SUMMIT: A Facility to Demonstrate High Speed Transport of Long Distance Highway Trucks, Fresh Water Carriers, and Low-Cost, Efficient Storage of Electrical Energy Using 2nd Generation Maglev Technology

By

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Background – U.S. Truck & Water Transport and Energy Storage Needs

The proposed SUMMIT (**SU**perconducting **M**aglev **M**ulti **I**ntegrated **T**esting) facility addresses 3 areas of major concern for U.S. transport and energy generation:

1. Reducing the cost and energy required for long-distance truck transport, together with reduction of the pollution and highway damage that they cause.
2. Efficient, low cost storage of electrical energy generated by clean, non-polluting renewable energy sources.
3. Low cost, energy efficient long-distance transport of large amounts of fresh water to regions with insufficient water resources, especially the U.S. Southwest.

The three areas are of particular importance to Nevada. The Interstate-15 (I-15) highway corridor is heavily congested, with long distance trucks being a major contributor to the congestion. They emit large quantities of pollution, especially diesel particulates that are very harmful to peoples' health. The highway trucks cause extensive damage to highways, shortening their life, and increasing maintenance and repair costs. A single 18-wheeler highway truck causes as much damage as thousands of autos, according to estimates from transportation experts.

Wind and solar renewable energy resources hold great promise in supplying large amounts of clean energy without the greenhouse gas emissions that are contributing to global warming. Nevada is a very attractive location for large amounts of wind and solar power.

However, wind power is highly variable, and only blows about 20% of the time, frequently blowing when electrical demand is low, and frequently not blowing when demand is high. Solar power is more regular, but at low output during peak demand periods in the morning and in the late afternoon. If wind and solar power are to become a major source of energy for the U.S., a low cost, efficient way to store large amounts of electrical output from them must be developed, so that the energy can be delivered to the electrical grid when needed.

Finally, Nevada and the Southwest in general are very short of water. Less water flows down the Colorado River, Lake Mead is drying up, and underground water table levels are rapidly dropping. There is abundant fresh water in the Columbia River, but pipeline delivery would be far too expensive for Nevada, Southern California, Arizona, and New Mexico.

How Maglev-2000 Can Help Meet U.S. Truck & Water Transport and Energy Storage Needs

The advanced 2nd generation Maglev-2000 system has the unique potential to enable cost effective, large-scale solutions in the above 3 areas of concern. The 2nd generation Maglev-2000 System can transport very large tonnages at high speed and low cost, with very high energy efficiency. It can transport heavy highway trucks at hundred of mph at considerably lower cost than driving by highway. A trucking company using Maglev would only need 1/5th as many trucks, compared to going by highway.

Similarly, very large quantities of fresh water, hundreds of millions of gallons of water per day, can be delivered over distances of hundreds of miles using Maglev at very low cost – less than 1 dollar per 1000 gallons. Las Vegas could be supplied with water from the Columbia River; Southern California could get water for its crops from the Columbia.

Finally, Maglev can be used to store very large amounts of electrical energy from wind and solar sources. The MAPS (Maglev Power System) stores electrical energy by moving heavy concrete blocks (~100 Tons per block) uphill to a storage site. When the electrical grid needs energy, the concrete blocks are moved downhill by the Maglev vehicles, converting the stored gravitational potential energy back into electrical energy. Going uphill, the Maglev propulsion System acts in the motor mode; going downhill, the Maglev propulsion system acts in the generator mode.

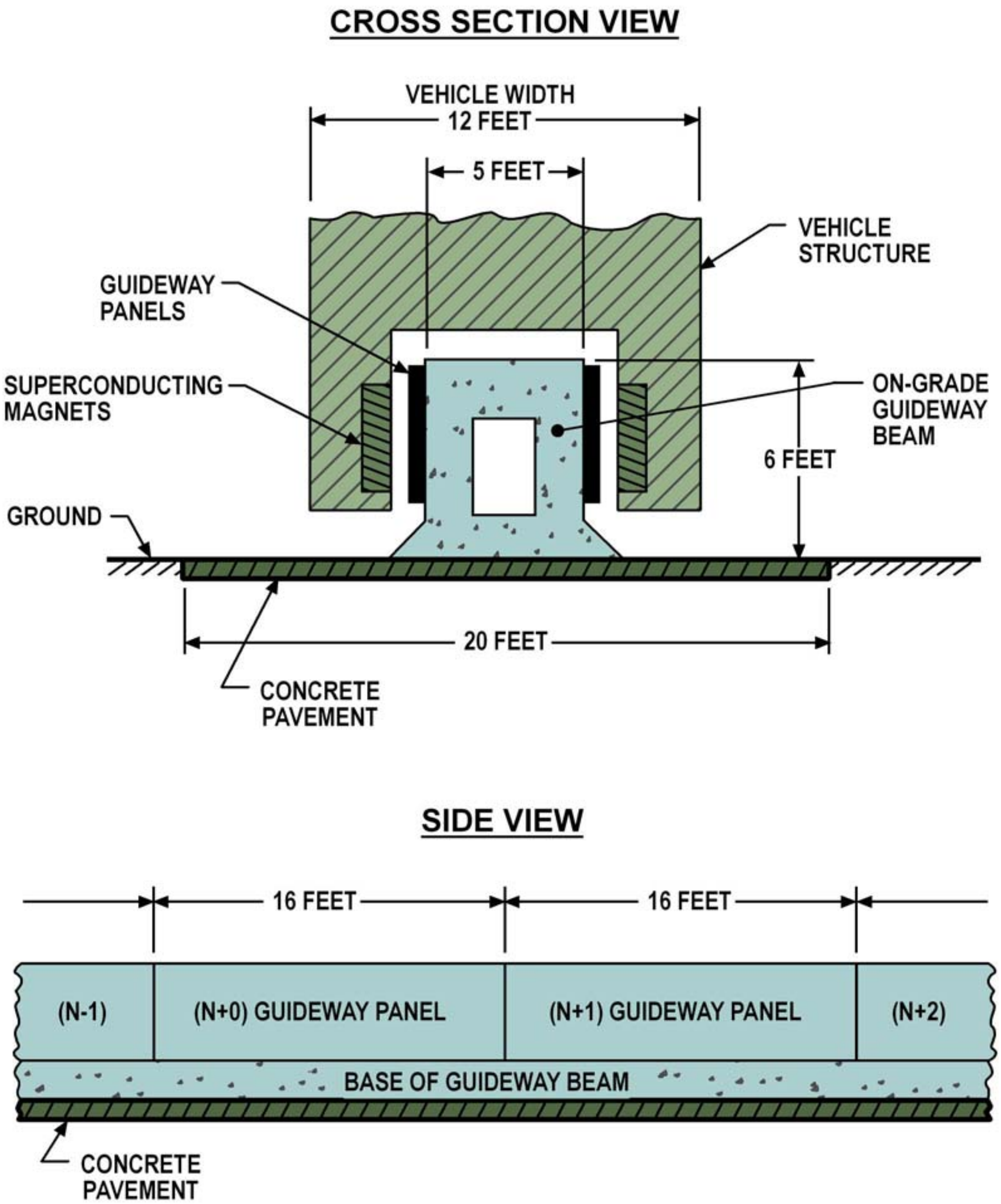
The MAPS storage system is very low in cost, about 2 cents per kilowatt hour stored, and 95% efficient (output electrical energy/input electrical energy). The storage cost of 2 cents/kWh is a small fraction of the selling price for peaking power, which can be as much as 50 cents or more per kWh. The only alternative power storage to MAPS is pumped hydro. Batteries, fuel cells/electrolyzers, flywheels, are just too expensive and inefficient. Pumped hydro has many problems – there are very few sites where it can be implemented, the environmental effects are very objectionable, and the overall energy efficiency is low. Only 60% of the input energy to pumped hydro is returned as electricity to the grid.

