

ASTRO(2005)10 (final)
Att.: Astro(2005)7
Astro(2005)8
Astro(2005)9
Astro(2005)5
Paris, 13th January 2006

EUROPEAN SPACE AGENCY
ASTRONOMY WORKING GROUP

Report of 123rd Meeting

held on

22-23 September 2005

at ESA Headquarters, Paris

Those present:

Members of the
Working Group:

C. Turon (Chair)
D. Barret
A. Bazzano
J. Cernicharo
A. Goobar
T. Henning
R.J. Ivison
G. Micela
A. Quirrenbach
P. Schneider
G. Rauw
P. Viana
R. Waters
D.M. Worrall
W.W. Zeilinger

(Apologies were received from S. Lilly who was unable to attend)

Invited expert: C. Done

ESA: S. Volonte (Executive Secretary)
J. Clavel, M. Kessler and other members of the Executive

1. Adoption of Agenda (ASTRO(2005)5)

After rearranging the order of some items, the agenda **was adopted.**

2. Approval of reports of previous meeting

Comments on draft report of the 121st meeting were expected by 26 September at the latest. Report of 122nd meeting would be circulated at later date.

3. Science Programme update

3.1 Present status

With the aid of a PC presentation, the Executive Secretary briefed the AWG on the situation of the Science Programme. On the basis of the results of the most recent industrial studies, cost estimates for GAIA and BepiColombo were being updated. Although the final estimates would not be available before the November SPC meeting (or even after), indications were that for both projects, the Costs at Completion (CaC) would be significantly higher than the target envelopes of 450 Meuros. This would impact on the current programme by delaying the start of the remaining missions (LISA and Solar Orbiter). Consequently, the implementation of Cosmic Vision 2015-2025 would likely be delayed with the consequence that the first Call for mission proposals could not be released in 2006 as expected by the community. Therefore a re-optimization of the current programme would be necessary but would significantly depend on the outcome of the forthcoming ministerial Council meeting.

3.2 Preparation of Ministerial meeting

The preparation of the Ministerial meeting was in general going well, regarding the Science Programme, indications were that delegations from some of the larger member states might not accept increasing the current Level of Resources (LoR) by 2.5% (this would be slightly in excess of the *present* official inflation rate) as in DG's proposal. They might accept an increment of 1% at most (unanimity is required in the LOR decision). For the moment the proposal of the DG was unchanged, and an increment of 2.5% was still being sought. If 1% were granted instead, the net loss to Science Programme would be either 90 or 62 MEuro, depending on whether the increment of 1% would start in 2006 or 2007.

3.3 Cosmic Vision 2015-2025

The Chair announced that the final version of the Cosmic Vision document had just been sent to print. She took the opportunity to reiterate her thanks to members of the AWG for their contributions to the preparation of the document. After some discussion and clarification, the AWG took note of the report.

4. Satellites in orbit

As an introduction to the discussion on the extension of the Newton and Integral missions, M. Kessler recalled the role and responsibilities respectively of the project scientists, mission managers and chairs of the user's groups

4.1 Extension of XMM-Newton operations

With the aid of a PC presentation, the project scientist, N. Schartel, reported on the scientific results obtained with XMM-Newton. He also presented some statistics about the publication rate. He reported on the status of the mission and presented comments from the user's group, on behalf of the chairman Prof. J. Schmitt. A discussion ensued where clarifications were given by the mission manager, F. Jansen. The AWG was impressed by the excellent science return from this cornerstone mission. XMM-Newton's growing publication rate had now exceeded Chandra's. The AWG expected the mission would maintain its world class scientific profile over the extension period under consideration.

This resulted in the AWG recommendation contained in document ASTRO(2005)7 attached.

4.2 Extension of Integral operations

The Project Scientist, C. Winkler, made an extensive PC presentation of the past two years of scientific results obtained with the Integral mission. He reported on the status of the mission operations which had seen an oversubscription factor of about 4 in the observing time for AO3. He also reported on the first meeting of the recently established Integral user's group chaired by Dr. C. Done. As the current SMP did not extend beyond the 5th year of operation, it was proposed to update it by reserving 20% as the fraction of guaranteed time for the 6th year (i.e. 2008), but not beyond. In the ensuing discussion clarifications were given on the proposed wording for rolling extension process and the need to update the SMP. The AWG expressed its satisfaction with the current status of the Integral Observatory and the level of science return which was a clear sign of a maturing mission. In order to exploit Integral's unique capabilities it was proposed that key projects be encouraged as much as possible.

A recommendation on the extension of Integral operations was formulated, see document ASTRO(2005)8.

4.3 HST status: No issue (see Annex)

4.4 ISO post operations phase: No issue (see Annex)

5. Nationally led projects

The only proposal received in the area of astronomy/astrophysics was for the World Space Observatory (WSO), an international UV project supported by Spain. It was agreed that the evaluation of the proposal would be carried out by 2 or 3 reviewers on behalf of the AWG. They would circulate their joint evaluation report prior to the next AWG meeting. The WSO proposal would be circulated to all AWG members by the end of the month.

The Project and Study Scientist Reports (see ANNEX) had been circulated to AWG before the meeting. Items of concern were discussed.

6. Projects under development

6.1 Herschel: The main issue was the consolidation of the instrument schedule. The maximum schedule contingency was 6 months.

6.2 Planck: The issue which was being worked out was the verification of the telescope performance.

6.3 JWST: The descopeing which had been decided to reduce the cost overrun would have no impact on the NIRSpec and MIRI, the two European provided instruments.

6.4 Corot: No issue

6.5 Astro-F: The call for observing proposals was issued on 21 September with responses to be provided by 18 November.

7. Projects in preparation

7.1 GAIA status: The project scientist, M. Perryman, made an extensive PC presentation on the status and schedule of the project which was being planned for a launch in late 2011 (see Annex for details).

