Former NRO Telescopes

Earlier this year, the National Reconnaissance Office (NRO) transferred two 2.4-meter, space flight qualified telescopes to NASA. This hardware, developed in the late 1990s, no longer meets future NRO mission requirements. The telescopes are similar to the Hubble Space Telescope in aperture size and optical configuration. They are Cassegrain in design, but have shorter overall length due to both smaller focal ratio (f/8) optics and reduced outer baffle tube length. The major difference is that these telescopes can accommodate wide field-of-view applications such as imaging or spectroscopy. For example, with an additional powered mirror in a three mirror anastigmat (TMA) configuration, we estimate that a one-third square degree, diffraction limited, field-of-view image is achievable. There is potentially room for three such imaging instruments and a total field-of-view of about one square degree.

There are currently no instruments or additional optical elements beyond the primary and secondary mirrors. The mirrors are fabricated from light weight, low thermal expansion glass. The coatings have cosmetically deteriorated with age and could be replaced with optimized coatings for a specific new application. The telescope's structure is composed of thermally stable composite material with invar joints and there is an array of heaters covering the structure to maintain a near-constant temperature of about 280K. Thus, the telescopes are designed to be extremely stable with respect to temperature variations. With modified thermal control, it may be possible to operate the telescopes down to a temperature of 250K. This capability is yet to be fully confirmed. The telescope design includes the capability for actuated

focus adjustments and actuated alignment positioning between the primary and secondary mirrors. The available flight equipment includes the Outer Barrel Assembly which functions as both telescope's outer baffle tube and its protective aperture doors. The mass of each telescope including the Outer Barrel Assembly is 1,120kg. However, there are a number of other required items.

Neither telescope constitutes a complete flight system. There is no spacecraft subsystem that would provide necessary power, communications, orbit maintenance propulsion, or coarse pointing control. As mentioned, there are no focal plane instruments or fine pointing control and some other telescope equipment needs to be replaced. These include the thermal and electrical accommodations for the new instruments, the internal stray light baffles for the telescope, the focus and alignment actuators, the control electronics for the structural heaters, and thermal blankets for Telescope #2. Telescope 1 and 2 are essentially identical. Telescope 2 has a small manufacturing flaw in the optical surface and it does not have thermal blankets. Depending on the details of a new application, the thermal blankets for Telescope 1 may need to be replaced, as well.