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NASA TECHNICAL MEMORANDUM

NASA TM-77882

X-Ray Satellite Status Report, Fourth Quarter 1984

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt (German Aerospace Research Establishment)

Translation of: "Roentgen-Satellit, Statusbericht 4. Quartal 1984", DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt) (German Aerospace Research Establishment), Document no. WF2/7804, Linder Hoehe, West Germany, December 31, 1984, pp. 1-59

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16. Abstract Topics included in this report include:
The projected launch date has been delayed approx. 7 weeks from the planned launch date. The Engineering Model (EM) of the automatic measurement and control system (AMCS) is in the critical phase. The contract change no. 1 to the main contract has been signed. A new version of the welding seam location specifications for the wide field camera (WFC) was proposed by the WFC Consortium. NASA-STS interface control documentation: the payload integration plan (PIP) has been signed. Production of the EM/QM prototype and ground station equipment has proceeded according to plan with the exception of some delays. Production of the EM equipment has begun. Preparations for the qualification tests of the EM/QM equipment and the integration of EM equipment has begun. During this reporting period the status review of the prime contractor took place. The cause of the delay in the launch date include the combined effects of the postponement of the target date for the EM equipment, along with the fact that only a structural model is available,

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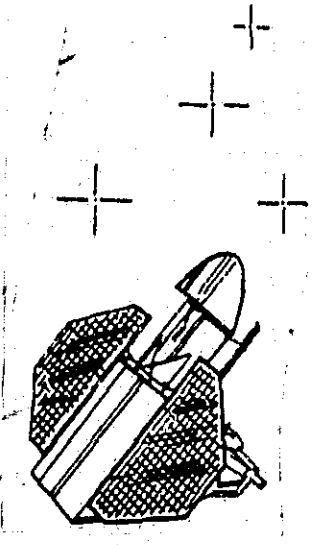

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1. Overview and Outlook /2

1.1 Work status

Summary:

The project is proceeding according to plan in the areas of technical performance and costs.

The projected launch date has been delayed approximately seven weeks from the planned launch date. The engineering model (EM) of the automatic measurement and control system (AMCS) is in the critical phase.

Documentation:

Prime contract: The contract change No. 1 to the main contract has been signed.

Specification document: A new version of the specifications for the welding seam locations of the Wide Field Camera (WFC) has been proposed by the WFC Consortium.

NASA-STS interface control documentation: The Payload Integration Plan (PIP) has been signed.

Development and production: Production of the EM/QM, prototype, and ground station equipment has proceeded with the exception of some delays. Production of the EM equipment has begun.

Tests: Preparations for the qualification tests of the EM/QM equipment and of EM equipment are proceeding. /3

Reviews: During this reporting period, the sixth status review of the prime contractor took place.

Milestones: No changes

Problems: Compared to the planned schedule, with launch date September 30, 1987, the current delay amounts to seven weeks.

The cause lies in the combined effects of the postponement of the target date for the EM equipment, along with the fact that only a structural model exists. Therefore, the EM delays follow linearly from the start date.

1.2 Outlook /4

With an additional FM primary structure (four-side panels above and below frame), a maximal 13.5 weeks delay can be made up during the integration of the EM. Advantages and disadvantages of such a possibility will be investigated and a decision will be arrived at.

The provision for orbital power supply for a supplemental heater in the S/C with shuttle power will be installed in the first change of the PIP. The Interface Control Document (ICD) of the shuttle will be revised until it is suitable for signing. Apart from that, the scheduled work will continue as planned.

1.3 Problem overview

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AREA		PROBLEM AREA	recently assumed	resolved
1.	Management	Presently no problem with prime contractor		
2.	System	Decision still open to measures for a load reduction of the FI since HRI-loads are not available		
		It remains to be investigated whether and to what extent measures are necessary to protect the highly integrated electronic components from radiation caused by cosmic rays (heavy ions)		x
3.	Mechanical subsystem	No problems at present		
4.	Electrical subsystem	No problems at present		
5.	Telescope	In their present form, the specifications for scattered light of the star sensor on the AKS system are not to be completed and require further discussion		
6.	Assembly, integration test	C.P. 11. time schedule.	x	
		Improvement of the schedule situation through a plan option with additional flight structure hardware		

1.3 Problem overview

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AREA		PROBLEM AREA	resolved	recently assumed
7.	Ground station equipment	No problems at present		
8.	Mission safety	Some long-lead items (components) could not yet be ordered		
9.	Carrier interface	No problems at present		
10.	Mission	No problems at present		
11.	Time schedule	Delay of completion date has been announced for the structure, data transmission, position control, mirror system and component procurement subsystems		

2.0 System

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System design

All important measures for protection of the safe modes against high energy cosmic rays have been established. The measures needed in the AMCE are presently being integrated. Changes in the AMCD have been integrated, following successful delivery of the box. The evaluation of the efforts towards determination of the ROSAT ion beam load has shown that in addition to the designated activities of safe mode protection and the exchange of endangered construction materials with SOS types, no further hardware measures are required.

Work in the reporting period continued to pertain to the system level with the following focal points:

- Clarification of further details of the shuttle mounting positions.
- Clarification of the AMCS mode switching before release of the satellite.
- Implementation of EMC analysis.

- Measures of monitoring contamination of the mirror system operations.

System budgets

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No significant changes have occurred in the performance, weight, RF link or position determination accuracy system budgets.

Documentation

The system specifications have been revised according to suggestions of the contracting agency and are to be reviewed.

3.0 Mechanical subsystem /9

3.1 Structure/mechanism

The five landing load cases were computed using coupled analysis computation.

The results and evaluation of these calculations will be available by the end of December 1984. Each of the 11 cases for cold and hot lift-off situations are to be computed in January or February, 1985.

For the static load tests, construction of the test stand has been completed and procurement efforts have begun. Load for the test, the load orientation and the placement of the payload had been defined. The test specifications await final definition.

Milling of the panels for the central structure are complete. The frame sections are presently being milled and bored. The WFC support structure is entirely completed the lathing of the outer contour of the cylinder for the support structure has been completed. Lathing and milling work for the cylinder and sill fittings are complete. The rough part of the solar generator central panel is finished.

