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Robotics | North America

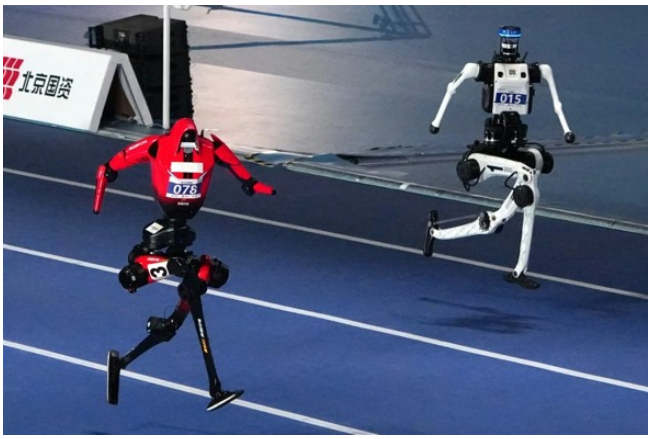
Actuators: Robot Muscle Needs American Hustle

We project robotics to drive supernormal growth in actuator demand, with key component volume rising up to 200-400x globally between 2025 and 2050, often accounting for 50% or more of the robotics BoM. The problem? The US can barely make them without China. Major change is needed to stay in the race PrivateCompany

The FCC may have just opened the door to reshoring robotics, but the US barely has its gear together... With its July decision, the FCC has barred new foreign-made humanoids, quadrupeds, and drones (inc. prev decision from Dec) from receiving authorization unless they are manufactured in the US and reach 65% domestic content requirements (rising to 75% in 2029). These local content targets are not remotely plausible, in our view. The ability for OEMs to hit that hurdle hinges heavily on the supply chain for actuators (motors, bearings, reducers, and sensors) that can account for up to 50%+ of a robot's bill of materials.

In our view, the current rate of change of China's robot supply chain capability may widen vs. the US at an accelerating rate over the next 5 years. ***In our opinion, decisive action is needed to keep the US competitive (relevant?) vs. the Chinese on AI-enabled robotics by 2030. While much work is left to do, this report helps identify US-exposed names with underappreciated optionality to the emerging physical AI/robotics ecosystem.***

Exhibit 1: China's Actuator Chops Were Recently on Full Display at the 2026 World Robot Conference in Beijing. Can the US compete?



Source: Xinhua (Official State Newspaper of China)

What now? We see 4 reshoring avenues and 3 possible scenarios playing out, each with different implied US robotics penetration:

- **4 Key Avenues:**

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investors should be aware that the firm may have a conflict of

Research as only a single factor in making their investment decision.

For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

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1. *Companies vertically integrate actuator production:* expect to happen, but scaling upstream manufacturing is very challenging for those unexperienced and may only be feasible for a few
2. *Foreign companies build capacity in US*: already happening at small scale, but policy overhang complicates
3. *Legacy companies expand adjacent capacity:* potential major long-term growth tailwind for US suppliers, but robotics is (at least for the near-term) lower margin and lower volume - may create some anxiety.
4. *Startups find more efficient ways to produce actuators:* potentially most impactful, but longer term

- **3 Future Scenarios:**
  - **Rapid Torque (Bull Case):** FCC decision triggers a supply-chain flywheel where legacy industrials, foreign entrants, and startups all scale together, collapsing prices and driving *US robots in service from 13mn (2025) to 55mn (2030) and 1.07bn (2050), with actuator demand up 9x and 284x respectively.*

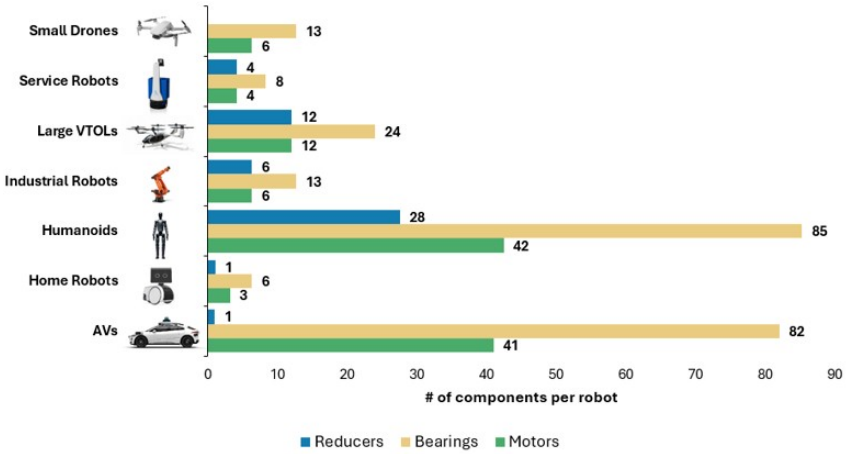
  - **Uneven Gear Up (Base Case):** Progress happens across all four avenues but unevenly, as top OEMs vertically integrate, foreign capital enters selectively via JVs, incumbents pursue targeted capacity and M&A, and startups fill niche gaps, *pushing US robots in service from 13mn (2025) to 34mn (2030) and 674mn (2050), with US actuator demand up 5x and 191x respectively.*

  - **Friction Losses (Bear Case):** Political uncertainty, capital caution, and weak innovation stall all four avenues, leaving US robotics penetration lagging global peers as *robots in service grow only from 13mn (2025) to 21mn (2030) and 364mn (2050), with US actuator demand up 4x and 119x respectively.*

Exhibit 2: 4 Avenues; 3 Scenarios for Robot Actuator Reshoring



Exhibit 3: Key Actuator Components per Robot (2026e)



Note: For more details, please request a copy of our global robot model. Meant to be a broad generalization. Pricing per component will differ materially between form factors.

Exhibit 4: Bull/Base/Bear Estimates for US Robotics Penetration (Mns Robots in Operation): 2025-2030

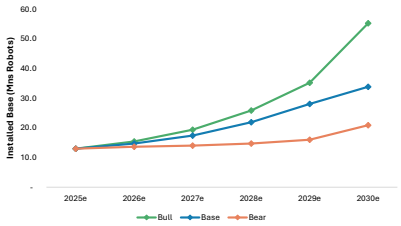
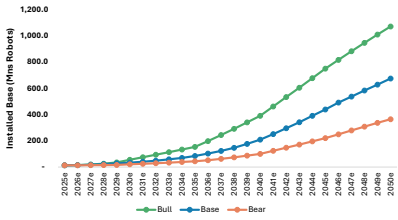


Exhibit 5: Bull/Base/Bear Estimates for US Robotics Penetration (Mns Robots in Operation): 2025-2050



Multipolarity in motion: we think the overall direction of travel is toward more restrictions, not fewer. We think the FCC's restriction exhibits the government's interest in pursuing AI sovereignty, vis-à-vis a gradual de-risking (not decoupling) as national security concerns increasingly extend into the physical AI stack. The upcoming US-China summit is a catalyst worth watching, but we see this as a data point on a longer-term trend toward multipolarity and the 'two worlds' dynamic of AI policy and adoption (see here for more). We see industrial policy crossing party lines, which means midterm elections are unlikely to change the current trajectory.

History suggests investors systematically under-price the "boring" component when a technology wave turns it into a bottleneck. Optical fiber spent much of the post-dot-com period as a low-margin commodity before AI data centers made it scarce again; DRAM was an archetypal boom-bust commodity the industry was selling below cost in 2022-23 before joining in as part of the "AI bottleneck" trades driving prices and demand materially higher; Large power transformers, historically a low-margin, capital-intensive business, now carry 2-3+ year lead-times; and gas turbines, often written off as structurally declining after the 2018-20 power writedowns, are effectively sold out. In each case, significant stock re-ratings followed supply that could not respond due to a lack of capacity or lost process knowledge. *We believe the market could be materially mis-framing actuator components as low-value content when supply may directly govern the pace of*

robotics penetration.

We Identify 4 key areas of potential bottleneck:

- **Rare Earth Magnets:** China controls 60% of mined magnetic rare earths, 91% of refining and 94% of sintered magnet production (IEA).
- **Reducers:** US firms remain largely dependent on Japanese harmonic, cycloidal, and planetary gearing suppliers with Chinese challengers scaling fast.
- **Screws:** Planetary roller screws in the US have historically been built in small, custom batches for aerospace, defense and medical customers.
- **6-Axis Force-Torque Sensors:** Major US incumbent with high share, but a very expensive component (up to $8k or more). China-based competitors scaling with cheaper alternatives - now potentially blocked from US.

Relevant Stocks? We Introduce the *"Motor Dozen"*: Public Companies Relevant to Building the US Actuator Supply Chain: Timken (TKR - Covered by Angel Castillo), MP Materials (MP - Covered by Carlos De Alba), Regal Rexnord (RRX - Not Covered), Allient (ALNT - Not Covered), Novanta (NOVT - Not Covered), Harmonic Drive Systems (6324.T - Covered by Lisa Jiang), RBC Bearings (RBC - Covered by Kristine Liwag), Moog (MOG.A - Covered by Kristine Liwag), Nabtesco (6268.T - Covered by Lisa Jiang), LeaderDrive (688017.SS - Covered by Sheng Zhong), Minebea Mitsumi (6479.T - Covered by Shoji Sato), Tesla (TSLA - Covered by Andrew Percoco).

This intentionally narrow list is meant to be tailored to companies we believe most relevant to supplying the US robotics market. For a more comprehensive list of global suppliers, please see our Humanoid 100.

Exhibit 6: We Introduce the : Public Companies Relevant to Building the US Actuator Supply Chain



Robotics actuators (all form factors) could theoretically transform component supplier revenue, exceeding current sales by an order of magnitude in some cases. To give investors a sense of scale for the opportunity (globally here, not just the US), we proxy the actuator opportunity as motors + bearings + reducers, sizing the 2030 global TAM at $94bn in our base case ($140bn bull, $71bn bear), and flex a hypothetical supplier's market share against it, expressing the resulting revenue as a percentage of the median Motor Dozen peer's 2025 sales ($2.1bn). Even modest share capture moves the needle. For example, 0.5% of the base-case 2030 TAM equals roughly 23% of the median peer's current sales, rising to about 46% at 1% share. Longer-dated numbers dwarf this. ***Our base-case TAM reaches $1.3tn by 2040 and $3.8tn by 2050, resulting in the same 1% share being worth roughly 6x the median peer's current annual revenue in 2040 and 18x in 2050.***

Exhibit 7: Even the bear case grows actuator component TAM 64x by 2050, theoretically making a 1% share worth 18x a median supplier's entire 2025 revenue (refers to global figures vs. US only in this case).

Total Actuator TAM

	2025	2030e	2040e	2050e
Bull		$140bn	$2.3tn	$6.5tn
Base	$21.8bn	$94bn	$1.3tn	$3.8tn
Bear		$71bn	$0.8tn	$1.4tn
Base case CAGR off 2025		34%	31%	23%

Supplier Revenue at 1% Share + Implied Increase vs. Median Peer 2025 Total Revs

Multiples below each figure are x the median Motor Dozen peer's 2025 sales ($2.1bn), which assumes no peer growth; a scale device, not a forward comparison

	2025	2030e	2040e	2050e
Bull		$1.4bn 0.7x	$23bn 11.0x	$65bn 31.4x
Base	$0.2bn	$0.9bn 0.5x	$13bn 6.2x	$38bn 18.3x
Bear		$0.7bn 0.3x	$7.5bn 3.6x	$14bn 6.7x

Note: Based on Motor Dozen list. Motor peers = Timken, Regal Rexnord, Allient, Moog, Minebea Mitsumi. Bearings peers = Timken, Regal Rexnord, RBC Bearings, Minebea Mitsumi. Reducer peers = Timken, Regal Rexnord, Harmonic Drive Systems, Nabtesco, Leaderdrive.

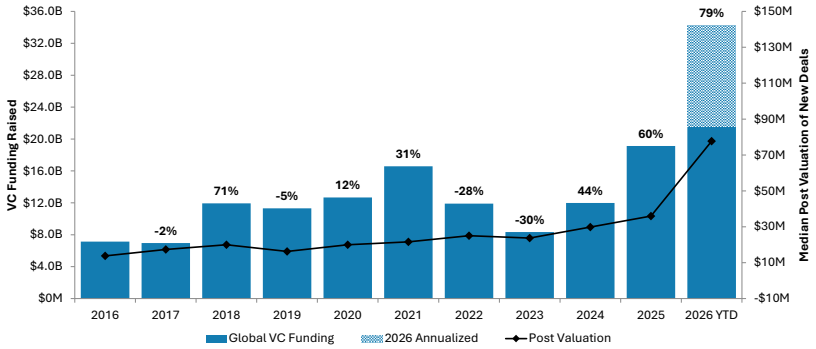
Exhibit 8: Exploded Actuator w/ Key Components, Prices, and Suppliers (Based on Generalized Design of Humanoid Robots Today)



Note: bars show 2025 unit cost, log scale; grey = China, colour = non-China. Reducer and screw graphics/costs are harmonic and planetary roller respectively, pricier than planetary reducer and ball screw; suppliers cover both.

Funding in 2026 for manufacturing-related startups are at an all-time high, already surpassing 2025 levels, and on pace for +80% y/y. "Manufacturing" is defined as any company that plays a role in the production of physical products: energy, defense tech, robotics, aerospace, space, materials, etc. After a number of large IPO exits this year, we could potentially expect (all-thing equal) even greater company formation as funds receive liquidity on long-held investments, LP's push for new bets, and employees/founders receive capital to start their next venture. *Why should public market investors care?* This cohort of companies could potentially represents the IPO pipeline for the next decade + a sizable % of the dollars invested in a manufacturing startup represents funding to compete with the incumbents. ***We highlight a handful of private startups exposed to the actuator supply chain: WestMag, Atlas Control Systems, Vulcan Elements, Hadrian.***

Exhibit 9: VC Funding for Manufacturing-Related Startups



Lessons from China. China faced the same actuator bottleneck less than a decade ago and has since largely solved the issue, enabled by localization first of downstream OEMs creating a large enough market for upstream domestic component suppliers. Domestic suppliers held roughly 41% of China's harmonic reducer market in 2017 but around 88% by 2025. Four features of China's industrial ecosystem supported this transition, namely: government tech roadmaps, state-directed capital investment, a large-scale technical labor force, and ample infrastructure investment.

Exhibit 10: China was in a similar position as the US less than a decade ago, and gradually localized its component supply chain, allowing it to become the dominant robotics player in the world.

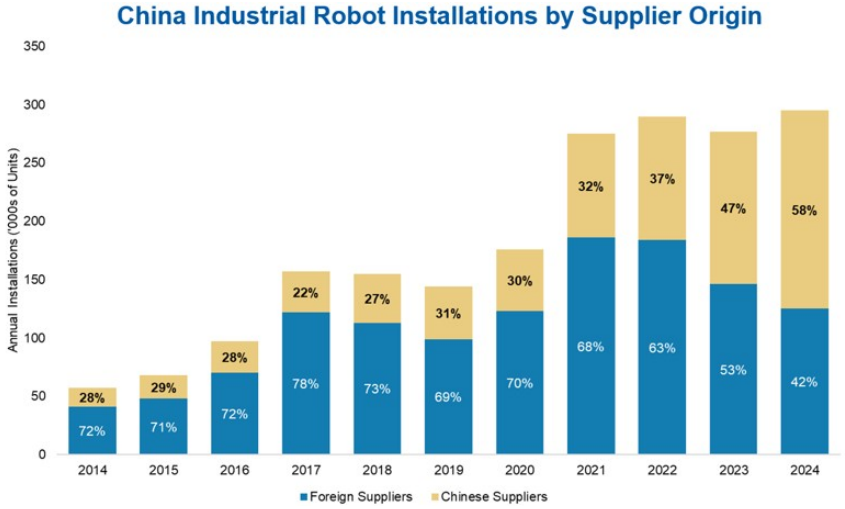


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9. Potential Foreign Capacity Expansion into the US

For Further Reading:

- Robotics: Humanoid Horizons: Do Robots Have a PR Problem? (28 Jul 2026)
-
- Space Exploration Technologies Corp.: SpaceX and Robotics (15 Jul 2026)
- China Industrials: Robotics: US Protectionism - Competition Rising (3 Aug 2026)
- Robotics: Thoughts on US Robot Protectionism (30 Jul 2026)
- Embodied AI: Who's Gonna Make the Bots? Adding Contract Manufacturers to the Humanoid 100 (26 Mar 2026)
- Humanoids: The Humanoid 100: Mapping the Humanoid Robot Value Chain (6 Feb 2025)



No Foreign Robots- What Now?

The recent FCC decision blocking foreign-produced robots and drones is intended to re-shore the largely-China dominated supply chain. We believe it will be a long, involved process. On July 28, the Trump administration through the FCC unveiled measures barring imports of new foreign-made humanoid and quadruped robots, alongside connected power inverters, framed as protecting the US AI buildout from national security threats and incentivizing the reshoring of key industries while adoption is still in the early stages. The decision placed "advanced robotic devices" FCC's Covered List, which mirrored FCC's December 2025 decision blocking imports of new foreign-made drones and critical components. This specific decision encompasses a wide range of products ranging from service robots, AMRs, humanoid, quadrupeds, and some consumer robotics; it would exclude most traditional industrial robots.

- **What is the FCC Covered List?** Equipment placed on the list is prohibited from receiving FCC equipment authorization for it to be imported, marketed, or sold in the US. Robots qualify because they carry embedded WiFi/Bluetooth/cellular radios. It's important to note that the restriction applies to new models seeking authorization. Existing authorized models already in the field are not retroactively banned. The FCC made a similar decision in December 2025 on drones, which blocked new foreign-made drones and critical components from receiving authorization, effectively restricting new products from Chinese leaders such as DJI while leaving previously approved models unaffected.
- **Potential read across for further AI protectionism:** The FCC Covered List has now been extended in sequence from telecom (Huawei/ZTE) in 2021 to drones in December 2025, consumer routers in March 2026, and now robots and inverters, signaling that the administration increasingly treats the full AI hardware stack (compute, power, and now embodied/physical AI) as within the same national-security perimeter.

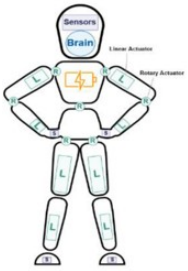
To be classified as US-produced, a robot must have at least 65% domestic content by value. We estimate actuator content alone can put a robot over that hurdle. A robotic device must qualify as a "domestic end product" under the Buy American rules to avoid being deemed "foreign-produced" by the FCC. In practice that means a robot or drone must be US-assembled with roughly 65% domestic content by value to escape the label. Based on analysis from our China Robotics team (led by Sheng Zhong), actuator content alone can account for nearly 50% or more of the total bill-of-materials of a humanoid robot with an up to 3x+ gap in price between China-produced and non-China-produced components. Combined with semiconductor and battery content, we believe it may be challenging for most US-assembled robots today to qualify. While our teams' prior analysis is specific to humanoids, from our conversations across the industry, this dynamic applies to nearly all robot form factors - especially drones where arguably >90% of the supply chain is centered in China.

- **To clarify, an "actuator" is general term for a mechanical part that converts energy into motion.** As a general rule of thumb, most robot joints = an actuator, but actuators are used in automotive, aerospace, industrials- any machine that moves. There are 2 main types: linear actuators which push and pull, and rotary

actuators which turn. They can be exploded into multiple subcomponents depending on the design: motors (inc rare earth magnets), bearings, reducers, screws, encoders, sensors - the vast majority of which is sourced from outside the US, generally Asia.

With the FCC decision, we believe our US robotics penetration projections could be at risk without key players in the supply chain stepping up. The US already trails China robotics penetration by a wide margin. According to the International Federation of Robotics (IFR), China represented >50% of all global industrial robot installations in 2024, putting it at 470 robots per 10,000 workers vs. 295 for the US. For humanoids specifically, data analytics firm Smart Analytics Global estimates that China-based OEMs accounted for >97% of global humanoid shipments in 1H26. In our model, the US represents just 8% of 2025 global shipments (inclusive of all form factors) vs. 33% for China, with the gap narrowing only modestly through 2030. Restricting foreign-made supply hinder a company's near term ability to source lower-cost components, putting pressure on manufacturing ability and adoption.

