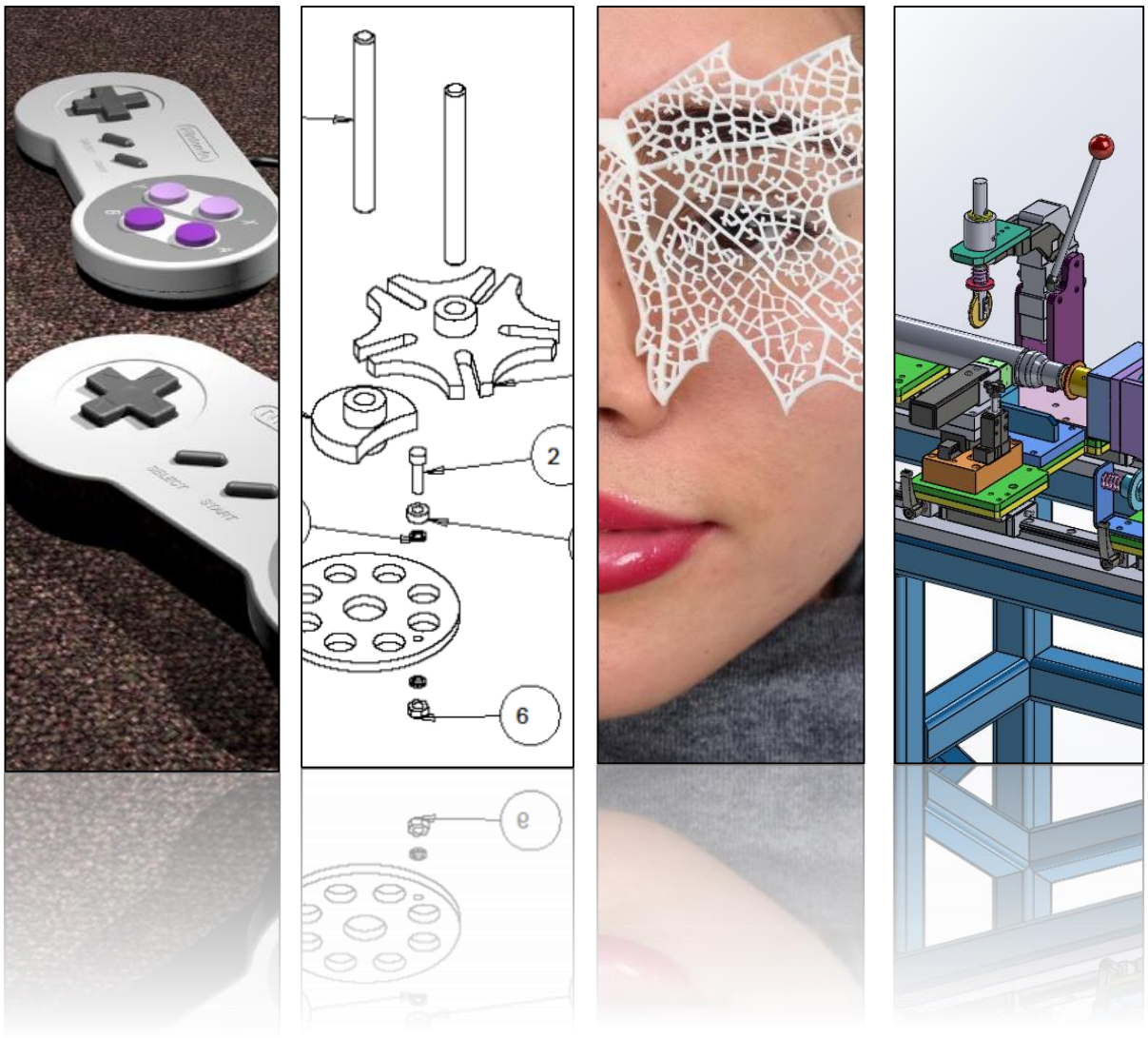
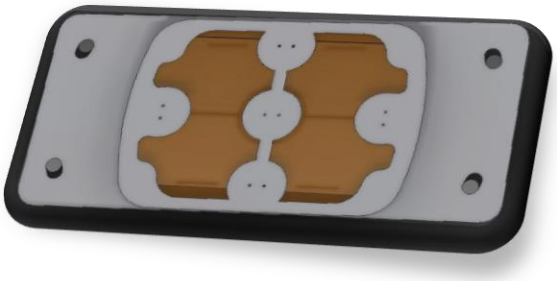
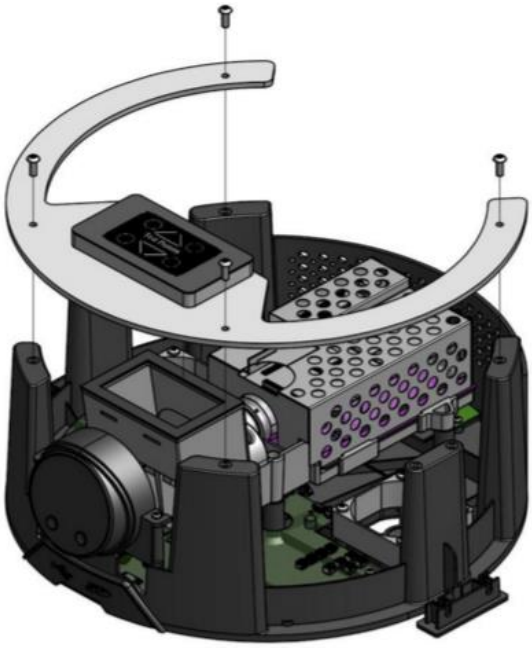
2016



