

TECHNICAL SPECIFICATIONS

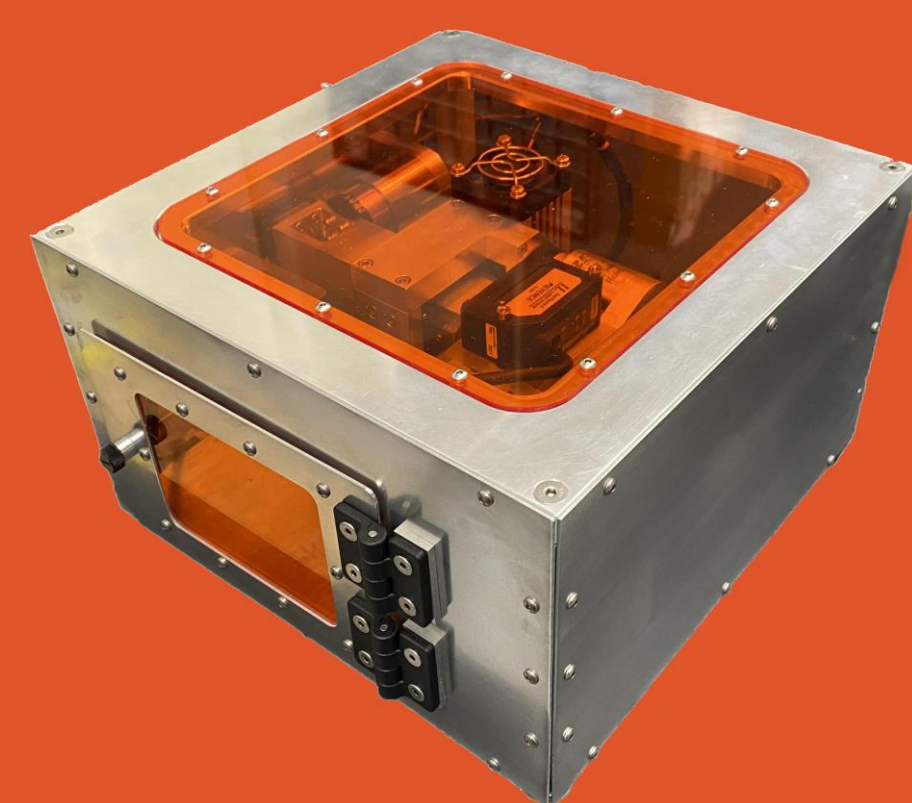
- Work envelope: 100 mm² (10 mm × 10 mm)
- 5 W diode laser head
- Position resolution: 1 μm
- Maximum axis acceleration: > 1 g
- Mass: 5.5 kg

ADDITIONAL FEATURES

- Full safety enclosure
- 3 laser-safe viewing windows
- 2 user access doors
- External electrical hardware enclosure
- 4 THK precision linear guides
- 3 BLI voice coil actuators (VCAs)
- 3 Keyence analog laser displacement sensors
- Closed-loop motion control via dSPACE