Problems: Up to this time, only 80% of the newly ordered rivets were delivered on time. Additional efforts are going to be undertaken to reduce the delivery time of the remaining rivets. Furthermore, the possibility of carrying out the riveting during assembly will be investigated. The schedule of structure verification has been produced and sent to NASA.

The work on the antenna boom mechanism (ABM) and telescope /10 cover mechanism (TDM) continue according to plan. The detail

work of the ABM is finished. In order to secure the radiation characteristics of the antenna, the boom has to be lengthened and the angle increased by 1 degree.

The TDM was installed in a test device. The first series of release tests have been successful.

The mechanical part of the separation switch mechanism also serves as part of the mechanism subsystem. A change proposal is presently being formulated.

3.2 Thermal budget /11

The heater design for the X-ray satellite in the shuttle bay was defined in detail and the heaters have been ordered for the STS. Change proposals for the STS have been prepared.

The multi-layer insulation (MLI) manufacturing is proceeding according to plan. Fabrication was begun with shaping of the MLI's and of the blankets. Approximately 80% of the templates for the blankets have been supplied. Due to delayed delivery of raw materials, there is a lag time of about four weeks. However, according to a statement from DS, this delay can be made up.

The test preparations for the solar simulation test were continued. The design of the test had been so defined that the mechanical and electrical mounting positions on the space simulation equipment (WSA) of the IABG are close to the final clarification. A preliminary draft outline is under consideration. The mirror test heater system is 80% completed.

4.0 Electrical subsystems

4.1 and 4.2. Power supply and pyrotechnics

The development status time schedule and the documentation preparation status for both subsystems were reviewed during the 6th Status Conference. The status of the development of the engineering model hardware (EM H/W) is as follows:

- Solar generator:
  - o mounting placements were defined
  - o tools and supplies are in production
  - o development is nearly completed.

- Electronic boxes (PDU, PCU, BCU, Shunt, Pyro):
  - o development of the boxes with corresponding documentation is 100% complete
  - o all parts for all boxes are in production
  - o mechanical production of an additional box (PDU) is finished; that of the shunt, 80% and the PCU 50% completed
  - o the electrical layout, manufacture and assembly of the individual printed circuit boards are complete
  - o nine of 15 BCU circuit boards and two of 16 PCU circuit boards have been tested. Results are not yet available.

- Battery
  - o development of the batteries is complete, with corresponding documentation. All parts are in production. Mechanical design is 20% finished.

The status of the manufacture of the EGSE subsystem is as follows:

Unit	Extent of completion
Simulators:	
o solar generator simulator	- 4 sections built and tested - remaining six sections being built
I/F computer	- built and tested
Battery simulator	- hardware operational
Unit tester (UT)	
UT battery	- 30%
UT BCU	- 40%
UT PCU	- 100%
UT PDU	- 40%
UT Shunt	- 50%
UT Pyro	- 60%

The status of the subsystem (S/S) is as follows:

- Energy supply S/S -, Pyro S/S -, BCU -, battery specifications status: refer to III Quarterly Report 1984.

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- Solar generator specifications: reviewed by DFVLR Project Management

- PDU specification: reviewed by DFVLR Project Management

- PCU specification: reviewed by DFVLR Project Management

- The release procedures by the prime contractor for the shunt specification has not yet been completed.

Time schedule, problems:

The pyrotechnics subsystem is within the time schedule.

A review of the delivery time schedule of the power supply S/S for system integration has shown that this will be delayed at least five weeks to March 15, 1985 due to the delayed integration of the shunt and PDU boxes. This was caused by the late delivery (4 months) of the shunt-relays and load resistance in the PDU. Technical problems within the subsystems and interfaces have not arisen.

4.3 Wiring /15

The subsystem was reviewed in the 6th Status Report.

The status of the development, manufacture and test of the EM cable harness is as follows:

- All mounting positions are defined and clarified.

- The production requirements are complete and have been released by the project management.

- In this reporting period, production of the four sections of the EM cable harness was begun.

  The current production status is:

power/pyro--wiring	approx. 80%
signal--wiring	approx. 40%
telescope--wiring	approx. 85%
antenna--wiring	approx. 80%

- The test requirements for the cabling are for the most part complete. The integration requirements for EM cabling are being currently supplied and are to be completed by the end of February, 1985.

- Outgassing tests have been carried out using heat-shrink molded sections of polyolefin, space polyolefin, Viton and electrically conductive adhesives by the Intaco. These tests have been carried out with the results that all requirements for chemical purity were met for the wiring of the planned space polyolefin components.

The status of the subsystem documentation is as follows: /16

- The harness specifications are still in the release phase at the prime contractor.

- The cable harness layout schematics have been updated.

- In order to provide a list of connectors, a computer program has been developed and successfully used. In this way, the compiled list was reviewed by the main contractor project team and released as the basis for the production of the cable harness.

Time schedule, problems

- At the midpoint of the report time frame, a further review of the effect of all of the remaining open mounting placements (SURS separation switch, STS heater) on the delivery of the tested EM-cable harness for system integration, yielded the following results:

As compared to the basic plan for delivery of the subsystem (planned December 21, 1984), a two-fold delay arises:

a) December 21, 1984--February 15, 1985: 8 weeks.
This delay is caused by the delayed definition of the mounting placements for the Grapple Fixture, SURS, and ion pumps.

b) February 18, 1985--March 15, 1985: 4 weeks (including one week buffer).

This delay is caused by the need to install an additional heating system in the S/C, which assures compliance with the lower temperature limit when shuttle doors are closed.

The effective delay is five weeks from the projected date of February 12, 1985 to the actual date of March 15, 1985 for EM-integration. Technical problems have not arisen in the report time frame. /17

4.4 Data processing /18

The manufacturing and assembly of the individual EM-circuit boards is completed except for some few specimens which need additional special handling. They are currently being tested for their functional ability.

The DPS enclosure is finished and ready for internal wiring. The implementation of the planned protective measures against SEU-effects, planned for already in the last quarter, were confirmed and released after additional review of the required expense.

Particular attention is currently being placed upon the following assembly groups:

- Telemetry interface module: Relative to its compatibility with the EGSE subsystem.

- DC/DC converter. Due to safety reasons, it had to be partially reworked and remanufactured. According to all expectations here, a few weeks delay in the delivery date of the DHS-EM is to be expected. Expected date: Mid/end of April, 1985.

