K1DM3 Design Note
Integration and Testing Plan
Version 1.2, April 11, 2016
By J. Xavier Prochaska, + all

I. Overview

This Design Note is an overview of the testing plan for K1DM3 at UCO during full scale development. It is intended to capture all of the major tests that should take place prior to the pre-ship review. It is likely that we will generate documents separate from this one to report the results and specific activities of the various tests.

II. Test Bed 2

Prerequisites:

1. Clamps [Done; adjust clamp force]
2. Rio? [1.5 months]
3. Final kinematics [Done]
4. LVDTs [Done]

Tests:

- Test clamp pressure [Done]
    - Goal/requirement: Achieve 340lbs
- Test kinematic repeatability
- Test positioning under varying gravity
    - Goal/requirement: Verify small movement ($<1\,\mathrm{mm}$)
- Test LVDT behavior

III. Mirror Assembly

Prerequisites:

1. Fabricated whiffle tree [End of June]
2. Axial, lateral rods
3. Pucks [End of April]
4. Dummy mirror [mid-May]
5. Mirror kinematics [mid-June]

Tests:

- Inspection test at TapeMation
- CCM Report of fabrication
- Test fitting
- Test vibrations

– Accelerometer

- Confirm kinematic coupling repeatability

    – Goal/requirement:
    – Additional materials/equipment: Last-word gauge
    – Procedure:

        1. Fasten swingarm-side kinematics on granite
        2. Install/remove 10 times and test positioning

- Test gluing strength [WMKO]

IV. Swing Arm Assembly

Prerequisites (for the latter tests listed below; note, none of the following are mounted to the inner drum):

1. Both Exlar actuators installed [End of May?]
2. Swingarm fabricated and assembled [mid-August]
3. Dummy mirror assembly [mid-May]
4. Upper bipod weldment [mid-August]
5. Compliant hinge assembly complete []
6. Canoe sphere mounts complete
7. Dampers installed

Tests:

- First test software algorithm for dual actuators [1; WD,MP; May 2016]

    – Goal/requirement:
    – Additional materials/equipment:
    – Procedure:

- Full Test software algorithm for dual actuators [1,2; WD,MP; May 2016]

    – Goal/requirement: Synchornized to within 1mm
    – Additional materials/equipment:
    – Procedure: Combine with clamping?

- Characterize mirror/swing arm kinematics [2]

    – Goal/requirement:
    – Additional materials/equipment:
    – Procedure:

- Test clamping procedure
- Test compliant hinge assembly [All but #3]

    – Goal/requirements:

        1. Offset of $< 1\,\text{mm}$ from center when at kinematics
        2. Offset of $< 1\,\text{mm}$ from center when clamped

- Additional materials/equipment:
- Procedure: Combine with clamping

- Perform drop tests (i.e. actuator 'failure')

  - Goal/requirements: Verify $< xx$m/s

- Verify kinematic coupling adjustment sensitivity

  - Goal/requirements: Measure positioning to $\sim 1''$ per smallest turn
  - Procedure:
    1. Assembly on granite
    2. Attach dial gauges

- Test repeatability in nominal gravity
- Test repeatability in varying gravity
- Measure retract position in varying gravity

V. Rotation Drum Assembly

Prerequisites:

- Inner drum fabricated
- Outer drum modified to allow bearings to be removed with M5 jacking screws
- Kaydon bearings
- Upper and lower retaining rings fabricated
- Ring gear fabrication complete
- Spur gear
- Custom electronic connectivity complete and mounted
- Cabling
- Compressed air connectivity complete and mounted
- Servos and harmonic reducers
- Renishaw encoder related parts
- Pneumatic actuator
- Spherical detent parts

Tests:

- Test power connectivity to upper assembly
- Test compressed air supply to upper assembly
- Test signal monitoring of upper assembly
- Measure runout of precision ID surface of inner drum (after mounting in hex fixture)
- Engage to all 8 locations of inner drum

VI. Full Assembly Testing

Prerequisites:

1. Upper bipod weldment attached in drum assembly
2. Swing arm attached to drum assembly
3. Mount on the hex fixture

Tests:

- Time testing of various motion and positioning operations
- Test at varying temperatures
- Test repeatability of deployment
- Measure flexure at various gravity vectors
- Vibration?
- Measure total electrical power consumption

    - Compute time average for various scenarios
    - Attach thermocouples to look for potential hot spots and thermal expansion deformation

- Simulate power outage and verify recovery
- Simulate actuator failure and verify recovery

VII. Alignment Testing?

Tests:

- Pre-alignment procedure
- Alignment procedure?