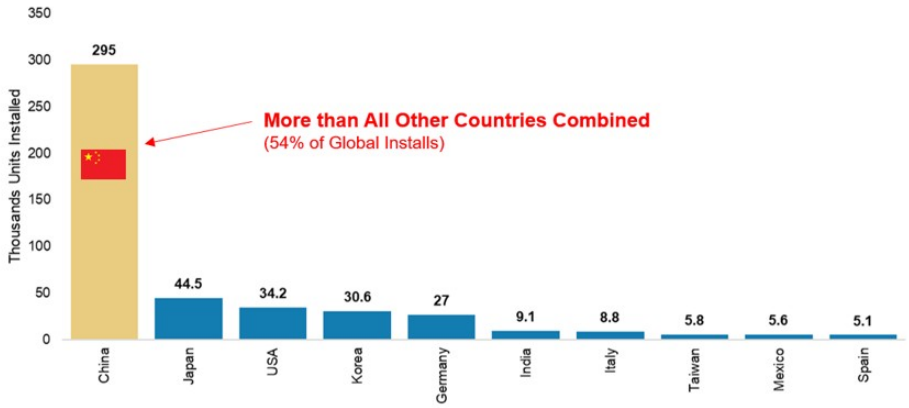
Exhibit 11: Estimated Humanoid Robot Bill-of-Materials (From China Industrials/ Robotics Team - led by Sheng Zhong)



	China Supply Chain		Non-China Supply Chain
	2025	2034 (~1mn sales)	2025
Total BoM/robot (US$ k)	46	16	131
Actuator	22	7	58
Dexterous hand	15	6	47
Feet	4	1	16
Vision	0.4	0.2	0.5
Chip+Software	3	1	7
Battery	0.1	0.1	0.3
Others	1	1	3

Note: BoM assumption is based on the latest spec for Tesla's Optimus, i.e. Gen 2 body parts (30 Degree of Freedom (DoF) by 14 rotary actuators and 14 linear actuators) and Gen 3 dexterous hand (22 DoF each hand with tendon + micro planetary roller screw for actuation and tactile sensor).

Exhibit 12: 2024 Industrial Robot Installations (Top 10 Countries) per IFR. *Note the FCC decision does not target industrial robots specifically, but we estimate that penetration for the form factors impacted look similar if not more extreme than trends shown here.*



We see 4 potential avenues whereby the US could build large-scale actuator manufacturing: *These are not mutually exclusive, and we'd expect each to happen at a*

different pace and scale.

- **Companies Vertical Integrate**: Many companies already argue that they practice "vertical integration", but from our experience, this generally applies only to the assembly level and the easiest-to-produce components (battery enclosures, plastic moldings, etc.). Even Tesla, arguably one of the most vertically integrated AI robotics companies today, is known to source actuator components from the China supply chain despite its stated goals to deeply vertically integrate overtime. We do expect more vertical integration, but the capital intensive nature of scaling manufacturing + logistics complexities combined with a largely startup dominated nature of robotics in the US (where greater $ continue to be required for compute) would limit ability in the near term.
- **Foreign Companies Build Capacity in the US:** Likely too early for advanced robotic OEMs given nascent nature of US market (mostly for R&D purposes), but some component suppliers already planning US and nearby capacity (ex: Leaderdrive's JV with Minth), and may see others take a more active approach to reshoring. Overall, we expect some on the margin, but outside of a drastic change in policy stance or a direct invitation, foreign-based (China-based especially) companies may be hesitant to commit capital in a relatively nascent market with broad political uncertainty.
- **Legacy US Companies Expand Adjacent Capacity:** Our channel checks with robotics companies suggest that, while multiple US-based suppliers exist for many critical actuator components, there is a significant gap in available volumes at price points comparable to those offered by Chinese suppliers. We think the FCC decision could accelerate the decision making process for many legacy industrial companies to expand capacity deeper into critical actuation technologies.
- **Startups Fill in Gap:** A number of startups (Westmag, Atlas Motion Systems, etc.) are directly targeting the actuator problem. We think company formation may still be in the early innings. It still won't be easy, but a multi-year manufacturing build out is well suited for patient private capital (debt + equity). Additionally, many robotics actuator buyers are themselves startups, offering ecosystem synergies (culture, speed, etc.). Venture capital investment for manufacturing-related startups is at an all-time high, with >$21bn invested YTD (on track for +80% y/y - PitchBook).

We update our Global Robot Model to include Bull/Bear cases for US robotics penetration and implied actuator content. In each scenario, we flex penetration across each major form factor and component pricing (higher in bear case, lower in bull case). *Reach out for a copy of the model.*

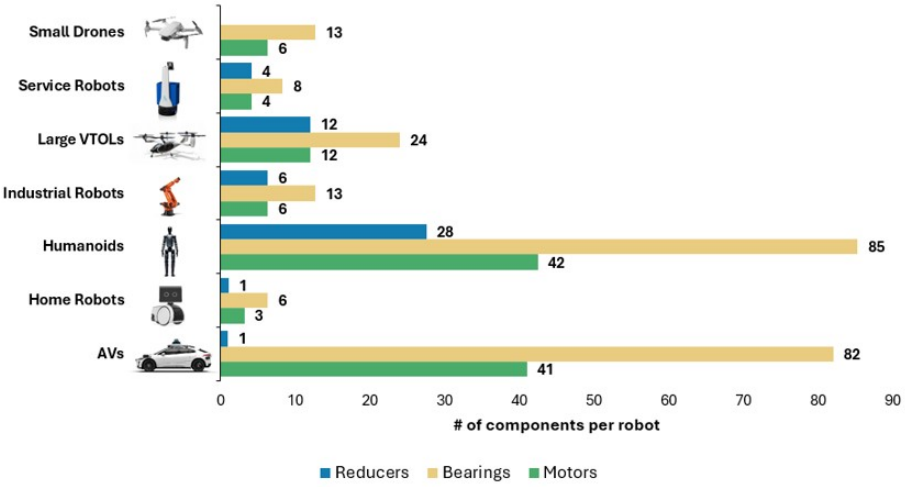
- **Rapid Torque (Bull Case):** FCC decision becomes a major demand signal for the broader supply chain, pulling legacy US industrials players deeper into actuation and drawing foreign suppliers into building US capacity. Startups address the lower-volume, most nascent markets incumbents are hesitant to commit capital to. As both capacity and demand multiplies, prices eventually collapse in an operating-leverage fueled flywheel effect. US robots in service (all form-factors) rise from 13mn in 2025 to 55mn by 2030 and 1.07bn by 2050. Implied robot actuator demand (using $'s worth of motors, bearings and reducers as a proxy) in the US increases by 9x 2025-2030 and 284x 2025-2050.

- **Uneven Gear Up (Base Case):** All four avenues progress, but unevenly. Leading OEMs deeply vertically integrate and smaller players remain at the assembly level. Foreign investment arrives selectively through JV's and plant expansions of existing capacity. Legacy industrials expand capacity in their existing lines and acquire capabilities through targeted M&A. Startups round out edges, with AI-driven innovation driving longer-term efficiency for broader industry. US robots in service (all form-factors) rise from 13mn in 2025 to 34mn by 2030 and 674mn by 2050. Implied robot actuator demand in the US increases by 5x 2025-2030 and 191x 2025-2050.
- **Friction Losses (Bear Case):** Very little change across all four avenues. Foreign suppliers are deterred by political uncertainty. Legacy industrials unwilling to build capacity over worry of margin dilution and upfront capital costs. Little innovation in overall manufacturing process. US robotics penetration lags rest of world, still progressing but at a materially lower pace. US robots in service (all form-factors) rise from 13mn in 2025 to 21mn by 2030 and 364mn by 2050. Implied robot actuator demand in the US increases by 4x 2025-2030 and 119x 2025-2050.

Exhibit 13: 4 Avenues; 3 Scenarios for Robot Actuator Reshoring



Exhibit 14: Key Actuator Components per Robot (2026e)



Note: For more details, please request a copy of our global robot model. Meant to be a broad generalization. Pricing per component will differ materially between form factors.

Exhibit 15: Bull/Base/Bear Estimates for US Robotics Penetration (Mns Robots in Operation): 2025-2030

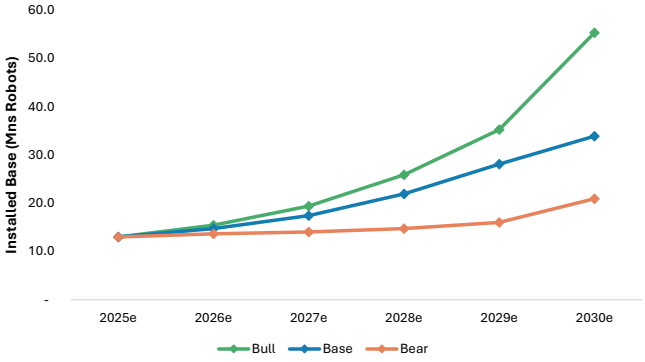


Exhibit 16: Bull/Base/Bear Estimates for US Robotics Penetration (Mns Robots in Operation): 2025-2050

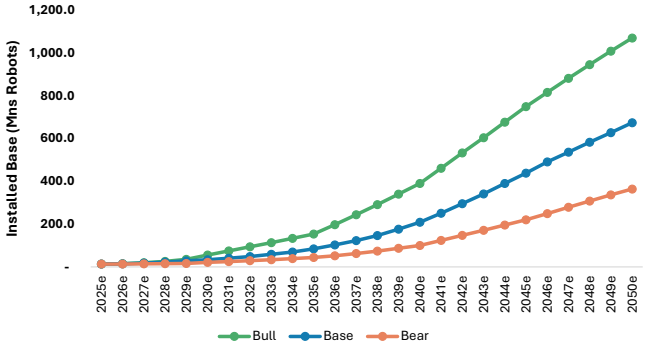


Exhibit 17: Implied US Robotics Motor Demand ($mns) and Increase vs. 2025 Levels

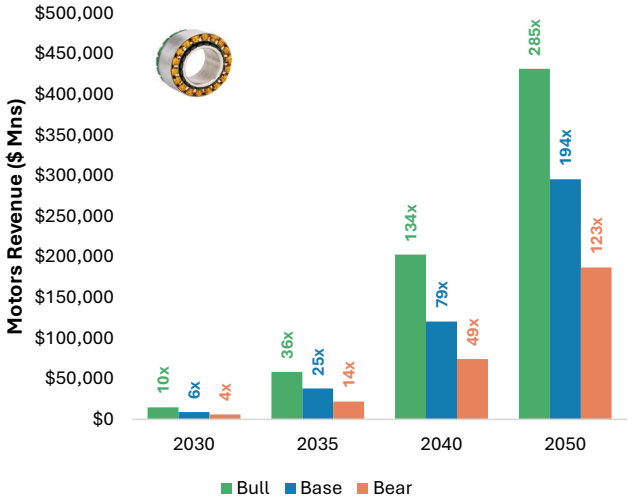


Exhibit 18: Implied US Robotics Bearing Demand ($mns) and Increase vs. 2025 Levels

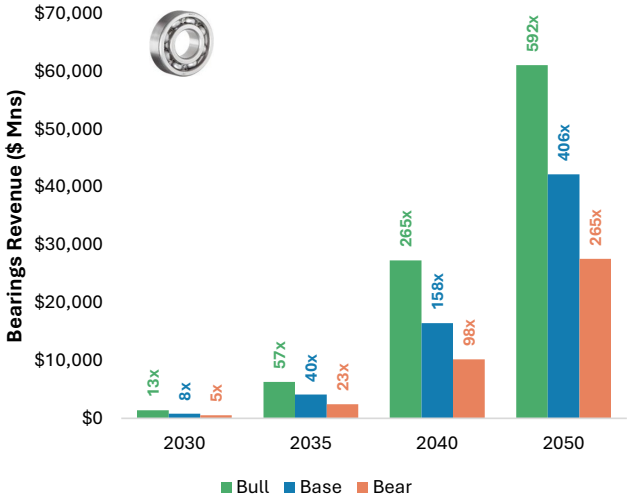


Exhibit 19: Implied US Robotics Reducer Demand ($mns) and Increase vs. 2025 Levels

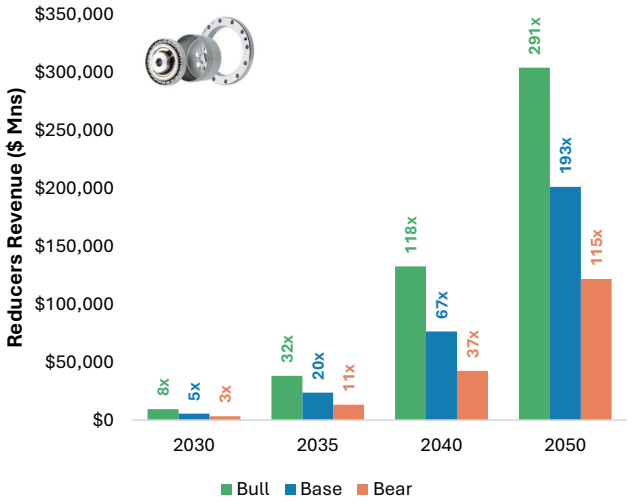
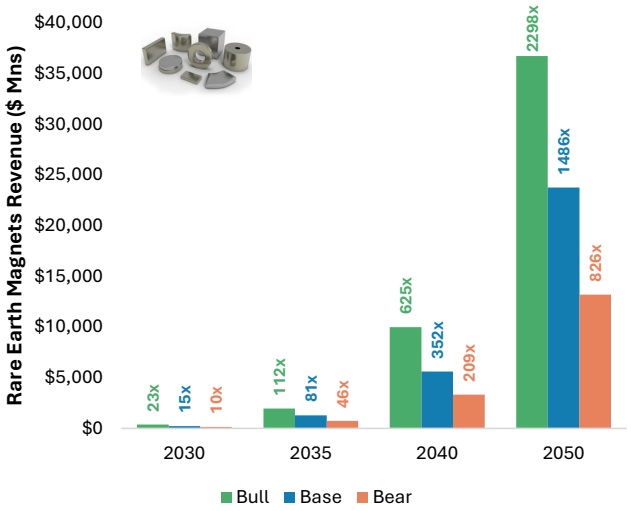


Exhibit 20: Implied US Rare Earth Magnet Demand for Robotics ($mns) and Increase vs. 2025 Levels



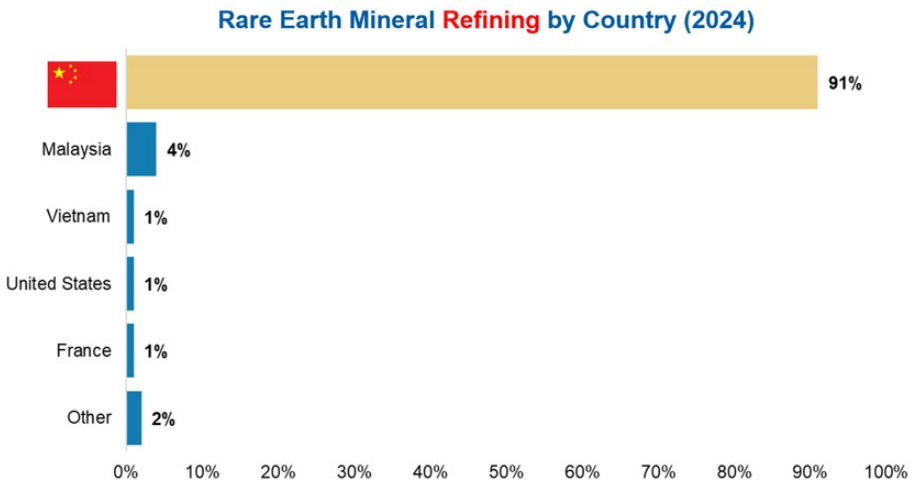
4 Areas Where Actuator Bottleneck Is Pronounced

We identify four chokepoints for scaling US actuator production for robotics at scale. Each is likely to reshore on a different timeline, and today only magnets attract meaningful federal support. We would also flag that the upstream machinery to produce each of the below is often custom produced for a given production line, meaning challenges are often deeper into the supply chain and more interconnected than many investors appreciate.

Rare earth magnets. In essentially all drones and robots, motors rely on magnets and electromagnets to create the forces to create rotary motion. According to the International Energy Agency (IEA), China accounted for 60% of global mined production of magnet rare earths in 2024, 91% of refined output and 94% of sintered permanent magnet production. China has used this critical chokepoint for geopolitical leverage in the past, including the 2010 rare earth export halt to Japan following a diplomatic dispute and the April 2025 export controls on seven heavy rare earths and permanent magnets themselves, which forced many Western automakers to cut or temporarily shut down production. The IEA expects capacity outside China to meet less than a fifth of magnet demand by 2035. Washington has responded with unusually direct instruments. In July 2025, the DoW took a $400mn convertible preferred position in MP Materials alongside a warrant, together with 15% of common stock on an as-converted basis, making it the largest shareholder in the company. This transaction was announced alongside a $110/kg NdPr price floor guarantee from the DoW on MP's future NdPr production. Moreover, the DoW is also supporting MP's downstream transition into rare earth magnets via a $140m EBITDA guarantee for the company's 10X magnet facility, targeting 7,000 tonnes of annual capacity bringing MP's annual magnet capacity to 10,000 tonnes. Similar deals followed with Vulcan Elements ($620mn Pentagon loan and $50mn Commerce equity stake, November 2025), USA Rare Earth ($1.6bn federal investment for a stake that could exceed 15%, January 2026), ReElement Technologies and Australia's Lynas ($96mn four-year DoW supply agreement with a $110/kg NdPr price floor, March 2026).

Relevant Stocks w/ Exposure to US: MP Materials (MP, Covered by Carlos De Alba), Lynas Rare Earths (LYC.AX, Covered by Rahul Anand), USA Rare Earths (UUSAR), Ilka Resources (ILU.AX, Covered by Rahul Anand), Ramaco Resources (METC, Covered by Carlos De Alba).

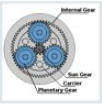
Exhibit 21: Rare Earth Refining by Country (IEA, 2024)



Reducers (Harmonic & Planetary). Motors by themselves spin very fast, but with little torque (i.e. strength) needed to do actual useful work. Most rotary joints on robots use a small gearbox between the motor and the limb to convert speed into strength. The Special Competitive Studies Project (non-partisan think tank) finds US firms are largely dependent on Japanese suppliers for harmonic reducers and cycloidal gearing. Prior to the FCC decision, Chinese suppliers were likely the fastest-growing challengers in US supply chains. Harmonic Drive Systems and Nabtesco (Japan) has traditionally led the market, with Leaderdrive (China) the greatest emerging player. Our China industrials team noted earlier this year that Leaderdrive ships roughly 50,000 units per month. It is expanding capacity to supply "a leading China integrator (with 80–90% share)" while also working with US and Korean integrators. *We believe attracting new investment may be just one part of solving the bottleneck.* A harmonic reducer, for example, functions by flexing a thin steel cup back and forth millions of times without it ever cracking, which puts unusual demands on the metallurgy and heat treatment of the gearing structure. Additionally, the gear teeth generally need to be ground to tolerances a fraction the width of a human hair since any error shows up as slop in the joint potentially resulting in a failed task which can shut down a production line, cause a safety incident, and otherwise hinder the productivity of the robot. As a result, the requirements for setting up large-scale gear production cannot be easily quantified in $ since the process knowledge is built up over decades on the factory floor.

Relevant Stocks w/ Exposure to US: Timken (TKR - Covered by Angel Castillo), Regal Rexnord (RRX - Not Covered), Harmonic Drive Systems (6324.T - Covered by Lisa Jiang).

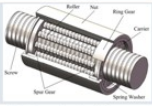
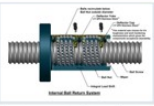
Exhibit 22: Harmonic Reducers vs. Planetary Reducers

Harmonic Reducer	Planetary Reducer
	
Strain wave gearing: a flexspline flexed inside a rigid circular spline	*Sun, planet and ring gears sharing load across multiple meshes*
Pros • Very high ratio in one stage, with near-zero backlash • Highest motion precision; compact and lightweight • Best fit: wrists, arms and dexterous hands	**Pros** • Higher transmission efficiency, so lower energy use • Higher payload and far better shock resistance • Best fit: lower limbs and upper arms under heavy load
Cons • Lower payload; limited resistance to shock and impact • Shorter service life under high dynamic load • Lower transmission efficiency than planetary gearing	**Cons** • Larger and heavier for the same output torque • Lower ratio per stage; needs stacking for high ratios • More backlash, so lower positioning precision
Key Suppliers Harmonic Drive Systems (6324 JP), Leaderdrive (688017 CH), Nidec Drive Systems (6594 JP), Timken/Cone Drive (TKR).	**Key Suppliers** Maxon (private), Sumitomo Heavy (6302 JP), Zhongda Leader (002896 CH), Zhaowei (003021 CH), Regal Rexnord (RRX); Nabtesco (6268 JP).

Screws (Planetary Roller Screws & Ball Screws). Some joints push and pull in a straight line (linear actuator) rather than rotate (rotary actuator). A roller screw handles the conversion of rotary motion from a motor into linear motion under heavy load. The category has historically been built in small batches for aerospace, defense and medical customers from companies such as Switzerland's GSA and Rollvis or Sweden's Ewellix (owned by Schaeffler). Robotics volumes would likely require purpose-built capacity. US suppliers exist, including Nook Industries (owned by Regal Rexnord), Moog, and Tolomatic, though they serve primarily specialized industrial and aerospace demand.