- Providing the additionally entered SEU-generated AMCS monitoring logic in the DPS for the purpose of redundancy in switching.

The Critical Design Review (CDR) of the recording equipment was successfully carried out. Above all, the primary temperature problem (maximum allowable recorder temperature) was taken care of satisfactorily. The danger of under-cooling of the equipment caused by being turned off in the case of DNEL, is avoided by switching to the standby mode (1.8 watt heating capacity). /19

Only the commando-interface of the recorder, with respect to the EMC-disturbance, must still be inspected and will be simple to modify, if necessary.

The parallel processing software development also proceeded according to plan in the detailed design and is close to completion. Here also, the software required for the EM delivery is considered to be finished on time.

The test equipment of the DHS was successfully put into service. Detailed design and software coding tasks are partially available, so that the initial test procedures pertaining to fixed parameters could be provided.

4.5 Data transmission /20

- Transponder

Production of the circuit boards and of the box with both transponders has been essentially completed. The quartz crystal could not be supplied on time. Because of this, the FM 1 will be available two weeks later than originally planned.

The reviewing of the qualifications "by similarity" showed that EMC tests must be repeated. Planning of the tests is underway.

- Decoder

Up to this point, production of the EM's goes without problem. Production and inspection of the unit tester have been fully completed.

- Antenna

Production of the components for the EM follows according to plan. Difficulties in delivery of an SMA-connector resulted in the first model delivered only being able to be used in the EM program. Whether or not a "refurbishment" to FM is possible is presently under consideration.

4.6 Position measurement/regulation /21

Work on the design and the coding of the AMCS--software, as well as the software necessary for the subsystem tests--could be continued without difficulty. Up to this point, the delays which have occurred towards the beginning of C/D phase could not be compensated.

- Star sensor

The sensor head and the associated test equipment have been produced. The sensor head was delivered from SIRA to MBB in early December. Through an enhancement of the digital electronics for the EM, it was possible to continue to use the available CCD (charged coupled device) despite its flaw in the EM-program. The noise values of the CCD exceeds the specification values. The current EM measurement by MBB will demonstrate to what extent the accuracy of measurement is being influenced.

- Gyroscope assembly

The EM of the gyroscope assembly was delivered. In the functional tests, a servomotor of the gyro failed. The causes are currently being analyzed. A modified design for a protective cage was constructed, which became necessary for safety reasons. Production of the converter circuit boards proceeds according to plan.

- Sun sensors

The necessary sensors for the EM have been produced. The acceptance tests have been completed with positive results.

- Magnetometer /22

The EM circuit boards were delivered. Manufacture of the EM measurement head proceeds according to plan.

- AMCE

The changes to the safe mode protection that were necessary for protection from SEU's could be completely determined. Changes to the EM's have begun.

- AMCD

Integration and test of the EM are complete. The EM was delivered to MBB.

- Reaction wheels

The wheels and steering electronics were completed. The acceptance tests have begun.

- Subsystem target date situation /23

Three independent components of the subsystem show respective delays of approximately two months and possibly more. Likewise, this leads to a delay of two months of the subsystem's delivery schedule for the EM. Along with the already mentioned software delay, the star sensor is also to be noted where here a setback has arisen from the delay in the delivery of the CCD. The AMCD is the third late component. The necessary additional qualifications and the required changes for protection of the safe modes against single event upsets are responsible for the delays.

5.0 Payload /24

5.1 X-ray telescope

With exception of the mirror system specifications whose release is in preparation at the prime contractor, all level IV specifications of the telescope subsystem are available. After the revised telescope specifications from the prime contractor were released, the specifications of the DFVLR-project management could be commented upon and released.

5.1.1 Structure and mechanics

Manufacture and adaptation of the structure sections is proceeding according to plan so that integration of the telescope is be expected to be completed on schedule in mid-February.

5.1.2 Magnetic deflector

Delivery and installation of the magnets are proceeding according to plan before integration of the deflectors in the telescope.

5.1.3 Alignment control system

Although problem of the scattered light requirements of the star sensor with regard to the ACS is still unspecified, in order to have the ACS available for the telescope integration at the appropriate time, production of the ACS had to be carried out according to plan. The specified scattered light requirements of the star sensors cannot be fulfilled from the ACS under certain conditions. The problem can be solved only from a systemic point of view.

5.1.4 Thermal control/thermal insulation /25

Because of modifications as a result of the scattered light tests and increased production expenditures, production of the thermal insulation is at the critical phase of integration in the telescope. In order to be able to abide by the schedule, it is planned to install the thermal insulation as late as possible into the telescope. It should be installed as the last component before the optical test and assembly of the FI-scale models, before the vibration test.

5.1.5 Mirror system

The demonstration model of the mirror system was disassembled according to the provision in the X-ray satellite C/D contract. The conversion to the STM follows corresponding to the revised schedule. The STM assembly is completed to a large degree, including the thermal and test hardware. If no unexpected problems appear during the vibration qualifications of the STM-mirror system, it will be ready for integration into the telescope on February 15, 1985.

In contracts with C. Zeiss separate from the total system for the X-ray satellite project, the status of the operations is as follows:

Demonstration model

At the PANTER test, up until mid-September, an unexpected scattered X-ray background at large angles was found. This was caused by contamination, in particular from the parabolic mirror. To determine the cause of contamination, an additional X-ray scattering measurement on the PANTER apparatus as well as measurements of the surface was implemented in an addendum to the demonstration model contract. Although the investigation did not result in a specific cause of the contamination, it was determined that:

- the contaminants are hydrocarbons
- the contamination probably occurred in the clean room of the adjustment stand at C. Zeiss
- the contaminants probably entered through the outer air mixture in the clean room (with little likelihood from a source inside the clean room).

C. Zeiss has implemented measures to eliminate the risk of contamination. The potential source within the clean room will be eliminated through improved precleaning and control. The intake of outer air was transferred from its previous position where it was exposed to environmental influences, to the roof of the C. Zeiss Integration Hall. The contamination control was installed between areas of the C/D operations in the clean area. Since then, with the aid of quartz micro-balances, no further evidence of contamination had been found.

The additional equipment at C. Zeiss has been received in the time frame of the report according to paragraph 640 Civil Code and made available for further use in conjunction with the X-ray satellite contract by C. Zeiss.

