RESPONSE OF ALDEN DAVe SYSTEMS FOLLOWING THE OUTLINE OF THE SANTA CRUZ REQUEST FOR QUALIFICATIONS FOR A PERSONAL RAPID TRANSIT (PRT) SYSTEM

December 4, 2008

Client References

Franklin P. Johnson Jr., in Palo Alto, founder of Asset Management Company, http://www.assetman.com/team/team_franklin.php is willing to serve as a personal reference for me. I hope that he will help us on any partnerships or ventures that would make sense in California or Silicon Valley. I can't imagine a better person to do it. His telephone number is 650-494-7400.

In reference to the Morgantown PRT, please contact Bob Hendershot, Systems Engineering Manager, at 304-293-5011. He is the head of the Morgantown personal rapid transit system. (The research and engineering executives I worked with for the United States Post Office Department and the Department of Transportation are no longer there.)

Project Team

Greg Teifert would be the project manager of any resulting project with Santa Cruz, as long as he is available at the time a go-ahead is given. His resume is attached. Mr. Alden would coordinate the work of Misters Teifert and Morley. Among those resources that Mr. Morley can use are Autonomous Solutions, Inc. and PST Technologies Inc. mentioned in our Logan Airport Proposal, which is attached.

Our YouTube video shows some of our history and much of the autonomous technology available. See http://www.youtube.com/watch?v=IGzNS5roflo . However, the requirements of the DARPA autonomous vehicle contests were far greater than needed in a suburban/urban application. For example there is presumably no need to try to attain top speeds of 50 mph. Also, maps of the routes to be taken were handed out the morning of the contest. Our routes, DAVeWays, are already in the DAVe memories.

The parallel processing software is the crux of the urban/suburban DAVe System. Dick Morley is ideal to lead our associates in this area, witness that Dick invented the PIM (Parallel Inference Machine) as described on page 23 of our attached Logan Proposal. Dick conceived the programmable logic controller, which now is used in almost all manufacturing from making autos to sewing shirts. See http://en.wikipedia.org/wiki/Programmable_logic_controller . With this background and his work on the Japanese high-speed railroad, Dick's systems have involved parallel processing with the need to handle interrupting, manual changes such as required in the DAVe System. (Luckily, our DAVes will not be moving at 300 mph.) He conceived ABS (Automatic Braking System) for airplanes, which is now used in most autos. Mr. Morley is an internationally recognized authority on automation and high technology.

Recognition of our innovative thinking, experience, top talent and contacts is illustrated by the fact that a leading PRT company in Europe has discussed with us the possibility of joint technical development. If we receive a contract or letter of intent from Santa Cruz and/or San Jose, we would reopen this discussion.

We are happy to hire local talent such as structural engineers registered in California that meet your approval.

Organization and Resumes

The backgrounds and resumes of our key people and founders are found in the attached Logan Proposal, pages 20 to 23 and 41 to 47. A photo of the founders is on the last page of this response. William Alden is CEO of ADS (Alden DAVe Systems) and would be over Mr. Teifert, with Dick Morley serving as Senior Technical Consultant.

ADS is presently a virtual company. Thus, it has low overhead and great flexibility. Most of our conferencing is done via the internet. We are a mixture of an engineering and business firm. So in this case, we can lead the designing of the system and then find the money to build the prototype. And if need be, we can find the concessionaire. For example, I have talked to Trent Vichie, Senior Vice President, Macquarie Securities USA, and he has indicated that he is willing to look over any solid deal that we have. As you probably know, they have bought and operate turnpikes, such as the Chicago Skyway at a price $1.8b. Macquarie also handles airports and airport parking garages.

PRT (DAVe) System Requirements

Level of development of existing systems:

Three of the key people on our team were involved in conceiving, selling, designing and helping to build the $130m Morgantown PRT system. See

http://www.progressiveengineer.com/pewebbackissues2002/PEWeb%2024%20Mar%2002-2/PRT.htm . The company at that time was the Alden Self-Transit Systems Company. With $2m in venture capital, we built a test track, demonstrating our ideas which were necessary to make a PRT system work: in-vehicle switch, third-rail design to match a guideway with no switches in it, a station layout accommodating through vehicles and stopping vehicles, and most important, the moving cell control system, which has served well to this day.

