KAP and MAQSAT-B2 – an Experimental Platform for Ariane 5 evolved from the Test Satellite for L521

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Abstract – For the successful Ariane Flight L521 – the qualification flight for the new heavy lift ECA version after failure of Ariane 5 L517 in December 2002 – Kayser-Threde was contracted again by Arianespace for design, manufacturing and qualification of MAQSAT-B2 as a further step in Kayser-Threde`s successful Ariane 5 dummy satellites and structures program. MAQSAT-B2 is a fully representative dummy satellite containing several technology experiments. The contract covered also complete electrical equipment for data acquisition, handling and transmitting to ground with design and qualification fully under Kayser-Threde's responsibility. This TMA acquired environmental data of approximately 60 sensors on Ariane and on MAQSAT and transmitted it online to Ariane ground stations until 3½ hours after lift-off. These data has allowed for confirming the environmental requirements for payloads on this new launcher generation. The experiments – selected by ESA – having had a flight opportunity on MAQSAT-B2 are: DVCAM – a French video kit for video data generation, a French Loop-Heat-Pipe experiment and SloshSat – a 127 kg micro satellite from the Netherlands with a complete experiment on board for analyzing sloshing fluids under 0g environment, which will be separated from MAQSAT-B2. Within a very tight schedule of 6 months the 3.6t satellite – fully qualified for Ariane 5 – has been realized. The paper shall give an overview of the complete project, which started end of September 2003 until final Qualification Review end of March 2004 as well as the mission phase. The development project phase was characterized by a short and comprehensive design phase, extensive MAI phase and compact qualification test phase at IABG. Both the mechanical and electrical design could only be established due to the experience and knowledge out of the former MAQSAT projects.

The success of MAQSAT-B2 and its instrument platform has led to further developments for a new generation of experimental platforms allowing easy access to space for in-orbit verification and launcher environment testing. Extracting the Instrument Platform from MAQSAT-B2, which accommodates the complete instrumentation and the experiments (the lower of the large cylinders to be seen on the previous figures), this structure can be integrated underneath the ACU and will stay mated to the Upper Stage of Ariane 5. Three baseline mission scenarios have been defined: 3 hours (for measuring the launcher environment and to expose experiments/technology demonstrators to the launcher environment), 3 days for short experiments and 1 year for long time experiments. For the first two missions power will be provided via batteries, the long mission will use solar power. Only the long-time mission will allow for telecommanding. The other ones will be controlled by an onboard timer. The KAP provides experimental payload mass of up to 220 kg having a complete mass of 600 kg. The outer structure of KAP is in the main load path and therefore designed to not introduce flux-peaks at the interfaces. The internal platform itself is supported to limit the loads on the equipment to an allowable level the equipment can withstand. A Phase A Study contracted by the DLR has been finished in spring 2005. A first flight is feasible for end of 2006/begin 2007.

1 – History of Kayser-Threde Dummy Satellites and Structures

For the test flights of Ariane 502 and 503 three different dummy satellites – one with instrumentation and autonomous telemetry system – were delivered by Kayser-Threde. The structures should simulate typical spacecraft physical and dynamic characteristics. The MAQSAT (MAQuette SATellite) spacecraft structure models allowed the tuning of mass properties and fundamental modes by attachment of trim masses at several locations. In addition to that, Kayser-Threde was contracted for six Modular Fitting Dummies (MFD), which are a kind of raising cylinders between launcher and payload adapter in order to fit launch mass and payload CoG and to attenuate shocks for sensitive payloads. In total KT produced up to the MAQSAT-H2/B2 program around 11 tons of GTO-hardware for Ariane 5 [1].

MAQSAT-B and MAQSAT-H were used for the first qualified flight of Ariane 5 basic version in 1997. MAQSAT-H e.g. consisted of an aluminium structure with a total mass of 2300 kg, an overall diameter of

2.7 m and a height of around 4 m. The design, manufacturing and qualification testing (vibration, static, acoustic tests) of payloads MAQSAT-B and MAQSAT-H was completed within eight months.

For Ariane 503 in 1998 a spacecraft Dummy had to be delivered within 3 months as replacement for a damaged payload. The mass properties and dynamic characteristics of MAQSAT-3 had to be identical to EUTELSAT W2, which was damaged shortly before launch. The design concept was totally open. Finally the spacecraft model consisted of an aluminium structure (welded flanges, riveted skins and internal platforms) with a total mass of 2600 kg and an overall diameter of 2.0 m with 3.5 m height. The tuning of mass properties and fundamental modes were required within ±5% to ± 10% accuracy and reached. Also significant damping could be realized [2].

For Ariane flight 513 (A5-basic) and Ariane flight 517 (1st A5-ECA), Kayser-Threde was contracted for the design, manufacturing and test for six MFD. The modularity of the MFD enables the Customer ArianeSPACE to adjust the final weight to the specific mass requirement and a certain flexibility of Ariane to possible payloads with respect to mass, CoG and dynamic behaviour and to lower the effort for the launch configuration analyses. Each MFD has a mass of around 650 kg and has an outer diameter of around 2.6 m and a height of 500 or 325 mm. The first set of two MFD 500 could be delivered only 9 weeks after kick-off and have been used for flight 513. For the first flight of ECA-version, the maximum payload capacity should be proved using the MFD 325. These “mass dummies” complemented the mass of the primary payloads to the total lift-off capacity of the new Ariane 5. Because of the positive experiences made with the MFD, it shall be used also for future flights due to their modularity.

FIG. 1: Dummy Satellite and Structures from KT, MAQSAT-B and H for L502 (left), MAQSAT-3 for L503 (center), two MFD325 for L517 (right, underneath ACU)

2 – MAQSAT-B2

2.1 Why another MAQSAT?

After failure of the first Ariane 5 ECA launch in December 2002 it was decided to avoid any further risk and to launch test/dummy satellites on the second ECA qualification flight. After elaborating concepts for a dummy satellite as upper passenger (called MAQSAT-H2) and a test satellite equipped with sensors for environmental measurements and experiments for in-orbit verification as lower passenger (called MAQSAT-B2), the contract has been given to KT in September 2003 with the goal to deliver two qualified MAQSATs (each of it in the range of 3,5t) within a very short time frame. Finally, only the lower test satellite MAQSAT-B2 and a paying customer on the upper position has been launched. MAQSAT-H2 was used as a dummy for that upper payload to guarantee the new ECA qualification flight in case of any problems with the upper passenger. A short description of MAQSAT-B2 is given hereafter. More details on MAQSAT-B2 and especially H2 are given in [3].

2.2 Specification

MAQSAT-B2 was required to be a structural dummy satellite representing typical static and dynamic characteristics. Due to the protoflight model philosophy and minimizing the risk for the launch, dedicated requirements for the dimensioning of the structure has been defined. The mechanical requirements are listed in the following table.

