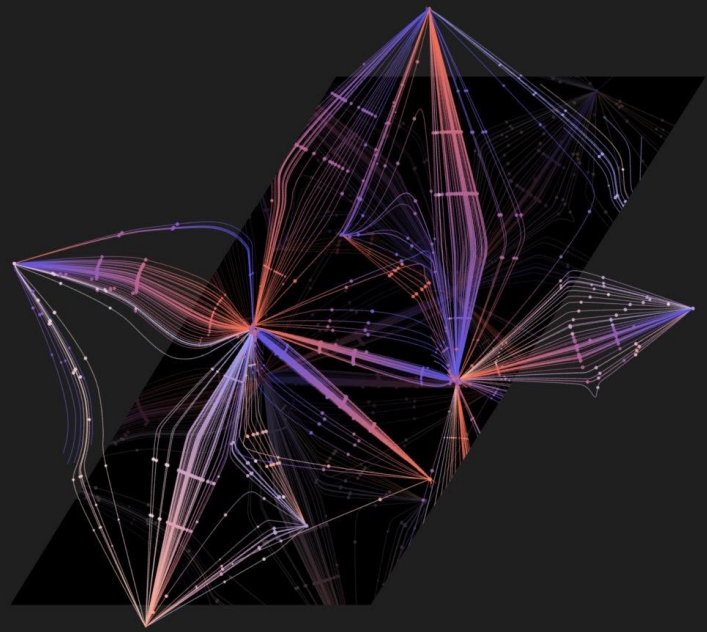
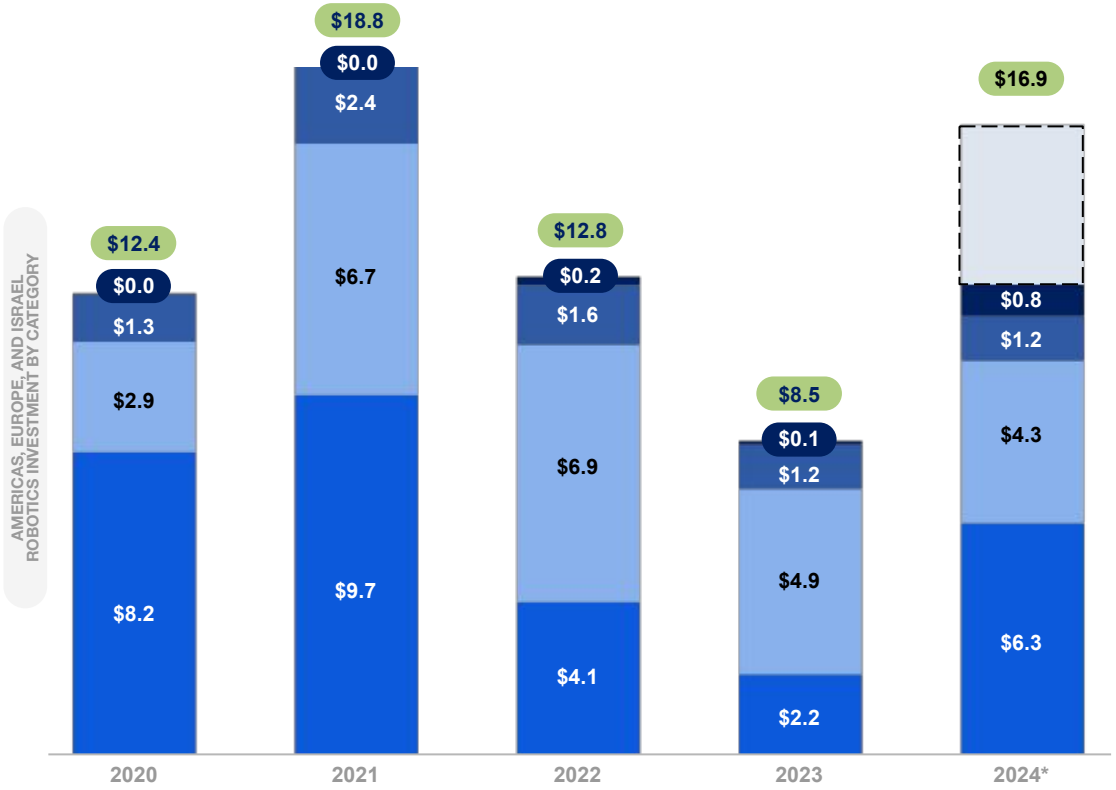
F/PRIME

State of Robotics

From Surge to Sobriety: Investment trends in 2024



2024 has seen a strong rebound in robotics investments



HUMANOID

Companies building robots that resemble human beings in form factor, agility and response.