Relevant Stocks w/ Exposure to US: Schaeffler (SHA0.F - Not Covered), Regal Rexnord (RRX - Not Covered), Moog (MOG.A - Covered by Kristine Liwag).

Exhibit 23: Planetary Roller Screws vs. Ball Screws

Planetary Roller Screw	Ball Screw
	
Threaded rollers orbit the shaft, giving multiple line contacts	*Recirculating balls between shaft and nut, giving point contact*
Pros • Highest payload and shock-load capacity per unit volume • Up to 15x longer travel life than an equivalent ball screw • High stiffness and precision; fine leads at high rpm	**Pros** • Low friction, roughly 90% efficiency: high speed, low heat • Mature, standardized process: lower cost, shorter lead times • Broader supplier base; easily back-driven and serviced
Cons • **2 to 5x higher ASP**; complex internal thread grinding • Supply-constrained, with limited global machining capacity • Higher friction, less back-drivable than ball screws	**Cons** • Point contact limits payload and shock tolerance • Shorter life under high dynamic robot duty cycles • Recirculation noise; backlash grows as balls wear
Key Suppliers GSA (Private), Schaeffler (SHA0.F), SKF (SKFB SS), THK (6481 JP), Moog (MOG.A), Bosch Rexroth (Private), Regal Rexnord (RRX). China: Hengli (601100 CH), Nanjing Technical Equipment.	**Key Suppliers** THK (6481 JP), NSK (6471 JP), NTN (6472 JP), HIWIN (2049 TT), PMI (4583 TT), TBI Motion (4540 TT), Schaeffler (SHA0.F), Regal Rexnord (RRX), Bosch Rexroth (Private).

6-Axis Force-Torque Sensors. A 6-axis force-torque sensor is a specialized device that detects forces and rotational torques simultaneously across all six degrees of freedom. They are very expensive, priced at up to $8,000 or even more. As a result, they are only placed on the most critical actuation joints for external contact. For humanoid robots- this generally means the wrist or the ankle. The is one component where the US has a dominant market share. ATI Industrial Automation, a subsidiary of Novanta (NOVT), largely controls the market today. China-based competitors such as Keli Sensing (603662.SS) have been making a push to create competing products at lower prices, but

the tight calibrations and metrology needed has created a relatively steep technical barrier. Our China Industrials team believes new China-based entrants into 6-Axis Force Sensing could be one of the primary drivers of cost reduction for the broader humanoid BoM. However, the recent FCC decision could shield Novanta's robotics market share, at least in the US market specifically. *Note that there are other force and torque sensors with less capabilities outside of specifically 6-Axis Force-Torque, but these have relatively low technical barriers and already fragmented market share.*

Relevant Stocks w/ Exposure to US: Novanta (NOVT)

Exhibit 24: 6-Axis Force Torque Sensor on a Robot Arm



Source: Novanta/ATI

Demand Scenarios & Sizing the Opportunity

Robot Actuator Demand Scenario Analysis

Model or "GROM", we project the global robotics TAM (installed base, unit sales, revenue) across key form factors for the US, China, and Rest-of-World. These key form factors include: autonomous vehicles, home robots, humanoids, industrial robots, large VTOLs, professional service robots, and small drones. The model also projects aggregate robotics demand across critical components, including: cameras, lidar, radar, motors, bearings, reducers, rare earth magnets, semiconductors, edge compute, and batteries. These estimates are intended to be updated periodically as the industry develops.

- *representative.*

We estimate that global robotics demand for motors, reducers, and bearings will rise by ~6x, ~4x, and ~6x respectively by 2030 and ~286x, ~389x, and ~240x respectively by 2050. Of this, the US represents 10% of total demand as we generally assume greater nearer-term penetration in the China domestic market and RoW markets that can benefit from lower-cost Chinese robotics supply, relative the US. For context, we estimate that in 2025, the US represents just 8% of global robotics demand vs. 33% of 2025 units for China. *We recognize these are very large numbers- this is due to the pure scale of the robotics opportunity, but also the incredibly small base of robotics deployments today.*

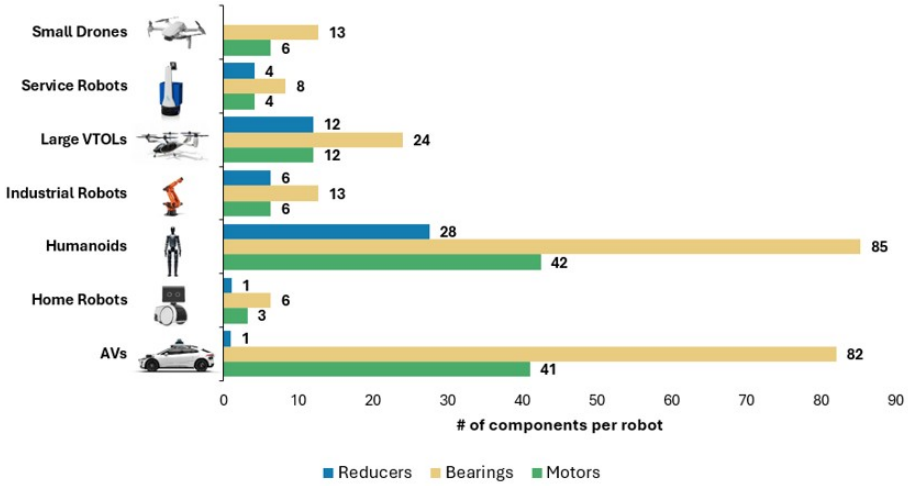
We update our Global Robot Model to include Bull/Bear cases for US robotics penetration and implied actuator content. In each scenario, we flex penetration across each major form factor and component pricing (higher in bear case, lower in bull case). *Reach out for a copy of the model.*

- **Rapid Torque (Bull Case):** FCC decision becomes a major demand signal for the broader supply chain, pulling legacy US industrials players deeper into actuation and drawing foreign suppliers into building US capacity. Startups address the lower-volume, most nascent markets incumbents are hesitant to commit capital to. As both capacity and demand multiplies, prices eventually collapse in an operating-leverage fueled flywheel effect. US robots in service (all form-factors) rise from 13mn in 2025 to 55mn by 2030 and 1.07bn by 2050. Implied robot actuator demand (using $'s worth of motors, bearings and reducers as a proxy) in the US increases by 9x 2025-2030 and 284x 2025-2050.
- **Uneven Gear Up (Base Case):** All four avenues progress, but unevenly. Leading OEMs deeply vertically integrate and smaller players remain at the assembly level. Foreign investment arrives selectively through JV's and plant expansions of existing capacity. Legacy industrials expand capacity in their existing lines and acquire capabilities through targeted M&A. Startups round out edges, with AI-driven innovation driving longer-term efficiency for broader industry. US robots in service (all form-factors) rise from 13mn in 2025 to 34mn by 2030 and 674mn by 2050. Implied robot actuator demand in the US increases by 5x 2025-2030 and 191x 2025-2050.

- **Friction Losses (Bear Case):** Very little change across all four avenues. Foreign suppliers are deterred by political uncertainty. Legacy industrials unwilling to build capacity over worry of margin dilution and upfront capital costs. Little innovation in overall manufacturing process. US robotics penetration lags rest of world, still progressing but at a materially lower pace. US robots in service (all form-factors) rise from 13mn in 2025 to 21mn by 2030 and 364mn by 2050. Implied robot actuator demand in the US increases by 4x 2025-2030 and 119x 2025-2050.

See more here:

Exhibit 25: Key Actuator Components per Robot (2026e)



Note: For more details, please request a copy of our global robot model. Meant to be a broad generalization. Pricing per component will differ materially between form factors.

US-Specific Robot Penetration Estimates & Implied Actuator Demand

Exhibit 26: Bull/Base/Bear Estimates for US Robotics Penetration (Mns Robots in Operation): 2025-2030

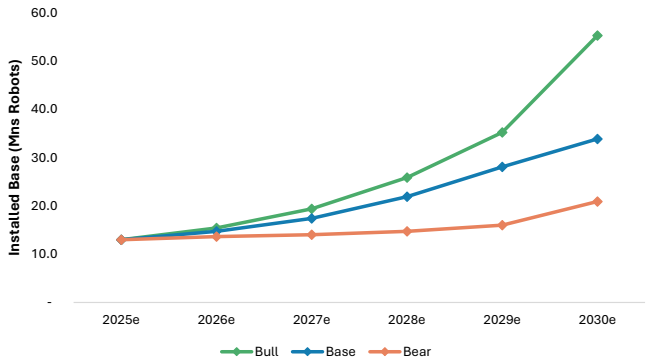


Exhibit 27: Bull/Base/Bear Estimates for US Robotics Penetration (Mns Robots in Operation): 2025-2050

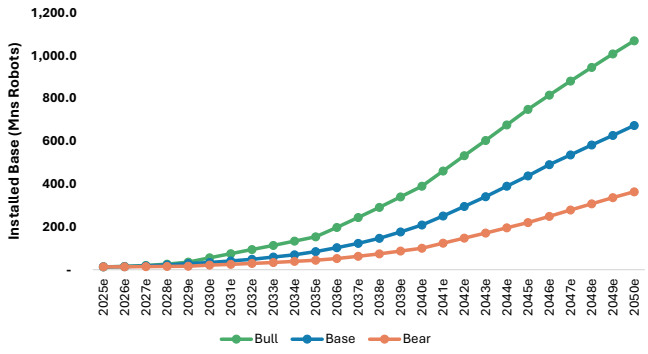


Exhibit 28: Bull/Base/Bear Estimates for US Robotics Unit Sales (Mns Robots): 2025-2030

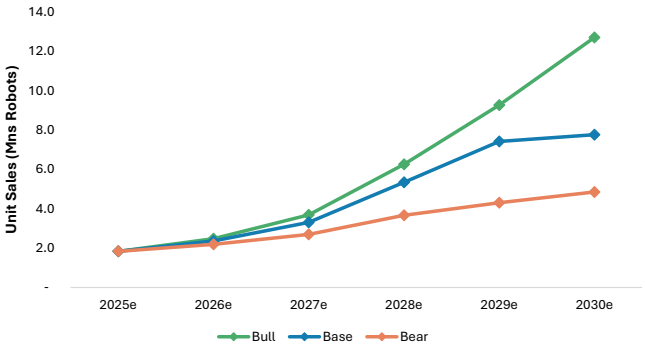


Exhibit 29: Bull/Base/Bear Estimates for US Robotics Unit Sales (Mns Robots): 2025-2050

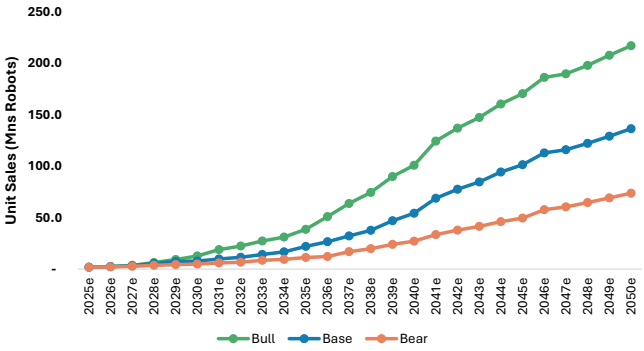


Exhibit 30: Implied US Robotics Motor Demand ($mns) and Increase vs. 2025 Levels

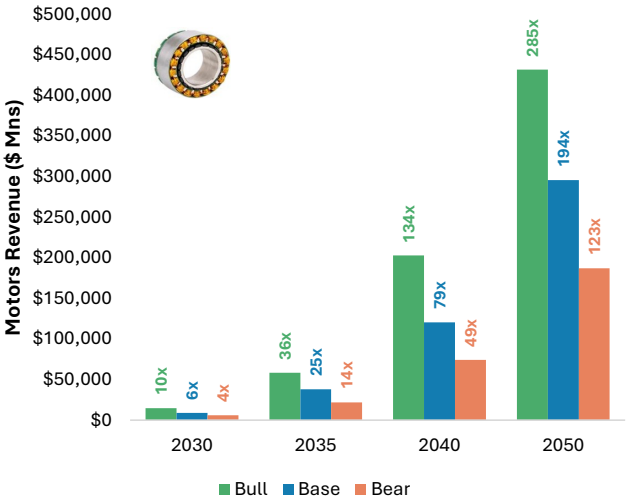


Exhibit 31: Implied US Robotics Bearing Demand ($mns) and Increase vs. 2025 Levels

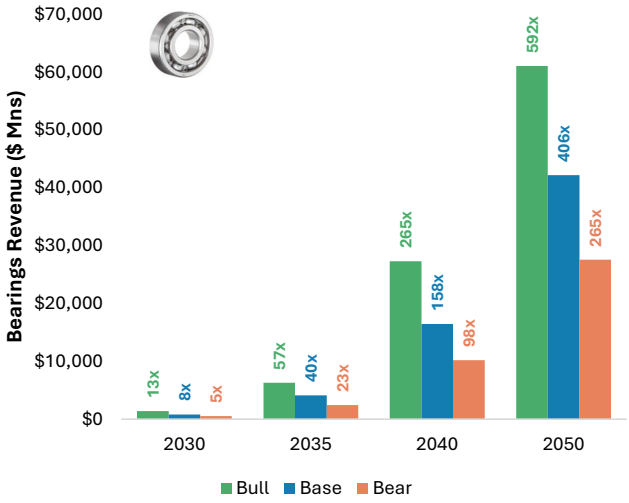


Exhibit 32: Implied US Robotics Reducer Demand ($mns) and Increase vs. 2025 Levels

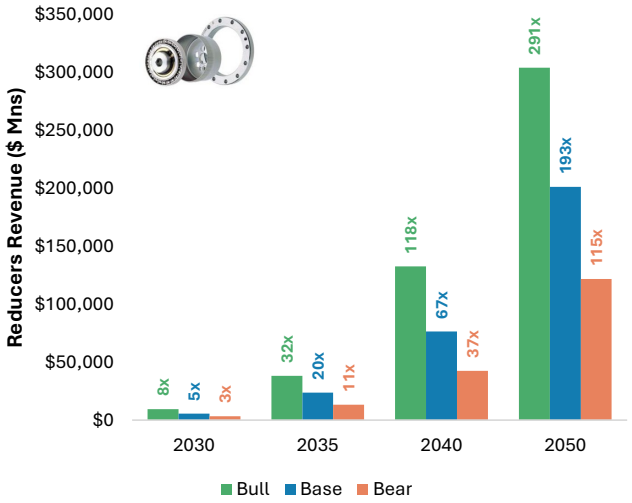


Exhibit 33: Implied US Rare Earth Magnet Demand for Robotics ($mns) and Increase vs. 2025 Levels

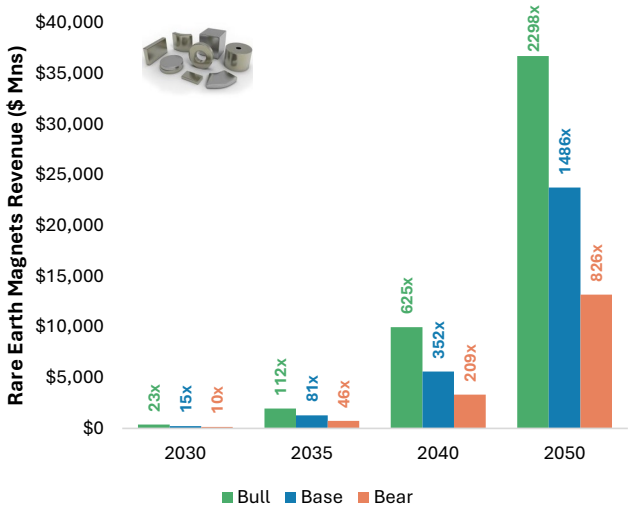


Exhibit 34:

US Robotics Bull/Base/Bear Analysis: Unit Sales, OEM Revenue, Installed Base

Bull/Bear Analysis	2024	2025e	2026e	2027e	2028e	2029e	2030e	2031e	2032e	2033e	2034e	2035e	2040e	2045e	2050e
Total US Robotics															
Unit Sales (mns)															
Bull	1.7	1.8	2.5	3.7	6.3	9.3	12.7	18.9	22.4	27.4	31.2	38.6	101.0	170.6	217.3
Base	1.7	1.8	2.4	3.3	5.3	7.4	7.8	9.8	11.4	14.3	16.8	22.1	54.4	101.5	136.6
Bear	1.7	1.8	2.2	2.7	3.7	4.3	4.9	6.0	6.7	8.5	9.4	11.2	27.2	49.6	73.8
Revenue ($ bns)															
Bull	$11	$13	$17	$28	$53	$89	$158	$352	$427	$483	$549	$652	$2,521	$4,775	$6,610
Base	$11	$13	$16	$25	$46	$69	$93	$133	$174	$227	$300	$409	$1,414	$3,037	$4,361
Bear	$11	$13	$16	$20	$34	$46	$60	$99	$116	$176	$198	$227	$824	$1,522	$2,490
Installed Base (mns)															
Bull	11.8	13.0	15.4	19.4	25.9	35.2	55.3	74.6	94.1	113.7	133.4	153.3	390.6	749.5	1,070.2
Base	11.8	13.0	14.7	17.4	21.9	28.1	33.9	41.0	48.8	58.6	69.7	84.7	208.8	438.2	674.0
Bear	11.8	13.0	13.6	14.1	14.8	16.0	20.9	25.0	29.1	34.0	38.9	43.8	100.5	219.9	364.3