We now stand ready to bring not only the Morgantown PRT to the next stage of development but also present-day PRT to a state-of- the- art stage: our DAVe (Dual-mode Autonomous Vehicle) System. The DAVe System is presently a concept. However, the System uses not only our vast Morgantown PRT experience, but also DAVe uses proven technology and components as shown in the Logan Proposal and the Logan Presentation DVD, cited above.

If ADS receives the go-ahead from Santa Cruz, ADS would raise the necessary funds to build a prototype system designed to meet the needs of Santa Cruz as determined by further studies, including market research. Other system requirements would be considered as long as they did not conflict with the needs of Santa Cruz. These requirements might be contributed by other prospects of ADS, e.g., Logan Airport, Foxwoods Casino, San Jose and groups such as those representing the handicapped, the unlicensed and elderly.

This project should be carried out in a cooperative collaborative and collegial style. For example, the engineering and student inputs of the University of Southern California Santa Cruz can be a part of the work process. We have not asked them about it, but from things they have said, we believe that the PRT operators and others at the University of West Virginia would be happy to follow the progress of the work and add their practical inputs gleaned from over 30 years of the very successful and major-accident-free operation of their PRT system.

Presently this is how our system works:

The DAVe System will help create a Garden City:

The DAVe System:

- Attracts auto drivers:
  - Safe
  - Minimum pollution
    - No smog
- Origin to destination
  - Conveniently
  - "You call, it comes."
    - Directly
    - Predictably
    - Quickly
- Provides transportation for all:
  -Elderly.
  -Children.
  -The unlicensed.
  -Handicapped
- With no capital, maintenance and operating costs to Santa Cruz and.
- At affordable cost to users
  - Wins easily over PRT systems with no need for costly and intrusive guideways or stations.
  - "Substitutes software for hardware"

Proposed Concept:

ADS personnel have designed and built automation systems, including material and people handling systems, around studies of the actual needs of the potential users. (Some of this history is shown in this YouTube video: http://www.youtube.com/watch?v=IGzNS5roflo .) ADS's study of MassPort's Logan Airport, Foxwood Casino, Harvard-Allston Campuses to Longwood medical area, Masdar, Abu Dhabi, et al. have revealed amazingly idle pathways, which narrow vehicles can easily utilize. We have found that potential users, especially young people, have no problem with the idea of autonomous vehicles moving among pedestrians. Lincoln, California and other towns has found that Neighborhood Electric Vehicles can move on certain highway lanes, multiuse lands and bike paths: http://www.lincolnev.com/ . The sharing of public ways with golf carts, bicycles, cars and pedestrians works in those cities doing it: see http://www.ci.lincoln.ca.us/pagedownloads/GCTP%20June%202006.pdf , Appendix A. Where exclusive pathways are required, the capital cost and intrusiveness of these DAVeWay structures are low since the vehicles are lighter and narrower than present PRT vehicles.

Other considerations in the design of our user-friendly DAVe were these:

- The average auto trip length is 9.5 miles. 61% of these trips are 0 to 5 miles, and another 17%, 6 to 10 miles.
- The average speed of 25% of the trips are less than 12 mph; 10%, 5 mph; 5%, 6 mph.
- 65% of vehicle trips contain just the driver; 20%+, the driver and passenger

(The above figures are from the National Household Travel Guide Survey of the Federal Highway administration in 2007.).

- Other studies indicate that the traffic in central cities at peak times moves at 3.5 mph. In the same conditions, a bicycle averages a speed of 12.5 mph.
- The average travel distance from home to park-and-ride stations is 3.4 miles

