MIT Lincoln Laboratory (MIT LL), a Department of Defense Federally-Funded Research & Development Center (DoD FFRDC), is developing a large number of optical technologies relevant to future NASA missions.

Technology for optical communications has been implemented in near-Earth missions such as for the Lunar Laser Communication Demonstration (LLCD), Laser Communications Relay Demonstration (LCRD), Terabyte Infrared Delivery (TBIRD), and Laser Enhanced Mission Communications Navigation and Operational Services Pipeline (LEMNOS). In addition, MIT LL provided the Photon-Counting Camera (PCC) beacon acquisition and tracking camera for the Deep Space Optical Communication (DSOC) technology demo on the Psyche spacecraft.

The photon-counting imager technology used in the DSOC PCC has also been used extensively for three-dimensional (3D) wide-area mapping in terrestrial and airborne scenarios by MIT LL and its technology transfer partners. The first application of this technology to NASA planetary science mission needs is through collaboration with the Jet Propulsion Laboratory (JPL) on demo of a brassboard hazard avoidance laser radar (ladar) for the Europa Lander mission concept. While this system is designed for short range (5m to 5km) operation, the same technology is being considered for 100's of km operation for NASA Earth-observing missions.

MIT LL has also developed a novel readout integrated circuit (ROIC) based on in-pixel digitization of the photo-signal that enables high-frame-rate, high-dynamic-range imaging, especially important in the infrared (3-12 microns wavelength). This Digital-pixel Focal Plane Array (DFPA) technology has been the subject of NASA technology development funding. One example is the "Non-Saturating, simultaneous multiband, infrared imager" in collaboration with JPL aimed at high-dynamic-range imaging of Io, Venus, and gas giants. Another collaboration with JPL is the "Panchromatic Fourier Transform Spectrometer (PanFTS)" system for ultra-wide-band (continuous coverage from ultraviolet (UV) to longwave infrared (LWIR)) atmospheric observations.

Finally, Charge-Coupled Devices (CCDs) developed at MIT LL have been used in visible and X-ray observatories, such as NASA's Transiting Exoplanet Survey Satellite (TESS), Chandra X-Ray Observatory, and the REXIS instrument on the OSIRIS-REx mission. Ongoing work enables higher frame rate operation through the Digital CCD project and wavelength extension into both the shortwave infrared and harder X-rays through Germanium (Ge) CCD projects.