Exhibit 35: US Robotics Bull/Base/Bear Analysis: Form Factor Adoption Detail

Bull/Bear by Form Factor:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2040	2045	2050
Autonomous Vehicles															
US Car Parc (units mns)	258.1	256.3	254.5	253.0	252.0	251.2	250.6	250.2	250.0	249.7	249.6	249.4	244.7	231.2	213.7
Bull L4/L5 % of Parc	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.5%	1.4%	2.3%	3.2%	4.1%	5.0%	19.0%	38.0%	64.0%
Base L4/L5 % of Parc	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.4%	0.6%	1.0%	1.5%	2.1%	3.0%	12.1%	29.4%	52.8%
Bear L4/L5 % of Parc	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.6%	0.85%	1.4%	2.0%	2.5%	9.5%	19.0%	36.0%
US AV Park (units mns)															
Bull	0.0	0.0	0.0	0.0	0.2	0.6	1.2	3.5	5.7	8.0	10.2	12.5	46.5	87.9	136.7
Base	0.0	0.0	0.0	0.0	0.2	0.5	1.0	1.6	2.4	3.6	5.3	7.5	29.6	68.0	112.7
Bear	0.0	0.0	0.0	0.0	0.2	0.5	0.8	1.5	2.1	3.5	4.9	6.2	23.2	43.9	76.9
Replacement Rate (% of prior park)	4.0%	4.0%	4.0%	4.0%	5.0%	5.0%	5.0%	6.0%	7.0%	7.0%	7.9%	8.0%	8.5%	10.4%	10.9%
US AV Sales (units mns)															
Bull	0.0	0.0	0.0	0.0	0.2	0.4	0.7	2.3	2.5	2.6	2.9	3.1	12.0	16.9	21.0
Base	0.0	0.0	0.0	0.0	0.2	0.3	0.5	0.7	0.9	1.4	2.0	2.6	7.9	15.4	18.6
Bear	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.7	0.7	1.5	1.6	1.8	7.0	8.5	13.3
US ASP (000's $)	$75.0	$71.3	$67.7	$65.7	$63.7	$61.8	$59.9	$58.7	$57.6	$56.4	$55.8	$55.3	$58.1	$61.1	$64.2
US AV Revenue ($ bns)															
Bull	$0	$0	$1	$2	$12	$24	$40	$137	$144	$149	$160	$169	$698	$1,035	$1,349
Base	$0	$0	$1	$2	$10	$21	$30	$40	$54	$77	$110	$143	$461	$939	$1,191
Bear	$0	$0	$0	$2	$10	$17	$24	$41	$43	$86	$92	$97	$408	$517	$857
Home Robots															
US Households (mns)	133	134	134	135	136	136	137	138	138	139	139	140	143	145	147
Bull Robots/Household	0.08	0.08	0.10	0.11	0.14	0.17	0.24	0.28	0.32	0.36	0.40	0.44	0.93	1.79	2.00
Base Robots/Household	0.08	0.08	0.09	0.10	0.12	0.14	0.15	0.17	0.18	0.20	0.21	0.25	0.51	1.04	1.25
Bear Robots/Household	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.10	0.11	0.12	0.12	0.13	0.24	0.54	0.70
US Home Robot Installed Base (units mns)															
Bull	10	11	13	15	19	23	33	39	45	50	56	62	133	260	294
Base	10	11	12	14	16	19	21	23	24	27	30	35	72	151	184
Bear	10	11	11	11	10	10	13	14	15	16	17	18	35	78	103
US Home Robot Sales (units mns)															
Bull	1	1	2	2	4	5	6	6	8	10	12	16	39	66	65
Base	1	1	2	2	3	4	4	4	4	6	6	9	21	39	41
Bear	1	1	1	2	2	2	2	2	3	3	4	5	10	20	23
US ASP (000's $)	$0.7	$0.7	$0.8	$0.8	$0.9	$1.0	$1.1	$1.3	$1.5	$1.7	$2.0	$2.3	$3.3	$3.6	$4.0
US Home Robot Revenue ($ bns)															
Bull	$1	$1	$1	$2	$3	$5	$7	$8	$11	$18	$23	$37	$128	$241	$261
Base	$1	$1	$1	$2	$3	$4	$4	$5	$6	$10	$12	$21	$69	$140	$163
Bear	$1	$1	$1	$1	$2	$2	$3	$3	$4	$6	$7	$11	$33	$73	$91
Humanoids															
US Population (mns)	344	346	348	350	352	353	355	356	358	360	361	363	370	376	380
Bull Robots/People	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.6%	0.7%	5.7%	19.9%	35.7%
Base Robots/People	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%	0.4%	2.8%	10.5%	20.4%
Bear Robots/People	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	1.0%	4.2%	9.2%
US Humanoid Installed Base (units mns)															
Bull	-	0	0	0	0	0	0	1	1	2	2	2	21	75	136
Base	-	0	0	0	0	0	0	0	0	1	1	1	10	39	78
Bear	-	0	0	0	0	0	0	0	0	0	0	1	4	16	35
US Humanoid Sales (units mns)															
Bull	-	0	0	0	0	0	0	0	0	1	1	1	7	19	27
Base	-	0	0	0	0	0	0	0	0	0	0	1	3	10	16
Bear	-	0	0	0	0	0	0	0	0	0	0	0	1	4	7
US ASP (000's $)	$200.0	$187.5	$175.0	$162.5	$150.0	$137.5	$130.0	$126.1	$122.3	$118.6	$115.1	$111.6	$95.9	$83.2	$75.2
US Humanoid Revenue ($ bns)															
Bull	$0	$1	$1	$2	$4	$8	$19	$42	$58	$63	$66	$112	$687	$1,542	$2,060
Base	$0	$1	$1	$1	$3	$5	$8	$14	$20	$23	$26	$57	$335	$810	$1,179
Bear	$0	$1	$1	$1	$2	$3	$4	$9	$12	$13	$14	$23	$117	$324	$530
Industrial Robots															
Manufacturing Workers (m's)	13	13	13	13	13	13	13	13	14	14	14	14	14	14	14
Bull Robots/Workers	0.03	0.03	0.03	0.04	0.04	0.05	0.07	0.08	0.10	0.11	0.12	0.14	0.35	0.79	1.18
Base Robots/Workers	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.29	0.67	1.02
Bear Robots/Workers	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.07	0.08	0.09	0.10	0.25	0.59	0.91
US Industrial Robot Installed Base (units mns)															
Bull	0	0	0	0	1	1	1	1	1	1	2	2	5	11	17
Base	0	0	0	0	1	1	1	1	1	1	1	2	4	9	15
Bear	0	0	0	0	0	1	1	1	1	1	1	1	3	8	13
US Industrial Robot Sales (units mns)															
Bull	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
Base	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3
Bear	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2
US ASP (000's $)	$55.0	$53.9	$52.8	$51.8	$50.7	$49.7	$48.7	$47.7	$46.8	$45.9	$44.9	$44.5	$42.3	$41.7	$42.9
US Industrial Robot Revenue ($ bns)															
Bull	$3	$3	$3	$3	$4	$5	$7	$9	$11	$12	$14	$16	$41	$89	$132
Base	$3	$3	$3	$3	$4	$4	$5	$6	$7	$9	$11	$13	$34	$75	$115
Bear	$3	$3	$3	$3	$4	$4	$5	$6	$7	$9	$10	$12	$29	$66	$102
Large VTOLs															
US Car Parc (mns)	258	256	254	253	252	251	251	250	250	250	250	249	245	231	214
Bull VTOLs/Cars	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.02%	0.02%	0.02%	0.22%	0.83%	1.65%
Base VTOLs/Cars	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.02%	0.14%	0.56%	1.17%
Bear VTOLs/Cars	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.09%	0.37%	0.81%
US Large VTOL Installed Base (units mns)															
Bull	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4
Base	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Bear	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
US Large VTOL Sales (units mns)															
Bull	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Base	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US ASP (000's $)	$5,000.0	$5,000.0	$5,000.0	$5,000.0	$4,750.0	$4,465.0	$4,107.8	$3,697.0	$3,327.3	$2,828.2	$2,404.0	$2,043.4	$1,126.6	$880.9	$796.3
US Large VTOL Revenue ($ bns)															
Bull	$0	$0	$0	$1	$2	$4	$12	$31	$45	$52	$54	$56	$236	$509	$598
Base	$0	$0	$0	$0	$1	$3	$5	$8	$14	$19	$26	$37	$149	$341	$423
Bear	$0	$0	$0	$0	$1	$2	$4	$8	$11	$18	$21	$24	$96	$228	$295
Professional Service Robots															
US Population (mns)	344	346	348	350	352	353	355	356	358	360	361	363	370	376	380
Bull PSRs/People	0.1%	0.1%	0.2%	0.4%	0.6%	1.0%	1.8%	2.9%	4.0%	5.1%	6.1%	7.2%	22.6%	45.9%	75.4%
Base PSRs/People	0.1%	0.1%	0.2%	0.3%	0.5%	0.7%	0.9%	1.3%	1.7%	2.2%	2.9%	3.8%	11.3%	24.7%	44.1%
Bear PSRs/People	0.1%	0.1%	0.2%	0.2%	0.3%	0.4%	0.4%	0.7%	0.9%	1.2%	1.4%	1.6%	4.3%	10.6%	21.0%
US PSR Installed Base (units mns)															
Bull	0	0	1	1	2	3	6	10	14	18	22	26	84	172	287
Base	0	0	1	1	2	2	3	4	6	8	11	14	42	93	168
Bear	0	0	1	1	1	1	2	2	3	4	5	6	16	40	80
US PSR Sales (units mns)															
Bull	0	0	0	0	0	1	1	2	2	3	4	5	15	31	48
Base	0	0	0	0	0	0	1	1	1	1	2	2	8	16	28
Bear	0	0	0	0	0	0	0	0	1	1	1	1	3	7	13
US ASP (000's $)	$50.0	$49.0	$48.0	$47.1	$46.1	$45.2	$44.3	$43.4	$42.5	$41.7	$40.9	$40.0	$37.3	$36.8	$37.9
US Professional Service Robot Revenue ($ bns)															
Bull	$4	$6	$8	$11	$16	$25	$46	$78	$103	$127	$163	$185	$571	$1,123	$1,831
Base	$4	$6	$7	$9	$14	$18	$24	$34	$43	$56	$78	$97	$285	$605	$1,070
Bear	$4	$6	$7	$7	$8	$9	$11	$18	$24	$29	$37	$42	$109	$259	$510
Small Drones															
US Population (mns)	344	346	348	350	352	353	355	356	358	360	361	363	370	376	380
Bull Drones/People	0.2%	0.3%	0.4%	0.7%	1.2%	2.0%	3.7%	5.6%	7.6%	9.5%	11.5%	13.4%	27.4%	37.8%	51.7%
Base Drones/People	0.2%	0.3%	0.4%	0.7%	1.1%	1.6%	2.1%	3.1%	4.1%	5.0%	6.0%	7.1%	13.7%	20.4%	30.2%
Bear Drones/People	0.2%	0.3%	0.4%	0.6%	0.8%	1.0%	1.3%	1.7%	2.1%	2.4%	2.8%	3.2%	5.2%	8.8%	14.4%
US Drone Installed Base (units mns)															
Bull	1	1	2	3	4	7	13	20	27	34	41	49	101	142	197
Base	1	1	1	2	4	6	8	11	15	18	22	26	51	77	115
Bear	1	1	1	2	3	3	5	6	7	9	10	12	19	33	55
US Drone Sales (units mns)															
Bull	0	0	1	1	2	3	5	8	9	10	12	13	27	35	52
Base	0	0	1	1	2	2	3	4	5	6	6	7	13	19	30
Bear	0	0	1	1	1	1	2	2	3	3	3	3	5	8	14
US ASP (000's $)	$6.8	$6.6	$6.5	$6.4	$6.3	$6.1	$6.0	$5.9	$5.9	$5.9	$5.9	$5.9	$6.1	$6.6	$7.3
US Drone Revenue ($ bns)															
Bull	$3	$3	$4	$7	$12	$18	$28	$47	$54	$62	$69	$78	$161	$235	$378
Base	$3	$3	$4	$6	$11	$14	$16	$26	$29	$33	$37	$41	$81	$127	$221
Bear	$3	$3	$3	$5	$8	$8	$10	$14	$15	$16	$17	$18	$31	$55	$105

Exhibit 36: US Robotics Bull/Base/Bear Analysis: Actuator Content Estimates

Implied US Actuator Component Demand	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2040	2045	2050
Motors per Robot by Form Factor (# per robot, y/y)															
Autonomous Vehicles	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
$/Component (Global Avg)	*$98*	*$96*	*$94*	*$92*	*$90*	*$88*	*$86*	*$85*	*$83*	*$81*	*$80*	*$78*	*$71*	*$64*	*$58*
Home Robots	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5
$/Component (Global Avg)	*$25*	*$25*	*$24*	*$24*	*$23*	*$23*	*$22*	*$22*	*$21*	*$21*	*$20*	*$20*	*$18*	*$16*	*$15*
Humanoids	40	40	42	45	48	51	55	57	59	61	63	66	76	81	86
$/Component (Global Avg)	*$206*	*$206*	*$149*	*$125*	*$97*	*$89*	*$75*	*$81*	*$69*	*$58*	*$49*	*$49*	*$38*	*$33*	*$28*
Industrial Robots	6	6	6	7	7	7	7	7	7	8	8	8	9	10	10
$/Component (Global Avg)	*$1,000*	*$981*	*$962*	*$943*	*$924*	*$905*	*$886*	*$869*	*$852*	*$835*	*$818*	*$801*	*$724*	*$658*	*$591*
Large VTOLs	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
$/Component (Global Avg)	*$13,000*	*$12,753*	*$12,505*	*$12,258*	*$12,011*	*$11,763*	*$11,516*	*$11,295*	*$11,073*	*$10,852*	*$10,631*	*$10,410*	*$9,409*	*$8,549*	*$7,688*
Prof. Service Robots	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6
$/Component (Global Avg)	*$1,000*	*$981*	*$962*	*$943*	*$924*	*$905*	*$886*	*$869*	*$852*	*$835*	*$818*	*$801*	*$724*	*$658*	*$591*
Small Drones	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
$/Component (Global Avg)	*$50*	*$49*	*$48*	*$47*	*$46*	*$45*	*$44*	*$43*	*$43*	*$42*	*$41*	*$40*	*$36*	*$33*	*$30*
US Price Premium vs Global Avg (x)															
Bull	1.50x	1.49x	1.49x	1.48x	1.46x	1.45x	1.44x	1.43x	1.41x	1.40x	1.38x	1.37x	1.29x	1.20x	1.10x
Base	1.50x	1.50x	1.50x	1.49x	1.49x	1.48x	1.47x	1.46x	1.45x	1.44x	1.43x	1.42x	1.35x	1.26x	1.15x
Bear	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.49x	1.49x	1.49x	1.48x	1.48x	1.47x	1.43x	1.36x	1.25x
Implied Motors Revenue ($ mns)															
Bull	$1,257	$1,514	$2,004	$3,023	$5,313	$8,667	$14,812	$31,576	$37,932	$43,673	$50,652	$58,488	$202,911	$355,836	$431,875
Base	$1,257	$1,525	$1,928	$2,752	$4,674	$6,885	$9,028	$12,767	$16,501	$21,570	$28,877	$37,968	$120,590	$236,352	$295,836
Bear	$1,257	$1,525	$1,845	$2,261	$3,461	$4,647	$5,936	$9,553	$11,349	$16,892	$19,503	$22,036	$74,308	$135,345	$187,281

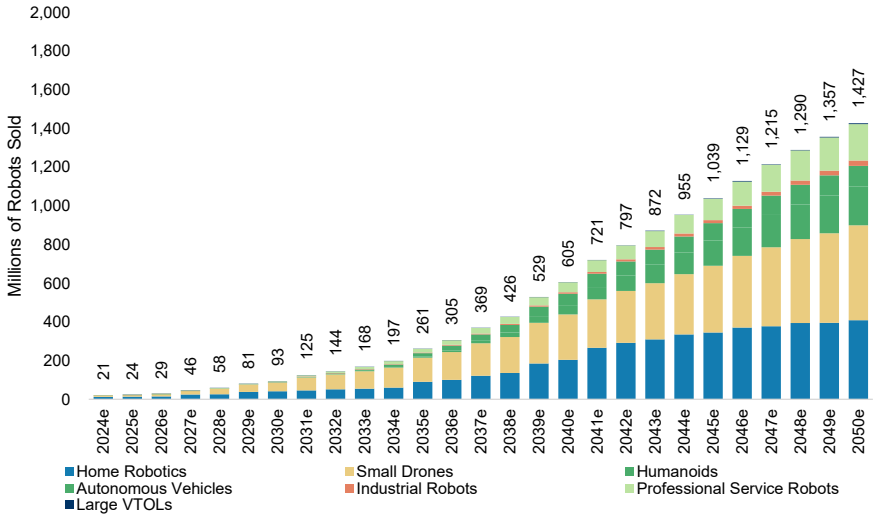
Bearings per Robot by Form Factor (# per robot, y/y)															
Autonomous Vehicles	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82
$/Component (Global Avg)	*$5*	*$5*	*$5*	*$5*	*$5*	*$5*	*$4*	*$4*	*$4*	*$4*	*$4*	*$4*	*$4*	*$3*	*$3*
Home Robots	6	6	6	7	7	7	7	7	7	8	8	8	9	10	10
$/Component (Global Avg)	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*
Humanoids	83	83	85	87	90	92	95	97	99	101	103	105	116	121	126
$/Component (Global Avg)	*$18*	*$18*	*$15*	*$14*	*$12*	*$12*	*$10*	*$12*	*$11*	*$9*	*$8*	*$8*	*$7*	*$6*	*$5*
Industrial Robots	12	12	13	13	13	14	14	14	15	15	16	16	18	19	20
$/Component (Global Avg)	*$30*	*$29*	*$29*	*$28*	*$28*	*$27*	*$27*	*$26*	*$26*	*$25*	*$25*	*$24*	*$22*	*$20*	*$18*
Large VTOLs	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
$/Component (Global Avg)	*$2,000*	*$1,962*	*$1,924*	*$1,886*	*$1,848*	*$1,810*	*$1,772*	*$1,738*	*$1,704*	*$1,670*	*$1,636*	*$1,601*	*$1,448*	*$1,315*	*$1,183*
Prof. Service Robots	8	8	8	9	9	9	9	9	9	10	10	10	11	12	12
$/Component (Global Avg)	*$30*	*$29*	*$29*	*$28*	*$28*	*$27*	*$27*	*$26*	*$26*	*$25*	*$25*	*$24*	*$22*	*$20*	*$18*
Small Drones	12	12	13	13	13	14	14	14	15	15	16	16	16	16	16
$/Component (Global Avg)	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$1*	*$1*	*$1*
US Price Premium vs Global Avg (x)															
Bull	1.50x	1.49x	1.49x	1.48x	1.46x	1.45x	1.44x	1.43x	1.41x	1.40x	1.38x	1.37x	1.29x	1.20x	1.10x
Base	1.50x	1.50x	1.50x	1.49x	1.49x	1.48x	1.47x	1.46x	1.45x	1.44x	1.43x	1.42x	1.35x	1.26x	1.15x
Bear	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.49x	1.49x	1.49x	1.48x	1.48x	1.47x	1.43x	1.36x	1.25x
Implied Bearings Revenue ($ mns)															
Bull	$82	$103	$140	$223	$432	$757	$1,376	$3,312	$4,063	$4,618	$5,182	$6,278	$27,331	$52,946	$61,090
Base	$82	$104	$135	$202	$380	$601	$817	$1,221	$1,631	$2,158	$2,886	$4,121	$16,476	$35,190	$42,212
Bear	$82	$104	$129	$169	$292	$413	$544	$952	$1,150	$1,779	$2,069	$2,449	$10,194	$21,157	$27,590

Reducers per Robot by Form Factor (# per robot, y/y)															
Autonomous Vehicles	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
$/Component (Global Avg)	*$1,500*	*$1,471*	*$1,443*	*$1,414*	*$1,386*	*$1,357*	*$1,329*	*$1,303*	*$1,278*	*$1,252*	*$1,227*	*$1,201*	*$1,086*	*$986*	*$887*
Home Robots	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
$/Component (Global Avg)	*$10*	*$10*	*$10*	*$9*	*$9*	*$9*	*$9*	*$9*	*$9*	*$8*	*$8*	*$8*	*$7*	*$7*	*$6*
Humanoids	27	27	28	28	28	28	29	29	29	29	29	30	32	33	34
$/Component (Global Avg)	*$183*	*$183*	*$156*	*$141*	*$119*	*$112*	*$99*	*$102*	*$91*	*$81*	*$72*	*$71*	*$58*	*$50*	*$44*
Industrial Robots	6	6	6	7	7	7	7	7	7	8	8	8	9	10	10
$/Component (Global Avg)	*$1,000*	*$981*	*$962*	*$943*	*$924*	*$905*	*$886*	*$869*	*$852*	*$835*	*$818*	*$801*	*$724*	*$658*	*$591*
Large VTOLs	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
$/Component (Global Avg)	*$5,000*	*$4,905*	*$4,810*	*$4,715*	*$4,619*	*$4,524*	*$4,429*	*$4,344*	*$4,259*	*$4,174*	*$4,089*	*$4,004*	*$3,619*	*$3,288*	*$2,957*
Prof. Service Robots	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6
$/Component (Global Avg)	*$1,000*	*$981*	*$962*	*$943*	*$924*	*$905*	*$886*	*$869*	*$852*	*$835*	*$818*	*$801*	*$724*	*$658*	*$591*
Small Drones	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$/Component (Global Avg)	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
US Price Premium vs Global Avg (x)															
Bull	1.50x	1.49x	1.49x	1.48x	1.46x	1.45x	1.44x	1.43x	1.41x	1.40x	1.38x	1.37x	1.29x	1.20x	1.10x
Base	1.50x	1.50x	1.50x	1.49x	1.49x	1.48x	1.47x	1.46x	1.45x	1.44x	1.43x	1.42x	1.35x	1.26x	1.15x
Bear	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.49x	1.49x	1.49x	1.48x	1.48x	1.47x	1.43x	1.36x	1.25x
Implied Reducers Revenue ($ mns)															
Bull	$966	$1,190	$1,519	$2,131	$3,377	$5,376	$9,421	$18,375	$23,078	$27,345	$33,035	$38,361	$132,813	$239,910	$304,522
Base	$966	$1,198	$1,466	$1,951	$2,949	$4,134	$5,505	$7,709	$10,113	$13,242	$18,124	$23,787	$76,531	$151,911	$201,535
Bear	$966	$1,198	$1,411	$1,569	$2,105	$2,727	$3,421	$5,525	$6,928	$9,661	$11,582	$13,222	$42,681	$84,124	$122,014

Rare Earth Magnets per Robot by Form Factor (kg per robot, y/y)															
Autonomous Vehicles	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
Home Robots	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
Humanoids	3	3	3	4	4	4	4	4	4	5	5	5	6	6	6
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
Industrial Robots	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
Large VTOLs	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
Prof. Service Robots	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
Small Drones	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$/kg (Global Avg)	*$50*	*$54*	*$58*	*$63*	*$67*	*$71*	*$75*	*$76*	*$77*	*$78*	*$79*	*$80*	*$86*	*$93*	*$100*
US Price Premium vs Global Avg (x)															
Bull	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x
Base	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x
Bear	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x	1.00x
Implied Rare Earth Magnets Revenue ($ mns)															
Bull	$12	$16	$24	$44	$104	$198	$373	$947	$1,158	$1,348	$1,585	$1,967	$9,994	$23,218	$36,747
Base	$12	$16	$23	$40	$90	$158	$233	$336	$463	$645	$900	$1,292	$5,624	$14,580	$23,765
Bear	$12	$16	$22	$33	$69	$110	$159	$269	$321	$547	$629	$742	$3,335	$7,195	$13,206

Global Robot Penetration Estimates & Implied Actuator Demand

Exhibit 37: We See 1.4 Billion in Annual Robot Unit Sales by 2050



Note: Final Hardware Sales Only- Software/Services, Maintenance, Supply Chains, etc. could theoretically multiply this figure.