Description of the Maglev-2000 System for Truck & Water Transport and Energy Storage

All 3 of the above applications – energy storage, water delivery, and long distance truck transport – would use the same type of on-grade guideway shown in the attached **Figure 1**. It is a simple concrete beam laid on a paved strip, similar to a highway lane, with panels containing ordinary aluminum loops attached to the vertical sides of the beam. The beams can be prefabricated and trucked to the guideway site, or simply poured in place like highways are. The cost of the guideway is very low, comparable to that of a 2 lane highway, i.e., a few million dollars per mile.

Unlike railroads, the Maglev vehicles magnetic force-loads that act on the beam are not concentrated at the point of contact of the wheels on rail but are instead are evenly distributed along the guideway beam, and are much smaller in magnitude than the loads applied to the RR

Figure 1



GUIDEWAY PANELS CONSIST OF LOOPS OF ALUMINUM CONDUCTOR ENCASED IN POLYMER CONCRETE

- 1 SET OF ALUMINUM LOOPS PROVIDES VERTICAL LIFT AND STABILITY
- 1 SET OF ALUMINUM LOOPS PROVIDES HORIZONTAL STABILITY
- 1 SET OF ALUMINUM LOOPS PROVIDES MAGNETIC PROPULSION
- PANEL DIMENSION: 4 FEET WIDE, 16 FEET LENGTH, 4 INCHES THICK

track by the wheels of a locomotive or railroad car. Consequently, the Maglev guideway does not require an expensive road bed to handle the large fluctuating forces from the rolling wheels of a train, and can operate without damage or expensive maintenance virtually indefinitely. Maglev vehicles, since they do not contact the guideway, cannot damage it or wear it away.

The 3 types of Maglev vehicles that would use the common type of guideway are shown in **Figures 2, 3, and 4**. The water transport vehicle has an inflatable bladder. When transporting water from a source to users, the bladder is inflated with water. After finishing the delivery, the bladder is completely deflated as the vehicle returns for the next load of water. This reduces air drag and propulsion energy for the return trip.

The highway truck transport Maglev vehicle has a streamlined shell that encloses the trucks carried inside the vehicle, again to minimize air drag and propulsion energy. The trucks simply drive onto the Maglev vehicle through an entrance at an end of the vehicle. After the trucks are onboard the entrance closes, and the Maglev vehicle begins its trip to the desired destination. Upon reaching the destination, the other end of the vehicle opens and the trucks quickly drive off. They then travel by highway for a few miles to deliver their loads. The procedure is similar to that used for the trucks that travel on railroad cars through the Channel Tunnel. Drive on-drive off time for the “Chunnel” trucks is only 90 seconds. During transport, the trucks are anchored to the floor of the transport vehicles by movable supports.

The water delivery and truck transport vehicles typically will travel for hundreds of miles between origin and destination at high speeds, i.e. 200 mph or more, so that minimizing air drag and propulsion energy demand is important.

For energy storage, however, typical trip distances between the lower altitude and higher altitude stations is only a few miles at most, and Maglev vehicle speeds are substantially lower, on the order of 100 mph, than those for long distance transport of highway trucks and water. Accordingly, the vehicles do not have to be streamlined. Instead, as illustrated in Figure 2, the Maglev energy storage vehicles has a simple flat surface on which the concrete blocks sit. The surface has roller bars and tilts to unload and load the blocks at the storage yards. For example, when a Maglev vehicle transporting a concrete block uphill reaches the storage yard, its surface will tilt, causing the block to move sideways onto an adjoining surface at the storage yard. To load a block onto the vehicles the roller bars on the storage surface tilt slightly, causing the block to move back onto the vehicle. The transfer process is fast and automatic, taking less than 1 minute. Transporting a 100 ton block 3000 feet uphill stores 250 kilowatt hours of electric energy.

As an example, transporting 200 blocks per hour uphill could store 50 megawatts of electric energy. Over an 8 hour period when the solar farms was at peak output, this would enable the storage of 400 megawatt hours of electric energy, ready to be delivered at whatever rate the electric grid would request. The rate would be controlled by the number of Maglev vehicles in a multi-vehicle consist, and their speed on the guideway. Power storage demand rates could be as low as a few megawatts to hundreds of megawatts, depending on source output and grid demand.

