CO-OP WORK REPORT

SCHOOL OF AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

PURDUE UNIVERSITY

WORK PERIOD
 # 4
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AT
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SUBMITTED BY
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During my fourth work session at Ball Aerospace & Technologies Corp., I worked on a laser communication program called Commercial Laser Communication Terminal, CLCT. The objective of CLCT is to provide a means of using lasers to communicate between satellites. Laser communication offers data rates that are orders of magnitude higher than conventional communication links and are significantly more secure. The long-term vision for laser communication is to utilize it for communications between ground, air, and space platforms including satellites and long-range spacecraft.

Upon my arrival at Ball, the CLCT team was completing demonstration hardware of the communication terminal. The terminal is composed of a gimbaled telescope that sends and receives the laser signal, a bench that optically manipulates the laser light, a fiber optic system that converts between electrical signals and laser light, and the system electronics. Although this terminal demonstrated the basic setup to be used in the flight hardware, the hardware used in the model was not flight qualified. The goal of the project I worked on was to flight qualify the existing demonstration hardware optic mount design. My project was to produce a detailed design of a flight-qualified optic mount and all the tooling required.

The mount I worked on included modifications based on problems found with the demonstration mount design and other modifications to produce flight-qualified hardware. One such modification was to make all the parts titanium. Another modification made was to make the mount a two-piece assembly consisting of a separate mount, to provide tip and tilt, and bezel, to hold the optic, (see Figure 1, Figure 2, and Figure 3). This two-part assembly was chosen because it can accommodate different shape and size optics in the same mount piece simply by using a different bezel. The mount has $\pm 1°$ of movement that is set using the push-pull pair of set screws in both the tip and tilt directions. The bezel size was designed to minimize thermally induced stress on the optic. This was done by calculating the optic to bezel bond thickness using the optic size and the coefficient of thermal expansion for the optic, adhesive, and bezel.

After the design of the mount and bezel were complete, I designed tooling to aid in the bonding of the optic to the bezel (see Figure 5) and tooling to allow for testing of the mount through vibration and temperature cycling (see Figure 6). There are selected areas on the optic, bezel, mount, and base plate that will be nickel-plated and mirrored to use as optical references to measure movement of each component during the tests.

Although I was not able to have the parts I designed manufactured and tested, I was able to produce mechanical drawings of the parts I designed to manufacture the hardware and I drafted a bonding procedure and a test procedure for the hardware. The most valuable things I learned about during my time at Ball this semester were how to use SolidWorks (CAD program), the general design process, how much effort is put into producing flight hardware, and how to make mechanical drawings from a CAD model.

