9 REASONS WHY 2ND GENERATION MAGLEV II IS MUCH BETTER THAN HIGH SPEED RAIL FOR MEETING U.S. TRANSPORT NEEDS

1. HSR routes cannot be privately financed and will require massive government subsidies. Maglev II can be privately financed after demonstration.

2. HSR travel per passenger mile will be much more expensive than Maglev II travel

3. HSR will not significantly contribute to meeting future U.S. transport needs. It will carry only a very small fraction, less than 1% of U.S. annual air passenger miles. Maglev II will result in major reductions in auto, truck, and air transport. HSR can only carry passengers and will be built only in a few isolated corridors that do not interconnect. Maglev II can carry passengers, intercity highway trucks and personal autos at lower cost and much greater speeds than by highway. The 25,000-mile National Maglev Network will interconnect all U.S. metropolitan areas. Passengers, trucks, and autos can go from the East Coast to the West Coast in a few hours.

4. HSR will not generate U.S. high tech jobs, and will increase the U.S. trade deficit by imports of HSR equipment. Maglev II will create hundreds of thousands of new high-tech jobs, and will greatly reduce the U.S. trade deficit by exports of U.S. Maglev equipment and by reductions in oil imports.

5. HSR average operating speeds in Europe are not much above 100 mph, when stations stops and accelerations/deceleration times are taken into account. Maglev II offers much higher average speed because vehicles can accelerate and decelerate much more rapidly, and electronically switch at high speed to off-line stations. Also, Maglev vehicles offer much greater frequency of service because they travel as individual units, not as long trains of many cars that require waiting to accumulate many passengers for the train.

6. HSR will not significantly reduce U.S. oil consumption. The 25,000-mile National Maglev II Network, in combination with electric autos, can eliminate most of the oil imports to the U.S.

7. HSR will not significantly reduce U.S. greenhouse gas emissions. The 25,000-mile National Maglev II Network, in combination with electric autos, can reduce U.S. CO_2 emissions by 20%.

8. HSR trains are extremely noisy and cause excessive noise levels to disturb people who live along the HSR route. Maglev travel is very quiet and will not bother people along a Maglev route.

9. HSR, when compared with U.S. Maglev, falls short of the mark in four critically important National missions areas: (1) rapid all-weather, evacuation and supply of areas hit by a natural disaster, (2) rapid shipments of goods and people in support of the Defense mission, (3) stabilization of the electricity supply by efficient storage of electricity for use when demand is high or interruption of electric service by failure of the grid, and (4) the capability to transport Billions of gallons of water per day to supply dry areas.

9 REASONS WHY 2ND GENERATION MAGLEV II IS MUCH BETTER THAN HIGH SPEED RAIL FOR MEETING U.S. TRANSPORT NEEDS

JAMES JORDAN AND JAMES POWELL

A program to build High Speed Rail (HSR) routes in the U.S. based on European steel-wheel train technology would be an economic disaster. Such a system would require massive government subsidies, and moreover would not significantly contribute to the goals of efficiently meeting future U.S. transport needs, of reducing U.S. dependency on oil imports, of cutting greenhouse gas emissions and of producing sustainable high tech jobs based on American manufacturing and ingenuity. The reasons for this are summarized below.

In contrast, the 2nd generation Maglev II transport system can be privately financed and will not require government subsidies, unlike HSR, which would be limited to a few isolated high traffic density routes servicing a small number of travelers. Maglev II can form a 25,000 mile National Maglev Network that would interconnect all major metropolitan areas in the continental U.S. 70% of the U.S. population would live within 15 miles of a Maglev station, from which they could reach any other metropolitan region in a few hours, traveling at an average speed of 250 mph, including station stops. In contrast, traveling by HSR, average speed would be much slower, and limited to a few city pairs, e.g. NYC to Washington, or Chicago to Minneapolis. If one lives in Chicago and wants to go to Cincinnati, there would be no HSR line to that city. If one lives in Cincinnati, there would be no HSR lines, period. The fastest average speed on European HSR lines is only 130 mph – 1/2 that of Maglev – because of station stops and the slow acceleration capability of HSR trains. A transcontinental trip on Maglev would take about 10 hours, only slightly longer than by air, when the access time to an airport is included. By HSR, it would take 20 hours.