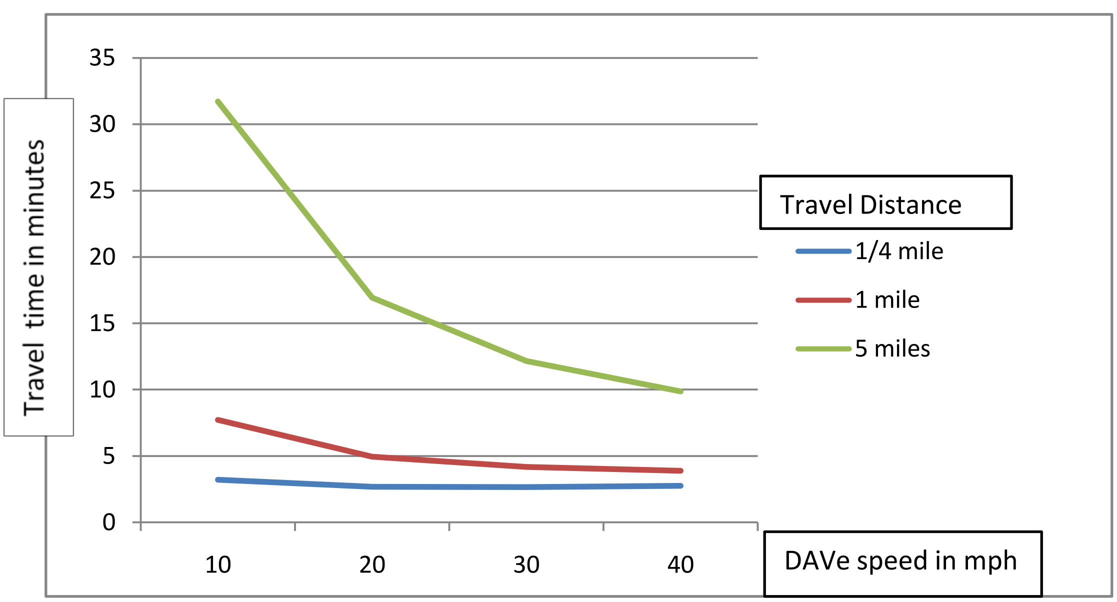
Below is a table, addressing the possibilities presented by the short distances, namely that high speeds are not necessarily needed for short distances

RELATIONSHIP OF TOTAL TRIP TIME TO DISTANCE

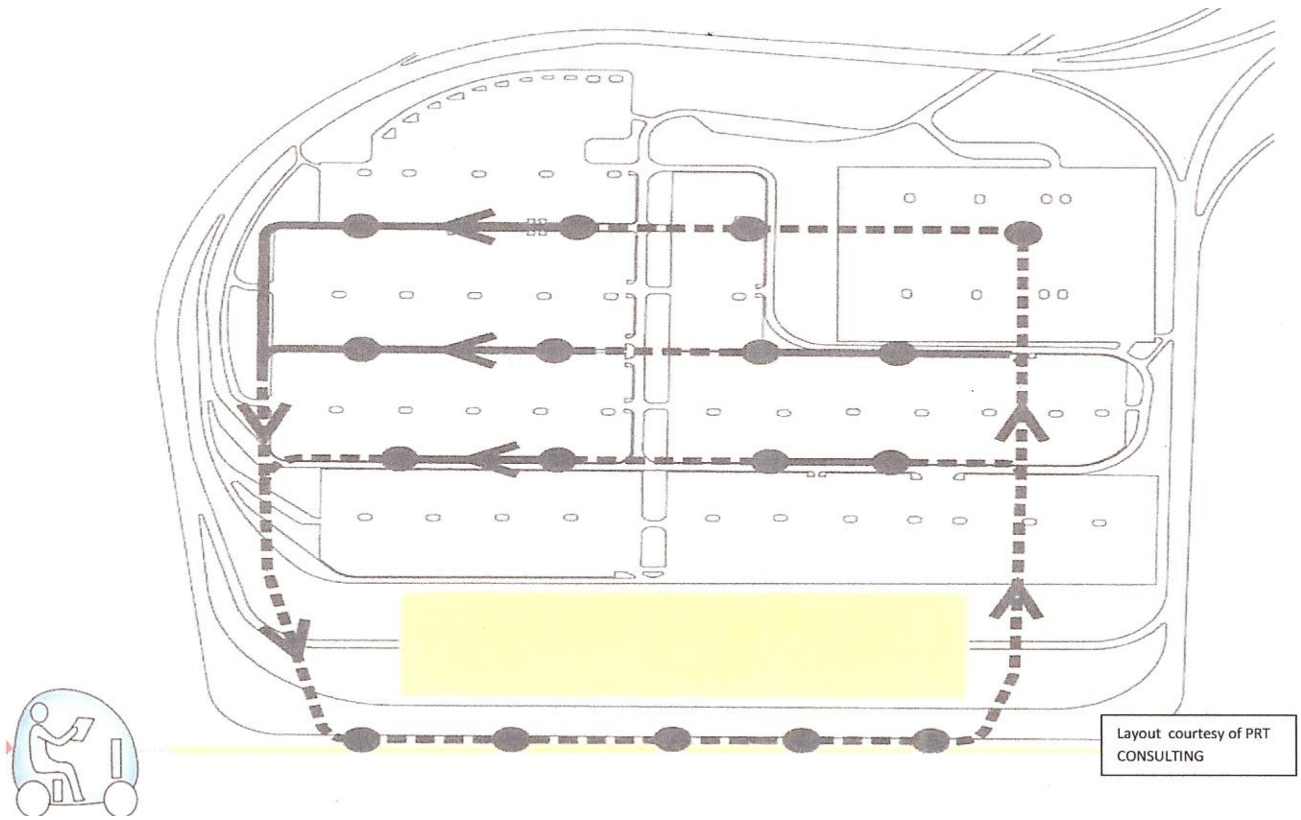
	CRUISING SPEEDS IN m.p.h.			
	10	20	30	40
TIME, in minutes:				
TO FIND VEHICLE, LOAD AND UNLOAD	1.5	1.5	1.5	1.5
TO ACCELERATE AND DECELERATE TO CRUISING SPEED	0.22	0.44	0.66	0.88
SET-UP TIME - A	1.72	1.94	2.16	2.38
TO TRAVEL, AT CRUISING SPEED - B				
- 1/4 Mile (1,320 FEET)	1.5	0.75	0.5	0.38
- 1 Mile	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
- 1 Mile	7.72	4.94	4.16	3.88
- 5 Miles	31.72	16.94	12.16	9.88