Appendix

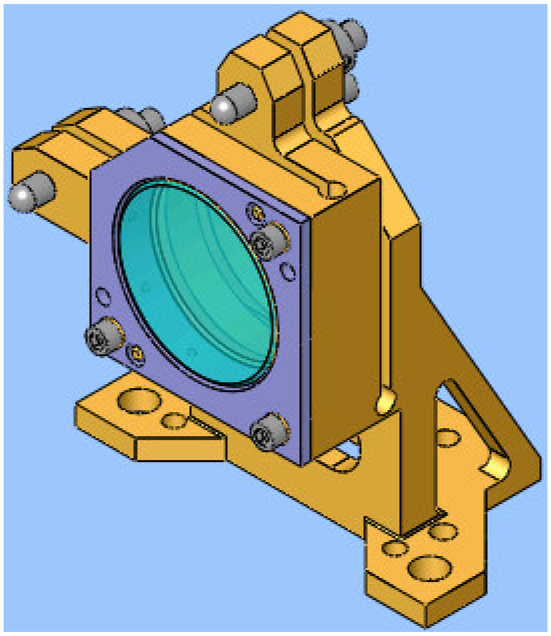

Figure 1: Tip-Tilt Mount Assembly

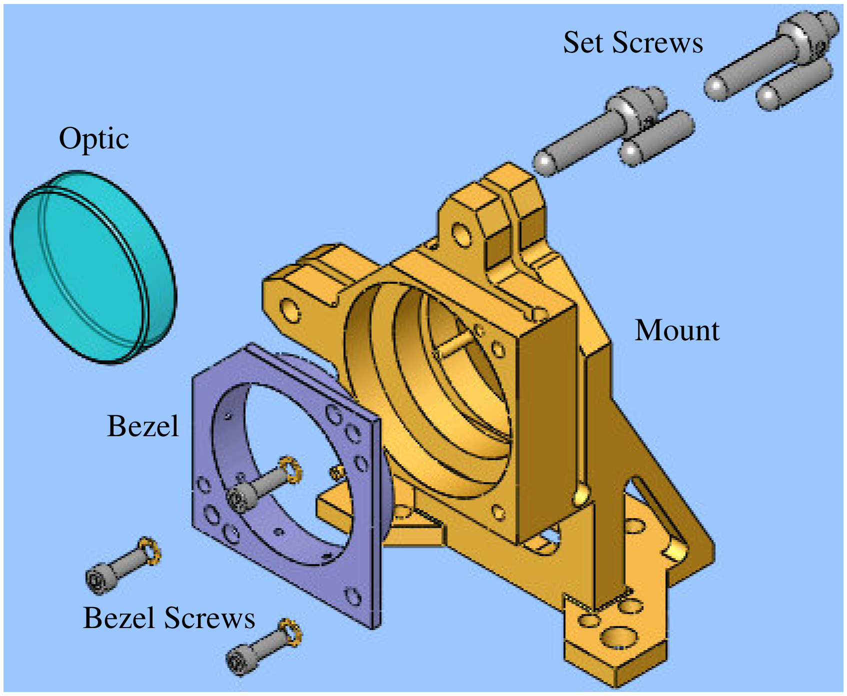

Figure 2: Exploded Tip-Tilt Mount Assembly

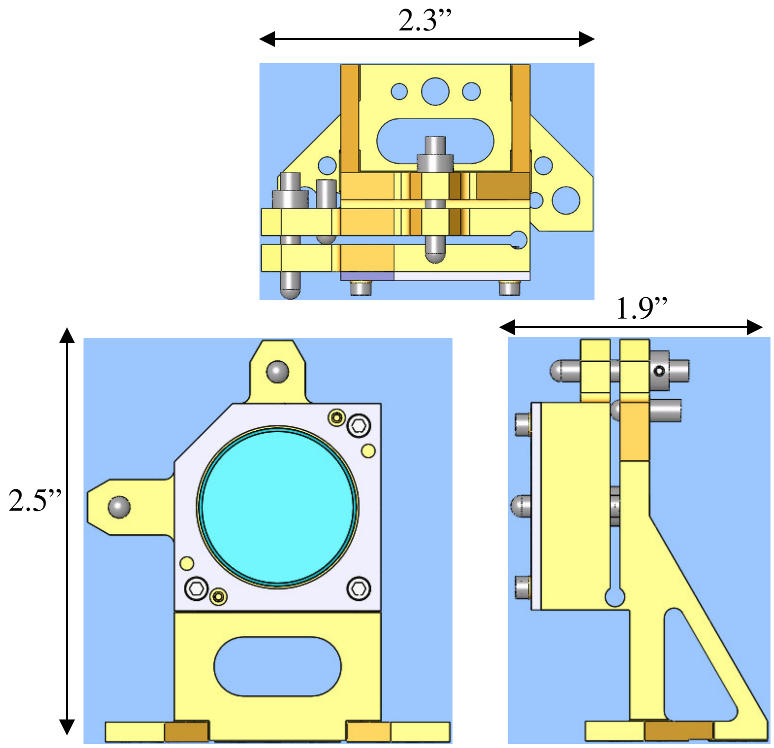

Figure 3: Tip-Tilt Mount Assembly 3-View