Figure 2

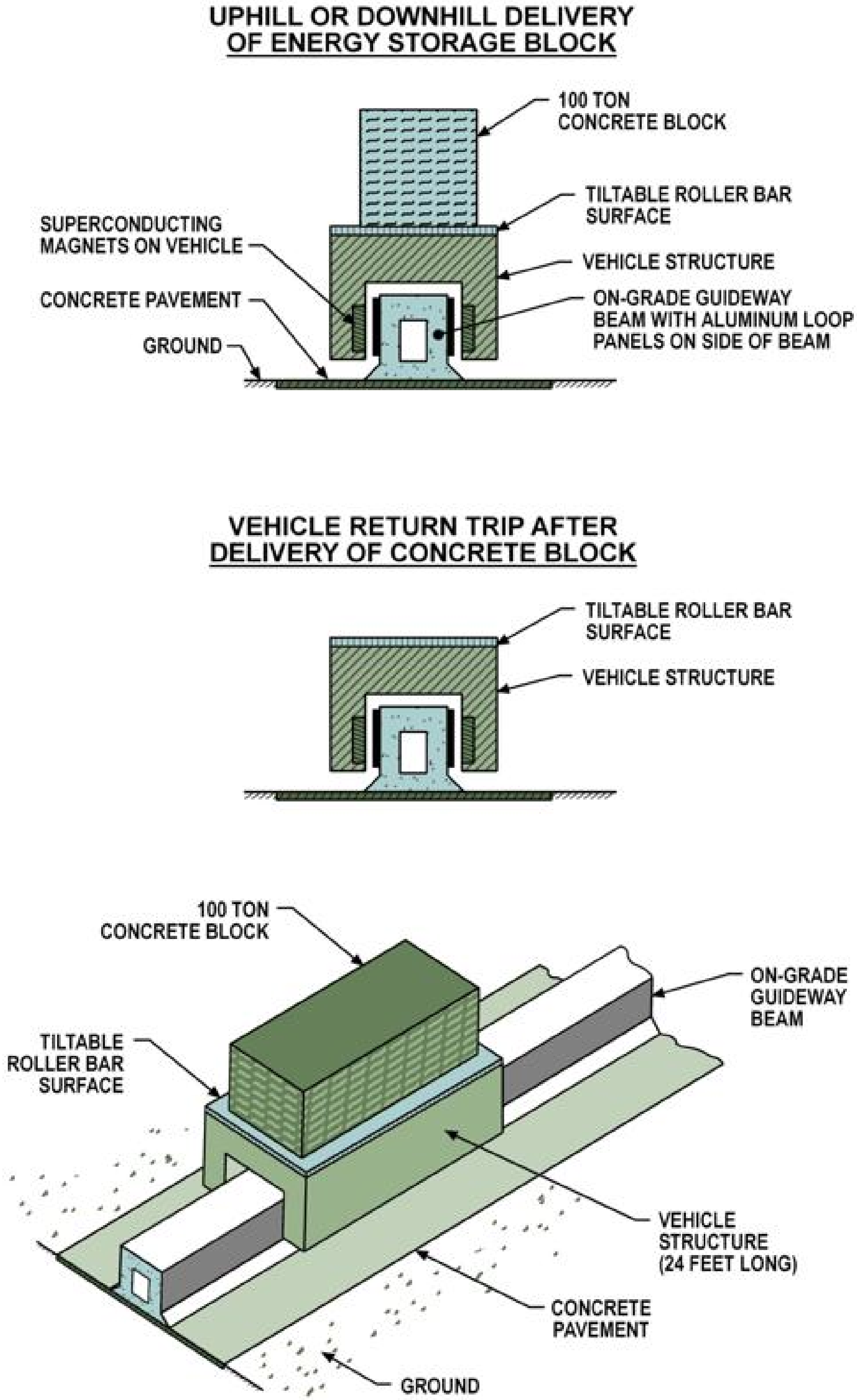

UPHILL OR DOWNHILL DELIVERY
OF ENERGY STORAGE BLOCK
100 TON
CONCRETE BLOCK
TILTABLE ROLLER BAR
SURFACE
SUPERCONDUCTING
MAGNETS ON VEHICLE
VEHICLE STRUCTURE
CONCRETE PAVEMENT
ON-GRADE GUIDEWAY
BEAM WITH ALUMINUM LOOP
PANELS ON SIDE OF BEAM
GROUND
VEHICLE RETURN TRIP AFTER
DELIVERY OF CONCRETE BLOCK
TILTABLE ROLLER BAR
SURFACE
VEHICLE STRUCTURE
100 TON
CONCRETE BLOCK
ON-GRADE
GUIDEWAY
BEAM
TILTABLE
ROLLER BAR
SURFACE
VEHICLE
STRUCTURE
(24 FEET LONG)
CONCRETE
PAVEMENT
GROUND