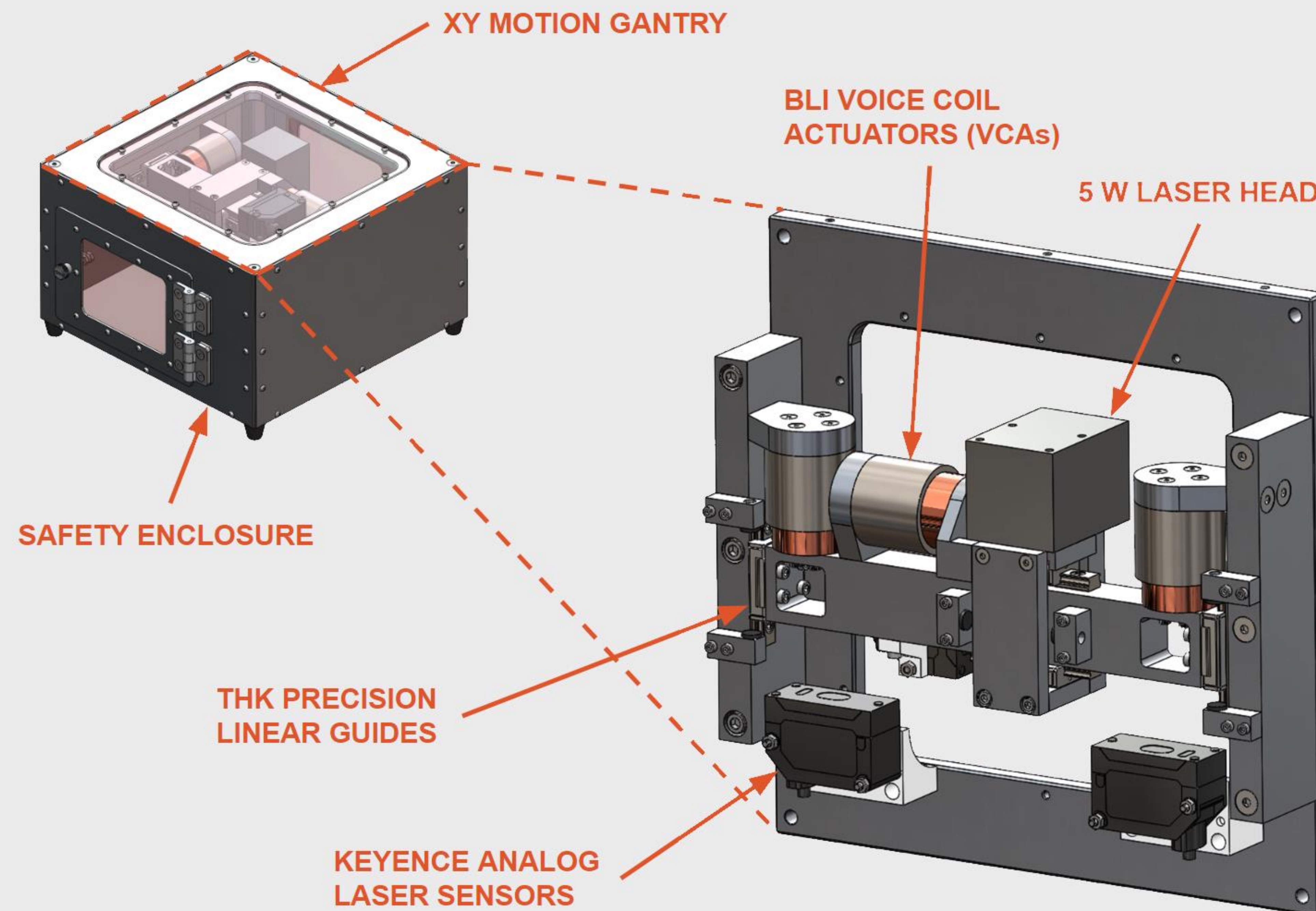
FUTURE POTENTIAL

- Versatility in laser head accommodation
- Repurposed to position a workpiece fixture in lieu of a laser head
- Repurposed as complimentary fine position correction stage



DESIGN OF A SMALL-SCALE LASER CUTTER/ENGRAVING STAGE

Cutting and engraving workpieces with a diode laser at micron-level precision.

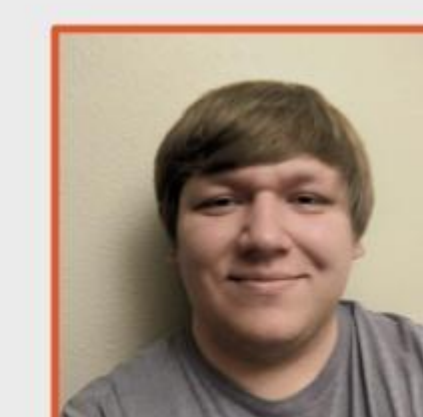


PROJECT OVERVIEW

A fully-enclosed two-axis motion stage was designed from scratch to achieve micron-level precision in laser cutting and engraving operations. The motion stage, which carries a 5 W diode laser head, utilizes three voice coil actuators (VCAs) for motion control and four precision linear guides for motion guidance.

Closed-loop control software designed through dSPACE and MATLAB Simulink provides accurate motion control for the stage by adjusting the power output to the VCAs based on input from three analog laser displacement sensors.