Exhibit 38: Robot Unit Sales by Region and Form Factor

Robots Sold (Millions)	2024e	2025e	2026e	2027e	2028e	2029e	2030e	2032e	2034e	2036e	2038e	2040e	2042e	2044e	2046e	2048e	2050e
Autonomous Vehicles	**0.00**	**0.01**	**0.05**	**0.15**	**0.49**	**0.95**	**1.5**	**3.6**	**11.7**	**24.1**	**39.2**	**59.1**	**73.2**	**84.3**	**96.4**	**101.5**	**105.2**
USA	0.00	0.00	0.01	0.03	0.16	0.33	0.5	0.9	2.0	3.5	5.9	7.9	10.7	13.7	17.7	18.4	18.6
China	0.00	0.00	0.05	0.09	0.23	0.47	0.7	1.3	2.8	4.8	7.2	9.6	13.9	18.2	22.7	23.9	23.9
Rest-of-World	0.00	0.00	0.00	0.02	0.09	0.15	0.3	1.4	6.9	15.9	26.1	41.6	48.7	52.5	55.9	59.2	62.7
Home Robotics	**12.5**	**13.8**	**15.5**	**24.8**	**26.5**	**38.2**	**41.8**	**51.3**	**61.2**	**100.9**	**136.4**	**204.7**	**291.7**	**335.7**	**371.2**	**394.2**	**408.7**
USA	1.1	1.3	1.6	2.0	3.1	4.3	3.9	4.2	6.2	10.4	14.0	21.1	33.6	38.3	41.4	38.9	40.8
China	3.3	3.4	3.6	8.8	6.9	12.4	13.7	14.1	14.3	28.3	40.4	53.7	89.4	106.5	96.4	107.7	101.1
Rest-of-World	8.1	9.1	10.3	14.0	16.5	21.5	24.2	33.1	40.7	62.2	82.0	129.9	168.8	190.9	233.4	247.6	266.9
Humanoids	**0.00**	**0.02**	**0.03**	**0.06**	**0.15**	**0.32**	**0.4**	**1.5**	**3.5**	**9.8**	**23.5**	**47.4**	**78.8**	**110.5**	**145.4**	**178.7**	**201.8**
USA	0.00	0.00	0.00	0.01	0.02	0.04	0.0	0.2	0.2	0.7	1.8	3.5	5.7	8.3	10.9	13.4	15.7
China	0.00	0.01	0.01	0.03	0.06	0.10	0.2	0.4	1.4	4.1	10.8	23.3	35.5	42.7	48.2	50.8	54.1
Rest-of-World	0.00	0.01	0.01	0.02	0.08	0.18	0.2	0.8	1.9	5.1	10.9	20.6	37.6	59.5	86.2	114.5	132.0
Industrial Robots	**0.5**	**0.6**	**0.7**	**0.9**	**1.0**	**1.2**	**1.5**	**2.1**	**2.9**	**4.1**	**5.6**	**7.8**	**11.0**	**14.9**	**17.7**	**22.4**	**28.1**
USA	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.5	0.8	1.2	1.7	1.9	2.3	2.7
China	0.3	0.4	0.4	0.5	0.6	0.8	0.9	1.3	1.7	2.2	2.9	3.6	4.5	5.5	6.7	8.0	9.7
Rest-of-World	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.6	1.0	1.5	2.2	3.4	5.4	7.7	9.1	12.1	15.8
Large VTOLs	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.02**	**0.04**	**0.10**	**0.24**	**0.47**	**0.84**	**1.39**	**2.04**	**2.69**	**3.09**	**3.81**
USA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.06	0.13	0.22	0.32	0.40	0.45	0.53
China	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.05	0.10	0.15	0.18	0.23	0.27	0.34	0.51	0.77
Rest-of-World	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.11	0.25	0.53	0.94	1.45	1.94	2.13	2.51
Professional Service Robots	**0.9**	**1.1**	**1.5**	**2.0**	**2.7**	**3.6**	**4.8**	**8.5**	**14.6**	**23.3**	**35.0**	**51.0**	**71.4**	**95.5**	**124.2**	**155.0**	**188.4**
USA	0.1	0.1	0.2	0.2	0.3	0.4	0.5	1.0	1.9	3.0	4.9	7.6	10.7	14.3	18.6	23.3	28.3
China	0.4	0.6	0.9	1.2	1.6	2.1	2.7	4.4	6.6	10.0	13.8	19.8	26.8	34.8	44.0	53.8	65.4
Rest-of-World	0.4	0.4	0.5	0.6	0.8	1.1	1.6	3.1	6.1	10.3	16.3	23.5	33.8	46.4	61.6	77.9	94.7
Small Drones	**7.4**	**8.0**	**11.2**	**17.7**	**27.3**	**36.5**	**43.2**	**77.4**	**103.2**	**142.9**	**186.0**	**234.6**	**269.3**	**311.9**	**371.1**	**434.9**	**491.1**
USA	0.4	0.4	0.6	1.0	1.7	2.3	2.7	5.0	6.2	8.8	10.6	13.3	15.5	17.8	22.0	25.8	30.1
China	2.8	3.5	4.4	5.6	7.0	8.7	10.8	16.9	26.9	40.8	54.1	68.1	76.0	90.0	101.1	111.7	122.7
Rest-of-World	4.2	4.2	6.2	11.1	18.7	25.5	29.8	55.5	70.1	93.5	121.3	153.2	177.7	204.1	247.9	297.6	338.3
Total Robots Sold (Millions)	**21**	**24**	**29**	**46**	**58**	**81**	**93**	**144**	**197**	**305**	**426**	**605**	**797**	**955**	**1,129**	**1,290**	**1,427**
USA	2	2	2	3	5	7	8	11	17	27	38	54	78	94	113	122	137
China	7	8	9	16	16	24	29	38	54	90	129	178	246	298	319	356	378
Rest-of-World	13	14	17	26	36	49	56	95	127	189	259	373	473	563	696	811	913

Exhibit 39: Global Robotics Component Demand: Electric Motors

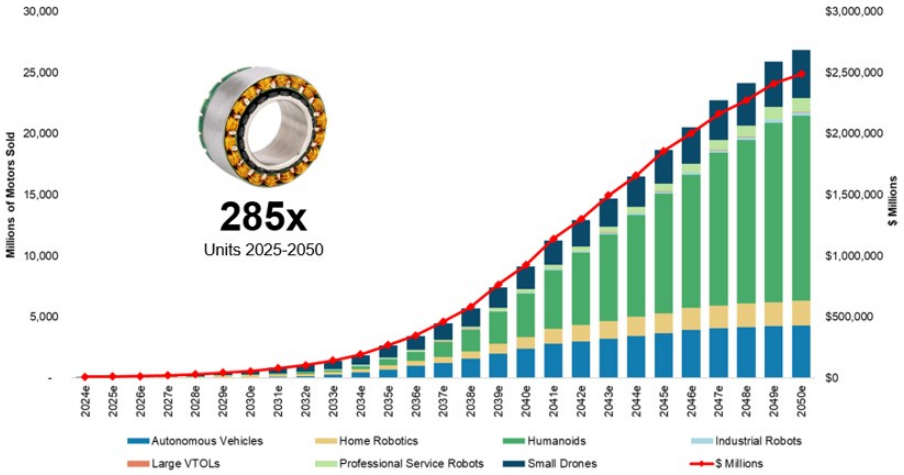


Exhibit 40: Global Robotics Component Demand: Bearings

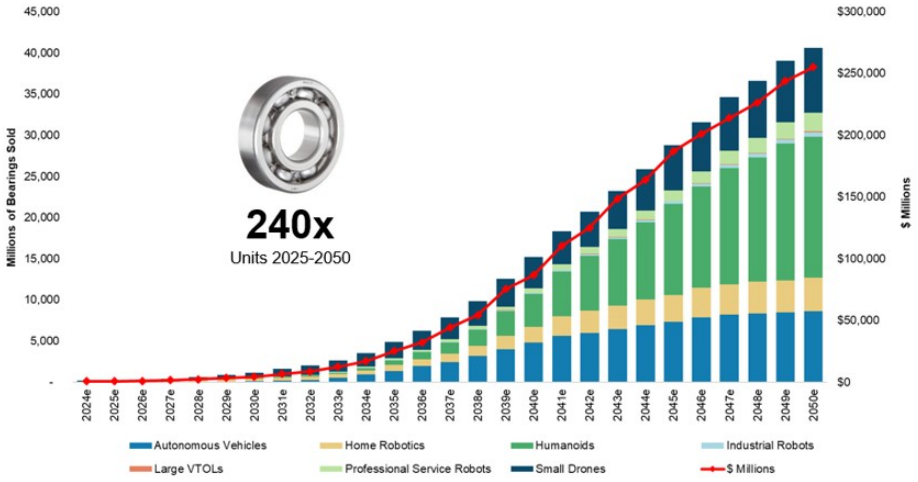


Exhibit 41: Global Robotics Component Demand: Reducers

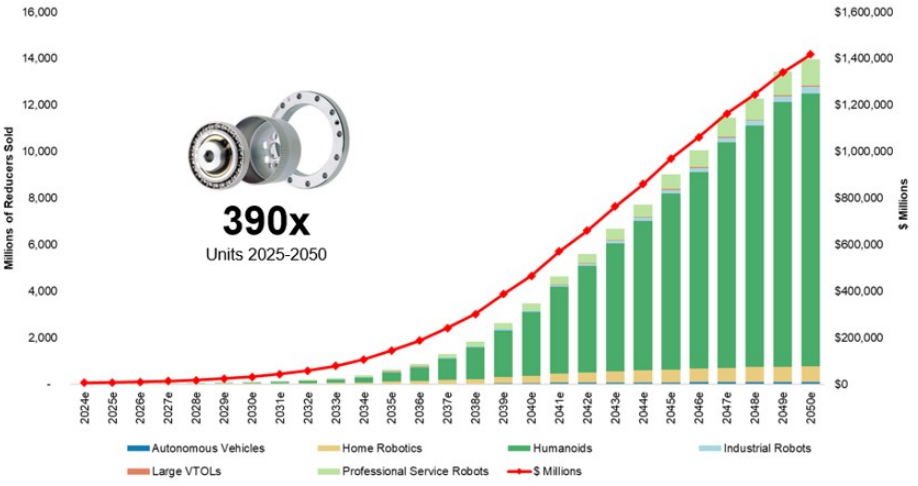
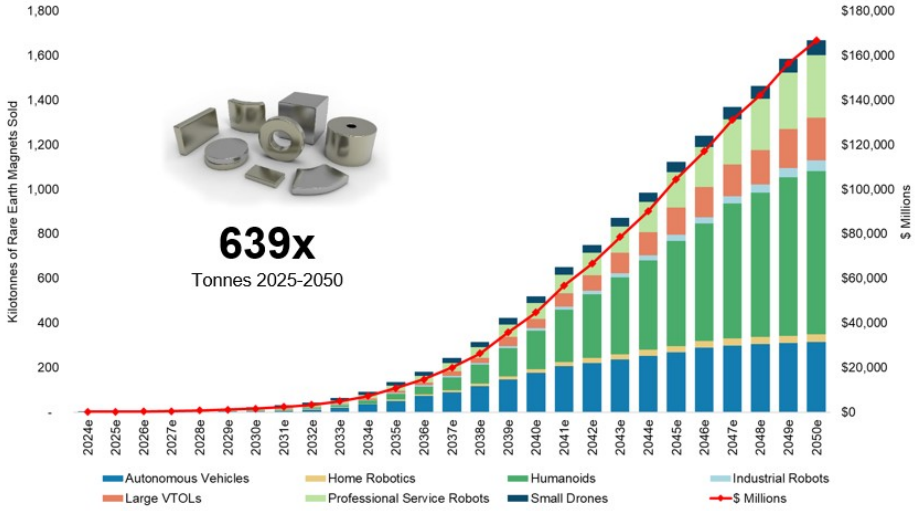


Exhibit 42: Global Robotics Component Demand: Rare Earth Magnets (NdFeB, SmCo, etc.)



Sizing the Component Opportunity for Suppliers

Robotics actuators (all form factors) could theoretically transform component supplier revenue, exceeding current sales by an order of magnitude in some cases. To give investors a sense of scale for the opportunity (globally here, not just the US), we decompose the actuator into its three major cost buckets, motors, bearings and reducers, sizing the 2030 global TAM at $94bn in our base case ($140bn bull, $71bn bear), and flex a hypothetical supplier's share of each component against that component's own TAM, expressing the result as a percentage of the relevant median Motor Dozen peer's 2025 sales. Even modest share capture moves the needle. At just 0.5% share, revenue equals roughly 6% of the median motor peer's current sales and roughly 8% for reducers, rising to about 12% and 16% respectively at 1% share, and to about 61% and 82% at 5%. The magnitude multiplies in 2040 and 2050. In 2040, the same 0.5% share is worth close to a full year of the median motor peer's current revenue and exceeds one for reducers, and by 2050 a 1% share is worth roughly 5x and 7x respectively. Our base-case actuator TAM compounds from $94bn in 2030 to $1.3tn in 2040 and $3.8tn in 2050, as global robotics penetration grows 17x, 15x and 10x across our bull, base and bear cases.

Exhibit 43: Even the bear case grows actuator component TAM 64x by 2050, theoretically making a 1% share worth 18x a median supplier's entire 2025 revenue (refers to global figures vs. US only in this case).

Total Actuator TAM

	2025	2030e	2040e	2050e
Bull		$140bn	$2.3tn	$6.5tn
Base	$21.8bn	$94bn	$1.3tn	$3.8tn
Bear		$71bn	$0.8tn	$1.4tn
Base case CAGR off 2025		34%	31%	23%

Supplier Revenue at 1% Share + Implied Increase vs. Median Peer 2025 Total Revs

Multiples below each figure are x the median Motor Dozen peer's 2025 sales ($2.1bn), which assumes no peer growth; a scale device, not a forward comparison

	2025	2030e	2040e	2050e
Bull		$1.4bn 0.7x	$23bn 11.0x	$65bn 31.4x
Base	$0.2bn	$0.9bn 0.5x	$13bn 6.2x	$38bn 18.3x
Bear		$0.7bn 0.3x	$7.5bn 3.6x	$14bn 6.7x

Note: Based on Motor Dozen list. Motor peers = Timken, Regal Rexnord, Allient, Moog, Minebea Mitsumi. Bearings peers = Timken, Regal Rexnord, RBC Bearings, Minebea Mitsumi. Reducer peers = Timken, Regal Rexnord, Harmonic Drive Systems, Nabtesco, Leaderdrive.

Exhibit 44: 2030 Actuator TAM/revenue sensitivity across Bull/Base/Bear cases, flexing supplier market share.

Global Component TAM in 2030 ($ mns)			
Component	Bull	Base	Bear
Motors	$82,278	$55,607	$42,255
Bearings	$7,622	$4,968	$3,769
Reducers	$50,543	$33,654	$25,272
Total Actuator	**$140,443**	**$94,228**	**$71,297**

2030 Rev. Sensitivity- Based on Global Share

Motor Share	Bull	Base	Bear
0.1%	$82	$56	$42
0.5%	$411	$278	$211
1.0%	$823	$556	$423
2.5%	$2,057	$1,390	$1,056
5.0%	$4,114	$2,780	$2,113
7.5%	$6,171	$4,170	$3,169
10.0%	$8,228	$5,561	$4,225
12.5%	$10,285	$6,951	$5,282
15.0%	$12,342	$8,341	$6,338

Bearings Share	Bull	Base	Bear
0.1%	$8	$5	$4
0.5%	$38	$25	$19
1.0%	$76	$50	$38
2.5%	$191	$124	$94
5.0%	$381	$248	$188
7.5%	$572	$373	$283
10.0%	$762	$497	$377
12.5%	$953	$621	$471
15.0%	$1,143	$745	$565

Reducer Share	Bull	Base	Bear
0.1%	$51	$34	$25
0.5%	$253	$168	$126
1.0%	$505	$337	$253
2.5%	$1,264	$841	$632
5.0%	$2,527	$1,683	$1,264
7.5%	$3,791	$2,524	$1,895
10.0%	$5,054	$3,365	$2,527
12.5%	$6,318	$4,207	$3,159
15.0%	$7,581	$5,048	$3,791

2030 Rev. Sensitivity as % of Median Peer 2025 Rev

Motor Share	Bull	Base	Bear
0.1%	1.8%	1.2%	0.9%
0.5%	9.0%	6.1%	4.6%
1.0%	18.0%	12.1%	9.2%
2.5%	44.9%	30.3%	23.1%
5.0%	89.8%	60.7%	46.1%
7.5%	134.7%	91.0%	69.2%
10.0%	179.6%	121.4%	92.2%
12.5%	224.5%	151.7%	115.3%
15.0%	269.4%	182.0%	138.3%

Bearings Share	Bull	Base	Bear
0.1%	0.1%	0.1%	0.1%
0.5%	0.7%	0.5%	0.4%
1.0%	1.4%	0.9%	0.7%
2.5%	3.6%	2.4%	1.8%
5.0%	7.2%	4.7%	3.6%
7.5%	10.9%	7.1%	5.4%
10.0%	14.5%	9.4%	7.2%
12.5%	18.1%	11.8%	9.0%
15.0%	21.7%	14.2%	10.8%

Reducer Share	Bull	Base	Bear
0.1%	2.5%	1.6%	1.2%
0.5%	12.3%	8.2%	6.1%
1.0%	24.6%	16.4%	12.3%
2.5%	61.4%	40.9%	30.7%
5.0%	122.8%	81.8%	61.4%
7.5%	184.2%	122.6%	92.1%
10.0%	245.6%	163.5%	122.8%
12.5%	307.0%	204.4%	153.5%
15.0%	368.3%	245.3%	184.2%

Note: Based on Motor Dozen list. Motor peers = Timken, Regal Rexnord, Allient, Moog, Minebea Mitsumi. Bearings peers = Timken, Regal Rexnord, RBC Bearings, Minebea Mitsumi. Reducer peers = Timken, Regal Rexnord, Harmonic Drive Systems, Nabtesco, Leaderdrive.

Exhibit 45: 2040 Actuator TAM/revenue sensitivity across Bull/Base/Bear cases, flexing supplier market share.

Global Component TAM in 2040 ($ mns)			
Component	Bull	Base	Bear
Motors	$1,280,459	$739,420	$437,921
Bearings	$190,780	$104,027	$52,393
Reducers	$788,364	$442,411	$259,785
Total Actuator	**$2,259,603**	**$1,285,858**	**$750,099**

2040 Rev. Sensitivity- Based on Global Share

Motor Share	Bull	Base	Bear
0.1%	$1,280	$739	$438
0.5%	$6,402	$3,697	$2,190
1.0%	$12,805	$7,394	$4,379
2.5%	$32,011	$18,486	$10,948
5.0%	$64,023	$36,971	$21,896
7.5%	$96,034	$55,457	$32,844
10.0%	$128,046	$73,942	$43,792
12.5%	$160,057	$92,428	$54,740
15.0%	$192,069	$110,913	$65,688

Bearings Share	Bull	Base	Bear
0.1%	$191	$104	$52
0.5%	$954	$520	$262
1.0%	$1,908	$1,040	$524
2.5%	$4,770	$2,601	$1,310
5.0%	$9,539	$5,201	$2,620
7.5%	$14,309	$7,802	$3,929
10.0%	$19,078	$10,403	$5,239
12.5%	$23,848	$13,003	$6,549
15.0%	$28,617	$15,604	$7,859

Reducer Share	Bull	Base	Bear
0.1%	$788	$442	$260
0.5%	$3,942	$2,212	$1,299
1.0%	$7,884	$4,424	$2,598
2.5%	$19,709	$11,060	$6,495
5.0%	$39,418	$22,121	$12,989
7.5%	$59,127	$33,181	$19,484
10.0%	$78,836	$44,241	$25,979
12.5%	$98,545	$55,301	$32,473
15.0%	$118,255	$66,362	$38,968

2040 Rev. Sensitivity as Multiple of Median Peer 2025 Rev

Motor Share	Bull	Base	Bear
0.1%	0.3x	0.2x	0.1x
0.5%	1.4x	0.8x	0.5x
1.0%	2.8x	1.6x	1.0x
2.5%	7.0x	4.0x	2.4x
5.0%	14.0x	8.1x	4.8x
7.5%	21.0x	12.1x	7.2x
10.0%	27.9x	16.1x	9.6x
12.5%	34.9x	20.2x	11.9x
15.0%	41.9x	24.2x	14.3x

Bearings Share	Bull	Base	Bear
0.1%	0.0x	0.0x	0.0x
0.5%	0.2x	0.1x	0.0x
1.0%	0.4x	0.2x	0.1x
2.5%	0.9x	0.5x	0.2x
5.0%	1.8x	1.0x	0.5x
7.5%	2.7x	1.5x	0.7x
10.0%	3.6x	2.0x	1.0x
12.5%	4.5x	2.5x	1.2x
15.0%	5.4x	3.0x	1.5x

Reducer Share	Bull	Base	Bear
0.1%	0.4x	0.2x	0.1x
0.5%	1.9x	1.1x	0.6x
1.0%	3.8x	2.1x	1.3x
2.5%	9.6x	5.4x	3.2x
5.0%	19.2x	10.7x	6.3x
7.5%	28.7x	16.1x	9.5x
10.0%	38.3x	21.5x	12.6x
12.5%	47.9x	26.9x	15.8x
15.0%	57.5x	32.2x	18.9x

Note: Based on Motor Dozen list. Motor peers = Timken, Regal Rexnord, Allient, Moog, Minebea Mitsumi. Bearings peers = Timken, Regal Rexnord, RBC Bearings, Minebea Mitsumi. Reducer peers = Timken, Regal Rexnord, Harmonic Drive Systems, Nabtesco, Leaderdrive.