HSR trains can only carry passengers. Different Maglev –2000 vehicles can carry passengers, or roll-on, roll-off, highway trucks, personal autos, and freight containers. Not only does this greatly increase the revenues on a Maglev route, as discussed below, enabling Maglev routes to be privately financed, but it also results in the Maglev II systems providing a much greater role in meeting U.S. future transport needs than possible with a few isolated HSR routes.

The 9 reasons why 2nd generation Maglev II is a much better transport system than HSR are given below.

1. HSR routes cannot be privately financed and will require massive government subsidies, 1st Generation Maglev will require massive government subsidies. 2nd Generation Maglev II routes can be privately financed.

The proposed New York to Washington, DC HSR route to replace Amtrak's Acela is projected to cost approximately 40 Billion dollars. The present ridership on Acela is 3.6 million passengers annually, or about 10,000 passengers daily.

10,000 passengers per day is typical of most HSR routes in Europe. The highest HSR ridership in Europe is 20,000 passengers per day on the EuroStar route between London and Paris, through the Chunnel at 50 cents per passenger mile, the typical fare for European HSR, and about what Acela passengers now pay. (The EuroStar carries about 70% of the London to Paris travel, and will not grow very much in coming years.) The revenue from 10,000 passengers per day would be about

400 million dollars annually for the 220 mile NYC-Washington HSR route. Assuming that 2/3 of the revenues go towards operating expenses, leaving 1/3 for profit (which is optimistic) **it would take 300 years to pay back the proposed HSR route construction cost.** Private investment would never undertake such a project. Even if traffic doubled to 20,000 passengers daily, equal to the London to Paris EuroStar, it still would take 150 years to pay back construction cost. It would require 300,000 passengers daily to pay back HSR construction costs in 10 years, the maximum payback time that private investment would tolerate. Such traffic densities are completely impossible for any potential HSR rote in America.

Conclusion? HSR routes in America will have to be financed by the government and heavily subsidized. Clearly not politically feasible.

The situation is very different for Maglev II routes. Because Maglev can transport high revenue roll-on, roll-off highway trucks, it can payback its guideway construction cost in under 5 years by carrying just 1/5th of the 15,000 highway trucks that travel daily on a typical Interstate. The transport outlay for intercity highway trucks in the U.S. is very large, over 300 Billion dollars annually, with a cost of 30 cents per ton-mile and average haul distances of 500 miles. With a net revenue of 17 cents per ton-mile and 3000 trucks daily (each with a typical 30 ton load) the 25 million dollar per mile construction cost of a Maglev route could be paid back in only 4 and one-half years. In practice the payback time will be even shorter, since most trucking companies will want to use Maglev (one truck going by Maglev can deliver 4 times as much load per week as by highway) and there will be additional revenue from transporting passengers and personal autos. The short payback time will attract private investment.

2. HSR Travel will be much more expensive than Maglev travel.
Representative U.S. passenger transport costs are given below

Table 1
Cost of Passenger Transport in the U.S. vs Transport Mode

Mode	Cost/Passenger Mile, Cents	Basis
Air Travel	12.7	U.S. Statistical Abstracts (2006 value)
Auto Travel	52 (per vehicle mile)	Datapedia of the United States (2005 value)
HSR Travel	50 Fare	Assumed same as Europe
	125 Gov't Subsidy for Construction	Based on 5% Interest Charges on $40 Billion HSR route Carrying 20,000 passengers per day
	175 Total True Cost	Carrying 20,000 passengers per day
Maglev	10	Net Revenue = 7 cents/PM after deducting operating costs

U.S. data shows that for trips up to ~1000 miles in length, more people drive than take airplanes. For longer trips they tend to go by air. With HSR fares per passenger mile 4 times greater than for air travel, it is very unlikely that people will decide to take HSR in preference to cars, until travel distances are even greater than 1000 miles. It is also unlikely that travelers will choose HSR over air travel because of the higher cost per passenger mile for HSR.

The 125 cents per passenger mile government subsidy assumes that the government sells bonds with a 5% return to pay for construction cost (the recent drop in interest rates for government bonds is only temporary), and that the HSR (route ridership is 20,000 passengers daily on the NYC-Washington DC route.

The Maglev II fare cost has a net revenue of 7 cents per passenger mile after deducting 3 cents per passenger mile for electrical energy cost, vehicle amortization (Maglev II vehicles are much lower in cost than airplanes), and personnel.