ENABLING SYSTEMS

Companies building solutions to enable the development of AV and Robotics, including sensors, LiDar, Drones, and hardware/software components.

VERTICAL ROBOTICS

Companies building vertical-specific robotics across industries including logistics, medical, defense and security, manufacturing, agriculture, construction, and mining.

AUTONOMOUS VEHICLES (AV)

Companies building solutions for public road deployments across passenger vehicles, trucking, and delivery.

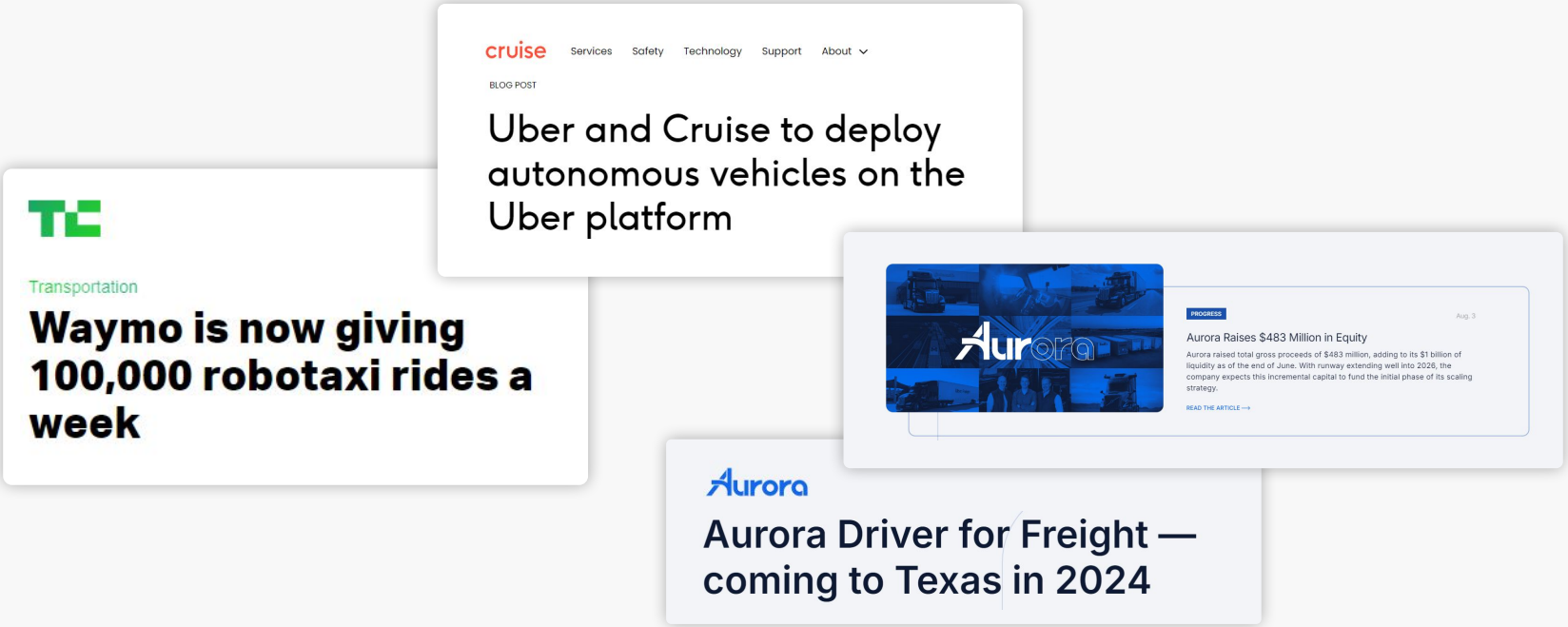
TOTAL | VERTICAL ROBOTICS
HUMANOID | AUTONOMOUS VEHICLES (AV)
ENABLING SYSTEMS | 2024 RUN RATE

Source: PitchBook, F-Prime team analysis

*Data through August 2024, Excludes $4B Cruise deal from run rate

Much of the funding surge has gone to the AV sector, as multiple players are finally starting to commercialize

AUTONOMOUS VEHICLES (AV)



