Wide-Field Infrared Survey Telescope
Astrophysics Focused Telescope Assets
Coronagraphic Science Investigation

Lockheed Martin Advanced Technology Center
Rick Kendrick, Jim Mulroy, Ray Bell, Eric Smith, Alan Duncan

January 5th, 2014
• The (WFIRST-AFTA) mission will have a subset of requirements that are critical to the coronagraphic science mission.

• Many of these requirements are associated with the GFE telescope assets and require a thorough understanding of both the system and component level requirements and the baseline performance of the GFE telescope hardware.

• The LM-ATC has a detailed knowledge of the class of telescope assets that are being provided by the AFTA original equipment manufacturer.

• LM also has experience with the manufacturing processes, materials and test capabilities for this class of instrument.
LM-ATC Coronagraph Experience

- LM ATC has been collaborating with the University of Arizona and the NASA Ames Research Center on exoplanet coronagraphic payloads for the past six years.
- EXCEDE PIAA coronagraph demonstration currently being carried out in LM vacuum chamber facility in Palo Alto. (Schneider, Belikov et. al.)
<table>
<thead>
<tr>
<th>Requirement / Characteristic</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid and high spatial frequency uncorrectable wavefront error minimization</td>
<td>Deformable mirror is capable of low order corrections only</td>
</tr>
<tr>
<td>Low order wavefront sensing and control</td>
<td>Low order correction consistent with diffraction limited 2.4 meter aperture</td>
</tr>
<tr>
<td>Attitude Control System and LOS control</td>
<td>LOS control consistent with $&lt; 1/10$ diffraction limit of 2.4 meter aperture</td>
</tr>
<tr>
<td>Pupil amplitude uniformity</td>
<td>Spatially Variant contamination as well as coating uniformity will affect PSF due to pupil amplitude variations</td>
</tr>
<tr>
<td>Polarization characteristics of the optical train</td>
<td>Polarization Maintaining Beam Train Necessary</td>
</tr>
<tr>
<td>Thermal control</td>
<td>Room Temperature Control to minimize WFE</td>
</tr>
<tr>
<td>PSF contamination by segmented aperture</td>
<td>GFE hardware has secondary mirror support obscuration</td>
</tr>
</tbody>
</table>

Driving requirements and desirable instrument characteristics associated with the WFIRST AFTA Coronagraph mission.
Lockheed Martin Relevant Experience

- Our assessment derives from our experience in line of sight control, Wavefront Sensing and Control, stray light management, and other capabilities required to integrate large precision electro-optical systems.

Hubble Space Telescope prime contractor

Airborne Laser beam control
Lockheed Martin Relevant Experience

- NIRCAM
- IRIS
- GOES-R
- AEHF
- MUOS
- Orion
- GPS III