MAGRAIL™ AND LIM-RAIL TECHNOLOGY DEVELOPMENT REPORT

High Speed Magnetic Levitation Transit on Standard Railway Infrastructure

A Multi-Phase Rail Transportation Solution:

Phase 1: LIM-Rail- A low cost rail electrification program that requires no modification to existing rolling stock

Phase 2: MagRail™- A low cost magnetically levitated vehicle platform capable of levitating off existing railroad tracks with limited infrastructure modifications

INNOVATIVE TRANSPORTATION SYSTEMS CORPORATION

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Executive Summary

In the media, global warming and dependence on fossil fuels have become growing international concerns while in the US, increased pressure is being placed on the reduction of passengers and freight on highways. At the same time, airlines are being required to move air cargo separately from passenger baggage and fuel costs continue to rise. In spite of the growing challenges these issues have created, US railways, highways, shipping yards, and airports continue to get more congested while railway operators such as Amtrak continue to lose money and face congressional budget cuts. A key factor fueling the escalating problem is that today's rail transportation system utilizes older technologies that do not take advantage of many recent advances in propulsion, speed, suspension, traction, power reduction, distribution, storage, and regeneration. As a result, the railway transportation system is needlessly expensive to operate due to inefficient energy consumption, unnecessary maintenance, and under-optimized throughput; is dependent on foreign oil due to large consumption of diesel fuels; is putting unnecessary strains on our ecosystem due to carbon emissions and noise pollution; and is not competitive with the speed and convenience of alternate transportation solutions, leading to unnecessary congestion on highways, airports, and seaports. Most of the approaches that are being proposed today, such as traditional maglev and high-speed rail, require expensive capital funding for new infrastructure and are not generally cross-compatible between freight and passenger transportation. Until now, there have not been any feasible solutions that would enhance today's rail transit system without the need for major overhauls or construction of costly new infrastructure. This is the void that Innovative Transportation Solutions Corporation (ITSC) proposes to fill with its ground-breaking MagRail™ and LIM-Rail technologies.

Based in San Diego California, ITSC is a socially and environmentally conscious company with a dedication to exploiting the latest advances in technological innovation to overcome today's most insurmountable challenges, both in our immediate lives and in the nation's future. ITSC was formed not in an executive boardroom or by an organizational boilerplate from a venture capitalist, but by a proven entrepreneur frustrated with the inadequacies of our nation's transportation system and inspired by vision of harmonious balance between nature and commerce. With a growing team of likeminded individuals and industry experts, ITSC has successfully developed key technologies that are positioned to revolutionize a marginalized and aging railway system. These technologies, including both the LIM-Rail and MagRail™ systems, propose to not only address many of today's pressing issues, but catapult California to the forefront of environmental and transportation innovation, revitalize a struggling rail industry, and stimulate Southern California's high-tech economy and skilled labor employment.

1 Introduction

This paper is provided to give a development update of select technologies being pursued by Innovative Transportation Solutions Corporation (ITSC). It has been structured to provide a brief overview of the technologies, the numerous benefits the technologies offer, the status of development, the market potential, and the plan to bring these technologies to market. This paper is not intended to provide a detailed description on how the technologies work.

2 Description of Technologies

LIM-Rail and MagRail are two technologies currently under development at ITSC. Separately, these technologies each promise to bring unique solutions to a problematic and underutilized railway system. Combined, these technologies could redefine the entire transportation industry.

2.1 LIM-Rail Technology

The patent pending LIM-Rail system utilizes linear induction motor (LIM) technology for railway propulsion. Linear induction motors, first conceived in 1905 by Robert Goddard[1] and demonstrated in 1935 by German engineer Hermann Kemper, are electric motors that produce motion along a linear stator instead of a cylindrical axis. Linear induction technologies similar to the ITSC LIM-Rail system have been utilized in a number of recent railway transit programs, including the Vancouver Light Rail, the Detroit People Mover, the JFK AirTrain, the Scarborough Light Rail, the Shanghai Transrapid maglev, and the General Atomics maglev[2] prototype. The LIM-Rail system proposed by ITSC differs from these conventional applications by reversing the stator and armature configuration. This new and innovative approach, as illustrated in Figure 1, utilizes linear synchronous or induction windings wrapped around an iron core, fastened to the railway ties, and powered by the electric grid to cleanly and inexpensively move standard cars with aluminum plates or permanent magnets attached to the underside. By passing the plates over the passive coils during breaking and downhill segments, this system also acts as a generator for grid power.