Exhibit 46: 2050 Actuator TAM/revenue sensitivity across Bull/Base/Bear cases, flexing supplier market share.

Global Component TAM in 2050 ($ mns)			
Component	**Bull**	**Base**	**Bear**
Motors	$3,567,527	$2,073,942	$786,409
Bearings	$594,544	$316,219	$103,669
Reducers	$2,299,886	$1,370,353	$497,996
Total Actuator	**$6,461,957**	**$3,760,514**	**$1,388,073**

2050 Rev. Sensitivity- Based on Global Share

Motor Share	Bull	Base	Bear
0.1%	$3,568	$2,074	$786
0.5%	$17,838	$10,370	$3,932
1.0%	$35,675	$20,739	$7,864
2.5%	$89,188	$51,849	$19,660
5.0%	$178,376	$103,697	$39,320
7.5%	$267,565	$155,546	$58,981
10.0%	$356,753	$207,394	$78,641
12.5%	$445,941	$259,243	$98,301
15.0%	$535,129	$311,091	$117,961

Bearings Share	Bull	Base	Bear
0.1%	$595	$316	$104
0.5%	$2,973	$1,581	$518
1.0%	$5,945	$3,162	$1,037
2.5%	$14,864	$7,905	$2,592
5.0%	$29,727	$15,811	$5,183
7.5%	$44,591	$23,716	$7,775
10.0%	$59,454	$31,622	$10,367
12.5%	$74,318	$39,527	$12,959
15.0%	$89,182	$47,433	$15,550

Reducer Share	Bull	Base	Bear
0.1%	$2,300	$1,370	$498
0.5%	$11,499	$6,852	$2,490
1.0%	$22,999	$13,704	$4,980
2.5%	$57,497	$34,259	$12,450
5.0%	$114,994	$68,518	$24,900
7.5%	$172,491	$102,776	$37,350
10.0%	$229,989	$137,035	$49,800
12.5%	$287,486	$171,294	$62,249
15.0%	$344,983	$205,553	$74,699

2050 Rev. Sensitivity as Multiple of Median Peer 2025 Rev

Motor Share	Bull	Base	Bear
0.1%	0.8x	0.5x	0.2x
0.5%	3.9x	2.3x	0.9x
1.0%	7.8x	4.5x	1.7x
2.5%	19.5x	11.3x	4.3x
5.0%	38.9x	22.6x	8.6x
7.5%	58.4x	33.9x	12.9x
10.0%	77.9x	45.3x	17.2x
12.5%	97.3x	56.6x	21.5x
15.0%	116.8x	67.9x	25.7x

Bearings Share	Bull	Base	Bear
0.1%	0.1x	0.1x	0.0x
0.5%	0.6x	0.3x	0.1x
1.0%	1.1x	0.6x	0.2x
2.5%	2.8x	1.5x	0.5x
5.0%	5.7x	3.0x	1.0x
7.5%	8.5x	4.5x	1.5x
10.0%	11.3x	6.0x	2.0x
12.5%	14.1x	7.5x	2.5x
15.0%	17.0x	9.0x	3.0x

Reducer Share	Bull	Base	Bear
0.1%	1.1x	0.7x	0.2x
0.5%	5.6x	3.3x	1.2x
1.0%	11.2x	6.7x	2.4x
2.5%	27.9x	16.6x	6.0x
5.0%	55.9x	33.3x	12.1x
7.5%	83.8x	49.9x	18.1x
10.0%	111.7x	66.6x	24.2x
12.5%	139.7x	83.2x	30.2x
15.0%	167.6x	99.9x	36.3x

Note: Based on Motor Dozen list. Motor peers = Timken, Regal Rexnord, Allient, Moog, Minebea Mitsumi. Bearings peers = Timken, Regal Rexnord, RBC Bearings, Minebea Mitsumi. Reducer peers = Timken, Regal Rexnord, Harmonic Drive Systems, Nabtesco, Leaderdrive.

The Motor Dozen: Companies Supporting the US Actuator Supply Chain

Timken (TKR - Covered by Angel Castillo): Timken has assembled a broad US-based actuator portfolio, spanning multiple reducer, bearing, and screw architectures through a series of targeted acquisitions. Its Industrial Motion segment now includes Cone Drive (harmonic/strain wave solutions, US-based), Spinea (cycloidal drives, European-based), CGI (precision gears for medical robotics, US-based), and Rollon (linear motion systems). The company's 2026 Investor Day presentation explicitly listed strain wave gearing and cycloidal reduction gears as products already deployed in robotic transfer units, with the company's "One Timken" go-to-market strategy bundling these with ball screws, encoders, precision linear guides, and servo gear drives into a system solution that it claims delivers up to 50x the lifetime revenue of a single-component sale.

- **US Exposure:** Timken's US manufacturing footprint is meaningfully concentrated in Ohio (HQ and bearings), and its robotics-relevant precision drive businesses are all US based: Cone Drive (Traverse City, MI), CGI (Keene and Lebanon, NH), and Rollon (Thorofare, NJ). US sales represented ~45% of total company 2Q26 sales.

Regal Rexnord (RRX - Not Covered): Regal Rexnord is one of the most commercially active of the western industrial companies in humanoid actuation order flow, having booked $40 million of humanoid-related orders to US-based OEMs during 2025 and developing what it describes as a "range of differentiated solutions to support robotic actuation, which spans humanoid, cobots and robotic surgery applications," with an opportunity funnel that, according to mgmt, grew beyond $200 million as of the 4Q25 earnings call. In 1Q26, the incoming CEO signaled direct engagement with leading US humanoid integrators, with a visit to Austin to meet with "one of the largest US robotics companies", potentially a reference to Tesla's Optimus program (we are not aware of any current or booked business between RRX and TSLA).

- **US Exposure:** Per RRX's FY25 10-K, as of December 31, 2025, approximately 20,000 of 28,700 full-time associates (70%) and 101 of its principal manufacturing and warehouse facilities were located outside the US, implying approximately 30% of workforce and ~37% of principal facilities are US-based. US represents ~41% of the company's total facility square footage.

Novanta (NOVT - Not Covered): Novanta's most strategically differentiated robotics asset is ATI Industrial Automation, a business it acquired in 2021 and is widely regarded as the global leader in robotic end-of-arm tooling and 6-axis force/torque sensing. ATI's sensors measure force and torque in all six degrees of freedom (Fx, Fy, Fz, Tx, Ty, Tz), providing robots with a "sense of touch" that mimics a human hand. ATI sensors are relatively form-factor agnostic and used in robotic surgery, haptics, rehabilitation, neurology, product testing, and warehouse automation. According to the 2Q26 earnings call, Gen AI-related applications (precision robotics, humanoids, warehouse automation, and semiconductors) are estimated at approximately 17% of total company revenue in 2Q26, growing approximately 25% year-over-year. Management expects humanoid-specific revenue to be more meaningful in 2027, with bookings improving rapidly from a small base.

- **US Exposure:** As of the company's FY25 10-K, approximately 36% of Novanta's ~3,000 employees were in the United States, 55% in Europe, and 9% in Asia. Novanta's US manufacturing sites for its Automation Enabling Technologies segment (which houses ATI and servo drives) are in Apex, NC; Bedford, MA; Marlborough, CT; Mukilteo, WA; and Rocklin, CA with additional international manufacturing in Suzhou, China and Taunton and Manchester, UK.

MP Materials (MP - Covered by Carlos De Alba): MP Materials is the only fully integrated US rare earth producer, operating the world's second-largest rare earth mine at Mountain Pass, CA, where it extracts, refines, and separates rare earth materials, and manufacturing finished NdFeB permanent magnets at its Independence facility in Fort Worth, Texas. It is expected to be the first scaled, fully integrated rare earth magnet manufacturing facility in the US in several decades. In July 2025, the Department of War (DoW, formerly the Department of Defense) provided MP with a $110/kg price floor guarantee on NdPr production along with a $140m minimum EBITDA guarantee for the company's 10X magnet facility (7kt of finished magnet capacity). As part of the deal, the DoW took a $400 million convertible preferred equity stake in the company alongside a warrant, together representing 15% of common stock on an as-converted and as-exercised basis, positioning the DoW as the company's largest shareholder.

- **US Exposure:** MP Materials is 100% US-based by design. All of its operating assets are located in the United States.

Harmonic Drive Systems (6324.T - Covered by Lisa Jiang): Harmonic Drive Systems announced to invest to expand capacity at its Beverly, Massachusetts facility in Feb 2026, targeting a roughly 50% increase in production capacity to 15,000 units per month by the end of 2026. The company believes the US humanoid robotics market represents a significant business opportunity. The company has been transferring production to its US and German subsidiaries to increase locally produced items for customers in each region. In its Q2 F3/26 results presentation, the company confirmed that North America orders increased year-over-year, "driven by large orders of products for AI robots," and that the company has started ramping up its structure at its North America plant given growth potential for AI robot-related demand in North America.

- **US Exposure:** HDS's US sub, Harmonic Drive L.L.C., is headquartered in Beverly, MA, and is the sole manufacturing entity for the North America segment. Net sales originating from the US represented around 20% of consolidated net sales. The US subsidiary is one of the two entities in HDS manufacturing precision strain wave gearings outside Japan.

Allient (ALNT - Not Covered): Allient is a US-based precision motion and controls company producing brushless servo and torque motors, coreless DC motors, integrated motor-drives, gearmotors, gearing, modular digital servo drives, motion controllers, and optical encoders, among other actuation components. The company's "industrial" segment, which represents approximately half of LTM revenue, is its primary growth engine, with industrial revenue up 17% year-over-year in 2Q26. Management has acknowledged humanoid robotics as an opportunity but has been measured about its current position. CEO Richard Warzala noted on the 4Q25 earnings call that "automation will come... in the form of our normal or typical industrial automation and even in the robotic side of it,

sometimes referred to as an exciting area of humanoids". On the 2Q26 call he cautioned that he "wouldn't want to indicate in any way that we're a supplier to the big integrators", but that they are seeing traction as the product portfolio evolves to meet the needs of newer areas of robotics. On the drone and unmanned vehicle side, Allient is more commercially advanced, launching a complete product line of commercial off-the-shelf propulsion motors and custom critical solutions.

- **US Exposure:** Revenue shipped to US customers was 55% of total revenue in full-year 2025. As of Dec. 31, 2025, approximately 63% of Allient's 2,478 full-time employees were located in North America (unclear what % US specifically - would be lower than headline), 29% in Europe, and the remainder in Asia-Pacific.

Moog (MOG.A - Covered by Kristine Liwag): Moog is a worldwide designer, manufacturer, and systems integrator of high-performance precision motion and fluid controls, with products spanning military aircraft, missiles, satellites, and industrial automation. Its industrial segment, which runs at approximately 24% of total sales, covers industrial automation, medical, simulation, and energy applications. Recent FCC decision may lead to companies such as Moog taking a more direct role in the supply chain.

- **US Exposure:** Per its FY25 10-K, Moog generated approximately 63% of fiscal year 2025 revenue in the United States, with 6% in Germany and 31% across other international markets. Its principal manufacturing facilities are located in the US, Philippines, UK, Germany, Italy, Costa Rica, China, Netherlands, Japan, Canada, India, and Lithuania (exact % originating from US unclear).

RBC Bearings (RBC- Covered by Kristine Liwag): RBC Bearings is a precision bearing and engineered components manufacturer serving industrial, aerospace, and defense markets, with a product portfolio spanning plain, roller, ball, and thin section bearings, mounted bearings, and enclosed gearing. Management's posture on humanoid robotics is measured and early-stage. On the 4Q26 earnings call, CEO Dr. Michael Hartnett sized total industrial automation exposure at approximately $40-$50 million annually (primarily semiconductor equipment) and characterized humanoid revenue as "still sample making," with no commercial volumes from any customer yet, though semiconductor-related demand was expected to become more meaningful in FY27.

- **US Exposure:** RBC's footprint is heavily domestic: 32 of 44 manufacturing facilities are US-based, approximately 72% of its 5,816 employees are in the US, and domestic sales represented ~89% of FY26 net revenues of $1.87 billion

Nabtesco (6268.T - Covered by Lisa Jiang): Nabtesco claims to be the largest RV precision reducer manufacturer in the world, with its Component Solutions (CMP) segment generating ¥45.5 billion in H1 2026 sales (+23.6% YoY). The company's primary humanoid-specific product initiative is the "RV mini Series", a compact, lightweight precision reduction gear designed to compete directly with harmonic/strain wave gearing in collaborative and humanoid robot wrist joints. Deliveries of RV mini to existing customers began in H2 2026, with the company targeting expansion into 6-axis vertical articulated industrial robots, collaborative robots, and machine tools and expecting revenue of 200mn in 2026. Nabtesco has a US footprint, mostly for sales, but limited US manufacturing facilities; with precision reduction gear production is mainly in Japan and

China. Besides this, their subsidiary in Germany also has the technology to produce harmonic drive reducer though currently the scale is still limited, but focus on the development in the future to supply to collaborative robotics and humanoid robotics.

- **US Exposure:** North America represented ¥14,523 million of H1 2026 net sales (8.7% of total ¥167,401 million), growing 27.0% YoY, the fastest regional growth rate (ex- "other regions") but from a small base. However, RV reducer takes small portion within their US revenue, as Nabtesco provides directly to robotics makers and at present there is no major robotics maker in US. But we estimate US exposure of their reducer business could be around 20% on end market basis.

LeaderDrive (688017.SS - Covered by Sheng Zhong): LeaderDrive (Leader Harmonious Drive Systems) is China's largest harmonic reducer manufacturer (with 30% market share in 2025, vs. HDS 7%) and has emerged as one of the more commercially advanced embodied AI robot component suppliers globally. 1H26 revenue reached Rmb349mn (+39% YoY), supported by strong industrial growth and rapid expansion in embodied AI (humanoid) applications. Humanoid robots is the primary growth driver, with 2Q26 shipments matching, if not surpassing, industrial robots. Its harmonic reducer capacity is expanding rapidly, now above 80k units/month and Leaderdrive targeting 120k by year-end, up from 50-60k in May. In 2Q26, humanoid In February 2026, LeaderDrive and Minth Group (425.HK) announced a joint venture in the United States. The JV, structured with Minth's California subsidiary holding 60% and LeaderDrive 40%, is designed to design, manufacture, and commercialize humanoid robot joint module assemblies for the North American market, with initial paid-in capital of $10 million contributed proportionally by both parties. The capacity will be in Tennessee, expecting capacity ramp up in 3Q/4Q26., with the entity primarily targeting North American humanoid OEM clients.

- **US Exposure:** LeaderDrive's revenue is overwhelmingly China-domestic: in 1H26, domestic sales were Rmb298mn (85% of total) and export sales were Rmb51mn (15%), with exports growing 78% YoY. The Minth JV represents LeaderDrive's primary vehicle for direct US manufacturing exposure, though the JV was still establishing initial capacity in 3Q26 and no US-specific revenue has been separately disclosed.

Minebea Mitsumi (6479.T - Covered by Shoji Sato): MinebeaMitsumi is one of the more commercially advanced of the Japanese precision component makers in terms of confirmed US humanoid robot order flow, with its Q1 FY3/27 results briefing (August 5, 2026) explicitly confirming that the company has "acquired large orders for body applications, etc., primarily from major US companies" across bearings, and is actively building out a mass production system for ball screws for hand applications. The company's humanoid robot product portfolio spans a broad component ranging from medium-size thin-section bearings and small deep groove bearings (body), small DC motors (hand and body), torque/force sensors (joint applications), ball screws (hand), thin-film sensors (MINEGE, 2 million units/month capacity established), and precision machined components (PMC) for body structures. At CES 2026, MinebeaMitsumi showcased a smart robotic hand developed in collaboration with Harmonic Drive Systems, incorporating 107 bearings, 5 sensors, and 11 actuators per hand, demonstrating its integration capability across the actuator stack.

- **US Exposure:** MinebeaMitsumi's primary US manufacturing entity is New Hampshire Ball Bearings, Inc. (NHBB), a 100%-owned subsidiary that manufactures precision bearings domestically and is listed as a production entity within the Precision Technologies segment. The confirmed large humanoid robot orders are from US OEMs, but primary production for humanoid-related components is based in Asia at this time.

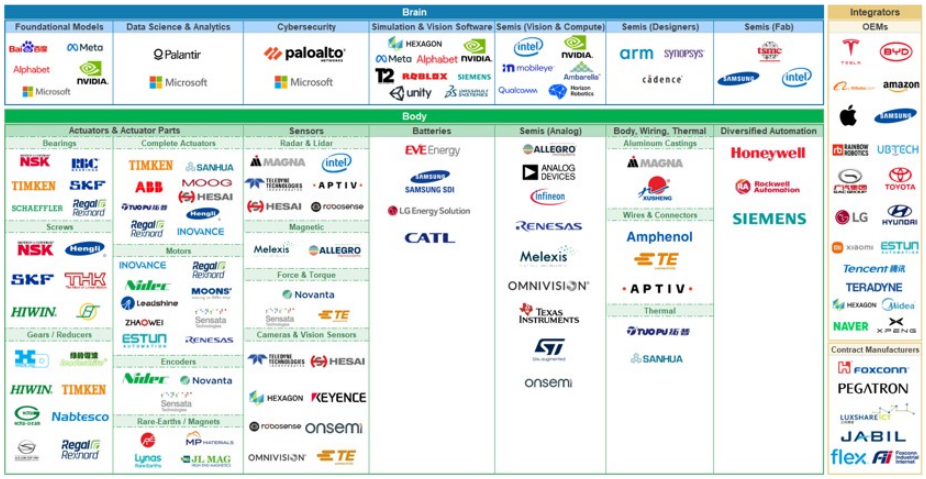
Tesla (TSLA - Covered by Andrew Percoco): Tesla's Optimus humanoid robot program is arguably one of the single largest demand catalysts in the humanoid actuator supply chain in the US, but it is also intended to be one of the most vertically integrated. Musk has described Optimus as "the hardest product to scale manufacturing that we've ever made at Tesla because everything on the robot is new," noting that "with Optimus, there is no supply chain" which requires Tesla to build the supply chain in its entirety or in-source production. As of Q2 2026, Tesla has decommissioned the Model S/X production lines at its Fremont, California factory and is installing first-generation Optimus production lines, with production expected to begin imminently; a second Optimus factory is under construction at Gigafactory Texas. Channel checks indicate the company has thus far sourced components from a large number of global suppliers, including China. However, we would expect the company to gradually vertically integrate over time. *Tesla is also widely considered the single largest manufacturer of EV motors in the US and would be well suited for building new supply chains that are today concentrated overseas.*

Exhibit 47: We Introduce the : Public Companies Relevant to Building the US Actuator Supply Chain:



Exhibit 48:

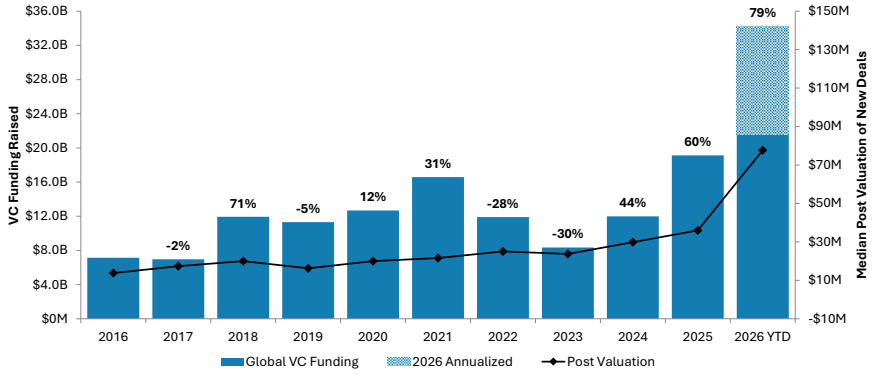
Enablers



Startups & Private Companies to Follow

Funding in 2026 for manufacturing-related startups are at an all-time high, already surpassing 2025 levels, and on pace for +80% y/y. "Manufacturing" is defined as any company that plays a role in the production of physical products: energy, defense tech, robotics, aerospace, space, materials, etc. After a number of large IPO exits this year, we could potentially expect (all-thing equal) even greater company formation as funds receive liquidity on long-held investments, LP's push for new bets, and employees/ founders receive capital to start their next venture. *Why should public market investors care?* This cohort of companies could potentially represent the IPO pipeline for the next decade + a sizable % of the dollars invested in a manufacturing startup represents funding to compete with the incumbents.

