Status of the SOFIA Water Vapor Monitor

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SUG WVM Recommendation

- **R11.2** : The SUG strongly recommends that the SOFIA Project Manager [a] charter a NASA Failure Review Board (FRB) to determine the root cause(s) of the failure, and [b] recommend a plan forward for how SOFIA should proceed wrt water vapor calibration. All aspects of the WVM and its existing requirements should be in scope of the FRB activity. The FRB should be chaired by ARC Engineering who is responsible for delivery of this system. The board should include broad external subject matter expertise. The FRB should produce a non-PowerPoint report following normal NASA FRB process. The FRB intensity of effort should be geared toward a near-term (Cycle 6) resolution. The SUG recommends that priority should be given to achieving precision (flight-to-flight long-term consistency) rather than absolute accuracy.

Program Response

- At the time of the last SUG the WVM had implemented upgraded H/W and S/W to address the issues with the WVM, but did not have data yet to evaluate the success of these changes.

- As these data became available it appeared that the changes were in fact successful (next slides), and the need for the recommended formal FRB was deemed to be overtaken by events, or at least its charter needed to be highly modified and its implementation delayed.

- The Program will ask the SMO for an evaluation of the current applicability of the WVM data for their instruments' calibrations

Example - Flight 450
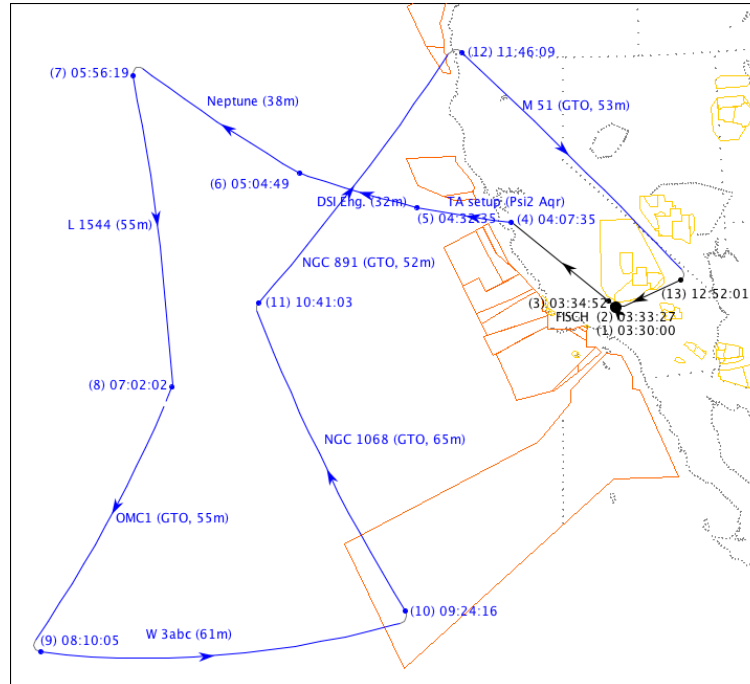
Flight Plan Filename: 201710_HA_NAPIER_WX12.fp
Flight Plan ID: 201710_HA_NAPIER
Est. Takeoff Time: 2017–Nov–09 03:30 UTC
Est. Landing Time: 2017–Nov–09 13:22 UTC
Flight Duration: 09:52
Sunset: 00:52:07   Sunset Az: 250   Sunrise: 14:20:42   Sunrise Az: 110   UTC
Weather Forecast: 1800 Tue Nov 07 2017 – 0600 Sat Nov 11 2017 UTC
Forecast Timestamp: 0440 Wed Nov 08 2017 PT
Saved: 2017–Nov–08 16:33 UTC User: ameyer