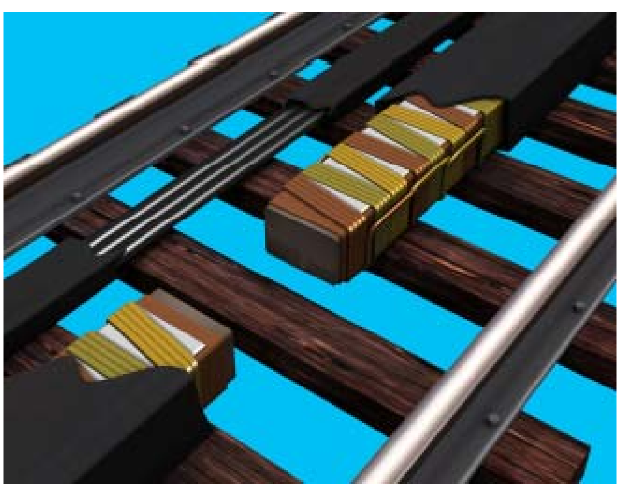


Figure 1: Proposed LIM-Rail Design

[1] Robert Goddard was also attributed with the invention of the liquid fuel rocket
[2] For the purposes of this report, linear Induction motors and linear synchronous motors are used interchangeably; each has some advantages and disadvantages but functionally fulfill the system requirements.

Historically, it was believed that a linear induction system with magnetic windings located in the underside of the rolling stock was less expensive to construct than one with the windings in the track itself due to materials and production requirements of the magnetic coils. However, with the magnetic coils mounted to the underside of cars, conventional systems have necessitated the addition of a wayside power source in the form of either a third rail or overhead catenary system, both of which cost nearly as much as the proposed LIM-Rail system alone. In addition, third rails and catenary wires present exposed live power sources that require additional system cost in the form of fencing, tunneling, or elevated tracks to meet public safety standards. The catenary overhead wires are considered visual pollution to an ever growing population. The proposed LIM-Rail system, on the other hand, is only energized when the vehicle is positioned directly above the coils, eliminating the safety hazard of exposed power sources. Conventional linear induction systems also require the replacement of existing rolling stock with proprietary cars designed specifically to operate on the modified track. The LIM-Rail system, on the other hand, provides a standardized design requiring little modification, allowing for relatively minor retro-fitting of existing cars and greater competition among rolling stock suppliers, both of which will help contain long term costs associated with the overall system. An additional benefit of LIM-Rail is the fact that the trains are capable of ascending grades more than twice as steep as conventional rail systems allowing for shorter and more direct routing in mountainous terrain when used in new applications.

The LIM-Rail design, because it is cross-compatible with standard rail operation, can be implemented in stages using a combination of standard locomotives and helper cars with plates or magnets mounted on the underside. This approach will allow for upgrades of the entire system in incremental steps without extensive periods of system downtime. As an example, LIM-Rail could be installed first in urban areas where pollution is of greatest concern. While operating in this area, helper cars with underside mounted plates would propel the train. However, when the train leaves the upgraded area, the conventional locomotive would be utilized to pull the cars to the next upgraded area. The outlying regions could be retrofitted with the LIM-Rail in stages that allow for the greatest reduction of harmful emissions in areas that create the largest impact to public health.

2.2 MagRail™ Technology

MagRail™ is a patent pending technology that utilizes properties of permanent and electromagnets, largely unknown to the academic or engineering communities, to suspend vehicles on existing railroad tracks. The MagRail™ technology is tangential to the technology used in Magnetic Levitation (maglev) Trains, conceived in 1915 by Robert Goddard and Emile Bachelet, and more recently demonstrated by a host of German, Japanese, and US companies. Traditional maglev trains use a series of magnets to lift and propel passenger trains to speeds in excess of 300 MPH with no physical contact to the supporting guide-way. In German and US maglev trains, electromagnets fitted on the underside/top or both of specially designed guide-ways are used to lift and propel the train that are wrapped around the guide-way while in the Japanese system, superconducting magnets on the vehicles and embedded windings in a u-shaped guide-way are used to repel and propel a vehicle lying within the guide-way itself. While maglev prototypes and commercial lines have demonstrated drastically reduced operating costs and carbon emissions, incompatibilities with existing rail infrastructure and $60-150 million per mile construction costs have become insurmountable impediments to mainstream adoption. The high cost of maglev systems results from the need for a standalone guide-way construction featuring active magnetic coils embedded directly into the guide-way and, in the case of the Japanese design, the addition of liquid cooled superconducting magnets. The MagRail™ concept, on the other hand, relies primarily on inexpensive permanent magnets for stand-alone levitation above standard steel railroad tracks without the need of wayside power sources. During operation, a low power control system can be used to center the vehicle between the tracks and assure no contact with the steel rails. This results in a permanently levitating platform or rail car without rolling resistance. An advantage of this technology is that it can be implemented on existing tracks and powered by a standard locomotive for immediate application with little infrastructure modification resulting in a substantial reduction in fuel consumption. It is also possible to propel the vehicle using an onboard source of power and a third passive iron rail or in conjunction with the LIM-rail concept described herein.

