

Exploring Humanoid Robots

Humanoid Robot Manufacturers VI

Jim Rauf

Exploring Humanoid Robots

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25 to 30 Humanoid Robot Developers & Manufacturers (2025)

Organization	Robot Name	Country	Readiness Level
Agility Robotics	Digit	USA	Commercial (pilot)
Tesla	Optimus	USA	Pre-commercial
Figure AI	Figure 01	USA	Pre-commercial
Sanctuary AI	Phoenix	Canada	Pre-commercial
Apptronik	Apollo	SA	Pre-commercial
1X Technologies	EVE	Norway	Pre-commercial
Fourier Intelligence	GR-1	China	Pre-commercial
Xiaomi	CyberOne	China	R&D / Showcase
UBTech / RobotEra	Walker X	China	R&D / Pre-commercial
PAL Robotics	TALOS	Spain	Commercial (limited)
Neura Robotics	Various	Germany	Pre-commercial
Engineered Arts	Ameca	UK	Commercial (demo)
Toleco Robotics	TBD	USA	R&D
Promobot	Promobot V.4	Russia	Commercial (niche)
Hanson Robotics	Sophia	Hong Kong	Commercial (demo)

Manufacturers

Agility Robotics (United States)



Company
Agility Robotics

Founded
2015

CEO
Peggy Johnson

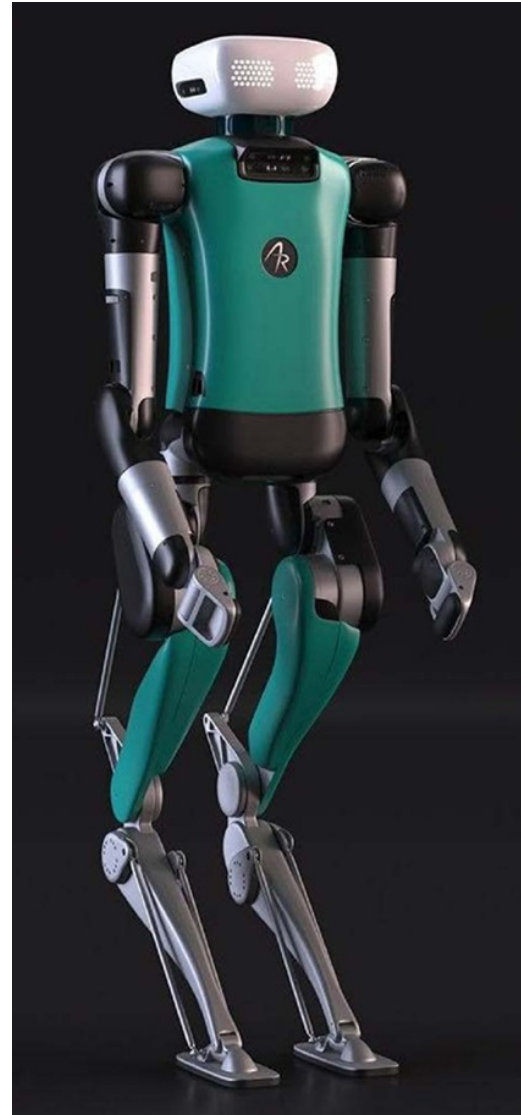
Valuation
~US\$1 Billion

Location
Oregon, USA

Robot
Digit

AI Partner(s)
NVIDIA

Website
agilityrobotics.com



- **Digit's** unique design features include telescopic, bird-like legs that allow it to crouch or reach to grab objects and move them to specified locations
- Digit is ideally suited for warehouse and logistics operations
- While pick-and-place might seem simple, it's historically been a low-skill, labor-intensive task
- Automating this task allows humans to focus higher-value work
- Investors have demonstrated confidence in the vision for the future of workplace automation

