Minn rfi

RESPONSE TO MINNESOTA DOT RFI, PRT VIABILITY AND BENEFITS

ALDEN DAVe SYSTEMS

(ADS)

Since 2004

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PROPOSED PRT CONCEPTS AND OBJECTIVES

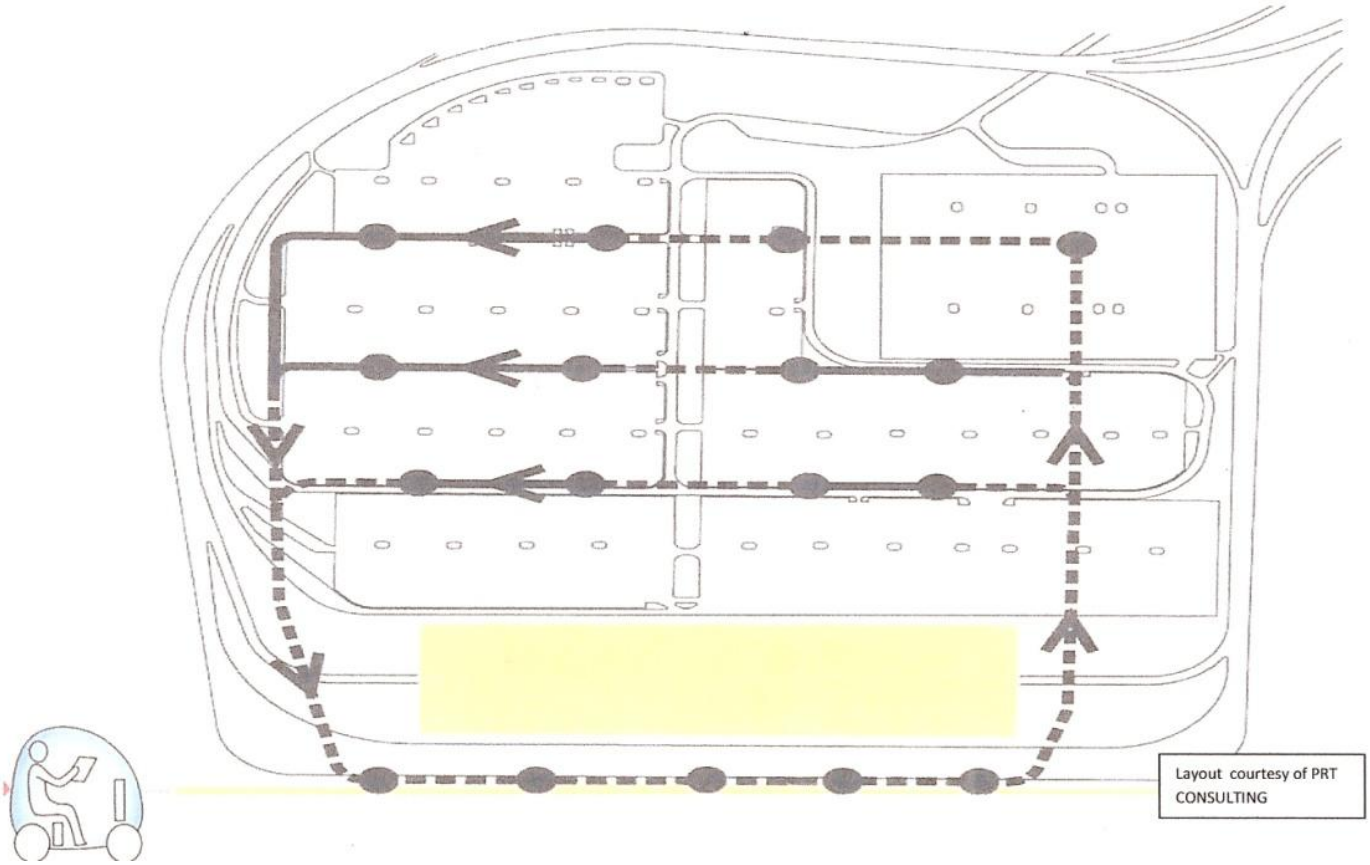
… ameliorating the ground transportation system crises with our simple, green system solution...

The DAVe (Dual-mode Autonomous Vehicle) System consists of a fleet of DAVes which can operate three ways:

- Autonomously,
- Under operator control,
- Under remote control from the CCC (Control and Communication Center).

DAVE is a truly personal means of transportation, but it goes far beyond the capabilities of the Morgantown and other, present Personal Rapid Transit (PRT) systems.

