

## FST6 July 6, 7 2000

### Notes

#### 1. Actions

- FST4A2: Flight spare go/no-go criteria - nothing to report.
- Others: Closed or to be dealt with later in the agenda

#### 2. Project status Francis Vandebussche/Thomas Passvogel

- The ITT will specify an Aluminium optical bench
- ITT timetable:

First draft ITT for TEB	31 May
First TEB meeting	19 June
Finalisation of IID-Bs in July for ITT	
Last TEB meeting	26 July
Release to industry	1 Sept
Proposal deadline	1 Dec
Phase B starts	1 June 2001

Industrial briefing took place on 30 June: 76 interested parties
- The Contractor will be requested to see if higher data rate is possible
- Relationship between Contractor and Instrument teams
  - Bidders will be asked to propose how relationship with PI teams
  - Potential contractors may contact PI teams in preparing their bids
  - IPC paper is available which explains policy on this - will make it available
- Action from Roger Bonnet on ESA team to organise special meetings on Instrument Operations and Cleanliness (cleanliness meeting in July sometime)
- Working groups: EMC and CDMS underway; Alignment will start
- Telescope: Peer review in June; CRR July  
NASA telescope provision to be confirmed before end of year by NASA
- System study report:
  - Cryostat: 66 K
  - Telescope: 76 K (large uncertainty - they didn't use latest telescope model)
  - Inside of sunshield: 180 K
  - Mass (inc. margin) = 5276 vs. 5310 Ariane launch mass capability
  - Pressure on instruments to keep mass under control from now on
- Alternative cryostat study (Air Liquide): results basically similar to baseline design
- Don't want to go below 2.5 mg s<sup>-1</sup> flow rate (problems with porous plug)
- Dornier study of payload interfaces:
  - Done - good results
  - Instrument design has changed a bit - masses have changed, esp. in focal plane
- Coordinated parts procurement:
  - Proposal evaluation to be completed 20 July
  - Need instrument parts list before 20 July
  - PIs reps will be invited to participate at meeting with selected agent
- Report on telescope peer review (T Passvogel):
  - Overall: the technology is ready to proceed
  - The viewgraphs were very nice but the JPL/COI documentation is completely inadequate
  - The problem of 2-m measurement has been solved
  - The baseline is now secondary reshaping to correct primary low-order errors
  - Material development is needed to go up to 3.5 m
  - Secondary adjust mechanism needed - needs to go into telescope spec.

- There is as yet nothing available to allow correlation between test results and model predictions
- Updated WFE budget: 10  $\mu\text{m}$  looks OK and 6  $\mu\text{m}$  looks difficult
- Test sequences for qualification and acceptance need to be defined
- Additional comments by Tom Phillips:
  - Documentation: Information probably exists but needs to be compiled
  - Specification is OK, goal may be within reach
  - Discrepancy between modelled and measured resonant frequency: possible inadequacy of the model to represent out-of-plane shear strength
  - Baffling not defined at the moment
  - Surface reflectivity: gold coating with protective layer; emissivity in FIRST range difficult to measure (say 2% to 0.5%). TP has asked them to measure if possible
  - Obscuration up from 3% to 5% (mainly due to tripod). Most of the 5% will end up on the sky, but some wont. Modelling needed - *Lightworks* are working on this.
  - Cost:
    - Telescope costing available from COI.
    - On-orbit secondary actuator needed to meet WFE goal, mainly uncertainty in primary ROC, which depends strongly on the achieved telescope temperature.
    - Costing for all of these means only one telescope can be afforded.
    - Proposed to qualify at component level.
    - So only one telescope but a very good one . . . . .
- SiC status:
  - One segment for 3.5 m contract continues
  - Will be made this year
  - Thomas: If SiC is the way to go, ESA will find the money (don't know how but it will be done)