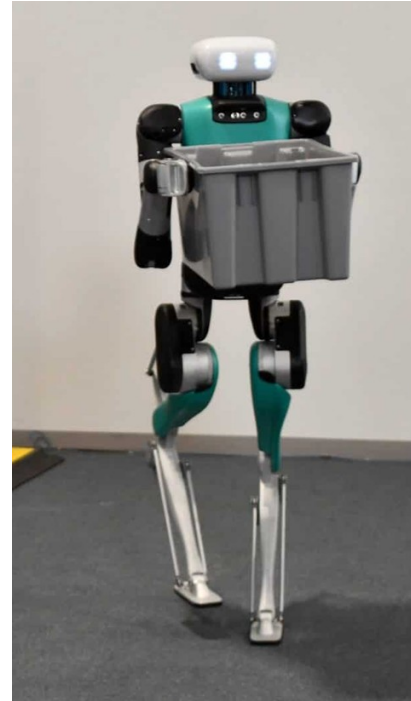
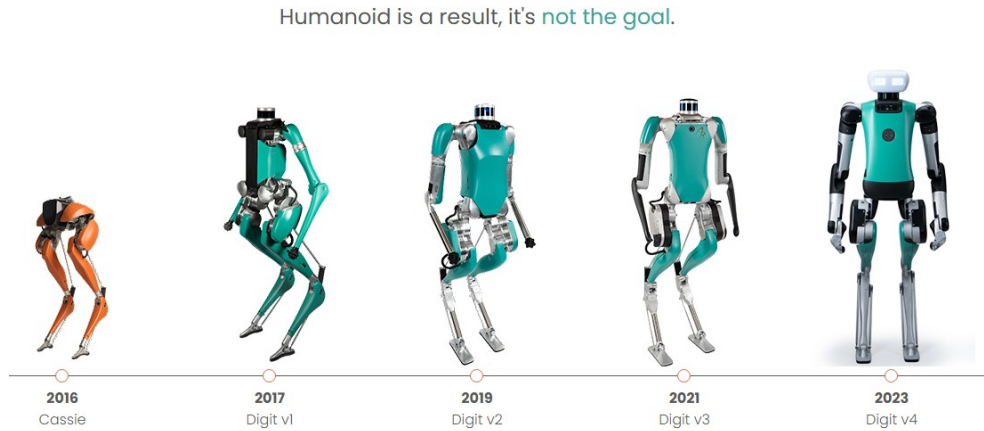
- **Partnerships:**

- The company has established strategic relationships with industry leaders , most notably **Amazon** which began testing a **Digit fleet** at its Seattle R&D facility for tote recycling in October 2023
- A groundbreaking deployment with **GXO Logistics** at a **SPANX** facility in Georgia marked the industry's first commercial implementation of a humanoid robot under a **robots as service model**
- Additionally, **Ricoh USA** provides comprehensive support services across North America

- **Commercialization Plans:**

- **Agility Robotics** is constructing "RoboFab," a 70,000-square-foot manufacturing facility in Salem, Oregon, with an annual production capacity of 10,000 units
- The company planed to deliver **Digits** to partner program customers in 2024, followed by general market availability in 2025
- With **projected ROI** under two years, **Digit** addresses the critical labor shortage in logistics, targeting over one million unfilled positions in the sector

Manufacturers Agility Robotics (United States)



https://cdn.prod.website-files.com/672aa4455c7532b497ba15be%2F67c14fb780ef9ee2a7142c23_digital-pittsbrugh-square-transcode.mp4

Manufacturers Boston Dynamics (United States)

Boston Dynamics

Founded
1992

CEO
Robert Playter

Valuation
~US\$1.1 Billion

Location
Massachusetts, USA

Robot
Atlas (Electric)

AI Partner
NVIDIA

Website
[bostondynamics.com](https://www.bostondynamics.com)



- **Description:** Boston Dynamics' **Atlas**, transitioning from hydraulic to all-electric power in 2024, represents the pinnacle of humanoid robotics innovation
- The robot demonstrates exceptional agility, capable of complex movements including running, jumping, and backflipping
- **Atlas** features advanced **three-fingered hands** and sophisticated sensor arrays that enable real-time adaptation and complex object manipulation in dynamic environments

Manufacturers Boston Dynamics (United States)



Height: 4 feet 11 inches (150 cm)

Weight: 196 pounds (89 kg)

Load: 55 pounds (25 kg)

Manufacturers Boston Dynamics (United States)

- **Major Partnerships:** A landmark collaboration with **Toyota Research Institute (TRI)** accelerates **Atlas's** development toward becoming a true general-purpose humanoid, combining Boston Dynamics' hardware expertise with TRI's advanced Large Behavior Models (LBMs)
- The company also maintains innovation through its independent AI Institute, focusing on next-generation robotics research while the main company pursues commercial applications
- **Commercialization Plans:** Following its \$1.1 billion acquisition by **Hyundai Motor Group in 2021**, Boston Dynamics is taking a methodical approach to **Atlas's** market entry, prioritizing reliability and practical utility
- Drawing from successful commercialization experiences with their **Spot** and **Stretch** robots, the company is carefully developing **Atlas** for industrial applications while maintaining its position at the forefront of robotics innovation

