**The OCU family of data is very limited at this time making it insignificant to analyze unit-to-unit variability, 6 Sigma. The 6 Sigma analysis will not be completed until there is a statistically significant body of data. 6 Sigma analysis will run once 20 units have completed IAT.**

**The OCU analysis will utilize the automated trend software implemented to streamline the ORCA trend analysis approval process. A program was developed to interpret the trend analysis outputs. These trend outputs are then compared to several pre-approved lists of acceptable criteria. What is on the lists will evolve over time (due to shifts in how the test stand acts, test set software changes, new piece part LDC, etc.). Currently there are 4 sets of comparisons (expanded acceptability is determined by ULA). These are:**

1. **6 Sigma Acceptability**
2. **Unit-to-Unit trend when comparing to the same unit (looking for shifts throughout IAT)**
3. **Unit-to-Unit trend when comparing different units**
4. **Unit-to-Unit trend when tests were run on different test sets**

**When different units are compared, the “same unit trend” rule list is applied first after which the “different unit trend” rule list is also applied. For the “different unit trend” the acceptability thresholds tend to be wider to account for normal unit to unit variation. If the tests were performed on different test sets, that rule list is also applied.**

**If a particular trend output falls within the acceptable criteria parameters, then the trend analysis is automatically approved (an email is still sent out). If a particular trend doesn’t pass, an email is sent out stating that ULA approval is required prior to proceeding with test or other processing of the unit. A unit that doesn’t pass the approved criteria list is common and should not be construed to be a bad unit.**

**General Notes on ORCA Trend Analysis**

Initial IAT functional, Pre-BurnIn, are trended against a different unit (typically the last completed unit).

All other functional throughout IAT are trended against the first functional, Pre-BurnIn.

In both cases, the software looks for the differences between two of the same measurements and reports if there is a shift of more than 5% relative to the min/max measurement span.

6 Sigma Trend Analysis compares the functional test to a family of other final functional. All measurements that are out by more than 3 standard deviations are reported. **Note: 6 Sigma will not be run until at least 10 units have been through IAT.**

**The listing below is the original set of criteria that was used as a guideline for approving the trend analysis. These criteria are based on the acceptance criteria used for ORCA which the OCU is very heavily based on.**

**The following is a list of signal that falls out during nearly each trend analysis and is considered normal deviation of the signals and measurement thereof. These are so common that a future revision of the trend analysis software will likely no longer report these ‘drop outs’ or only report when exceeding a less stringent threshold.**

Time\_Meas – This is a measurement of the amount of time it takes for the 2nd inhibit switch to time out.

RTD – This is a temperature reading and is easily affected by differences in the room temperature and whether or not the temperature chamber door is left open or closed.

PS1\_Lct – This measurement typically varies on the order of 5 – 10% and thus drops out because of the 5% measurement shift reporting threshold currently used.

Time\_Meas\_USEC – This measurement is the amount of time from when a firing command is received to when voltage is measured on the pyro output. Percentage wise these measurements will vary significantly because the results are quantized into 10us blocks.

**The following is a list of signals that typically fall out as a result of testing on different test stands (for same unit trend analysis) and causes a lot of repeat fall out:**

Cnt\_Pwr1\_In\_Out - One of the power supplies used is typically about 100mV higher as measured at the sense point in on test stand vs the other which causes this fallout.

Cnt\_Pwr2\_In\_Out - One of the power supplies used is typically about 100mV higher as measured at the sense point in on test stand vs the other which causes this fallout.

1ST\_Arm\_St - One of the power supplies used is typically about 100mV higher as measured at the sense point in on test stand vs the other which causes this fallout.

Ps1\_Hct - This is the total firing current in which variances can be seen due to slight test stand loading differences. This measurement occasionally also falls out on the same test stand.

Ps1\_Lct - Although this falls out normally, it tends to fall out more frequently when changing test stands

**The following is a list of signals that have been observed to fall out occasionally on same unit trend analysis.**

5VDC\_TP - Examination of historical test data files reveals that small variances in this signal can occur

Pyro\_Out – Further investigation reveals that there is also normal deviation in this signal due to the single sample acquisition method and the difficulty with taking this measurement at the exact same moment in relative time to the firing event for this cross talk measurement.

