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Programme Overview

After many years of planning, design and analyses, INTEGRAL is now definitely in its hardware phase: the STM programme is in full swing and the EM programme is under preparation.

In this phase, it is crucial to harmonise the efforts of Industry, PI consortium and the ESA partners. For this reason, we plan to issue a periodic INTEGRAL Newsletter. We hope that the information provided is of interest to you and we are looking ahead to your comments and proposals for future issues.



INTEGRAL STM IN THE ESTEC CLEAN ROOM



Spacecraft

S/C Engineering Status

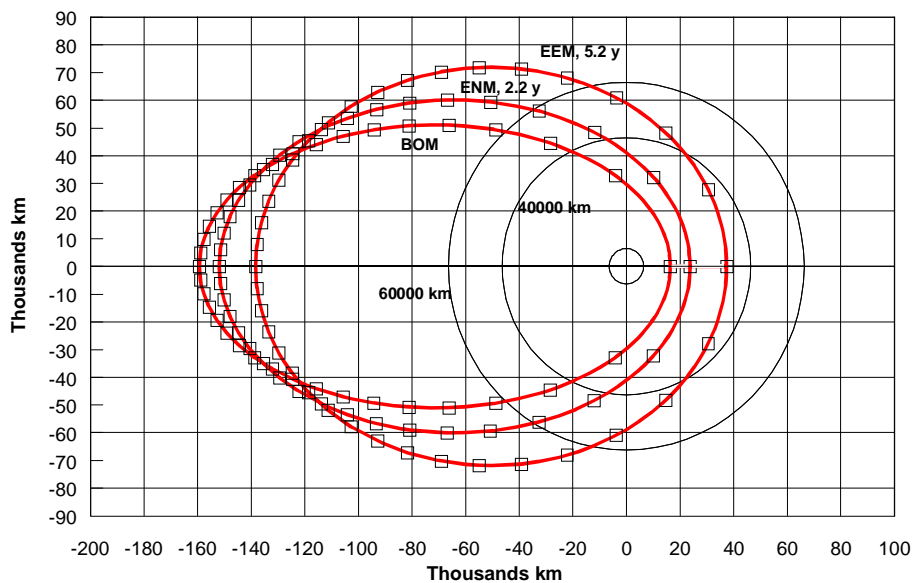
S/C resources:

The power budget situation has further eroded as an outcome of the instruments Hardware Design Review (HDR). The impact of the increase of power demand from all the experiments is that the Sun aspect angle constraint might have to be reduced to 30° during the first year of operation.

The mass situation is much more healthy and it has been decided to deplete part of the available margin by increasing the fuel mass by 50 kg and improve the shielding of the IBIS collimator tube and hopper.

System design:

In order to maintain a positive telemetry link margin for the new 72 hour Proton orbit (see figure), it has been decided to increase the modulation index and to improve the RF cable.



	Time below 60,000 km	Time below 40,000 km
Beginning of Mission (BOM)	17 %	10 %
End Nominal Mission (ENM)	19 %	10%
End Extended Mission (EEM)	21 %	9%
Time ticks along orbit every 2 hours		

NEW PROTON 72 HOUR ORBIT

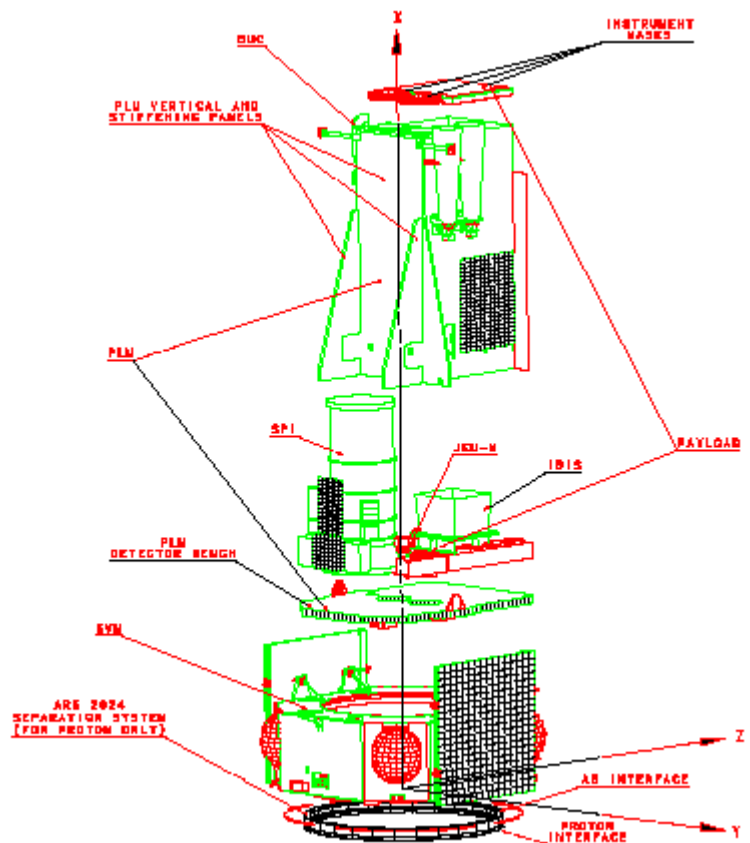


All the failure modes of the onboard autonomous functions have been studied in detail. As a consequence the heater concept and the preprogrammed switching sequences in the PDU's are under revision.