Source: F-Prime team analysis

Humanoids have been one of the hottest new areas to emerge

HUMANOIDS

STARTUPS

VentureBeat

1X, robotic startup backed by OpenAI, receives $100M in funding

Shubham Sharma

@mr_bumss

January 11, 2024 10:07 AM

TC

Featured Article

Figure rides the humanoid robot hype wave to $2.6B valuation

The Bay Area firm is raising $675M from Microsoft, OpenAI, Amazon, Nvidia, Intel Capital and more

Brian Heater / 5:00 AM PST • February 29, 2024 Comment

CORPORATES

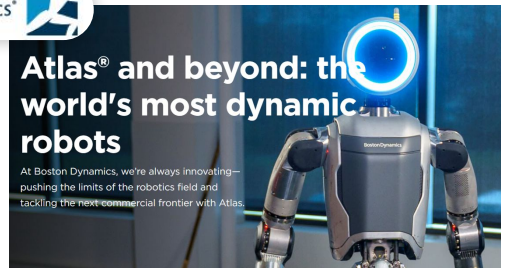
TESLA

Tesla Bot

Create a general purpose, bi-pedal, autonomous humanoid robot capable of performing unsafe, repetitive or boring tasks. Achieving that end goal requires building the software stacks that enable balance, navigation, perception and interaction with the physical world. We're hiring deep learning, computer vision, motion planning, controls, mechanical and general software engineers to solve some of our hardest engineering challenges.

See Opportunities

Boston Dynamics



Source: F-Prime team analysis

Robotic foundation models have attracted significant interest in an effort to unlock growth for the sector

ENABLING SYSTEMS

STARTUPS

m:ginative

VENTURE CAPITAL · STARTUPS · ROBOTICS

Physical Intelligence Raises $70M to Build AI-Powered Robots for Any Application

RICHARD BANFIELD
MARCH 12, 2024 • 2 MIN READ

VENTURE CAPITAL · STARTUPS · ROBOTICS

Skild.ai Raises $300M Series A with $1.5B Valuation

CHRIS MCKAY
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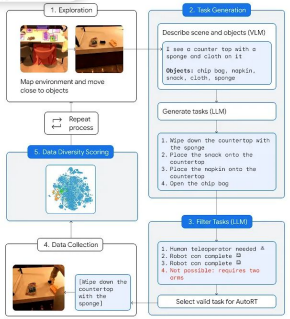
covariant

The Pick — The Industry

The Future of Robotics: Robotics Foundation Models and the role of data

CORPORATES

Google DeepMind



NVIDIA

NVIDIA Announces Project GR00T Foundation Model for Humanoid Robots and Major Isaac Robotics Platform Update

Isaac Robotics Platform Now Provides Developers New Robot Training Simulator, Jetson Thor Robot Computer, Generative AI Foundation Models, and CUDA-Accelerated Perception and Manipulation Libraries

ACADEMIA

arXiv:2312.07843v1 [cs.RO] 13 Dec 2023

Foundation Models in Robotics: Applications, Challenges, and the Future

Roya Firoozi[1], Johnathan Tucker[1], Stephen Tian[1], Anirudha Majumdar[2,6], Jiankai Sun[1], Weiyu Liu[1], Yuke Zhu[3,4], Shuran Song[5], Ashish Kapoor[6], Karol Hausman[1,6], Brian Ichter[6], Danny Driess[6,7], Jiajun Wu[1], Cewu Lu[8], Mac Schwager[1]
[1]Stanford University, [2]Princeton University, [3]UT Austin, [4]NVIDIA, [5]Scaled Foundations, [6]Google DeepMind, [7]TU Berlin, [8]Shanghai Jiao Tong University

arXiv > cs > arXiv:2312.08782

Computer Science > Robotics

[Submitted on 14 Dec 2023 (v1), last revised 15 Dec 2023 (this version, v2)]

Toward General-Purpose Robots via Foundation Models: A Survey and Meta-Analysis

Yafei Hu, Quanting Xie, Vidhi Jain, Jonathan Francis, Jay Patrikar, Nikhil Keetha, Seungchan Kim, Yaqi Xie, Tianyi Zhang, Shibo Zhao, Yu Quan Chong, Chen Wang, Katia Sycara, Matthew Johnson-Roberson, Dhruv Batra, Xiaolong Wang, Sebastian Scherer, Zsolt Kira, Fe

arXiv > cs > arXiv:2402.05741

Computer Science > Robotics

[Submitted on 8 Feb 2024]