Manufacturers

Figure AI (United States)

 FIGURE

Company
Figure AI

Founded
2022

CEO
Brett Adcock

Valuation
2.6 Billion

Location
California, USA

Robot(s)
Figure 02, Figure 01

AI Partner(s)
NVIDIA, OpenAI

Website
figure.ai



- **Figure AI's** second-generation humanoid robot, **Figure 02**, represents a quantum leap in autonomous robotics technology
- The sleek, matte-black robot features advanced **speech-to-speech capabilities** and sophisticated hand-eye coordination through six onboard RGB cameras
- Its **fourth-generation hands** offer remarkable dexterity with 16 degrees of freedom.
Height: 5 feet 6 inches (168cm) Weight: 132 pounds (60 kg)
Load: 44 pounds (20 kg)

Manufacturers Figure AI (United States)

Figure AI (United States)

- **Robots: Figure 01 and Figure 02**
- Established in 2022, Figure AI focuses on creating AI-powered humanoid robots for manual labor
- In 2024, the company secured \$675 million in funding from investors including **OpenAI**, **Microsoft**, **Nvidia**, and **Jeff Bezos**, valuing the company at \$2.6 billion
- The robot's enhanced computational capabilities, powered by **NVIDIA** processors with tripled CPU and GPU capacity, enable sophisticated **AI inference** and **autonomous operation**
- **Major Partnerships:** Figure AI has secured strategic partnerships with industry leaders Microsoft and OpenAI for AI development, while also establishing a significant presence in manufacturing through **BMW**
- A successful pilot program at **BMW's** Spartanburg, South Carolina plant demonstrated Figure 02's capabilities in continuous operation through seven-day workweeks, handling various tasks including tote movement
- The permanent deployment of a robot fleet to **BMW's** facility began in January 2024

Manufacturers Figure AI (United States)

Commercialization Plans: Backed by \$675 million in Series B funding from prominent investors including Microsoft, OpenAI, and Intel, Figure AI is pursuing both industrial and domestic applications

- While the company focuses primarily on manufacturing deployment, it has begun exploring household applications, including kitchen assistance tasks

- Founder **Brett Adcock** has outlined plans to achieve a **sub-\$20,000 price point**, making the technology more accessible for widespread adoption

“If these robots can do everything a human can, I have to think that we'd be able to **put 3 to 5 billion in the workforce.**”

– Brett Adcock, CEO



Company
Tesla

Founded
2003

CEO
Elon Musk

Market Cap
~US\$1.04 Trillion
(as of November 11, 2024)

Location
Texas, USA

Robot(s)
Optimus
Gen-2, Gen-3

AI Partner
Internal AI Division

Website
tesla.co m



- **Gen-2 & Gen3 Description: Tesla's Optimus** program shows two generations with rapidly advancing capabilities
- The **Gen-2** model features enhanced sensors and improved locomotion, demonstrating tasks from factory operations to synchronized dance routines
- The upcoming **Gen-3** marks a significant advancement in dexterity with 22degrees of freedom in hand movement

Height: Approximately 5'8"
(1.73 m)
Weight: Around 125 lbs (57 kg)
Primary Use: Industrial and home automation
Estimated Price: ~\$30,000

- **Major Partnerships:** Unlike competitors, **Tesla** leverages its **internal AI division** and vast automotive technology stack, integrating advanced machine learning capabilities developed through its vehicle autonomy program
- The company's **vertical integration** allows for rapid development and deployment of new features
- **Commercialization Plans:** **Tesla** planned to deploy ~1,000 **Optimus** units in its own factories throughout 2024
- **Elon Musk** projects an eventual **consumer price point of \$20,000-\$30,000**, positioning **Optimus** for both **industrial** and **domestic** applications
- The company's ambitious vision includes applications ranging from factory labor to home assistance
- **Musk** suggesting **Optimus** could become "*the biggest product ever of any kind.*"

<https://www.bing.com/videos/riverview/relatedvideo?q=tesla+robots&mid=A4D9AD9D399AC8C63BCAA4D9AD9D399AC8C63BCA&mmscn=stvo&FORM=VCGVRP>

Manufacturers Unitree (China)