AOCS/RCS:

The AOCS EM S/S test campaign has now started. Some of the FM units have been delivered in preparation of the S/S FM campaign scheduled to start September 98. The progress of the Rate Measurement Unit (RMU), which is a specific Integral unit used by the failure correction function in case of an attitude anomaly, is very good. All the confidence testing, radiation, shock and random vibrations have all been successfully completed. The DM is already delivered and the EQM is due to start qualification testing in August.

The qualification of the special Integral diaphragm tanks is ongoing. The shells and the diaphragms for the FM tanks are already manufactured and waiting for assembly pending successful qualification.



S/C EXPLODED VIEW

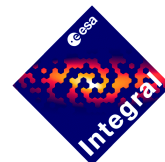
Thermal/Structure:

The Thermal Balance (TB) test has positively confirmed the overall thermal design of the S/C. In particular the thermal control of the IBIS detector and the thermal design of the instrument masks performed as expected. The experiments have been provided with all the data. Detailed correlation of the thermal mathematical models is expected by end September.

Go-ahead has been given to the start of manufacturing of the flight model of the PLM structure.

Other units:

All the other S/C flight model units are under manufacturing or test.



S/C Verification Program

STM:

The Structural Thermal Model of Integral is proceeding in its test program according to plan. The Service Module, received from XMM after completion of their mechanical/thermal qualification, had to undergo a few planned modifications (i.e. thruster locations, antenna positioning, I/F SVM/PLM, various S/S boxes, MLI configuration). The instruments have been integrated for the first time on the PLM. No specific problem has been encountered. Due to a major effort by Alenia, CASA, Austrian Aerospace and Contraves the crucial start date for the TB test has been maintained.

After successful completion of the Thermal Balance Test and the Mass Properties measurements, the mechanical qualification tests (modal survey, acoustic and shock separation) have started. The STM programme is planned to end in October 98 with the vibration test at IABG.



PLM/SVM STM CONNECTION

The operations and handling of the STM revealed that some modifications of the MGSE will be necessary to guaranty efficient and safe operations for the FM programme.

EM:

Information on the EM will be provided in the next issue.



Payload

Following the delivery of the STMs of each instrument to the spacecraft, the Instrument Hardware Design Reviews (IHDR) of each instrument were held in June/July. The main focus of these reviews was to review the status of the EM, including hardware/software development and documentation. In most cases, problems with EM development led to a decision to split the EM deliveries in two: first the electronic boxes, second the detectors. Documentation was in most cases not adequate and special actions have been agreed to recover the situation.

Summary status per instrument is provided below:

Instrument Status

Instrument	Main Concern	Hardware/Software Delivery Status	Documentation Status
SPI	<ul style="list-style-type: none"> • Cryocooler power in case of failure • Compliance of TM/TC definition with PSD 	<ul style="list-style-type: none"> • No major change, SEM/EM approach 	<ul style="list-style-type: none"> • User Manual lacks parameter description and procedures
IBIS	<ul style="list-style-type: none"> • S/W and operations concept 	<ul style="list-style-type: none"> • EM delivery split into EM0, EM1 	<ul style="list-style-type: none"> • Special sessions agreed for overhaul of documentation
JEM-X	<ul style="list-style-type: none"> • Manufacturing of PCBs 	<ul style="list-style-type: none"> • EM split into DFEE and Detectors 	<ul style="list-style-type: none"> • Adequate
OMC	<ul style="list-style-type: none"> • S/W development 	<ul style="list-style-type: none"> • EM can still be delivered as one unit 	<ul style="list-style-type: none"> • Local rework of documentation agreed

Launcher

The arrangement for the provision of the Proton launcher has still not entered into force. A meeting to discuss the share of funds between RSA and the Academy of Sciences is planned in August.

In the mean time, discussions are ongoing between ESA, RSA and Russian industry on the terms of an adaptation contract to cover some specific interface issues of the INTEGRAL launch on Proton. Interface work is also progressing and all basic parameters, defining the simplified injection scenario into the transfer orbit of the new 72 hour mission orbit, have been agreed with the Russian partners.