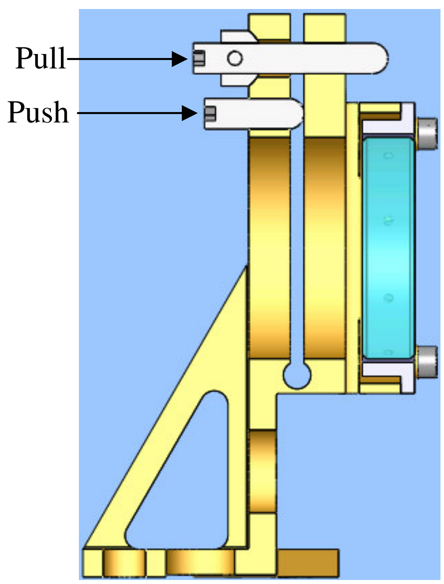

Figure 4: Tip-Tilt Mount Assembly Section View

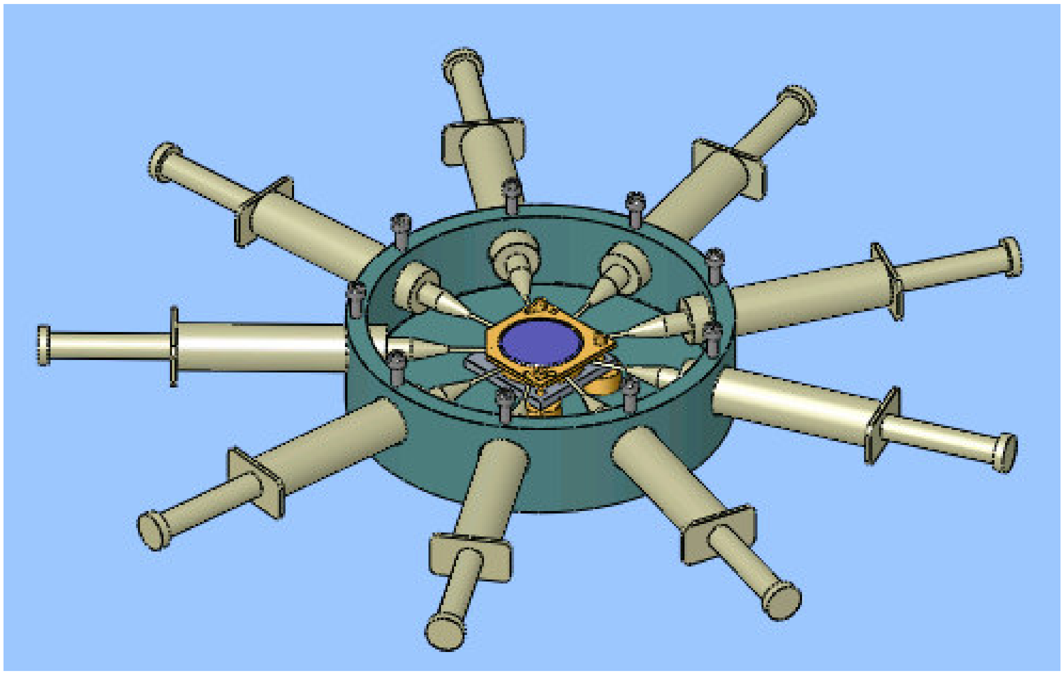

Figure 5: Optic to Bezel Bonding Set-Up

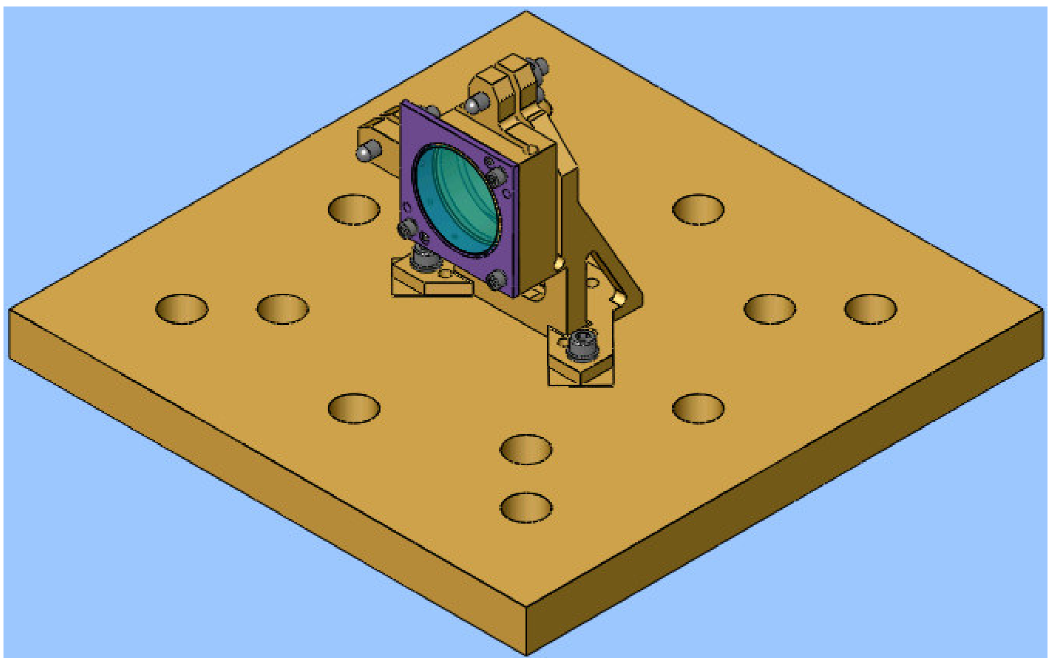

Figure 6: Tip-Tilt Mount Assembly Test Set-Up