3 Value Proposition

Both the LIM-Rail and MagRail technologies offer numerous benefits to individuals, businesses, and governmental agencies as well as the entire eco-system as a whole. The following sections will explore the value of implementing these solutions and the stakeholders who have a vested interest in seeing these technologies brought to market.

3.1 LIM-Rail Solution

LIM-Rail, by eliminating combustion engines from the locomotive, reduces the weight of the rolling stock, the power required for propulsion, and carbon emissions. The linear induction system provides a more efficient means of locomotive propulsion, reducing dependence on fossil fuels and associated operating costs. Energy savings are further exploited by regenerative energy production during braking and downhill segments. A recent analysis performed on the Cajon Pass in the Los Angeles Basin showed that by installing LIM-Rail on the downhill section of the Pass, enough energy would be produced to power over 20,000 area homes. Because only the portion of the rail being used for propulsion is powered, the LIM-Rail system also provides a safer alternative than an electrified third rail. In addition, unlike an overhead wire system, the LIM-Rail is mounted on the track cross ties and does not require expensive maintenance and periodic replacement. The LIM-Rail provides numerous additional benefits to society by eliminating engine noise or unsightly overhead power lines, and allowing for low and flat floors more conducive to accessibility for those with disabilities.

The ITSC LIM-Rail system specifically addresses many concerns and issues present for a number of local rail system operators in the Southern California Region. For example, the LIM-Rail system would allow for light rail implementation in areas that are legally restricted from using overhead catenary wires such as the City of Irvine, California. In addition, the LIM-Rail system has been viewed as a seamless solution for the Metropolitan Transit System for San Diego County which is in need of replacing their entire aged light rail catenary system due to equipment decaying and associated maintenance costs while needing to expand the track system. Also in San Diego County, new trolleys are being constructed with lowered entry doors to accommodate federal and state accessibility requirements, however, the center isle must be raised to accommodate the motor. The LIM-Rail concept will remove the engine from the trolleys and allow for lower flat floors to meet state and local accessibility standards. For the Ports of Los Angeles and Long Beach, the United States largest shipping facility, there has been a strong interest expressed in using this new LIM-Rail configuration to eliminate diesel pollution in the Port to Near Port Terminal currently under development.

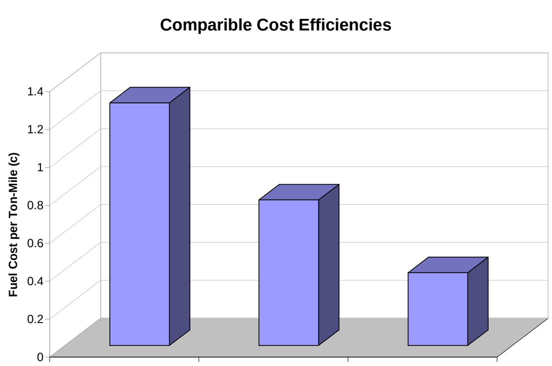
3.2 MagRail™ Solution

MagRail™, by eliminating rolling friction on cars, significantly reduces power requirements, operational and maintenance costs, dependency on fossil fuels, carbon emissions, and noise pollution of standard railway systems. The absence of rolling friction also allows for greater acceleration and sustained speeds for both cargo and passenger rail, providing decreased travel times and increased system throughput. The technology allows for all of this increased benefit with little modification to existing railway infrastructure. Existing railcars can be fitted with MagRail™ technology, and MagRail cars are cross compatible with standard rolling stock and can be used interchangeably within the same train consist. MagRail™ cars can be mobilized using several methods, including standard locomotives, LIM-Rail, or a specialized steel rail added to the track to both center the cars between the rails and provide forward acceleration and deceleration. All of this flexibility allows railway operators to phase in MagRail™ technology to existing fleet without experiencing downtime.