Adaptation of the single mirror of the flight model is proceeding according to plan. Meanwhile, three mirrors have been successfully X-ray optically measured on the PANTER equipment.

5.1.6 Focal instrumentation (FI) /27

The vibration test of the FI-EM structure provided greater than approximately 30% diminished random vibration load in comparison to the previous assumptions. The test was carried out with scale models of the components for verification of the finite element model. Likewise, the "limit loads" in the FI will decrease. A short report on the complete test evaluation is being prepared by DS as a sub-contractor of the MPE.

The electrical integration of the HRI-EM in the FI was successfully completed in the report time frame. Since SAO wanted to take back the HRI-EM for further tests in the USA, mechanical compatibility in the EM structure had been dispensed with. No problems are expected since the installation had already been proven with the HRI scale model.

The schedule for production of the FI-EM is indeed quite narrow. However, from the present point of view, the availability target date of April 1, 1985 is not yet in jeopardy.

The FI scale model which will be applied to telescope vibration is being prepared at MPE. The level-0 document, "Specifications for the Focal Instrumentation/Spacecraft Mounting Placements", was signed in the agreed revision I and released.

5.2 WFC /28

- With regard to level 0 document, "Spacecraft/SUV Wide Field Camera, Interface Requirements", issue 3, the design of revision A is available. Fundamental changes affect:
  - o power supply to the ion pumps through the SURS connection,
  - o field of view of the WFC--star sensor (possible scattered light from the baffle of the X-ray satellite star sensor),
  - o increased capacity requirements (primarily for the energy converter of the star sensor).

The technical observations to the changes are being processed.

- A several day interface conference in October at the Universities of Birmingham, Leicester and in the MSSL, was exceptionally productive and achieved significant progress.

- Technical questions about the power supply of the ion pumps were discussed in November at the MPE. The results are recorded in the protocol.

- The time needed for the check-out of the experiments on the RMS-Arm of the shuttle, and the consequences of a go/no-go decision, will be discussed.

- The co-alignment specifications of the WFC were analytically verified and documented.

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- There is agreement that the acoustic test for qualification of the STM is to be extended from 30 to 60 seconds.

- The arrival of the thermisters for the STM has been confirmed by RAL.

- Data processing plans will be discussed within the framework of the EORD (Experiment Operations Requirements Document) as far as it affects the GSOC.

- Presently there are no problems with regard to the placement of the EM.

6.0 Assembly, integration and tests

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The AIT plan was reviewed by the DFVLR project management. DS obtained numerous comments for integration into the AIT plan.

Discussions covering the planning options for compensation of the time delays in the S/S structure resulted that constructing a second complete central structure is the most practical method. A definitive decision can be carried out in the second quarter of 1985.

The environmental and test specifications were revised. Guidelines and a detailed time plan had been provided for the integration regulations.

Because of installation of the additional heater in the X-ray satellite, and the corresponding extra tests, (Solar Sim and TV), the prime contractor Dornier System announced a six-day extension of the solar simulation tests.

7.0 Ground station equipment /31

7.1 EGSE and check-out software

All of the originally planned hardware for the EGSE, including all peripheral devices, has arrived in the meantime and been successfully integrated for the work in the local mode. Some additional articles of hardware whose use has been designated as necessary because of the software development are being reordered. Their integration in the operable EGSE has been perceived to be without problems. The interface of the experimentation-EGSE's were produced and tested with the installation of the Decnet send and receive tasks.

The arising disturbance with the PASCAL compiler was avoided by introduction of another compiler model. According to present opinion, the thereby occurring delays in development of the TT&C software will have no influence upon the AIT sequence.

The software operations with ESTEC as well as with DS proceed smoothly and rapidly. The next iterative steps towards installation of special user requirements (monitor tables, command sequences, etc.) are to be discussed at the next status meeting in mid-January 1985 among those involved.

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7.2 MGSE

The production of the S/C transport container of the telescope receiving frame and assembly support, of the frame and assembly support for the central structure as well as the heating instruments for the telescope and central structure, proceed according to plan.

The detailed construction and request for bids for the vibration adapter were provided.

Construction of the S/C vertical assembly support of the WSA adapter and the S/C heating instruments is completed.

7.3 OGSE

The optical test stand was manufactured by C. Zeiss according to schedule. It is currently being assembled in the integration clean room at Dornier Systems.

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8.0 Mission safety

STS safety (flight and ground operations)

The review protocol of phase I "Safety Reviews" (flight and ground operations) was transferred from NASA and distributed to the participating institutions. The following documentation relevant to safety is currently being reviewed by the GSFC project management:

- Amended plan of structure verification for the S/C (DS responsibility)
- material lists of the DS subsystems, FI and WFC, taking into consideration the recommended additional information to particular design items from the GSFC in the 1. stage.

Reliability

The reviewing of the "single point failure list", reliability analysis and the provision of the FMECA are further delayed due to labor relations problems at the prime contractor.

Central structural member procurement

The activities in this area were essentially determined by:

- Reviewing of further "high reliability" procurement specifications and "upgrading procedures (UP's), and their negotiations with the agency under consultation by the DFVLR project management. /34
- Review and release of open procurement proposals insofar as they will not be influenced by open specifications with regard to "screening upgrading" procedures.
- Introduction of special measures towards raising the level of quality (screening/upgrading) with an additional nine types of building parts (five due to time problem drawbacks due to a lack of technical alternatives, four due to technical problems) which do not correspond to the anticipated level of quality for the X-ray satellite.
- Negotiations of the agency with European/American test facilities over the test program in the UP's for 12 IC types and discussion of the results.

- Ordering the final structural members which have not yet been ordered.

- Elaboration of proposals from the agency towards providing a delivery plan for building parts. The review of these proposals along with the users will follows in January, 1985.

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9.0 Carrier interface

PIP JSC 18410

As compared with the last version of October 11, 1984 to be considered by the project management, and a revision through JSC in the meantime, further changes had been agreed upon before signing. These were entered in the signature copies dated November 26, 1984. It was agreed upon that JSC adapt the pending version to the distribution under the corresponding signing date November 26, 1984 and arrange the printing of the PIP.

