of one or two block commands and buffering by the spacecraft. Depending on the spacecraft design, command buffering by the spacecraft could be done in a time-tagged buffer or in the MMU (if one is available). The optimal combination is TBD.

  - If there is no complete station coverage i.e. only one GS (with MMU on-board) either the instruments need to be more autonomous (and therefore possibly more costly) to take care of themselves during the non-contact periods or the OBDH must carry out instrument monitoring and ensure instrument safety (as it does for the other spacecraft subsystems during "autonomy").
    Furthermore, special provisions must be made, during non contact periods, to cover anomalies such as failure to acquire a guide star or any problem with the "stored" command schedule.

- It was agreed that the system should not prevent commands to be sent to the instruments which are not PRIME. Operational procedures might enforce certain restrictions but these should not be the result of system design limitations.

- The AOT concept was re-discussed. Point 13 of the Appendix (Issue 1.) attached to the first minutes is misleading and will be re-written.(see AI # 2/1). It was stated again that the concept of AOT to shield the "proposer" from the complexities of the science instruments shall be maintained. The system should allow proposers to specify their inputs in terms of the "science" to be carried out. It was suggested that proposers should be asked to provide more input than

what seems strictly necessary (this would reduce the impact of necessary changes later on). It was also stated that input in terms of S/N is not adequate. Monolithic implementation of the AOT logic (as was done for ISO) is not the correct approach. More flexibility in the combination of the AOT building blocks (ICSs) is required. A CUS-like approach should be implemented. It was confirmed that the approach of validation of individual instrument mnemonics at ILT-level, combination into ICSs, ICS testing in the AIV programme and final ICS selection for the operations was correct. This should lead to a total of about 10 ICSs per instrument.

- The concept of TDATA briefly addressed in the first meeting was re-visited. It is agreed that the missing functionality provided by TDATA in ISO can be provided for FIRST via a unique mechanism, namely a "command" with associated parameter(s) addressed to the science instruments. The associated administrative information (e.g. Proposer's_ID, Proposal_ID, etc.) is kept in the Data Base.

2. OVERALL DEVELOPMENTS SINCE FIRST FSODG MEETING

The status was presented by J. A. Steinz. The FIRST Pre-Phase B Schedule, Issue 02, 1996 dated 01-MAR-96 was distributed to the FSODG members. Main points presented were:

- The SSAC has recommended to the SPC selection of the COBRAS/SAMBA mission as M3. According to D/SCI this might have an impact on both FIRST and COBRAS/SAMBA schedules. Furthermore several key milestones for M3 and FIRST are close in time. In addition the recommendation to implement the Mercury cornerstone with a Launch date of 2009 might cause a clash with FIRST. As a result D/SCI is re-examining the entire situation. In the meantime no change in the FIRST schedule. In particular Mission Reconfirmation is still scheduled for June '97 (with an upper limit for overall FIRST cost of 675 MAU).

- The schedules of the scientific instruments are critical (on the project critical path). Instrument development is expected to take 6-7 years. PI-type groups need to be strengthen to carry out the necessary work.

- Both cryostat and cryo-cooler studies are progressing well. Cryo-cooler option much improved. Decision in the Fall of '96.

- A development Ge:Ga stressed detector was overstressed and broke. A delay of some months is likely.

- A study to assess suitability of the XMM bus for FIRST is underway (considering both cryostat and cryo-cooler options), with a re-examination of several orbit options. The most promising combination seems to be: Ariane 5 single launch + XMM bus + XMM orbit. Results of the study in October '96.

- Telescope: Most critical area. Determines FIRST viability. CFRP Reflector not finalised yet. The proposed coating facility at Calar Alto, Spain would be adequate (with some modifications). Alternative reflector technologies under study (Al and SiC type). It is intended to choose the reflector technologies (baseline + 1 back-up) by the end of the year.

3. REVIEW/DISCUSSION OF "DRAFT" WRITE-UPS

The "write-ups" were distributed to the FSODG members prior to the meeting and presented by the authors. The minutes records the main points raised during the presentation and subsequent discussions.