UnitreeRobotics

Company
Unitree Robotics

Founded
2016

CEO
XingXing Wang

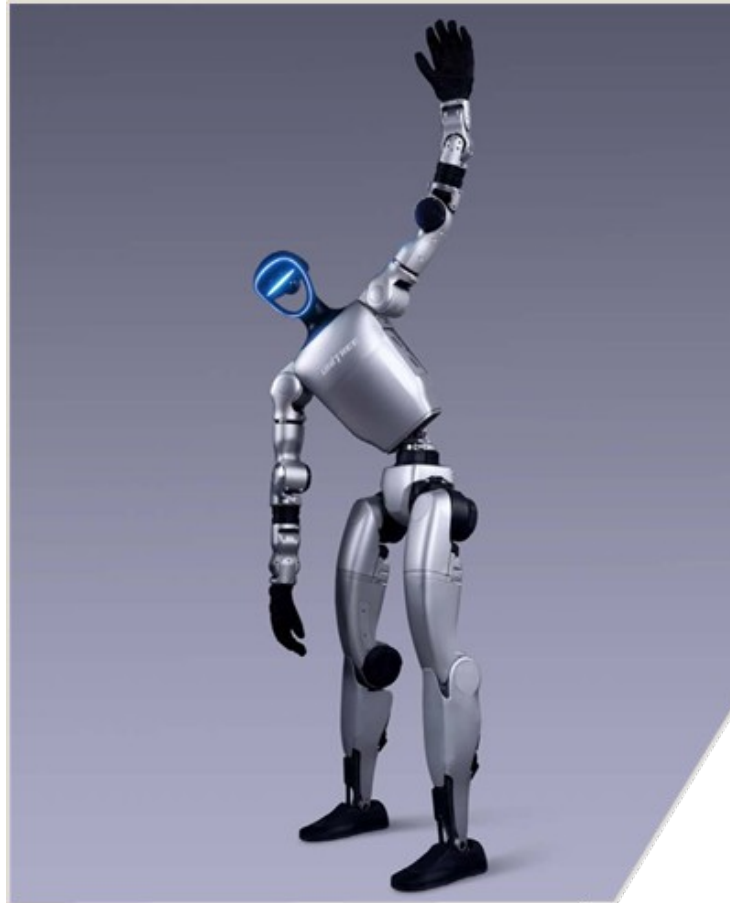
Valuation
~US\$1 Billion

Location
Hong Kong, China

Robot(s)
H1, G1

AI Partner
NVIDIA

Website:
unitree.co m



Description: Unitree has two distinctive models: the **industrial-focused H1** and the **compact G1**

Both robots showcase exceptional mobility, demonstrated through groundbreaking untethered walking demonstrations at CES 2024 and NVIDIA GTC

The robots feature sophisticated sensing capabilities, including **3D LiDAR, Intel RealSense D435 depth cameras**, and **noise-canceling microphone arrays**

H1 G1

Height	5ft 11in	4 ft 2 in
Weight	104 lbs	77 lbs
Load	66 lbs	7 lbs

Manufacturers Unitree (China)

Major Partnerships: Unitree has established a key partnership with **NVIDIA**, incorporating **NVIDIA ORIN** controllers in the **G1's** EDU version

- This collaboration enhances the robots' **AI capabilities**

Commercialization Plans:

Employing a *vertical integration strategy* for manufacturing, led remarkable cost efficiency

- The **H1** is positioned as a high-end **industrial robot** at \$90,000
- The **G1** has a \$16,000 starting price
- Both models are currently available for educational, research, and industrial applications, with the company focusing on making advanced robotics more accessible through competitive pricing

Manufacturers Apptronik (United States)

Apptronik

Founded

2016

CEO

Jeff Cardenas

Valuation

~US\$1 Billion

Location

Texas, USA

Robot

Apollo

AI Partner

NVIDIA

Website

apptronik.co m



- **Apollo** , Apptronik's versatile humanoid robot, is result of over a decade of research
- It features linear actuators that mimic human muscle mechanics, enabling a full range of mobility and precise force control
- Its advanced safety systems allow for direct human collaboration in various workplace settings
- The robot integrates with **NVIDIA's** foundation model for robot learning through Project GR00T, enhancing its adaptive capabilities

Manufacturers Apptronik (United States)

Major Partnerships: Apptronik maintains strategic partnerships with **NASA**, building on their collaboration on the Valkyrie robot