TAB. 1: Mechanical specification for MAQSAT-B2

Mass	3.500 kg ± 10 kg
Trim Masses	± 300 kg
CoG	1.640 mm ± 100 mm
1st Mode lateral	> 15 Hz with effective mass > 50%
1st Mode axial	> 30 Hz with effective mass > 30%
Structural Damping	1%
MoS	100%
APEX-Factor	1.25
Maximum Overflux	10%

For the electrical subsystem a specific measurement plan for the 60 environmental sensors and specific electrical requirements for the already identified experiments has been specified. A complete harness system has been specified interfacing with the launcher, the sensors outside MAQSAT-B2 and the GSE.

2.2 Experiments on board

The chance has been taken to use MAQSAT-B2 not only for environmental measurements during Lift-Off (as done on MAQSAT-B) but also as a platform to bring experiments and even a mini-satellite into space due to the fact, that the required mass is not necessarily to be realized by mechanical structure only. This flexibility - to turn required structural mass into payload mass - has allowed for integrating a French Loop-Heat-Pipe experiment of CNES and a video system of Dassault. Due to the fact, that MAQSAT-B2 was not required to be separated from the upper stage, the pyro-signal has been used to separate SloshSat, a Dutch mini-satellite to analyze sloshing fluids under microgravity.

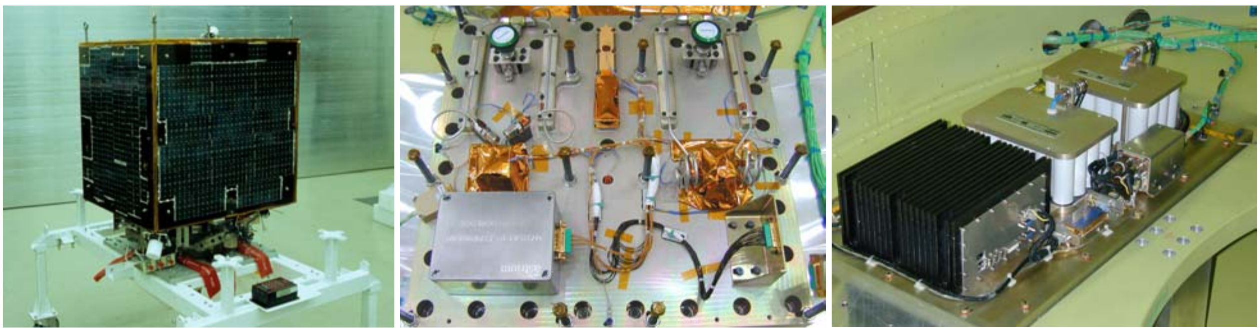

FIG. 2: Experiments onboard MAQSAT-B2, SloshSat (left), Boucle Fluide (center), DVCAM (right)

2.3 Mechanical Design

The mechanical design of MAQSAT-B2 has followed the experience from the previous dummy structures and satellite programs: a modular stacking of milled aluminium plates and riveted aluminium cylinders by playing with the geometrical dimensions (e.g. plate thickness) to adopt the static and dynamic properties. A big plate having the interface structure to the clampband interface and the damper system underneath is carrying an inner and outer tower structure, which are covered by a common top plate with the separation system for SloshSat. Two MFD500 not used up to that time by Arianespace has been integrated in the outer tower cylinder leading to the MAQSAT-B2 outer diameter of 2.624 mm for the bolted interfaces. The overall height including SloshSat is 3.680 mm. Due to the fact, that it was requested to have a delivery configuration with an overall height of not more than 2.600 mm to allow for a standardized transport, the lowest cylinder was designed to be removable (SloshSat was delivered separately to the launch site).

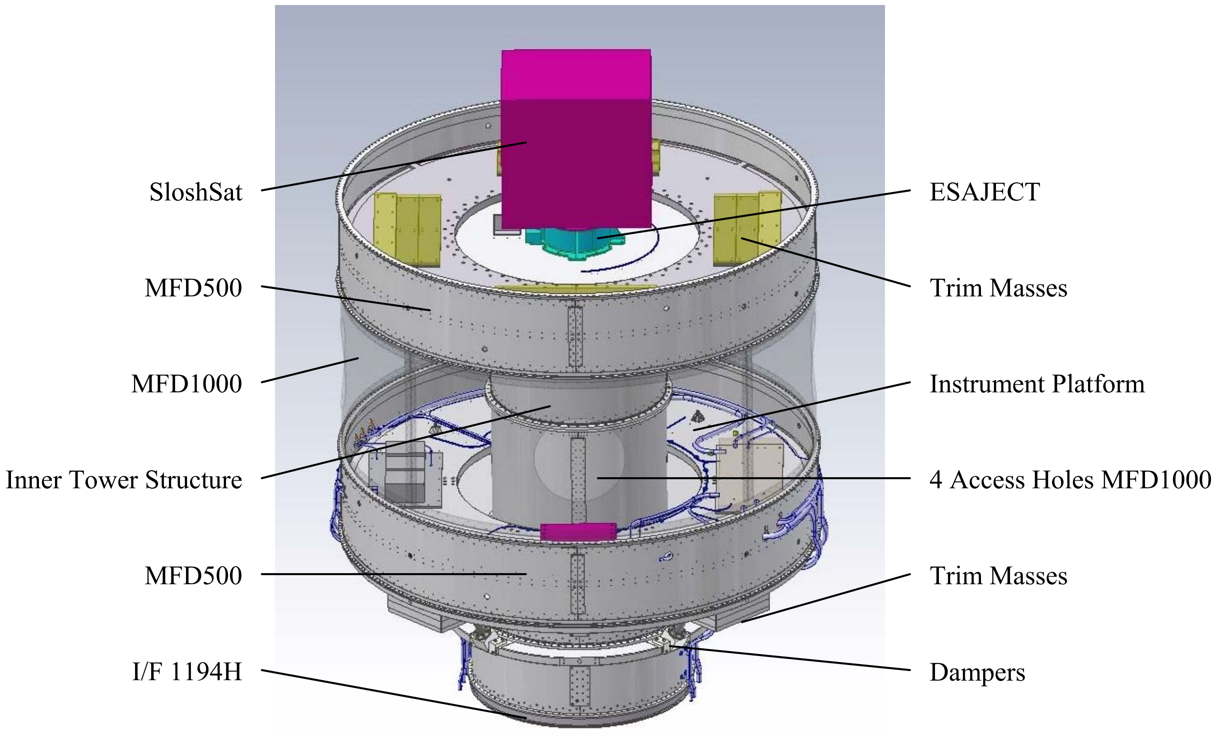

FIG. 3: Design of MAQSAT-B2

2.4 Electrical System

The electrical system (SES) of MAQSAT-B2 has been defined and designed to be able to provide the complete necessary infrastructure to the experiments and to transmit the data from the experiments and sensors to ground using antennas installed on the outside of the fairing. The SES consists of the complete harness and the so-called TMA (Telemesure Assemblage) package which has been integrated by two separate decks on the Instrument Platform of MAQSAT-B2: a battery deck and an instrumentation deck.