Figure 3

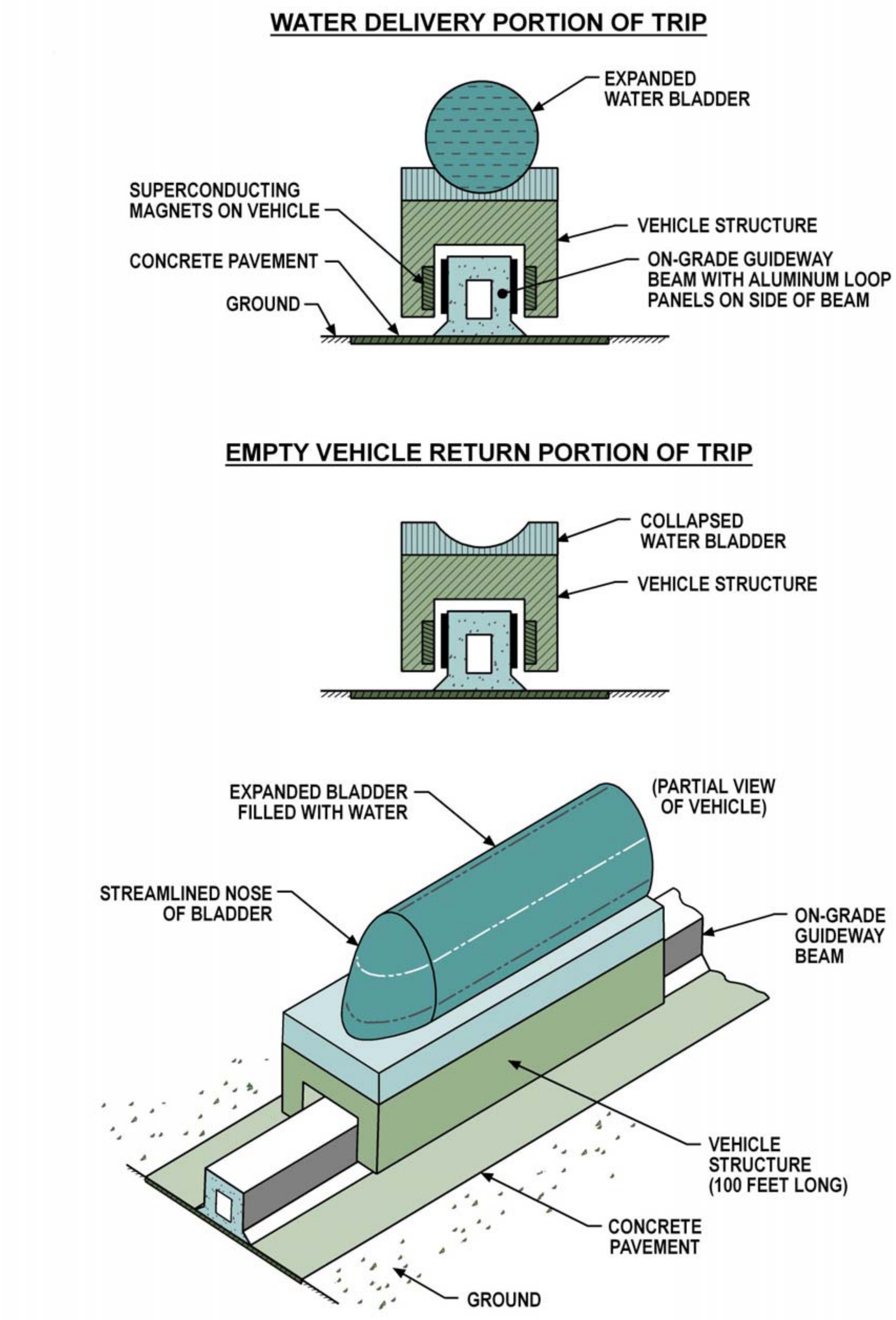

WATER DELIVERY PORTION OF TRIP
EXPANDED WATER BLADDER
SUPERCONDUCTING MAGNETS ON VEHICLE
VEHICLE STRUCTURE
CONCRETE PAVEMENT
ON-GRADE GUIDEWAY BEAM WITH ALUMINUM LOOP PANELS ON SIDE OF BEAM
GROUND
EMPTY VEHICLE RETURN PORTION OF TRIP
COLLAPSED WATER BLADDER
VEHICLE STRUCTURE
EXPANDED BLADDER FILLED WITH WATER
(PARTIAL VIEW OF VEHICLE)
STREAMLINED NOSE OF BLADDER
ON-GRADE GUIDEWAY BEAM
VEHICLE STRUCTURE (100 FEET LONG)
CONCRETE PAVEMENT
GROUND