3.1 Proposal Handling Subsystem

The Proposal (or Observation) Handling Subsystem -input provided by G. Pilbratt and K. King- (AI # 1/2) was presented by K. King. The following points are recorded:

- Design of the Proposal Selection System depends to a large extent on how FIRST observing time will be offered to the scientific community (see AI # 2/5). Two scenarios are possible: handling of multiple inputs prepared on a variety of computer hardware, or processing of a few "coordinated" inputs.

- Instrument time estimators are required. Users can access via a server or "down-load" remotely to their site. In the second case a strict control of the S/W version # is required to avoid CC problems due to users making use of outdated "local" versions.

- To enter the details of (or update to) the individual observations it is preferable to rely on a central site with a limited number of knowledgeable people.

- The Observation database is central to the Observation Entry System. It should allow the selection of observations based on several keys (instrument "modes", wavelength range, time(s) of observation, priority, proposer, etc.).

- The database should allow changes to a *selected* set of observations.

- Duplications between proposals/observations can be identified by means of specific database queries.

3.2 Mission Planning Subsystem

The input provided by A. Robson- (AI # 1/3) was presented by him. The approach selected relies on the concept of "Instrument Control Centres" (ICCs) providing their inputs directly to the MOCC. Implementation is the simplest if only one prime instrument per orbit is selected. In this case each ICC can prepare its input independently of the others. If multi-instrument observing programmes need to be

implemented (the general case), coordination between the ICCs is required before the individual inputs are submitted to the MOCC. The following points were recorded during the discussion:

- The execution of routine science and spacecraft operations requires the use of a Centralised Command Schedule (CCS) -as in ISO- and the possibility to insert commands based on real time decisions.

- Scheduling -as opposed to "planning" - (wether one or multi-instrument per orbit) and CCS generation are carried out by the MOCC.

- "Linking" of observations should be, if required for FIRST, implemented (after Project's Scientist approval) via the standard facilities of the scheduling system, not using a "special" scheme.

- "Concatenation" (as defined in ISO) should not be implemented for FIRST. This implies that slewing time should *not* (as was the case in ISO) be charged to the individual observations. This charging policy was, in ISO, one of the main motivations to "abuse" the concatenation option. Note also that in the case of LWS for example, existence of a raster pointing mode with "off-position" as proposed for FIRST would have made concatenation unnecessary. It was also noted that the "un-concatenating" which in ISO became necessary as a result of changes in the observing programmes turned out to be an error-prone and tedious process. This must be avoided for FIRST. If "grouping" of observations is required this should be carried out using standard functions of the mission planning/scheduling system.

- The often debated issue of one instrument per orbit versus multi-instrument operations surfaced again. The members of the FSODG are split on the issue. In order to gain insight based on practical data it was agreed that an investigation will be carried out on ISO data, in particular an assessment of the slew overheads in various scenarios (see AI # 2/3)

3.3 Scientific Data Processing

The topic was introduced by O. Bauer. (AI # 1/4). The following points were noted:

- There is agreement on the suite of packages (based on the ISO-model) which are required to carry out FIRST scientific data processing.

- These packages should have as much commonality as possible (e.g. standard common routines to access the different input data and format the external output files) but no attempt should be made to build large packages for all instruments (e.g. Pipeline Processing in ISO).

- The output files shall be formatted according to the astronomical standard in use at the time (currently FITS).

- Raw data, rather than processed data should be made available to the community. The "best" calibration data and "best" processing S/W available should be accessible to the users.

- Instrument Dedicated Teams (IDTs) should be set up early. Ideally these teams should include ESA staff. There is no agreement (yet) on the funding of these ESA staff.

- Product distribution: Rather than "distribute" products, selected sets of data should be made "available" to the community (according to proper access rules). At the time of FIRST, ISDN access should be ubiquitous, cheap and easy. Users would connect to the Archive at their own costs. It is expected that if some sort of distribution were nonetheless required this would be easy to achieve (today one would use CD-ROMs).

3.4 FIRST Mission Archive

The topic was introduced by P. Roelfsema. (AI # 1/5). The following points were noted:

- S/W items (e.g. processing algorithms) and instrument on-board S/W data shall be added to the Archive.

- The Archive should be "central" i.e. in one place. There does not seem to be any overriding reason currently to have a "distributed" archive. Distribution complicates the logistic (maintenance of distributed hardware, possible problems with access lines, loss of functionality when some "nodes" are down, etc.).

