MINUTES OF THE EQUATOR-S PLANNING MEETING

MPE - GARCHING

NOVEMBER 15 - 16, 1991

1. PROJECT STATUS AND FUTURE

After welcoming the participants G. Haerendel gave a brief history of the project. He reported that NASA had expressed strong support of the mission and was willing to dedicate a standard 4-stage Scout vehicle to EQUATOR-S. A decision of DARA on the requested support of the S/C development was still pending. U. Ponzi described the status of the San Marco Scout program which was introduced to the public at a press conference in Rome on November 4 and at which EQUATOR-S was announced as the payload.

All parties agreed on an April 1, 1994 launch date.

2. SAN MARCO LAUNCHER AND LAUNCH RANGE DEVELOPMENT

M. Sirinian described the concept of the San Marco Scout and stressed the point that by adding a new first stage (4 Algol III motors) little change was introduced in the acceleration profile. The whole system was designed with the aim to minimize modifications and thereby the risks.

The theoretical performance data (see Annex 3) indicate that a 175 kg payload can be injected into a 500 km x 10 R_E eccentric orbit. This mass includes 9.4 kg of the E-Section on top of the 5th stage with clamp band. The 5th stage and S/C are spun up to a maximum rate of 180 r.p.m. which, after burn-out, is reduced by a yo-yo to the rate required by EQUATOR-S (~ 60 r.p.m.). The dispersion was quoted to be ± 3500 km (95 % probability).

A technology package to be integrated somewhere on the 5th stage or S/C adapter (item 1) the S/C (items 2 and 3) (Annex 4) was presented by the University of Rome. It includes three parts:

(1) accelerometers and rate gyros
(2) monitoring of solar cell degradation
(3) monitoring of electronic component degradation involving a dosimeter.

The mass of (1) was estimated to be less than 9 kg and the mass of (3) was estimated to be 0.5 kg.

Since the dispersion of the 5th stage depends critically on the balancing of the stack and since 5th stage and S/C can only be balanced separately, care has to be taken with regard to proper alignment.

3. S/C DESIGN UPDATES

(a) Mechanical

J. Stöcker described the modifications of the S/C since the June 14/15 meeting. The main change was an enlargement of the diameter and the adoption of a dodecahedron for the cross-section. A discussion arose about the mating procedure with the 5th stage. J. Stöcker proposed to install the lower set of solar panels after mating. No support structure is foreseen for these panels, they support each other.

The major design and schedule driving items are seen to be:

(1) the solar panel - S/C interfaces
(2) the static and dynamic loads
(3) the definition of the torquing and attitude control strategy.

Actions were defined with regard to these topics.

(b) Electrical

F. Melzner stated that the power supply would provide regulated voltage of 28 V ± 3 %. R. Torbert voiced concern since the EDI experiment requires power regulated to ± 1 %.

4. EXPERIMENT UPDATES

4.1. Magnetometer: Power increase from 3.0 W to 4.5 W.

4.2. EDI: 1 kg needed for shielding;
New mass: 10.5 kg
Burst rate: 10.7 kbits/s; 16 kbits/s for check-out.

4.3. 3D-Electron Analyzer:
Redesign of Analyzer Box needed in order to accommodate desired sensor orientation.

4.4. Ion Composition Instrument:
Mass increase from 7.5 kg to 8.4 kg.
Power: 6.1 W , peak power: 6.5 W.
Burst rate: 70 kbits/s.

4.5. Energetic Particle Instrument:
No change. DPU may be separated (not physically) from DPU of 3D-El. Analyzer.

4.6. Potential Control Instrument:
Mass increase: 1.9 kg → 2.1 kg.

In summary, there are the following changes with respect to the mass breakdown in the Blue Book (Page 27):

S/C Adapter (E-Section):	+ 9.4 kg
Vehicle Diagnostic Package:	+ 9.0 kg
Monitoring Device of Electronics:	+ 0.5 kg
Experiments:	+ 2.1 kg
Sum	+ 21.0 kg

Since the theoretical mass is 175 kg as compared with 170 kg adopted in the Blue Book, the margin has decreased from 30.2 to 14.2 kg.