Like LIM-Rail, MagRail™ technology provides a near-term solution to many transportation problems existing today. The decreased fuel consumption and pollution could provide immediate relief from diesel emissions in areas near the Ports of Los Angeles and Long Beach. In addition, the reduction in fuel consumption and fewer parts maintenance problems decrease costs and make rail transport a more viable option. Finally, the increased speed and throughput will make rail transit a more attractive means of transport for both passengers and shipping outfits, spurring rider-ship and utilization of the existing infrastructure.

3.3 LIM-Rail and MagRail™ Combined

A rail system combining both the MagRail™ and LIM-Rail technologies would provide a very low cost, high speed transit system allowing for completely frictionless levitation and propulsion on existing railroad tracks, powered almost entirely by the electric grid, all for less than 10% of the cost ofcurrent maglev systems. Figure 2 depicts a comparison of cost efficiencies and NOx emissions between freight transport by trucking, standard rail, and standard magnetic levitation train. At this point, it is too early in development to determine whether the combination of technologies would meet or exceed standard maglev performance; however, the promise of MagRail™ and LIM-Rail applications is profound. With little to no change in the rail industry infrastructure, the technologies can be used to drastically reduce fuel consumption and carbon emissions of freight and passenger railway cars while reducing operating and maintenance costs and increasing the operating speed and throughput capacity.



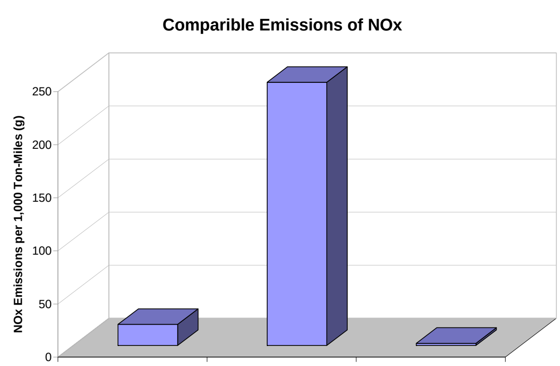


Figure 2: Comparable cost savings between trucking, diesel rail, and maglev transportation

3.4 Stakeholders

The value proposition for MagRail™ and LIM-Rail technologies can be broken into three categories of stakeholders, Railway Operators, Society & Government, and Passengers and Shipping Outfits. The benefits for each group are covered in the following sections.

3.4.1 Railway Operators

Railway operators have an enormous potential to reduce operational costs and increase revenue by using the MagRail™ technology. The cost savings will come primarily by way of reduced fuel consumption due to increased efficiencies and the reduction of operating and maintenance costs due to solid state construction and frictionless travel. In addition, personnel and logistical support can be reduced as a result of the use of linear induction or synchronous motor winding on the tracks combined with GPS tracking. An increase in revenue can be achieved by the attraction of more customers and increased capacity provided by the increased speeds and automated control, for both passenger and freight travel. LIM-Rail can eliminate the need for locomotives.

3.4.2 Society and Government

Society, and consequently the Government, stand to gain quality of air due to reduced emissions. The technology will also drastically reduce, if not almost completely negate, the noise pollution of railway operation. In addition, by offering more cost effective and faster point-to-point options, MagRail™ could help relieve highway, airport, and shipping yard congestion. Finally, sustainable energy generation is possible when using the linear induction or synchronous system to slow trains going down long inclines.

3.4.3 Passengers and Shipping Outfits

Passengers and shipping outfits stand to gain by the use of MagRail™ operated lines due to an alternate travel option to other transportation means such as highway, conventional train, and airplanes. With rising fuel costs, this form of travel could drastically reduce the price for and eliminate shorter less profitable airline routes while increasing the convenience through the number of stations, increased speed and subsequently decreased travel times.

4 Stage of Development

The following section will highlight the progress of LIM-Rail and MagRail™ technology development in preparation for commercial application.