ICD--A 18410

- The project management formally communicated to NASA on November 20, 1984 that they had finally decided upon the second possibility offered by NASA: Providing for the additional heating system installed in the X-ray satellite in an "orbiter interface box" (OIB).

- After further reviewing the production responsibility for the OIB, NASA notified the project management that it is ready to make available the qualified OIB along with their assumed responsibility for connecting the OIB to the orbiter H/W. This follows under the condition that the X-ray satellite project management make available to NASA all recommended design information for building and development of the OIB.

- According to the PIP time schedule of November 26, 1984, the temporary version of the ICD is calculated through NASA-JSC for the end of December, 1984 to the beginning of January, 1985. /36

PIP annex

The "preliminary issue January 1985" of the PIP Annex 8 (launch site support plan) was directed to the X-ray satellite project management from KSC for reviewing. This edition contains the results of the point discussions between NASA-KSC and the GSFC/FFVLR project management of October 3, 1984 in reference to the proposed "preliminary issue September 1984" from KSC in September, 1984.

The "launch and landing (L+L) program requirement document (PRD), Vol. II Cargo, accompanying the launch site support plan" could not yet be finally revised by the project management.

/37

10.0 Mission operations

Within a suggested status review of all projects, a review of this internal DFVLR work package took place in December. The basis of this review was the X-ray satellite project plan (preliminary draft of October 2, 1984) with schedule, work structure plan and total cost calculations.

The inherent personnel requirement is being raised to nine man-years in 1985 (planned: 14 man-years). The means of covering for sub-contracting is again open in 1985. For clarification of the further direction of action, discussions take place between DFVLR-VO and BMFT.

In order to acquire sufficient familiarity with the position measurement and position control system, a DFVLR worker has been transferred to MBB.

The development concept for the position measurement and position control simulator was supplied and the recommended hardware identified.

Completion of the "Experiment Operations Requirement Document" (EORD) is being undertaken.

/38

11. Time schedule

The planned dates for the launch dates are pin-pointed in the following documents:

1.	Dornier time schedule	: Sept. 30, 1987
2.	Contract milestone schedule, M 11	: Oct. 30, 1987
3.	NASA schedule in PIP supplement	: Sept. 30, 1987

In comparison to the planned starting date, September 30, 1987, the current plan shows a delay of approximately seven weeks (November 17, 1987).

The delay arises from the combined effects of the scheduled delivery target date of the EM-subsystem with the fact that there exists only a model of the structure. This structure model will be re-used after the EM integration for the FM (i.e., "protoflight" model with refurbishment).

From this, the greatest delay with the EM-subsystem delivery extends linearly from the launch target date.

The delivery delays of the subsystem result in the following schedule listed in descending amounts:

automatic measurement/control	:	7.5 weeks
structure	:	5 weeks
power supply without solar generator	:	5 weeks
wiring	:	5 weeks
data processing	:	3 weeks
data transmission--decoder	:	3 weeks

A correction for these delay dates of the affected subsystems /39
is no longer possible. This is because the planned date lies in a time frame between February 12, 1985 and June 10, 1985.

Pushing back the actual launch date from the planned date is nonetheless possible if a second structure is introduced as a flight structure which allows a de-coupling of the FM integration from the EM integration. In this case, the FM integration could begin according to plan on March 20, 1986. This is possible since the ground equipment is going to again be available at Dornier after the completion of all EM tests after February 18, 1986, and the flight units of the subsystem are in the plan.

The possibility of introducing an additional FM structure is being reviewed. The relationship between the time schedules is depicted in the time schedules provided.

ROSAT

AUTHOR:
DEPART. PRP

A R O S A T PHASE C/D
MAJOR BARCHART

HP: 0000
PL-2002-6100 DS/002

PLAN. 200-82 PAGE: 1

NR. DAYS/PLU: 5 NR. DAYS/WEK:5 HAS/DAY: 8.00

MILESTONES (CONTRACTUAL)

M1	START PHASE C/D	03.10.83			
M2	DESIGN REVIEW NR 1	17.05.84			
M3	STM SPIEGELSYST.AN AIT	01.02.85			
M4	START MOD.SURV.TEST	02.09.85			
M5	DESIGN REVIEW NR 2	02.12.85			
M6	END OF STM S/C TEST	14.02.86	M9	PRE-SHIPPING REVIEW	15.06.87
M7	FM SPIEGELSYST.AN AIT	03.03.86	M10	END OF TESTS IN PPF	10.09.87
M8	START FM S/C ENVIRONM.TEST	15.10.86	M11	LAUNCH	30.10.87

DS-BARCHART OF 30APR.84
WITH ACTUAL DELAYS REPORTED
BY 10.DEC.84

LEGEND
PLANNED/ACTUAL
BUFFER
TIME NOW
NOT ALL S/S

BARCHART

CUM NUM	ACTIVITY DESCRIPTION
1	MILESTONES
2	
3	S/C DESIGN
4	S/S DEVELOPMENT
5	MANUFACTURING EM,QM
6	S/S-TESTS EM,QM
7	MANUFACT.MA-STM
8	TESTS MA STM
9	EEE PARTS PROCUREMENT
10	MANUFACTURING FM
11	S/S-TESTS FM
12	MANUFACTURING,TESTS MA-FM
13	
14	AIT-TELESCOPE QM
15	AIT-BUS EM
16	AIT-S/C STM, 1.IST
17	ENVIRONMENTAL TESTS S/C-STM
18	S/C-COMPATIBILITY TESTS
19	
20	AIT-TELESCOPE FM
21	AIT-BUS FM
22	AIT-S/C FM, 2.IST
23	ENVIRONMENTAL TESTS S/C-FM
24	X-RAY PERFORM.TESTS TELESC.
25	
26	FINAL IST
27	BUFFER FOR S/C
28	TRANSPORT KSC
29	REINTEGR.AND TEST PPF
30	VPF
31	RSS,LAUNCH PAD

