

04 / EXECUTIVE BRIEFING

NLT143 RESEARCH

~~Actuators are the write head of physical AI.~~

Boardroom-ready. Thirteen panels: thesis, market, playbook, ask.

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01 - The framing

- Manufacturing is CPU.
- Real estate is storage.
- Transport is network.
- Actuators are the write head.

02 · The chokepoint

- Cognition is improving faster than embodiment.
- Models are not the binding constraint anymore.
- Actuators are.

03 - What is an actuator

- A power source.
- A converter.
- A control input.
- Remove any one and the device stops being an actuator.

04 - The eleven families

- Electric rotary, electric linear, stepper, hydraulic, pneumatic.
- Piezoelectric, shape memory alloy, electrostatic, magnetostrictive, dielectric elastomer, pyrotechnic.
- First five do the bulk of the world's work. Other six fill specialty niches.

05 - The market today

- \$150M humanoid actuator market in 2024.
- \$9.86B in the 2030 base case.
- 80% CAGR through 2030.

06 - The forecast spread

- Bear: \$4.2B in 2030.
- Base: \$9.86B in 2030.
- Bull: \$18.0B in 2030.
- Triangulated from Yole, Valuates, IDTechEx, Goldman.

07 - The cost curve

- \$150k humanoid in 2024 → \$20k to \$40k at scale by 2030.
- Actuators are 40-55% of BOM today, declining toward 30%.
- Curve closes only if actuator volumes ramp to millions/year.

08 - Who is building

- Tesla, Figure, Aptronik, BYD: vertically integrating.
- Agility, Unitree, AgiBot, UBTECH: buying or partnering.
- China supply chain is two to three years ahead and hardening.

09 · The supply chain risk

- Critical SKUs: harmonic drives (Japan), high-end BLDC (Germany, Switzerland).
- U.S. imports almost all of both.
- CHIPS Act analog for actuators is overdue.

10 - Strategic implications

- Industrial operators: treat actuators as strategic supply.
- Builders: vertical integration is table stakes for defensibility.
- Capital: picks-and-shovels framing has a longer half-life than platforms.
- Policy: domestic capacity is a national security input.

11 · The build-buy-partner ladder

- Below 1,000/year: buy.
- 1,000-50,000/year: partner with two suppliers per family.
- Above 50,000/year, stable spec: build.
- Always internalize specification and integration.

12 · The risk register

- Single-source supply.
- Geopolitical exposure.
- Specification creep.
- Reliability tail in field conditions.
- Talent concentration.

13 · The ask

- Treat actuator capability as a strategic asset, not a part.
- Lock specs at gate 2.
- Qualify second sources on every SKU above BOM 80th percentile.
- Instrument every actuator from day one.
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