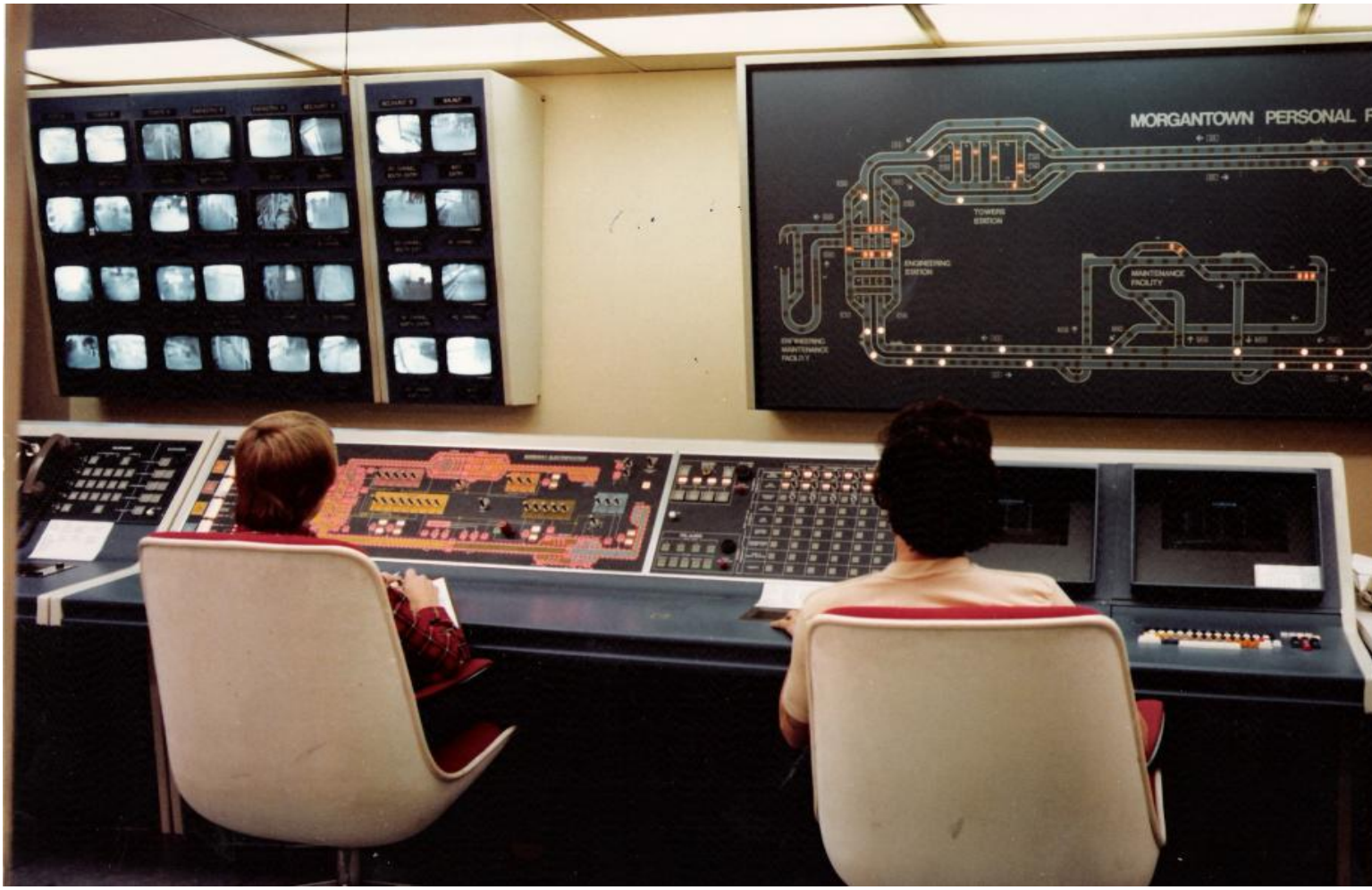
Users can call a DAVe to their location with a mobile or landline phone and activate a DAVe with a credit or debit card. A DAVe follows a virtual map in its computer:



The DAVe can go from any one point to any other point on the "DAVeWay" routes.

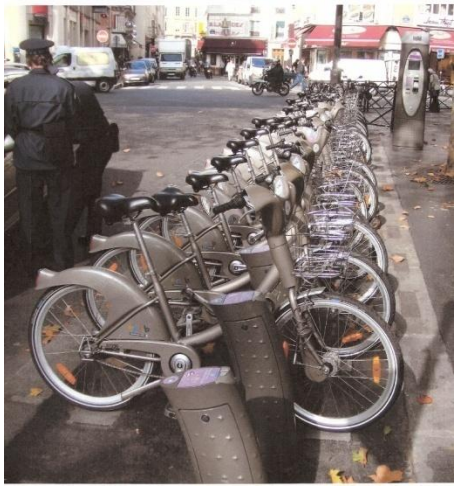
DAVe has sensors that allow it to operate among pedestrians, vehicles and other obstacles. For safety and security, a DAVe also has 360 degree cameras which record people and activity within and around the vehicle. Like the automobile or taxi, the DAVe goes from where and when the passenger wants directly to

where she/he wants. The central computer in the CCC provides safety redundancy and maximizes the utilization of the inventory of DAVes. Pictured below is the CCC in the forerunner Morgantown PRT system.



The technology for doing all this is available, and demonstrated in our, early YouTube DVD: http://www.youtube.com/watch?v=IGzNS5roflo

The community use of conveyances for short trips has been proven by such systems as Zipcar[i] , adding 3,000 members per month[ii] and Velib in Paris (80,000 renters/day)[iii],). Some 50 cities have bike-sharing programs.

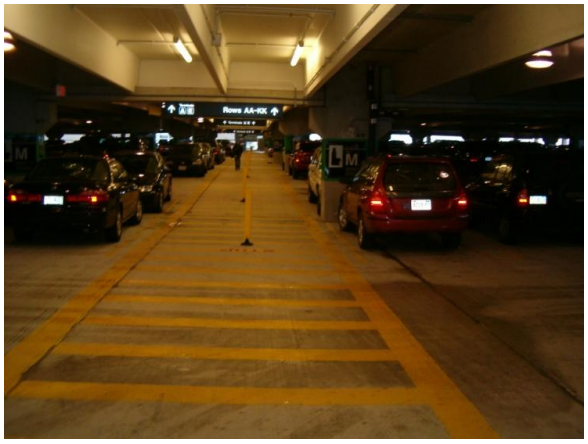


Two major improvements over these systems by DAVe are the minimization of vandalism provided by the in-vehicle monitoring, and the DAVe System automatically moving empty vehicles quickly, often from the most economic parking areas, and directly to where they are needed or will be needed.