The overall power need for the MAQSAT-B2 mission duration of up to 3,5 h has been identified to 20 Ah which has been realized using 4 qualified Ariane 4 batteries. The instrumentation deck contained a BMO-K, a Power Distribution Module PDM, a Command and Isolating Module CDI, a CMA 2000 Encoder and a Transmitter. The BMO-K was used for external / internal switching of the TMA and for providing battery power to the consumers. A Power Distribution Module PDM is used to connect the 4 batteries to the BMO-K and to provide house-keeping channels. The CDI was used to provide manual check-out functions during verification and assembly tests. CMA 2000 is the encoder which provides voltage input and additional conditioner and filter functions for all sensor data inputs. Finally, the transmitter is used to provide RF link during flight for all data acquired in the CMA 2000. The complete system design and development of the TMA including software was under KT responsibility except the link budget itself which has been covered by Arianespace. The single parts and elements are mainly COTS products (e.g. encoder, transmitter, batteries) already qualified; only few of them had to be newly designed.

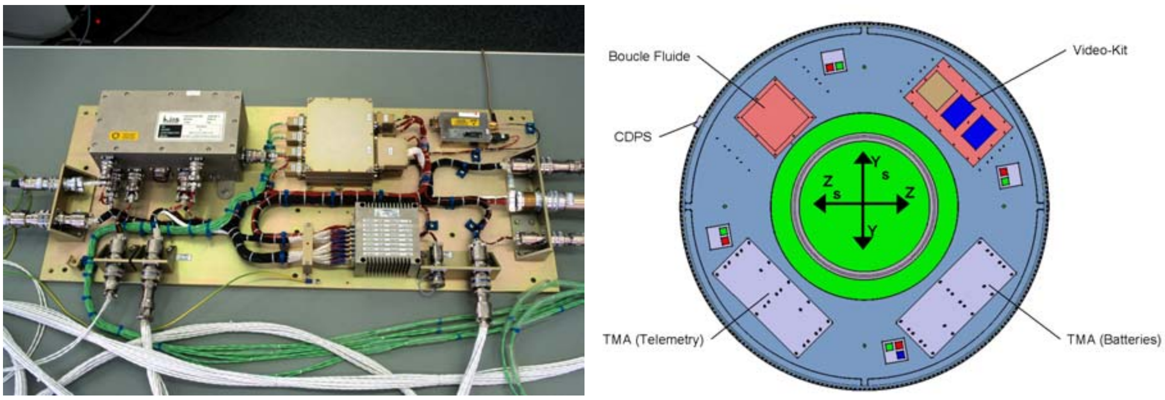

FIG. 3: MAQSAT-B2 TMA Instrumentation deck (left) and Instrument Platform arrangement (right, top view)

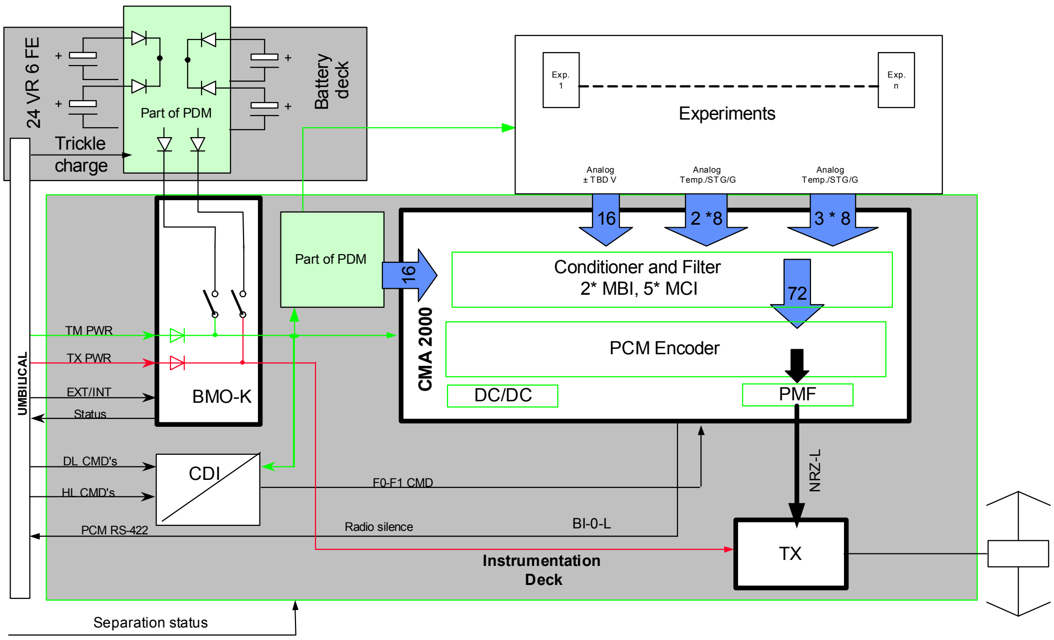

FIG. 3: MAQSAT-B2 TMA block diagram

2.4 MAIV Program

Due to the criticality of MAQSAT-B2 w.r.t. the overall ECA qualification program, an extensive verification plan has been realized. First of all the mechanical and electrical design has been verified by analysis providing finally sufficient margin to give a release for LLI procurement very in advance and finally for MAI of (both) MAQSATs. After final integration of the experiments and instrumentation a complete qualification test program has been realized. The following tests have been performed: vibration test, acoustic test, shock test and EMC test (all at Iabg test facilities in Ottobrunn, Germany).