- Recent partnerships include **Mercedes-Benz** for manufacturing applications and **GXO Logistics** for warehouse automation, demonstrating Apollo's versatility across industries

Commercialization Plans: The company is conducting proof-of-concept programs with both **Mercedes-Benz** and **GXO Logistics**, focusing on automating physically demanding activities

Apollo



Height: Approximately 1.7 m

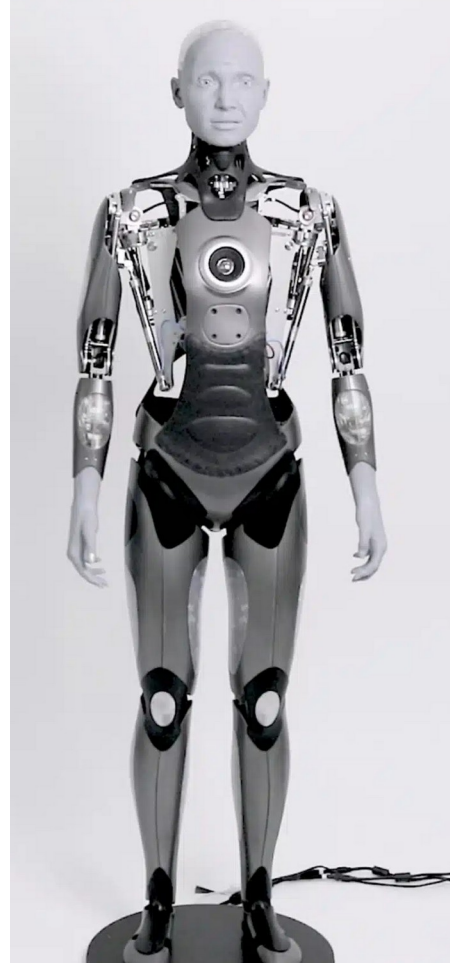
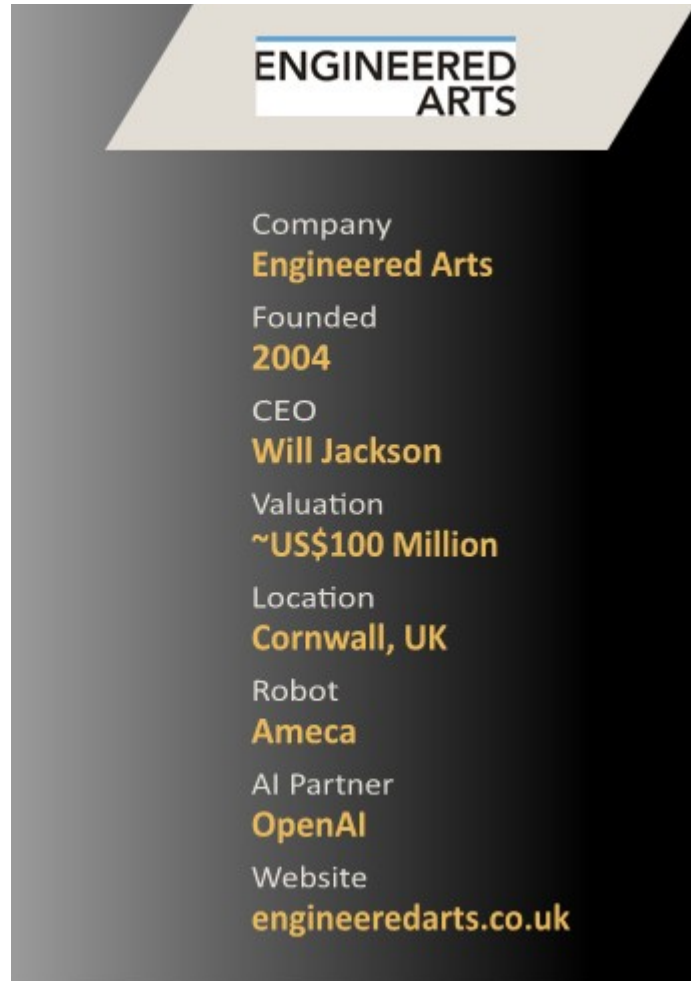
Weight: Around 60 kg

Degrees of Freedom: 28+ joints for refined motion control

Battery Life: Estimated at 5 hours per charge

Primary Use: Industrial automation and manufacturing support

Manufacturers Engineered Arts (United Kingdom)



Engineered Arts' **Ameca** represents a breakthrough in human-like robot interaction, featuring remarkably sophisticated **facial expressions** and **conversational abilities**. The robot incorporates 27 facial actuators, 5 neck actuators, and over 60 actuators in total, enabling nuanced emotional expressions and natural movements.