ADS's design uses advanced, proven components and technology, and features, most significantly, software which enables the DAVe System to operate without infrastructure of any kind. The DAVes are far safer than manually controlled vehicles, because DAVe's detection of obstacles, and its response time is almost instantaneous, compared to the 2.5 seconds response time of humans. DAVe can sense the distance to an obstacle or person as it approaches such. It can decrease speed and, as necessary, apply braking. This type of control is shown in our aforementioned video.

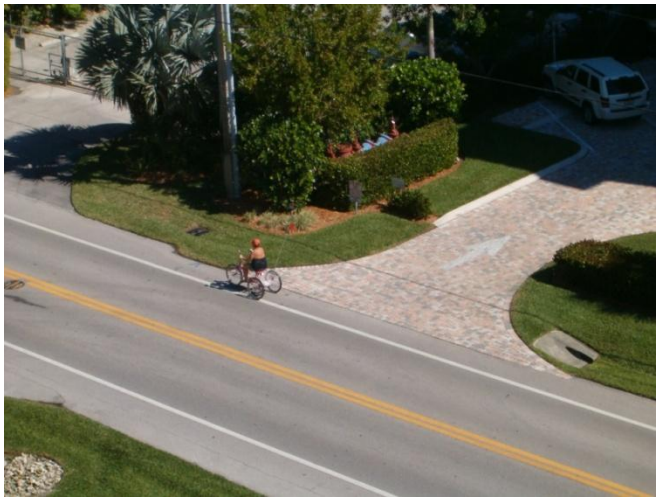
The DAVes will drive on existing roads, multi-use lanes, sidewalks, alley ways, bike lanes/paths and pedestrian paths, as available and allowed, much like golf carts, Segways, scooters, LEVs, NEVs and bicycles do:

Open paths at Logan Airport:



And the same spaces at Baltimore-Washington International Airport:

Outdoor, available paths:



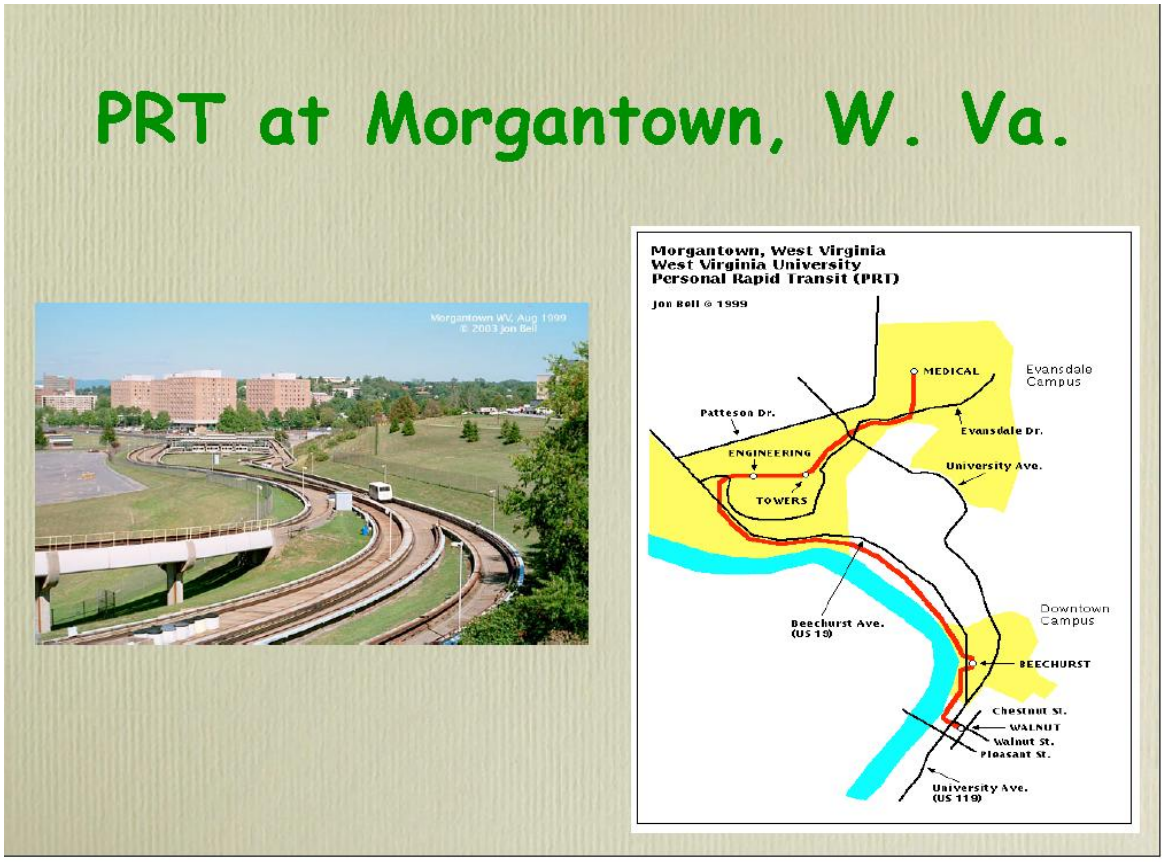
When DAVe, light-duty guideways do need to be built or elevated, the cost is still lower, compared to all competing PRT systems, and the aesthetics, far more attractive, as pictured below, in an artist's concept:

The elimination of station and guideways infrastructure represents a major capital cost reduction for installers of this System: of over 50%, compared to PRT. Our DAVe (Dual-mode

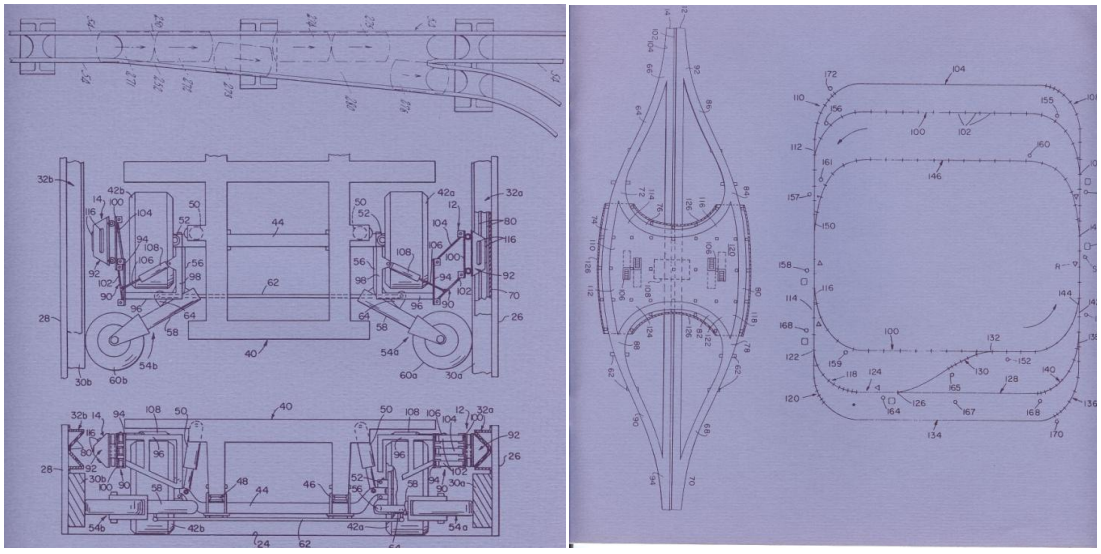
Autonomous Vehicle
uses the space of a slightly enlarged, electrically-powered wheel chair and would go anywhere a powered wheelchair can go. The DAVe System will also operate other vehicles, such as this solar, electric golf cart, and the standard, industrial utility vehicle and electric roadable car, such

as the SmartCar as shown below:

The basic system design work of ADS has been ongoing since 2004, using the requirements of Plymouth Rock Studio (PRS), University of Massachusetts/Dartmouth, Logan Airport, Foxwoods Casino, Falmouth/Woods Hole, San Jose, Santa Cruz and the Harvard/Allston/ Longwood medical campuses connection and others. Several of the ADS team were responsible for the concepts and some of the construction of the fully automated Personal Rapid System in Morgantown West Virginia[iv]. Boeing was the general contractor, brought in by Alden.



Below is the drawing from the patent on the Alden in-vehicle switch, used in the Morgantown PRT. This patent was one of 37 worldwide patents on different aspects of the system, including Morley's moving-cell, vehicle control system, shown to the right, below.



The top executives at the planned, $400,000,000 PRS (Plymouth Rock Studio)[v] have met with ADS and have indicated that they wish to consider using the DAVe System. They wish to meet again as soon as the first shovel is in the ground.

Paramount Studio in Hollywood uses 350 golf carts to move people and material between the many soundstage studios. 100 DAVes might do the same amount of work at PRS because the dispatching of DAVes is optimized.

When a studio person needs a DAVe, she/he telephones for one. (Think of it as the "Dial-A-DAVe System".) The nearest, idle DAVe is dispatched by the computer at the CCC. PRS will be in the business of renting studios and facilities to motion picture and TV/video production companies. The CEO of PRS stressed to us that these rentals have to produce profits for PRS.

A DAVe could be rented by the minute by the production companies. Thus, with material handling and transportation immediately available at the touch of a button, and only for the time they need it, they save money. Because facilities and production crews are often costing thousands of dollars per minute, the DAVe system puts money in their pockets for a win-win situation. The CEO at PRS feels that the studios in Hollywood are all good prospects for our DAVe System.

The University of West Virginia had savings with our PRT, simply by being able to schedule classes for students with only one intervening class session, even though the classrooms might be miles apart. They also saved by eliminating bus transportation for the students between campuses.

Some University of Massachusetts Dartmouth professors and executives met with us and saw these advantages, plus safety, especially for women at night, along with proper utilization of parking lots for students and faculty.

At Logan Airport, 60% of people surveyed were willing to pay five dollars or more for them to be taken, with their bags, from their cars in the parking garage directly to the terminal. Elimination of confusion, anxiety and personal safety concerns ranked high in their choice of this automatic transportation.

At UMass/ Dartmouth and PRS, ADS has offered to be or find a concessionaire to finance the fleet of DAVes and installation of the CCC.

ADS will use off-the-shelf vehicles and supply electric and/or mechanical linkages to control their steering, speed and braking. Thus, these linkages and the software for the DAVe computers and the computer in the CCC are what ADS will provide. Once established, ADS will outsource all but the software development and maintenance. ADS will do all those things necessary to make a sale: marketing, selling, arranging individual system financing or concessionairing, if desired by the customer.