Considering our studies and these facts, the DAVe carries one person. However, if desired, it can be designed to carry two people, the driver and passenger, presumably back to back. Plus, the DAVe meets the requirement of places such as airports in that the DAVes can go anywhere that a wheelchair can go. Thus, the narrow DAVe can go on bike paths, multiuse lanes and sidewalks with the ability to bypass stopped DAVes or other obstacles, as the neighborhood electric vehicles do in Lincoln, CA. Above is an artist's concept of a DAVe. DAVe Systems can be designed to have the DAVes travel in trains in order to increase capacity or to handle a group. It should be noted, however, that feeder lines such as walkways in airports do not usually carry large numbers. As you know, dual-mode means that the driver can drive the DAVe. Under his/her control the DAVe can drive itself autonomously, such as demonstrated in the many DARPA contests and shown in our aforementioned video. While driving autonomously, the DAVe is under a control system consisting of the computer and obstacle detectors. In the computer is a map of the DAVeWays of the airport, town, casino or what-have-you. This is suggested in the schematic of an airport garage, shown below in the simplest terms.



A central DAVe computer system computer keeps track of the DAVes, and fetches and dispatches them to maximize customer service and utilization of vehicles. This computer in the CCC (Command & Control Center) can override the control system of an individual DAVe if needed. Operators at the CCC can override the central computer, if needed. An operator can talk to and see DAVe occupants as needed. This communication system is similar to that in the Morgantown PRT. (See photos below.)

Our attached proposal to Logan Airport describes our autonomous vehicle system, at that time, April 2007.

Attached are notes from our Harvard-Allston Campuses to Harvard Medical School study which provide further details on DAVes operating in an urban environment. It also is indicative of the possibilities for Santa Cruz. Upon our first looking at connecting the Harvard bioscience building in densely populated Allston to the Medical School in Boston without building guideways seemed impossible. However, upon study, it was found that there were idle sidewalks, multiuse lanes, bicycle lanes and pedestrian paths on the Harvard Business School campus, leading to the Paul Dudley White bicycle path, which led most of the way along the scenic Charles River to BU. A low-traffic road was discovered that led almost directly to the Longwood medical area. Most cities have side streets and alleyways waiting to be used for alternate traffic.

