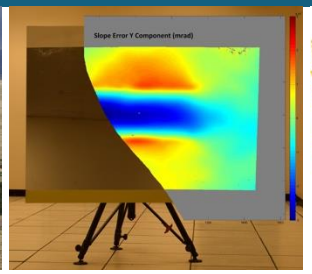
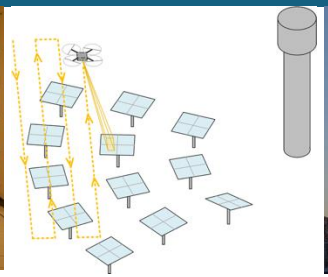
Domestic Heliostat Component Supply Chain

Current Snapshot and Supplier Interviews





Ryan Flynn, Dainen Sands, David Griffin

August 18th, 2026

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

SAND2026-25289PE

Overview

- Summary
- Supplier Table
- Supplier Information
- Bottlenecks and Next Steps

Concentrating Solar Optics Laboratory (CSOL):

Felicia Brimigion
Randy Brost
Nikhet Chowdhury
Robert Crandell
Anthony Evans
Ryan Flynn
Luis Garcia Maldonado
Kevin Good
Margaret Gordon
David Griffin
Alan Hsieh
Robert Keene
Tristan Larkin
Dimitri Madden
Tyler Peters
Nick Phelps
Dainen Sands
Jeff Sharpe
Aaron Spieles
NSTTF Team

and Kenneth Armijo

We thank:

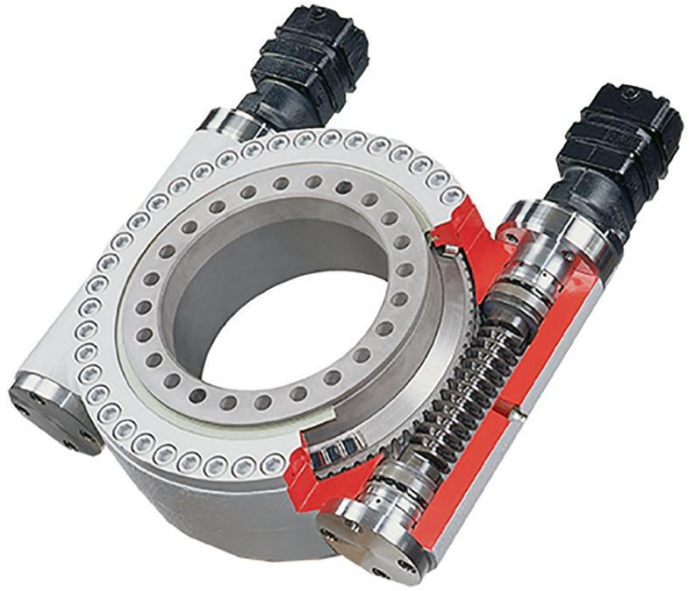
U.S. DEPARTMENT of ENERGY
Office of Critical Minerals and Energy Innovation

Sandia National Laboratories
LDRD LABORATORY DIRECTED RESEARCH & DEVELOPMENT

HelioCon Task 6: Components and Controls

Supply Chain Analysis – A current snapshot of the domestic American supply chain

- Supply chain report currently in development
- Focused on specialized components instead of bulk materials
  - Slew Drives (Sandia National Labs)
  - Linear Actuators (National Lab of the Rockies)
- Identify areas for stakeholder consideration to support domestic manufacturing
- Summary:
  - Very small footprint for specialized components
  - Cost driven by materials, infrastructure, lack of near-term steady demand
  - Immediate cost reductions will primarily be design-related
  - Development encouraged by manufacturing proximity, pivot capabilities of existing manufacturing, government subsidies, and continued development of expertise, repeatability and networks



IMO USA Corp., "Introduction to Slew Drives."
Source: https://www.imousacorp.com/2019/08/13/introduction-slew-drives/

