AAReST Project: Ae105 Class Involvement

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**Deployable Boom**

The boom is a carbon-fiber composite tube with tape-spring hinges that enable the boom to be stowed in a compact configuration for launch. In orbit, the boom unfolds to a length of 1.29m, and holds a 4kg optical detector at the end. The deployable boom is a key enabler for a prime focus telescope with a 1.2m focal length.

The boom is packaged in a planar configuration that can be easily deployed quasi-statically. A quasi-static deployment system based on cable-and-pulley mechanism was successfully tested using a gravity offload system. Such a deployment allows for the use of stiffer hinges, which would otherwise produce prohibitively large accelerations during deployment.

The CTE of the carbon fiber boom is $2 \times 10^{-6} \text{ K}^{-1}$; this leads to a $\pm 200\mu\text{m}$ axial displacement of optical detector. This displacement can be compensated for by the adjustable mirrors on the MirrorCraft.

The AAReST demonstration mission is a prime focus space telescope with a 1.2m focal length. The primary mirror consists of four 10cm-diameter segments mounted on 3U CubeSats. A deployable boom provides the necessary separation between the primary mirror and the optical detector. The MirrorCraft can manoeuvre and re-dock to change the telescope aperture.

**Optical Detector**

The optical detector, which is mounted at the end of the boom, captures the light from the primary mirror, and focuses it onto an image sensor. The optical detector also provides shape feedback during the calibration of the adjustable mirrors.

After initial boom deployment, and after reconfiguration of the MirrorCraft, the adjustable mirror segments need to be calibrated. For calibration, light from individual segments must be isolated; this is done by a masking mechanism.

Folded and deployed tape-spring hinge (left). Packaging configuration for the boom. (right).

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