Torrent Readiness Review

Manufacturing & Test
Manufacturing Overview

- It starts with an order.....
  - Orders are turned into customer specifications by the detector engineer assigned to the order.
  - The customer specifications are entered into the Torrent configuration tools (Torrent sysConfig).
  - The configuration tools then generate the basic system configuration files needed to build and run a Torrent DHE system. These files become part of the configuration documentation deliverable.
  - Any additional system information goes into the configuration documentation.
  - Hardware is assembled, configured, and tested per the configuration documentation package.

- The result is a configured Torrent DHE system ready to be integrated to a detector by a detector engineer.
Manufacturing - DHE
Hardware Receiving

- The hardware to assemble a completed Torrent DHE consists of the electronics printed circuit boards, flex cables, and the mechanical housings for the circuit board assemblies.
  - Parts will be ordered to build multiple systems in order to minimize setup and other recurring fees.
  - Mechanical parts will be lot sampled for fit, form, and function upon receipt and then placed into inventory.
  - Electronics assemblies will be inspected according to existing incoming receiving procedures and placed into inventory.
  - Electronics assembly receiving procedures include visual inspection and power supply impedance checks.
  - Discrepant material is documented and returned to vendor for resolution. *The exception being minor rework to circuit boards.*
Manufacturing - DHE
Mechanical housing subassemblies

- Mechanical parts will be assembled ready to have the electronics installed into them.
  - The controllers will be assembled “ready for PCB’s and flex cables” and placed into inventory.
  - The generic transition module’s (TSM) will be assembled “ready for PCB’s, wiring, and Dewar interface” and placed into inventory.
  - Custom transition modules will not be pre-assembled. They will be assembled on an order by order basis.
Manufacturing - DHE Hardware
Torrent Controller Unit
Manufacturing - DHE Hardware
Generic Torrent Transition Module (TSM)
Manufacturing - DHE Electronics Hardware

- PCB’s are tested on the Torrent test fixture prior to becoming eligible for integration into a Torrent DHE system.
- Flex cables are pre-assembled in house and are also tested on the Torrent test fixture.
- All electronics hardware that has passed testing is returned to inventory.
- Electronics hardware that fails test will be kept in a diagnostic loop out of inventory until repaired and passed or deemed as scrap and replaced.
Manufacturing - DHE Hardware Assembly

- Configured and tested circuit boards and flex cables are installed into the controller mechanical subassemblies.
- Once a controller is assembled it is tested on the Torrent test fixture.
- The transition module Dewar specific wiring and Dewar specific interface are assembled.
- The controller is then mated to the transition module.
- Together they are a Torrent DHE which is ready for integration to a detector.
Test Overview

- The Torrent test concept is based on an automated test screen with test operator interaction.
- The Torrent test software will be developed in the LabView graphical programming language.
- The Torrent test hardware will consist of a custom designed test fixture and a USB 2.0 capable PAN computer with a fiber interface.
Test - Concept

- Machine based semi-automated test execution that requires test operator interaction and oversight.
- Test step pass/fail results will be determined by measured values conforming to an acceptance window which guarantees consistent screening results.
- Acceptance windows will be determined statistically during test development.
- Failures must be acknowledged by the test operator in order to continue the subtest.
- Acknowledged failures will be documented in the test report preventing a false pass result.
- Programmed parts such as FPGA eeproms and calibration eeproms are programmed during test.
The initial GUI will allow the selection of an assembly subtest.
The available subtests will be:
- PSM test
- LCB test (requires FPGA eeprom firmware programming)
- Mezzanine test
- CCD AFE test (requires calibration eeprom programming)
- IR AFE test (requires calibration eeprom programming)
- Generic Pre-Amp test
- Utility board test
- Flex cable test
- Controller system test
Test - Software Design

- Once an assembly subtest is chosen, instructions for configuring the test fixture and resident boards are to be displayed.
- The test operator will then make the necessary configuration changes to the fixture and install the unit under test (UUT).
- The subtest can then be executed.
  - Should a subtest step fail, a pop-up window describing the specific details of the failure will appear.
  - The test operator can then choose to abort the test, loop on the failure for diagnostics, or acknowledge the failure and continue the subtest.
Test - Software Design

- Upon successful completion of a subtest the program will save the test report data file and return to the initial GUI.
- The operator can then choose to exit or continue testing.
- The test report data file is considered a documentation deliverable with the system.
- Certain subtests will also produce and program eeprom calibration data, which will be saved as an eeprom mirror file. These mirror files are also a system deliverable.
- All documentation deliverables will be uniquely archived on an NOAO server.
Test Fixture Design

- The test fixture is configurable depending on which assembly is being tested.
  - Configurations are: PSM test, LCB test, Mezzanine test, AFE CCD test, AFE IR test, Generic Pre-Amp test, Utility board test, Flex cable test, and Controller test.
- All but the Controller test will use some combination of “resident” test boards.
- Each configuration requires an adapter/load board and specific UUT interface cables.
- A resident 24Vdc “brick” provides system power.
Test - Fixture Design
Block Diagram

Test Fixture PAN Computer Running LabView and PAN software

USB 2.0
7 port Hub

Analog Input
64 Ch 50 MHz
USB 2.0 DAQ Module

Analog Output
16 Ch
USB 2.0 DAQ Module

PWM Output
10 Ch 20 MHz
USB 2.0 DAQ Module

Counter Input
4 Ch 20 MHz
USB 2.0 DAQ Module

Digital I/O
96 CH
USB 2.0 DAQ Module

Torrent Test Fixture - Test Signal Standard Interface

Resident Test LCB
Resident Test Mezz board
Resident Test AFE

Resident Test PSM
Resident Test Utility Board
Resident Test Pre-Amp

PCB Test Adaptors (change depending on the test)

Controller Test Adaptor

Flex Cable Adaptors

PSM Test Adaptor & Dynamic Load Board

PSM Under Test

UUT substitutes into test system
+24V 60W Torrent Block Power Supply
Test development and cost

- The estimated development time for the Torrent test fixture is five to six man months.
- Hardware costs for the test development are estimated to be around $20K
  - Includes USB acquisition modules, custom test load boards, adapters, and resident test boards.
- Development software costs are estimated to be $4.3K.
- There is a manual fallback for testing should the development not be completed before the first system order.
  - The manual fallback adds in considerable test time to the manufacturing process.
Torrent Sparing

- At least one spare controller is recommended to be on hand at the observatory.
- Failed controllers would be returned to Tucson for troubleshooting and repair.
- In the event of a failure an on hand controller could be pre-shipped in order to ensure sparing at the observatory.
- An option to the above would be that observatories could build their own Torrent test fixture and diagnose or repair controller failures on site.