Collected Data from Suppliers

Company	Product Relevant to CSP	Location of Headquarters	Location of Manufacturing	Product Relevance to CSP	Customization	Scale	Lead time	Notes	Supply Chain risks
Company A	Slew Drives/Worm Drives	USA	Slew drivees: China Worm drives: USA						
Company B	Slew Drives	Germany	Gemany	Investigated heliostat application so they have designs and drawings	Will make custom drives including zero backlash options and what ever is needed	High volumes are possible but are you willing to pay for it.	6-9 months for scale up.	Are investigating assembly in the US to bypass tarrifs.	
Company C	Slew Drives	USA	Manufactures gears in US. Drives and bearings are made in China and Germany.	Currently investigating slew drives for PV. Only have zerobacklash options for spur gear slewing	Has a US shop for bearing and drive modification	With an order greater than 20,000 slew drive they would start a dedicated line.	Estimated a year for expanding production to meet demand.	Tarriffs continue to affect slew drive made in china. Investigating assembling in the US to bypass them.	
Company D	Planetary, harmonic, cycloidal Drives	USA	USA	Have done work for Satellite antennas and PV. They find arid climates easier to work with	They started off by customizing gear boxes and continue to do so.	Have handled orders exceeding 30,000 units in a year.	1-2 week design time followed by cnc machine programing.	They can produce slew drive housing if was to be paired with their gear boxes. Gears for these slewdrives would be aquired elsewhere	No problems with raw materials. Out of standard bearings or seals add 10 weeks to production.
Company E	Rack and pinon systems	USA	USA	No direct. Have a rotary indexer just like the Solar dynamics Sun Ring heliostat, however they haven't partnered with them	"Heavily customizable industry to match our needed accuracy range"	They currently make less than 30,000 a year but are not at capacity. "Scale Can be Purchased"		The rotary indexer is strikeingly similar to slew drives	Purchase materials from North America. They haven't been affected by tarrifs.
Company F	Section bearings	USA	USA	They have made lots of antennas.		They domesitcally manufacture 100,000 bearings yearly (of all diameters). They could ramp up to meet demand.	Estimated 12 to 20 weeks to ramp up production to meet demand. Deciding factor is diameter.	Manufactures large volumes of thin section bearings domestically, with small quantities (50 per year) of slew drives for military contracts	There isn't enough domestic demand for slewing rings. Domestic material costs of slewing rings cost more than a finished drive from china

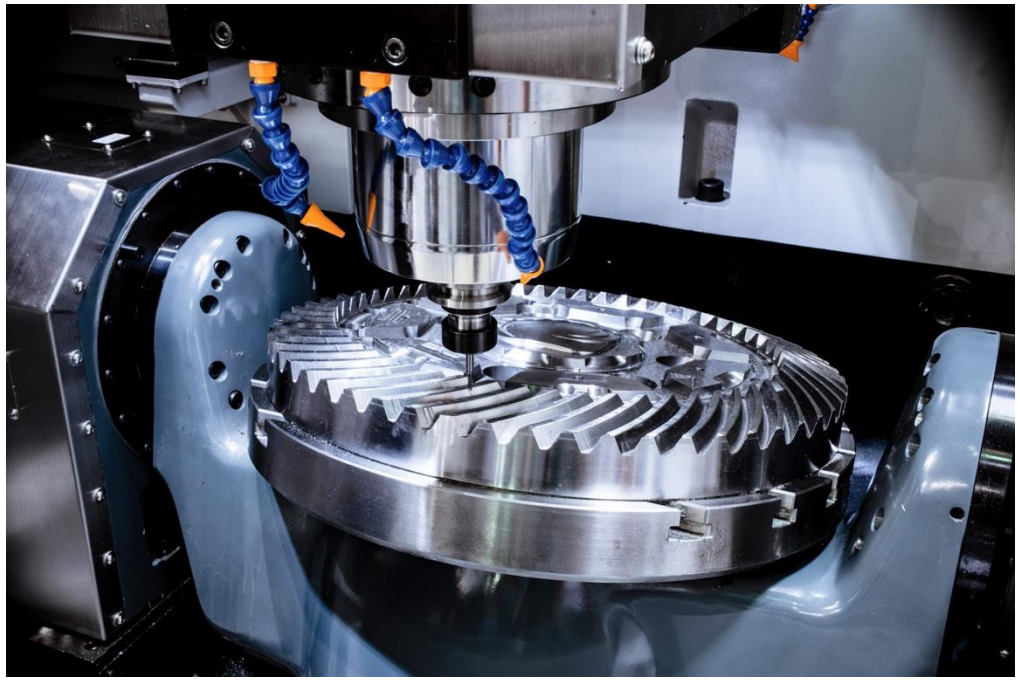
Supplier Information

Supplier Trends:

- When asked how high they could jump, the response was always, how high do you need us to jump
  - Specifics are needed to get specifics
  - Companies commonly estimated that it would take less than a year to scale up to meet demand
- USA manufacturing of slew drives is not currently cost competitive
  - "Chinese slew drives 10% as expensive as American slew drives"
  - "…our material costs are higher than a completed slew drive from China would cost"
- Most procured slew drives or slew drive components from Chinese manufactures
- Suppliers that still operate have a long history and thrive from specific applications of their technologies instead of supplying in large quantities

➢ ***Suppliers in other countries still source components from China due to cost***

Bottlenecks and Next Steps



https://www.fastems.com/cnc-machining/

➢ ***Difficult for suppliers to discuss their ability to meet demand without design specifications***

Challenges Cited by Suppliers

Capital expenditures to ramp up are very high

Many sub-components are imported

- Every sub-component supplier not guaranteed to ramp up
- Imported components identified as critical by external parties are at risk for leverage

Custom solutions are the most likely option but require custom tools

For Immediate Impact

Reference or base designs for heliostats engineered around specialized components

Find out which models suppliers recommend to use in a base design based on availability, cost, and supply chain risk

Legal Notice

BACKUP SLIDES

What is a Slew Drive?