OCT DEC FEB APR JUN AUG OCT DEC FEB APR JUN AUG OCT DEC FEB APR JUN AUG OCT DEC FEB APR JUN AUG OCT

1984 1985 1986 1987

TIME NOW	10.12.84
AUTHOR:	BITZER
DEPART.	PBP

ROSAT - BARCHART
EM.QM.STM AIT

ISSUE : 3

DORNIER SYSTEM FRIEDRICHSHAFEN

PLAN: 6-37 PAGE: 1

WK. DAYS/PLU: 5 WK. DAYS/WEE:5 HRS/DAY: 8.00

Milestones

1.2.85 ▽M3 | 2.9.85 ▽M4 | 2.12.85 ▽M5 | 14.2.86 ▽M6

BARCHART

CUR NUM	SHR NUM	ACTIVITY DESCRIPTION	ACT. DUR.	EARLY START	EARLY FINISH
1	12	MR.FLS.MED & OPT.TEST	9.6	01FEB85	26FEB85
2	13		5.6	18FEB85	13MAR85
3	16	GYP-MM/ST-STR/MM-TEST THERM.M/M	2.0	13FEB85	26FEB85
4	17		2.0	20FEB85	13MAR85
5	24	TH.BAFFLE/OPT.TESTS FI-MM DOOR/ALIGNEM.	3.6	27FEB85	21MAR85
6	25		3.6	15MAR85	08APR85
7	30	TRANSP.& VIBR.TELESC.AT IABG	5.6	22MAR85	10APR85
8	31		3.6	10APR85	16APR85
9	36	OPT.TEST ALIGNEM. MOUNT FI-EM THERM.M/M	3.6	18APR85	18APR85
10	37		3.6	19APR85	30APR85
11	56	CENTR.STRUCT./PS/S & HARNESS INT.	3.6	01FEB85	25FEB85
12	57		3.6	18MAR85	11APR85
13	60	DECODER INTEGR.	0.6	26FEB85	26FEB85
14	61		6.6	12APR85	16APR85
15	64	DHS INTEGR.	2.0	01MAR85	18MAR85
16	65		2.0	17APR85	30APR85
17	66	PYRO & TRANSPONDER INTEGR.	1.6	15MAR85	25MAR85
18	68		1.6	02MAY85	13MAY85
19	72	WFC-ER INTEGR.	1.0	27MAR85	02APR85
20	73		1.0	16MAY85	22MAY85
21	78	ANT.& ANT.BOOM INTEGR.	0.0	03APR85	10APR85
22	79		0.0	23MAY85	28MAY85
23	82	THERM.H/W INTEGR.	3.6	11APR85	06MAY85
24	83		3.6	30MAY85	26JUN85
25	86	SUPP.STRUCT & SOL.PANELS INTEGR.	3.0	07MAY85	10MAY85
26	87		8.0	27JUN85	02JUL85
27	90	MOUNT.TELESC.& FI INTEGR.	2.0	13MAY85	20MAY85
28	91		2.0	03JUL85	16JUL85
29	98	INTEGR. AOCS ALIGNMENT	2.0	30MAY85	21JUN85
30	99		2.0	31JUL85	19AUG85
31	102	PRE IST	2.0	29JUN85	11JUL85
32	103		2.0	20AUG85	06SEP85
33	104	I.IST ENC TEST EXCH.WFC & TA	3.0	12JUL85	01AUG85
34	105		3.0	09SEP85	27SEP85
35	106	TRANSP.& MODAL SURVEY AT IABG	4.0	02AUG85	29AUG85
36	108		4.0	30SEP85	25OCT85
37	110	SOLAR SIMULAT AT IABG	7.0	30AUG85	17OCT85
38	111		7.0	28OCT85	19DEC85
39	112	MOUNT TEST WFC-ER	0.6	10OCT85	22OCT85
40	113		0.6	19DEC85	21DEC85
41	114	TRANSP.& ENC TEST (ABB)	3.0	23OCT85	13NOV85
42	115		3.0	07JAN86	27JAN86
43	116	TRANSP.& COMPAT.TEST (GSOC)	2.0	14NOV85	06DEC85
44	117		2.0	28JAN86	14FEB86
45	118	TRANSP.& DISMOUNT STN AT BS	3.0	05DEC85	08JAN86
46	119		3.0	17FEB86	07MAR86
47	120	TCS-SUIT CASE TEST (JSC)	2.0	10JAN86	23JAN86
48	121		2.0	10MAR86	21MAR86
49	122	TRANSP.& TEL.HANDL.TEST & FI EGSE RPE	4.0	10JAN86	06FEB86
50	123		4.0	10MAR86	08APR86
51	124	STRUCT.STR TO HBB (REFURBISHMENT)	9.2	10JAN86	10MAR86
52	125		9.2	10MAR86	21MAY86

