



PHOTO CAPTION: Computer illustration of author's proposed elevated system using technology similar to ski slope gondolas. The author contends his approach is cheaper and faster to implement. Illustration courtesy of Michal Golinski.

Meet Mister PRT

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A proposal for a cost-effective Personal Rapid Transport system.

OUT of the **BOX** Series

*Articles about innovative but definitely not mainstream transportation, energy and policy concepts. We invite you to submit your **Out of the Box** ideas to editor@evworld.com*

Personal Rapid Transit (PRT) systems were invented at least a couple of decades ago, but none has succeeded commercially as yet. One reason is the resistance of various vested interests and lobbies, preserving their kingdoms which are large, expensive infrastructures. Ignorance on the part of policy and decision makers is the other factor, while lack of inexpensive means to implement computer control and sensor/automation functions played a major role too.

But these obstacles have mostly crumbled now and this is why, PRTs will likely avalanche across the World soon, as no other transportation system to date. They just have too many good qualities. What more could one wish for than having a public transportation system, which is individual, collision-free, comfortable, safe, non-stop, inexpensive to use, operate and build and almost does not require any ground space? Oh, and is also "unworthy as a terrorist target".

Reader is referred to other easily accessible material describing the nature and benefits of PRT systems, as there is not

enough space here to elaborate on them. A good starting point are websites: <http://kinetic.seattle.wa.us/prt.html>
www.advancedtransit.org and <http://www.electric-bikes.com/prt.htm>

Suffice to say, that for above mentioned reasons, PRT systems are likely to become a new mode of city transportation within the next decade or so. The World's first commercial operation has already been ordered and it is ULTra system at Heathrow airport in UK. Although it is not very good PRT solution (slow, battery driven, low throughput and driving on mini freeways), yet it is a breakthrough.

However there are other systems in development and fighting for recognition and orders.

MISTER is one of the latest and serious contenders, because it is a high capacity system (16,000 passengers/hr) and without many problems of its competitors like ULTra. MISTER has already got several Letters Of Intent from cities, which want it a.s.a.p. It also has gathered support of several transport experts from the academic and commercial fields and research funds are being sought for this project at some Universities. If therefore confirms its credibility as a project for today, not a science fiction.

If MISTER's designer, Ollie Mikosza, succeeds in drawing private investment for this project, it is likely that the prototype and production plant could be ready in 2 years.

After all, one does not have to be an Einstein to conclude, that it cannot take more than 2-3 months to design a truss rail and support columns, then another 3-6 months to build a 1 mile test track. Furthermore, to design and build a dozen of such simple vehicles cannot take more than 12-18 months (concurrently with infrastructure). Computer and automation systems will take longest, yet no more than 2 years, also concurrently. And all of this can be done by only a 200-300 people at an estimated cost of some \$40 mln. It seems a petty cash amount, when compared to the infrastructure costs, where a mile of a light rail will cost this much and recently scuttled (just as well) Seattle monorail was planned at some \$1 bln/mile right?!

Like other PRT systems, MISTER will be a Private Transportation System for the Public, because it will not likely see much of a support from the city councils not to mention governments. They cannot spend public money on "untested" ideas, because they will rather keep wasting them on the "tested ones". But all that MISTER needs is that it is allowed to happen and not acted against by those public institutions, which supposedly act in people's interest.

It is OK if no subsidies come from public sources, since private investors will reap enormous rewards. They will surely be found, as MISTER should, by all accounts, be very profitable indeed. Not only will it run without subsidies, as opposed to most current public transportation systems, but it will probably rake in profits well over 50% p/a (more details in the economic section below).

Seemingly, there are currently no transportation systems, whether individual vehicles or public, which can solve the city transport and congestions problems at all, never mind in any comparable, economical and quick manner, as MISTER.

All research into improvements of existing systems (which costs billions of dollars annually), have only a marginal and cosmetic character, without any structural or qualitative changes. Most of USA citizens, despite the best road infrastructure in the World, should by now see clearly for themselves and on daily basis, that the more roads are built, the more traffic jams ensue and there is no light in the tunnel.