A slew drive is a compact, enclosed gearbox that safely rotates heavy loads along one or multiple axes while supporting intense radial, axial, and tilting moment loads. It combines a slewing ring bearing, a worm gear or spur gear set, housing, and a motor interface into a single, high-torque unit

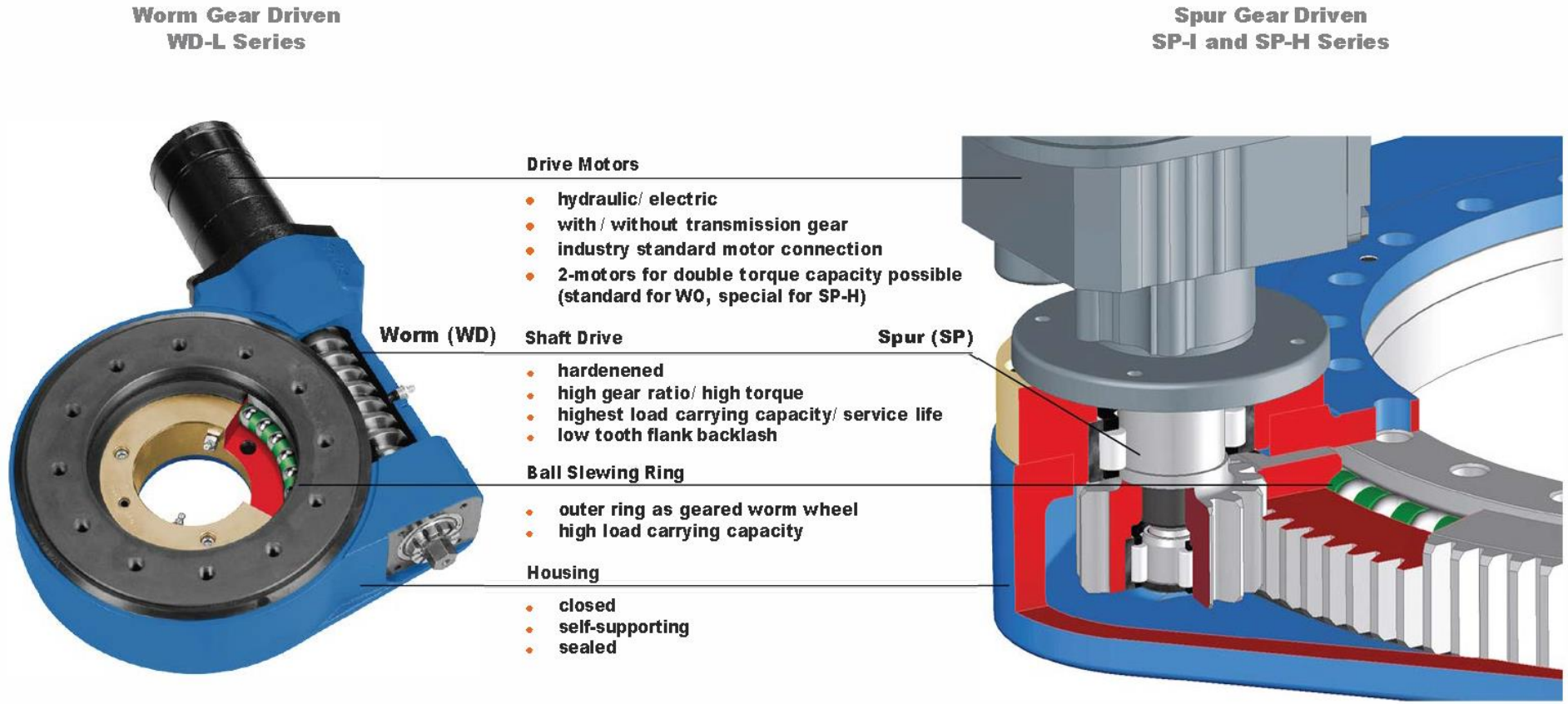


Image courtesy of IMO USA Corp., "Slew Drives & Slew Bearings" (work-gear-driven and spur-gear-driven models). Source: imousacorp.com (accessed Aug 12, 2026)

Requirements

Target: IP66 or IP67 for dust/water ingress; consider NEMA 4X for corrosion resistance if coastal (or salt-spray coating / stainless fasteners).

Operating temperature: e.g., −20 °C to +60 °C (adjust to site climate).

Duty cycle spec: nominal 10% typical; emergency 100% continuous for 15 minutes.

Specify peak torque and continuous torque numbers (to be calculated from mirror area, wind pressure at 17 m/s, lever arm, and safety factor). Example calculation step recommended below.

Life goal: e.g., 20 years design life