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| | REXUS/BEXUS<br>Preliminary Design Review | Experiment Team: | CHAOS |
| | | Vehicle and Flight number: | BX35 |
| Location: ESRANGE Space Center, Kiruna, SE | | Date: 05.02.24 | |

**Review Board Members:**

Steffen Calmer (ZARM)
Simon Mawn (ZARM, chair)
Sophia Wolters (ZARM)
Merle Cornelius (ZARM)
Michael Becker (DLR)
Koen DeBeule (ESA)
Maximilian Nürmberger (ESA)
Pieotr Skrzypek (ESA)
Leonard Koobow (MORABA)
Emil Nordqvist (SSC)
Márton Gálbacs (SSC)
Michael Lundin (SSC)
Luca Bardazzi (Alumni)

**Experiment Team Members:**

Ava Pohley (TL, present)
Hannes Ebeling (TL, present)
Pierre Bornfleth (pressent)
Hannah Sophie Grimm (present)
Janna Martens
Jasper Mess (present)
Justus Mickausch (present)
Clara Pittschellis
Nicolas Rohrbeck
Tom Ruge


**Summary of Main Actions for the Experiment Team:**

1. Pressure container: calculation and design have to be delivered.
2. Deliver schematics of HV board

**Review Result:** pass

Next SED version V2 due to 05 May 2024

*Explanation of the Report:*
*In the following document the board member comments are sorted by the chapters of the SED beginning with SED chapter 2. Comments are divided into RIDS and Remarks:*

- ***RID** (Review Items Discrepancy) is the mechanism used to record questions or identified problems and solutions arising from examination of the review documentation and discussion. They are issues, identified by a reviewer, that are not compliant with a requirement, a review objective or a design goal. A RID will be followed up during the next project steps by the organizers and must be fulfilled by the team in order to pass the review.*
- ***Remarks** contain considerations a team should make and recommendations from the board members.*

## 1 General

### 1.1 Presentation

### 1.2 SED (editorial)

REAMRK: Explain abbreviations when you use them for the first time in the chapter (e.g. in electronics).
REMARK: Very good document, looks like a proper scientific paper.

## 2 REQUIREMENTS AND CONSTRAINTS

RID: Design requirements of the cherenkov detector are missing.
REMARK: Some functional requirements are like objectives.
REMARK: What functions do you need for radiation measurements? You need to fulfill the objectives.
REMARK: Data requirements tend to explain the design. That is already a solution to how to fulfil what should be the requirement.
REMARK: Add a performance requirement regarding the noise level of the HV board if it poses a disturbance.
REMARK: Make sure you can realize the lower range measurement of pressure.
REMARK: Think about the constraints more in detail. Specify the exam periods. Include time at the lab, sponsoring and manufacturing opportunities.
REMARK: SF10 – typo, the other way around?

## 3 PROJECT PLANNING

### 3.1 WBS

REMARK: Add workpackages for the ground station development.
REMARK: Include system level tasks regarding integration and testing.
REMARK: Assign only one person per package (in charge).
REMARK: Gather the available manpower: who has how much time and when? Indicate with colors where there are bottlenecks.

### 3.2 Schedule

REMARK: Data analysis can start before testing is over. Preparations and methods of data analysis can be in parallel to other work.
REMARK: In the gantt chart, add interdependencies between items, indicate critical items (e.g. from mechanic workshop that might be delayed) and include the progress.
REMARK: Turn gantt chart 90 degrees, turn page into landscape using latex command.

### 3.3 Resources

REMARK: Add a column for delivery/manufacturing state in the budget table.
REMARK: Include and indicate past and future expenses in the budget table.
REMARK: Include travel expenses (more team members than sponsored), indicate who is sponsoring what.
REMARK: For external support, make clear how they are supporting your team.

### 3.4 Outreach

REMARK: Show the logos of the project partners (ESA, Zarm, DLR, SSC, SNSA, …) at the website. Respect the outreach guidline (on the team site).
REMARK: CHAOSjunior well received.

### 3.5 Risks

REMARK: Consider a lower risks for delivery.
REMARK: Include other mitigation techniques than double hardware.
REMARK: Separate TC20 into rising and lowering temperature profile and their mitigation.

## 4 EXPERIMENT

### 4.1 Mechanics

RID: Since you already send out a lot, also provide the drawings in the SED.

REMARK: Make the mounting of the SSD (page 31) and the overlapping stands more clear.
REMARK: Detail the fixation of the parts to the baseplate and to the styrofoam box.
REMARK: You might have problems with condensation on the box if it is not flushed with nitrogen before the flight.
RID: The pressurization of the off-the-shelf aluminum box needs calculation about stiffness, ceiling, screwing, … Please provide it as soon as you have it. It also needs testing, the manual describes the safety factor. Alternatively provide information about a ready manufactured box
RID: Think about the fixation to the gondola and detail it in the SED.
REMARK: Write a requirement for the line of sight within the gondola and other experiments.
REMARK: Think about whether you want to test the suspension of the sensors. They will have to endure the transport and whole flight sequence.

### 4.2 Electronics

RID: Include a table or graph for the power consumption. W and Wh
REMARK: Fill the SED with the information you provided at PDR.
REMARK: Mention in SED which board you are doing yourself, mention what has heritage.
RID: Define all interfaces.
REMARK: Create a subchapter for each sensor with details about what they are doing, their accuracy and interface, add (at least part of) datasheet to the appendix.
REMARK: Describe how the HV is generated and controlled.
REMARK: Take care of HV safety during testing, and later for flight and recovery personnel (maybe add indicator outside for personnel when it is safe/not for touching).
REMARK: Provide details and schematics on everything, even if you just take it from others (at least interfaces).

### 4.3 Thermal

REMARK: Define the thermal critical components.
RID: Define the power produced by your experiment for further calculation and simulation.

### 4.4 Software

REMARK: Good progress already. Don't forget testing.
REMARK: Think about failures. What if something goes wrong, what if one board reboots. Add tests of failure scenarios.
REMARK: Adapt software to BEXUS campaign: define tests at launch campaign and restarts.
REMARK: Make root file system image to prepare for reboots
REMARK: Think about error detection for radiation effects.

# 5 VERIFICATION AND TESTING

## 5.1 Verification Matrix

REMARK: Good matrix and good notes beneath. But it would be easier to read if the notes are directly in the test table, even if it doubles for some tests.
REMARK: Some verifications can be a review – e.g. read data sheet.
REMARK: Explain the test procedure for T-02 Vibration Test.

# 6 LAUNCH CAMPAIGN PREPARATION

REMARK: Include the mounting and position requirements. Mention what you need!
REMARK: Have all risks in the risk table and repeat the flight risks in the launch campaign chapter.
REMARK: Mitigate “sharp edges”, manufacturing as mitigation
REMARK: Add details for the safety of the recovery personnel: they need a verification to know it’s safe (otherwise there has to be a protocol to wait until battery is drained including a safety margin or a similar approach).