CUR NUM	SHR NUM	ACTIVITY DESCRIPTION	ACT. DUR.	EARLY START	EARLY FINISH

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY

1985 1986

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY

1985 1986

TIME NOW	10.12.86
AUTHOR:	BITZER
DEPART.	PBP

ROSAT - BARCHART
FM AIT

ISSUE : 3

DORNIER SYSTEM
FRIEDRICHSHAFEN

PLAN: 6-36

PAGE: 1

WK. DAYS/PLN: 5 WK. DAYS/WEK:5 HRS/DAY: 8.00

Milestones

3.3.86 ▽M7
15.10.86 ▽M8
15.6.87 ▽M9
10.9.87 ▽M10
30.10.87 ▽M11

BARCHART

CUR RUN	SHR ANA	ACTIVITY DESCRIPTION	ACT. DUR.	EARLY START	EARLY FINISH
1	0	MR.FLS.RED INTEGR.& OPT.TEST	2.6	17MAR86	06APR86
2	5		2.6	17MAR86	06APR86
3	14	GTP-ER, ST-STR EM TB H/W TEST H/W	2.6	21MAR86	09APR86
4	15		2.6	21MAR86	09APR86
5	22	THERM.BAFFLE,DOOR,FI-MOUNT OPT TEST	2.6	07APR86	24APR86
6	23		2.6	07APR86	24APR86
7	24	TRANSP.& VIBR.TEST AT ERNO	2.6	25APR86	08MAY86
8	25		2.6	25APR86	08MAY86
9	26	TRANSP.& OPT.TEST ALIGNM. MOUNT.TEST RING	2.6	09MAY86	23MAY86
10	27		2.6	09MAY86	23MAY86
11	28	TRANSP.& FOCAL LENGTH AT MPE	4.4	11JUN86	18JUL86
12	29		4.4	11JUN86	18JUL86
13	36	INTEGR.CENTR.STRUCT.,PSS & HARNESS	3.4	17MAR86	08APR86
14	37		3.4	22MAY86	10JUN86
15	60	INTEGR.DECODER	8.8	11APR86	15APR86
16	61		8.8	20JUN86	26JUN86
17	44	INTEGR.DHS	2.0	16APR86	28APR86
18	45		2.0	25JUN86	08JUL86
19	50	INTEGR.PIRO & TRANSPONDER	1.0	30APR86	15MAY86
20	51		1.0	09JUL86	10JUL86
21	54	INTEGR.WFC	1.0	16MAY86	23MAY86
22	55		1.0	21JUL86	25JUL86
23	68	INTEGR. RAT.& ANTENNA BOOM	0.0	29MAY86	02JUN86
24	81		0.0	28JUL86	31JUL86
25	82	INTEGR.THERM.H/W	3.0	05JUN86	25JUN86
26	83		3.0	01AUG86	21AUG86
27	86	INTEGR. SUPP.STRUCT.& SOL.PANELS	0.0	26JUN86	01JUL86
28	87		0.0	22AUG86	27AUG86
29	68	MOUNT.FL.RING, FI. ALIGNM.. MOUNT TELESC.	2.2	15JUL86	28JUL86
30	69		2.2	28AUG86	11SEP86
31	76	INTEGR. BHCS & ALIGNEMENT	2.8	30JUL86	18AUG86
32	77		2.8	12SEP86	01OCT86
33	78	FHE IST	2.6	18AUG86	03SEP86
34	79		2.6	02OCT86	17OCT86
35	74	2.1ST	2.8	04SEP86	17SEP86
36	75		2.8	20OCT86	31OCT86
37	80	EMC TEST	1.0	10SEP86	24SEP86
38	81		1.0	03NOV86	07NOV86
39	82	TRANSP.& THERM.VACUUM AT ERNO	5.8	25SEP86	29OCT86
40	87		5.8	10NOV86	15DEC86
41	89	ACCOUSTIC NOISE AT ERNO	3.0	30OCT86	20NOV86
42	85		3.0	16DEC86	19JAN87
43	88	TRANSP.& COMPAT.TEST AT GSOC	4.0	21NOV86	18DEC86
44	89		4.0	20JAN87	16FEB87
45	68	TRANSP.DISH.TELESC FI-ALIGN. OPT TEST	3.8	19DEC86	22JAN87
46	69		3.8	17FEB87	09MAR87
47	90	TRANSP.TELESC. X-RAY PERFORM.TEST	12.8	23JAN87	16APR87
48	91		12.8	10MAR87	08JUN87
49	94	TRANSP.MOUNT.TELESC.FL.-RING FINAL IST	4.8	21APR87	19MAY87
50	95		4.8	10JUN87	08JUL87
51	96	BUFFER	4.8	20MAY87	23JUN87
52	97		4.8	10JUL87	06AUG87
53	98	TRANSP. ESC	2.6	25JUN87	10JUL87
54	99		2.6	07AUG87	25AUG87
55	100	REINTEGR. & TEST AT PPF	5.8	13JUL87	19AUG87
56	101		5.8	26AUG87	28SEP87
57	102	PPF	2.8	17AUG87	03SEP87
58	103		2.8	30SEP87	19OCT87
59	104	RSS LAUNCH PAD	4.2	04SEP87	02OCT87
60	105		4.2	20OCT87	17NOV87