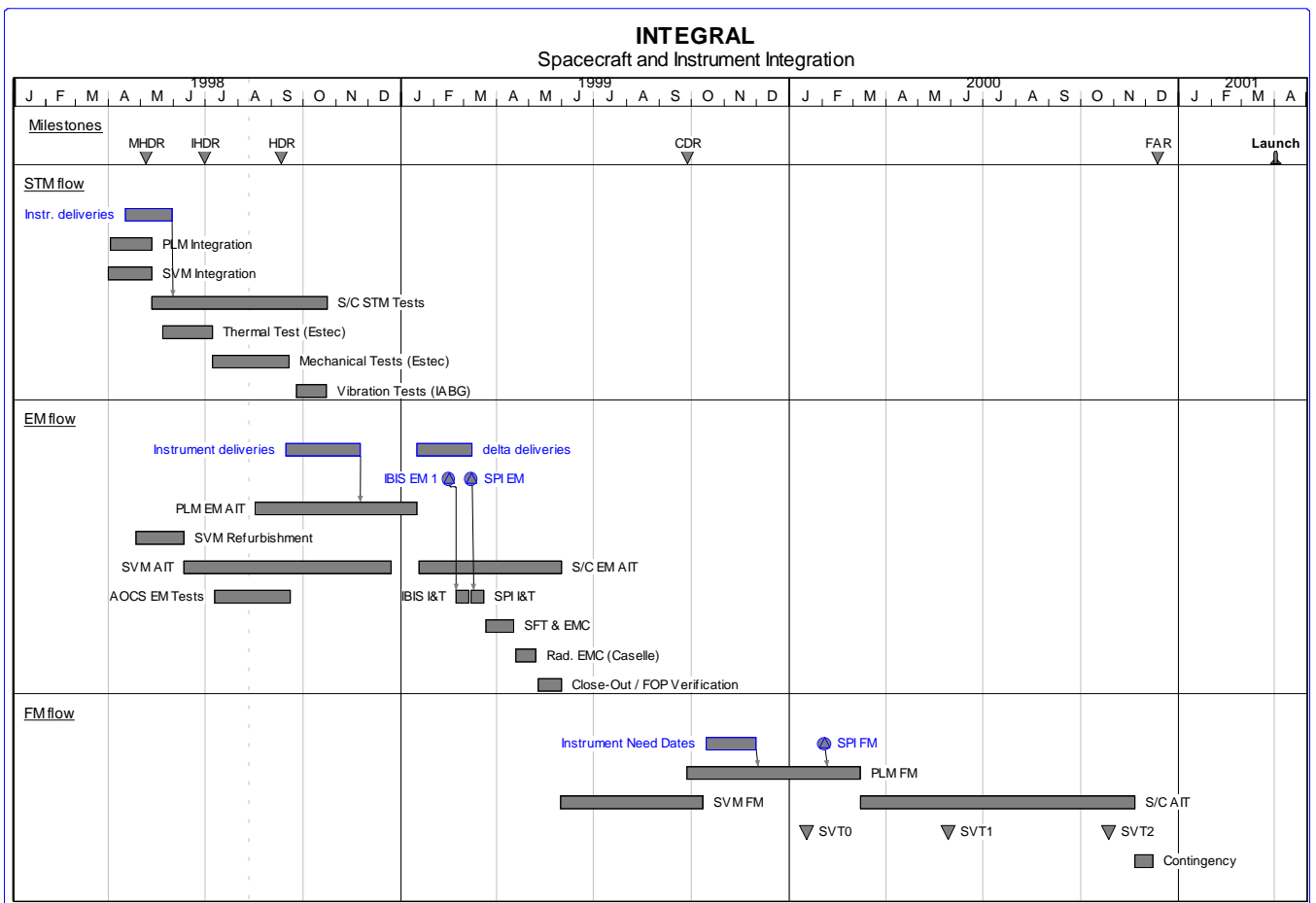
In parallel, a contract with Arianespace has been issued to maintain compatibility with the backup launcher, Ariane 5.



Overall Schedule

The current baseline satellite master schedule resulting from the instruments HDR is attached. Discussions are ongoing with Alenia to verify its feasibility.

A final agreement should be reached during the **System HDR** planned from end of August until the board meeting on 10 September.



CURRENT BASELINE SATELLITE MASTER SCHEDULE (AUG 98)



Documentation

Recent updates to high level requirements:

Document	Reference	Issue/Rev	Date	Comments
System Requirements Document	INT-SR-0001	2/1	May 98	

INTEGRAL Web Resources

ESA Science Web Site	http://sci.esa.int/integral	general information on the mission, latest news, science workshop, other links and much more
ESA anonymous ftp server for INTEGRAL	ftp://ftp.estec.esa.nl/pub/integral	SRD, EID A updates stored there. File ippd.htm provides links to other password restricted resources
RID system for reviews	https://spdext.estec.esa.nl:1083	password controlled, used by panel members during reviews
Alenia INTEGRAL page	http://www.alespazio.it/frsci.htm	summary with graphics

Other Information ...

We are planning to report on Science News, Ground Segment status and other topics in our next issue. Your contributions are welcome.

Please note that Alenia also produces a periodic newsletter providing more insight into the industrial activities. Please contact the Alenia or ESTEC team to receive a copy.