Despite this, surprisingly, there are quite a few individuals (in addition to vested interests) who are ignorant enough and trying hard to make a joke out of PRT systems. Having looked at some of such websites, I wonder why did they not stay in caves or in the trees ? Perhaps they should go back there, as the progress can only be made by the people who dare to do things differently. Opponents major anti PRT argument is that "it hasn't been done yet". Well, climb back the evolution tree and stay there, will you !?

A good examples of the lack of real intelligence, never mind imagination is given below. And those were people who changed the course of history, because they were the best of the best. So what am I complaining about if run of the mill

ignoramus, techno or bureau "...crats" cannot be convinced ?! ☺

My favorites are:

"640K ought to be enough for anybody." -- Bill Gates, 1981

"Heavier-than-air flying machines are impossible," -- Lord Kelvin, president, Royal Society, 1895.

"Man will never reach the moon regardless of all future scientific advances." -- Dr. Lee DeForest, Inventor of TV

Only radical, yet people friendly solution of PRT type, like MISTER, can do it.

More details about MISTER can be found at: <http://www.mist-er.com/index-en.htm>

How will this be possible ?! It is quite simple because 3 main components of any transportation system are staffing, maintenance-repairs and energy. Each of those will cost 5-10 times less in MISTER, hence the profit potential will be huge and the capital expenditure will also be several times less than any roads or rails infrastructure.

What is different about MISTER as compared to other PRT systems ?

It seems to be a unique combination of the simplest and most common sense solutions, which, surprisingly, no one else has come up with.

Firstly, MISTER's vehicles, similar to ski gondolas (for max 4 persons), will travel at low speeds of some 40km/h. They will not require any exotic nor expensive technologies like MAGLEV (in SkyTran) nor unguided steering control and batteries (in ULTra).

Secondly, it will use an overhead, vertical "truss mono rail", which is simplest, safest and lightest construction possible. Contrary to assertions of some "bottom rail" proponents, it is easier to "hang down" from a single rail (like from a tree branch) than to "stand up" on it. Vehicle movement, wind dynamics and friction/energy efficiency are better in overhead rail configurations. Vehicles can also be lighter (tara of 200-300 kg). Lightness of the vehicles will translate into lightness of the mono-rail infrastructure and supporting poles (spaced every 20-30m).

MISTER gondolas will travel independently of each other, powered by a small electric motors (approx 20 KW for take off and 2 KW for cruising). Low but constant speed together with high max density of approx 1 sec headway (10 m), makes all the difference in system throughput and capacity, comparable to metro.

Thirdly, electric motors will run on external power, so no battery charging, no power converters will be needed.

Finally, use of a "static rail switches" (crossovers), where rails do not move, but gondola suspension-propulsion caddy is switching from one rail onto a parallel section of the other rail, provides for fail safe and non-wearing mechanism of diverging and merging from/onto the main transport rails. It is similar to a freeway exit/entry, except that lines do not join but run in parallel for a while, for a sufficient distance to "jump across".

The rest is a matter of sensors, computer control and automation, although it will be by far the hardest part to do. However, it is entirely feasible TODAY and much simpler than controlling e.g. Mars mission.

Off-line stops, will be small but even with only 10 vehicle berths (length of a 2 buses), can handle some 3000+ passengers per hour. This figure is assuming an average of 1.5 passengers per vehicle and 20 sec cycle for un/loading, which is an ample time even for 2-4 people to get out of and into the vehicle. Of course it does not mean that if someone takes 40 secs to get in/out then his legs will be cut off. But since an average bus doesn't stop for more than a minute (with many people getting out and in), then a average of 20 secs for a carload seems more than reasonable. And a wheelchair access will not be a problem either, as MISTER stops will mostly be on the street level or inside the buildings.

Vehicles will be autonomous, i.e. they will decide on the route taken to the destination and will handle all start/stop decisions, change of route during the travel etc. Of course they will have to co-operate with station and central computer systems but only in the exchange of the information, not decisions. In addition, each computer system will have triple redundancy to safety.