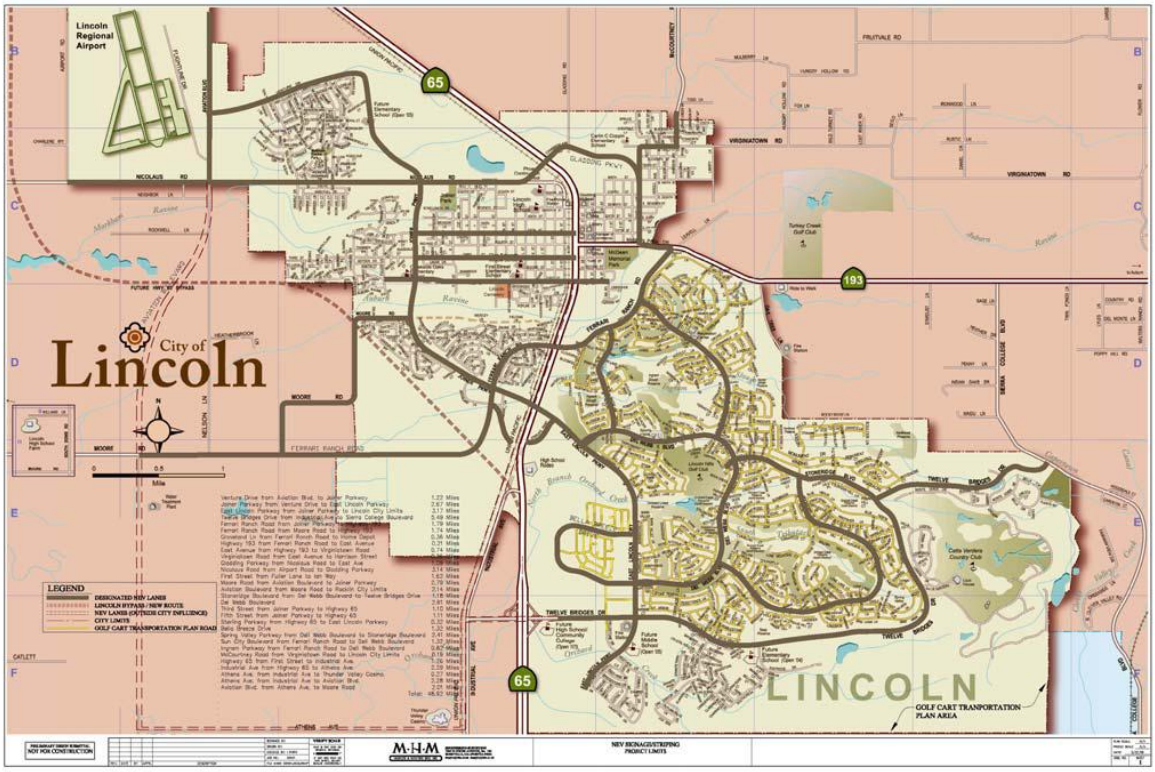
PUBLIC INVOLVEMENT APPROACH:

The government and public would have to be involved in approving the use of rights-of- ways by the DAVe, such as multi-use lanes, bike lanes, et al. Since a DAVe reacts two times as fast upon seeing an obstacle or person, it is much safer than bicycles, electric wheelchairs, Segways, etc. Using existing rights-of-way does not add the expense and unsightliness of PRT guideways and stations. Thus, this would be presumably preferable to the general public.

Communities, such as Lincoln, California, allow some or all of the following on some or all of these ways listed above: golf carts, Segways, scooters, LEVs (Light Electric Vehicles), NEVs (Neighborhood Electric Vehicles) and bicycles.

Hundreds of NEVs travel on any road in Lincoln, which have a speed limit of 35 mph, and travel on bike lanes also[vi].

The circulation plan for NEVs in Lincoln, CA:



While city, downtown auto traffic moves at a speed as low as 3 mph, bicycles move in parallel, bike lanes, at an average speed of 12 mph. In these paths, DAVe would have the same advantage over the auto. In ADS's Harvard Study "One Campus", an auto traveling from the Allston Campus to the Medical School moves at an average speed of 15 mph and takes 12 minutes. The DAVe travels on a shorter, prettier route at 12mph, in less than 11 minutes, for a saving of almost 12% in portal-to-portal travel time.

INTEGRATION WITH AND IMPACT EXISTING ON TRANSIT SYSTEMS AND RIGHT OF WAY

A 2 ton, $20,000 vehicle sits for 10 hours in a lot worth $1m/acre. Multiply that by 35 million vehicles.

The DAVe System can ultimately have a very large, positive effect on the energy and climate change crisis. One of the obvious applications is in ferrying commuters to and from Park-and-Ride areas, especially in TODs (Transit-Oriented Developments).

In 2003, there were 170 million commuters, 22.4% of which, 38.08 million, used both their auto and rail or rapid transit to get to work[vii].[1] Since 1.08 people are in the commuting automobile[viii], this means that 35.26 million vehicles make this trip daily. Presumably they use a Park-and-Ride lot or garage to store their car during the workday. The average travel distance from home to Park-and-Ride stations is 3.4 miles. In 2,000, the average miles per gallon for passenger cars were 22 mpg[ix]. Thus, the 6.8 mile round trip would take a little more than .3 gallons. This, multiplied by the number of Park-and-Ride commuter vehicles, would be almost 10.6 million gallons per day or almost 53 million gallons per workweek. If only 10% of these riders switched to using the DAVe System, there would be a gross savings of 5.3 million gallons per week.