TEAM MEMBERS



Evan Campbell
Logistics Manager



Clinton Pedersen
Manufacturing Coordinator



Nathan Ross
Mechanical Coordinator

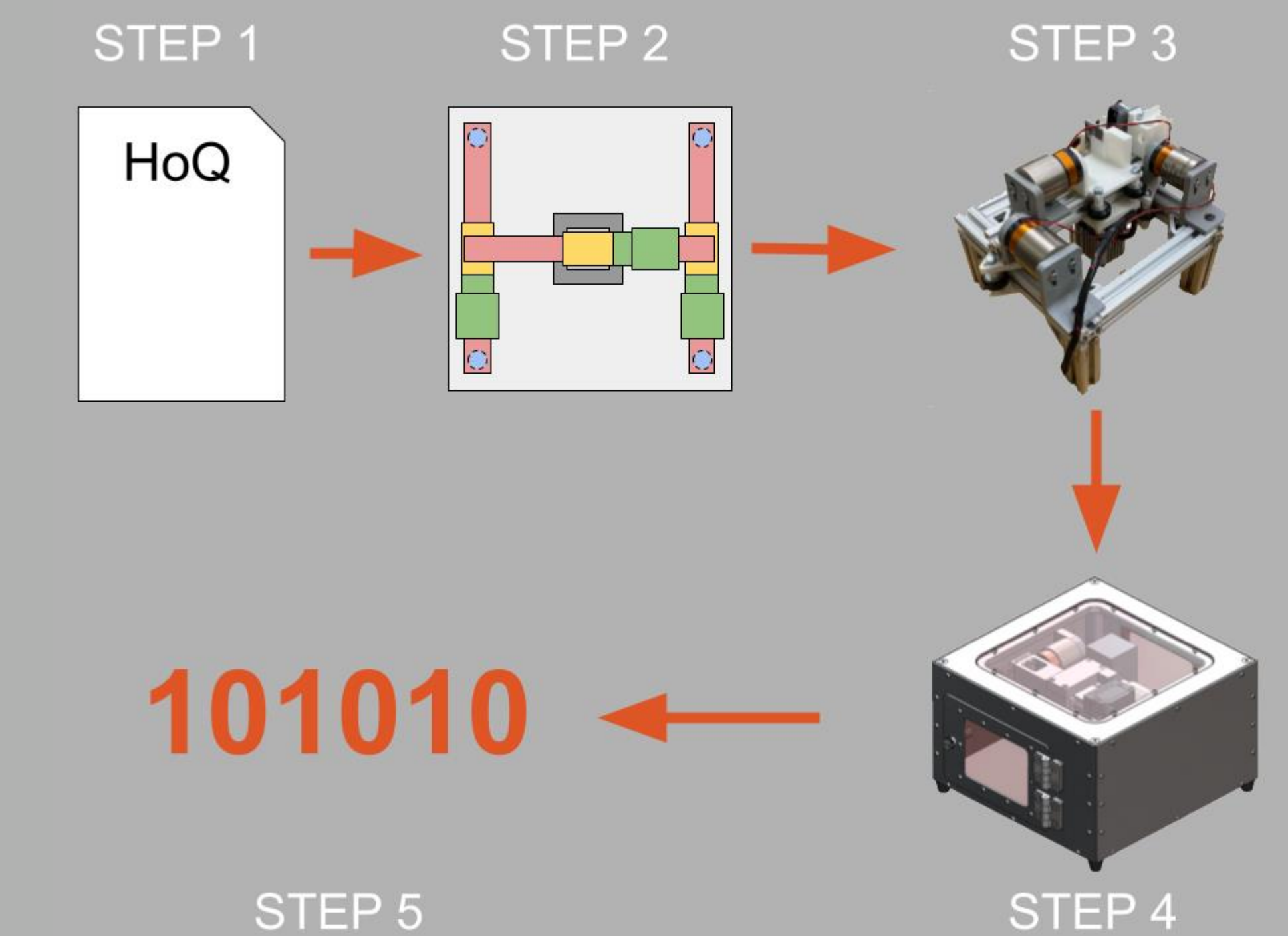


Joseph Tinnell
Project Manager



Samuel Wurtz
Software Coordinator

DESIGN PROCESS



1. Product Requirements – Developed a House of Quality (HoQ) to document customer's requirements.
2. Concept Development – Evaluated various design concepts against HoQ.
3. Prototype – Created a physical prototype to assess the viability of the chosen design concept.
4. Design Refinement – Developed a more sophisticated design which met all customer requirements.
5. Programming – Created closed-loop control software for proper machine function.

VOICE COIL ACTUATORS – A CLOSER LOOK

- Named after one of its first historical uses to vibrate the paper cone of a loudspeaker
- Generate an axial force proportional to supplied current
- Infinitely precise (theoretically)