Passengers safety will be guaranteed by a multitude of sensors and perhaps cameras. It will be very hard for any unsocial element to escape consequences of its bad behavior and since nobody will have to travel with strangers, therefore this major transport commute risk will be eliminated.

Sample Scenario: Brown Family Goes to Cinema

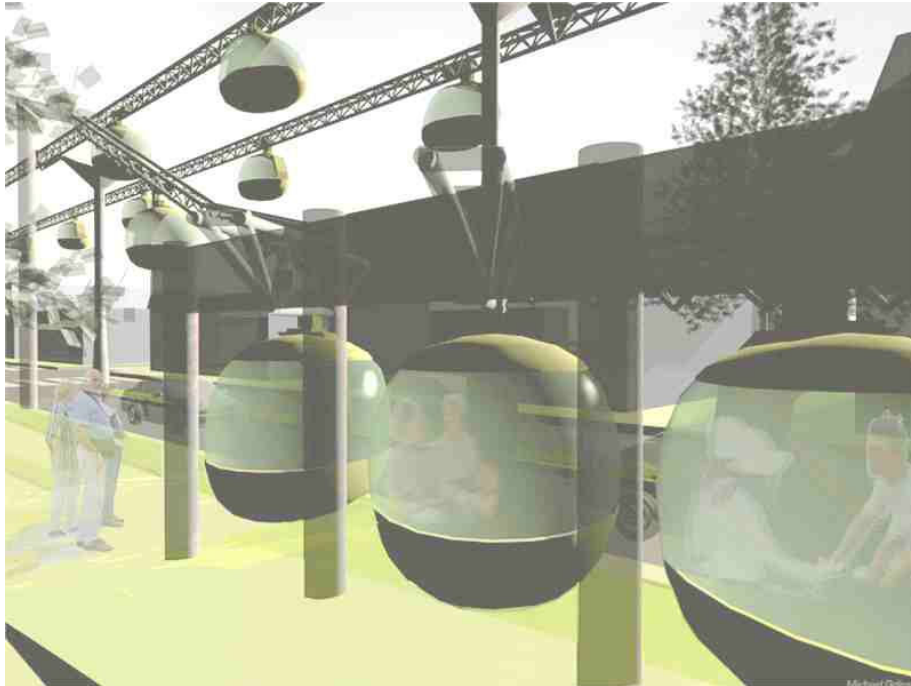
- They go to the nearest MISTER Stop (max of 200-300 m away from their apartment).
- Select destination (theater complex in a MALL, 3 miles away) and validate their identity + payment capability via ticket card (like CC, Debit Card etc.).
- Board waiting PAT (if not there, one will arrive in max of 2 mins).
- PAT accelerates to 40 km/h and merges into main MISTER line, 6-10 m above the street.
- They have only 8 minutes before reaching destination (no stopping) to chat, watch city sights, TV, commercials or listen to music.
- PAT leaves main transit line for an off-line stop inside the MALL, near the movies complex.
- Browns' family disembark and PAT is available for another trip, anywhere else on the MISTER network.

All of these simple yet inexpensive solutions will result in a system which will have an outstanding maximum throughput of some 16,000 passengers p/hour on a single rail in one direction. It is more than many metro systems, not to mention buses or tramway lines. And this capacity can be easily and inexpensively doubled by using a two level rail system stacked on the same column structure (a bit stronger but hardly visible in the diameter of the columns)). Of course, it is not likely that any single section of the rail network will be so loaded, since the traffic will be distributed more evenly in all directions and over most links (between intersections). Usually, it will be a small fraction of the maximum capacity. MISTER (even a single level structure) could handle all of the London's metro daily passenger load with only of 25% of its capacity.