Figure 4

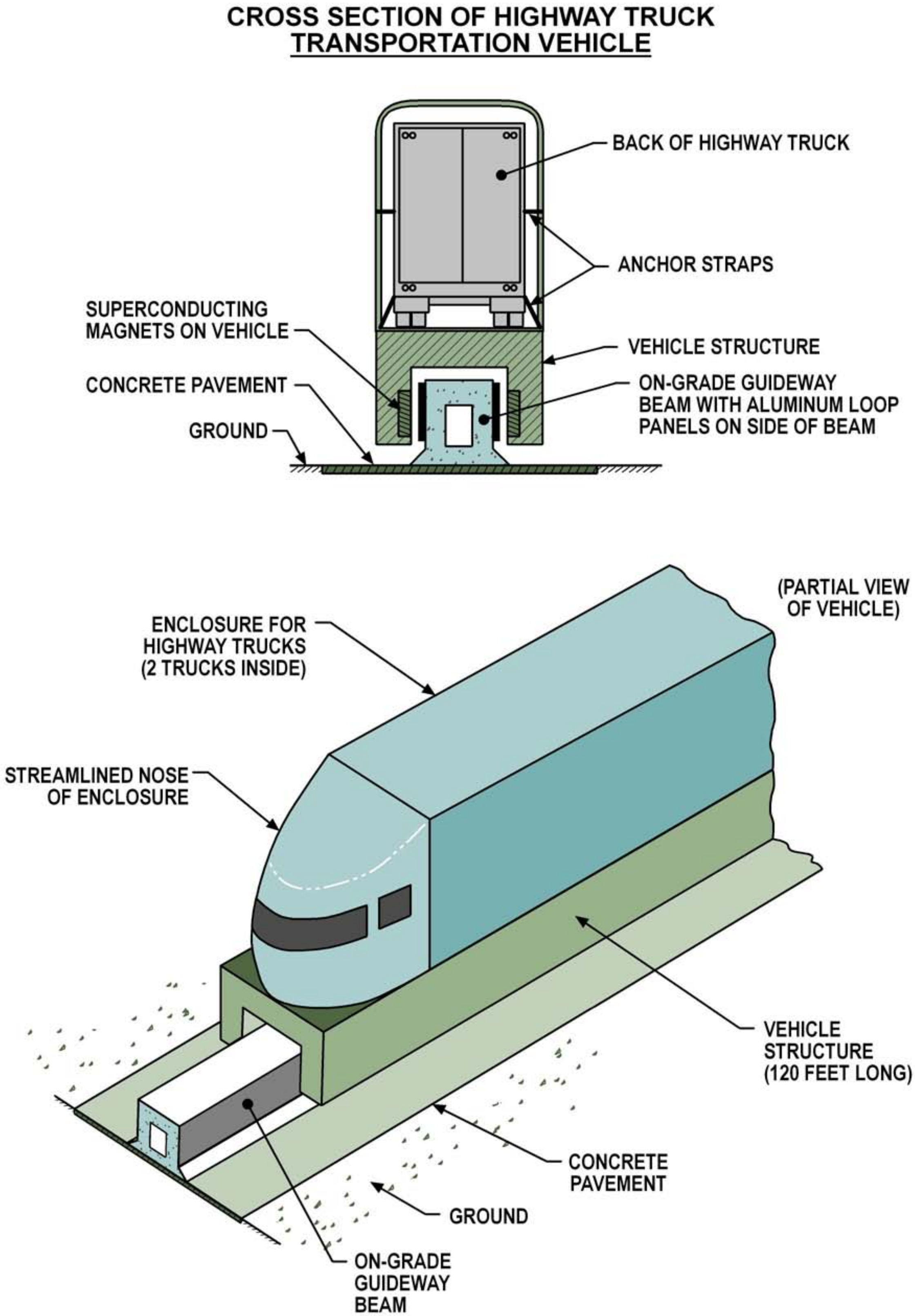

CROSS SECTION OF HIGHWAY TRUCK
TRANSPORTATION VEHICLE
BACK OF HIGHWAY TRUCK
ANCHOR STRAPS
SUPERCONDUCTING
MAGNETS ON VEHICLE
VEHICLE STRUCTURE
CONCRETE PAVEMENT
ON-GRADE GUIDEWAY
BEAM WITH ALUMINUM LOOP
PANELS ON SIDE OF BEAM
GROUND
(PARTIAL VIEW
OF VEHICLE)
ENCLOSURE FOR
HIGHWAY TRUCKS
(2 TRUCKS INSIDE)
STREAMLINED NOSE
OF ENCLOSURE
VEHICLE
STRUCTURE
(120 FEET LONG)
CONCRETE
PAVEMENT
GROUND
ON-GRADE
GUIDEWAY
BEAM

Table 1 summarizes the principal features and parameters of the 3 Maglev applications. All 3 applications would use the common guideway design and on-grade construction, with the difference being that the energy storage guideway would go uphill at a relatively steep angle, e.g. 30 degrees, while the water and truck transport guideway would primarily follow relatively flat terrain, only climbing hills when necessary.

Table 1
Principal Features and Parameters of Maglev Technology for Energy Storage, Transport of Fresh Water, and Transport of Highway Trucks as Compared to Present Technologies

Features and Parameters	Energy Storage	Transport of Fresh Water	Transport of Highway Trucks
Configuration of Load Structure on Maglev Chassis	Flat Surface Holding Heavy Concrete Block	Streamlined Expandable Water Bladder	Streamlined Enclosure with Trucks Inside
Transport Load Per Vehicle	100 Ton Block	200 Tons of Water (50,000 gallons)	80 Tons (2 Trucks)
Vehicle Length/Width	24/12 Feet	100/12 Feet	120/12 Feet
Illustrative Performance on a Maglev Route (Can Be Greater)	400 Megawatt Hours 100 Megawatts Storage/Delivery Rate	1 Billion Gallons/Day	6,000 Trucks Daily
Maximum Speed, MPH	150	200	250
Typical Travel Distance, Miles	3 to 5 (Round Trip)	200 to 600 (Round Trip)	200 to 2,500 (One Way)
Present Technology	Pumped Hydro	Pipeline	Driving By Highway
Maglev Energy Efficiency	~95% (Percent of Input Energy	~10 kWh(e) per 1000 gallons (600 mile round trip)	0.16 kWh(e) per ton mile
Energy Efficiency w/Present Technology	~60% (Return to Grid)	~20 kWh(e) per 1000 gallons (300 mile one-way)	0.33 kWh(th) per ton mile
Maglev Transport Unit Cost	~2 Cents/kWh(e)	~$1/1000 gallons for 300 mile delivery	~10 cents/ton mile
Present Technology Unit Cost	~10 Cents/kWh(e)	~$5/1000 gallons for 300 mile delivery	~30 cents/ton mile

All 3 Maglev applications have lower costs per unit of transport or energy storage than present technologies do and higher energy efficiencies. For example, the unit cost of Maglev energy storage is about 2 cents per kWh(e) compared to about 10 cents per kWh(e) for pumped hydro. The efficiency of Maglev energy storage is approximately 95% -- that is, 95% of the input electrical energy is returned to the electrical grid, while the efficiency of pumped hydro is only about 60%.

With regard to fresh water transport, the situation is essentially the same. The unit cost for transport is much less for Superconducting Maglev than by pipeline, approximately $1 per 1000 gallons for a delivery distance of 300 miles, compared to about $5 per 1000 gallons for pipeline. The Great Man-Made River pipeline in Libya delivers approximately 1 Billion gallons of water per day to Libya's coastal cities from inland wells, over a distance of about 300 miles. The construction cost of the Man Made River was 30 Billion dollars. At amortization and maintenance charges of 5% per year, which is low, this amounts to approximately $5 per 1000 gallons, not including the cost of pumping energy, which is considerably greater than the energy cost of water transport by Superconducting Maglev.

Even more important, its pipelines are not practical in terrain that is substantially rising and falling in elevation, but requires installation in relatively flat terrain. A 300 foot rise or fall in elevation will decrease or increase the water pressure inside the pipeline by 150 psi, an unacceptable amount for a pipeline diameter of 13 feet or greater, which is needed to carry a billion gallons daily. If the pipeline route goes uphill by a substantial amount, a pump will be required to compensate for the rise in elevation. Likewise, if it goes downhill by a substantial amount, a turbine will be needed to lower the pressure in the pipe. The output power from the turbine can be fed to the pump but there will be substantial hydraulic and electrical losses that make it impractical for large pipelines in terrain with substantial changes in elevation, such as the route between the Columbia River in Oregon and Las Vegas and the rest of the U.S. Southwest.