3. HSR will not significantly contribute to meeting future U.S. transport needs. Maglev II will result in significant reductions in auto, truck, and air transport.
Table 2 shows the total passenger miles and truck ton-miles for the existing modes of transport in the U.S., plus projections of what HSR and Maglev could do if implemented.

Table 2
Annual U.S. Passenger and Truck Ton Miles vs Transport Mode

Mode	Parameter		Basis
Auto & SUV	2.7 Trillion	Vehicle Miles	Statistical Abstracts (1.5 Pass'gers/vehicle)
	~ 4 Trillion	Passenger Miles	
Air	745 Million	Passengers Emplaned	U.S. Statistical Abstract (2006 Values)
	797 Billion	Passenger Miles	
Amtrak	25 Million	Passengers Carried	U.S. Statistical Abstract (2006 Values)
	5.4 Billion	Passenger Miles	
Intercity Trucks	1.05 Trillion	Ton Miles	U.S. Statistical Abstract (2006 Values)
HSR	80 Million	Projected Passengers	11 HSR Systems 20,000 Pass/Day 200 miles Avg
	16 Billion	Projected Passenger Miles	
Maglev	2 Billion	Projected Passengers	Projected for 25,000 mile National Maglev Network
	800 Billion	Projected Passenger Miles	
	500 Billion	Projected Intercity Ton Miles	

Even if 11 HSR systems are built in the U.S., and in the unlikely event that each system were to carry 20,000 passengers daily, the maximum ridership in Europe (most routes are substantially less), HSR would only handle 16 Billion passenger miles, 1/50th of domestic air travel. 2% of the U.S. air travel market. What good would that be? How would it contribute in any significant way to U.S. transport needs?

In contrast, the 25,000 mile National Maglev Network would capture most of the U.S. domestic air travel market, most of the intercity truck market, and a large fraction of the long distance automobile trip market because drivers will be able to take their personal autos with them if they want to.

4. HSR will not generate U.S. high tech jobs, and will increase the U.S. trade deficit by imports of HSR equipment. Maglev II will create hundreds of thousands of new high-tech jobs, and will greatly reduce the U.S. trade deficit by exports of U.S. Maglev equipment and by reductions in oil imports.
HSR is a fully mature technology, with no opportunity to create high tech design and manufacturing jobs and profits will be in foreign countries. The only U.S. jobs will be construction jobs to lay rail and build stations. **The high cost of importing HSR equipment will significantly increase the U.S. trade deficit, now at 700 Billion dollars annually. Moreover, HSR will not significantly decrease U.s. oil consumption, so that the 500 Billion dollars America spends per year on oil imports will not be reduced.**

Maglev II, in contrast, will create hundreds of thousands of new high tech jobs in designing and manufacturing Maglev equipment. Maglev will decrease the U.S.trade deficit, not increase it, by exporting Maglev equipment to other countries. The export value of Maglev equipment will be many Billions of dollars annually. In addition, by reducing oil imports, the 25,000 mile National Maglev Network will shrink the annual U.S. Trade deficit by hundreds of Billions of dollars.

If the U.S. does not grasp the opportunity to develop a domestic Maglev industry, it will ultimately need to import foreign Maglev Systems, because HSR will not meet U.S. transport needs. One container ship can import 20 miles of prefabricated Maglev II guideway along with Maglev II vehicles. Instead of decreasing the U.S. trade deficit, and helping to restore the manufacturing industry in the U.S., HSR would continue America's manufacturing decline.

5. HSR average operating speeds in Europe are not much above 100 mph, when stations stops and accelerations/deceleration times are taken into account. Maglev II offers much higher average speed because vehicles can accelerate and decelerate much more rapidly, and electronically switch at high speed to off-line stations. Also, Maglev vehicles offer much greater frequency of service because they travel as individual units, not as long trains of many cars that require waiting to accumulate many passengers for the train.
The fastest average HSR speed in Europe is on the TGV Paris-Lyon line, at 130 mph. The maximum HSR speed is 220 mph. Average speed for HSR is significantly less than the maximum speed, because of intermediate station stops, and the low acceleration/deceleration rates for HSR trains, on the order of only $1/5^{th}$ that of an automobile that goes from 0 to 60 mph in 12 seconds – a rather low rate for the average auto.

