

Mark1 Pre-Application Questionnaire

Mark1 is a Developer-as-a-Service for capital intensive, first of a kind industrial climate technologies. We work with technology companies to maximize the opportunity for deploying their first commercial-scale projects.

The Mark1 program is designed for companies that are nearing or have completed commissioning of your technology pilot. This pre-application questionnaire is intended to capture information that will allow us to evaluate the likelihood that you are a good fit for the program.

Upon submittal you will have an opportunity to schedule a call to learn more about the program.

First name* Robert

Last name* Means

Email* Rob@MilpitasPRT.com

Website URL <https://MilpitasPRT.com/>

Company name* LoopWorks

What is your company's mission?* "Provide climate-friendly and easy-to-use Personal Rapid Transit (PRT) for movement around Milpitas that bypasses traffic with quick, point-to-point and fare-free rides."

While our mission is limited to Milpitas, our long-term [Vision](#) extends worldwide: *The LoopWorks PRT project inspires rapid adoption of advanced transit that dramatically reduces transportation sector emissions.*

Please provide a high level explanation of your technology*

Personal Rapid Transit (PRT, aka “podcar network”) is an elevated, electric, on-demand, private, non-stop point-to-point, and networked system with many small neighborhood stations. It works like a horizontal elevator. Go to your local podcar stop, enter a vehicle, select your destination, and ride quickly to it. Rather than an innovation in technology, PRT recombines established technologies in a new, synergistic way.

In the universe of transportation options, PRT (1-6 passengers per vehicle) falls under the Automated Transit Network (ATN) umbrella, along with it’s bigger cousins Group Rapid Transit (GRT, 7-24 passengers) and Automated People Movers (APM, 25-100 passengers). PRT utilizes 2 fundamental innovations in public transit that lead to extraordinary service: 1) PRT uses small, automated cabs, so it can provide 24/7 service with [low O&M costs](https://milpitasprt.com/technology/cost/om-costs/) (<https://milpitasprt.com/technology/cost/om-costs/>); 2) PRT [guideways](https://milpitasprt.com/technology/hardware/#guideway) (<https://milpitasprt.com/technology/hardware/#guideway>) are elevated and [stations](https://milpitasprt.com/technology/hardware/#station) (<https://milpitasprt.com/technology/hardware/#station>) are off-line, so riders travel non-stop from origin to destination – arriving quicker than driving.

Various flavors of PRT have been proposed (see https://en.wikipedia.org/wiki/Personal_rapid_transit and <https://www.advancedtransit.org/advanced-transit/system-comparison/>). The ITNS design that LoopWorks will employ in the Milpitas PRT project was open-source developed by engineers. Among their few major design decisions were 1) keep the weight low (to keep the guideway cost low), and 2)

use [linear induction motors](https://www.advancedtransit.org/advanced-transit/system-comparison/) (<https://www.advancedtransit.org/advanced-transit/system-comparison/>) which, though typically more expensive, are better able to control vehicles in all weather conditions.

The prototype ITNS design won competitions in Chicago, SeaTac, and Cincinnati. In 2003, the prototype materialized with the construction of a fully automatic vehicle for a budget of only \$600,000, and only 6 months from the initial order-to-proceed until operation. The vehicle operated as designed on a 60-ft section of covered-steel-truss guideway at the 2003 Minnesota State Fair 12 hours per day for 12 days with no failures. The prototype design is clear and detailed by ITNS (<https://milpitasprt.com/wp-content/uploads/technical-specifications.pdf>) and the LoopWorks website (<https://milpitasprt.com/technology/>).

More importantly than the hardware/software of any PRT technology is the leverage such a tool provides to change how people and things move. Clearly, driverless vehicles have shown us that computer-directed vehicles are within our technical abilities. They have not shown us the difference made by providing elevated and dedicated “roads” for those vehicles:

- How much does it impact transit ridership generally ([which could mushroom](#))?
- What are the capital expenditure (CapEx) costs (which could be [far lower](#) than other mass transit options)?
- What are the Operations and Maintenance (O&M) costs (which could be [far lower](#) than other mass transit options)?
- Which social indicators change with PRT’s arrival?

Learn more details about the hardware technology at <https://milpitasprt.com/technology/hardware/>

Please describe your company's go to market strategy*

PRT recombines established hardware technologies in a new way. Similarly, the “go to market strategy” of LoopWorks recombines established ownership models in a way that empowers others to develop a projected \$1T industry. While LoopWorks focuses on Milpitas as its sole market, its open-source design and project transparency invite other communities and companies to create their own systems. Once demonstrated in Milpitas, PRT technology could sweep the country as electric streetcars did in their time.

LoopWorks expects the [high value](#) of PRT to attract the CapEx funding required. Whether reducing transportation-sector emissions, making a profit, or delivering superior service, the Milpitas PRT demonstration project presents tremendous value to investors.

