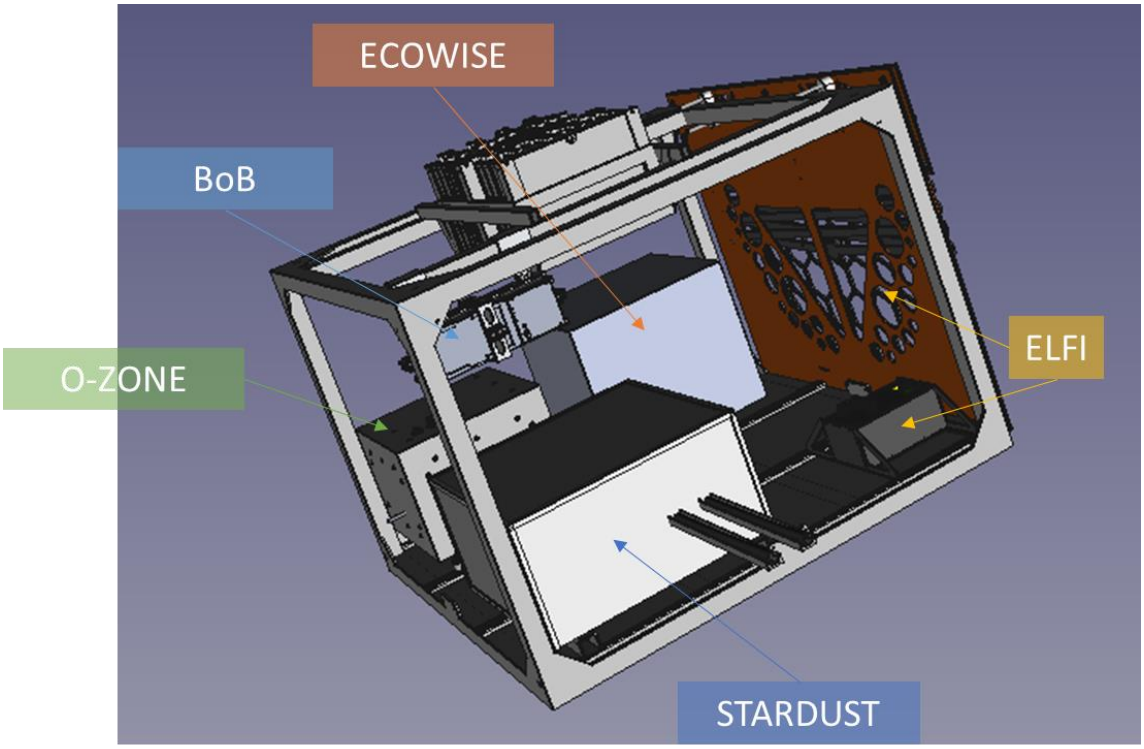
BEXUS 30
Interface discussion report



Date of discussion: 13 May 2020

Presenter and Minutes:

- [redacted]

Teams:

- BoB
- ECO-WISE
- ELFI
- O-Zone
- Stardust

1. FLIGHT REQUIREMENTS & MASS BUDGET

Payload	Flight Path	Altitude [km]	Floating time	Launch time
BoB	No req.	[25;30]	>30min	No req.
ECO-WISE	No req.	Usual maximum altitude of BEXUS	[1;5] h	Day time
ELFI	No req.	>20	No req.	No req.
O-ZONE	No req.	>20	1h30min	No req.
STARDUST	Register the balloon track	>15	No req.	No req.
Sum		**>25**	**>1h**	**Day time**

Table 1-1 – Flight requirements summary

- Only 1 hour of float duration can be guaranteed. Superior flight duration is depending upon weather conditions, especially the strength of the wind.
- The launch will occur during **day time**.

Experiment	Proposal	PDR	CDR	EAR / Flight
BoB	2,4	5,5	4,76	
ECO-WISE	14.5	12 / 15 max	10	
ELFI	3,5*	6 max	8	
O-ZONE	5	14 / 15 max	13,3	
STARDUST	5	6,8	6,6*	
Total	**30,4**	**44,3**	**42,66**	

Table 1-2 – Mass evolution summary for BEXUS 30 payloads in kg

	Mass [kg]
Payload (all experiments)	42,66
Empty gondola	27
E-Link	27
Empire	8
Cover	2,5
Batteries	10,2
Crash pads	2,5
Flight train	18,4
Parachute (80m^2)	9,5
Balloon (Zodiac 12 SF)	101,4
Total Vehicle Mass	263,16

Table 1-3 – BEXUS 30 vehicle mass breakdown

Main Balloon	**Zodiac 12SF (12 000 m^3), Load: 100-554 kg**
Parachute	80 m^2, Impact velocity: 6,42 m/s^2
Launch method	Esrange dynamic launch procedure
Total mass (kg)	263,16
Flight predictions	1976 standard atmosphere Float altitude estimation: 25 800 m Float pressure estimation: 22 mbar Float temperature estimation: -50,7 degC Estimated ascent time: ~1h30 @5m/s

Table 1-4 – BEXUS 30 predicted flight performance

- (*) The mass presented in Stardust SED represents the total mass (with attachments).
- The total mass of experiments is reaching **42.7 kg**.
- The float altitude is estimated **at 25 800 m**.