Average HSR speeds are significantly lower for other European HSR lines. The new HSR line between Madrid and Seville has a somewhat lower average speed of 120 mph. **The Eurostar train between London and Paris for example averages 110 mph, not much greater than the Boston- Washington Acela trains, which averages 83 mph.**

At 130 miles per hour, it would take 20 hours for an HSR train to travel from NYC to Los Angeles compared to about 9 hours by air, when the security time is included.

The average speed on Maglev II routes will be much greater, because the vehicles can electronically switch at full speed to secondary guideways that lead to off-line stations. Traveling on Maglev II, the passenger vehicle would bypass stations at high speed that it was not scheduled to stop at, providing, non-stop service for most passengers. Moreover, the Maglev vehicles can easily accelerate as fast as automobiles, eliminating the long time to attain speed required by HSR trains. **With a maximum speed of 300 mph for Maglev II vehicles, average speeds of 250 mph can be readily achieved, enabling a cross-country trip in only 10 hours – twice as fast as HSR, and almost as fast as air.**

Since Maglev vehicles can travel as individual units with 100 passengers, instead of long HSR trains with many cars and many hundreds of passengers (The EuroStar has 800 passengers per train), travelers on Maglev will not have to wait more than a few minutes between Maglev vehicles instead of hours, as often is the case for HSR trains.

6. HSR will not significantly reduce U.S. oil consumption. The 25,000 mile National Maglev II Network, in combination with electric autos, can eliminate most of the oil imports to the U.S.

Although HSR trains are electrically powered, this will only meet a very small percentage of U.S. transport demand, and consequently have very little impact on U.S. oil imports. The U.S. currently consumes about 5 billion barrels of oil per year for transport, with another 2.5 Billion barrels going for industrial and residential use.

The recent Oak Ridge study on energy use for transportation shows an average consumption of about 6 barrels of oil per 10,000 passenger miles for both air and auto transport. **On this basis, 16 Billion passenger miles for HSR transport in the U.S., 3 times greater than the 5.4 Billion passenger miles presently supplied by Amtrak, would only save 10 million barrels of oil per year, just 1/500th of what America presently consumes for transport – a trivial amount in terms of reducing oil imports.**

In contrast, Maglev II, in combination with electric autos, can save several billion barrels of oil annually, the 25,000 mile National Maglev Network would transport the bulk of the long distance movement of passengers and freight by air, autos, and trucks. Short local trips of 50 to 100 miles would be provided by electric automobiles. Maglev II would enable travelers to take their personal autos with them in long distance trips, if they wanted to do so.

7. HSR will not significantly reduce U.S. greenhouse gas emissions. The 25,000 mile National Maglev II Network, in combination with electric autos, can reduce CO_2 emissions by 20%.

CO_2 emissions from the U.S. transport sector are approximately 2 Billion tons per year, about the same amount as from U.S. coal fired power plants, and one-third of all U.S. CO_2 emissions.

HSR trains, as noted in reason #6, would only save 1/500th of present U.S. transport oil consumption, so are related reduction in CO_2 emissions would be 1/500th x 1/3 or 0.07%. **HSR has virtually zero effect on U.S. greenhouse gas emissions.**

Maglev in combination with electric autos, on the other hand, can cut U.S. CO_2 emissions from 2 Billion tons per year by a factor of approximately 2/3, resulting in a reduction of 20% from the total current emissions for the U.S.

Maglev would provide most of the long distance trips now made by oil fueled trucks, airplanes, and autos. Electric autos would be used for short local trips of 50 to 100 miles between recharging. For travelers wanting to take their autos with them for long trips, they could take them on Maglev vehicles, at lower cost and much more rapidly than by driving.

The future reductions in CO_2 emissions by implementing Maglev would be much larger than the ~ 1 Billion tons savings based on current transport levels. Passenger miles and truck ton miles are projected to almost double in the next 20 years as the U.S. population grows and living standards improve. In addition, as oil supplies shrink, it will be necessary to manufacture synfuels from coal and oil shale, if the U.S. continues to depend on oil-fueled transport (Biofuels can only supply a tiny fraction of U.S. transport fuel needs). Manufacturing a gallon of synfuel from coal or oil shale doubles the effective CO_2 release to the atmosphere, as compared to extracting conventional oil from the ground and using it for transport.