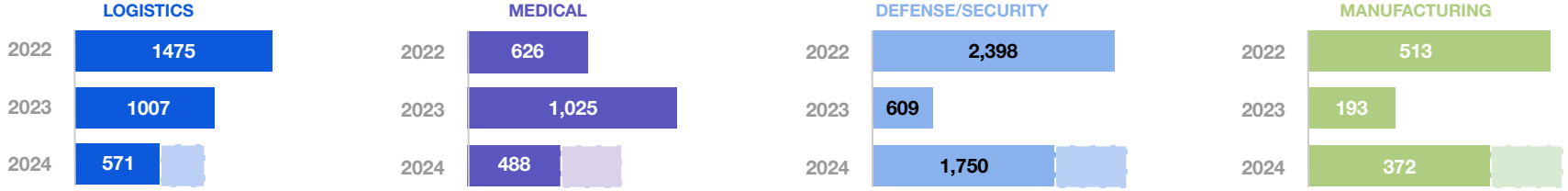
Real-World Robot Applications of Foundation Models: A Review

Kento Kawaharazuka, Tatsuya Matsushima, Andrew Gambardella, Jiaxian Guo, Chris Paxton, Andy Zeng

Source: F-Prime team analysis

Vertical Robotics investment continues at a similar pace to the last two years

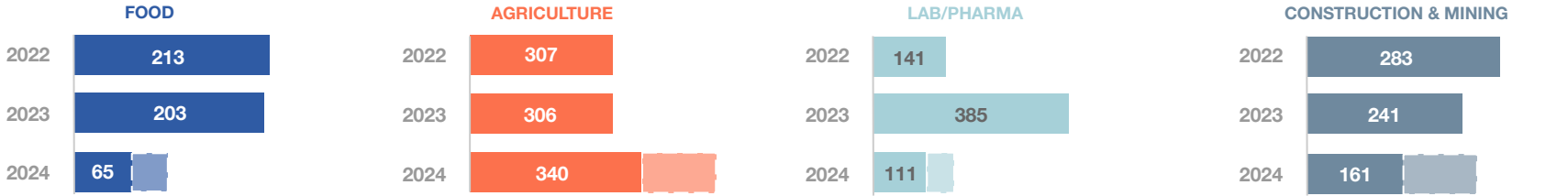
ESTABLISHED SEGMENTS: > $500M INVESTED/YR



HIGHEST FUNDED PRIVATE COMPANIES 2020-2024

GreyOrange · zipline · EXOTEC · Noah Medical · CMR SURGICAL · Distalmotion · ANDURIL · EPIRUS · Shield AI · FLEXIV · Bright Machines · path ROBOTICS