2. POWER INTERFACE

The teams are reminded that they shall **use the correct connector coding**.

Amphenol PT02E8-4P	
Pin A	+
Pin B	-, do not connect to chassis or ground
Pin C	empty
Pin D	empty

Table 2-1 – Power connector coding

Experiment	External Power		Peak Power [W] / *[A]*		Average Power [W] / *[A]*		Requested BX Batteries	
	PDR	CDR	PDR	CDR	PDR	CDR	PDR	CDR
BoB	no	No	42W / 7,5A	32W / 1,15A	17,5W / 4,7A	16,3W / 0,73A	1	1
ECO-WISE	TBD	**No**	?	**75,5W / 2,52A**	?	**62W / 2,2A**	1	**TBD**
ELFI	no	No	10W / 1A	10W / 1A	5W / 0,2A	5W / 0,2A	1	1
O-zone	1x CR3032	1xCR1220	52W / 1,7A	40W / 1,4A	30W / 1,1A	26W / 0,9A	1	1
STARDUST	no	No	83,65W / 3A	28W / 1A	68,65W / 2,45A	16,2W / 0,56A	1	1
Total	**-**	**-**	**-**	**-**	**121,2W / 8,5 A +ECO-WISE**	**125.5W / 4.6 A**	**5**	**5**

Table 2-2 – Electrical consumption evolution summary

- ECO-WISE: power consumption done with a float duration of 4,5 hours. The team shall calculate the power consumption for minimum 1 hour of float and find the limit float time duration to run on a single BEXUS battery. If not possible, please contact SSC to request a second battery.
- O-Zone: 1 battery will be sufficient.

3. E-LINK INTERFACE

Experiment	E-Link connections		Data Rate downlink [Kbits/s]		Data Rate uplink [Kbits/s]	
	PDR	CDR	PDR	CDR	PDR	CDR
BoB	1	1	146 max	404 max / 31,8	1 max	1,2
ECO-WISE	1	1	1	1,5	0,5	0,5
ELFI	1	1	30	30	0,1	0,1
O-ZONE	1	1	150 / 200 max	1,7	20 / 100 max	1,5
STARDUST	1	1	256 B/S max and 128 B/s average	4 max	4 B/s max and 2 B/s average	4 max
Total	-	-	377	437,2	102	7,3

Table 3-1 – Data budget evolution summary

- Data rate is quite low for all the teams
- BoB: The peak download corresponds to the downloading of pictures. The team shall provide more information on the downloading plan in order to better coordinate with the teams.
- ELFI: The experiment is very sensitive to radio frequency interference. A questionnaire has been sent to all BEXUS 30 experiments to collect all possible disturbances for ELFI team.

4. ACCOMMODATION SESSION

4.1. Comments on provided CAD

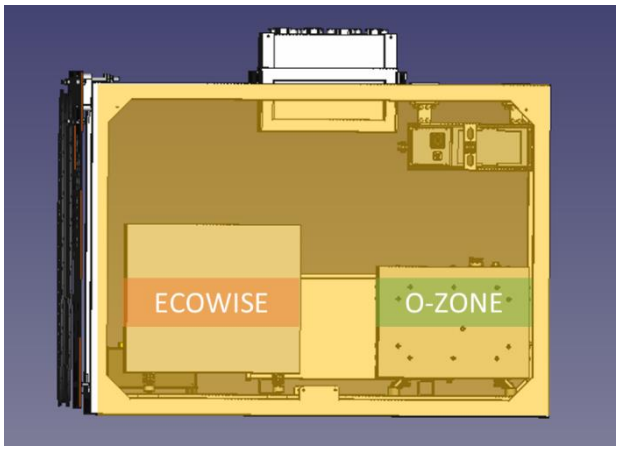


Figure 1 – View of the gondola from the HERCULES launch vehicle

- Hercules side will be ECO-WISE/O-Zone side.
- Batteries will be placed on top of the gondola.

