Mosaic-1.1 Test, Engineering and Commissioning Plan

This version of the Mosaic-1.1 Test, Engineering and Commissioning Plan (TECP) is a top-level outline of the tests that must be completed at the telescope before science observing can begin. The primary purpose of this outline is allow reasonable estimates of the time needed at the telescope to be determined so that T&E time can be requested by the March 31, 2010 deadline. In some cases, the test definition includes a testing methodology, but, in general, the details relating to tests (e.g. criteria, test order, test method, etc.) will be added in a later revision of this document.

This TECP assumes that the upgraded Mosaic instrument will be required to meet all of the Project requirements during Lab Integration Acceptance Testing.

1. **Off-Telescope Tests (October 11-17, 2010)**

   The instrument shall be located in computer room at the 4-meter and kept cold. A second user interface workstation needs to be set up in a convenient location (e.g. far end of control room or large coude room). We need to warn observers that we may need access to the control room possibly into the evening while we conduct these tests. Kitt Peak support personnel should be included for training purposes (e.g. Instrument Specialists, Mountain Electronics, etc.)

   1.1. **Sanity Check**

       1.1.1. Test network configuration and access to new Mosaic computers.

       1.1.2. Test communication to host 4-m computers (get a list of computers from B. Marshall).

       1.1.3. Functional operation – verify the instrument survived the trip (CCD readout, shutter control, filter control, temperature control). Need service connections, such as compressed air.

   1.2. **Performance Tests** – take biases to check noise and stability (e.g. during filter moves). Check performance with spare cards.

   1.3. **Test Features** (e.g. autolog, binning, scripting, writing DVDs, etc.)

   1.4. **Alerts and Auto-email** (e.g. high Dewar temperature email warning)

   1.5. **Data Transfer and Archiving** – verify images are properly received and archived downtown. Verify headers are formatted and populated correctly and are compatible with IRAF routines.

   1.6. **Test NOCS initialization command** – verify NOCS settings are reverted to default parameters.

   1.7. **Verify setup and operation of spare computer.**

   1.8. **Test both Tan and Nutmeg as user workstations.** Verify VNC operation.

2. **Install Mosaic on Telescope (October 18, 2010)**

   Cass instrument installed for science observing

Telescope can be scheduled for Cass instrument observing. Day and night access needed to second workstation in control room. These tests can be performed during the day and night while the telescope is scheduled for other (Cass) observing programs (**Verify that instrument is operational in F8 position.). Kitt Peak Observing Assistants and Observing Support personnel should be included for training.

3.1. Functional operation – check all systems for proper operation and control (image acquisition, shutter, filter, temperature, ADC). During the day verify that telescope focus and offset control (GWC interface) are functional. **Verify F8-->PF flip.**

3.2. Test remote reset of electronics. Test reliability of power-up sequences. Have support staff initialize system solo.

3.3. Quick Look Features – On the fly flats (OTFF), bias subtraction.

3.4. Image Header Format – verify that image headers have correct format and content.

3.5. CCD Noise Performance – acquire bias images during normal observing conditions (telescope tracking, dome tracking, etc) and check for noise sources (banding) and bias instability. Measure read noise at all gain settings.

3.6. CCD Linearity and Saturation – use dome flats to evaluate the photon transfer characteristics and measure gain(s). Develop procedures and scripts to allow this to be repeated periodically for performance monitoring.

3.7. Temperature Stability – monitor temperature during the course of the night as a function of airmass (LN2 tank orientation), and ambient temperature.

3.8. Ghost Pupil – obtain dome flats to evaluate the level of the ghost pupil.

3.9. Obtain flat-field sequences to determine the shutter correction.

3.10. Test single-amp read modes


These five nights are to be dedicated to science commissioning of Mosaic-1.1. In general, the first half of the nights will be used for functional tests (when more support people need to be on call) and the later half will be used for science verification. We recommend that the observer scheduled on Mosaic-1.1 following the commissioning be a 0.9-m user that can participate toward the end of commissioning and then lead the effort when the instrument moves to the 0.9-m. The observing run following the commissioning run will be high-risk shared observing as it will be the commissioning contingency for unforeseen problems such as weather or technical delays.

4.1. Functional Tests (first half of first two nights)

4.1.1. Focus sequence tested at zenith during twilight [1 hour]

4.1.2. Pointing, offsetting, and dithering [2 hours]
   - Optimize the dither pattern for new CCD gaps
4.1.3. Guiding (determine offset from CCD to guide camera) [2 hours]

4.1.4. Observe rich star field (e.g. Trumpler 37) to evaluate the PSF across the focal plane (i.e. planarity). Also verify best focus occurs at the nominal focus position. [1 hour]

4.1.5. Filter control manual operation and automated (DOOBS) [1 hour]

4.1.6. ADC control – test by turning tracking on and off at high airmass using U-band filter. [1 hour]

4.2. Science Verification (2nd half of first two nights, all of last three nights)

4.2.1. Standard star observations under the conditions listed below to determine the photometric transformation, QE, and gain:
   • Two standard stars (one red, one blue) placed on each CCD and imaged in UBVRI filters. [three 30s exposures + 20s readout x 2 stds x 8 CCDs x 5 filters = 240 images @ 3.33 hours]
   • Various Airmasses – Measure standards at four airmasses between 1.0 and 2.5 at one gain setting in B & R filters on all eight CCDs. [2.67 hours]
   • Signal to Noise Tables – observe standard stars at various integration times in UBVRI and at all different CCD gain settings to determine SNR, gain, and saturation for each CCD. [1 hour x 8 CCDs = 8 hours].
   • Landolt fields – observe several fields in UBVRI in two offset positions at several airmasses. [2 hours]
   • Exposure time calculator updates – no additional on-sky images required.

4.2.2. Obtain long exposures on extended objects. These can be used for “pretty pictures”. [two objects at 4 hrs each = 8 hours of observing].

4.2.3. Astrometry – observe an astrometric cluster (e.g. Trumpler 37) in UBVRI filters. [2 hours] Send image to SDM group for analysis. This will test the Mosaic pipeline as well.

4.2.4. Fringing - Obtain narrow-band images, as well as z-band/I-band images to evaluate fringing. [2 hour]

4.2.5. Bright objects – Evaluate crosstalk, ghosts, saturation, and scattering. [2 hours]

4.2.6. Time varying objects – observe a time varying object (e.g. an eclipse) to validate the header timing [1 hour]

4.2.7. Observe a star cluster to evaluate the small-scale spatially variant photometry. Observe cluster in several offset positions. [1 hour]

5. Mosaic Available for Shared Risk Observing (October 30, 2010)

The first shared-risk observing run may be used for T&E contingency nights if Commissioning is not completed on schedule due to unforeseen problems such as weather or technical delays.
6. **On-Telescope, On-Sky Follow-up Testing (two nights about a month after Commissioning on the first two nights of a scheduled Mosaic-1.1 observing block)**

This is a place holder in case the data analysis from the commissioning run identifies further testing that is needed. This time will be returned if it is not needed.

7. **Documentation**
   7.1. Verify cabling is clearly labeled and documented.
   7.2. Verify all documentation (user and technical) is on-line and available to KP support personnel.