EMERGING SEGMENTS: < $500M INVESTED/YR



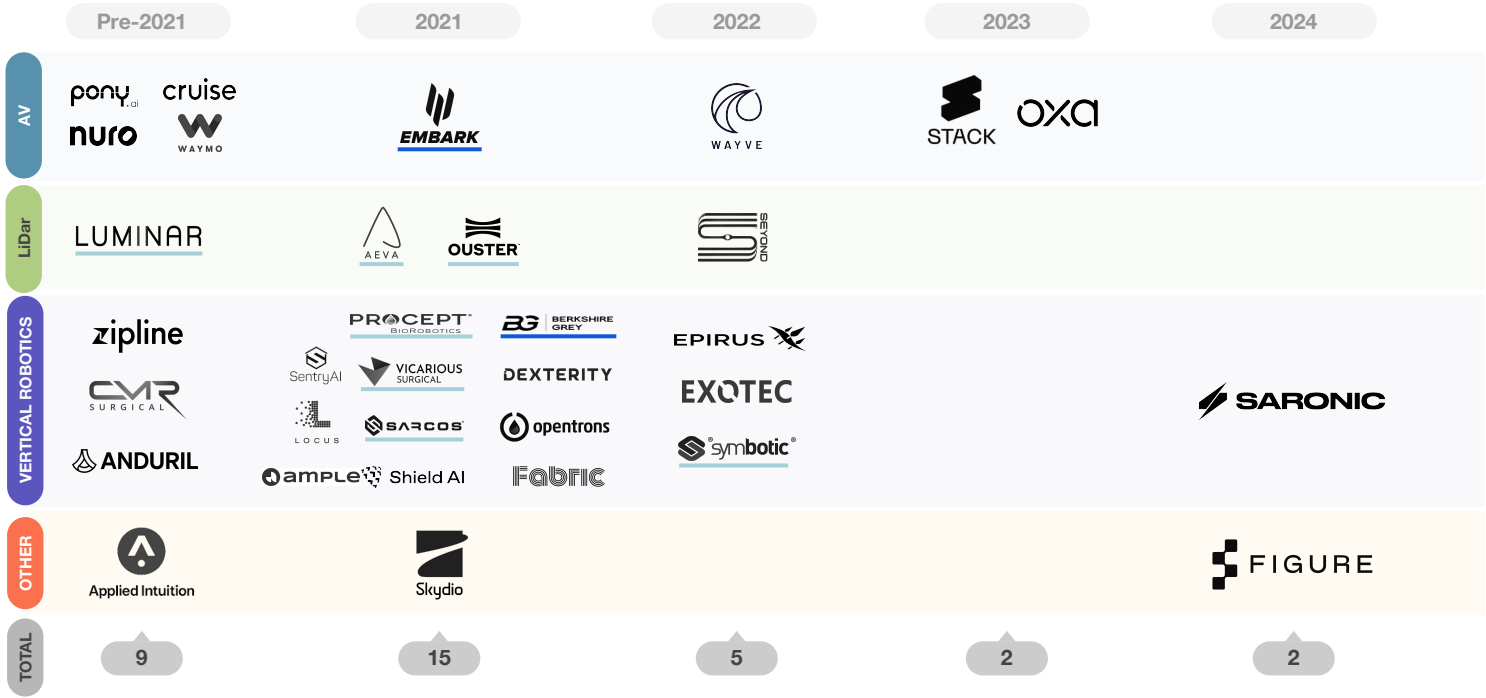
HIGHEST FUNDED PRIVATE COMPANIES 2020-2024

SOFT ROBOTICS · BEAR ROBOTICS · MISO ROBOTICS · MONARCH. · CARBON ROBOTICS · IRONOX · opentrons · CELLARES · culture BIOSCIENCES · BUILT ROBOTICS · SafeAI · Diamond Age

Source: PitchBook, F-Prime team analysis

Much of the robotics industry's value is locked in private robotics unicorns

New Robotics Unicorns in each of the last 5 years



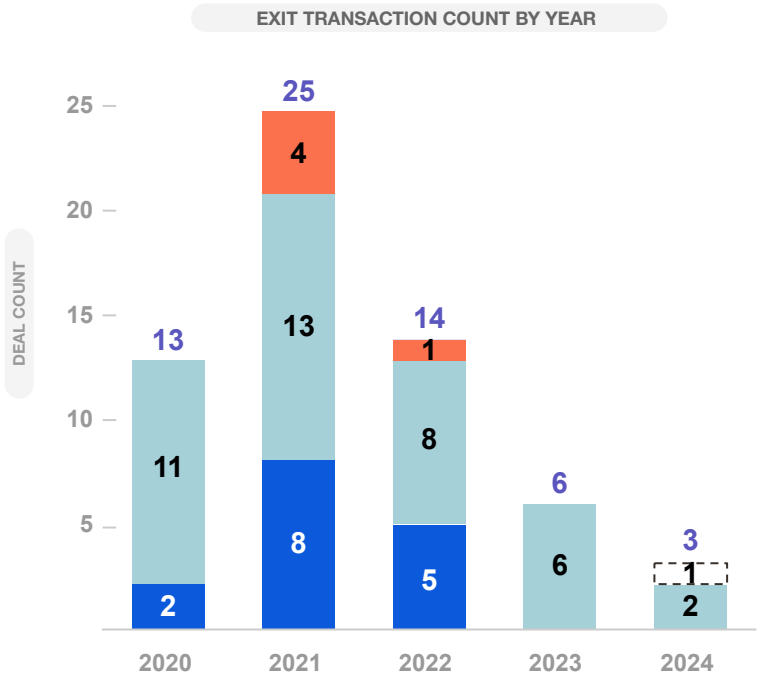
24
Private unicorns representing
$150B
last round valuation **