The AWG noted that the final performance requirements adopted in July 2005 after iteration between the project team, the science team, and the industrial teams was acceptable but emphasizes that absolutely no further degradation in the astrometric accuracy would be admitted.

7.2 GAIA preparation of data analysis system: The data processing and analysis system was also presented by M. Perryman (see Annex for details). The Project Scientist said that the problem was too big for the community alone and too complex for ESA alone and that each party had a knowledge to bring, in close cooperation with the other ones. The AWG noted that ESAC, in particular, has a crucial contribution to provide in the overall system architecture and in the initial treatments to be performed (data ingestion, preprocessing, data base, and astrometric iterative solution), and that it was very important that the ESAC team be adequately sized.

A Data Processing Analysis Consortium (DPAC) will be formally established through an AO process around mid-2006. In the mean time, the SMP should be ready by early 2006, for approval by the SPC at the latest in May 2006, after which time the AO for data processing will be issued. In the SMP, it will be important to stress that some data will be made easily accessible early into the mission, i.e. 2 years after launch.

8. Future Mission Studies

8.1 Darwin

8.1.1 Genie status: see below

8.1.2 Genie science case: In addition to the annexed report (see Annex), the study scientist, M. Fridlund, briefed the AWG on the recent TE-SAT activities

related to the Darwin studies. Regarding Genie, the final report of the Genie Science Advisory Team (SAT) had been circulated to the AWG in preparation for the present meeting. In this report, the SAT concluded that Genie could achieve its scientific goals provided that the polarization properties of both arms of the VLTI interferometer could be measured and controlled to the required accuracy. Therefore SAT recommended that polarization measurements be carried out before any decision would be taken on a possible implementation of Genie. In the ensuing discussion, AWG was informed that the cost of Genie was estimated by SCI-A, at around 15 Meuro while the VLTI polarization measurements would cost about 300 Keuro. It should be noticed that 15 Meuros is a significant part of the whole funding allocated to the technological studies preparatory to Darwin. The Executive Secretary invited the AWG to reflect on the need to proceed with Genie and advise on the issue.

Finally, the AWG endorsed the conclusions of the SAT and formulated the recommendation contained in ASTRO(2005)9.

8.2 XEUS: In addition to the report of the study scientist, A. Parmar (see Annex), the Executive Secretary confirmed the strong Japanese interest in continuing to collaborate with ESA on XEUS, expressed in the recent bilateral ISAS-ESA Science meeting held in Tokyo in early September.

8.3 Lobster and Rosita: A. Parmar reported on the change of concept of both the Lobster and Rosita payloads which were now being considered jointly in the context of a collaborative free-flyer mission with Russia (see details in Annex). The AWG expressed satisfaction at this alternative approach which seemed to offer new promising scientific capabilities for both payloads.

9. New membership for 2006

Six AWG members were reaching the end of their term of office in 2005. The Executive Secretary informed the AWG that Catherine Turon had accepted the proposal of the Executive to continue to chair the group for a further year. Peter Schneider was also invited to serve on the AWG for a further year. He eventually agreed to the proposal. As a result, four new members were still being needed. The Secretary showed the table of fields indicating the areas where expertise would be missing and would require replacement. Potential candidates for new membership had been proposed by AWG members from which a preliminary selection was made. It appeared however, that candidates from small ESA member states were missing. It was eventually agreed that C. Turon would send immediately the full list of candidates proposed so far, with a request for further names to be proposed from small member states. New proposals should reach the Chair and the Secretary by 7 October at the latest. They would then compile the final proposal to be made to the Executive.

10. Any other matter

A. Parmar briefly reported on the Astro-E2/Suzaku situation resulting from the failure of the bolometer instrument. A new AO for European observing proposals was being prepared in coordination with Japan and would be released shortly.

11. Date and place of next meeting(s)

- 12-13 January 2006 in ESA HQ, Paris
- 6-7 April 2006 in ESA HQ, Paris or ESTEC
- 28-29 September 2006 in ESA HQ, Paris

ANNEX

Project and Study Scientist Reports for AWG # 123

09 September 2005

Report compiled, using inputs from Study and Project Scientists by:

- Jean Clavel, Astrophysics Missions Division,
- Martin Kessler, Science Operations & Data Systems Division.

4 Satellites in orbit

4.1 XMM-Newton: Fred Jansen

As of 8 September 2005, the overall completion status of the observing programme is as follows:

- AO-3 programme: 98.5 %
- AO-4 programme: 42.1 %

Completion of the above programmes is expected by March 2006, in line with the planned start of AO-5 observations.

Several Targets-of-Opportunity and Discretionary Time targets were observed, namely EXO 0748-676, GB 1428+4217, SN2005cs, GRB 050713, GRB 050730, SN 2005db and GRB 050820B.

The fifth announcement of opportunity (AO-5) was issued on 5 September 2005 on schedule (due date for proposals: 14 October 2005 (12:00 UT)). All OTAC arrangements are running smoothly.

A new version of the XMM-Newton Science Analysis System (SAS) (version 6.5) was released on 17 August. Among many improvements, the new version allows better modelling of spatial and temporal response dependencies of the MOS cameras and therefore leads to a much better cross-calibration among the EPIC instruments. New RGS tasks allow the combination of RGS spectra and response files. A final combined spectrum file can be obtained, together with response matrix and background files.

Version 2.8 of the XMM-Newton Science Archive (XSA) was released on 2 August 2005. Among other improvements, the new version for the first time allows access to a sample of multi-colour optical images from the XMM-Newton Survey Science Centre X-ray Identification follow-up program and provides a data quality report for each observation. The XMM-Newton Science Archive (XSA) had 1550 external registered users as of 23 August. In total about 960 separate data sets (Observation Data Files (ODF) / Pipeline Products (PPS) files) were downloaded by 132 external users in July 2005.

