Long Distance Laser Reflection for Methane Emission Monitoring

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Overview:

- LongPath uses Nobel Prize winning technology to locate and monitor methane leaks in oil and gas fields
- The monitoring system utilizes **a constellation of ~30 retroreflector (mirror)** towers that surround a central node
- Current tower installation process is costly and logistically challenging
- This projects aims to reduce installation complexity by eliminating ground penetration and associated specialized equipment

Current Installation Procedure:

- Hydrovac (liquifies soil and removes it using a vacuum) creates a mounting hole
- A 5-foot section of standard steel pipe with a pipe flange is fixed in the hole with concrete
- The tilt-pole is mounted to this exposed flange using another pipe flange with a telehandler (forklift with an extendable arm)

Key Design Specifications:

The new tower design maintains safety and performance without ground penetration:

- ✓ Structural integrity in **80 MPH winds** (150 lbf)
- ✓ <3" of deflection in 20 MPH winds for operability
- ✓ No abrasion risk to humans or livestock
- ✓ Service requires basic tool kit
- ✓ Employ widely available materials and equipment
- ✓ **Factor of Safety of 3**
- ✓ Intuitive installation guide
- ✓ Estimated installation time per pole of <1 hr

The New Retroreflector Tower:

LongPath's Tilt-pole and Retroreflector:

- Accommodates existing tilt-pole design and retroreflector mounting

New Custom Base:

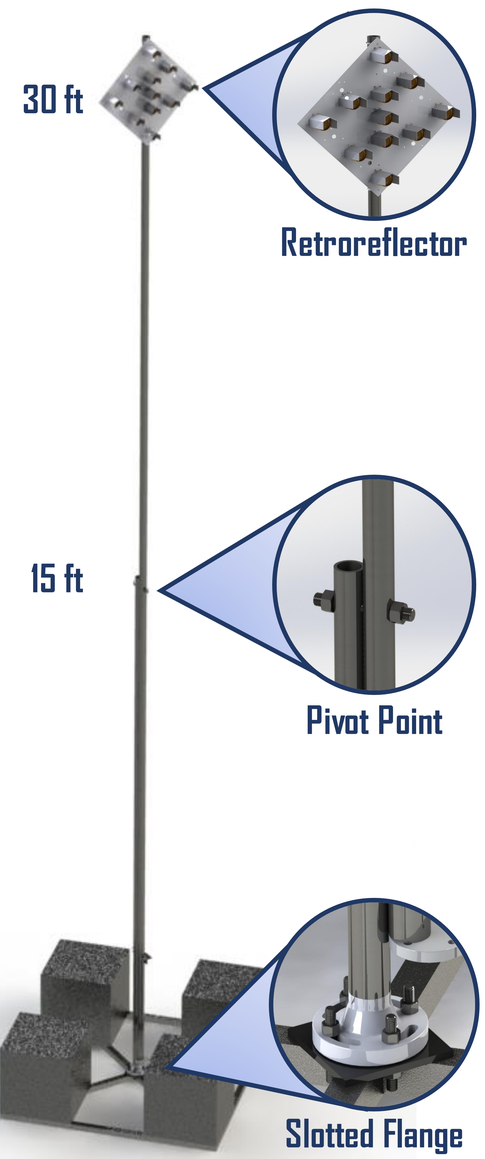
- 6' x 6' frame made of cut and welded 2"x2" square tubing with interior "x-shape" for strength and connection plate mounting
- **Custom** connection plate designed to fit with historic LongPath tilt-poles and new slotted flange

Slotted Flange:

- Standard Grainger pipe flange
- **Innovated: 4 milled slots** for precise alignment, rapid installation, and easier line of sight validation

Bin Blocks:

- **Standard concrete waste product**
- Each 2'x2'x2' block weighs 1,200 lbs

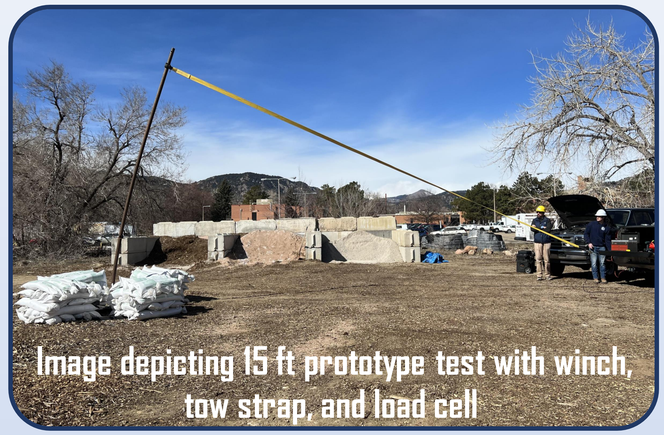


Outcomes:

- FEA and testing show new design meets all specifications
- Constellation install time decreased from 7 business days to 30 hours (estimated)
- Labor requirement decreased from 10 specialists to 3 LongPath employees
- Total Price per pole: $1,360

Future Work:

- Cost analysis and high-volume vendor selection
- Full scale testing



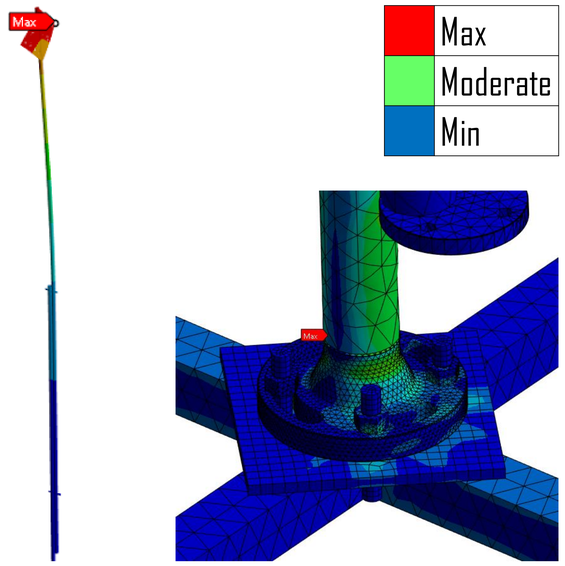
Testing/Analysis:

Set-up:

- Tested 15 ft, scaled prototype
- 20 sandbags simulated a bin block
- Connected tow strap to a winch and load cell for measurable and continuous force

Results:

- Specification Verification: 260 lbf at 14 feet (simulates 80 MPH wind)
- Max Test Force: 330 lbf



FEA demonstrates design meets 3" deflection requirement and factor of safety of 3 for strength

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