Exhibit 49: VC Funding for Manufacturing-Related Startups



Note: The content addressing private companies is being provided for informational purposes only and does not constitute a solicitation or imply future research coverage if the company goes public. Content is based on unaudited information. No investment recommendation is provided as there is limited public information available for private companies. Investors should conduct their own due diligence and be aware that additional or different information may be provided by the company.

Any valuation information provided here is included for illustrative purposes only. The information is based on publicly available information (funding rounds, company

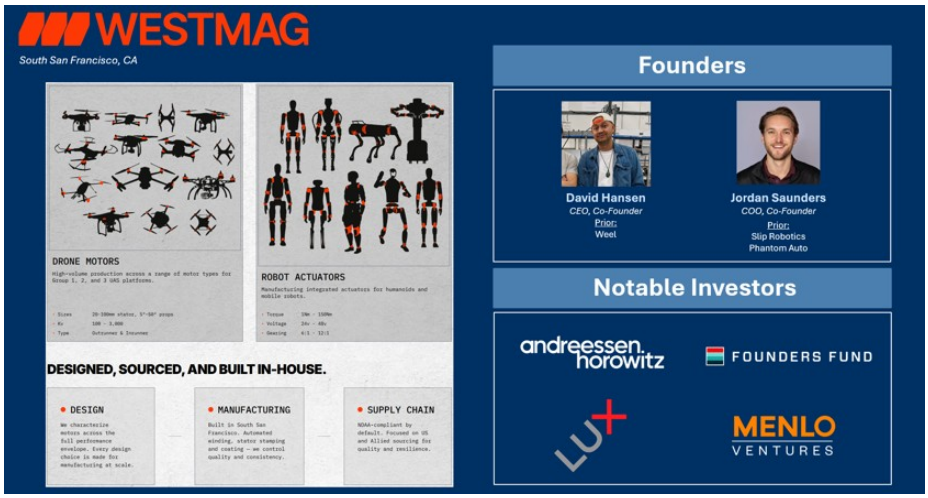
Research.

Westmag (short for Western Magnetics Company) is a US-based manufacturer of drone motors and robot actuators building domestic capacity for the components that physically move drones and humanoids. The company was co-founded by David Hansen (CEO) and Jordan Sanders (COO) and emerged from stealth in June 2026, having closed its funding in 2025 and spent the intervening period building industrial capacity, securing suppliers, and validating product with high-volume customers. Westmag designs and manufactures brushless DC motors along with integrated actuators for robots, all built in South San Francisco, with a production platform covering drone motor sizes from 20 to 100mm stator diameter and robot actuators delivering between 1 and 150 Nm of torque.

Westmag designs and builds motors and actuators on a shared architecture, as both draw on many of the same materials and production processes. Its Factory 01 facility (South San Francisco) winds, assembles and validates every unit on one integrated production platform. Management frames the bet around manufacturing efficiently at high volume, arguing that motors cap out at 100% efficiency, so a percentage point of improvement buys little if the company cannot build at scale and win adoption. Westmag is also pushing upstream into subcomponent work, including electrical steel stamping and rare earth magnet finishing, sourcing from suppliers in the US and allied countries such as Japan, and it holds NDAA compliance by default.

The company is early stage in its funding journey but with backing from notable investors, raising an $11mn June 2026 seed round led by Andreesen Horowitz with participation from Founders Fund, Lux Capital, Menlo Ventures, and others.

Exhibit 50: Westmag Company Profile



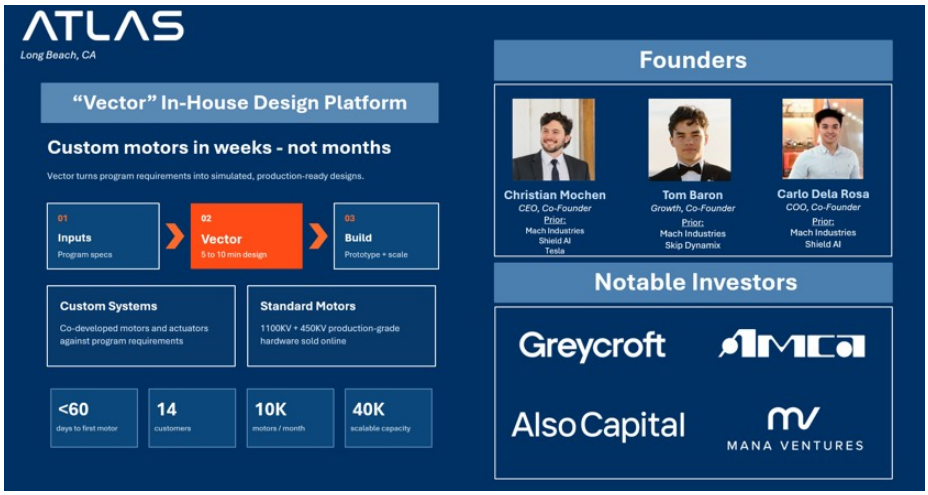
Atlas Motion Systems (legal name Atlas Propulsion, Inc.) is a US-based designer of brushless DC motors and actuators for defense and robotics platforms, built around an AI-native design tool the company says compresses custom motion system development from months into weeks. The company was co-founded by CEO Christian Mochen, Tom Baron and COO Carlo Dela Rosa, who met at Shield AI and Mach Industries and experienced component procurement delays firsthand. It emerged from stealth in August 2026 with a team it describes as drawn from Tesla, Shield AI, Anduril, Dyson and MITRE. Atlas designs and prototypes in Long Beach, California, and currently runs volume production in the Philippines, with plans to eventually build capacity in the US. Its line spans custom motion systems co-developed against a customer's program requirements and a Standard Motor series (1100KV and 450KV) sold directly online, letting independent builders buy production-grade hardware without enterprise procurement.

The company claims to have built an in-house design platform called 'Vector' that ingests program requirements, generates a design, simulates it, and connects into prototyping and production, which management claims produces a finished design in five to ten minutes against a conventional cycle measured in months. The company reportedly incorporated in February 2026 and shipped its first motor in under 60 days. According to an interview with Tectonic defence, it has 14 customers as of August, is in the six figures of revenue

with seven figures expected in September, and can produce 10,000 motors a month with capacity scalable to 40,000. The majority of early customers are drone companies, though none have been explicitly named. Management chose the Philippines on the view that a cost-competitive US motor facility is difficult to stand up at global scale, citing the country's existing manufacturing infrastructure and talent pool, and its status as a longstanding US treaty ally ahead of the Pentagon's 2027 restrictions on Chinese-linked supply chains. Co-founder Tom Baron has said the intent is not to remain a manufacture-abroad company, framing the current setup as a way to regain technical manufacturing capability, though no US facility has been announced at this time.

Similar to Westmag, the company is very early stage at this time, recently raising $11.5mn in an August 2026 Series A led by Greycroft (valuation undisclosed), with participation from Advanced Manufacturing Company of America (AMCA), Ravelin Capital, Also Capital, ENEA Capital, Mana Ventures, Sunflower Capital and others.

Exhibit 51: Atlas Motion Systems Company Profile



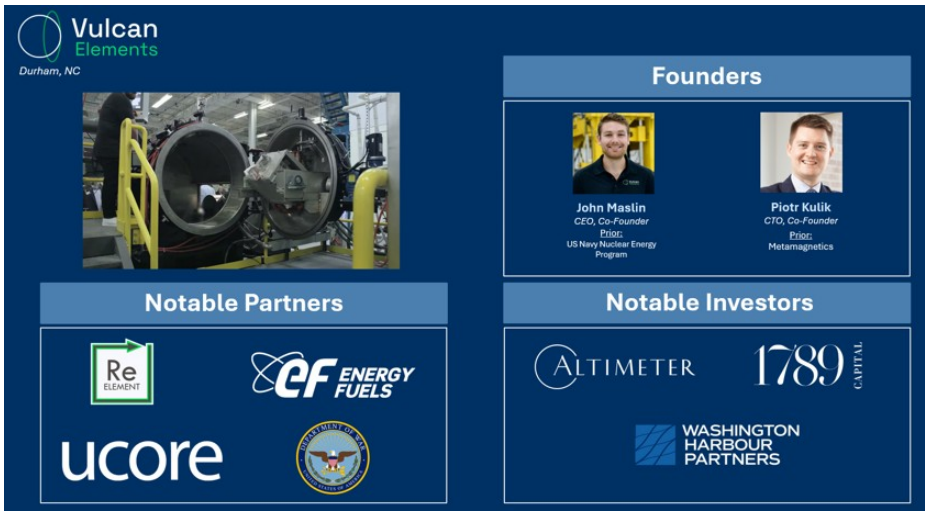
Vulcan Elements is a US manufacturer of sintered neodymium iron boron permanent magnets, attempting to build domestic capacity for the magnets used in electric motors and actuators across drones, robotics, satellites, and defense platforms. It was founded in Boston in 2023 by John Maslin (CEO), a former Navy officer who managed finances for the naval nuclear propulsion program and started the business while at Harvard, alongside Piotr Kulik (CTO), with Jake Bowles as COO. Vulcan opened its first manufacturing and R&D facility in Research Triangle Park in March 2025, a roughly 21,000 square foot site with a Consarc strip casting furnace and a process the company says Ames National Laboratory has validated. Reported capacity was around 10 metric tons per year as of October 2025.

Vulcan claims to source materials and equipment only from US or allied suppliers with no Chinese entities in the supply chain, including ReElement Technologies in Indiana, Consarc in New Jersey, and Energy Fuels in Colorado. In November 2025 it announced a $1.4 billion partnership with the US government and ReElement. Vulcan's portion comprises a $620 million conditional loan from the Office of Strategic Capital, $50 million in CHIPS Act incentives from Commerce, and roughly $550 million in private capital, with the remainder covering an $80 million loan to ReElement and matched private capital. The Department

of War is to receive warrants in both companies and Commerce $50 million of equity in Vulcan. The proceeds are intended to fund a $918 million plant in Benson, North Carolina, targeting 10,000 metric tons of annual capacity and around 1,000 jobs. Note this implies a roughly thousandfold increase on current reported capacity, that the loan remains conditional, and that roughly $120 million of state and local incentives are performance-contingent.

According to PitchBook, the company has raised ~$500 million to-date (excludes federal loan), most recently a $430mn early-stage round in April 2026, reportedly to help construct the North Carolina magnet production facility. Current investors include Altimeter Capital Management, Washington Harbour, and 1789 Capital, among others.

Exhibit 52: Vulcan Elements Company Profile



Hadrian is a US advanced manufacturing company operating highly automated factories that produce precision machined components and assemblies for aerospace, defense, and industrial customers, sold under a model it calls Factories-as-a-Service. The company was founded around 2020 by Chris Power (CEO), an Australian founder whose stated premise is that US defense output is limited primarily by the availability of skilled machinist labor fragmented across thousands of various family-owned machine shops, which automation could consolidate and streamline. The company pairs its plants with proprietary software called "Opus", which it says reads legacy part designs and coordinates machining, inspection, and scheduling. Hadrian claims it can bring a factory online in roughly six months and trains technicians from non-manufacturing backgrounds in 30 to 60 days. Reported customers include Lockheed Martin, RTX, and Anduril.

Hadrian has expanded quickly from its original Hawthorne and Torrance, CA sites. It opened a Mesa, AZ facility in January 2026 and a Muscle Shoals, AL plant thereafter dedicated to submarine-related production. The company launched a Hadrian Maritime division following its Series C, and in March 2026 the Navy indicated Hadrian would mass-produce components in Alabama for Virginia-class and Columbia-class submarines. Management has said it intends to expand into munitions and autonomous systems. Relevance to actuator components is indirect today since precision machining capacity is critical to manufacture gearing, housings, and screw hardware. Hadrian has not indicated it is targeting this end market today.

According to PitchBook and company disclosures, Hadrian has raised roughly $1.7 billion in equity to-date (additional debt facilities not included in this figure), most recently a $1.37 billion Series D in August 2026 at a reported $7.87 billion post-money valuation. The round was co-led by WCM Investment Management, Washington Harbour Partners, Valor Equity Partners, 137 Ventures, and Baillie Gifford, with JPMorgan Chase's Strategic Investment Group as anchor co-lead. Other reported participants include Founders Fund, Lux Capital, Andreessen Horowitz, CapitalG, Altimeter, Apollo-managed funds, and 1789 Capital.

Exhibit 53: Hadrian Company Profile



Lessons from China: From Bottleneck to Localization

Sheng Zhong, Carlos Chai

1. Downstream localization led to strong core component localization

Lesson from harmonic reducers. Harmonic reducers, a core component for industrial robots and increasingly humanoid robots, were historically dominated by overseas suppliers such as Harmonic Drive Systems and Nidec. Overseas players still held around 59% of China's market in 2017, but localization progressed rapidly thereafter, with domestic suppliers' share rising from ~41% in 2017 to ~88% in 2025.

Importantly, this localization breakthrough was built on years of prior technology accumulation. Leaderdrive, now the largest domestic supplier with ~30% share in 2025, was founded in 2003 and spent more than a decade accumulating reducer design and manufacturing know-how, including the development of its proprietary P-type tooth profile, before reaching large-scale commercialization. Other domestic suppliers followed different technical paths, supported by China's deep engineering talent pool and broad precision-manufacturing supply chain. For example, Laifual, the second largest domestic supplier with 12% share in 2025, followed a similar path with Harmonic Drive Systems. We see that successful localization in China is rarely a sudden technological breakthrough; rather, it is typically the result of prolonged R&D that becomes commercially viable once downstream demand reaches sufficient scale.

Downstream industrial-robot localization was the key catalyst. China's industrial-robot market was heavily dependent on foreign OEMs (>70%) during the 2010s, while overall adoption was still relatively low, and annual installations were only ~57k units in 2014, according to IFR. As domestic robot demand expanded and Chinese robot OEMs gained share through the late 2010s and early 2020s, they created a sufficiently large customer base for domestic core-component suppliers such as Leaderdrive and Laifual.

Domestic reducer suppliers initially competed less on absolute technological leadership and more on cost, delivery, customization and local service. They typically offered shorter lead times, faster onsite support and materially better economics than overseas suppliers, allowing them to penetrate first into mid-/low-end SCARA robots and cobots, where precision and lifetime requirements were relatively less demanding. Rising shipment volumes then generated manufacturing experience, field data and cash flow for further R&D and capacity investment, enabling domestic suppliers to improve product reliability and move progressively into higher-end applications.

In our other report, we also studied China's localization progress across other industries, where **midstream and upstream localization tends to accelerate only after downstream domestic suppliers reach meaningful scale,** as a larger domestic customer base strengthens both the commercial incentive and the ability to qualify local components. Based on our cross-industry analysis, localization often follows a stepwise trajectory, the process accelerates during downstream upcycles and periods of rapid capacity expansion; once downstream localization reaches roughly 30%, incentives for component localization rise materially; and when component localization approaches

~40%, competition typically intensifies and pricing pressure begins to emerge. While the initial 0–1 stage remains highly uncertain, moving from <10% to >50% localization has typically taken around a decade across many of the industries we studied.

Exhibit 54: China domestic harmonic reducer suppliers are gaining from foreign players (dotted lines).

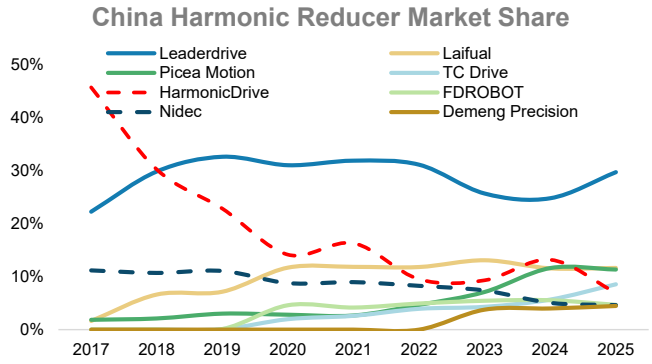
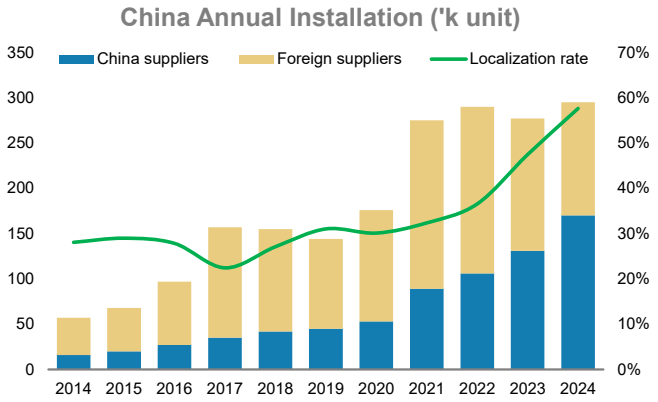


Exhibit 55: China industrial robot domestic mix exceeded 50% in 2024.



2. Planetary roller screws and 6-axis sensors could be the next localization breakthroughs

Chinese suppliers are rapidly catching up in planetary roller screws and 6-axis force/torque sensors. High-end planetary roller screws remain dominated by European and Japanese suppliers such as Schaeffler, Rollvis and NSK, while ATI remains a leading player in 6-axis force/torque sensors. The gap is not only in product design, but also in manufacturing know-how and process consistency. For planetary roller screws, the key challenges are achieving high precision and stable quality at mass-production yields; for 6-axis sensors, calibration, decoupling, temperature drift and batch-to-batch consistency remain key barriers.

We believe Chinese suppliers are now entering the 1–10 commercialization and manufacturing-learning stage. With the rapid development of humanoid and embodied robots, rising downstream demand and increasing investment from machinery, auto and electronics supply-chain companies could help China replicate the localization path seen in harmonic reducers a decade ago. According to MIR, domestic suppliers surpassed foreign players in China's 6-axis force/torque sensor market for the first time in 2025, reaching a combined market share of 59%, up from ~20% in 2020, supported by rapid embodied-robot demand growth and better cost competitiveness. For planetary roller screws, suppliers such as Hengli Hydraulic, Shuanglin and Seepin have already developed relevant products and entered testing or validation with domestic and overseas humanoid robot integrators.

We are therefore optimistic that both planetary roller screws and 6-axis force/torque sensors can achieve meaningful localization over the coming years, supported by rapid downstream volume growth, cost advantages, and stronger customization and co-development capabilities versus foreign suppliers.

3. China's unique industrial ecosystem

In the past decades, China has built the most comprehensive industrial ecosystem in the world – a uniquely integrated system of forward-looking government leadership (central + local government), efficient industry execution along the whole value chain, and enormous supporting systems including financial, education, infrastructure, etc.

1. The government sets the direction for localization priorities. The *Green Book on Technological Innovation in Key Areas of China's Manufacturing Industry* set the technology roadmap for the country. First published in 2015 and revised through 2025, the document identified bottlenecks and translated broad ambitions into specific industries, technologies, key products, and multi-year objectives. The roadmap was only one layer. Strategic direction was reinforced through a broader policy toolkit: national R&D programs, industrial funds, tax incentives, standards, demonstration projects, government procurement, financing support, industrial parks, and local-government initiatives.