In contrast, elevation changes pose no problem for superconducting maglev transport of water. The high speed train of Superconducting Maglev water transport vehicles simply coasts up and down hill with small changes in velocity – increasing speed slightly going downhill, and decreasing speed slightly going uphill. No propulsion energy input is needed; in fact, once the Superconducting Maglev water train gets up to its operating speed, it can coast for hundreds of miles before requiring more propulsion power.

The third application is the transport of highway trucks. Not only can Maglev transport highway trucks 5 times faster than if they went by highway (300 mph vs 60 mph) but this allows trucking to operate with far fewer trucks in their fleet to make deliveries, saving a great deal of money. Moreover, the operating cost per ton-mile by Maglev is only about 10 cents per ton mile compared to approximately 30 cents per ton-mile by highway, and the energy efficiency for truck transport by Maglev is considerably greater than by highway.

The cost figures for Maglev include the costs for amortization of the guideway and vehicles, propulsion energy, maintenance, and system personnel. In contrast, the costs for truck transport by highway do not cover the repair and maintenance costs to the highway caused by heavy trucks – one truck can cause as much highway damage as several thousand cars, according to the U.S. DOT, and do not include the costs of the deaths and injuries due to truck accidents not the congestion delay costs.

Description of the Proposed SUMMIT Test Facility

The SUMMIT (**SU**perconducting **M**aglev **M**ulti **I**ntegrated **T**esting) facility will demonstrate and certify Maglev vehicles for the 3 following types of service:

1. Electrical energy storage
2. Long distance transport of fresh water
3. Long distance high speed transport of highway trucks.

The 3 types of Maglev vehicles will use a common design on-grade guideway that can be installed at low cost. The guideway beam will be poured concrete monorail box beam positioned on a standard type concrete highway paved lane that will be approximately 20 feet in width.

The on-grade guideway beam has aluminum loop panels on each side of the beam. The aluminum loops interact with superconducting magnets on the vehicle (Figures 1,2, 3 & 4) to levitate and propel the Maglev vehicles. The levitation process is inherently stable; any external force acting on the Maglev vehicle – winds, curves, grade, etc., is instantly opposed by magnetic forces that act to keep the vehicle levitated. A set of aluminum loops in the panel carry AC current that push on the vehicle's superconducting magnets propelling it along the guideway.

The SUMMIT Facility would test full scale prototypes of the 3 Maglev vehicles on the on-grade guideway, the SUMMIT facility would have 2 phases, as described below:

Phase 1: Design, Construction of Guideway and Vehicles, and Initial Testing

The Phase 1 guideway would be approximately 4 miles in length (Figure 5). One end of the guideway would go uphill at an angle of 20 to 30 degrees, with an elevation rise in the range of 1500 to 3000 feet, depending on the location of the facility. The length of the ascending portion of the guideway would be in the range of 1/2 to 1 mile, again depending on the location of the facility, the remaining ~3 to 4 miles of the guideway would be on relatively flat terrain.

The following tests would be carried out on the 3 types of Maglev vehicles:

- Stable levitation of the vehicles when moving along the guideway.
- Stable levitation when stopped at designated locations.
- Acceleration to design speed using the magnetic propulsion system in the motor mode.
- Deceleration to a stop at a designated location using the magnetic propulsion system in the generation mode.
- Measurement of magnetic restoring forces as a function of displacement from the equilibrium suspension point.
- Measurement of propulsion energy efficiency, air drag losses, and I^2R losses in the aluminum guideway loops.
- Measurement of the amount of vehicle kinetic energy that can be recovered during braking and returned to the electric grid.

- Braking and vehicles set-down response if propulsion power input to the guideway is suddenly shut-off.
- Ability to load and unload 100-Ton Block from Maglev vehicle and to transport up and down grade.
- Ability to load and unload 50,000 gallons of water from Maglev vehicle and transport it along guideway.
- Ability to load and unload 2 fully loaded highway trucks on a Maglev vehicle and transport it along guideway.

Figure 5 shows a layout of the SUMMIT Facility.

At the end of Phase 1, which will be carried out over a period of 3 years, the following will have been established:

- Feasibility of Maglev for energy storage, water transport and highway truck transport.
- Performance data on load, speed, and power capability of Maglev transport vehicles.
- Safety data on vehicle stability and operating margins
- Optimum manufacturing methods for vehicles, guideway beams and panels, superconducting magnets, controls, etc., together with data on manufacturing costs.

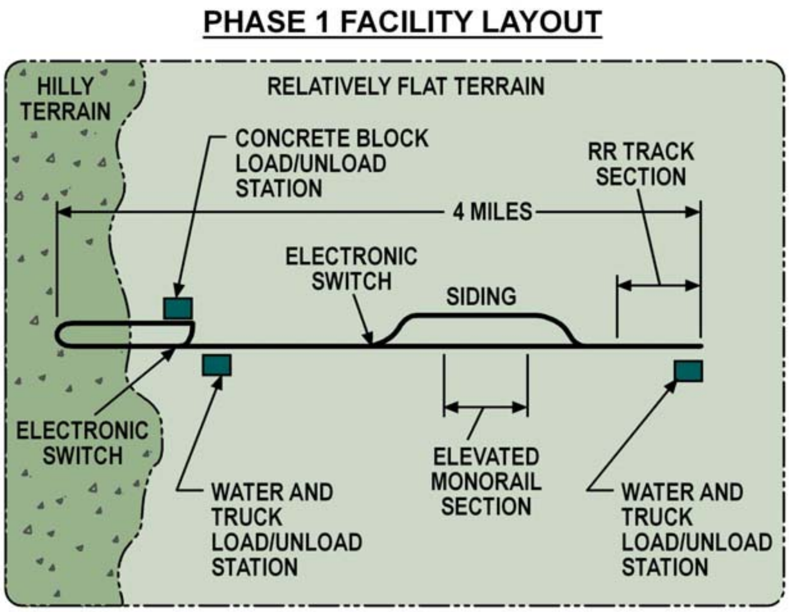
Phase 2: Extended Testing of Vehicles and Guideway System Developed in Phase 1