Dan Porter

PROFESSIONAL PORTFOLIO





PROJECTOR CALIBRATION

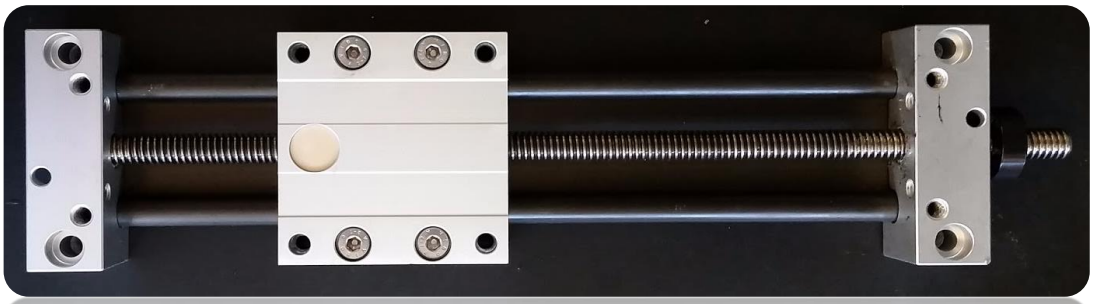
Autodesk

When first arriving to the Ember team, the original procedure for installation of the projector was a visual guide to help the operators align the projectors by eye. As the calibration of the projector is the most crucial component of print accuracy, a new quantifiable procedure was required.

With budgetary restrictions, a high precision optical sensor was not an option. In order to meet the cost restrictions, a custom system was designed and fabricated at Pier 9 using laser cutters, 3D printers, and an Arduino Uno. The key component to this assembly was the low cost photo resistors used to detect the calibration image from the projector.

The calibration window is comprised of a base acrylic piece with thin slots calibrated to the correct scale of the projected image, the second and third pieces then seal the photo resistors away from environmental light which the resistors are sensitive to.

The Arduino box has two sets of displayed information. The first display with the scale represents the alignment of the window the projected image. The operator can get close to alignment with the orange acrylic window, but the lights ensure a precise alignment with the projected image which can be slightly rotated. Once both blue lights are lit, the window is fastened in place and the operator begins to scale the image until the green light of the traffic light is lit.