As alluded to in the Harvard notes, the DAVe System solution is similar to the bike rental systems in Europe such as that very successful one in Paris: http://en.wikipedia.org/wiki/Velib . The only differences are that our vehicles are covered, available to any person, much safer and have the automatic capability, which allows matching inventory to actual needs with minimum labor. As we mentioned in our Logan proposal, the occupants of the DAVe will be viewed by the camera in the DAVe and recorded so damage to the vehicle and stealing it is minimized. Obviously, a person uses a credit/debit card to "start" a DAVe. If a user steals a DAVe, at the minimum, they would be charged for the cost of the car and not be allowed to use a DAVe again.

Similarly, our system has some of the good attributes of the fast-growing Zipcar except that our vehicles are small enough to dart among traffic and along narrow paths. Again, our DAVe System has automatic balancing of inventory. See http://www.zipcar.com/about/ . And in our System when you wish a vehicle be brought to you, the DAVe can be automatically sent to you via the nearest spot on the DAVeWay network.

Status of regulatory submittals, review, testing or approvals:

Included in the design requirements are those of regulatory bodies. However, it is likely that most of these are already met since the DAVe is a variation of the NEV (Neighborhood Electric Vehicle) which has performance requirements already legislated, as suggested at: http://www.lincolnev.com/ . The sharing of public ways with golf carts, bicycles, Segways, cars and pedestrians in those cities doing it: see http://www.ci.lincoln.ca.us/pagedownloads/GCTP%20June%202006.pdf , Appendix A.

The "eyes and ears" of a DAVe are always alert, unlike those of human beings. Also, the response time of humans is 2 1/2 seconds. The response time of electronic obstacle detection and braking is almost instantaneous. Thus, a DAVe mixing with other forms of traffic is far safer than, say, a bicycle or Segway. Any concessionaire running a DAVe system is going to have a great interest in helping maintain safe and comfortable DAVeWays, thus all bicyclists and pedestrians should greet the arrival of another, strong force to help improve their lanes and ways.

Since the DAVe is, in a sense, an autonomous wheelchair with a cover on it, the elderly, young and handicapped should greet its introduction. Preliminary study by ADS indicates that the DAVe can meet the American with Disabilities Act Standards for Accessible Design.

If there happens to be a problem with some regulations, it is possible that there might have to be some give and take by those authorities that set the regulations, since the DAVe System can be a universal system offering transportation to everyone, it is likely that appropriate changes in the regulations would be made by regulating bodies.

Estimate of capital Costs to build the system:

The capital costs of production DAVes should be in the order of $7500-$10,000 per each vehicle. The cost of planning and engineering will vary with the size of the DAVe System but would be in the order of $2 million, up. If special, exclusive DAVeWays need to be built, on the surface they would cost similar to the cost of bikeways. If elevated, the structures would cost in the order of walkways, certainly a fraction of the cost of the present PRT guideways.

Below is an attempt at comparing costs of DAVe with PRT. This is very problematical, because the only fair comparison is to compare both systems on a given, actual site.

ESTIMATED COMPARATIVE PRT CAPITAL COSTS

	DAVe	PRT	DAVe (FOR 10 MI. ROUTE &100 VEHICLES)	PRT (FOR 10 MI. ROUTE &100 VEHICLES)
Vehicle	$7,500 TO $15,000 I OR 2 PEOPLE	$25,000 TO $45,000 1 TO 4 PASSENGERS	$750,000 TO $1,500,000	$2,500,000 TO $4,500,000
	DAVeWay	**Guideway**		
Elevated	$1m TO $2 m	$4.5m TO $6.75m/ mile	$10m TO $20m	$45m TO $67.5m
Ground level	$200,000 TO $300,000	$3m TO $5m	$2m TO $3m	$30m to $50m
Civil engineering, misc.	Minimal	Comparatively Large		
Stations	0	$1m TO $5m		$20m TO $100m 20 STA.
Purchase of land for infrastructure	Minimal	Comparatively Large		
Central Control system	$5m TO $15m	$3 TO $10m	$5m TO $15m	$3 TO $10m

The DAVe System would rarely need elevated or surface structures.