- It might be useful, for performance reasons, to have subsets of the Archive at specific locations but this is not a "hard" requirement. Possible Archive integrity issues need to be addressed in this case.

- Proper redundancy (hardware and procedures) shall be included in the central Archive in order to guarantee safety of the data (classical protection against fire, theft, vermin, etc.).

- Long term archiving of intermediate data products should be avoided. If necessary, re-processing can be carried out.

- Defining the relationships between the various data items stored in the Archive is seen as one of the major jobs to be carried out in preparation for science operations. This is seen as a team work involving database specialists, operations staff, and instrument specialists.

- Definition of the database must be expanded to include "calibration" observations and "engineering" type activities such as detector curing (e.g. detector curing during station hand-over for ISO).

- More "structure" than in the case of ISO is required (per orbit) for the non-scientific activities. This structure shall make it possible to establish a connection between the input (proposal, what was scheduled, etc.) and the output (the actual observation). This connection is very difficult in the case of ISO.

4. OPERATIONAL SCENARIOS

The review and subsequent discussions of the main subsystems write-ups led to the generation of two major Science Operations scenarios. Both scenarios rely on the existence of dedicated "Instrument Control Centres" (ICCs) - one ICC per instrument- In both scenarios the Mission Operations Control Centre (MOCC) is located at ESOC and is responsible for mission scheduling. In both scenarios the ICCs are *not* involved in Proposal Handling.

Scenario # 1 is based on the existence of a "FIRST Science Centre" which houses the FIRST Archive and provides the necessary "science coordination" function.

Scenario # 2 foresees a direct connection of the ICCs to the MOCC.

The scenarios will be described and costed separately before the next meeting. The functional descriptions will be based on the write-ups produced for the meeting, with the changes introduced during the discussion. Costing will include an estimate of the manpower required and manpower deployment profiles (see AI # 2/6 and 2/7).

5. REVIEW OF SATELLITE SYSTEM SPECIFICATIONS

The Satellite System Specs. were reviewed (AI # 1/6). The purpose was to assess if inconsistencies do exist between these specs and the issues addressed by the FSODG. A list of inconsistencies, suggested updates, requests for clarification will be compiled and kept up-to-date (see AI # 2/2). The following main points were recorded:

- Launcher configuration and FIRST orbit need to be finalised.
- One month for the PV phase is much too short. It is likely that several delta_PVs (in particular if the cryo-cooler option is selected) will be required throughout the mission.
- On-board data storage (commands, HK-TM, Science-TM) needs to be finalised. Time-tagged buffer sizing is too small.
- Number of Ground Stations needs to be confirmed (full or partial TM-TC coverage?).
- Applicability of the earth and moon constraints needs to be confirmed/clarified. Do instruments require a shutter to be used during perigee passage ?

- Radiation monitoring is required. This could be achieved through an on-board H/W monitor or via modelling (radiation model, solar activity model). ISO data should be used.

- Battery sizing: currently batteries are sized for short eclipses only. On an ISO-type orbit long eclipses would occur at near-apogee. With the cryo-cooler option the entire orbit would be useless. (this might be acceptable).

- Raster pointing: It should be possible (as in ISO) to specify a dwell time between lines *different* from the dwell time between points (this allows calibrations to be inserted within very long rasters). Definition of the raster pattern axes must be clarified. The duration t_{off} of stable pointing in the "off" position should be selectable.

- Telemetry and Telecommand Requirements: The text shall be made compatible with the TM and TC packet standards.

- The requirement on positive verification of command execution must be clarified: (i) TM format is not compatible with packet TM. (ii) The requirement may not be applicable to the science instruments in all cases.

- It is *not* necessary to provide facilities to stretch out a new software load from ground over several ground station passes. This is an unnecessary costly complication.

- The on-target flag should *not* be delivered to the instrument. An indication in the TM is enough.

6. INSTRUMENT ISSUES

Introduced by H. Schaap. The following points were noted:

- A draft model EID-B is under preparation by the Project.

- H. Schaap will discuss with INTEGRAL their solution to the OBDH-Instrument interface problem.

- The FSODG approach preserves commonality between the operations and the checkout requirements. C/O procedures are very similar to the AOT-CUS outputs. in AIV the CCE will send TM packets directly to the Instrument Stations.