The **Generation 2** version showcases advanced capabilities including stable diffusion for creative tasks and sophisticated AI-driven interactions, though walking functionality remains under development.

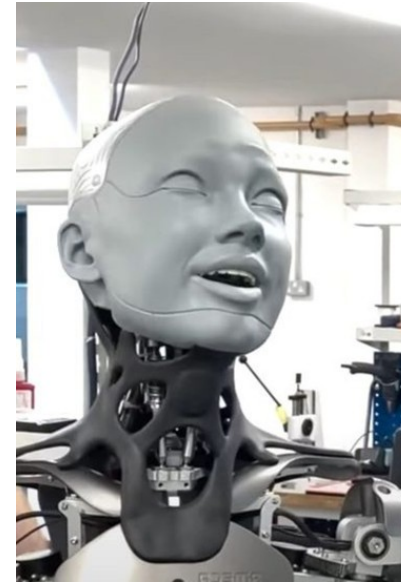
Manufacturers Engineered Arts (United Kingdom)

- **Engineered Arts – Ameca**

Ameca by Engineered Arts is noted for its incredibly **lifelike expressions** and natural interaction capabilities

Often featured in demonstrations and media, **Ameca** is redefining what it means to have a socially interactive robot

- **Ameca's** design is centered around human-like communication, featuring an expressive face and fluid body movements
- It is perfect for customer service, education, and entertainment, offering a glimpse into the future of human-robot collaboration



Height: ~ 5 ft 6 in
Over 50 lifelike facial expressions
More than 20 joints for both facial and body movements
Primary Use: Social interaction and customer service
Interaction: Advanced voice and conversational AI

Manufacturers Engineered Arts (United Kingdom)

- **Major Partnerships:** The robot's development platform supports major frameworks including **ROS**, **Mujoco**, and **NVIDIA's Isaac Lab**, facilitating broad collaboration with developers and researchers in the robotics community
- **Commercialization Plans:** Building on GR-1's success as a mass-produced humanoid, **GR-2** targets the growing elderly care market, where U.S. in-home care costs exceed \$60,000 annually
- The robot's enhanced capabilities and improved **manufacturing efficiency** position it as a scalable solution for healthcare applications



Height: Approximately 5 ft 6 in

Facial Expressions: Over 50 lifelike expressions

Degrees of Freedom: More than 20 joints for both facial and body movements

Primary Use: Social interaction and customer service

Interaction: Advanced voice and conversational AI

Manufacturers Sanctuary (Canada)

 SANCTUARY AI

Company
Sanctuary AI

Founded
2018

CEO
James Wells (Interim)

Valuation
Undisclosed

Location
Vancouver, Canada

Robot
Phoenix (Generation 7)

AI Partner
NVIDIA

Website
sanctuary.ai



- **Description:** Sanctuary AI's Phoenix, now in its seventh generation
- It is their general-purpose robot
- The robot has advanced dexterity with improved range of motion in wrists, hands, and elbows, supported by sophisticated visual acuity and tactile sensing systems
- Height: 5 feet 7 inches (170 cm)
- Weight: 155 pounds (70.3 kg)
- Load: 55 pounds (25 kg)

Manufacturers Sanctuary (Canada)

- **Major Partnerships:** A strategic partnership with **Magna International** positions Phoenix for deployment in automotive manufacturing facilities
- **Magna** will also serve as a contract manufacturer for future Phoenix units, streamlining production capabilities and scaling potential
- **Commercialization Plans:** Following successful retail deployment at Mark's store in Langley, British Columbia, where Phoenix completed 110 distinct tasks, the company is expanding into manufacturing applications
- Recent hardware optimizations have reduced the bill of materials and increased build efficiency, supporting broader commercial deployment
- Phoenix's AI control system, Carbon, enables task automation within 24 hours, a dramatic improvement from previous weeks-long training periods

Manufacturers

1X Technologies



Company
1X Technologies

Founded
2014

CEO
Bernt Øyvind Børnich

Valuation
~US\$375 Million

Location
California, USA

Robot(s)
NEO

AI Partner
OpenAI, NVIDIA

Website
1x.tech



- **Description:** 1X Technologies' NEO Beta, represents a significant evolution from their wheeled EVE model to a sophisticated bipedal platform engineered for home environments