Traditional mass transit options often miss the mark on service, speed, and reliability. PRT is a transformative, high-efficiency technology with the potential to decarbonize the transportation sector while broadening access with high-level transit service! PRT will reduce traffic congestion while increasing energy efficiency, safety, and - most dramatically - ridership of existing public and private transportation options. PRT promotes transportation equity, mobility for handicapped, and safety for elders – simply put, it will improve the lives of people. Sharing that vision is our market strategy. LoopWorks will secure grant funding for engineering and construction from organizations engaged in reducing greenhouse gas emissions, increasing transit ridership, or promoting social equity. Grant money eliminates the need to pay for both capital costs and interest on debt. Building with grants means that all revenue can be applied to running the system and serving people.

While PRT has been technically and financially viable for the past 40 years, institutional inertia and fear of political consequences have impeded progress. To reduce fear and avoid institutional resistance, LoopWorks employs 3 innovative strategies:

1. Use a vehicle design that minimizes guideway size and markedly reduces cost.
2. Adopt a California Mutual Benefit Corporation legal structure to provide flexibility and transparency unavailable through governmental, for-profit, and tax-exempt corporate structures.
3. Seek gratis/free funding from foundations, investment groups, and government agencies (federal/state) for designing and building the system in order to minimize delay and ensure financial viability.

Based on that 2003 Minnesota State Fair demonstration, the technology is ready for a “prototype demonstration in an operational environment.” Successful completion of this \$60M R&D project will also yield CapEx numbers to inform commercial investors, and likely kick-start a \$1T advanced transit industry that employs replication, scaling, and network effects to rapidly grow opportunities worldwide. Although LoopWorks can provide consulting services, others will manage the replication and scaling needed to grow this advanced transit industry into its total addressable market (TAM) of \$1T.

The target markets are metropolitan areas needing improved transit due to congestion, pollution, or legal requirements to reduce CO₂ emissions. According to PRT company Glydways, about 5,000 cities on Earth need - but only 178 cities have - mass transit systems. PRT can provide 24/7 service to an area of 10 square miles through 80 neighborhood podcar stops for under \$1B. By contrast, the local transit agency plans to spend \$12B on 4 commuter rail stations along a 6-mile corridor (<https://vtabart.org/>).

PRT can grow locally (as planned for Milpitas), replicated virally, and scale to serve large metropolitan areas like San José. A total addressable market (TAM) of \$1T is estimated from a need for 150 PRT systems that each cost about \$7B and serve 100 square-miles (<https://milpitasprt.com/wp-content/uploads/BART-PRT-flyer.pdf>).

PRT is a high impact innovation. LoopWorks expects the high value of PRT to attract the CapEx funding required for the Milpitas PRT demonstration project. After that, the industry could mushroom rapidly.

For the technology you want to scale, do you have a commissioned pilot?* Please enter Yes or No and describe the current status

While LoopWorks lacks a “commissioned pilot”, we have a clear plan for the demonstration project in the highly-congested Metro Area of Milpitas. Upon completion, LoopWorks plans to grow the initial system to serve most of Milpitas. A bigger opportunity to demonstrate scalability lies in San José where a 10-square-mile project to connect BART and Caltrain could expand into the first 100-square-mile metropolitan network.

Unlike basic or high-tech research, LoopWorks proposes to apply existing knowledge and established technologies to create a PRT network. The [prototype ITNS design](#) that LoopWorks will employ in the Milpitas PRT project was created by many engineers through an open-source process using now-expired patents. The Milpitas PRT project estimated to cost \$6M for all pre-construction engineering, planning, and permitting. In addition to contacting all stakeholders for input, a trustworthy construction company will review the basic design and implementation plan to ensure both are technically feasible.

Learn more about the technology at <https://milpitasprt.com/technology/>

Has your technology been deployed previously at full commercial scale?*

~~Yes~~

No

Please provide a narrative of the project you want to develop with Mark1:* Please include your current estimate of the project's capital expense (capex).

In Milpitas, like many cities across America, walking and biking are discouraged by physical barriers and high traffic volumes that prevent people from easily moving around town without a car. That's especially true in the Metro Area of Milpitas where barriers include 2 major roads (Montague Expressway and Capitol Ave/Great Mall Parkway), 2 rail lines (Union Pacific and BART), and 2 creeks. Even driving around the area is sometimes difficult. While most South Bay areas do not experience congestion, the Milpitas Metro Area does. In the past decade, 7000 housing units were built there; another 7000 are expected over the next decade.