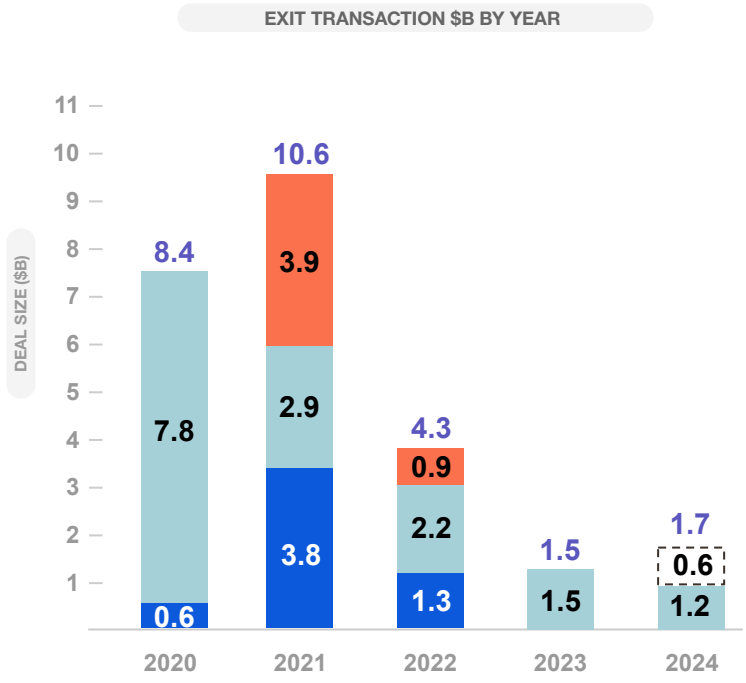
Source: PitchBook, F-Prime team analysis
*Public market caps dropped below $1B in subsequent years