2. Capital - A state-directed platform to support key industrial companies. Through bank credit guidance, policy-bank lending, PBOC structural tools, government-guided funds, bond financing, and SOE capital, the state channels resources to priority sectors. For example, in August 2025, the PBOC and six departments issued Guidelines on More Financial Support for Advanced Manufacturing. Financial institutions must meet effective manufacturing credit demand and provide diversified financing to advanced industries

3. Talent - China has an unparalleled technical labor base. China has the world's largest STEM graduate base, with new majors added at an accelerated rate. China has produced more STEM PhDs than the US since the mid-2000s and now graduates over 2mn STEM students each year. Universities offer strategic emerging majors aligned with policy direction, with most in AI, digital economy, and smart manufacturing during 2020–24.

4. Infra - China's ample and efficient base for the industrial sector. China's power supply is highly sufficient and among the lowest-cost across major manufacturing economies. Decades of robust infrastructure investment created massive road and railway networks of 5.5mn km and 162,100 km, respectively, providing accessible inland freight connectivity. Externally, China owns 6 of the world's top 10 ports and 17 of the top 50, opening the door for efficient global exports.

Exhibit 56: China localization and technical roadmap across key industries

Industry	2015	2017	2019	2023	2025
Communications equipment	**Build globally competitive industry**; raise domestic supply of core equipment/chips	**World-leading by 2025**	**World-leading by 2025**	Upgrade toward next-gen communications and core technology autonomy	**Maintain world-leading through 2030 + strengthen original innovation**
Semiconductors / IC	Raise domestic supply; **~40% by 2020 / ~70% by 2025**	Strengthen chips, equipment, materials and process localization	Close major gap in IC and semiconductor equipment	Strengthen advanced-node and supply-chain autonomy	**World-advanced by 2035**
Basic / industrial software	Build autonomous OS / industrial-software capability	Strengthen industrial software and control systems	Close large gap versus global leaders	Build domestic industrial-software ecosystem	**Still a gap vs global leaders by 2035**
New displays	Build advanced domestic display capability	Strengthen equipment/material localization	Upgrade high-end display technology	Move toward global competitiveness	**World-leading by 2035**
High-end CNC / machines tool	High-end CNC/basic equipment, localization at **~80% by 2025**	**World-advanced by 2025**	Continue high-end localization	Break through core CNC systems/components	**World-advanced by 2035**
Robotics	Build domestic industry; localize reducers, servos, controllers	**World-advanced by 2025**	Increase high-end robot/core-component localization	Move toward intelligent/high-end robots	**World-leading by 2035**
Aerospace	Develop domestic commercial aircraft, engines and core systems	**World-advanced by 2025**	**World-advanced by 2025**	Strengthen aircraft, engines and key systems	**World-advanced by 2035**
Shipbuilding / offshore	Upgrade into high-end; increase component localization	Strengthen high-end vessels and offshore systems	Build advanced ship/offshore capability	Not separately listed	**Maintain world-leading through 2030 + original innovation**
Advanced railway	Major products reach international-leading level; expand global share	**World-leading by 2025**	**World-leading by 2025**	Upgrade toward intelligent/green systems	**Maintain world-leading through 2030 + original innovation**
NEV / intelligent vehicles	Build complete domestic EV chain; **~3m annual sales and >80% domestic share by 2025**	Strengthen domestic batteries, and complete-vehicle chain	**World-advanced by 2025**	Shift from electrification toward intelligent/networked vehicles	**Maintain world-leading through 2030 + original innovation**
Power equipment / storage	Build world-class generation/grid equipment; high domestic supply	**World-leading by 2025**	Transmission **world-leading**; generation **world-advanced** by 2025	Expand toward new power systems and storage	**Power: world-leading through 2030; storage: world-leading by 2035**
Agricultural equipment	Localize high-end machinery/core components	Strengthen intelligent/high-end agricultural equipment	Close large gap versus advanced countries	Continue "补短板" in high-end equipment/components	**World-leading by 2035**
New materials	Raise domestic supply of strategic materials; **>85% in key applications by 2025**	Strengthen key-material security across priority industries	Improve autonomous supply of strategic materials	Treat materials as a core supply-chain security issue	**World-advanced by 2035**
Biopharma / medical devices	Build innovative drugs and high-end devices; internationalize Chinese products	Strengthen innovative drugs and high-end medical equipment	Move toward innovation-led industry	Improve high-end R&D and equipment capability	**World-advanced by 2035**
Food	-	-	**Added:** shift from scale to quality, nutrition and advanced processing	Upgrade automation/processing technology	**World-advanced by 2035**
Textiles	-	-	**Added; world-leading by 2025**	Move toward technology, brands and green manufacturing	**Maintain world-leading through 2030 + original innovation**
Building materials	-	-	**Added; world-advanced by 2025**	Shift toward advanced/green materials	**World-leading by 2035**
Home appliances / smart home	-	-	**Added; world-leading by 2025**	Upgrade toward smart/connected products	**Maintain world-leading through 2030 + original innovation**
Instrumentation	Break through sensors, measurement instruments and control systems	Strengthen precision instrumentation	-	**Added as strategic priority**	**Still a gap vs global leaders by 2035**
Construction machinery	-	-	-	**Added:** high-end, intelligent and green equipment	**World-leading by 2035**

Research.

Exhibit 57: Industrial loan balances recently reached a record Rmb28trn, although loan growth has continued to moderate since end-2023.

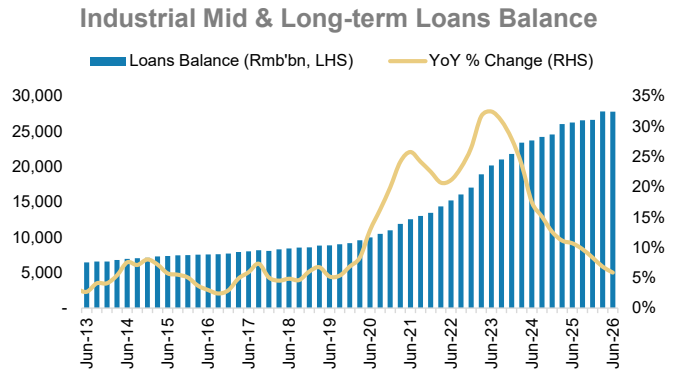


Exhibit 58: A huge STEM graduate base in China supports the adoption and deployment of industrial AI

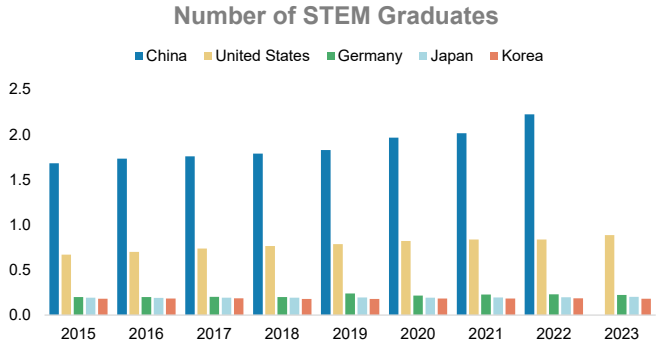


Exhibit 59: The number of R&D researchers (inclusive of all sectors) per million people has tripled in the past two decades to support domestic technology development.

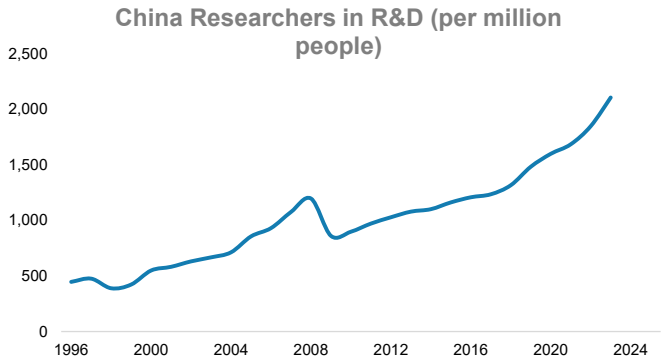
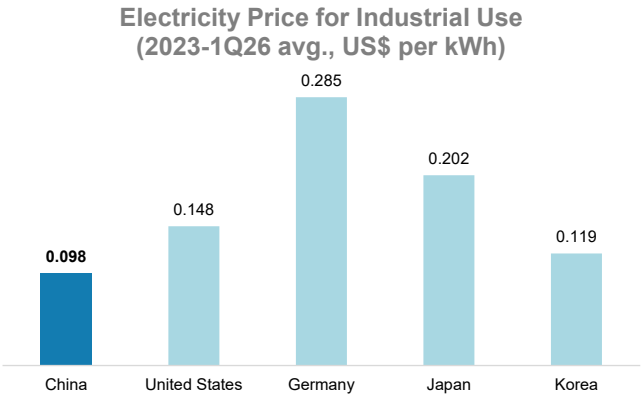


Exhibit 60: China's industrial electricity prices remain among the lowest across major manufacturing economies.



US Public Policy: Seeking AI Sovereignty

Ariana Salvatore

We see the FCC's move on robotics as a data point in a longer-term transition toward multipolarity and a focus on AI sovereignty. We've long argued that the US-China relationship is best characterized as competitive within the boundaries of what we call 'tactical escalation.' In other words, a durable equilibrium short of full decoupling, but one in which both sides increasingly de-risk in an effort to prioritize national security and resilience over economic efficiency, even when that means higher costs, duplicated capacity, or reduced market access. Gradual de-risking, rather than de-coupling, remains our base case given existing mutual dependencies (chips for rare earths, as we outline here) achieved via the employment of both tariff and non-tariff barriers. As we note in our recent insight, AI capability is coming into focus as a source of national economic and geopolitical power, leading to the need for countries to secure domestic AI capabilities. **Hence, governments are viewing AI sovereignty as a strategic imperative - and by extension the physical hardware that embodies it**.

We'd highlight the upcoming US-China summit as an important catalyst. As noted above, the mutual dependencies - US reliance on Chinese rare earths, and Chinese reliance on US chips - has, in our view, kept both sides from escalating past a certain point. With that said, we see scope for escalation into the summit especially as the administration has focused on its economic campaign against Iran (which includes movement toward a secondary sanctions regime). The actuator/robotics restrictions could become a topic of discussion ahead of or during the summit, as both governments continue to use trade and technology policy as leverage. In the intermediate term, we still think both sides are inclined toward managing the relationship, as we explain here.

When it comes to broader tech restrictions, we think a number of tools already exist within the executive branch. BIS (under the Commerce Department) could expand its existing Entity List to include Chinese AI developers. That would potentially require US cloud providers to remove officially hosted models, enterprise-software companies to terminate licensing agreements, and model marketplaces to de-list products associated with the designated company. The Commerce Department could also use the Information and Communications Technology and Services (ICTS) supply-chain regime (the "connected software applications" review) to review and/or prohibit any transaction involving foreign-linked software, cloud services, or AI applications that are deemed to pose a national security risk. Other potential options include Treasury sanctions under OFAC, Justice Department restrictions on transactions exposing bulk personal data, federal procurement exclusions, and Federal Trade Commission (FTC) enforcement actions requiring the deletion of AI models trained on unlawfully obtained data. The recent FCC actions - to the point above - are another example of these tools in action.

Can this posture change with upcoming elections? We've been of the view that AI and China-competition policy is likely to continue regardless of the election outcome, reflecting bipartisan alignment around AI as a strategic priority. Further, we see broader industrial policy (the "New Washington Consensus") as a legitimate tool of US strategy: tariffs raised in Trump's first term largely remained in place under Biden, many of the sectors subject to the Sec. 232 tariffs were similarly the subjects of a Biden-era Supply

Chain Exec Order, and Democrats' critiques of this year's tariff hikes are more about execution risks and alignment with policy goals, but not intrinsic to the policy tool or principle.

Potential Foreign Capacity Expansion into the US

Despite recent rhetoric against China-made robots, we are not fully convinced the administration is entirely against foreign robotics companies - as long as they build in the United States. In January at the Detroit Economic Club, President Donald Trump expressed openness to allowing Chinese automakers to sell vehicles in the US only if they build manufacturing plants and hire American workers inside the United States, saying quote: *"If they want to come in and build the plant and hire you and hire your friends and your neighbors, that's great. I love that. Let China come in, let Japan come in."* While we don't necessarily expect a major announcement, with China's Xi set to visit the United States in September, we would be curious if any agreements are met on building industrial capacity in the US - or if the recent FCC agreements could serve as a future bargaining chip between the two countries.

Multiple foreign component suppliers are already planning US capacity, and we could expect a more active approach among others.

- **Component suppliers** are already planning overseas capacity in the US or other countries, such as Leaderdrive's JV with Minth. We believe US integrators remain a key target for suppliers to penetrate.
- **For humanoid integrators**, most of them do not have a US production now given the industry/s early stage and volume. But we think it is likely that they will more actively establish US capacity when US supply chain availability improves in the longer term, when US demand reaches a level that justifies investment.
- **For other robot makers.** We think there is a likelihood that localised production in the US will take place. Geekplus and Navimow (the lawn mower subsidiary of Ninebot) have stated that their existing robots are not affected. In response to this announcement, Geekplus said it plans to establish US capacity in Atlanta.

Following the FCC decision, we would expect similar announcements of this type, and think supplier reshoring runs several years ahead of integrator reshoring.

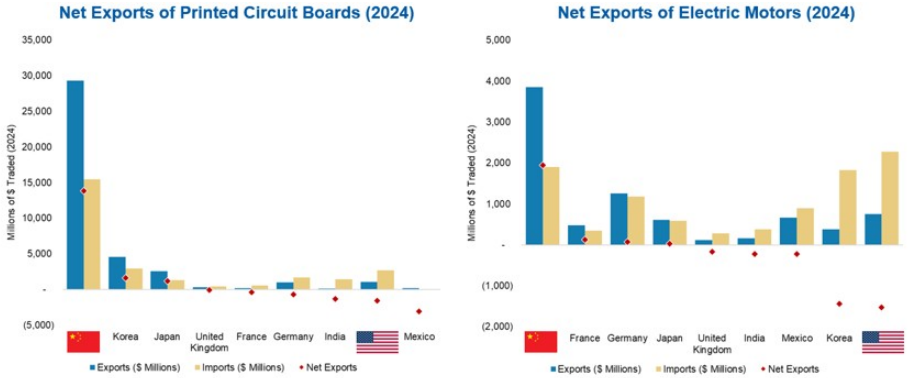
By contrast, we believe foreign integrators/OEMs lack enough incentive (today) build production in the US. Based on checks from our China Robotics team, for humanoid and quadruped OEMs, the US remains primarily an R&D market with universities and research labs representing a large % of the customer base. Additionally, product iteration cycles are relatively fast and unit volumes are low, meaning the economics of standing up large-scale US assembly likely results in the math not penciling out at this time. However, we would expect non-US humanoid brands to revisit this once US demand scales enough to justify the investment and once local supply chain availability improves, which is itself partly a function of how quickly the suppliers above build out capacity as well as the US govt's reaction to initial entrants.

Examples with EV's and construction machinery would suggest reshoring does happen, but slowly. Neither sector faces an outright import ban, although tariffs, geopolitical risk and Buy America procurement rules have slowly and steadily pulled production onshore. For example, Hyundai opened its Georgia Metaplant in March 2025 as part of a US$12.6bn commitment, Volvo CE invested US$40mn in Shippensburg, PA for excavators and wheel-loaders, and Komatsu expanded North American manufacturing,

remanufacturing and service in 2026.

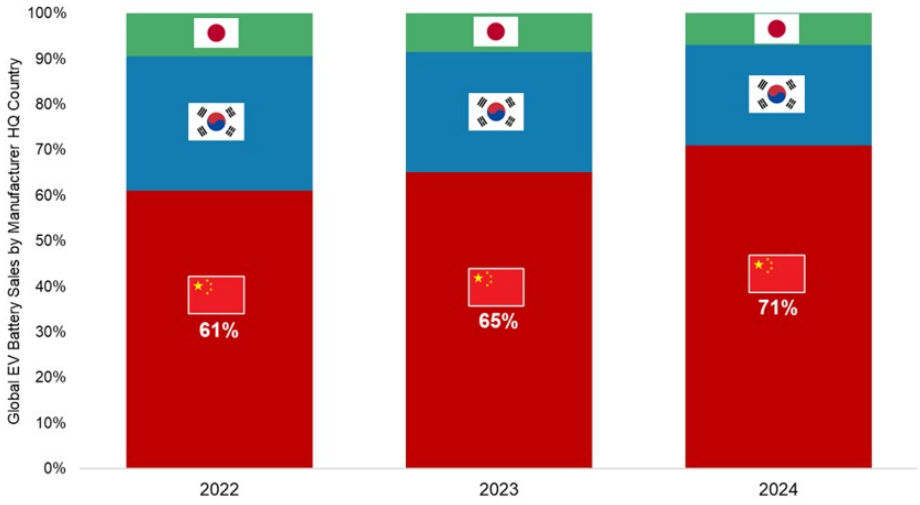
See more: *China Industrials: Robotics: US Protectionism - Competition Rising (3 Aug 2026)*

Exhibit 61: Net Exports of PCB's and Electric Motors Across Major Economies (2024-latest year with data available for all economies shown)



Note: Charts show results across select major economies, not a global ranking.

Exhibit 62: Global EV Battery Manufacturing Share (IEA)



Auto Suppliers: Robotics Reshoring Broadens the Domestic Content Opportunity

Auto suppliers could play an important supporting role in the robotics reshoring push. As discussed earlier in this note, the FCC decision makes US assembly and ~65% domestic content by value the hurdle, putting critical components, not just final assembly, in focus. This is especially relevant for actuator-related components, including motors, bearings, reducers, screws, encoders, and sensors, which can represent nearly 50% or more of a robot's BoM and remain heavily Asia-sourced. In our prior Auto Suppliers and AI Robots note, we argued that US auto suppliers could eventually play some role in the physical AI supply chain given overlap across motion, sensing, power distribution, electronics, sourcing, manufacturing, and design.

Robotics remain nascent for most auto suppliers, but their supply chain scale, manufacturing footprint and domestic footprint create a broader opportunity for legacy auto suppliers. The clearest potential beneficiaries from robotics reshoring opportunities in our auto supplier coverage are **APTV, MGA, MBLY, BWA, DCH, VGNT, LEA, VC.**

Potential beneficiaries:

- **Aptiv (Covered by Andrew Percoco):** APTV has the clearest robotics-exposure in our coverage, with direct overlap across perception, compute, sensor fusion, software, connectors, and high-speed interconnects. The opportunity is centered on perception and electronics content rather than mechanical actuator hardware. Robotics revenue remains immaterial today, but APTV has disclosed three robotics partnerships, one meaningful commercial agreement, a >$500mn five-year drone award, and management sees a path to ~$300mn of annual robotics / drone revenue over the next few years.
- **Magna (Covered by Andrew Percoco):** MGA has potential robotics exposure through its breadth across structures, electronics, sensing, drivetrain / eDrive, systems integration and auto-grade manufacturing. MGA does not disclose robotics actuator content today, so we would frame the opportunity more broadly around industrialization support for complex motion-related systems where scale, quality, and execution matter. Its Sanctuary AI partnership, 100+ internal robotics deployments, and initial wins across adjacent markets support the opportunity, with management focused on leveraging existing technology, capacity, and automotive-grade quality with limited incremental capital.
- **Mobileye (Covered by Andrew Percoco):** MBLY is the cleanest compute / perception name in the coverage, with robotics relevance centered on compute, perception, autonomy software, sensor fusion, simulation, and safety validation rather than actuator hardware. Mobileye also recently acquired Mentee Robotics (in house humanoid development), which it expects to be production-capable by late 2026 / early 2027 and commercial rollout targeted for 2028.
- **Borgwarner (Covered by Andrew Percoco):** BWA has potential long-term relevance to robotics through its motor, power electronics, and control capabilities, but disclosed robotics exposure is limited today. The opportunity would likely be tied to scaled supply of motion-control or powertrain-adjacent

systems.

- **Versigent (Covered by Andrew Percoco):** VGNT provides enabling electrical-architecture across power / data distribution, harnessing, high-voltage systems and complex electrical networks. This is an electrical systems opportunity rather than actuator hardware, with direct robotics exposure very limited today.
- **Lear (Covered by Andrew Percoco):** Similar to VGNT, LEA's E-Systems business could have longer-term relevance in connectors, electronics and automated connector manufacturing as robotics platforms add electrical complexity.
- **Dauch (Covered by Andrew Percoco):** DCH's legacy American Axle / Dowlais portfolio could overlap with actuator-adjacent mechanical content over time, including gears, reducers, shafts, and related precision components. We would frame this as longer-term localized supply-chain optionality for robotics, although today's exposure is immaterial.
- **Visteon (Covered by Andrew Percoco):** VC's SmartCore / HPC, domain-controller and embedded-software capabilities could become relevant as robotics platforms adopt more centralized compute and control architectures. We would frame this as longer-term electronics optionality for robotics, with no disclosed exposure today.