4.1 LIM-Rail Technology

Linear induction motors have been in commercial use in the rail industry for a number of years, however, in a reverse configuration than the proposed LIM-Rail solution. The LIM-Rail solution places the field portion of the motor mounted on the track and the armature on the vehicle. An adaptation similar to this concept has been tested and is currently being produced by General Atomics for the launch and arrest of aircraft on United States Navy aircraft carriers. Because of the extensive work done in prior linear induction motors applications, dating all the way back to the beginning of the 20th century, most of the underlying technology has been tested and proven. The only activities currently remaining to commercialize this new adaptation is a series of sizing and trade studies followed by the construction of a full-scale prototype demonstrator. Several California transit agencies have expressed interest in purchasing the system and have offered to provide track facilities for concept demonstration. All of the required hardware for this new system currently exists off the shelf having been designed for other applications. With the support of government agencies and a commercial partner, LIM-Rail can be ready for commercialization within one year.

4.2 MagRail™ Technology

The MagRail™ technology is currently in the product development stage. A patent has been filed for the underlining technology followed by a number of provisional patents as the development progresses. The base patent was developed by Philip A. Studer, a retired NASA engineer with over 27 patents in the last 40 years, 18 of which relate to electro-magnetic motion systems. Mr. Studer, one of the inventors of the magnetic bearing making modern space travel possible, was recognized as the NASA Scientist of the Year in 1983. Exclusive rights to the patent have been purchased by Sandor Shapery and licensed to Innovative Transportation Systems Corporation. Additional patents by Mr. Shapery have resulted from design innovations to the original Studer concept. ITSC is in the preliminary stages of technology development and has expressed interest in eventually licensing the technology, or producing the MagRail™ components for sale to rolling stock providers. ITSC principals are funding mathematical modeling, design improvement, and small scale concept prototyping activities through university consultants at the Massachusetts Institute of Technology and the University of California – San Diego.

To date, advanced mathematical modeling and simulations have been performed by Dr. Bruce Montgomery, Professor emeritus at MIT, to prove the initial concept and commercial viability, including a track switching modeling analysis. Dr. Montgomery, in collaboration with Phillip Studer and Sandor Shapery, is currently modeling numerous variants to improve operations while working to meet standard rail design and switching constraints. In related efforts, University of California- San Diego professor Dr. Miroslav Krstic, head of the UCSD Control Institute, is developing a control system to levitate a a 1/8th scale platform on on simulated steel railroad tracks.

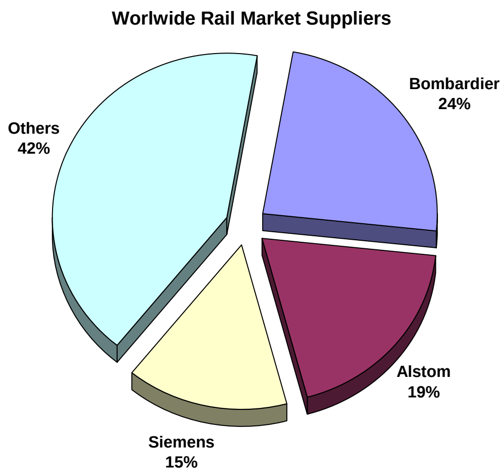
The next planned phase for MagRail™ development involves the construction of a full scale prototype that can levitate above standard railroad tracks without modification. Because of the way railway switches and grade crossings are designed, the levitation and accompanying control system must operate exclusively on the top and inside of the existing tracks simulating the action of train wheels when switching tracks. This innovative patented design has overcome the considerable challenge in designing the layout of the structure to support the magnetic field current without losing efficiency and flux while allowing for seamless track changes. In addition, the design of switches and grade crossings contains only a 1-7/8" gap in the horizontal and vertical axes, furthering the complications of maintaining field flux and adequate support structure. These challenges are all being addressed in the patent pending MagRail™.

5 Industry Overview

The railway industry presents a large, developed, and competitive global market. The majority of this industry belongs to foreign owned companies who have been established in the industry for decades. The following section will explore the current status of the railway industry.

5.1 Worldwide Market

The accessible worldwide market for rail equipment is substantial. As derived from the UNICEF 2007 Worldwide Rail Market Study, the overall rail market is worth approximately $102 billion in 2008 and consists of signal, rail control, infrastructure, and rolling stock segments. Attachment 1 contains a table of the industry broken out by region and segment, while Figure 3 shows a graphical representation. Infrastructure is the $20 billion portion that pertains to the LIM-Rail technologies while Rolling stock is the $35 billion segment that pertains to the MagRail™ technology. Because both technologies combined allow trains to travel in excess of 300 MPH and operate on standard rail, these systems would have the ability to compete in the light rail, freight, regional and commuter, as well as intercity high speed trains.