BoB

- No interference

ECO-WISE

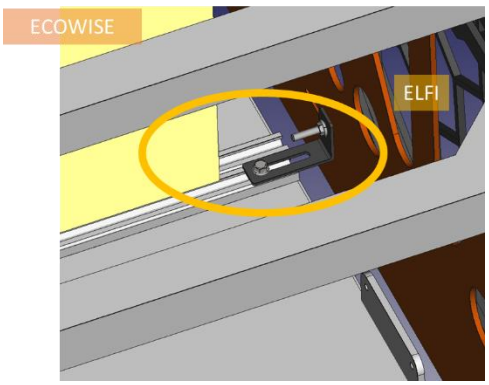


Figure 2 – Margin on the fixation rail

- The team shall think about implementing a safety cap on the outlet/inlet pipes.
- The pipe should go further out of the thermal insulation.
- Comment: ECO-WISE experiment and the ELFI L-shape bracket are close to each others (but no interference)
- The team shall add connectors for power and E-link on the CAD.
- The team shall update the CAD model with the updated mechanical interface.

ELFI

- Tension lines will be attached behind ELFI antenna. The team has reported that it would not be an issue.

- The team shall consider that all possible falling components shall be attached by a safety line (i.e.the antenna and the scissors mechanism).

OZONE

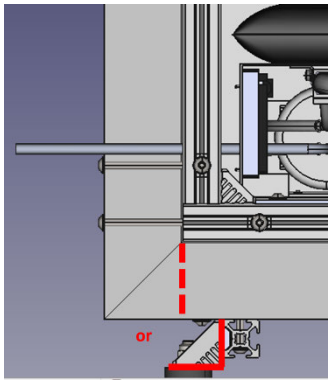


Figure 3 – O-Zone fixation to gondola

- Access to the rubber bumper nut is complicated by the thermal insulation. The team should try to change the cut-out and the assembly method of the insulation or use a L-shape bracket instead to ease the access to fixations.
- The team shall consider implementing remove before flight tags on pipe safety caps.
- The team shall update the CAD.

STARDUST

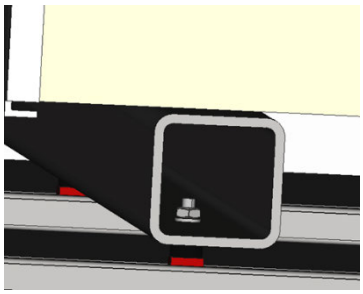


Figure 4 – Stardust rail fixation

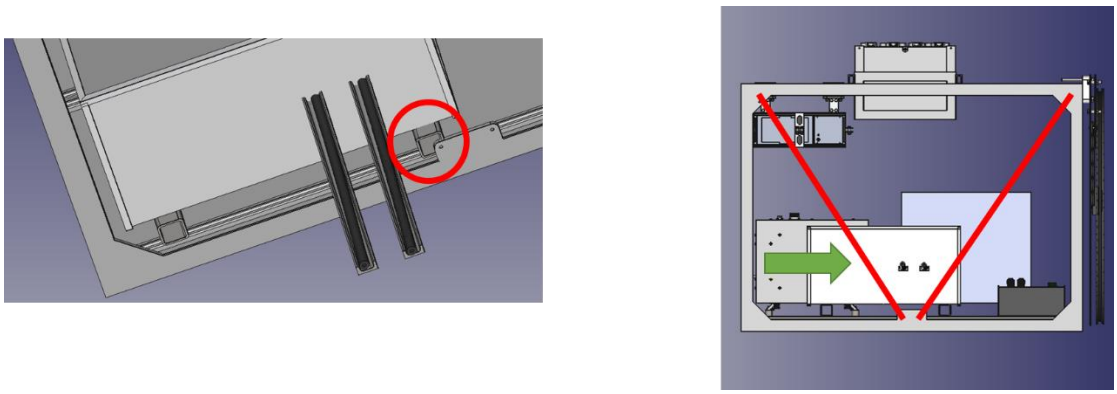


Figure 5 - Stardust mechanical interference with tension cables (left) and easiest solution (right)

- The rubber bumper seems not to be standard. The team shall check the rubber bumpers dimensions and update the CAD file.

- It is hardly possible to tighten the nut within the rail. The team shall modify this mechanical part by drilling the full profile and add the nut on the top of the profile instead of inside the profile.
- Interference have been detected between the experiment pipes, rail and tension cables. The easiest solution is to move the experiment further in the centre as shown in Figure 4.
- If the experiment needs to be more covered by the curtain, then, the team should investigate if it is possible to lower down the external pipes
- The team shall update the CAD.

