

Herschel Prelaunch & Early Orbit phase Lessons Learned

(Moderator: L.O'Rourke)

Readiness of the System for COP & PV

- **H137 : ICC-MOC interfaces**
 - Having ICC systems at MOC was considered invaluable
- **HLORTBD : Big Balls in the Operations DB – TC History not imported – was this one minor failure of the smooth transition?**
 - Conclusion from meeting was that there was a workaround in place via analysis of the file delivered by MOC. It was one minor failure of the smooth transition and showed that not everything can be transitioned into operations.
- **HLORTBD : Manual commanding interface** : an output of the SOVT lesson learned – SOVT-2 (PV phase). Was it an interface only recognised at the end i.e. use of the Versant DB.
 - Yes, the focus of the system was primarily on the main ops phase rather than COP/PV.
- **HLORTBD : A significant amount of extra tools developed for ops support leading up to launch & during COP & PV** : work done leading up to launch for gap detection, specific tools to support planning group etc.
 - Lesson learned : the main system supports operations but expect to generate additional tools/software to make operations easier.
- **H36 : Proper use of version control system for deliveries during COP/PV. (Michael O)** : During COP and PV the ICCs planned the operational days for their instruments and delivered files (AOR, POS, ICP, README etc) to the HSC. The delivery consisted of one compressed tar-archive which was uploaded to the HSC via cvs. The cvs version control system was here merely used for allowing the file transfer to the HSC, non of its features as a versioning system was used.
 - This was exercised leading up to launch and it was always recognised to be cumbersome but it required a lot of checking on both sides to confirm correct delivery. There was no deliveries ever made which were impacted by errors introduced in using this interface. Changing this such that the real use of cvs was in fact considered in detail but the approach of “if it’s not broken then don’t fix it” was applied due to the fact we were in operations and the criticality of the deliveries as regards their impact on commanding was highly important in that respect.

Turnaround time for COP & PV

- **H128 : Ground System Development (Micha)** : The Commissioning Phase was a busy period interleaving manual activities with Mission Planning driven activities. The flexibility and workload of the Flight Control Team was stretched to the maximum extend due to too many incidences of having received the Mission Planning input in MOC very late. Short-time turn-around cycles for Mission Planning had been discussed in past Herschel Engineering Working Group meetings as being “the exceptional case”, but turned out to be the rule rather than the exception. Recommendation: Avoid short-time turn-around cycles for Mission Planning, unless exceptionally needed. Alternatively dimension the Mission Planning Team according to the needs
 - Indeed, maybe there was an underestimation of the manpower required. Could it have been seen beforehand – not really. But the wish to avoid helium loss and to finish the COP & PV phase and to speed up the turnaround was very high.

The Importance of (RMS) & SOVT

- **H129 : : The usefulness of SOVTs (Micha)** : In the end both Herschel and Planck came to full system-level science operation very smoothly. I am convinced that the SOVTs built the foundation for this. There is a similar experience reported by NASA for the Spitzer telescope. I paraphrase their summary – SOVT type tests cost effort but are worth it! Recommendation: Rigorously defend SOVTs for those hard life-limit missions where prompt start of smooth science operations is essential.
- **H132 : Operations preparations, end to end tests and simulations**
- **H151 : Pre-launch Operations Rehearsals / Simulations are indispensable to the successful integration of an (S)GS.**
- **HTBD : RMS, SOVT – was a difficult battle with project**

Overall lessons learned feedback on the above

- Ensure there are top level requirements already agreed in the early stages of the mission. This makes it very difficult for them to be descope as it requires top level management approval.
- Getting the ground segment involved already in the Industry tests (RMS) was of benefit to the overall ground segment validation
- The need for these tests not only for lifetime limited satellites but all satellites, is a must.
- The fight with project will be long and drawn out but is worth the effort. It is very important to ensure what are the benefits to the ground segment validation are clear to project so that it becomes clear that if they descope then they take the responsibility for this not being validated.

The Importance of Simulations

- **H44 : Simulations are a must** (Russ) ; Simulations are a must: the SVT and SOVT campaigns were not only paramount to debug the ground segment, but also to make people acquainted with the typical flow of communication and data (uplink/downlink) in a real-life fashion
 - More linked to the need for the SOVT but certainly an important point that simulations as a whole
- **H132 : Operations preparations, end to end tests and simulations** (Tanya) The end to end tests and simulations came to the attention of the ICCs relatively caused a significant burden on the ICC operations team where were simultaneously trying to cope with the demands of producing all the required deliveries to ESOC and finish IST (including tests in Kourou). As a consequence there was a direct impact on these deliverables and deliveries were made late. Also staff were already exhausted before launch. Planning by ESA of exercises requiring critical ICC personnel should be done by taking the ICC workload and schedules into direct consideration. Plans should allow for critical staff to have sufficient rest before launch.
 - This was recognised also by the HIFI & PACS ICC although their statement was that they considered the TBTV test more important for them as an instrument centre than the SOVT.
 - It was also seen that the SPIRE ICC did have less involvement in the Simulations as they were so overloaded
 - The need for such tests were discussed and agreed to be essential but consideration of the ICC manpower close to launch need to be done.
- **H151 : Operations Rehearsals / Simulations are indispensable to the successful integration of an (S)GS.** (Leo) SOVTs & Simulations are absolutely key to debugging the overall system during integration and ensuring operational readiness at launch. Further details: ISO ran 2 major SGS simulations exercises in the months before launch. Herschel SGS was exercised during the two SOVTs (with real Spacecraft data) and in three dedicated Simulations(*) periods (2x12 days and 1x5 days) with MOC collaboration with respect to key interfaces and using replayed S/C telemetry from the SOVTs. The final, shorter Herschel simulation was added and executed just weeks before launch to validate repairs made in response to the earlier exercises, and brought the SGS finally to full launch readiness. Clearly, every attempt should be made to make these exercises as procedurally representative as possible, including, as appropriate, non-nominal working hours, and the injection of simulated contingencies.
 - See responses to H132

Readiness of the Instruments

- **H42 (Russ) : Understanding of Instruments Not Mature at Launch** Instrument design: don't assume that the instrument settings are mature by the time you launch - ILT's are ALWAYS too tight, so they will continue in orbit. Being able to modify fundamental settings in space is key to the optimum science output (ex. for [HIFI](#): LO settings for purity/ sensitivity improvement).

- **Tony : My feeling was that "on-the-ground" this was understood.** It was certainly subject of discussion regarding when we can get out of COP/PV phases. Herschel had complex instrument and complex modes -- and quite a few of them. It was clear that, in the end, it would be difficult to fit the "official" timeline. Probably the most glaring example of the problem that can arise by trying too hard to stick to top-level planning timelines is that pointing was not fully commissioned during COP -- but the desire to move on and get COP out of the way was too great.... There were checkpoints for the release of each observing mode -- very good, and should be used in the future. There was not (and people hardly had the time) a proper pre-assessment before the COP review. By the time we got to COP review Herschel was going to pass come what may (barring absolute disaster).
- These two points (Russ & Tony's) were discussed and agreed by all. The drive to finish the COP by industry was also recognised.