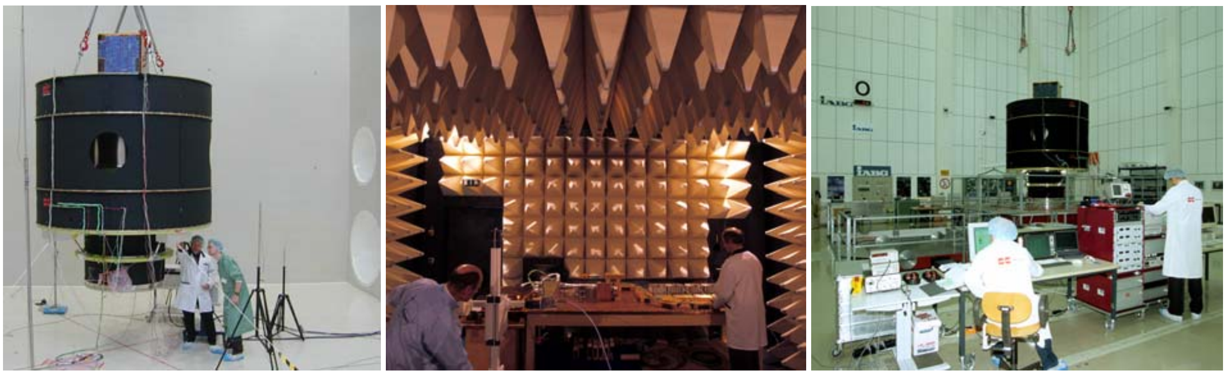

FIG. 4: MAQSAT-B2 qualification program, acoustic test (left), EMC test (center) and vibration test (right)

2.5 POC, Mission and Results

8 months after Kick-Off two qualified MAQSATs have been delivered to the customer. They have been shipped to the launch site, where the PRE-POC took place in August 2004. During the final POC MAQSAT-B2 has been integrated to the launcher shortly before the final launch date of 12.02.2005. The qualification flight was successful finally and all systems including MAQSAT-B2 went perfectly. All requested environmental data has been acquired and transmitted to ground. The assessment and evaluation has been done by the launcher authority. Some few results provided from Arianespace are presented hereafter.

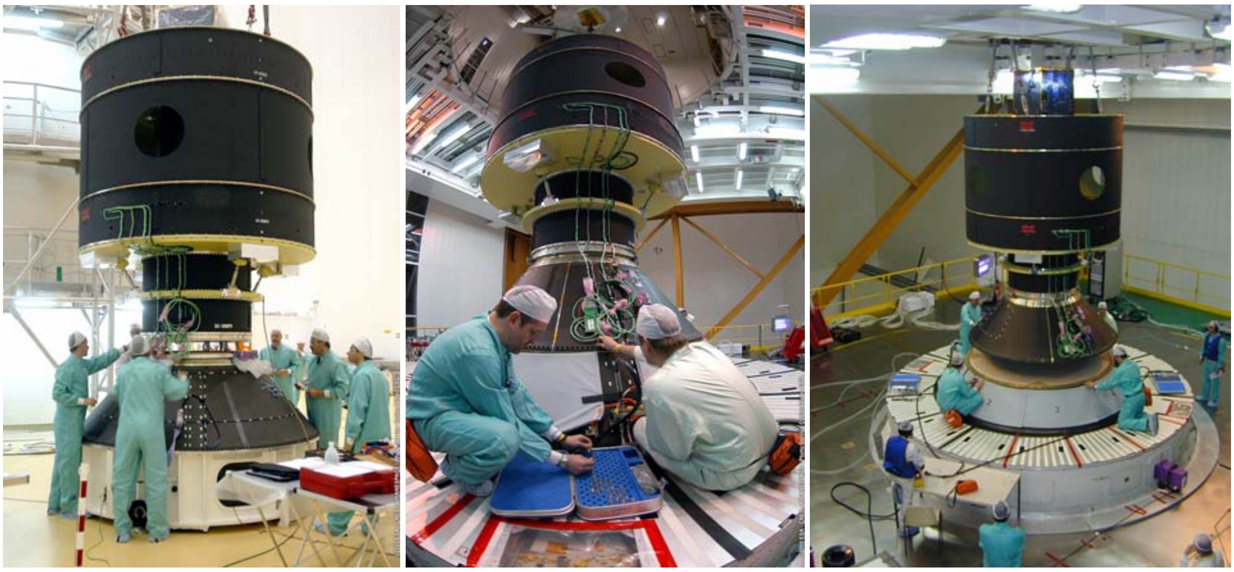

FIG. 5: MAQSAT-B2 integration onto Ariane 5

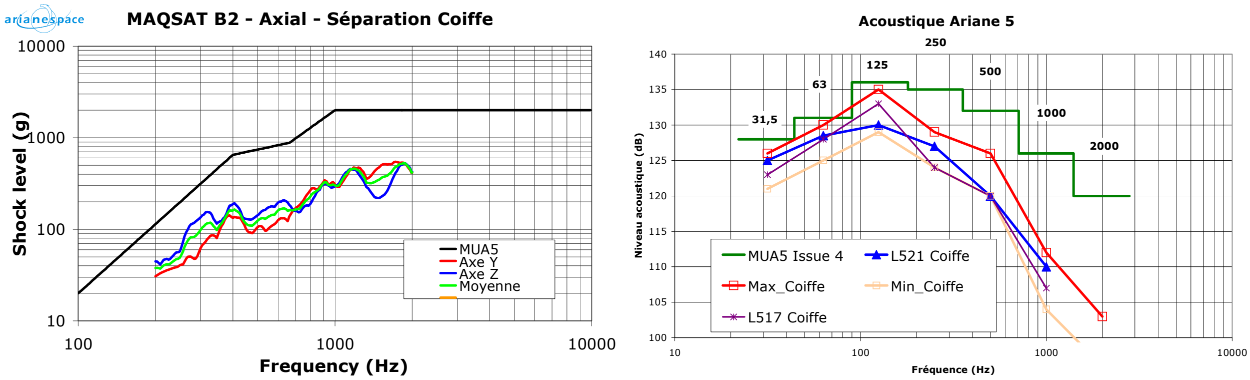

FIG. 6: Achieved shock level on L521 during fairing separation (left) and achieved overall acoustic level on L521

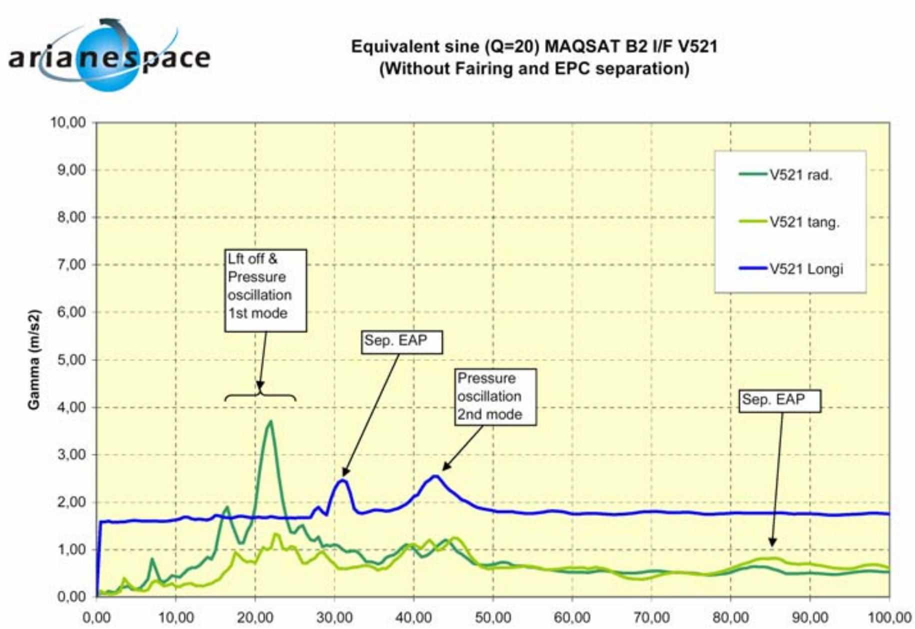

FIG. 7: Equivalent sine on MAQSAT-B2

The measured values for shock on MAQSAT-B2 (covered by the qualification) have shown that fairing separation is the dimensioning load case. Both shock and acoustic environment for the payload of Ariane 5 ECA is covered by the Ariane 5 User Manual with sufficient margin.

