Automated Radiographic Panel Positioner

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Background & Applications

Explosive Ordnance Disposal (EOD) technicians and civilian bomb technicians operate in high-risk, time-sensitive environments where safety and efficiency are critical. This system enhances radiographic imaging to better protect operators and support mission success by:

- Reducing human exposure in bomb defusal environments.
- Enabling remote movement of the radiographic panel within a 47 square foot zone.
- Directly supporting LANL's national security mission and public safety.

Design Overview

- Consists of 3 main subassemblies: Base, Joint, and Panel Mount.
- Two rotating arms provide 2 degrees of freedom, enabling smooth motion across the imaging area.
- Designed for rapid setup, portability, and precise positioning.

Panel Mount Subassembly

Panel Leveling Motor

Limit Switch

Accelerometer & IMU Housing

Joint Subassembly

Crossed Roller Bearing

100:1 Harmonic Drive Gearbox

6061 Aluminum Arms

ScanSilc Digital X-Ray Panel

Weather-Resistant Electrical Boxes

Steel Base Frame

Software Development

User Interface
- Input panel destination (manual or sequence)
- Display positioner status (Ready, Moving, Error)
- Confirm/cancel image and select next

Motion Planning
- Calculates panel position
- Plans smooth movement path
- Sends target angles to motors

Motor Control
- Drives motors to target positions
- Adjusts motion with sensor feedback
- Ensures accurate panel placement

Emergency Logic
- E-stop input override
- Safety abort switch in UI
- Hardware limits

Sensor Feedback
- Encoders → Joint angles
- Limit switches → Angle calibration
- IMU → Panel leveling, Positional feedback