7. CONCLUSIONS

The two main scenarios listed under 4. will be elaborated and preliminary manpower and cost estimates will be provided for discussion at the next meeting.

8. PLANNING OF FSODG WORK

Point 10 records all Action Items to be carried out by the members of the FSODG until the next meeting.
This meeting will take place in Garching (MPE) on 10-11 June 1996. It will start at lunch time on the 10th and finish at 17:00 (TBC) on the 11th. P. Estaria will propose an agenda. At the end of the meeting all the inputs required to prepare the presentation of the FSODG's findings to the SAG on the 25-26 June 1996 must be available

9. AOB

There was no AOB.

10. LIST OF ACTIONS

All Action Items (AI # 1/1 to AI # 1/6) from the first FSODG meeting have been closed. The following actions have been allocated as a result of this meeting:

- **AI 2/1: Estaria: Due date: 25 June '96**
  Update (to Issue 2.) Technical Note PT-TN-02067 summarising the main points from the FSODG meetings. This note will be expanded and updated as the FSODG work progresses.

- **AI 2/2: Estaria: Due date: end-October '96 (draft)**
  Issue a Technical Note outlining the discrepancies between the Satellite System Specs and the operational issues addressed by the FSODG. This note will be expanded and updated as the FSODG work progresses.

- **AI 2/3: Robson: Due date: 25 June '96**
  Investigate on ISO the relative efficiencies/merits of the one instrument per orbit scenario versus multi-instrument operations.

- **AI 2/4: Bauer + Roelfsema: Due date: 10 June '96**
  Provide a cost estimate (include rough manpower deployment profile) for an Instrument Control Centre (ICC) for scenario #1 and #2.

- **AI 2/5: Pilbratt: Due date: September '96 SAG meeting**
  Start preliminary investigations on ways to allocate FIRST ISO observing time (key programmes, guaranteed time, open time, etc.). This topic will be addressed at the presentation to the SAG in June.

- **AI 2/6: Estaria Due date: 17 May '96**
  Provide functional description of Scenario # 1.

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- **AI 2/7: Robson** **Due date: 17 May '96**
  Provide functional description Scenario # 2. Provide costing for the MOCC.

- **AI 2/8: King:** **Due date: 10 June '96**
  Provide a cost estimate (include rough manpower development profile) of the FIRST Science Centre for scenarios #1 and #2.

- **AI 2/9: Bauer:** **Due date: 10 June '96**
  Present preliminary findings of the FSODG to the SAG chairman (R. Genzel).

P. Estaria

P. ESTARIA

From: AROBSON --ESOC Date and time 96-05-21 12:28:42
To: OTTOB --EXTERNAL BAUER OTTO KENKING --EXTERNAL KING KEN
ROELF --EXTERNAL ROELFSMA_PETER
cc: PILBRAT --EXTERNAL PILBRATT GOERAN PESTARIA--ESTEC
HSCHAAP --ESTEC

FROM : Andy Robson
Subject: fsodg scenario 2
in the draft minutes of the 2nd meeting, section 4 (P.6) 3rd para., i asked pierre to remove " which houses the FIRST archive "
Otto objects strongly. Nevertheless in my description, dated 15 may, you will see that i do not include a general FIRST archive (the central feature of scenario 1) in the MOC. i have included however, a multi-purpose Server to enable the ICCs to pull off the Tm, commands, schedule and all other data relevant to the instrument observations. this means that the ICC has to implement/operate its own instrument observation archive/server for observers. this is one of the implications of scenario 2 -- and certainly makes the cost of the ICC a lot higher(and possibly less attractive) than scenario 1. however, to include a general FIRST archive in the MOC would drive up the MOC and therefore the ESA costs. you may argue that it wouldn't cost much more to incorporate a few more features into the scenario 2 MOC server, to carry ICC deliverables such as instrument processing s/w, calibrations, news etc. At the s/w and h/w level , this may be right -- but for definition, test, operations(all the complaints from observers on missing ICC deliverables) and security measures for the satellite operations systems, i would expect a significant cost. it also would involve MOC in the science data management (also in the post-ops phase) which is not at all desirable.

Regards
End of Message