3 – Kayser-Threde Ariane Platform KAP

3.1 Concept Overview

The MFD project of Kayser-Threde in 2002 has led to start a brainstorming on how to use the possible additional allocated mass for Ariane 5 to trim the payload configuration in a more efficient way. An easy and cost-efficient access to space for scientific and/or technology experiments for in-orbit verification is still limited due to missing flight opportunities and significant costs for single piggy-back solutions or respective complete “Technology Satellite” missions. Therefore, the logic path was to adapt the MFD to an intelligent platform called KAP (Kayser-Threde Ariane Platform) for in-orbit verification using the allocated mass and volume with the goal to decrease significantly the launch costs per kg experimental payload.

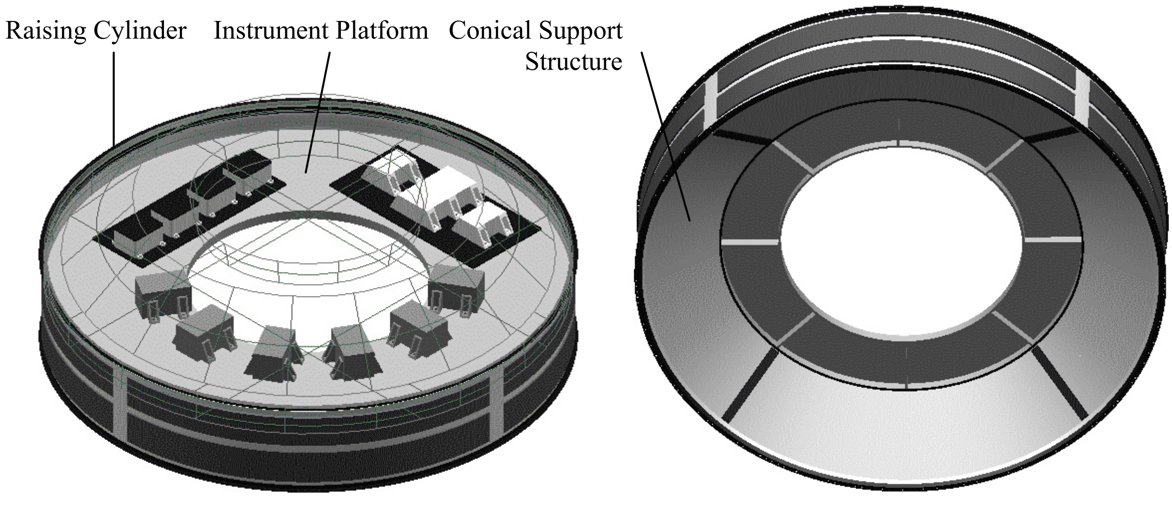

FIG. 8: Kayser-Threde Ariane Platform (KAP)

Three different missions are foreseen as outlined in the following table.

TAB. 2: KAP Mission Scenarios

Name	Duration	Major Characteristics
KAP-SM	3 h (short mission)	Online data transfer with 15kbps, power via batteries, 120-220 kg payload at 600 kg total mass, 100W const. payload power, antennas attached outside of Ariane (e.g. on ACY), possibility of implementation of Ariane environmental sensors
KAP-MM	3 days (medium m.)	Data storage and data transfer during playback with 15kbps to GSOC Weilheim, power via batteries, 80-180 kg payload at 600 kg total mass, 25W average payload power
KAP-LM	1 year (long mission)	Data storage and data transfer during playback with 15kbps to GSOC Weilheim, power via solar generators, 80-180 kg payload at 600 kg total mass, 50W average payload power
KAP-SM+	3 h (short mission)	Online data transfer with 15kbps, power via batteries, 100 kg payload at 350 kg total mass (simplified design w/o inner platform and all equipment attached directly on the inside of the raising cylinder, 100W const. payload power, antennas attached outside of Ariane (e.g. on ACY), possibility of implementation of Ariane environmental sensors

KAP will be located underneath the payload of an Ariane 5 launch - same as for MFD. To serve as a technology platform it has to be equipped with an autonomous telemetry system and autonomous power system to be able to provide a full working infrastructure for the experiments.

Basic idea of the KAP mission concept is to have no separation, means to remain fixed to the Ariane 5 upper stage during lift-off, primary payload separation and after upper stage passivation. Therefore, the orbit and resulting environmental conditions are given by the respective GTO orbit defined by the need of the main passengers. For the SM concept - means KAP working during lift-off - the data can be transmitted to ground using the running Ariane 5 RF capabilities. For the MM and LM concept - means activation of KAP after upper stage "switch-off" - a detailed mission analysis have shown, that there is sufficient contact time to the selected ground station GSOC in Weilheim, Germany for data transfer. The mission profile of all three different mission scenarios is shown in the following figure. It has to be noted, that these mission concept definitions has been done to start the KAP global mission analysis. Any combination like SM with MM mission - means KAP working from lift-off until mission end after 3 days - is feasible and can be realized with the elaborated electrical architecture concepts.