An XMM-Newton SAS training workshop (5th ESAC SAS Workshop) was held in ESAC from 7 – 10 June. As in previous years, the attendance at the workshop was limited to 20 persons reflecting the number of available computer places for the practical training. The 20 participants gave very positive feedback during the final round-table discussion.

In total 905 papers – either completely or partly based on XMM-Newton observations – had been published in the refereed literature before 8 September.

At present about 360 scientists have registered for the XMM-SOC-organized X-ray/astrophysical conference with the title “The X-ray Universe 2005” (26-30 September in the EUROFORUM, El Escorial, Madrid). Further registrations are being put on a waiting list so as not to exceed the capacities of the conference centre. The scientific organizing committee has selected 120 contributions for oral presentation and the corresponding speakers have been notified.

4.2 Integral: Chris Winkler & Peter Kretschmar

INTEGRAL operations continue smoothly with the spacecraft, instruments and ground segment performing nominally. The 6th SPI annealing took place from 14 - 29 June without problems. Heavy solar activity led to some data loss, e.g., on 22/23 August.

Besides various normal targets, INTEGRAL TOO observations have been done for the flaring blazar 3C 454.3, two Black Hole Candidates (SWIFT J1753.5-0127 and XTE J1818-245) and the Be/X-ray binary 3A 0535+262.

The ISOC Science Data Archive (ISDA) was opened to the public on 14 July, giving alternative access – with an interface similar to that of XMM – to the public INTEGRAL data. The latest version of the Off-line Scientific Analysis software (OSA 5) was released on 1 July, with a special issue of the ISDC newsletter.

The first meeting of the Integral User Group took place on 11-12 July. Several recommendations were made with a view to maximize scientific return. As one of the first activities, the ISDC has compiled a cross-calibration report.

Preparations have begun for the INTEGRAL AO4, with observations starting a year from now. The nomination of the TAC members is ongoing.

The number of refereed/non-refereed scientific publications over the period 01 Dec 2002 until 30 June 2005 is 102/288, respectively; with the figures for 2005 being 33/30. Since the last report, 22 Astronomer’s Telegrams have been issued by INTEGRAL.

An in-depth study of the Galactic Centre (using approximately 7 Msec of INTEGRAL observations) was presented by Bélanger et al. (ApJ accepted). They find a faint persistent source within 1’ of Sgr A* with no variability. In combination with recent HESS results, this suggests a compact diffuse emission region.

The all-sky distribution of 511 keV emission, as observed by SPI, has been analyzed by Knoedlseder et al. (A&A, accepted). The main contribution found is emission from the Galactic Bulge region with weak contribution from the disk.

Krivonos et al. (ApJ 625, 89) use the serendipitous sources detected in a deep observation of the Coma cluster to extend extragalactic source counts in the 20-50 keV band to a flux limit of ~1 mCrab improving previous results by a sensitivity gain of >10.

Two years of INTEGRAL monitoring of SGR 1806-20 are summarized in recent paper by Götz et al. (A&A accepted), covering more than 200 individual bursts and following the source from quiescence to frenzied activity.

Falanga et al. (A&A 436, 647) have combined INTEGRAL data with simultaneous XMM and RXTE observations to study the 0.5-200 keV spectrum of the transient accreting msec pulsar

XTE J1807-294, which can be described as thermal Comptonization by ~ 40 keV electrons, much hotter than the previously obtained values with low energy data.

GRBs and one X-ray flash in the FOV have been observed on May 2, 4, 20 & 22; June 26 and July 14. Three of these fell also into the FOV of the JEM-X monitor. In June also the Optical Monitor Camera triggered successfully, but Alpha Crucis, the 13th brightest star in the sky, was only arcseconds from the GRB and saturated the CCD image.

4.3 HST: Duccio Macchetto

The Hubble spacecraft is operating nominally, with the exception of the Space Telescope Imaging Spectrograph (STIS), one of the five on-board science instruments, which failed on August 3rd, 2004.