Financing Options:

ADS prefers to use the private enterprise route, simply because it can be much faster than through most government channels. The MassPort/Logan proposal was structured on the basis that the system would be installed as a moneymaking concession. If Santa Cruz signed a contract agreeing to use the DAVe System, if it met stated requirements in the progress tests, ADS would work with Santa Cruz and build the prototype. ADS would need to raise the money to do this. We know that venture money looks for real interest on the part of the customer, preferably with some token payments to speed the raising of venture money.

ADS, like Alden Self-Transit Systems Company, however, is a practical company and will be open to all sources of money, such as grants and federal contracts. Despite being a very small company, Alden Self- Transit Systems Company was able to win the competition at the University of West Virginia. And then, in partnership with Boeing win the Morgantown PRT contract. Alden solicited Boeing, and got them on board in the beginning.

The Definition of the Roles and Relationship between the Proposer, Other Partners, and the City:

ADS is flexible, and can handle the design and building of the prototypes. We welcome cooperation with Santa Cruz's personnel. We welcome partners.

At Morgantown, we brought in Boeing to be the prime contractor. We licensed them and consulted with them on our designs while we built the prototype vehicles and the third rail per our patents and designs.

Financial plan and capabilities:

Silicon Valley and the Northeast are known as sources of venture capital. ADS has made preliminary contact with some of the leaders in venture capital and feel that when there is solid interest from a prospect, such as Santa Cruz, necessary funds will be forthcoming as an investment in ADS.

Largely through our present and past associations at Harvard University, and the Advanced Transit Association, we have contacts who could lead us to money sources and/or key decision-makers in places such as Washington, DC, Dubai and Abu Dubai.

Energy use and environmental impact of proposed system. Viability of solar or alternative energy use.

Using electric battery power, it is estimated that a DAVe would consume energy what is equivalent to 300 miles per gallon in an automobile. On page 13 of the Logan Proposal is an illustration of solar power being used to help run the fleet of Autonomous Vehicles (now called DAVes).

However, as mentioned above, design specifications and alternatives would ideally be laid out at the beginning, so that the optimum energy systems would be considered. For example, vehicles and even automobiles are being driven with compressed air. Would that be an optimal solution, especially if most of the trips in Santa Cruz are only a few minutes long?

As you know, much wasted energy goes into constructing buildings and other infrastructures. Since the DAVe System does not require guideways or stations for the most part, then there are tremendous energy savings, as well as capital cost savings.

Our DAVe System is comparable to the Zipcar system, who claim that one Zipcar removes 20 privately owned cars. Many of their members report that they have sold their cars or are using public transit more.

If a DAVe drives from homes to a rail or bus station 10 times, it will remove 10 cars from the road that morning.

Design and operational considerations specific to Santa Cruz.

It is possible for our System to improve the overall general environment: one can imagine a fleet of DAVes gently and quietly gliding over the University Campus and through the City over your wonderful network of bike paths, and over other ways open to them, such as multiuse lanes on highways: a truly user-friendly, culture-friendly, community-friendly system available to all.

Allowing dual-mode DAVes to go where there are people provides a sense of community and conviviality such as found in a bazaar. (The vehicles below are open, and the DAVes would have some form of cover that could have openings for fresh air and to talk to people.)

Electric Wheel chair near Harvard Square:

"Catching up" on the side walk:

Electric scooter at Foxwoods Casino:

Any new system will not please everyone completely, but the DAVe System, should please the most people the best of any system. For example, by minimizing elevated structures, the sweeping vision of the Campus and City, with its great aesthetics, is maintained. Where elevated structures are needed, e.g. over an intersection with heavy traffic, they can be very lacey and beautiful, because of the light weight of the small DAVe. See below:

It is possible to lay DAVeWays over existing lawns and still maintain the green, e.g. with Grassy Pavers: www.grassypavers.com .

Construction, Maintenance, Operation and Safety.

To minimize costs and maximize aesthetics, every effort will be made to use existing infrastructure such as the extensive bike paths of Santa Cruz. As our video illustrates even existing elevators can be use to give the system a three-dimensional capability.

As with Zipcar and Verlib in Paris, the main maintenance is with the vehicles. Electric cars have far less reliability problems then gasoline autos.