Dropped*: Embark, Berkshire Grey, Vicarious Surgical, Sarcos, Aeva, Ouster

M&A IPO

The lack of M&A or public offerings continue to be an industry headwind



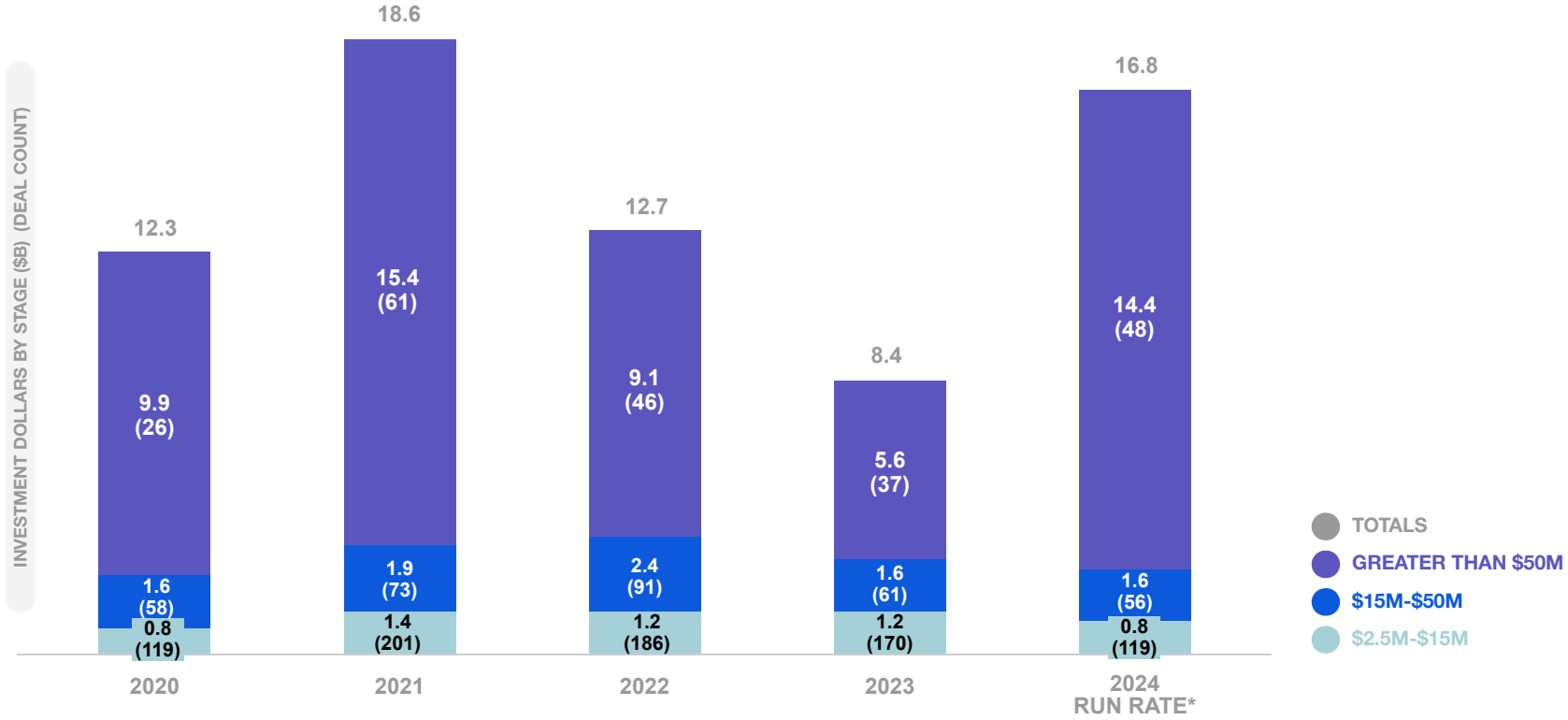


2024 RUN RATE
MERGER/ACQUISITION
IPO
SPAC

Only includes transactions >$25M

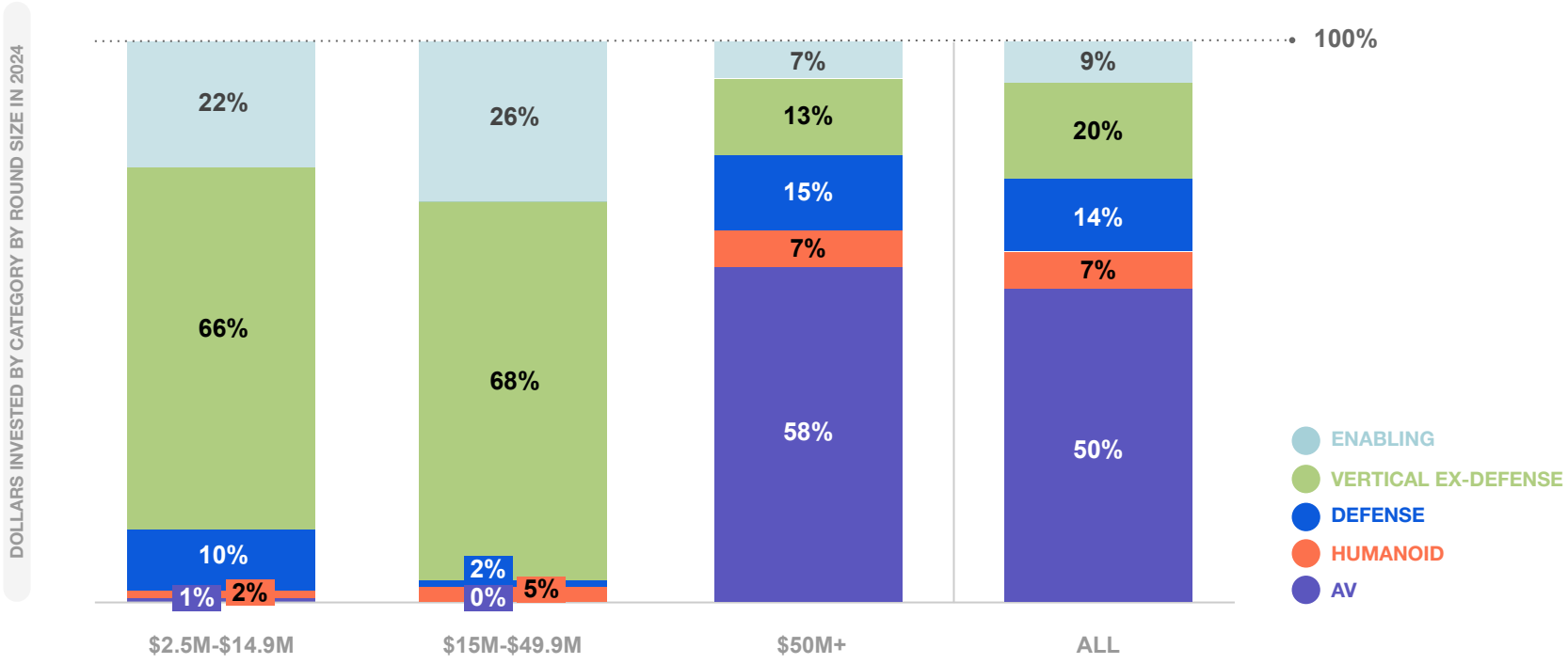
Source: PitchBook, F-Prime team analysis