Orca\_Impedance – this calculated measurement falls out as a result of shifts in the firing current (ps1\_lct)

Ps1\_Hct - This is the total firing current measured when firing multiple EEDS at once. Occasionally slight variances are observed in this measurement.

RTD\_1\_2\_Out - This value may also shift slightly as a result of differences in the unit temperature

PTOR\_B\_0 - Examination of historical test data files reveals that small variances in this signal can occur

ARM\_CMD\_1ST\_ARM\_ST -This measurement has been observed to fall out on three separate occasions on three separate units. In each case, the amount of time measured was towards the lower end of the test limit.

1ST\_IN\_Safe -The resolution of this test causes measurements to vary up to 30%

1ST\_Safe\_St -This measurement typically varies 5-10%

1ST\_Arm\_St -This measurement typically varies 5-10%

**The following is a list of signals that commonly falls out during (multi unit) 6 Sigma Trend Analysis:**

Pyro\_Out - Generally this number will be zero (on average), however occasionally, due to the sampling method larger values will be observed ( up to 250mV).

Pyro\_CmdX\_Out - Where X is a number of 1 through 30. This falls out because the majority of the time it registers on the DMM as 0.0001V, but sometimes it reads as 0.0002V.

**OCU SN0034 Trend Analysis Summary**

**Listed below are trend fallout items that were not automatically approved. For full trend fallout details, refer to the appropriate trend Excel file in the ADP.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Channel 1 Trend Fallout** | | **Channel 2 Trend Fallout** | |
| **Initial Ambient/**  **Pre-Thermal** | **Pos\_Bit\_M\_Tp\_Out**  **Neg\_Bit\_M\_Tp\_Out**  **2Inh\_Gd\_Tp\_Out**  **3Inh\_Gd\_Tp\_Out**  **1ST\_Safe\_St** | **All normal fallout based on ORCA history or explained by test measurement variations** | **1ST\_Safe\_St** | **All normal fallout based on ORCA history or explained by test measurement variations** |
| **Post-Thermal/**  **Pre-Vibe** | **None** | **All Approved** | **None** | **All Approved** |
| **Post-Vibe/**  **Pre-BurnIn** | **1ST\_Safe\_St** | **All Acceptable** | **1ST\_Safe\_St** | **All Acceptable** |
| **Post-BurnIn/**  **Pre-Thermal** | **1ST\_Safe\_St** | **All Acceptable** | **1ST\_Safe\_St** | **All Acceptable** |
| **Final Ambient** | **1ST\_Safe\_St** | **All Acceptable** | **1ST\_Safe\_St** | **All Acceptable** |

**OCU SN0034 Six Sigma Analysis Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Channel 1 Trend Fallout** | | **Channel 2 Trend Fallout** | |
| **Initial Ambient/**  **Pre-Thermal** | **None** | **All normal fallout based on ORCA history or explained by test measurement variations** | **None** | **All normal fallout based on ORCA history or explained by test measurement variations** |
| **Post-Thermal/**  **Pre-Vibe** | **Pos\_Bias\_Tp\_Out** | **All Acceptable** | **None** | **All Approved** |
| **Post-Vibe/**  **Pre-BurnIn** | **P\_Bat\_Sig\_Out** | **All Acceptable** | **None** | **All Approved** |
| **Post-BurnIn/**  **Pre-Thermal** | **P\_Bat\_Sig\_Out**  **Pos\_Bias\_Tp\_Out** | **All Approved** | **None** | **All Approved** |
| **Final Ambient** | **P\_Bat\_Sig\_Out**  **Pos\_Bias\_Tp\_Out** | **All Approved** | **None** | **All Approved** |

**Based on this trend analysis, OCU SN0034 is acceptable for flight.**

/s/ Peter van der Hoop on 10/20/2016

OCU CRE

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