The growing U.S. transport demand plus the use of synfuels to replace depleting conventional oil would increase U.S. CO_2 transport emissions from the current 2 Billion tons per year to 8 Billion tons per year, if the U.S. continues to rely on oil fueled transport. U.S. total CO_2 emissions would essentially double from 6 Billion tons per year to 12 Billions per year. Maglev will prevent this increase from happening.

8. HSR trains are extremely noisy and cause excessive noise levels to disturb people who live along the HSR route. Maglev travel is very quiet and will not bother people along a Maglev route. Steel-wheel on rail noise is highly objectionable to people who live near rail lines and a major factor in local opposition to installation of new rail lines. Maglev vehicles do not contact the guideway, and produce no mechanical noise. There is some aerodynamic noise at very high speeds; however, in the Maglev II system the high-speed intercity vehicles operated on guideways alongside the Interstate Highways, and the Maglev noise levels are well below those levels that already exist on the Interstates. In the urban/suburban portions of metropolitan regions, the maximum Maglev speed will be 100 mph, with noise levels far lower than those for commuter and light rail. In fact, since Maglev will use existing rail lines in urban/suburban areas, with the very quiet levitated Maglev vehicles making no rail noise. Local people will welcome the conversion to Maglev.

9. HSR, when compared with U.S. Maglev, falls short of the mark in four critically important National missions areas: (1) rapid all-weather, evacuation and supply of areas hit by a natural disaster, (2) rapid shipments of goods and people in support of the Defense mission, (3) stabilization of the electricity supply by efficient storage of electricity for use when demand is high or interruption of electric service by failure of the grid, and (4) the capability to transport Billions of gallons of water to supply dry areas.

HSR will not be able to significantly evacuate large numbers of people from metropolitan areas that experience natural disasters, or a chemical, biological or nuclear terrorist attack. As evidenced by Hurricanes Katrina and Rita, there exists no effective way to evacuate large numbers of people from stricken metropolitan regions like New Orleans, Houston, and most of the major population areas in the U.S. Roads get jammed with cars, autos run out of gas, accidents occur, etc.

High Speed Rail cannot serve as an emergency evacuation system in America. The passenger capacity is too small and most cities would not be served by High Speed Rail lines.

However, with the 25,000 mile National Maglev Network that interconnected all of the major metropolitan regions in the U.S., large numbers of refugees from a stricken area could be transported to many different cities, easing the load on each of the refuge points. For example, by coupling 5 Maglev vehicles into a single consist with 1 minute headway between consists, and 160 people per vehicle, 50,000 people per hour could be transported to many other cities on the network or 1.2 million people per day. Highways could not begin to handle that load, no could airways,, conventional rail, or high-speed rail.

High Speed Rail can only transport passengers and not freight. Conventional rail averages only about 20 mph in moving freight across country, plus the long periods needed to lead up the many cars on a typical freight train. In contrast, Maglev can move freight at 300 mph across country, and transport it on single vehicles. This fast transport is extremely important for moving materiel that would be vitally needed for National Defense.

High Speed Rail has no role whatever for energy storage of electricity. In contrast, Maglev vehicles can b e used to store many hundreds of megawatt hours of electrical energy by transporting heavy concrete blocks from a lower to higher elevation, and returning the electrical energy to the grid by transporting them back downhill converting their stored potential energy back to electrical power. The cost of storing electric energy using Maglev is very low, only about 2 cents per kilowatt hour, compared to the typical power cost of 10 or more cents per kilowatt hour.

Maglev energy storage units can be located anywhere in the U.S. In hilly terrain, they would use the natural differences in elevation, with a guideway going between higher and lower elevations for the transport of the concrete blocks. In flat terrain they would use an underground shaft or inclined tunnel in which the blocks would move.

Maglev energy storage can be used to stabilize electrical grids, so that damage to an individual transmission line or a power plant would not shut down a large regional grid.

Maglev energy storage can also be used to store electrical power form highly variable solar and wind power sources. So far, there has been no practical way to store wind and solar power other than pumped hydro, which is very limited in locations where it can be applied. Maglev energy storage will enable solar and wind power to play a much greater role in U.S. energy production. Finally, Maglev can transport very large volumes of water, billions of gallons per day, over long distances, hundred of miles, at much lower cost than by pipeline, with much lower power requirements, Maglev could dramatically help water scarce regions like Nevada, Southern California, and Arizona meet their water needs.