Bradley Kingsley Portfolio

Projects: 2022-2023 (selected)

Professional:

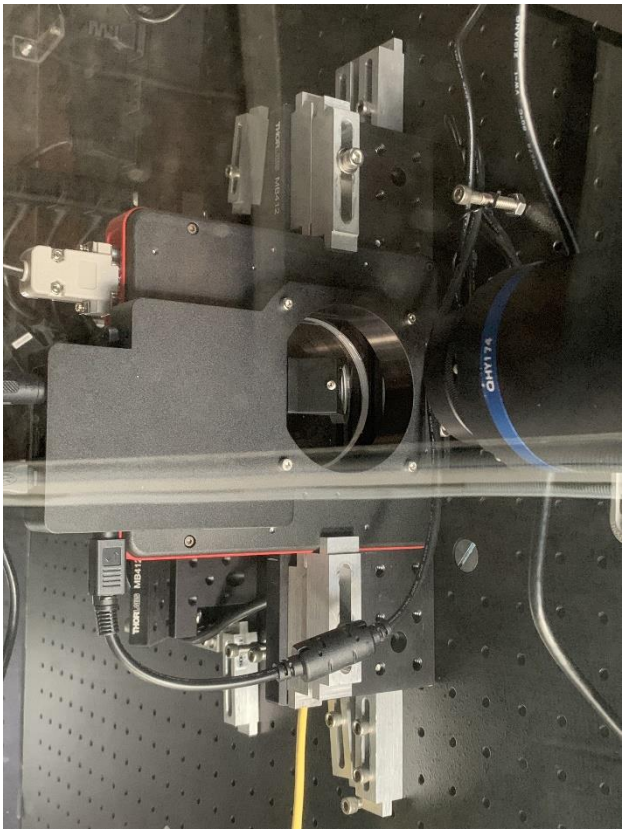
Vacuum Plug

This is an 8.000” vacuum plug which was designed, manufactured, and installed for use on the array. The standard vacuum plug used in this position is a solid 1” thick aluminum disk, these have been difficult to install and difficult to seal. This design improves installation by having a center pull handle, helps seal better due to a 2” thickness, and the design has excess material removed to reduce weight.

Optics Slide Light Sheild

This part was a light shield for use on a ELL20K ThorLabs Optical slide, the design uses 3D printing to enable complex geometry to block a LED light shining from the circuit board. The LED indicator light disrupted the optical path; thus, a cover was designed to minimize light pollution. The design was 3D printed and had a friction fit to the circuit board for attachment. This slide was used on a Planewave 1m telescope for a tip/tilt adaptive optics system.

Pick-Off Camera Beam Splitter Mount



The design shown is a mount for a 70/30 beam splitter to be inserted into a pickoff camera. The design incorporates off-axis to on-axis picking, direct fit part, and 3D printing. The original SBIG StarChaser utilized an off-axis mirror to redirect a portion of light into a camera, it was desired to pick on-center with a beam splitter, with minimal light loss due to mount size. The mount uses a 70/30 beam splitter held in a ring by 3-point mounting (Yoder) and an adjustable nylon tip set screw. The mount fit into the original SBIG mounting position and performed properly in use.

1 Meter Integration Concrete

The concrete shown for use in the 1-meter integration project consisted of two 4ft x 4ft x 10in pads and two 2ft x 2ft x 10in pads. The design, fill material, surveying, framing, concrete work, and position verification was completed as an individual project. Assistance was required and organized to accommodate the project time scale. The positioning of the pads was critical, requiring additional verification. The concrete poured has been cured and used for proof of concept of the 1-meter project.

Inner Room Periscope Development

The photo shown is the machining process used to ensure a flat surface, within required tolerance, was achieved for a periscope tube being mounted on the machined surface. The bottom of the rectangular tube is being used to mount on an optics bench, allowing mirror mounts to be placed on the tubing, and a periscope to be made. The bottom mounting surface of the tube required a tight perpendicular tolerance, the on-site mill was not easily capable of completing this process. The tubing was mounted on the lathe cross-slide, clamped with 3 clamps, and indicated to be parallel to the lathe ways. A fly cutter was used to take a few thousandths of an inch off per swing, this process was able to create the perpendicularity required for this design. The ‘mini periscopes’ are currently in use at NPOI.

Actuation of non-actuated Mirror Mounts

The photo shown is a NewPort Optics mount modified to use piezoelectric actuators for the angle adjustments and slide adjustment. The original mounts were thumb screws for actuation, the thumb screws did not have the fine adjustability required. Pico motors were used to allow remote actuation without direct human contact. The mirror mount was disassembled and modified using a milling machine with an end mill and counter-bore drill set. The modification drawing created ensured the hex nut would fit with clearance for a nut driver and ensure motor rotations did not interfere with other objects/beams. The end mill was used to break the anodize surface and complete bulk cutting. The counter-bore drill was used to ensure a flat surface for the motor to mount to. A surface which is not flat will cause rocking of the motor, this will cause hysteresis drift within the mounting surfaces, not allowed in this application. 6 total mounts were modified for use in the beam combiner systems.