### 3. Rationale for 3-hour Daily Telecommand Period (DTCP)      Pierre Estaria

- FIRST and Planck have to be operated in sequence, not in parallel
- Perth is the routine ground station (Kourou for commissioning/emergencies)
- Perth is also serving critical Rosetta operations in the same time frame (2007 - 11)
- Rosetta has priority (they've paid for the new ground-station)
- A single team at ESOC will deal with FIRST and Planck
- Operational constraints mean that DTCP can't be shorter than 2 hrs
- The duration of DTCP will be fixed in phase B
- The ITT specifies 3 hrs max. The Prime is expected to come up with something between 2 and 3.
- *Ad hoc* action will be taken in the event of a lost pass
- Lots of things have to be done during DTCP . . . see viewgraph
- Scientific operations are possible (but restricted viewing/possible EM disturbances)

#### Comments:

- Thijs: Period should be flexible so that it can be made as short as possible
- Pierre: It's not cast in stone . . .

### 4. FSC status      Goran Pilbratt

- Operations Scenario Document V1 will be out soon
- FSC SI: Draft 0.4 beign reviewed in ESA. Will be updated and circulated to ICCs
- FIRST/Planck Project team will review FSC and ICC SIPs in Autumn 2000
- FSPMP (Software Project Management Plan) = response of FSC team to the SIP: draft exists on DMS

- FSC development KO meeting occurred in Feb
- FIRST Use-case meeting took place 17 April 2000 (Appendix 2 in minutes of that meeting describes process and explains “actors”, “use-cases”, etc.)
- FGSSE (FIRST Ground Segment System Engineering group): meets regularly and produces lots of stuff
- Schedule:
  - Actor and Use-case docs. by Summer 2000
  - Common Object Model Oct. 2000
  - Formal reviews: FSC System Requirements Review Oct. 2000  
PDR of FSC System V0.1 (for ILTs) October 2000
- Monthly FSCDT progress reports are available on DMS
- NASA FIRST Science Support Center
- Peer review 14 June chaired by Gary Melnick
- JPL/IPAC = NASA contribution
- Bill Langer = JPL lead; Steve Lord = IPAC lead
- Support US observers as for ISO
- Provide certain tools such as IRSKY, SIRTF information, etc. (but this is not primary purpose)
- Budget = \$15M (~92SY) until launch with linear rising profile starting 2 yrs from now
- Reach 20 FTE 1 year before launch
- Noted that this is too late. George Helou and Guy Stringfellow are aware of this.
- About 30 people (\$7M pa) during operations (30% more than ISO; 1/3 of SIRTF)

## 5. HIFI status      Thijs de Graauw

- Loss of Band 7 means HD no longer possible
- Several H<sub>2</sub>O backbone lines also go
- Some ground state ionic lines also go
- HIFI lookig at science implications
- Open procurement issues
  - Canadian provision of LO source unit
  - Triplers and isolators
  - JPL deliveries under discussion
  - Band 6 considered as a potential de-scope item
- HIFI re-scoping instrument configuration to optimise science (low impact on interfaces)
- ISVR
  - Recommendations
    - Continue to work on simplifying the instrument
    - Look at deleting wideband spectrometer and upgrading high resolution spectrometer
    - Resolve funding issues
    - Protect Band 6 if possible
    - Work on development schedule and make it compatible with the ESA project need dates
    - Continue development of the LO system
    - Implement the technology road-map approach in a systematic manner as a tool to measure progress
  - Conclusions
    - ISVR completed
    - HIFI development critical, esp. Band 6 mixers and the LO system
- JPL Delta PDR for mixers and LO sources early next year
- Business agreement with JPL not yet signed - some differences to be resolved
  - Band 6 delivery: JPL definition of “best efforts” includes non-delivery - not acceptable to Thijs
- Instrument design
  - ICU (=DPU) going well