PRT is demand driven and MISTER vehicles will be in large oversupply thus waiting for passengers, unlike in current systems. Nothing moves unless there is someone wanting to travel. Well, this is not entirely true, as the computer system will have to make some automatic adjustments to the distribution of vehicles, in anticipation of peak times, sports or cultural events etc. Some simulations of such systems came up with figures of 30% of empty runs. This seems high and is largely dependent on the supply of vehicles in the system but even if we had to return each vehicle empty to its starting point, the energy costs would be minimal. This will not be logistics or a business problem, as it will cost only around 1 cent p/mile to move an empty vehicle, therefore it will be insignificant in comparison to the ticket charges. Even if the travel cost will be some \$0,20-0,30 mile (and reducing the further distance you travel), it will be similar or less than current public transport ticket costs and much less than using private cars or taxis.

As a result, PRTs of MISTER parameters, may significantly change, for better, the way we travel in the cities and beyond. It may also revolutionize the goods delivery logistics as well. New businesses will spring up all around cargo stations (probably

run by former bus drivers), where owner operators will be delivering (on a golf cart like vehicles) small loads of goods to shops within few hundred yards radius of the cargo stops. Imagine what energy and congestion savings this will produce, when 10 ton trucks are no longer clogging up city streets to deliver 100 kg of sugar to a corner shop.



MISTER PRT concept

MISTER benefits:

- high throughput (metro like, 16,000+ passengers p/h) per any direction
- no collisions, therefore maximum safety
- individual and direct mode of transportation for each passenger or cargo between start and destination, no queuing, delays, congestion and empty runs.
- major reduction of air pollution
- substantial reduction in energy consumption per payload unit
- major reduction in cost and time of infrastructure development even within inner city, while traffic payload is comparable to Metro
- major reduction for infrastructure real estate demands
- anti-terrorist structure, due to "target disbursement"
- anti-flooding quality, since it operates meters above the ground
- major reduction of transit times between start and destination
- reduction in remaining road vehicles congestions, accidents, traffic jams and reduction in number of trucks delivering/collecting goods within city

Although MISTER System is initially planned for city deployment, but in time it may become competitive even to rail traffic for shorter inter-city routes, as potentially achievable speeds could be around 150 km/h (perhaps inside under pressurized, transparent tunnels).

Probably within the next 10 years, there will also be a possibility of placing MISTER gondolas upon an electric trolley (like a golf cart, less overhead caddy) upon arrival at the station and then it will travel autonomously from/to the station on the existing urban road network, on a door-to-door basis. Such self navigating systems are already being tested. On October 8, 2005 five vehicles drove over 130 miles of broken desert, over mountain passes, and through tunnels. None of the vehicles had a human driver, not even any remote control. Stanley, the winner, will be on a freeway near you soon

<http://tinyurl.co.uk/7s2x>

Thanks to the low cost of a variety of sensors, SOCRATES will enable control of operating parameters of all devices and e.g. to decide that a particular vehicle is automatically sent for a service after diagnosing raised temperature of a wheel bearing or a failure of one of the onboard computers.

Economic and Operational Considerations

The test of any mass transport success is not the number of people on the train or bus, but the number of cars removed from the road. In all of U.S. urban areas except New York and Chicago, transit ridership is less than 3% of total travelers !

Contrary to the doomsday preachers, systems like MISTER, which can provide such numerous qualities and benefits to the public at a cost comparable to current public transport system, will unquestionably win with the private car, bus or any existing travel method to/from work or for shopping and entertainment/sports venues. Even lunch meetings a few miles away will be more convenient with the help of MISTER than a limousine. Since stations/stops will be inexpensive to build, larger companies, hotels etc., will easily fork out \$100-300 K to have it installed inside their building, perhaps even one on the "executive floor" J

According to the conservative estimates, the maximum costs of a 1 km, two way, MISTER system (including rolling stock) will be under \$5 mln/km.

Above figure is also corroborated by a number of independent sources, one of which is: <http://www.atstld.co.uk/fact.html> except that MISTER will be less costly than ULTra.