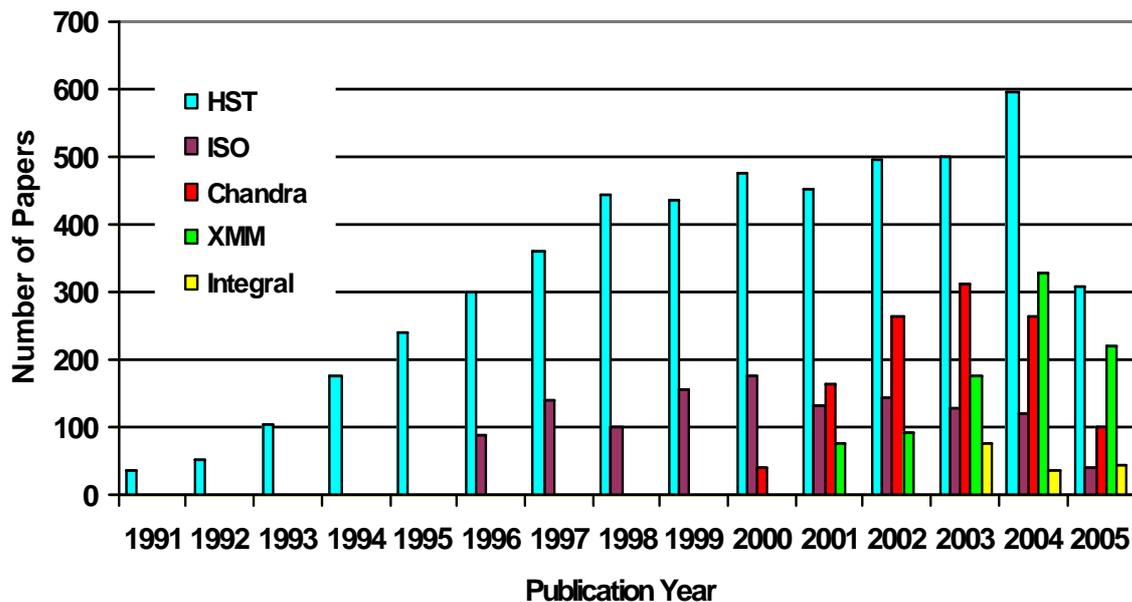
To extend the expected scientific lifetime of HST, preparations were made over the last year to switch-off one of the gyros and operate in a two-gyro configuration. The on-orbit two-gyro mode test using all science instruments was carried out in February and given the excellent results, HST was transitioned to Two Gyro mode on August 28. So far, all telescope operations have gone forward as expected, including guide star acquisitions, slews, etc. Gyro 4 is the gyro that has been taken out of the control loop. All indications are that the performance in two-gyro mode is excellent. Measurements of the point-spread function (PSF) with the Advanced Camera for Surveys (ACS) show extremely small differences, if any, between two-gyro and three-gyro mode. Measurements taken with a 14th magnitude guide star are essentially the same as those made with a brighter guide star. Measurements of the PSF of the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) are consistent with the ACS results, and a first look shows that the NICMOS coronagraphic performance is unchanged. The performance of the magnetometer guiding has been excellent, with relatively small errors (typically 1-2 degrees) accumulating during occultation and slews. The Two-gyro mode requires the on-board software to identify star fields found by the Fixed-Head Star Trackers, and then to measure and correct the pointing error. The FHSTs occasionally loose stars, track on apparent moving objects, and can misinterpret scattered light as stars. The design of two-gyro mode has taken these types of issues into account, and so far has been shown to be quite robust. This test also exercised the major modifications that have been made to the scheduling systems. This early introduction of the two-gyro science mode is expected to extend the observing lifetime of HST with the current set of gyros by at least 9 months to late-2008, corresponding to 2400 to 3000 more orbits of useful science.

Plans for a shuttle born SM4 servicing mission continue; however the final decision on whether to actually fly the mission will only be made after a successful second flight of the shuttle, now expected for the early spring of 2006. In the meantime it is likely that the NASA Administrator will decide that it is not necessary to include a de-orbit module in this mission. Current estimates indicate that HST will not re-enter the atmosphere before 2020, and that provides ample time to find alternative means for a controlled de-orbit. Removing the de-orbit module will significantly simplify the mission as well as decrease the risk associated with a new development and the associated risk to the astronauts.

To assess the impact of Hubble observations on astrophysical research, standard objective measures of productivity and impact need to be used. One of these measures is the annual number of published papers based on Hubble data. Following a strong and regular increase of publications during the first eight years of Hubble, the number of papers continued to increase, although at a slower pace during the past several years. However, the year 2004 saw

another significant increase, reaching a new record value of 601 published papers based on Hubble data, over 100 more than in the previous year. The current total of refereed papers based on Hubble data is over 4800. The figure compares the number of refereed papers per year based on Hubble data to those based on data from other space observatories. These numbers clearly show the large impact of Hubble-based science, compared to other major space-based astronomical observatories.

Number of Refereed Papers per Year Based on HST, ISO, Chandra, XMM, and Integral



HST captured the dramatic effects of the collision early July 4 between an 820-pound projectile released by the Deep Impact spacecraft and comet 9P/Tempel 1. Visible-light images - taken by the Advanced Camera for Surveys' High Resolution Camera - show the evolution of material that was blasted off the comet as it expands and diffuses into interplanetary space. See the images at

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/17/image/f>

HST successfully observed three targets on the Moon: the Apollo 15 landing site, the Apollo 17 landing site, and the Aristarchus crater. These observations were taken to support activities related to NASA's exploration initiative. All indications from the science team are that the data meet their needs. The observations required substantial manual scheduling, real-time pointing control support (PCS group), and quick data turn-around.

4.4 Infrared Space Observatory (ISO) active archive phase: Alberto Salama

Two major upgrades of the ISO Data Archive were released in the reporting period. Version 8, released on 10 May, incorporates new functionalities that have been developed for other archives at ESAC, via the use of a Common User Interface, and will simplify its maintenance after the end of the ISO Active Archive Phase. Version 9, released on 27 July, provides recommended datasets per observation to the user, the best Highly Processed Data Products (HPDP) or the legacy pipeline products, thus fulfilling a major Mid Term Review recommendation.

The ISO Data Archive statistics for June to August 2005 show 120 users downloading 5938 observations (the equivalent of 19 % of its scientific observations content). 36 users retrieved 1420 observations belonging to 10 different Highly Processed Data sets.

ISO continues to have a significant presence in the refereed literature, with 1264 papers published to date (~130 per year in the Active Archive Phase, 56 in 2005 to date).

6 Projects under development

6.1 Herschel: Göran Pilbratt

The instrument cryogenic qualification model (CQM) focal plane units (FPU) were integrated onto the optical bench of the engineering qualification model EQM (Herschel focal plane 'simulator' using refurbished ISO equipment) by EADS-Astrium, several months ago. The actual EQM instrument tests will start later in September 2005.

The instrument Flight Model (FM) delivery dates have been consistently slipping over the last year or so and are now on the critical path. A special meeting with the 5 Herschel and Planck PIs and representatives of their funding agencies was held in ESTEC on 26 July 2005 to try and rectify the situation. At the meeting, all 5 PIs requested a delay of several months. However, no such delay can be granted until the instrument FM delivery dates are at least stabilised. A concerted effort to consolidate individual instrument schedules is now being put in place, and a follow-up management meeting is planned on 20 October 2005. The SPC and SSAC are fully informed of the situation.