Flight 450 Zenith Water Vapor
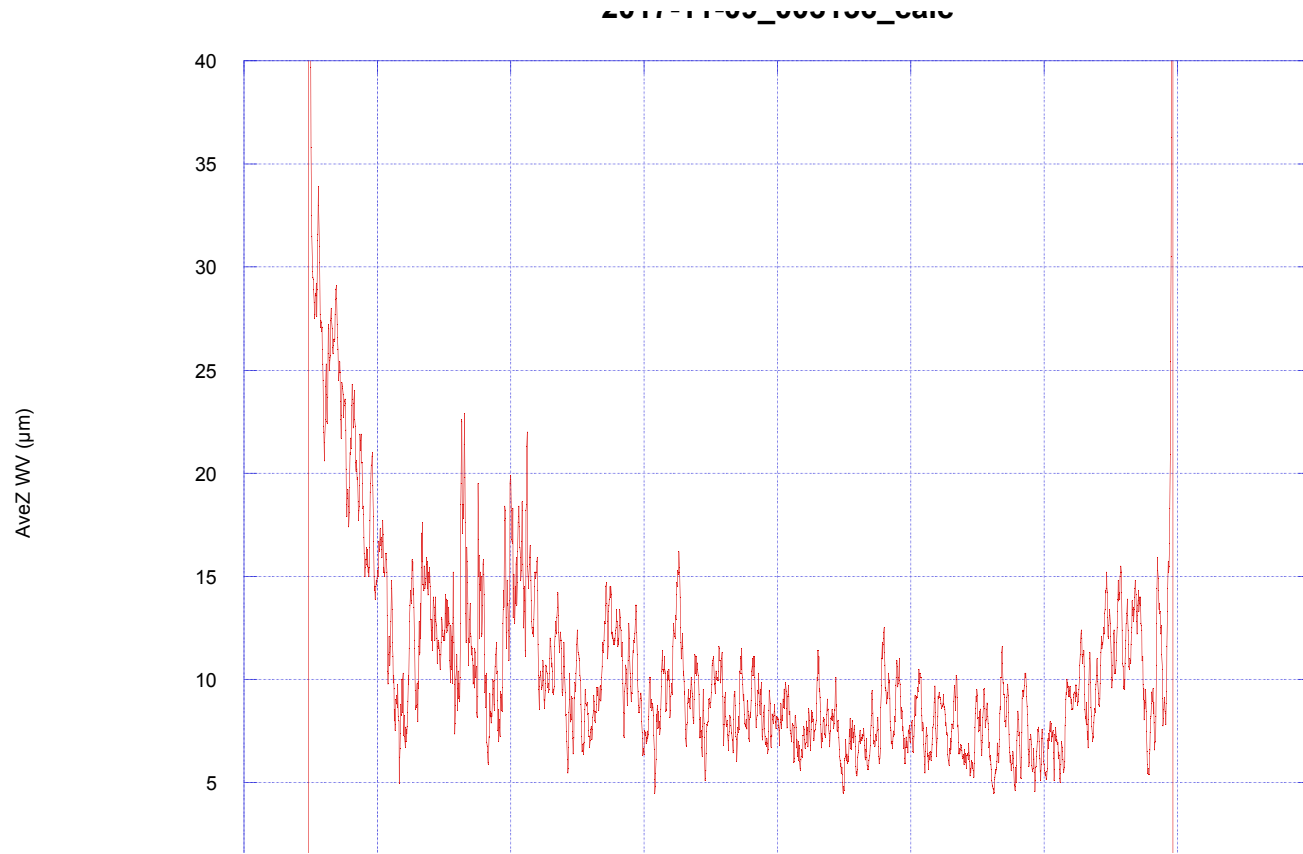
The Latest HAWC+ Flights Look OK So Far

- HAWC+ has been able to successfully subscribe to WVM data through the SCL

- And populate it into their headers accordingly

- The WVM data appear to be reasonably well-behaved (values ~ agree with pre-flight predictions and vary as expected with altitude)

- The comparison between the WVM values and the values derived by looking at the HAWC+ data will be done after the current flight series

The Hardware Upgrade was Successful

- There have been no hardware failures since the new motor controller hardware was installed in March

- The new motor controller hardware is currently being installed in the WVM backup hardware set

However, All Is Not Perfect

- There is a problem with the WVM data being written to the Archiver

    - The WVM data on the Archiver were being overwritten with corrupted data every 60 seconds

    - The WVM data being written into the WVM computer's own internal solid state hard drive showed no problems

    - A fix was developed for the WVM software that changed the disk permissions, but this had the effect of disabling some (rarely used) WVM data used for trouble-shooting. This partial fix is now being used.

- A more robust fix has also been developed, but has not been deployed yet because it has turned out that this issue is just one of the symptoms of systemic communications issues in the MCCS which are being addressed more globally.

Future Work

- Use comparisons with HAWC+ and other SI calibration object data to refine the WVM calibration

- Although we feel that the full might and majesty of a NASA formal Failure Review Board is no longer warranted, we do still plan on convening a tiger team to review and advise us on our calibration path forward.

- There are some further upgrades that have been requested to the WVM software (have it subscribe to the telescope elevation angle and perform its own LOS water vapor calculations for example), but these need to be balanced with other liens on the SOFIA program funds