In 2020, the Milpitas Transit Center became fully operational by providing access to commuter rail (BART), light rail (LRT), a bus hub, and Uber/Lyft along with provisions for cyclists and pedestrians. Unfortunately, various barriers and already-bad traffic congestion discourage access to that cornucopia of transportation options. Already-bad traffic congestion in the Milpitas Metro Area will worsen as the BART transit hub comes to serve the projected 25,000 daily riders (12,000 daily BART riders plus a similar number for all other transit hub options). Expected soon are driverless vehicles that will further increase congestion due to use by people currently unable to drive and dead-heading (driving around empty to fetch the next rider). The opening of the Transit Center combined with a rapidly-growing population means the need for bike/pedestrian crossings of Metro Area barriers is also growing rapidly.

Most of the area proposed to be served by PRT is in transportation disadvantaged census tracts that are noisy, overburdened, and underserved. A Milpitas PRT System will mitigate both the congestion and the accessibility issues. Using small electric vehicles on elevated guideways, unobstructed by ground-level conditions, residents from 7 separate housing areas could easily access the Milpitas Transit Center (BART, LRT and bus terminal), the two elementary schools, the Great Mall shopping center, and three city parks.

Using 3 innovative strategies, LoopWorks will offer the Milpitas Metro Area an on-demand, point-to-point, all-electric Personal Rapid Transit (PRT) system that is owned and controlled locally. A PRT

system will mitigate congestion and accessibility issues, while demonstrating a new transit mode that could be replicated in most major cities to dramatically reduce CO₂ emissions.

As shown in the project poster at <https://milpitasprt.com/wp-content/uploads/posterPRT-2022-w-QR.pdf>, an initial dual-loop PRT system is proposed to include 4 miles of guideway connecting 12 stations for a cost of \$60M (4 miles x \$15M/mile), or about the cost of Milpitas City Hall in inflation-adjusted dollars.



Readers correctly viewing this project through a research and development (R&D) lens will be pleased that a list of research opportunities and development reports is part of the [LoopWorks Business Plan](https://milpitasprt.com/wp-content/uploads/business-plan.pdf) (<https://milpitasprt.com/wp-content/uploads/business-plan.pdf>). Specifically, the section entitled *Performance Reports – The Big Payoff* (pages 65-69) addresses Data to Collect and Share, Vehicle Performance and Efficiency, 3rd Party Data, along with other valuable data and metrics.

One specific metric important to monitor is public transit ridership. Based on many studies, PRT will spark a dramatic increase. As shown below (<https://milpitasprt.com/technology/service-levels/#share>), PRT service is expected to increase transit ridership by factors 2X to 10X. Such far higher use of existing public transit resources would create ripple effects to observe.

CapEx

Pre-development work for the project (final design, engineering, and permitting) is expected to cost around \$6M, while actual construction of the 4 miles of guideway and 12 stations will run about \$60M. At \$15M/guideway-mile, the ITNS flavor of PRT costs far less than the estimate \$25M/guideway-mile proposed by the leading contender, Glydways. While LoopWorks will use single-direction guideway loops to serve an area, Glydways offers primarily dual-direction corridor service like buses.

The major milestones planned for the Pre-development phase are listed in the *Design and Management Costs* section of the [LoopWorks Business Plan](#). As stated there, [PRT capital costs are far less](#) than other elevated, mass-transit systems due to lower design weight stemming from this key observation:

By studying the dynamics of vehicles or trains moving over elevated guideways [7] it became clear that if the people-carrying capacity of the vehicles can be distributed over the guideway in many small units in which adult passengers are all seated instead of a few large conventional vehicles of the same capacity, the weight per unit of length of the guideway can be reduced by a factor of at least 20. (See page 211 of [Contributions to the Development of Personal Rapid Transit](#) by J. Edward Anderson.)

Another financial metric to consider is operation and maintenance (O&M) costs. Annual O&M for traditional/mass transit runs 3% - 5% of capital costs. Estimates put [PRT O&M costs](#) in the range of 1% - 3% of capital costs, or between \$0.6M and \$1.8M per year (\$60M x 1-3%). While a dramatic reduction, we have experience with other electric vehicle technology that supports the claim. As [Seth Miller points out](#), "The total cost of owning an electric vehicle is, over its entire life, roughly 1/4 to 1/3 the cost of a gasoline-powered vehicle." It is not the fuel that costs so much but the driver and the support staff. With less maintenance and no need for drivers, clearly the O&M costs could be substantially reduced.

How did you hear about Mark1?*

As a 30-year member of RMI, I received their email notice about the Mark1 program.

Mark1 is committed to protecting and respecting your privacy, and we'll only use your personal information to administer your account and to provide the products and services you requested from us. From time to time, we would like to contact you about our products and services, as well as other content that may be of interest to you. If you consent to us contacting you for this purpose, please tick below to say how you would like us to contact you:
I agree to receive other communications from Mark1.

You can unsubscribe from these communications at any time. For more information on how to unsubscribe, our privacy practices, and how we are committed to protecting and respecting your privacy, please review our Privacy Policy.

By clicking submit below, you consent to allow Mark1 to store and process the personal information submitted above to provide you the content requested.