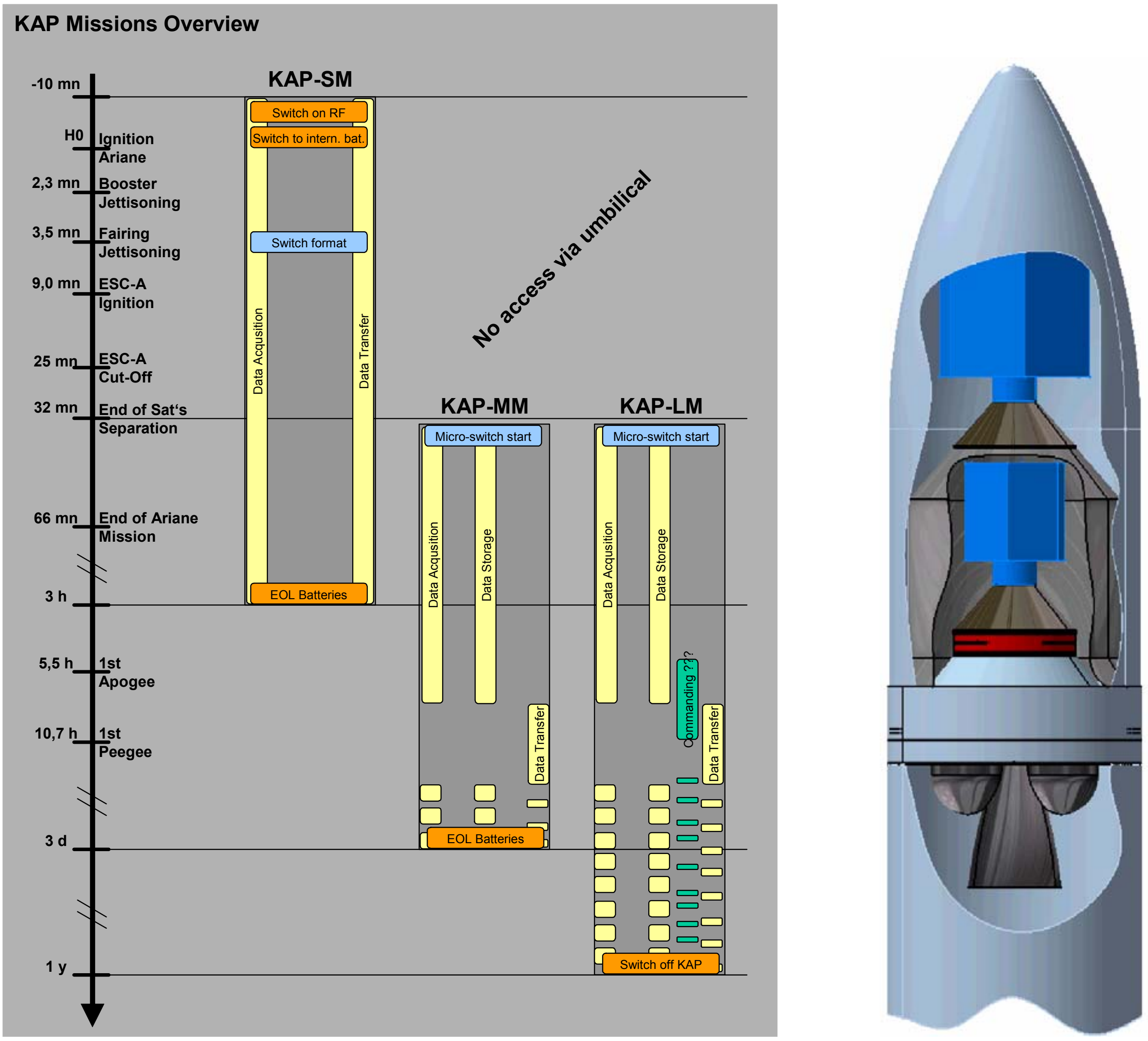

FIG. 9: Mission profile of KAP: baseline mission scenarios (left) and KAP accommodation on Ariane 5 (in red, right)

3.2 KAP Specification and Constraints

It is obvious that such kind of platform being no longer a simple metallic structure as the MFD will have an impact to the overall launcher configuration. The constraints, requirements and boundary conditions for a KAP have been derived from the previous Ariane MAQSAT and MFD projects and précised in close collaboration with Arianespace. Top level requirements are: 1) demonstrating a satisfying qualification status and 2) no constraints on the launcher. KAP has to fulfill all requirements being typically applicable for structures in the Ariane 5 payload area as documented in the several General Specifications (electrical, mechanical etc.). Besides that, a specific one for KAP has been elaborated together with Arianespace. The interfaces to the launcher have to be minimized to increase the chance of a flight opportunity. Final goal was to derive a concept as a kind of a standardized black box being exactly described which is then easy for the launcher authority to integrate in the Ariane 5 models to evaluate the overall global characteristics. If one imagines of a commercial KAP product with a certain flight sequence (e.g. one KAP a year) also certain flexibility is needed for KAP to manage the payload configurations and to avoid any risk or influence on the primary passengers. Finally, all safety requirements has to be fulfilled, which are rather stringent for Ariane 5 to minimize any risk to the launcher and the primary passengers.

3.3 Electrical Architecture

The electrical architecture of the KAP Short Mission is identical to the one of the MAQSAT-B2 instrument platform. According to the chapter before, the short mission is more interesting due to being working during lift-off. The MAQSAT-B2 program was a major step in development and successful verification of the autonomous KAP platform because it could be demonstrated, that such kind of subsystem is fully compatible to the complete system. The data being acquired during the KAP Short Mission will be transmitted down simultaneously using the Ariane 5 RF system and Arianespace ground station network. After passivation of the upper stage, this cannot be done any longer and the data has to be transmitted to ground using a specific ground station contacted during a specific time per day. This means, the data has to be stored on board and send down only during dedicated time slots. The CMA2000 cannot be used for that purpose.

For the Medium Mission a more advanced onboard system is needed. Here, Kayser-Threde has adapted the experience from another experimental platform: the sounding rocket program TEXUS/MAXUS providing 7 and 14 minutes of µg-environment respectively to experiments on board. Kayser-Threde's responsibility in that program is the provision of the necessary infrastructure to the experiments. Its encoder system called CTS3000 is now the baseline for the KAP Medium Mission providing now the necessary functionality. Besides that, the system is more powerful in terms of interfaces to the experiments. The CTS 3000 Encoder has a modular design which allows a centralized design (box with the master and slave together in one housing similar to the CMA 2000 design) or a decentralized design, where each experiment or several experiments gets one slave within the experiment electronic. This allows for reducing the harness because of the concentration of the measurement data to one serial data stream. The power for the Medium Mission will be provided again by a battery package, now using Li-Ion batteries to limit the mass impact. Finally, the MM mission duration is limited by the power system. It has been estimated to have a three days mission, but this can be more or less depending on the final experiments configuration. For the downlink own antennas have to be used, which will be placed on the outside of the raising cylinder. This means, the Medium Mission has even less constraints to the launcher than the Short Mission. But it depends on the experiments itself, what kind of phase shall be monitored and also a combination of both mission scenarios is feasible.