5. EXPERIMENT - S/C INTERFACES

F. Melzner distributed a hand-out on the Internal Data Transmission (Annex 5).

6. ON-BOARD DATA SYSTEM

The real-time data rate proposed by F. Melzner is 16.4 kbits/s. The burst rate will be 131 kbits/s.
The allocations will be redistributed by F. Melzner.

7. ORBIT DESIGN AND RADIATION ENVIRONMENT

C. Ulivieri presented calculations of the development of the orbital parameters of a 520 km x 10 R_E orbit during 1 year (see Annex 1). The height of perigee will be modulated by solar and lunar perturbations by about ± 100 km; the inclination will grow from 2.9 to 5.0 degrees.

8. MISSION OPERATIONS

F. Guckenbiehl summarized the inputs needed for proper planning of GSOC and urged the project management to submit a formal request for mission support a.s.a.p. A discussion dealt with the advantages and disadvantages of packet telemetry. EQUATOR-S will not use standard packet TM, and in so far will be considered by GSOC as a non-standard system. Instrument control can be handled by the experimenters in near real-time by computer link, GSOC providing the formats. A 56-kbits/s line between GSOC and MPE exists already for ROSAT.

Another unresolved topic is the data storage media and distribution policy. GSOC proposes the use of Exabyte tapes. The use of DATs was also discussed.

Since no transponder will be installed on the S/C, only angle tracking can be done by GSOC. R. Adkins proposed to request through NASA tracking by NORAD after launch.

9. DATA DISSEMINATION

After a long discussion it was concluded that the data system should be modelled after the MPE center of the CLUSTER Science Data System (CSDS). Compatibility with the GGS (CDHF) will be the topic of a working group consisting of: W. Baumjohann (MPE), L. Kistler and R. Torbert (UNH), M. Dobrowolny (ISFI), N.N. (GSOC), Bill Worrell (GSFC), M. di Ruscio (U of Rome) and H. Lühr (TUB). The chairman will be: W. Baumjohann.

10. MODEL PHILOSOPHY AND Q/A

J. Stöcker described the purpose of the structural model (physical properties, vibrations, etc.) to which mass dummies of the instruments will have to be delivered by about Sept. 1992. The requirements on the mass dummies are to provide: shape, foot prints, representative mass and c.g. location and connector locations, and they must withstand the vibrational tests. All this can be provided by one model or by two separate ones (Two models would allow parallel work on the harness which will be developed on a separate wooden S/C model.).

A lively discussion dealt with the role of the solar simulation test and the importance of the thermal analysis model. It was concluded that

- the Solar Sim. Test will be done only with the fully integrated S/C;
- this test may be replaced (mainly for financial reasons) by a thermovacuum test with thermal balancing;
- a good thermal model was of greatest importance (industrial subcontractor).

Antenna tests can be done with the structural model. A suitcase model will be provided by MPE for interface tests with GSOC (Weilheim) and possibly the launch site. MPE will also provide the data base for Mission Control.

Quality Assurance will be based on proper parts inspection and component tracing by log book (S/C).
The instruments being derivates of experiments for on-going major space mission are regarded as sufficiently qualified. Also for them log books will be kept.

Other Items:

- The instrument check-out at launch site will be under the responsibility of each experimenter.
- D.c. magnetic cleanliness tests are required on unit level.
- No EMC test is needed for S/C, only power line test are to be performed by the integration team.
- The last action of a magnetorquer activation is the demagnetization.

11. PROJECT STRUCTURE

G. Haerendel proposed a single P.I. leadership of the EQUATOR-S project. The individual experiments will be under the responsibility of Lead Investigators. G. Haerendel will act as P.I., R. Torbert as Deputy P.I. The group accepted this proposal.

An integrated Science and Engineering team will implement the development of S/C and scientific payload. Frequent routine meetings of this team will guarantee transparency, early identification of problems and joint finding of solutions.

12. SCHEDULE

See Annex 6.

13. ACTION ITEMS

Annex 7.

14. NEXT MEETING

January 30/31, 1992 at MPE.

November 27, 1991

Gerhard Haerendel

H. Hippmann