It is estimated that an electrically-powered DAVe would perform at the equivalent of 300 gallons per mile. Thus, 35.26 million DAVe 6.8 round trips would consume the equivalent of only .0023 gallons per trip per DAVe or .08 million gallons/day or .4 million gallons/week. Were only 10% of the trips were carried out

by DAVe, then this would take .04 million gallons/week and the net savings of the DAVe System than would be 5.26 million gallons per week.

Ingersoll Rand provides figures showing that their Club Car golf cart's cost of electricity is around $.0002 per mile, whereas their gas-version golf cart costs in the order of $.04 per mile. This shows that the electric vehicle does provide net energy savings to the nation/world.

Compared to the bus and rail, the big attraction of the auto is that the passenger(s) can leave from where they are, when they want, to travel to a spot close to their destination. In most towns, villages and TODs (Transit-Oriented Developments) DAVe would take riders from their curb or driveway to the Park-and-Ride lot, simulating the convenience, comfort, security and privacy of the personal automobile. Thus, it seems possible that DAVe could attract even more than 10% of the Park-and-Ride commuters.

By using bike lanes, multiuse lanes, empty sidewalks and other and other underutilized rights-of-way, the DAVe System makes great use of past community investments.

Pedestrians and bikers using these as well find they have an ally in the DAVe concessionaire, who will join them in maintaining, improving and expanding their rights-of-way.

SCOPE THE SYSTEM (TRACK/GUIDE WAY LENGTH, NUMBER OF STATIONS, NUMBER OF VEHICLES, MAINTENANCE FACILITY)

There are no guideways, stations or ramps. Since you enter a DAVe the same as you do your auto or get on your bicycle, there are no stations. A station can essentially be any curb.

The number of vehicles varies with vehicle occupancy, average speed of the vehicles, and average trip lengths. Upon study, it has been found that most communities have an amazing number of underutilized rights-of-way. This helps allow trip lengths to be minimal and the System's capacity to be high.

Maintenance and parking facilities for DAVes are required. Since the DAVes are small, minimal space is required. At peak hours, DAVes will be zipping from point A to point X following the actual or predicted demand. At slow times, the DAVe's can be sent autonomously to parking spots in outlying areas where the costs are lower.

ALTERNATIVES AND/OR PRELIMINARY ENGINEERING ANALYSIS:

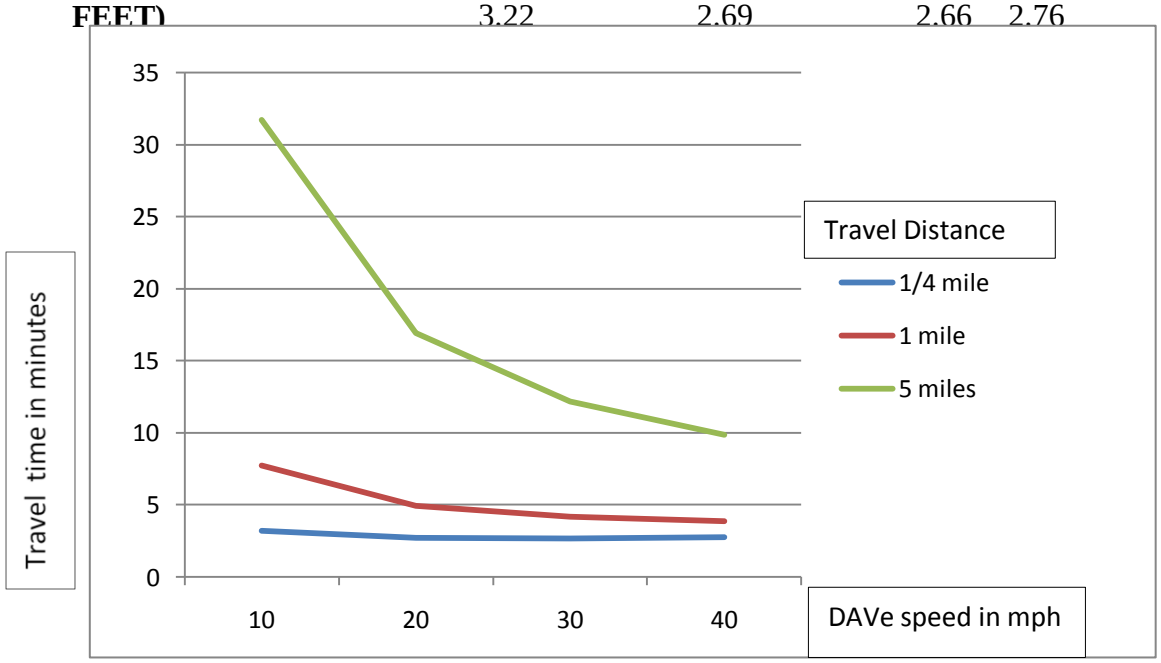
The 53 page Proposal to MassPort's Logan Airport is available to you.