The robot features advanced sensors and AI systems that enable natural **human interaction**, emotion recognition, and seamless integration with home automation systems

Height: 5 feet 5 inches (165 cm)

Weight: 66 pounds (30 kg)

Load: 44 pounds (20 kg)

Manufacturers 1X Technologies

- **NEO's** sophisticated **AI system** incorporates a groundbreaking generative model trained on thousands of hours of real-world robot operation data
 - Focused on home environments
 - **Investment backing** from **Tiger Global, OpenAI, and EQT Ventures** strengthens their market position
- **Commercialization Plans:** 1X Technologies has outlined ambitious deployment targets, aiming to place thousands of units in 2025 and potentially millions by 2028
 - Their focus on home environments positions **NEO** as a pioneering platform for domestic robotics integration

Major Japanese Humanoid Robot Manufacturers & Developers

Company / Institution	Key Humanoid Robots	Focus Areas	Current Status
Toyota Motor Corporation	T-HR3	Telepresence, remote operation, medical support	✓ Active
Kawasaki Heavy Industries	Kaleido	Disaster response, biped locomotion, strength assistance	✓ Active
SoftBank Robotics	Pepper, NAO	Customer service, education, social robots	✓ Active (less focus on hardware recently)
AIST (with Kawada Robotics)	HRP-2, HRP-4, HRP-5P	Research, disaster robotics, assistive tech	✓ Active
Osaka University + ATR	Geminoid, Repliee Q2, Erica	Android science, social robotics, realistic appearance	✓ Active (Prof. Hiroshi Ishiguro Lab)
Tokyo Institute of Technology	Musio (in partnership), humanoid R&D	AI, cognition, robotics research	✓ Active in academia
Miraikan (Museum)	Otonaroid, Kodomoroid	Public education, android interaction	✓ Active (in exhibits)
THK Co., Ltd.	N/A (component supplier)	Precision actuators, servos for humanoids	✓ Active (industry supplier)
ZMP Inc.	PATORO (patrol robot)	Autonomous systems, robotic mobility	✓ Active (limited humanoid focus)

Major Japanese Humanoid Robot Manufacturers & Developers

Toyota Motor Corporation

- Famous for: T-HR3 (humanoid robot designed for remote control and telepresence)
- Focus: Partner robots, medical care, mobility support

Kawasaki Heavy Industries

- Famous for: Kaleido (a full-size humanoid robot)
- Focus: Industrial robots, humanoids for disaster response

SoftBank Robotics

- Famous for: Pepper (semi-humanoid social robot), and NAO (developed by Aldebaran, now owned by SoftBank)
- Focus: Human-robot interaction, customer service
- Shifting focus recently to AI rather than hardware

AIST (National Institute of Advanced Industrial Science and Technology)

- Famous for: HRP (Humanoid Robotics Project) series — HRP-2, HRP-4

Major Japanese Humanoid Robot Manufacturers & Developers

Osaka University & ATR (Advanced Telecommunications Research Institute International)

- Famous for: Geminoid, Repliee Q — hyper-realistic androids by Prof. Hiroshi Ishiguro
- Focus: Android science, social interaction

Tokyo Institute of Technology

- Famous for: Musio (partnered with AKA) and humanoid robotics research
- Focus: Research-based humanoid design, cognition
- Active in research

Miraikan (National Museum of Emerging Science and Innovation)

- Famous for: Androids like Otonaroid and Kodomoroid
- Focus: Exhibition, education, human-robot relationship
- Status: Works closely with Prof. Ishiguro and ATR

THK Co., Ltd.

- Famous for: Support in developing actuators and components for humanoid robots
- Focus: Precision mechanical parts for humanoids

Manufacturers Variations in Approach

- Have VC /self financing
- Targeting specific applications
- Emphasized various capabilities
 - Facial expressions
 - Advanced hands
 - Mobility
 - Dexterity
 - Reduced power consumption
- Incorporated AI and advanced sensors
- Partnered with AI software and hardware suppliers
- Worked with component suppliers
- Some adopted vertical integration manufacturing
- Driving manufacturing cost reductions
- Field “Testing” with selected potential customers

Applications for Humanoid Robots



Next Session

Effects on Society