0.25 0.5 0.75 1.00

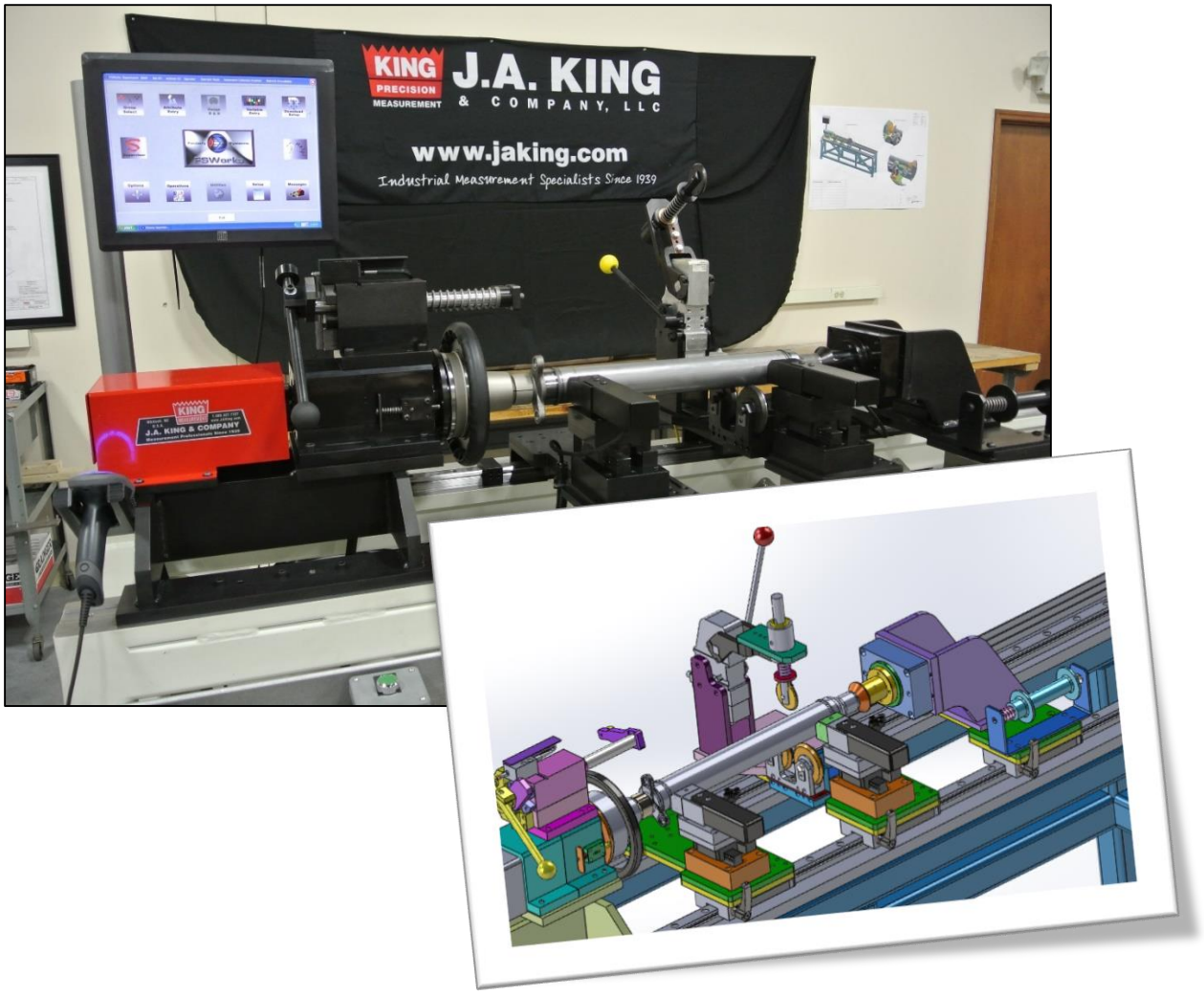
lb-in

LINEAR DRIVE NOISE

Autodesk

One of the many linear drive issues that arose on the Ember 3D printer was the wavy effect caused on prints. Through testing, the source of the error was determined to originate from the set screws which clamp the Z-axis carriage to the linear rail. If the set screws were too loose, a wave pattern appeared on the prints, however if the screws were too tight the friction of the carriage exceeded the max torque of the stepper motor and caused a grinding noise from the missed steps.

Through extensive rounds of testing, an ideal torque value of 0.5 lb-in was determined to create the smoothest print surface possible without the motor skipping steps. Through observation of the print cycle, it was also determined that the stepper motor was prone to skip steps above travel speeds of 4500 microns/sec. With the rapid travels lowered to 3500 microns/sec, a higher torque of 0.75 lb-in could be used to create an even smoother surface.