The Herschel STM service module (SVM) has undergone testing in the ESTEC Large Space Simulator (LSS) and is now in storage. On 16 Aug 2005 the Herschel Proto Flight-Model (PFM) Payload Module (PLM) arrived at ESTEC, and was installed in the Test Centre. The PFM PLM currently contains thermal mass dummies representing the instrument FPU. It will now be mated with the SVM, the sunshade/solar shield and with additional hardware representing the telescope and prepared for integrated test in the LSS. These tests should provide a reliable estimate of the expected lifetime of Herschel.

The Herschel FM telescope has been manufactured and aligned under ambient conditions; all results indicate that the performance meet the specifications. The telescope will now be installed in Intespace, Toulouse for mechanical testing, and later in CSL, Liège for cryogenic testing.

6.2 Planck: Jan Tauber

The reflector and telescope verification approach is being consolidated; i.e. the tests to be performed have been decided. The accuracies that will be achieved in each test and therefore the final *knowledge* of the performance of the optical system, is still being assessed.

Development of the LFI instrument hardware is advancing. The LFI Qualification Model has been integrated and cryo-tested. The test and the calibration of the FM detector chains are continuing in parallel. The first stage of the Science Verification Review for LFI (addressing calibration and performance) is completed and a report with important recommendations has been issued. The Qualification Review started in May and should end in early October.

Both flight units of the 20 K sorption cooler have been delivered to ESA. Issues regarding lifetime and redundancy are not yet resolved; further tests are currently being carried-out on the qualification satellite to determine the criticality of these issues.

The Cryo-qualification model of the HFI instrument has been delivered to ESA and integrated into the Cryo-qualification Satellite. The flight detector chains are being tested and prepared for integration into the flight focal plane. Testing of the assembled flight unit will start in the November-December timeframe.

The Cryo-qualification model of the satellite is now being tested in CSL (Liège). Passive cooling has worked remarkably well; now the active elements of the cooler chain are being turned on one by one. Note that this model does not include LFI, nor the compressor part of the sorption cooler.

As a result of the recent Review of the Science Ground Segment, a “minimum launch system” to which “strict PA/QA” must be applied has been defined. An evaluation of PA practices is now ongoing. In parallel, an end-to-end plan for DPC pipeline testing has been prepared and largely agreed with the Data Processing Centres.

Meetings are taking place between ESA, (Herschel and Planck) PIs, and funding agencies, to determine means for the instruments to meet the general schedule of the project (see previous section).

6.3 JWST: Peter Jakobsen

The European side of the JWST project has so far not been directly affected by the current NASA budget crisis (see below). In particular, the development of NIRSpec and the MIRI Optics Module are continuing as planned. MIRI recently completed its Structural and Thermal Model. Current NIRSpec activities focus around selecting the sub-contractors for the various instrument components and subsystems.

On June 10, the new NASA Administrator, Michael Griffin, signed off on JWST being launched on an ESA-supplied Ariane V. Although the final official decision still awaits approval by the US State Department, NASA is proceeding on the assumption that such approval will be forthcoming.

In late April, the JWST US Prime Contractor, Northrop-Grumman, formally notified NASA HQ that it anticipated a 270M\$ cost overrun of its contract and requested a launch delay of one year to complete construction and testing of the observatory. With the total impact of the launch delay and extra contingency factored in, this in turn resulted in an overall cost increase of the JWST project from 1.9G\$ to 2.9G\$. Faced with this large cost increase, NASA HQ called for three different reviews of the JWST project which were carried out over the summer:

- 1) The NASA Project was instructed to explore the potential savings that would result from de-scoping the mission to its minimal "science floor" by eliminating the MIRI instrument and reducing the primary mirror to the equivalent of a 4 m. This study concluded that the JWST project is too far advanced in its development that even such drastic measures would not save more than 200M\$.

2) A Science Assessment Team (SAT) consisting of external scientists was appointed to reassess the JWST science case and propose potential areas for savings within the JWST instruments and observatory. The SAT delivered its final findings to NASA on August 23. In short, the SAT strongly endorsed the JWST science case and recommended that NIRCам, NIRSpec and MIRI instruments not be de-scoped and remain as they are. Discussions are, however, still going on with Canada concerning the capabilities of the Tuneable Filter (TF) mode of the CSA-provided Fine Guidance Sensor (FGS). A likely outcome is that the FGS will only contain a single TF channel instead of the two originally foreseen. This will reportedly save 80 kg of payload mass.

The SAT also recommended that the following areas be explored with a view to reducing the overall cost of the JWST mission: i) relaxing the performance of the telescope at wavelengths shorter than 2 micron; ii) relaxing the temporal image stability requirements on the telescope, and iii) relaxing the cleanliness specifications placed on the primary mirror, thereby potentially allowing simplification of the system level integration and test program. The NASA Project, Prime Contractor and the Science Working Group are presently engaged in critically assessing these recommendations.

3) Lastly, an Independent Review Panel was charged with reassessing the various cost estimates of the JWST mission. While this committee has yet to officially report on its findings, the preliminary reports suggest that the panel is unlikely to find major fault with the latest NASA cost estimates generated by the NASA JWST Project.

How the already strained NASA science budget is to absorb such a large increase in the cost of JWST in the coming years is not clear at this point. Nonetheless, the current crisis has reached a temporary respite with NASA HQ having recently allocated 348M\$ for JWST development for fiscal year 2006. This will enable the JWST project to continue forward, but not toward a launch in 2011. The launch date will remain uncertain until the larger budget problem is solved, but a date in mid 2013 is looking increasingly likely

The ongoing budget crisis notwithstanding, the JWST project recently passed a major milestone on August 17, when the last of the 18 1.3 m hexagonal beryllium blanks of the JWST primary mirror left the Brush Wellman manufacturing plant in Ohio for coarse machining and light-weighting at Axsys in Alabama. The final optical polishing will be carried out by Tinsley in California.