- HRS going well
- ITT for common optics goes out in September
- Detailed design of mixer assemblies also well advanced
- LO chain development not going as fast as would like
- DM master plan
  - DM testing completed by mid 2002 for input to FM design
  - FM delivery to ESA still in Dec. 2004
  - 11 months allocated for AIV
- Critical areas (as presented at May 23 Payload Readiness Review)
- Comments on loss of Band 7:
  - PC: What about removing low frequency bands to make high frequencies possible?
  - PE: 550 - 560 GHz can never be done from the ground
  - 2400-2700 GHz loss due to Band 7
  - N<sup>+</sup> 122  $\mu$ m; HD 112  $\mu$ m
  - PC: Band 6 loss would be much more serious
  - MH: Good riddance to Band 7. Risk was too high, and effort needed to develop it too great. FIRST will have too many capabilities to be used effectively in the time available. It will be a better system overall without Band 7. Wait for the next mission.
  - PC: But FIRST is a poor telescope at low frequency . . . .
  - TdG: Not practically possible to trade low-freq capability for high-freq capability.
  - Conclusion: It's a pity but not a large loss of science.
  - Thijs will not let Band 6 fall

## 6. PACS Status      Albrecht Poglitsch

- Instrument redesign
  - Bolometer arrays give better sensitivity and better fov than before
  - Saved 15 mirrors
  - Cooler will be identical to the SPIRE cooler
  - Cooler plus bolometer arrays will be delivered as a single unit by CEA
  - Optics redesigned
  - Good photometer image quality Strehl ratios 0.96 or better and distortion less than 1 pixel
  - Spectrometer image quality
  - Optical design will be finalised by mid-July
  - Mechanical design in progress
  - May give up 15-K thermal interface
  - Chopper contract now placed with industry
  - Photoconductor array development
    - QM fabrication started
    - QE measured once to be OK but yet to be confirmed, but can't delay QM fabrication
    - Temporary 10-channel dual JFET TIA readout built for EM QE measurements
    - May increase stress on LW photoconductors to make sure that 205  $\mu$ m line is OK
    - CRE:
      - DC-coupled design abandoned.
      - AC coupled design OK for Gain, dynamic range and BW but noise and hysteresis requirements not yet met.
      - Kink effect being modelled as a function of transistor geometry
      - New transistor design should be better (but maybe gain might be too low)
    - Bolometers
      - Red:  $2 \times 16^2$       8 pW       $NEP_{ph} = 2.3 \times 10^{-16}$
      - Blue  $4 \times 2 \times 16^2$       4 pW       $NEP_{ph} = 1.4 \times 10^{-16}$
      - Array assemble 90 mm dia

- Readout: BAU at 100 K is TBD. CEA don't like it but PACS to keep it in the system for now.
- Noise measurements show that  $\sim 10^{-16}$  NEP is achieved.
- Would like signal freq range of 32 Hz down to 0.2 Hz
- ICC activities
- SIP preparation
  - Lots of meetings held/attended
  - Major tasks
    - ICC Systeme Eng
    - Common EGSE concept
    - Etc. etc.
  - Definition of observing modes and observing profile
  - Serendipity surveys with PACS not feasible as detector/readout too slow
  - Starting to work on end-to-end instrument/observation simulator
    - Sky simulation
    - Observing modes
    - Detectors and signal chain
    - Compression, telemetry and decompression
    - Data analysis
    - Core team now formed to do this
- PACS Consortium
  - CEA: Suzanne Madden, Louis Rodriguez, Marc Sauvage
  - Martine Joubert = French representative on the PACS Steering Committee
- Adoption of new bolometer concept  
Conditions: Technical feasibility and schedule compatibility, no cost increase to others, no impact on SPIRE, endorsement by funding agencies, endorsement by FST.
- Problem areas
  - Late approval of Belgian Prodex programme
  - Problem with Austrian funding after government reorganisation (working to resolve this)

Comments:

- MH: How much helium is consumed by the cooler and what's the lifetime implication?  
GP: About a month per cooler.
- Data compression requirement now only about a factor of 4
- PE: Increase in detector numbers very good

## 7. SPIRE status **Matt Griffin**

Blah blah . . . . .