All of the funding gains of 2024 have been for mega rounds of >$50M; early and mid-stage rounds continue to decline and are now at 2020 levels



Source: PitchBook, F-Prime team analysis
*Data through August 2024, Excludes $4B Cruise deal from run rate

Mega rounds are primarily in AV, Defense, and, to some extent, Humanoids; earlier stage deals are mostly focused on Vertical Robotics



	$2.5M-$14.9M	$15M-$49.9M	$50M+	ALL
DOLLARS INVESTED	$562M	$1.1B	$10.9B	$12.5B
DEAL COUNT	78	37	31	146

Source: PitchBook, F-Prime team analysis

Despite the growth in mega rounds, the last 18 months have seen many well-funded robotics companies shut down or get restructured

COMPANY	FOUNDING YEAR	TOTAL FUNDING	OUTCOME
zume	2015	$446M	Shut Down
covariant	2017	$245M	Acqui-hire by Amazon
Takeoff	2016	$171M	Bankruptcy
PRECISIONHAWK	2010	$139M	Shut Down
RIGHTHAND ROBOTICS	2014	$125M	Restructuring
Phantom Auto	2017	$95M	Shut Down
VEO ROBOTICS	2016	$69M	Asset Sale to Symbotic
READY ROBOTICS	2016	$44M	Shut Down

Source: PitchBook, TechCrunch, The Robot Report, F-Prime team analysis

Public companies in the sector have mostly underperformed the market

COMPANY	MARKET CAP (08/30/2024)	LTM REVENUE	LTM REVENUE GROWTH	EV/LTM REVENUE	LTM EBITDA MARGIN	12 MONTH STOCK PERFORMANCE	SEGMENT
INTUITIVE	$175.1B	$7.6B	14%	23.1x	34%	1.5x	Medical
symbotic	$11.2B	$1.7B	63%	6.7x	-5%	0.5x	Logistics
Aurora	$8.0B	NA	NA	NA	NA	1.5x	AV
PROCEPT BioRobotics	$4.1B	$177M	74%	22.5x	-59%	2.3x	Medical
AutoStore	$3.6B	$613M	-1%	6.4x	38%	0.6x	Logistics
robosense	$638M	$213M	121%	1.3x	-252%	0.3x	LiDar
LUMINAR	$504M	$76M	40%	13.2x	NA	0.2x	LiDar
HESAI	$504M	$251M	13%	0.8x	-25%	0.4x	LiDar
OUSTER	$343M	$100M	69%	2.3x	-58%	1.3x	LiDar

S&P up 1.25x YoY

Source: CapIQ, Ycharts, Stock Analysis
F-Prime team analysis

Note: Only includes Americas, Europe, Israel & Hong Kong with public listing in last five years. Excludes companies with market cap <$250M.

How should startups navigate the current investment climate?

- The bar is higher than ever. Investor interest in robotics continues to rise, but as the space matures, expectations are high. A marginally better offering won't cut it. Teams must credibly demonstrate unique technical and business insight to solve a problem that no one else can.

- Use case selection matters. Solutions must address the sweet spot of high ROI, low-friction adoption, significant TAM, and technical defensibility. Many companies struggle with taking too much time and money to get to market, insufficient customer pull to drive adoption, and too many 'me-too' competitors.

- Traction matters. After the seed round, investors expect production-level traction. Not pilots. Not LOIs. Not undelivered contracts.

- Be realistic. Overly ambitious growth projections can be a red flag. Robotics business always take more time and money to scale than you think. Setting the right expectations with investors can avoid difficult choices down the road.

- Late stage investors are ready to invest if you can hit breakout velocity (scale, growth, positive GM).

State of Robotics Team

Sanjay Aggarwal
Venture Partner

Betsy Mulé
Senior Associate

Learn more about F-Prime:

F-Prime Capital Website

F-Prime Reports & Research:

State of Robotics
Robotics Roundup

Email:

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About F-Prime

We create and invest in healthcare and technology companies that impact lives all over the world. We have over 200 companies in our portfolio, including 23 that we started. Our global portfolio is spread across the US, Europe, and Asia.

Note: Above listing is a sample of robotics portfolio companies in the F-Prime and Eight Roads funds.