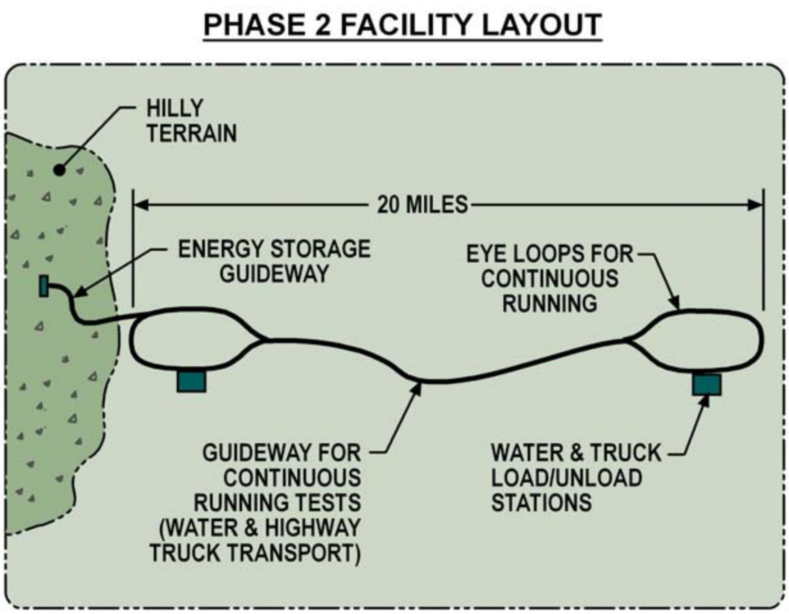
Phase 2 would extend the guideway constructed in Phase 1 and configure it for continuous running. The ~4 mile guideway built in Phase 1 would be a single line, requiring stopping at each end, and then accelerating back to speed on the return leg. While this configuration can demonstrate speed, acceleration, deceleration, load capability, response to external forces during the time it takes to travel from one end of the guideway to the other, it cannot demonstrate long term reliability and running performance.

Phase 2 will extend the guideway to a length of ~20 miles with a loop at each end (Figure 5), so that the Maglev vehicles can run at high speed continuously along the guideway. Operating at 6000 hours per year and 200 mph, a Maglev vehicle will accumulate a total running distance of 1.2 million miles per year, demonstrating high reliability and the ability to operate with very low maintenance. Multiple vehicles will be able to operate on the guideway, e.g., several water transport vehicles coupled together as a single consist, and several highway truck carriers operating as individual vehicles. The energy storage guideway would probably operate as a separate unit to demonstrate better the energy storage and energy retrieval capabilities of Maglev.

The guideway would incorporate electronic switching sections to demonstrate the ability of vehicles to switch from the main line to off-line stations for unloading and loading operations. This main guideway would also incorporate elevated monorail guideway sections enabling vehicles to pass over depressions in the terrain, roadways, etc. Using electronic switching, the Maglev vehicles could also transition to a section of conventional railroad track that had been adapted for Maglev travel.

Figure 5





Phase 2 would be carried out over a period of 2 years. At the conclusion of Phase 2, the following will have been established:

- Reliability of long-term operating performance.
- Long term maintenance procedures.
- Ability to operate in all weather conditions.
- Validation of projected operating costs.

After completing Phase 2, the 3 Maglev systems will be ready for commercial implementation.

The projected cost for the 3 year Phase 1 program is 160 million dollars, including design and construction of the 4 mile guideway, prototype Maglev vehicles for the 3 applications, power systems for vehicles propulsion, operating tests of the prototype vehicles, and design of the guideway and vehicles for Phase 2 testing, and initiation of construction for Phase 2.

The projected cost for the 2 year Phase 2 program is 170 million dollars, including the completion of the 20 mile guideway and commercially ready Maglev vehicles for long term testing and the operating tests themselves.

Benefits of the SUMMIT Program

The SUMMIT program will establish the operational feasibility and economic attractiveness of Maglev for the 3 commercial applications:

- Energy Storage
- Long distance transport of fresh water at low cost
- Long distance transport of highway trucks at low cost

The 3 applications will be of benefit to the U.S. generally, but of special benefit to Nevada and the other States of the Southwestern U.S. Nevada and the Southwest in general are prime locations for renewable wind and solar power generation. However, the utility of large wind and solar power farms to meet U.S. power needs as presently constrained by the need to match their time varying output to the demands of the electrical grid. Maglev energy storage will enable very efficient, very low cost storage of electrical power, so that wind and solar power output can meet the time varying power demands of the electrical grid.

The long distance transport of fresh water at affordable cost is critically important to Nevada and its neighboring States in the Southwest. Lake Mead is drying up, water resources are shrinking, and drought conditions are worsening. Bringing large amounts of fresh water from the Columbia River and other sources would ease restrictions on water use for crops and people living in the water scarce areas.

The long distance transport of highway trucks by Maglev would greatly ease highway congestion in all parts of the U.S. The I-15, I-5 and other highways in Nevada, California, and their neighboring States are highly congested, with long delays. The delays, besides being very aggravating, consume copious amounts of fuel, adding to the Nation's oil import needs and greenhouse gas emissions. Taking trucks off the highways will reduce accidental deaths and injuries, and also reduce damage to public health from the pollutants and micro-particles emitted from the diesel trucks. In addition, damage to highway pavements and the resultant costs of repair and maintenance will be greatly reduced. A single 18-wheeler truck causes as much damage to highways as thousands of automobiles, according to the U.S. DOT.