## 8. NASA Confirmation Readiness Review, 18-20 July

- European attendance: Michel Anderegg, Planck PIs, or PMs, someone from HIFI

## 9. FIRST/Planck synergy

- Status: Working groups were defined. Not much output yet. Reports from Blain (Group 3), de Zotti (Group 4) plus initial notes from Giard.
- Other surveys also critical (Astro-F, radio, SIRTf, etc.)
- Important to view it as a single integrated scientific programme rather than FIRST helping Planck or *vice versa* - need common group to optimise the science
- Impossible at this stage to be specific about how to define the follow-up programme
- But essential to put the right mechanisms in place to be able to react quickly

- Conclusions:
  - Need to get reports from the five defined topic teams
  - Good idea to make it a topic for discussion at the Toledo meeting

## 10. FIRST Optical Systems Scientist

- After May 23 meeting Roger Bonnet felt telescope overview was missing
- This position would provide such overview
- AO to be issued ASAP
- ST agrees that it's a good idea

## 11. Toledo Symposium

- 2nd announcement out
- s63 responses so far
- Need to issue 3rd announcement soon (after IAU?) with call for papers/posters
- Martin Harwit suggestions for workshop/discussion sessions:
  - Establish a set of strawman key projects
  - See what FIRST should accomplish
  - Generate feedback to instruments (e.g., AOTs of special interest)
  - Define what's possible given the instruments' capabilities
  - Define a minimum programme that FIRST should leave as a legacy
  - Set in motion a process of refinement of the key projects
- Contributed talks plus around 1.5 hrs discussion each day
- Format for discussion groups
  - Day 1:
    - Mission Scientists to organise discussion sessions, invite and brief the discussion leaders
    - A: Galaxies, Galaxy Formation and Cosmology
      - Blain, Genzel, Pettini, Harwit, Puget, Elbaz, Barthel
    - B: Stars, Star Formation, Planet Formation, Planetary Systems, Stellar Evolution, Interstellar Medium
      - Harvey, Evans, Andre, Cabrit, Waelkens, Chernicharo, Encrenaz, Barlow
    - Named people to think about the following questions and lead discussion:
      - What are the key issues?
      - What can FIRST contribute and what are other facilities going to do?
      - What key projects should emerge, and how will FIRST capabilities help to achieve these?
    - Day 2 etc.: Split up into sub-groups (to be defined by the groups themselves)
- Deadline for registration: October 1st
- Poster will be modified and made available on the web

## 12. Key Projects

- Science Management Plan is only place where Key Project is defined (page 22)
  - > 50% of GT expected to be used for Key Projects
- MJG Key Programme definition
  - Minimum length of time (say 100 or 200 hours)
  - High priority observations, and to be done early in the mission
  - Focus on getting data-sets into the public domain in useful archival form (possibly for a range of scientific studies)
- Action on all to define what they mean by Key Programme
- Action on each PI to suggest a couple of potential key projects (what, how long)

### **13. PACS/SPIRE Partner/Parallel Mode**

- Discussion at SPIRE review
- Now the data rate may go up
- Action on MJG and AP to re-examine possible benefits (for shallow surveys) and feasibility of partner/parallel mode (by end October).

### **14. Written material on FIRST Science**

- Göran has got input from Paul and Martin
- HIFI has created science web site (not yet public; Göran has the link)
- Scheme to set up instrument pages pointed at from ESTEC FIRST page

### **15. Next meetings**

- FST7: November 13 and 14 at QMW confirmed
- FST8: March 8 and 9 ESTEC

### **16. AOB**

- Albrecht Poglitsch:
  - Gyros on FIRST are much inferior to those on SOFIA (1" stability over 20-30 minutes). Stability very important - e.g., for overlaying line scans of fields containing weak sources. SOFIA gyros are not hugely expensive (0.5MEuro). Also useful for solar system observations. This option should be looked at by the Project.
- Tom Phillips:
  - Telescope baffling design - clear responsibility for this is not defined
    - GP: This should be given to the Optical Systems Scientist to examine
    - AP: What about Jean-Michel Lamarre's suggestion that reflective baffle should be used
  - "Decision" by JPL not to build a spare telescope. It would need another ~ \$4M to provide spare - would take the project over budget. Does the FST believe that there's any compelling reason to have a spare telescope?
    - TP: Are we now so certain that the risk is so low that we can adopt a proto-flight philosophy? It's a major change - can't sort it out without detailed discussions.
- Paul Barthel: FIRSED proceedings will be out soon
- Pierre Encrenaz: Submillimeter Spectroscopy from Space symposium planned for Bratislava