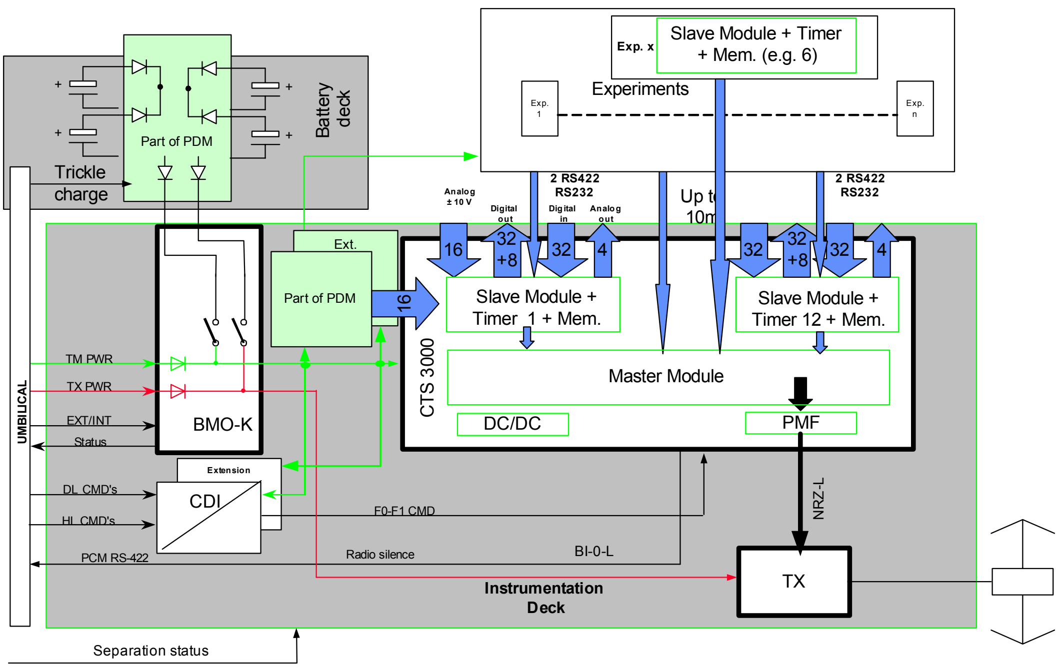

FIG. 10: KAP Medium Mission TMA Block Diagram (the one of KAP Short Mission is identical to MAQSAT-B2 shown in Figure 3)

It is necessary to now, that the Short and Medium Mission will be controlled autonomously by an onboard timer. Telecommanding is not foreseen and would complicate the mission profile unnecessarily. Only for the Long Mission of 1 year, the system has to provide this capability to allow for operations from ground. The reason for analyzing also such kind of long mission was to identify the constraints and technical risk if going to such kind of system. KAP LM might not be the best platform for a 1 year in-orbit mission, but it is obvious, that it will be still the most cost-efficient one comparing to full working technology satellites, which was the primary goal for that development. This means a full working onboard computer system is needed in combination with a solar generator. Here, the outer surface can be fully used for placing solar cells. Due to the fact, that the upper stage is no longer controlled after passivation it will have a kind of nutation which has been accounted for sizing of the solar cell area. Also for that mission concept the complete system has been defined and verified by respective analyses e.g. for the power and link budget. Finally, the EGSE for all three mission scenarios has been defined completely based on the existing experience and hardware from the previous mission.

3.4 Environmental Analyses

The KAP environment is defined by the Ariane 5 environment and the final upper stage orbit (GTO). A complete set of environmental analyses have been performed to allow for defining this environment for the experimental payload. This includes radiation, irridation and thermal and mechanical environment (also within fairing and during lift-off). For the dedicated mechanical loads specified for the experiments the goal was to be within SG-1-40 requirements envelope. For shock protection further respective means by introducing dampers at the mounting interface can be realized in case of experiment’s high shock sensitivity.

3.5 Examples of Typical KAP Payload

Typical examples of technology experiments as payload on KAP are: solar arrays, Gyros, electronics, laser, antenna, special equipment for future scientific missions, star sensors, communication equipment, navigation equipment, GPS and GALILEO equipment, simple mechanisms, MEMS, thermal equipment, any new sensors in general. More advanced experiments able to be accommodated on KAP are e.g.: heat pipe experiments, video experiments, sloshing/fluid experiments, electronic drift or 3D-plasma analyzer, deployment experiments etc. The limit is more or less only the compatibility with the overall Ariane 5 boundary conditions like fulfilling the stringent safety requirements.

3.6 Experiments Interfaces and Infrastructure

All experiments will have a dedicated mechanical mounting interface to the Instruments Platform. Here the interface pattern can be adapted from the experiments itself. Mass, volume and envelope for the experiments is available in a sufficient way due to the overall payload mass of up to 220 kg and the available envelope as shown in Figure 11. For the first series of standardized KAPs a height of 500 mm for the raising cylinder identical to the MFD has been defined with respective available envelope into the ACU. For the future other options are thinkable like separation of ACU to have free view or even separation to deep space or to increase the raising cylinder height to provide even more envelope and volume to the experiments. The KAP shall serve as a platform with sufficient flexibility allowing for developing a class of experiments in mass and size which was up to no not thinkable. The electrical interfaces are summarized in Table 3 for all three mission scenarios. In case of combining SM and MM mission (means KAP operations from lift-off until up to 3 days) the data given for the MM mission are applicable.

The necessary MGSE for the KAP and especially the EGSE also for the experiments is fully defined and derived from previous Ariane projects and already available. The EGSE consists of the Check-out Terminal Equipment (COTE) both for the Telemetry Assembly (TMA) or in case of the Long term Mission for the On-Board Computer (OBC) and the Experiments and the Overall Check-out Equipment OCOE and the interface cables to both the TMA / OBC and the range. The Experiment COTE is in a slave configuration to the TMA COTE. Power is provided from the TMA COTE. The typical experiment COTE consists of (can be adapted) an Experiment Control Unit, a power supply for external supply of the experiment and a Power Supply Control PSC units for remote control and voltage / current measurement of power supplies. For each experiment an OCOE Laptop will be made available on site to provide the experimenters with a special user software control and monitoring functions of the Experiment COTE.