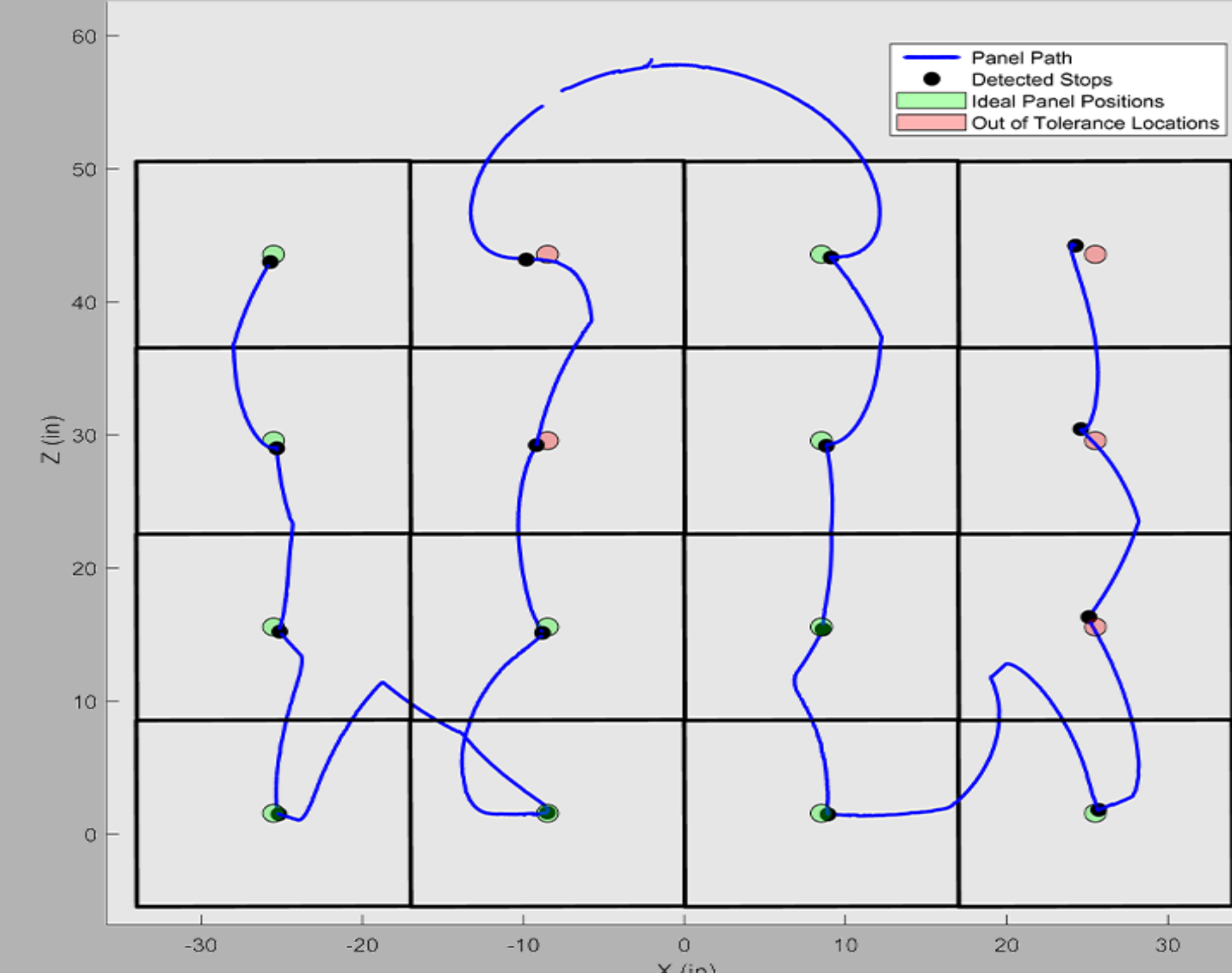## Verification & Validation
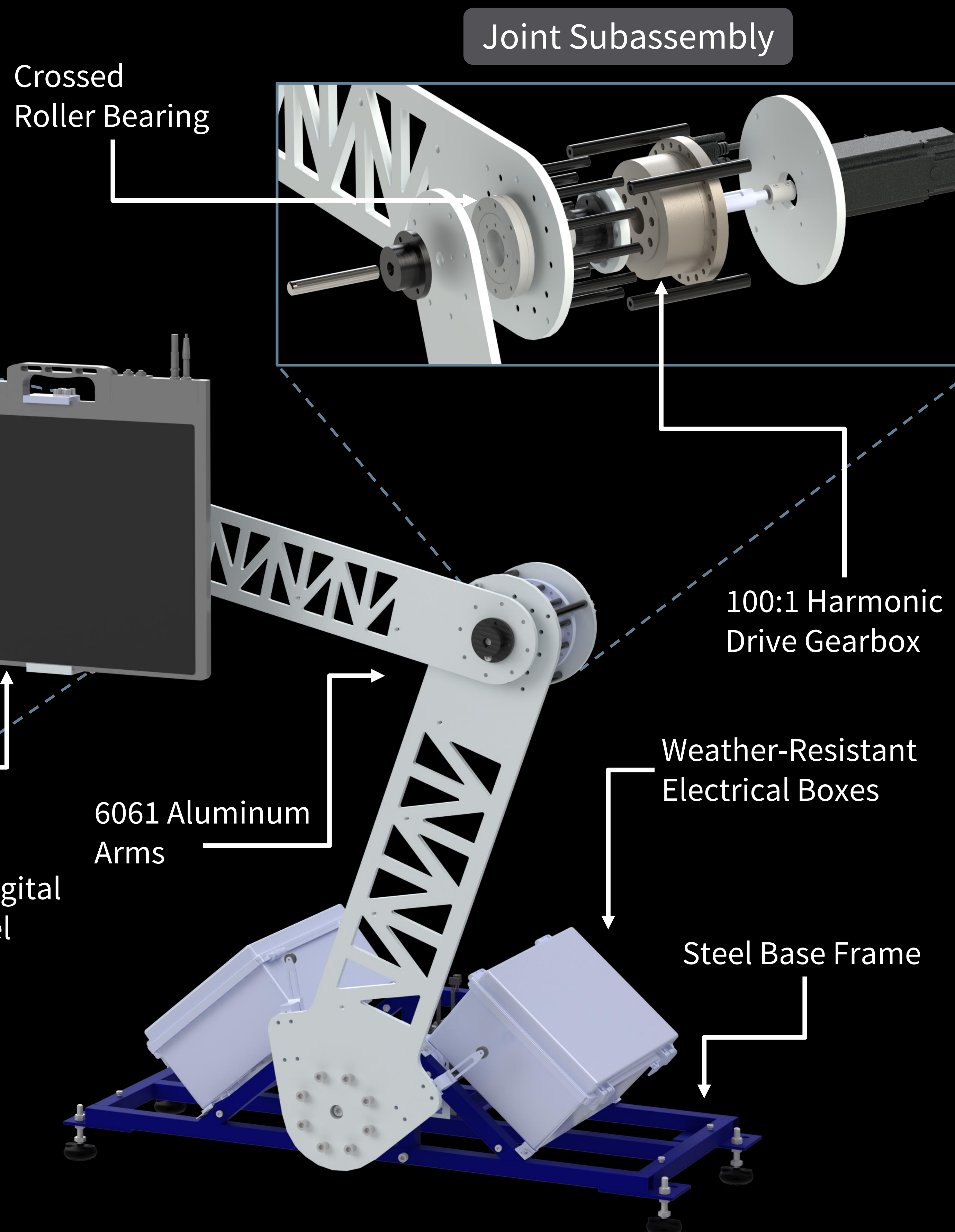
- Full autonomous imaging sequence performed by the panel positioner.
- Actual stops remain within ±0.50" of programmed locations.
- Entire scan sequence is completed in under 3 minutes.
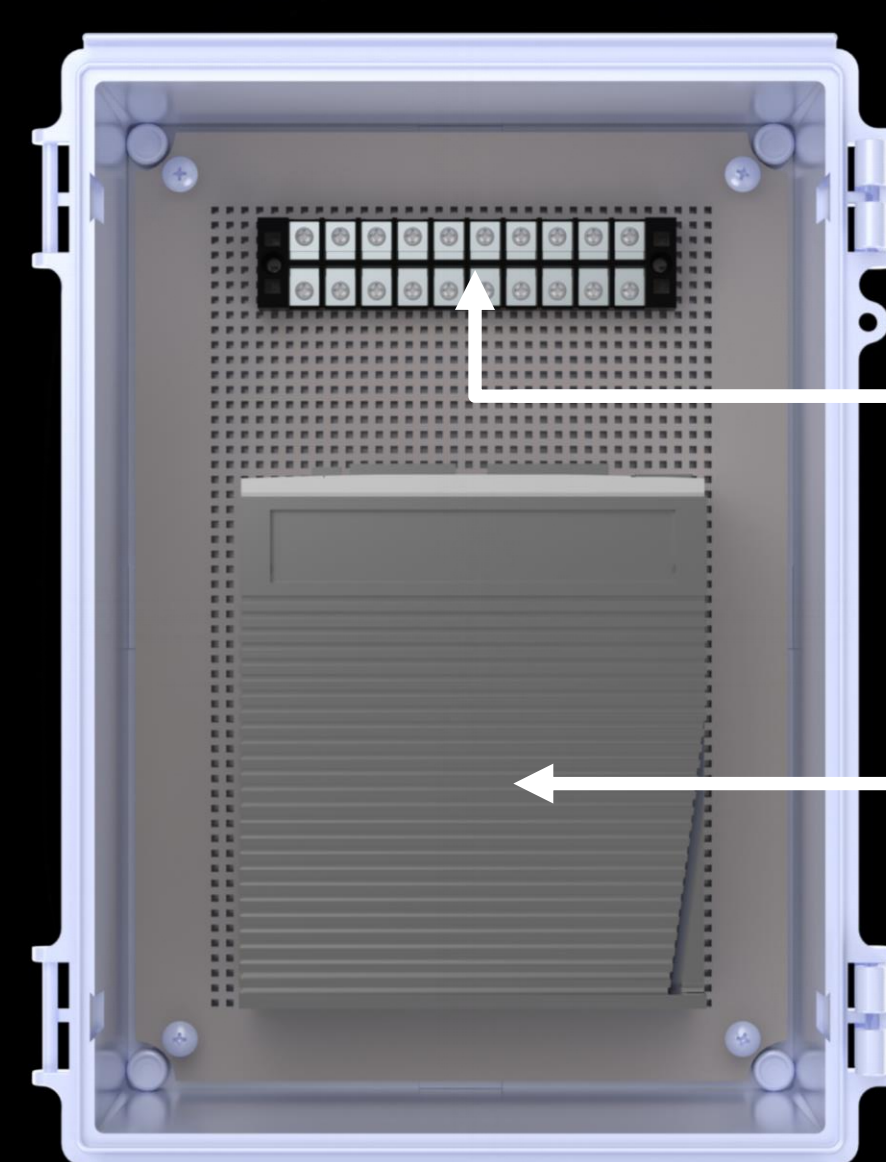
Standard Sequence Positional Accuracy
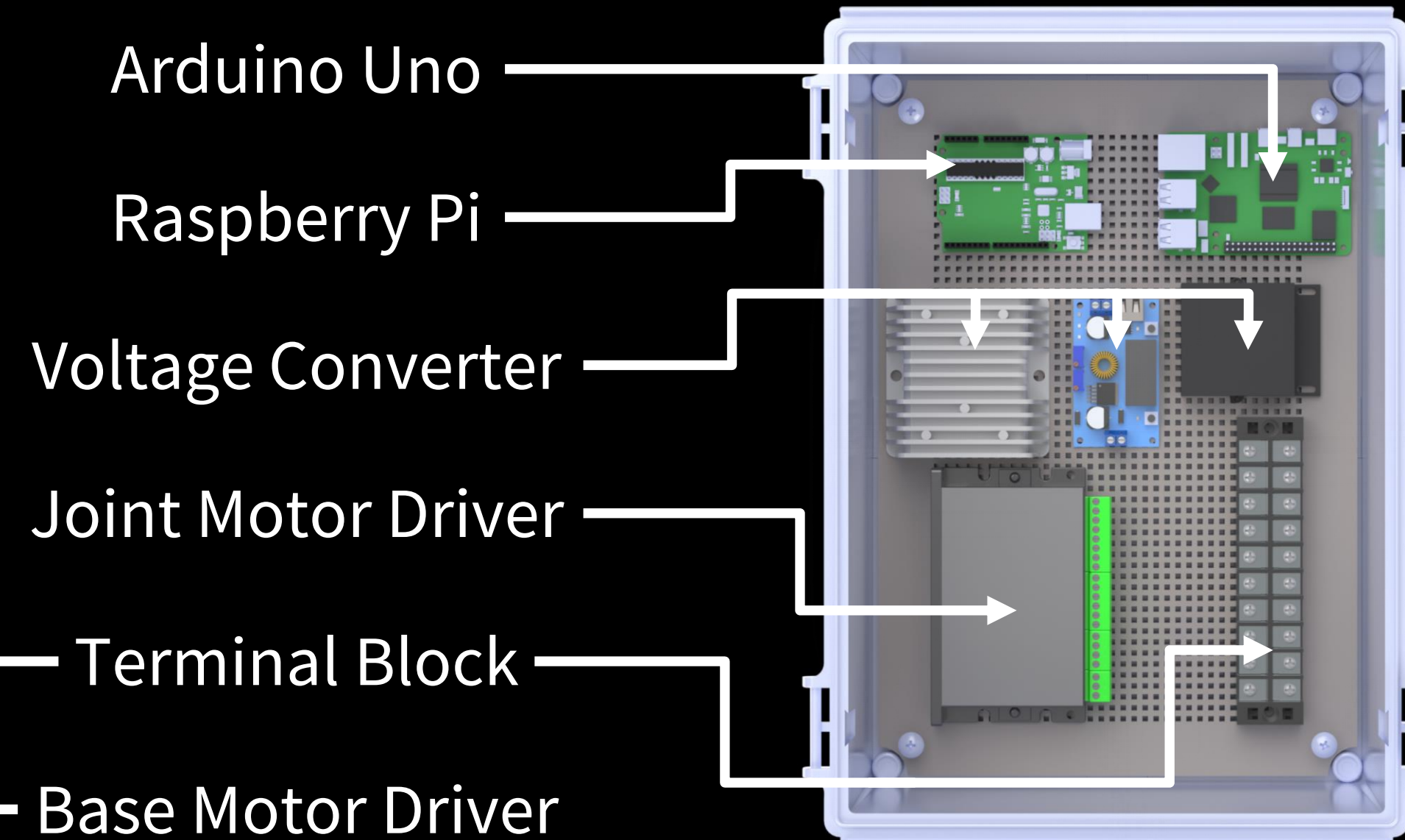

Key Design Requirements

General	Performance	Environmental
☑ Setup in ≤10 minutes (2-person)	☑ 68" x 56" minimum imaging area	☑ Operate on snow, gravel, concrete
☑ Easily lifted by 2 people (NIOSH)	☑ ±0.125" positional accuracy	☑ Withstand 10° incline without tipping
☑ Fit in travel case (40" x 24" x 18")	☑ Position panel in ≤20 seconds	☑ Resistant to light wind loading (10 mph)
☑ Operable by 1 trained user	☑ Panel battery removable in-mount	☑ Weather-resistant electronics housing

High Voltage Box

Low Voltage Box

Arduino Uno

Raspberry Pi

Voltage Converter

Joint Motor Driver

Terminal Block

Base Motor Driver

Next Steps & Impact

Los Alamos National Laboratory identifies strong potential for operational use in counterterrorism and national security applications and is interested in continued development focused on:

- Further reducing system weight for improved field portability.
- Integrating onboard power and panel charging for extended deployment.
- Enhancing software integration with existing imaging software.