

# Autonomous eTractor Pull-off with AI

By John Benson

September 2023

## 1. Introduction

Right under my damn nose it was!

For the nitpickers out there, I write about electric vehicles, and per the Oxford Dictionary, “a vehicle is ‘...a thing used for transporting people or goods, especially on land, such as a car, truck, or cart.’ Merriam-Webster defines it as ‘...a means of carrying or transporting something, including planes, trains, and other vehicles: such as a motor vehicle.’ The US Legal website defines it as ‘something used as an instrument of conveyance. It can include any conveyance used for transporting passengers or things by land, water, or air. It can be a self-propelled conveyance that runs on tires like a motor vehicle.’ ”<sup>1</sup>

Thus a tractor that is capable of carrying a driver (or be driverless), and also capable of carrying other things is definitely a vehicle. If it is battery-powered, it an electric vehicle.

As for my nose, the company making this EV is Monarch Tractor, and they are on the other side of Livermore, CA where I have lived for over 30 years.

If you are curious about the “AI” (artificial intelligence) in the title of this post, Monarch Tractors also makes a software package called Wingspan AI. This package does much more than control tractors, and this post is about Monarch’s Tractors and their AI.

## 2. Monarch Tractor

*Monarch Tractor, a startup cofounded by a member of the Mondavi wine family, is leveraging technology more commonly associated with battery-powered Teslas and autonomous Waymo vans to create electric robotic tractors it says can make farming safer and more sustainable. The Silicon Valley-based company just raised \$20 million as it prepares to start deliveries.*<sup>2</sup>

*Monarch, which came out of stealth in late 2020, said funds from its Series A round will help it expand operations beyond the U.S. to international markets. Deliveries of its first tractors, priced from \$50,000, begin in late 2021. Investors in the round include Japanese auto-parts maker Musashi Seimitsu Industry, European agricultural and commercial vehicle maker CNH Industrial and India’s VST Tillers Tractors. Silicon Valley-based At One Ventures and private capital group MUUS also invested in the round.*

---

<sup>1</sup> Above quoted text per Microsoft Bing Generative AI.

<sup>2</sup> Alan Ohnsman, Forbes, “Here Come The Farm Robots: Startup Raises \$20 Million For Autonomous Electric Tractors,” Mar 16, 2021, <https://www.forbes.com/sites/alanohnsman/2021/03/16/here-come-the-farm-robots-startup-raises-20-million-for-autonomous-electric-tractors/?sh=5ce546157e24>, Mr. Ohnsman can be forgiven for confusing Silicon Valley (Santa Clara Valley) with Livermore Valley as they are both in the SF Bay Area, and both do high-tech and wines.

**Author's comment:** Note the above excerpt is from a March 2021 article. The first delivery to Wente Vineyard was in April 2021, per the press release linked below. Wente's main winery is in Livermore about half way between my home and Monarch. Their Vineyards stretch across much of South Livermore Valley and are protected from development by the South Livermore Valley Area Plan created in 1993.<sup>3</sup>

<https://www.monarchtractor.com/news/first-monarch-tractor-reports-to-work-at-wente-vineyards>

*"The food ecosystem is ready for transformation with farmers demanding sustainable tools that can increase efficiency and farm profitability," CEO and cofounder Praveen Penmetsa said. "We have seen an incredible and accelerating demand for our Monarch Tractor."*

*Livermore, California-based Monarch, along with industrial giants like John Deere, see big opportunities to make farming more efficient and provide new options for farmers in regions where human labor may be scarce through the use of advanced sensors, software and computing power. And unlike self-driving vehicles operated in cities and on public roads, low-speed autonomous Ag-equipment doesn't require federal or state approval for use on off-road and on private land.*

*Monarch calls its tractor "driver optional," as it can be operated as a conventional vehicle. It performs programmed tasks without a driver or an operator can use interactive "Gesture" and "Shadow" modes to have it follow workers in the field. The tractor is designed with roll and collision-prevention and has 360-degree computer vision. It can collect and analyze more than 240GB of crop data per day. That information can be used to make adjustments in the kinds of implements the vehicle is using and provide long-term yield estimates, crop growth stages and plant health metrics. The vehicle's battery system can also serve as a remote power supply.*



Monarch Tractor's founders are, from left, President Mark Schwager, Chief Farming Officer Carlo Mondovi, CEO Praveen Panmetsa and CTO Zachary Omohundro (MONARCH TRACTOR)

<sup>3</sup> [https://www.acgov.org/cda/planning/landuseprojects/slvap\\_report.htm](https://www.acgov.org/cda/planning/landuseprojects/slvap_report.htm)

## 2.1. Tractor

The current Monarch product is the Mk V. It has 40 to 70 horsepower, and up to 14 hours of runtime. It is fully integrated into the Wingspan AI. The web page linked below has an excellent description, and footnote 4 at the end of this page has a link to the Monarch home page, which has a good video of the Mk V Tractor in Action.<sup>4</sup>

<https://www.monarchtractor.com/mk-v-electric-tractor>

## 2.2. WingspanAI

*WingspanAI is the farm control center for your MK-V, empowering you with greater control and visibility over your tractors from anywhere in the world — right in the palm of your hand.*

*Access the true power of your MK-V with automated operations planning, remote fleet management, tractor performance reports, maintenance diagnostics, and more.*