6.4 COROT: Annie Baglin & Thien Lam-Trong

Globally, everything is nominal. However, the launch date had to be postponed to the end of August 2006 to accommodate a delay of CALIPSO, a "Proteus" mission just before COROT which uses the same facilities at Alcatel, Cannes.

The COROT instrument has been completely and successfully assembled in Toulouse.



Some problems have been encountered but they are all well understood and solutions are being implemented. The only one worth reporting concerns errors in micro-sequences implemented in the Field Programmable Gate Arrays (FPGA). These will be exchanged (without de-mating the instrument) just prior to the last thermal-vacuum tests.

Integration of the Control Centre has been successfully completed while that of the Mission Centre is in progress. The latter is however impacted by the scarcity of allocated Spanish resources (e.g. no money for travels, etc.). Upgrade of the Brazilian ground station by CNES and INPE has started in earnest and considerable progress has also been achieved in adapting the Vienna MOST ground station to the need of COROT. Preparation of the End-to-end System Tests is underway while that of the launch operations has been initiated.

The 8th COROT week took place in Toulouse in May. The field of view of the first two long observations have been selected. The Scientific Committee held its 16th meeting in Paris on September 5th. The replies to the first AO for additional programmes were reviewed and proposals have been selected. In order to confirm their feasibility and to optimise the order in which they will be scheduled, 3 short observations will go through a 6-months technical evaluation.

6.5 ASTRO-F: Alberto Salama & Martin Kessler

The launch window for ASTRO-F has been confirmed as 30 January – 28 February 2006. ASTRO-F has passed a vibration test in May. No change in the telescope alignment has been observed. The test schedule suffered a delay of a few weeks with the replacement of transistors in the Earth Sensor. The satellite will undergo a thermal vacuum test in September. The Data Handling Unit (DHU)/Data Recorder (DR) interface will need to be repaired afterwards, with still no impact to the target launch date. Instruments are healthy, with the exception of one dispersion element of the IRC camera (13-19 microns), which became opaque due to thermal stress in maintenance work between instrumental tests. There is no change of other observing modes in design and performance.

Preparation of the Call for Proposals proceeds at high pace, in close collaboration with ISAS. The Call will be issued mid September with the deadline for proposals being 18 November 2005. ESAC issued a Call for Letters of Intent in May, and received 129 letters from 83

investigators spread over 14 European countries, showing a considerable interest in this infrared facility. A workshop will be held at ESAC on 23 September to aid potential observers in the preparation of their proposals (with the participation of three mission experts from Japan). The ESAC website is <http://www.astro-f.esac.esa.int/>

Coding of the pointing reconstruction software proceeds smoothly at ESAC. A feasibility analysis has been performed and the Software Specification document is in an advanced stage of preparation. The beta release of v1.0 of the software is planned for October 2005. The input reference catalogues have been released, containing about 3.5 million sources. Work has started on the definition of the interactive analysis tools, for testing, validation and quality control.

7 Projects in preparation and ongoing studies

7.1 & 7.2 GAIA: Michael Perryman

Following the schedule anticipated in the previous report, the final presentations of the definition phase (Phase B1) were held on 7-8 June at ESTEC. The two competing industrial teams, Alenia/Alcatel and EADS-Astrium, separately presented the results of their detailed studies into all aspects of the Gaia satellite. The Invitation to Tender (ITT) to the industry for Phases B2/C/D (detailed design, development, and launch) was issued by ESA on 1 July, with a deadline of 4 October. The subsequent extensive review process will be completed by the end of December, with resulting Adjudication Committee and Industrial Policy Committee decisions expected by the end of February 2006, allowing the start of Phase B2 at that point. The current target launch date is late 2011.

The lengthy iteration of the science goals/feasibility/cost/schedule between the project team, the science team, and the industrial teams, has converged toward an agreed upon finalised Mission Requirements Document, a crucial part of the ITT data package. However, details of the two competing industrial designs are not yet widely known (and what is known to ESA is confidential until the selection is made). The final performance requirements specify astrometry of 1 billion stars to $V=20$, with 5-year mean-sky parallax accuracies of 7, 7, 7 microarcsec (un-reddened B1V, G2V, M6V) at $V<10$; 25, 24, 12 microarcsec at $V=15$; and 300, 300, 100 microarcsec at $V=20$. Photometric requirements are functions of magnitude, spectral band, and spectral type, but extend to completeness at 20 magnitudes, and are roughly consistent with the original mission goals in 2000. Radial velocity requirements include completeness at $V=13, 17.5, 18.5$ (for B1V, G2V, K1IIImp), and accuracies of 15km/s at $V=12, 16.5, 17$. Design goals at 0.5 magnitudes fainter limits are feasible if L3CCD technology can be accepted on the basis of cost and programmatic risk.

The final presentation of the 3-year study to develop a fully functional technology demonstrator model of the CCD focal plane was held in ESTEC on 23 June. The study objectives were to assess the feasibility of the Gaia-specific large, high-performance CCDs, assess the ultimate electro-optical performances of the massive focal plane in a multi-CCD configuration, develop the associated thermal and mechanical tools and performances, and develop the associated integrated drive electronics. On 9 June, and in anticipation of the long CCD procurement schedule, the first contract was awarded to e2v technologies (Chelmsford, UK) who will supply around 100 flight CCDs.