Below is a table, addressing the possibilities presented by the short distances, namely that high speeds are not necessarily needed for short distances:

RELATIONSHIP OF TOTAL TRIP TIME TO DISTANCE

	CRUISING SPEEDS IN m.p.h.			
	10	20	30	40
TIME, in minutes:				
TO FIND VEHICLE, LOAD AND UNLOAD	1.5	1.5	1.5	1.5
TO ACCELERATE AND DECELERATE TO CRUISING SPEED	0.22	0.44	0.66	0.88
SET-UP TIME - A	1.72	1.94	2.16	2.38
TO TRAVEL, AT CRUISING SPEED - B				
- 1/4 Mile (1,320 FEET)	1.5	0.75	0.5	0.38
- 1 Mile	6	3	2	1.5
- 5 Miles	30	15	10	7.5
TOTAL PORTAL-TO-PORTAL - A+B				

	CRUISING SPEEDS IN m.p.h.			
	10	20	30	40
- 1/4 Mile (1,320 FEET)	3.22	2.69	2.66	2.76



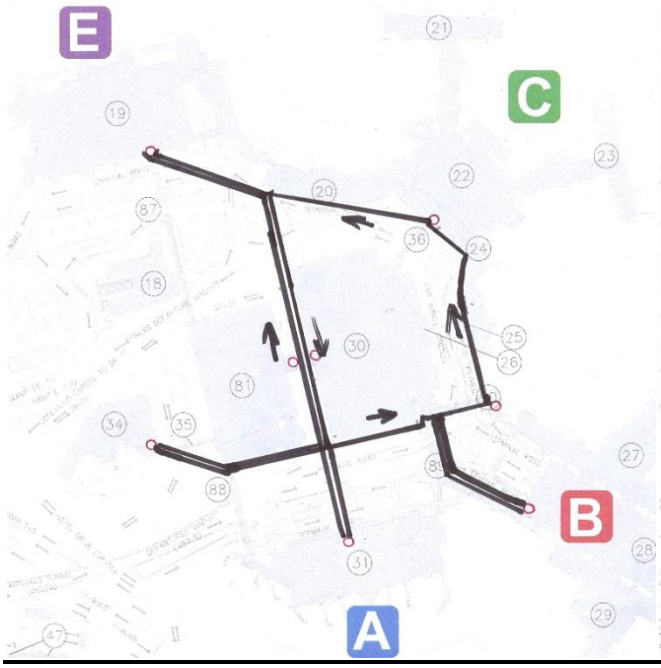
TECHNOLOGY UTILIZED:

We are in the early stages of planning a prototype demonstration in the basement tunnels at a local, leading university. A professor, who has partaken in two DARPA demonstrations projects, will work with us. His numerous published papers show his approach. We also will refer to the work of INRIA with their CyberCar[x].

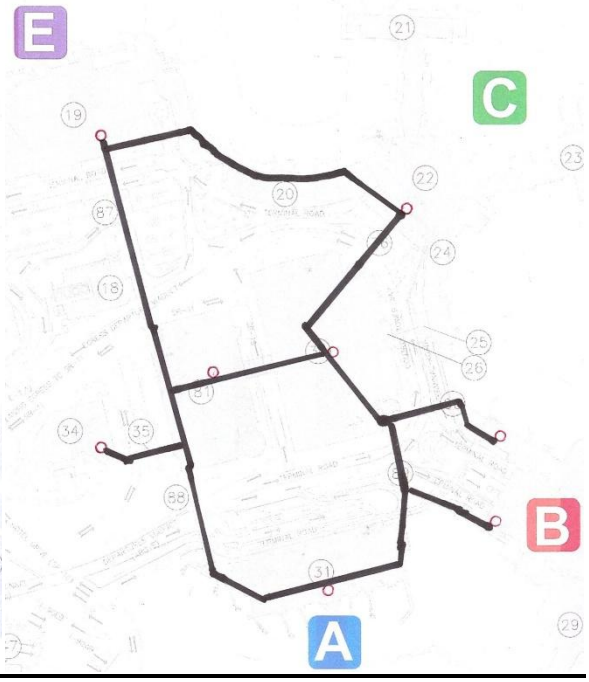
ESTIMATE OF CAPITAL COSTS OF SOME EXAMPLE OPTIONS:

Using the figures available on an ULTra PRT system envisioned in 2008 for Daventry[xi], we have run a comparison with what that system would cost at Logan compared to the DAVE System.

ULTra PRT at Logan



DAVE System at Logan



As suggested in the photos above, DAVe can use existing surfaces. ULTra uses specially prepared surfaces for stations and guideways. Just as people do not need stations in order to mount bicycles, wheelchairs or enter automobiles, so DAVe does not require stations.

With no need for stations and special guideways, the DAVE System for Logan would be 60% less expensive: eliminating the usual capital cost of stations, guideways, ramps, rights-of-way et al.:

	LOGAN AIRPORT COMPARATIVE SYSTEM CAPITAL COSTS					
	ULTra System			DAVe System		
	Logan ULTra Units	Unit Cost Estimates in $	Totals	Logan DAVe Units	Unit Cost Estimates in $	Totals
Guideway, single track, elevated, in feet	**2,000**	$ 973	$ 1,946,121	**0**		
Guideway, double track, elevated, in feet	**2,800**	$ 1,919	$ 5,373,073	**0**		
Stations, single track, elevated	4	$ 337,410	$ 1,349,640	0		
Stations, double track, elevated	4	$ 674,820	$ 2,699,280	0		
Vehicles	20	$ 81,500	$ 1,630,000	30	$ 30,000	$ 900,000
Maintenance, charging, CCC, parking facilities			$ 1,500,000			$ 2,000,000
Computer, SW. communication			$ 2,500,000			$ 4,000,000
Engineering, Project management			$ 8,000,000			$ 1,500,000
			$ 24,998,114			$ 8,400,000

ESTIMATE OF OPERATING AND MAINTENANCE COSTS OF SOME EXAMPLE OPTIONS:

Logan DAVe M&O

ANNUAL MAINTENANCE & OPERATING COST

	Morgantown PRT 04/'05 2,000,000 riders/yr. 200,000 uses/vehicle/yr.		**Logan Airport** DAVe System 420,000 riders/yr. 300,000uses/DAVe/yr.
Personnel	$ 1,705,695	$	400,000
Fringe Benefits	$ 561,908	$	133,200
Liability & other insurance		$	50,000
General Expenses	$ 159,188	$	35,000
Utilities			
Electricity	$ 248,846	$	50,000
Gas heat for snow/ice	$ 165,898		
Overhead	$ 193,610	$	50,000
Equipment	$ 13,160	$	10,000
Vehicle Repairs	$ 195,417	$	100,000
Other Repairs	$ 178,322	$	50,000
Sub-Total	$ 3,422,044	$	878,200
Rent to MassPort Authority		$	200,000
Depreciation on $8.4m over 20 years		$	420,000
Interest on debt of $8.4m @ 8%		$	672,000
	Sub-total	$	1,292,000
TOTAL		$	2,170,200

EXAMPLE OF REVENUE GENERATION OF SOME EXAMPLE OPTIONS:

Logan Airport DAVe Profit

			% OF GROSS INCOME
NUMBER OF RIDERS*	420,000		
ROUND TRIP FARE	$ 11.00		
REVENUE		$ 4,620,000	
INTER-TERMINAL RIDERS, ONE WAY	60,000		
ADDED REVENUE, at $5.50 /rider		$ 330,000	
SECURITY INPUTS TO HOST		$ 300,000	
ADVERTISING		$ 150,000	
GROSS INCOME		$ 5,400,000	
M&O COSTS, above		$ 2,170,000	
NET REVENUE		$ 3,230,000	59.8
5% CUT TO LOGAN		$ 161,500	
NET TO CONCESSIONAIRE		$ 3,068,500	56.8

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*1,000,000 cars/yr. in central garage x 1.4 psgrs./car x 30% choosing to use DAVe; in a 2006 market survey over 67% indicated that would choose to use autonomous vehicles between the Central Garage and the Terminal. 30% is used here to be conservative.

This profit of $3 million on the DAVe System installation pays the full cost of the $8.4 million installation in 2.7 years.

Carts carrying luggage in airports, such as SmarteCarte, at $3 to $5 per use, are viewed as a cash-cow for the operator.

ANNUAL DAVe PROFIT ESTIMATES				
	Plymouth Rock Studios		Umass Dartmouth	
NUMBER OF USES	1,000,000		400,000	
TRIP FARE	$5		$4	
REVENUE	$ 5,000,000		$ 1,600,000	
SECURITY INPUTS TO HOST	$ 100,000		$ 300,000	
ADVERTISING	$ 100,000		$ 150,000	
GROSS INCOME	$ 5,200,000		$ 2,050,000	
M&O COSTS, above	$ 3,830,000		$ 1,817,000	
NET REVENUE	$ 1,370,000		$ 233,000	
5% CUT TO HOST	$ 68,500		$ 11,650	
NET TO CONCESSIONAIRE	$ 1,301,500		$ 221,350	
% OF GROSS INCOME	25.0		10.8	

ANTICIPATED BENEFITS FROM THE DEMONSTRATION:

- Good transportation can be obtained without 2nd and 3rd autos and subsidies
  - A big step toward the garden community with safer roads, cleaner, quieter air and a gentler pace
- The taxes and payroll paid by the concessionaire help the community
  - The community gives up nothing and gains greatly

PROPOSED PUBLIC-PRIVATE PARTNERSHIP ARRANGEMENTS

Once our presently proposed, first demonstration system is operating and proven, ADS will install systems in areas which have enough feasible lanes/paths and indications of profitable operation, ADS will install a system, much as Zipcar does. ADS would encourage local involvement and having a local concessionaire. Our bringing in Boeing to do the Morgantown PRT indicates our willingness to work with appropriate partners.

OTHER LOCAL INVOLVEMENT

Our working with DOT/UMTA and the University of West Virginia on the Morgantown PRT and our proposed demonstration at a leading university indicate our interest and success in working with Universities and public agencies.

It is possible to envision manufacture within Minnesota of ADS's electro-mechanisms for standard, electric vehicle chassis and perhaps even final assembly of DAVes.

Alden DAVe Systems - Since 2004

508-540-2899 wla07@comcast.net

[i] (http://www.zipcar.com
[ii] http://www.boston.com/business/globe/articles/2006/08/13/zipcar_is_geared_toward_growth
[iii] http://wheels.blogs.nytimes.com/2009/02/11/vandalism-vexes-paris-bike-rental-system
[iv] http://en.wikipedia.org/wiki/Morgantown_Personal_Rapid_Transit
[v] http://plymouthrockstudios.com/home.html
[vi] See http://www.lincolnev.com .
[vii] See www.bts.gov/publications/omnistats/volume_03_issue_04/html/entire.html
[viii] http://www.fhwa.dot.gov/ctpp/jtw/executive.htm
[ix] http://www.bts.gov/publications/transportation_indicators/december_2001/Environment/html/Average_Motor_Vehicle_Miles_Per_Gallon.html
[x] http://hal.inria.fr/docs/00/04/10/16/PDF/SF-ITSWC-05-Parent.pdf
[xi] Cost Summary, section 6.2.6, p. 83: http://faculty.washington.edu/jbs/itrans/big/DAVentry%20PRT%20Scoping%20Study.pdf