Gimbal Mount Modification

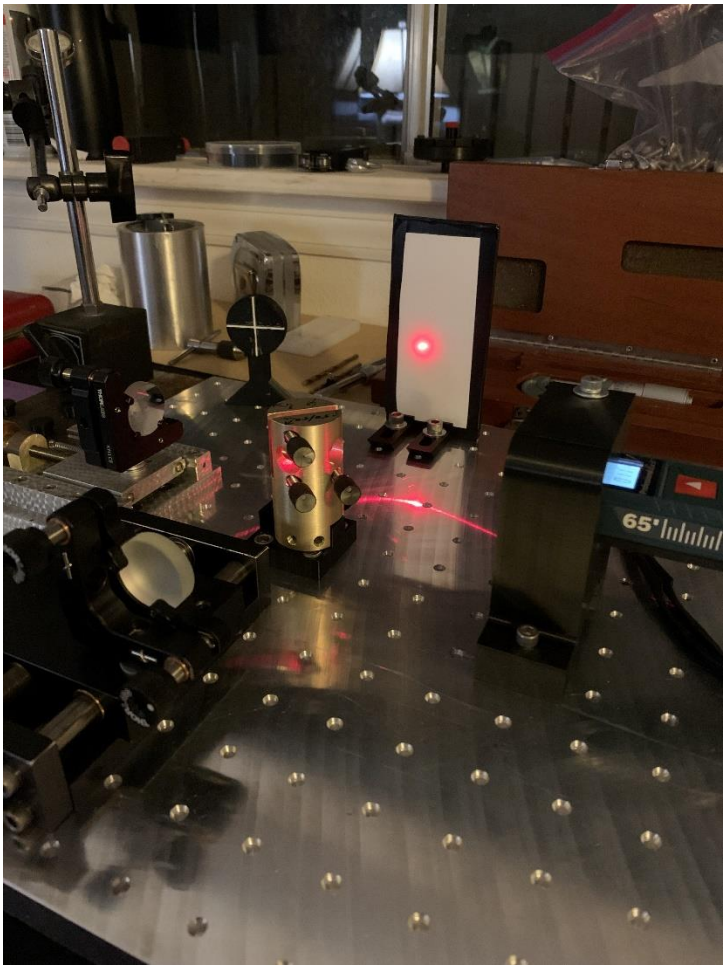
The Newport optics 8-inch gimbal mount was modified to receive motor mics for actuating the elevation and azimuth axis of the mount. The photo shows a gimbal mount with a modified azimuth adjustment, being adjusted by a DC motor mic. The modifications required were a new push tab, new push bar, modified Barrell, and additional spacer ring. The push tab was modified to accept a ball bearing, the ball bearing will contact a hardened flat on the motor mic, this allows for no issues with angle change as the mount rotates radially. The ball bearing is epoxied into a counterbore, ensuring the epoxy does not interfere with the contact point. A new push bar was made to ensure the full range of motion was allowed, and the motor mic range was not restricted. The barrel was modified to fit a ½-40 thread, which the motor mic is threaded. The spacer ring was added to correct the length difference between the old manual adjuster and motor mic inserted length. The result of this project was a 2 actuated axis mirror mount able to be adjusted using DC power. Additionally, the mirror cells were thermally clearanced to ensure safe use over the NPOI site temperature range. The mirror mounts are currently sitting on the array, used in the 1-meter project testing.

Individual:

Rear Axle Rebuild and Upgrade

The rebuild of a General Motors truck 12-Bolt rear end was completed after the original gearing and traction device was no longer able to provide reliable service as needed. The original parts were worn and severely pitted on the surface. A new ring, pinion, bearings, and carrier were installed and patterned. The axle was removed from the truck, and the axle disassembled to allow for cleaning. The original parts showed wear on the clutch surfaces (limited slip differential) and pitting on the hardened ring gear mating surface. The ring gear was bolted and torqued to the carrier and the pattern and backlash were fine adjusted to obtain a proper wear pattern, using shims and iteration. The pinion preload was then measured and adjusted to the desired value in in-lbs. Once the pattern, backlash, and preload were complete the axle was reassembled into the truck and filled with oil. The truck was run on jackstands to do a pre-break-in of the gears, then the proper steps were followed to begin the meshing break-in. The results were a fully rebuilt rear axle that will be used as a daily driver.

Desk-Top Interferometer Study



The desk-top interferometry study was started due to a large interest in general interferometry. A standard Michalson Interferometer is being developed from the bottom up. The current status of the study is a laser can be split and reflected off mirrors to return to a common location (the image card). The current design is a self-made 5/8” thick optical breadboard, 2 ThorLabs KM1CE mounts, 2 linear slides, a 50/50 beam splitter, and a distance measuring laser on 3D printed mount. This is a cheap setup to ensure my beam paths can be aligned, the spacing is available on the breadboard, and my optical alignment procedure is correct. Continuing the study on Michalson Interferometers will continue until fringes can be found repeatably and the theory is fully comprehended.

1977 Chevrolet K10 Scottsdale

The 1977 Chevrolet K10 was fully rebuilt from the ground up from 2016 to current, being the whole truck was disassembled and reassembled after restoration. The truck has been used as a daily driver since 2016. The restoration incudes new floors, undercoating, body work, paint work, engine rebuild, transmission rebuild, transfer case rebuild, rear axle rebuild, custom hydraulic clutch system, custom interior (dash/seats/console), suspension modification/upgrades, steering system upgrade, typical repairs/maintenance, etc. The truck restoration has been beneficial in learning mechanical systems, assembling large quantities of parts for dynamic function, hand on work, and diagnostic processes.