**Control:** *Plan and execute autonomous operations for your MK-V through the WingspanAI app.*

**Visibility:** *Gain deeper visibility into your operations with live video feeds and real-time alerts.*

**Insight:** *Track important metrics daily, weekly, and over time to reduce overhead and increase efficiencies.*

The web page linked below is the WingspanAI Page and contains additional information:

<https://www.monarchtractor.com/digital-solutions>

## 3. Recent Speech by Monarch CEO

*It's been dubbed Amazon's secret conference. Each year, Amazon Founder and Executive Chair, Jeff Bezos, invites an exclusive gathering of leading voices across machine-learning, automation, robotics, and space (aka MARS). For MARS 2023, Bezos invited Monarch CEO and Co-Founder, Praveen Penmetsa, to take center stage with his powerful, presentation, "Automating the Most Important Vehicle in the World."<sup>5</sup>*

*Speaking to a prestigious audience of tech disruptors and innovators, Penmetsa's presentation addressed the importance of automating and digitizing the world's most important vehicle: the tractor. After pointing out that the small tractor is the most used farm device on the planet, he introduced Monarch's MK-V as the type of tractor that will revolutionize farming. The electric, driver-optional, and connected MK-V is a sub-100HP small tractor whose innovations bridge the gap between solving problems farmers face right now to safeguarding a farm's health and profitability for the future. What followed was a rare, inside look at the development of Monarch's technology.*

### 3.1. Optimizing What Matters

*"Farmers have tried to optimize their operations through larger equipment and more chemicals, leading to negative outcomes," Penmetsa says.*

---

<sup>4</sup> Monarch Homepage, <https://www.monarchtractor.com/>

<sup>5</sup> Monarch, "Monarch CEO Shares an Insider's Look of Monarch's Ag Technology," June 21, 2023, <https://www.monarchtractor.com/news/insiders-look-of-monarchs-ag-technology>

*These problematic outcomes include greater economic pressures, soil erosion, human health issues, ecosystem destruction, and proliferation of cheap, unhealthy foods. Transformation comes from reimagining the small tractor. Penmetsa got intimate with the creative thought process and Ag-technology behind the MK-V and how it solves farmers' challenges. For Monarch, elevating the tractor's performance, familiarity, usefulness, and safety with farmer-first solutions were paramount.*

*"What started off as a fairly simple challenge was not that simple anymore," Penmetsa recalls. "Every farmer should be able to use this with no training, no mapping, and less than an hour of setup. It's so intuitive, that they can see value from day one."*

*The MK-V also tackles unreliable power grids and blackouts. Penmetsa explains, "It's a huge challenge for energy resilience and energy capacity for our rural grids and that's the case all over the world. Our tractor is going to break that log jam by providing energy storage at the edge and capacity at the edge of our grids."*

*On the digital side, because the tractor is involved in operations that stretch from spring preparations to fall harvest, it becomes the ideal platform to tell a farmer what's happening on the farm based on the data it collects. Farmers get valuable Ag-intelligence without having to manually enter any information.*

*In addition to energy and data, Monarch's impact extends to safety. In a United States Department of Agriculture (USDA) study, research revealed that from 2015 to 2019 more than 62,000 people were treated in emergency room departments from nonfatal, agricultural-related injuries. Nearly a third were youths. Fatalities, meanwhile, are seven times higher than the national average of other industries, based on data from the U.S. Bureau of Labor Statistics.*

*"We've become so decoupled from the farm ecosystem, that we don't realize that agriculture is one of the most dangerous professions on the planet," Penmetsa says.*

### **3.2. Giving Farming a Future**

*When developing electric tractor prototypes, Penmetsa asked a farmer what he would do with all the savings he would incur with an electric tractor. The farmer replied that he would send his children to college because "there is no future in farming." Penmetsa recognized how critical it was to change that reality.*

*As the catalyst for that change, the MK-V drives farm operations savings by helping farmers gain labor efficiencies and a safer working environment. Energy savings are realized through emission reductions, transportable power, and with the addition of renewable energy sources, farmers can add energy independence to their gains. Collectively, these deliverables are changing a statement of "there is no future in farming," to "there is a future, it's profitable and sustainable from the farm community all the way to that of the planet."*

**Final author's comment:** An average of once a week I travel from Livermore to our mountain home in Arnold (4,000 ft. in the Sierra Nevada Mountains) or vice versa. In this trip I pass through the San Joaquin Valley, which is primary Ag-land. Although some farmers there are starting to install large photovoltaic (PV) arrays on their property, these are few and far between.

The Monarch Tractor provides a missing element to accelerate the adoption of PV – a battery energy storage system (BESS) with wheels. It also directly turns the electrical output of PV into the tasks that tractors perform.

See the article through the link below for an example of turning solar energy into these tasks.

**Off-grid solar canopy charges electric tractor at California winery**

[https://pv-magazine-usa.com/2023/09/05/off-grid-solar-canopy-charges-electric-tractor-at-california-winery/?utm\\_source=USA+%7C+Newsletter&utm\\_campaign=2757298d66-RSS\\_EMAIL\\_CAMPAIGN&utm\\_medium=email&utm\\_term=0\\_80e0d17bb8-2757298d66-159946110](https://pv-magazine-usa.com/2023/09/05/off-grid-solar-canopy-charges-electric-tractor-at-california-winery/?utm_source=USA+%7C+Newsletter&utm_campaign=2757298d66-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_80e0d17bb8-2757298d66-159946110)