Finally, MISTER profitability will be based on the following:

Three major cost components, accounting for 80-90% of all costs, will not be just halved, but made some 5-10 times less costly than in the current systems. Largest cost element is staffing, usually between 40-60% of the overall costs. Therefore it is not hard to realize, that a driverless, fully automated MISTER system, will require far fewer people, only needed for management, computer systems supervision (no development!), administration and service/maintenance. Even in this last category, there will be far fewer people than at the current bus/train depots, since MISTER vehicles will report themselves for repairs or service. Their complexity, and therefore failure rates, will be much less than anything else that moves on the road/rail currently. Therefore staffing costs will plummet to some 5-10% of the current systems operating costs. Second item, maintenance and repair materials will also drop from current 15-25% to 5-10% for the reasons just mentioned above (simplicity and automation). And the third major cost component, energy bill, currently some 10-20% of the operations, will drop to 2-5% range, since the cost of electricity per passenger-km will be around 1 cent or less!

So in the case of MISTER system, these 3 main cost elements, instead of 80-90% will be 12-25%. This is where the profits are. And, please, do not doubt above figures. They are provable but you can do some calculations for yourselves. Check how much does it cost if the cruising energy consumption for a 500 kg total weight (vehicle + passengers) is under 2 kW and a 10 sec burst during takeoff needs a 20 KW power (remember that we'll travel at 40 km/h and 1 KWh costs some \$0,20). And we do not even calculate in this equation, energy recovery during the breaking time!

Official data obtained from Transport for London's (TFL) corp., and Underground (metro) in particular, shows that their income is some 30C per passenger-km and average trip is 7 km. If MISTER was to replace the entire London's Underground

system (some 400 km of 2 way track, 8 bln psgr-km p/year) it could do it using only 25% of its single line level capacity (there can be two levels) and would repay itself fully in 1.5 years. And this is on the assumption of an inflated 50% cost factor, instead of the more likely 15-30%. This includes capital repayment, interest and the works! It really does not want to be any different.

Once again, the fundamental reason for this outstanding financial attractiveness is that the operations cost savings are not some in 10-20% (which would be great achievement anyway) but they are in the TEN FOLD category and capital costs will be small too (only approx. \$5m/km). So the profitability MUST be exceptional and cannot fail. The more work, the denser and harder working MISTER, the quicker the ROI.

Readers' attention is drawn to a very informative website [1], with multitude of links to articles and discussions on the subject of MISTER like systems. For those not familiar with this concept, it should be a convincing source of performance and cost information, confirming all of the assertions made in this paper.

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As an author, I'd like to thank everybody for their coments so far and to explain few things, which seem to have been misunderstood.

No automated, door-to-door ground transport (electric or not) will solve traffic jam problems.

MISTER has patented extension, whereby within probably 5 years after making 1st system, it will have door-to-door service. In that extension of 1st version, gondola vehicles will be transfered at the stops onto the electric platforms (like a golf cart), which will drive automatically to the door. From there, it will go to pick up soeone else at their door step and return to the nearest stop for a transfer via rails to the stop colsest to the destination. There the process will be repeated. etc.

The only solution to fight congestion is to RE-USE the veicles. We'll still have our cars for special trips etc., but for 80% of transport needs, MISTER will solve our problems.

MISTER will be warm (easy to heat up small space in a short time, when there are no intermediate stops). It can also have enclosed stop areas and on a ground level or inside buildings..

MISTER will be very much foul weather proof.

Average speed of 40km/h is much better than 80-100km/h top speed by metro, or other "sequential stop" transport. No metro in the World has a 40 km average speed and if one adds "walking and waiting time" at the stations, it gets well below 30 km/h.

Digging underground is too costly and won't ever get you close enough to your destination, unless it is „on the line“. MISTER will get most people closer to their target (max of 250m) than any group transit. And when version-2 is implemented, it will get you to/from the door.

MISTER will have smallest "sky blocking" factor or „footprint“ of any elevated structures..

There will be no need for elevated platforms (as in some other designs). A street level stop will be standard, unless we want to place it inside malls, offices etc.

I hope that these clarifications might change perspective of previous and future readers.

Keep checking MISTER progress at www.mist-er.com

Best regards

Ollie