4.2. Covering

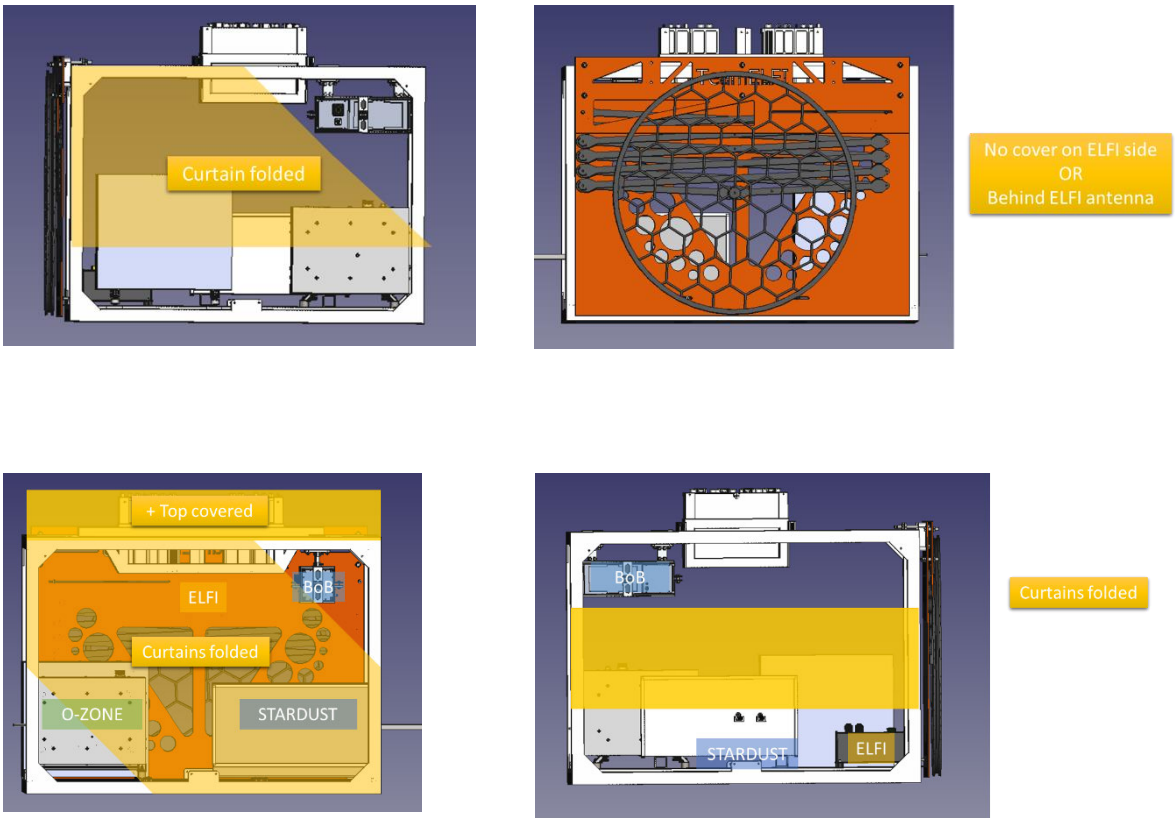


Figure 6 – Proposed curtains position on each side of the gondola

- New curtains set up due to BoB flight requirements (the experiment shall be exposed to sunlight).

4.3. Team preparation, in-flight actions and discussion

BoB

- Before launch:
  - Worms will be frozen at the lab.
  - Feed the C elegans before the flight (need communication during this phase)
  - Remove a cover blanket
- Ascent and float phase: The experiment will be heated and the motor will rotate the wheel.

ECO-WISE

- Before launch: The team plans to warm up the pump.
- Ascent and float phase: Pumping in and out the air.
- Descent phase: The experiment will be placed in safe mode.
- The air to be pumped out will be the same that is pumped in.

ELFI

- Before launch:
  - The team needs to attach the antenna on the pad.
- Ascent and float phase: The team is sampling the RF spectrum during the flight (most operations in the ascent phase).
- The team needs to recover the SD card.
- The experiment is extremely sensitive to vibration sources (microphonic effect of vibrations). The teams shall provide information on their vibration sources.

OZONE

- Ascent phase: Filters will be actuated.
- Float phase: Canister and filters will be actuated.
- Once finished the experiment will be stopped and put in safe mode.
- As the experiment is pumping in and out the air, measurements may be affected by outgassing material. BoB team has some rubber parts. BoB shall provide information on the material used and its characteristics.

STARDUST

- Before launch:
  - The team requested to have access to the experiment as late as possible to maintain and mitigate contamination.
  - The team is planning to spray BEXUS gondola with isopropanol mixed with water. The solution should dry in less than 10 minutes.
  - In order to mitigate contamination, BX30 teams should wear gloves to work on the gondola after decontamination.
- Float phase: Pump in the air.
- Descent phase: All valves will be closed.
- The team is requesting a quick recovery by helicopter if possible. “Quick recovery” shall be defined by the team (hours? Within a day?...).