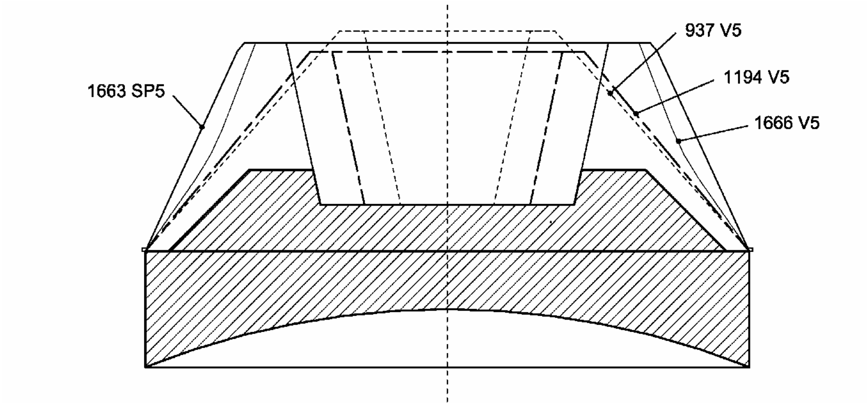

FIG. 11: Maximum useable envelope for KAP and its experiments

TAB. 3: KAP Electrical Interfaces to the Experiments

Interface	**SM**	**MM**	**LM**	**Remark**
Power I/F	28V 100W const. for the payloads	28V 25W average for the payloads	28V 100W const. for the payloads	
	6 outlets 2 x PCDU (increments of 4)	6 outlets 2 x PCDU (increments of 4)	10 outlets 1 x PDU (increments of 10)	Includes Current protection
Data I/F	2 serial async. lines (up to 6 possible) (- 1 x MilBus possible) (CMA 2000) - 16 anal. channels with conditioning - 80 standard analogue channels - 20 digital in - 1 serial synchr. Baseline one unit. (2 units max.)	6 serial async. Lines with 1 master & 2 slaves (each slave increases by 2) (CTS3000) - 64 anal. channels - 96 digital in - 72 digital out (relay/TTL commands) - 8 analogue out - 1 serial synchr. Baseline two slaves (12 Slaves Max.)	4 serial async. Lines up to 8 with 2 Boards (OBC SAAB) 1 x Mil Bus & Space wire) - 48 anal. channels 96 Thermistor channels 16 digital inputs 8 digital digital outputs Per I/O Board Baseline one (6 x I/O Boards max)	RS422 max. rate 38.4 k Baud Data Handling Systems can be increased in size with the constraint of more mass and power needed (reduces resources from the payloads)
Timer / computer	None	Timer time line controlled by programming	Computer time line controlled by telecommand	
Telecommand	None	None	19.2 Kbit/sec	
Telemetry	500Kbit/sec S-Band link, switch to 100Kbit/sec (Kourou)	15Kbit/sec S-Band link 411MBit/per day (GSCO Weilheim)	15Kbit/sec S-Band link 411MBit/per day (GSCO Weilheim)	
Mass Memory	None	32Mbyte per slave	4GByte flash EDAC protected	
Heater I/F	32 Watt		32W (20% of orbit)	
EGSE I/F	Via LAPTOP for each Exp. Ethernet for Data, 28V power	Via LAPTOP for each Exp. Ethernet for Data, 28V power	Via LAPTOP for each Exp. Ethernet for Data, 28V power	

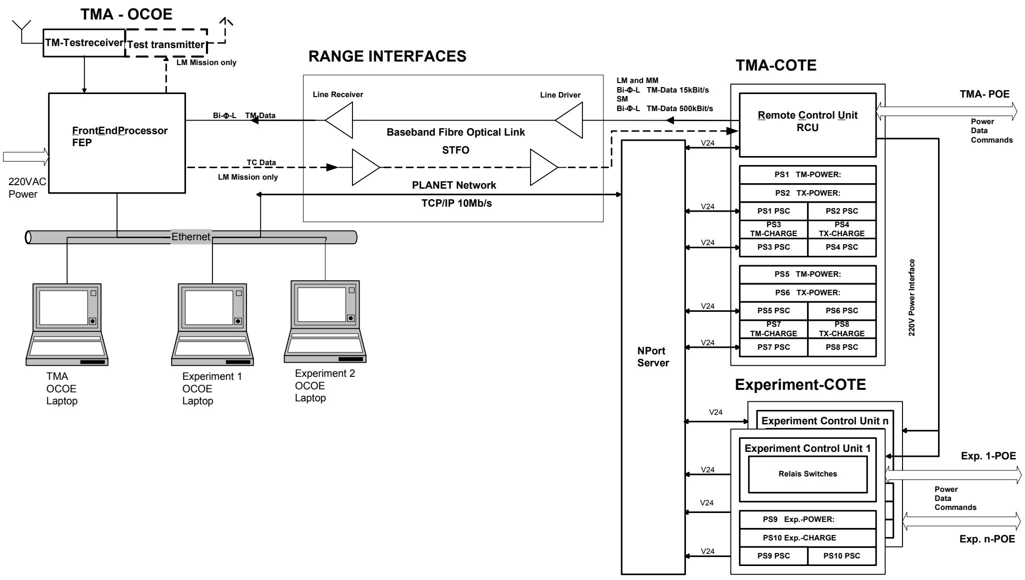

FIG. 12: KAP OCOE – COTE test / range configuration

3.7 KAP User's Manual

For the KAP payload a complete User Manual has been released which is available on request via the author (see email contact on paper front page). This User Manual is covering all needs for the KAP payload including the qualification logic and documentation to be provided and shall serve as an applicable document for any payload accommodated on KAP.

3.8 Outlook

The presented concept is meanwhile of a kind of maturity which allows for thinking about a transfer to other launchers of the Arianespace launcher family. Besides the mechanical adaptation to the respective mechanical and electrical interfaces (e.g. decrease of outer diameter) the main electrical architecture concept can be copied. For launchers going into LEO, already during Lift-Off a continuous data downstream is not possible and thus the Medium Mission telemetry and link concept is the baseline. Respective assessments and analyses have been performed already and demonstrated the transferability to other launchers. For the KAP implementation it is planned to collect interests of experimenters via national agencies and ESTEC flight opportunity department to be able to select and define a demonstrator mission concept. All experimenters being interested in a flight opportunity with KAP are kindly asked to contact the author to get more detailed information about the KAP next steps.

4 – Acknowledgment

For the MAQSAT-B2 project the authors and the complete KT project team express their thanks to all people on Arianespace, CNES and ESA side having supported the challenging 8 months project. The KAP Phase A study has been funded by DLR within contract no. 50JR0453 in the frame of its OOV-programme. Also for that project, Kayser-Threde wants to thank Arianespace for its support and interest in KAP as a possible future commercial payload platform on Ariane 5.

References

[1] C. Kaiser, E. Pfeiffer, C. Widani, W. Gambietz: *Ariane 5 Dummy Satellites and Structures*, 54th IAF Congress, Bremen, September 2003, Paper 16131

[2] Eder J., Burger F.: *MAQSAT-3 on Ariane L503 - The Structural Design of a Simulated Satellite with Tuneable Performances*, 41th AIAA Structures, Structural Dynamics, and Materials Conference, 3.-6.4.2000, Atlanta GA, Paper A00-24515

[3] C. Kaiser, E. Pfeiffer, G. Schmitt, C. Widani: *MAQSAT-B2*, DGLR Annual Congress, 25.-28.9.2005, Friedrichshafen,