The cost of developing the 3 Maglev applications will be tiny compared to the social and economic benefits they will produce. The benefits will pay back the cost of development manifold.

And Finally – It's About Jobs

America needs to create millions of new, well-paid jobs to stop the continuing decline in housing, healthcare, education, infrastructure, national security and other important areas. In this endeavor, it is crucial that the new jobs:

1. Provide long-term payoffs, in terms of making the U.S. more competitive in the World economy, increasing U.S. manufacturing exports, increasing U.S. self-sufficiency and reducing the U.S. trade deficit and the need to borrow from abroad.
2. Be funded primarily by the private sector, not by the government, and that the jobs created actually reduce the government deficit and total debt. Government funds should work towards creating the conditions that will attract private investment into ventures that generate the new jobs, and not directly fund the jobs themselves.
3. Reduce U.S. dependence on foreign oil imports, cut greenhouse gas emissions, improve the environment, move towards "greener" energy sources, and reduce the damage to public health caused by pollutants from existing power plants and transportation systems.

We believe that Maglev will be a major mode of 21st Century transport and that it can create millions of U.S. jobs. Maglev vehicles are magnetically levitated and propelled along a guideway without mechanical contact or friction at hundreds of miles per hour. They have no engines, do not burn oil, are much more energy efficient than autos, airplanes, and trains, whether they are high speed rail or commuter rail types. Maglev vehicles do not emit pollutants or greenhouse gases, are very quiet without rail or engine noise, and very smooth, vibration-free, comfortable ride.

The new 2nd generation Maglev-2000 system is a major evolutionary step beyond the present 1st generation Japanese and German Maglev systems – as far advanced as modern jet airliners are beyond the 1930's DC-3 and a quantum step change in transportation beyond the steel-wheel on steel rail guided surface transportation systems, which have changed little since their 19th Century advances. The unique and very important capabilities include:

- Maglev-2000 routes can be privately financed with government funding and subsidies.
- Much lower construction cost – less than 1/3 of Japanese and German 1st generation Maglev systems.
- Ability to transport highway trucks at 300 miles per hour and much lower cost per ton-mile than driving by highway or by piggy-back rail.
- Ability to transport passengers with trip times comparable to airplanes, but more comfortably, more conveniently and at lower cost.
- Ability to adapt existing heavy rail and commuter real tracks for levitated Maglev vehicles, at very low cost, e.g. 4 million dollars per 2-way mile. Trip times for travelers are reduced and fares are considerably lower, and government subsidies – which now are much greater than fare revenues – will be virtually eliminated.
- Ability to function as a 25,000 mile long National Maglev Network that will interconnect all major U.S. major metropolitan areas with 300 miles per hour travel of passengers, highway trucks, personal autos, and freight containers. Transport costs will be greatly

reduced. Over 70% of the U.S. population will live within 15 miles of a local Maglev station, from which they can rapidly travel to any other station in the U.S.

If the U.S. chooses to build steel-wheel HSR systems, American transport will continue to deteriorate with ever scarcer and higher priced oil fuel, ever more congested highways and airways. The small benefits that HSR lines will provide to a few local regions will come at the price of very few new jobs and major increases in the U.S. Government deficits and the U.S. trade deficit. Superconducting Maglev, on the other hand will provide major benefits in the areas outlined above.

The privately financed 25,000 mile long National Maglev Network **will create more than 1 million new jobs in a wide variety of industries**, including materials production, -- concrete, aluminum wire guideway loops, electronic power switches and controls, sensors, superconductors, etc. – manufacture of vehicles and cryogenic equipment, construction of elevated high speed guideways, adaptation of existing railroad tracks, and operating personnel – traffic control, guideway and vehicle maintenance, station operation, and other allied skill sets.

U.S. transport accounts for roughly 25% of World transport. **A U.S. based Maglev industry would generate well over an additional 1 million manufacturing jobs in the U.S. for exports of U.S. 2nd generation Maglev systems to the rest of the World**. 1 container ship can transport 20 miles of prefabricated 2nd generation Maglev-2000 guideway beams and associated Maglev vehicles from the U.S. to any port in the World. Once unloaded at the port, the guideway beams and vehicles can be easily trucked to the construction site, there to be quickly erected for operation by conventional cranes at very low cost.

Maglev is inevitable because it has high energy efficiency, much lower cost of transport, does not depend on oil, does not contribute to global warming, increases economic efficiency and productivity and does not harm the environment.

The only question is: will America lead the world in 2nd generation superconducting Maglev, with a manufacturing industry that will create millions of new jobs and many billions in exports, or will America buy it from abroad and lose the opportunity for new jobs and a massive export industry? The container ships carrying Maglev guideway beams and vehicles can just as easily sail into U.S. ports as out of them. America has only a few years to seize the 2nd generation superconducting Maglev opportunity before another Country takes it.

The SUMMIT program will accelerate the integration of 2nd generation superconducting Maglev systems into service for a national logistics network, low-cost efficient storage of electrical energy complementing other renewable sources, and will provide a new option for fresh water distribution in the United States. With Nevada in a leadership role on the SUMMIT program the Silver State could benefit from a diversity of high tech and manufacturing jobs that will draw the much needed alternative for a State economy that is highly dependent upon the singular revenue of the resort and tourism sector while entering the nascent domain of renewable energy sources. This SUMMIT initiative is also a vital organizing framework for the scientific, technical and sustainability programs of the Nevada's higher education system. It is projected that full-funding of the five year, two phase SUMMIT testbed would create over 3,000 high paying jobs in

Nevada alone. Of equal importance it will provide the magnet for drawing in scores of research, development and manufacturing enterprises providing products and services to an emerging Maglev industry. This American manufacturing renewal can provide Nevada with the global leadership role for a green, sustainable transportation infrastructure and advanced maglev energy storage.

The flaccid response to the stimulus of the American Recovery and Reinvestment Act has told us quite clearly that it's no longer about "shovel ready" jobs, it's all about building a new foundation for enduring American enterprise and ingenuity. Are we up to this bold task?

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