CUR RUN	SHR ANA	ACTIVITY DESCRIPTION	ACT. DUR.	EARLY START	EARLY FINISH

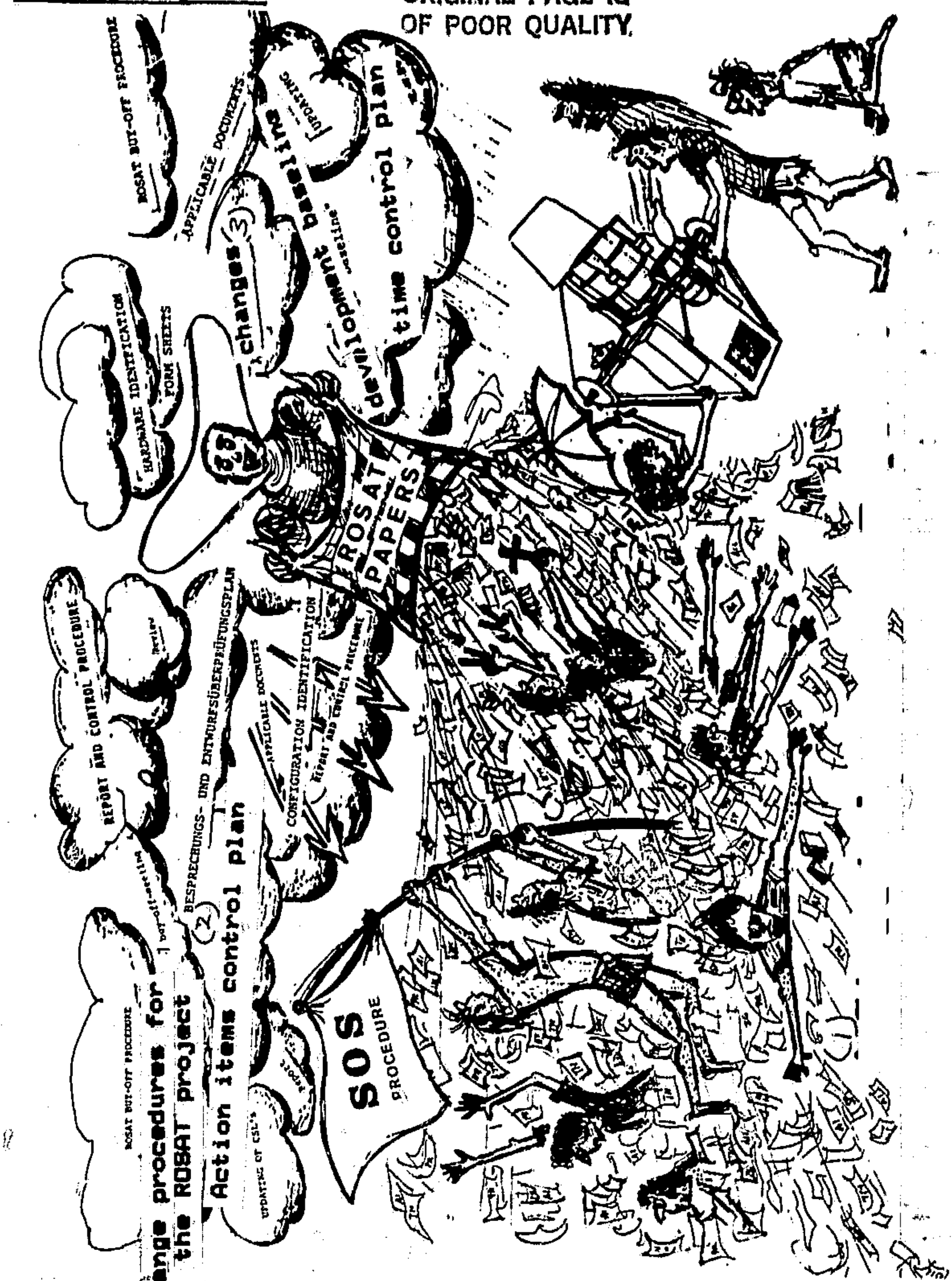
1986 1987

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV

1986 1987

13.0 Supplement

ORIGINAL PAGE IS
OF POOR QUALITY



/1/ Stop the deluge of Acid Paper !
The forest and ROSAT will be grateful !

DFVLR
BPT

13.1 Personnel employment

hierarchy

x-ray satellite mirror system

ROENTGENSATELLIT

Personnel utilization

STATUS:

	time frame	planned	projected	time frame	planned	projected	time frame RAUM	projected		time frame	planned		projected
category I	12/84	13.0	8.2										
category II	12/84	3.5	0.9										
category III	12/84	4.0	4.1										
total	12/84	20.5	13.2										

DMOD	Demodulator
DNEL	Disconnection of Non-Essential Loads
DPS	Data Processing System
DS	Dornier System
ECS	Environmental Control System
EED	Electro-Explosive Device
EEL	Experiment-Electronics
EGSE	Electrical Ground Support Equipment
EM	Engineering Model
EMC	Electromagnetic Compatibility
EOL	End-of-Life
EROD	Experiment Operations Requirements Document
EPD	External Power Dumper
EUV	Extreme Ultraviolet
FI	Focal Plane Instrumentation
FLS	Fiducial Light System
FM	Flight Model
FWHM	Full Width at Half Maximum
GF	Grapple Fixture
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
GSOC	German Space Operations Center
GVS	Gas Supply System
GYP	Gyropackage
GYPE	Gyropackage Electronics
GYPS	Gyropackage Sensor

/1/ INVAR tradename for a particular steel alloy

/2/ German

/3/ MPE Max Planck Institute for Physics and Astrophysics

HC	Heater Control
HEAO-2	High Energy Astronomy Observatory ("Einstein")
HK	Housekeeping
HP	High Power
HRI	High Resolution Imager
INVAR	Handelsname für eine besondere Stahllegierung (1)
JSC	Johnson Space Center
kbps	Kilobit per second (deutsch: kbit/s)
KSC	Kennedy Space Center
LCL	Latching Current Limiter
LED	Light Emitting Diode
LHC	Left-hand Circulation
LP	Low Power
MA	Mirror Assembly
MAC	Mirror Attachment Cone
Mbps	Megabit per second (deutsch: Megabit/s)
MC	Magnetic Coil (2)
MCC	Mission Control Center
MCP	Microchannel Plate
MDM	Multiplexer/Demultiplexer
MED	Magnetic Electron Deflector
MES	Mechanisms Subsystem
MGSE	Mechanical Ground Support Equipment
MLI	Multilayer Insulation
MM	Magnetometer
MOU	Memorandum of Understanding
MPE	Max-Planck-Institut für Physik und Astrophysik

/1/ Max Planck Corporation

MPG	Max-Planck-Gesellschaft (1)
MPSS	Mission Planning and Scheduling System
MSA	Main Solar Array
MUC	Multi-Use Container
MUDAS	Modular Universal Data Acquisition and Control System
MVL	Main Voltage Limiter
NASA	National Aeronautics and Space Administration
NRZ/L-Code	Non-Return-to-Zero/L-Code
NSI	NASA Standard Initiator
OBC	Onboard Computer
OGSE	Optical Ground Support Equipment
OSR	Optical Surface Reflector
PCU	Power Control Unit
PDU	Power Distribution Unit
PETS	Payload Environmental Transportation System
PGHM	Payload Ground Handling Mechanism
PHP	Paraboloid-Hyperboloid Pair
POCC	Payload Operations Control Center
PPF	Payload Processing Facility
PSE	Payload Support Equipment
PSK	Phase-shift Keying
PSPC	Position Sensitive Proportional Counter
PSS	Power Supply Subsystem
PYB	Pyrotechnics Electronic Box
QM	Qualification Model

RAL	Rutherford Appleton Laboratory
RE	Radiated Emission
RF	Radio Frequency
RMC	Right-hand Circulation
RMS	Remote Manipulator System
ROSAT	X-ray satellite
RS	Radiated Susceptibility
RSS	Rotating Service Structure
RT	Real Time
RW	Reaction Wheel
RX	Receiver
S/C	Spacecraft
SERC	Science & Engineering Research Council
S/L	Serial Load
SOC	Science Operations Center
SPL Code	Split Phase Level Code
SSM	Single Surface Mirror
ST	Star Tracker
STC	Star Tracker Camera
STE	Star Tracker Electronics
STM	Structural Thermal Model
STS	Space Transportation System
TC	Telecommand
T/C	Thermal Control
TCE	Thermal Conditoning Equipment
TCS	Telecommunication Subsystem
TM	Telemetry
TR	Tape Recorder

/1/ trade name for the glass-ceramic material of the mirror

TT & C	Telemetry, Tracking and Command
TX	Transmitter
VPHD	Vertical Payload Handling Device
VPF	Vertical Processing Facility
WDE	Wheel Drive Electronics
WFC	Wide Field Camera
XRT	X-Ray Telescope
ZERODUR	trade name for the glass-ceramic material of the mirror des Spiegels
ZDE	Central Data Electronics