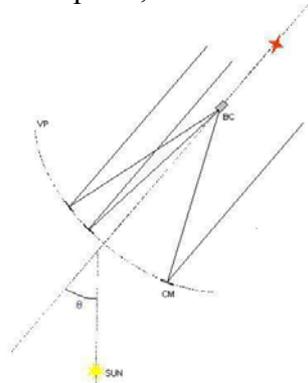
Planning for the construction of an overall Data Processing Consortium continues intensively. By the deadline of 20 March, 177 Letters of Intent (LoI) had been received, illustrating the strong interest of the community in participating in the data reduction effort. The intent is to synthesize the LoI together with the deliberations of the Gaia Science Team over the last four years, and propose an overall structure for the Gaia data processing effort. This task has been entrusted by the Gaia Science Team to an ad hoc “Data Analysis Coordination Committee” (chairs: Francois Mignard & Coryn Bailer-Jones). The DACC held its first meeting at ESTEC on 15-16 June. The committee will work until early 2006 to define and put into place the Gaia Data Processing Consortium, which in turn will conceive, implement and operate the Gaia data processing system. The main tasks of the DACC are to design a workable structure for the data processing and to match the community interests (as expressed by the Letters of Intent) to the required tasks. The foreseen structure is centred on 7 Coordination Units, further details of which will be presented at the meeting.

In summary, the project will enter the implementation phase in early 2006 with an expected launch commitment of late 2011. In parallel, a pan-European Gaia Data Processing Consortium will be in place, for which national commitments will be formalised in response to a subsequent ESA AO.

8 Future mission Studies

8.1 IRSI-Darwin: Malcolm Fridlund

The Tender Evaluation of the Darwin industrial system level study has been completed and two contracts have been awarded for two studies to be run in parallel for 12 months, with the possibility of further extensions if necessary. Kick-off is expected by the end of September. The studies will focus on the four-spacecraft configurations extensively studied within ESA. These configurations are based on 3-4 m class Herschel type telescopes, polished to normal optical quality ($\text{rms} < \lambda / 10 @ 5000 \text{ \AA}$). The scientific capabilities are significantly enhanced with respect to the 2000 Alcatel study configuration. The two main configurations are 1) planar triangular (2-D or “Charles”) configuration and 2) 3-dimensional, with the mirror spacecrafts formation-flying along a curve and the beam combiner spacecraft sitting at the focal point, as illustrated in the figure below (the so-called 3-D or “Emma” configuration):



The Terrestrial Exoplanets Science Advisory Team (TE-SAT) will publish its interim report on the scientific case, bio-markers and recommendations in early 2006. Further activities will await the outcome of the Cosmic Vision process.

The GENIE Science Advisory Team (SAT) has completed its report, which has been circulated to the AWG. In summary, the SAT finds that GENIE can achieve its scientific goals provided that the polarization properties of both arms of the VLTI interferometer can be measured and controlled to the required accuracy. It thus recommends that ESA and ESO jointly carry-out polarisation measurements before any decision is taken regarding a possible implementation of GENIE.

8.2 XEUS: Arvind Parmar

An International XEUS workshop was held at MPE in May. It was attended by ~75 scientists, mostly from the different XEUS working groups (astrophysics, telescope and instruments). The focus of the workshop was on the scientific performances that would be achievable with the revolutionary silicon High-Precision Pore optics technology and the corresponding 10 m^2 collecting area which it provides at 1 keV, at a spatial resolution of between 2 and 5 arcseconds.

The informal collaboration between ESA, NASA and JAXA scientists on a joint X-ray observatory have been unilaterally suspended by our US colleagues who regard it as unwise to link their “approved” Constellation-X mission to a European project whose fate is unsafe given ESA programme uncertainties. It was particularly annoying that this decision was made without consulting any of the European or Japanese scientists involved. The US scientists are prepared to reconsider their decision once the outcome of the Cosmic Vision process is known. The European scientists have informed their US colleagues that the door remains open to future collaboration. The JAXA team confirmed their continued participation in the XEUS activities.

Prior to the US decision, the mission profile consisted of two Formation Flying spacecrafts at L2 launched by a NASA Delta IV Heavy rocket. The Delta IV Heavy can lift a mass of 9.2 tonne to L2. The revised baseline envisages a launch by an Ariane V ECA whose capability is reduced to 6.8 tonne. Since the previous XEUS design was already mass critical, this reduction in lift capability means that XEUS will have to have a lighter mirror than previously envisaged, with probably a significant decrease in the high-energy ($>10 \text{ keV}$) effective area as well as a simpler focal plane. This would still allow to perform the “core science” deep Universe studies, since these require a large collecting area only at energies $\leq 2 \text{ keV}$. Several possible mission scenarios and their corresponding scientific capabilities are currently being explored.

8.3 Lobster & Rosita: Arvind Parmar

These missions are no longer regarded as potential ISS payloads. In the case of Rosita, an all-sky X-ray survey instrument, the PI (G. Hasinger) has written to D/SCI requesting that a free-flyer option be considered. He was concerned with possible contamination of the X-ray mirrors in the ISS environment and uncertainties brought about by the likely retirement of the shuttle fleet in the 2010 timeframe. In the case of Lobster, an X-ray all-sky monitor, the phase-A study for accommodation on the ISS was technically successful, but the PI (G. Fraser) is concerned about funding possibilities within the UK for an ISS payload (the UK does not contribute to the ISS which is an optional programme of ESA).

Alternative mission scenarios have therefore been investigated. Collaboration with the Russian Space Agency (Roskosmos) seems most promising. A working group consisting of the two instrument PIs and their representatives, Roskosmos and IKI representatives and the

ESA study scientist have examined a number of possible mission concepts. The main scientific goal is to perform the first medium energy (2-10 keV) all-sky survey since the 1970's to detect ~50,000 obscured active galactic nuclei and deeper surveys of selected regions of sky to detect ~100,000 clusters of galaxies. Studies of the X-ray emission from clusters of galaxies appears to be a promising technique for investigating the detailed geometry of the Universe since clusters can be regarded as "standard candles" in a similar way as Sn Ia explosions. Synergy with LISA and the possibility to perform detailed X-ray investigation of black-hole mergers is also scientifically attractive.