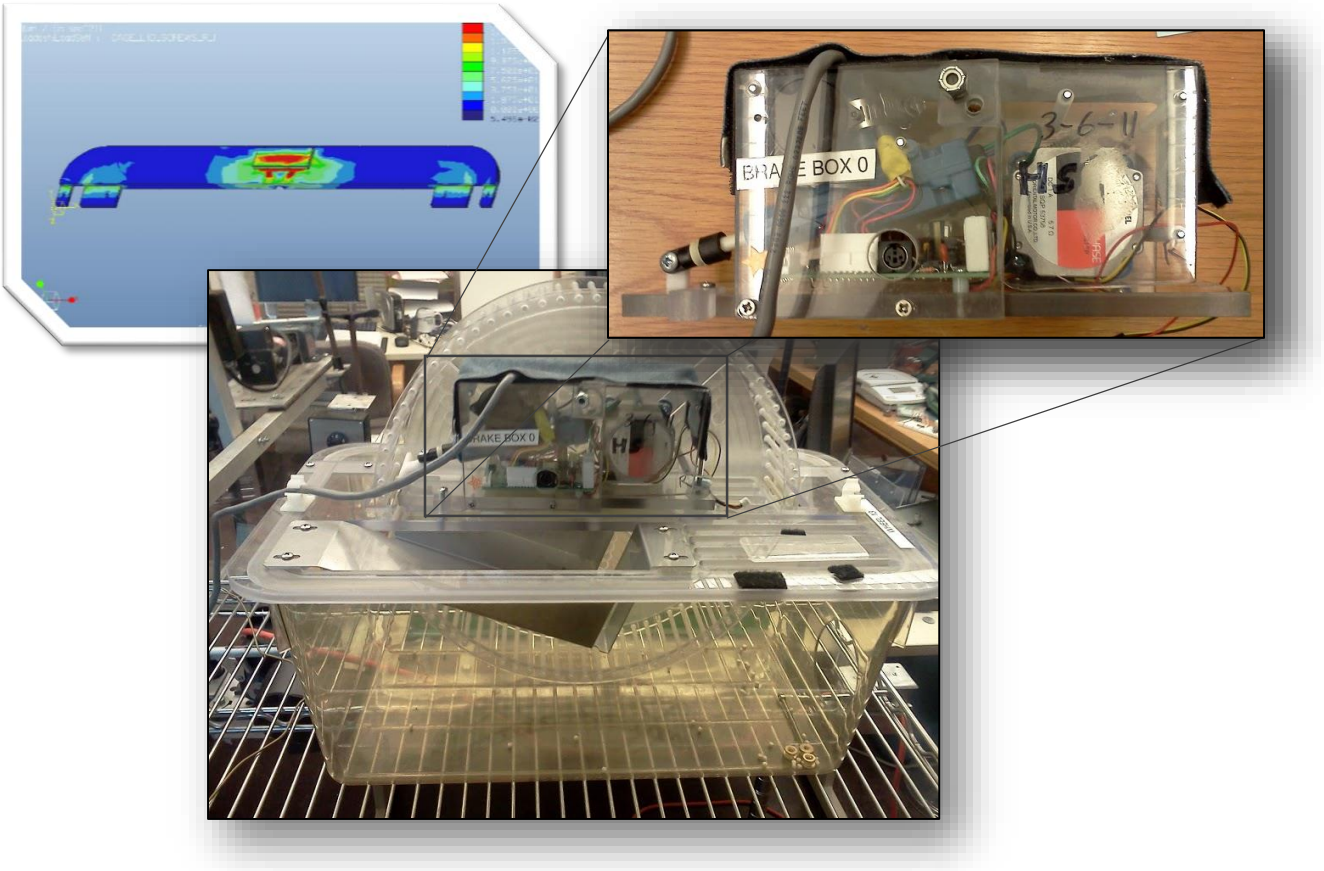


DRIVE SHAFT GAUGE

J.A. King & Co.

A drive shaft manufacturing company required a reliable method of measuring the run-out, concentricity, and length of their drive shafts after friction welding the two joints to the main shaft body. To achieve this, a robust gauge was designed in SolidWorks, toleranced for manufacturing, machined by in-house and contract manufacturers, and finally calibrated to ±0.02 mm.

With interchangeable attachments for each end of the shaft, the gauge can adapt to future drive shaft configurations and be easily repaired. Integrated with the customer's preferred testing software, the gauge is easily operated with live feedback and data logging.



AUTOMATED RUNNING WHEEL

Cancer Prevention Lab

For a past exercise study in which lab rats are under a strict exercise schedule, a system with mechanical components controlled by the time of day was created with PIC microcontrollers. Although functional, the system was unreliable mechanically and electronically.

The first problem to address was the universal failure of an acrylic component on the cage lid. The piece was designed too thin for the given load and it began to fail on each cage. In order to repair the cage quickly, a strengthening patch was designed in SolidWorks, put through FEA, and attached to all unbroken cage lids. The patch proved effective as no other lids failed.

The second improvement was in the code for the PIC microcontroller. The mechatronic system frequently had errors with time deviation and IR sensor false triggers. Through a cleanup of the PIC BASIC code and intensive testing with live rats, the system was improved to only deviate three minutes in one week and have only one recorded false trigger a day among all 24 cages.