Using an installation of 100 DAVes, one can guesstimate that the cost per ride might be around $4. (See Annual M&O table below.)The rate for the Verlib bike in Paris is free for the first 30 minutes, and one euro for the next hour, and so. The rate for Zipcar in San Francisco ranges from $8.33 to $9.25 per hour. DAVes produced in large numbers should be considerably cheaper than a Detroit automobile since the DAVe is a highly utilitarian vehicle: just what it needs for a ride lasting only a few minutes. (The drive of the DAVe from the Harvard-Allston Campus to the Medical School was estimated to be less than 11 minutes. The Logan trip averaged 3 minutes.) A very detailed engineering study for the City of Lincoln on their NEV Transportation Plan (http://www.ci.lincoln.ca.us/pagedownloads/Final%20NEV%20Transportation%20Plan.pdf , p.8) states that the annual operating cost of a gas auto is $3,520 as against the cost for neighborhood electric vehicle of $560.

Below is a hypothetical set of figures on M&O costs of an urban/suburban DAVe System concession or franchise, presuming the use of existing infrastructure:

ANNUAL MAINTENANCE & OPERATING COSTS

	(For Comparison)	Before payments to Santa Cruz
	Morgantown PRT	
	04/'05	
	2m riders/yr.	2m riders/yr., at start
Personnel	$ 1,705,695	$ 2,000,000
Fringe Benefits	$ 561,908	$ 666,000
General Expenses	$ 159,188	$ 200,000
Utilities		
Electricity	$ 248,846	$ 400,000
Gas heat for snow/ice	$ 165,898	
Overhead	$ 193,610	$ 200,000
Equipment	$ 13,160	$ 20,000
Vehicle Repairs	$ 195,417	$ 100,000
Other Repairs	$ 178,322	$ 100,000
Sub-total	$ 2,841,535	$ 3,686,000
Liability & other insurance		$ 500,000
Software lease to ADS		$ 1,000,000

Depreciation over 20 years of	$14,000,000*	system	$	700,000
Interest on debt of @ 8%			$	1,120,000
Sub-total			$	3,320,000
Sub-total			$	7,006,000
20 % Contingency			$	1,401,200
TOTAL			**$**	**8,407,200**
			Cost/ride	**$4.20**

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*100 DAVes @ $10,000……………………………………………………..$ 1,000,000

CCC, including communication and computer …………………………... 6,000,000

Recharging stations, application engineering, G&A, misc., contingency….. 7,000,000

Total …………………………………………………………………………$ 14,000,000

Over 41,000 people lost their lives on the nation's highways in 2006. According to the **Bicycle Almanac**, cyclists are somewhere between 3 and 12 times likely to die as motorists per passenger mile. See http://bicycleuniverse.info/transpo/almanac-safety.html . A reason, presumably for this difference is that bicycles have less protection such as a cover. The DAVe, of course, has a cover. Also, DAVes would move at slower speeds than autos and protected very adequately with the inner skeleton structure that is planned. More importantly, the DAVe is scanning the roads continually for near and far objects and responding accordingly. Thus, where there is the clear, straight shot ahead the DAVe moves more quickly, just as an automobile should do. Where there are near obstacles, the DAVe would slow down accordingly, as shown in our video. The response time of the electronic and computer controls is far faster than that of a human and obviously more reliable. Every day we all depend on the reliability of electronics/chips/computers in our cars, elevators and airplanes. Since the volume of traffic would be higher on the bike paths, multiuse lanes etc., it will pay to have all the safety features that often are lacking now, e.g., elimination of potholes, use of stoplights, adequate signage. It would seem clear that safety would be greatly improved with the DAVe System.

Time line that addresses each phase of development, implementation and operation.

As mentioned above, we design systems around specific needs. An application study, which presumably would include market research, might take up to six months.

The designing and building of two prototype DAVes, and first-cut software would take in the order of nine months. The first tests of the DAVes can be done in a parking lot, as shown in our video. A room would be needed for the CCC.

The redesign and building a second generation DAVes, and a CCC for testing would take six months. The implementation of the room for the CCC and the design and building of production model DAVes and full software is estimated to take six months.

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Founders of Alden DAVe Systems:

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