The mission concept under investigation consists of a Soyuz launched from Kourou carrying a Russian Yamal spacecraft with a payload consisting of Rosita and Lobster-like instrumentation, together with a Russian led instrument which could be a high-energy survey detector. The mission would be nationally funded, with a small ESA participation in the framework of a call for nationally led projects.

ASTRO(2005)7
Paris, 22nd September 2005

EUROPEAN SPACE AGENCY

ASTRONOMY WORKING GROUP

Recommendation on the extension of the XMM-Newton mission

At its 123rd meeting held on 22-23 September 2005 at ESA Headquarters, Paris, the Astronomy Working Group (AWG) was briefed on the status of ESA's XMM-Newton mission, and asked to recommend extension of the XMM-Newton operations until 31 March 2010, i.e. for a further 2 years beyond the current approved period.

The AWG is impressed by the excellent science return from this ESA cornerstone mission. XMM-Newton's growing publication rate has now exceeded Chandra's. The AWG expects the mission will maintain its world class scientific profile over the period under consideration.

Thus, **the AWG strongly recommends the proposed extension.**

EUROPEAN SPACE AGENCY

ASTRONOMY WORKING GROUP

Recommendation on the extension of the INTEGRAL mission

At its 123rd meeting held on 22-23 September 2005 at ESA Headquarters, Paris, the Astronomy Working Group (AWG) was briefed on the first three years of science operations of the Integral Observatory. The AWG was asked to express a view on the current and projected scientific performance of the mission, and on the Executive's proposed mission extension to 2010, with a further review in 2 years time for the period 2009-2012. Furthermore, the AWG was invited to endorse the proposed change to the science management plan.

The AWG expressed its satisfaction with the current status of the Integral Observatory and its science returns. Integral provides a powerful capability to explore extreme phenomena and the AWG was pleased to see clear signs of a maturing mission.

Exploitation of Integral's unique capabilities through key projects should be encouraged and every effort made to increase involvement of the broader community by making data more easily available, and publicising the mission's achievements and capabilities.

Therefore, the AWG recommends approval of the 4-year rolling extension and expects to review the science case for the last two years, as part of any further extension.

In addition, the AWG endorses the proposed change to the Science Management Plan which states that 20% of observing time in 2008 be dedicated to the core programme.

ASTRO(2005)9
Paris, 22nd September 2005

EUROPEAN SPACE AGENCY

ASTRONOMY WORKING GROUP

Recommendation on the GENIE instrument

and on Polarization Measurements at the VLTI

At its 123rd meeting held on 22-23 September 2005 at ESA Headquarters, Paris, the Astronomy Working Group (AWG) was briefed by the ESA Study Scientist on the status of GENIE and on the report prepared by the GENIE-SAT (SCI-SA GENIE 2005:2), circulated to the AWG members in advance of the meeting. This report includes a summary of the results from two parallel industrial phase A studies of the instrument.

The AWG endorses the recommendation of the GENIE-SAT to conduct measurements at the European Southern Observatory's Very Large Telescope Interferometer (VLTI) in order to characterize the differential polarization between two arms of the interferometer. Such measurements are a prerequisite for assessing the feasibility of GENIE. Furthermore, the polarization measurements will directly contribute to the technical development of DARWIN by establishing sensitive measurement and calibration procedures for polarization effects in infrared interferometers. The success of the DARWIN mission will depend critically on tight control of all polarization effects and the proposed measurements at the VLTI will provide an important step towards understanding the relevant issues.

Therefore, the AWG recommends that measurements be conducted at the VLTI to characterize the differential polarization between two interferometer arms at infrared wavelengths.

The industrial studies have demonstrated that GENIE will be feasible provided that polarization effects can be controlled to a sufficient level. It has become apparent, however, that the implementation of GENIE at the VLTI will face certain difficulties related to the limitations of the existing facility, which had not been designed for the very stringent requirements of nulling interferometry. Before any recommendation can be made on the future development of GENIE, alternative ways should be investigated in which the technical and astronomical goals of GENIE might be achievable. These goals include the demonstration of nulling interferometry in a complete instrument and the measurement of the level of exozodiacal light around DARWIN target stars.

The AWG recommends that alternative ways to achieve the technical and astronomical goals of GENIE should be investigated, in order to optimize the technical and scientific preparation of DARWIN before any decision is made on the possible implementation of GENIE.

EUROPEAN SPACE AGENCY
ASTRONOMY WORKING GROUP

123rd Meeting

to be held on

22-23 September 2005

*(commencing at 14.00 hrs on the 22nd
and foreseen to end at 13.00 hrs on the 23rd)*

at ESA Headquarters, Paris
(Room 137)

Draft AGENDA

1. Adoption of Agenda (ASTRO(2005)5)
2. Approval of report of 121st and 122nd meetings
(ASTRO(2005)3 and ASTRO(2005)6)
3. Science Programme update
 - 3.1 Present status
 - 3.2 Preparation of Ministerial meeting
 - 3.3 Cosmic Vision 2015-2025
4. Satellites in orbit
 - 4.1 Extension of XMM-Newton operations
 - 4.2 Extension of Integral operations
 - 4.3 HST status
 - 4.4 ISO post operations phase
5. Nationally led projects
 - 5.1 Evaluation of proposals
6. Projects under development
 - 6.1 Herschel
 - 6.2 Planck
 - 6.3 JWST
 - 6.4 Corot
 - 6.5 Astro-F

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7. Projects in preparation
 - 7.1 GAIA status
 - 7.2 GAIA preparation of data analysis system

8. Future mission studies
 - 8.1 Darwin
 - 8.1.1 Genie status
 - 8.1.2 Genie science case
 - 8.2 XEUS
 - 8.3 Lobster and Rosita

9. New membership for 2006

10. Any other matter

11. Date and place of next meetings

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