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OpTIIX: An ISS-based Testbed Paving the Roadmap toward a Next Generation Large Aperture UV/Optical Space Telescope

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The next generation large aperture UV/Optical space telescope will need a diameter substantially larger than even that of JWST in order to address some of the most compelling unanswered scientific quests. These quests include understanding the earliest phases of the Universe and detecting life on exo-planets by studying spectra of their atmospheres. Such 8-16 meter telescopes face severe challenges in terms of cost and complexity and are unlikely to be affordable unless a new paradigm is adopted for their design and construction. The conventional approach is to use monolithic or pre-assembled segmented mirrors requiring complicated and risky deployments and relying on future heavy-lift vehicles, large fairings and complex geometry. The new paradigm is to launch component modules on relatively small vehicles and then perform in-orbit robotic assembly of those modules.

The Optical Testbed and Integration on ISS eXperiment (OpTIIX) is designed to demonstrate, at low cost by leveraging the infrastructure provided by ISS, telescope assembly technologies and end-to-end optical system technologies. The use of ISS as a testbed permits the concentration of resources on reducing the technical risks associated with robotically integrating the components. These include laser metrology and wavefront sensing and control (WFS&C) systems, an imaging instrument, lightweight, low-cost deformable primary mirror segments and the secondary mirror. These elements are then aligned to a diffraction-limited optical system in space. The capability to assemble the optical system and remove and replace components via the existing ISS robotic systems like the Special Purpose Dexterous Manipulator (SPDM), or by the ISS flight crew, allows for future experimentation, as well as repair.