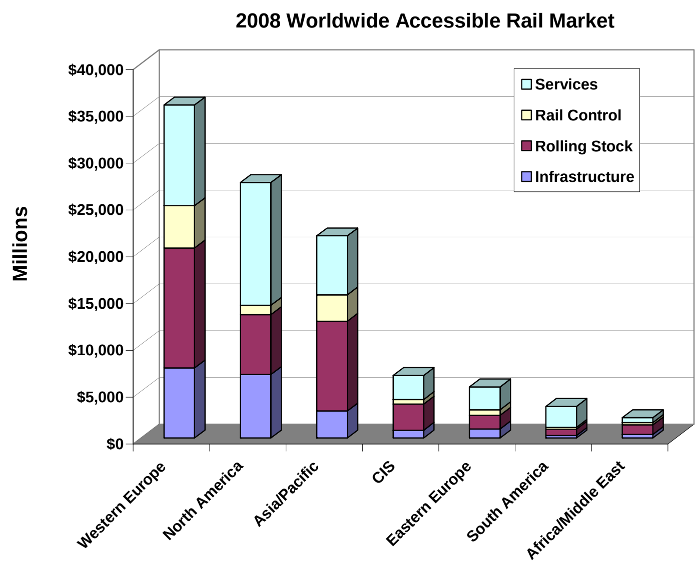


Figure 3: World-wide Accessible Rail Market Potential and Current Supplier Penetration

5.1.1 High Speed Rail

Western Europe and Asian countries, such as Japan, France and now China, have been leaders in the development of high speed rail routes. Travelers can easily find routes where trains exceed 150 miles per hour and China has recently begun to add high speed capability using expensive maglev technology. Because maglev trains require standalone transportation systems, the expense of installing a maglev system can be enormous. MagRail™ technology has the ability to compete directly with maglev because it can be installed at a much lower cost because it uses existing railroad tracks. MagRail™ can also compete against typical high speed trains because of its higher top speed and lower operating costs.

High speed trains have not had very much success in the United States, mostly because Americans generally associate themselves with their cars and rely heavily on air transportation for longer trips. Amtrak's yearly budget battles show that passenger rail in general has not had much political support. However, several factors are making high speed rail in the United States more attractive. As the cost of oil continues to rise other modes of transportation are becoming more expensive. MagRail's™ technology reduces the operating cost of an already efficient mode of transportation and therefore makes high speed rail an attractive option. Another factor is that air traffic has been increasing and delays in air travel have become more prevalent. High speed rail would be able to compete against short-haul air travel because of its dependability and comfort and lack of frustrating security lines while MagRail™ takes those benefits to new levels. Finally, Inter-city transportation will become more popular as urbanization continues to strain the U.S. interstate highway system making travel by road more difficult in the country's urban cores.

5.1.2 Freight

The freight car segment is also a promising opportunity for the MagRail™ technology because the freight car hovers above the rail eliminating the rolling friction on the car. Because each car can weigh hundreds of tons, and a train thousands of tons, reducing the friction of each car can have enormous savings on fuel costs. Applying MagRail™ technology to freight also has other key features. Conversion costs are low because levitating railcars with permanent magnets that will levitate for hundreds of years without an independent power source can be built at low costs. Only a small amount of electric power to run the control system is required to frictionlessly levitate and move the rail car. Such control system can be energized through battery packs on each rail car, through generators on the locomotive or induction pickups above the linear induction windings. (Locomotives are actually hybrid vehicles where massive diesel engines power generators which then power electric motors at the drive wheels.) Again, the rail infrastructure would not need to be restructured since MagRail™ can work on existing railroads. Also, freight could be moved at higher speeds. With proper coordination, the high speed lines could be run on the same tracks as the freight lines, which is not currently the case in Europe where high speed trains are more prevalent. The freight car market is also a substantial market as North American railcar manufacturers supplied approximately 75,000 cars to the railroad industry last year.

5.2 Competitors and Buyers

After some recent consolidation in the industry, the general rail market is currently dominated by three major players. As shown in the pie chart in Figure 3, the major players are Bombardier based in Canada, Alstom in France, and Siemens in Germany with 24%, 19%, and 15% of the market respectively. Downward pricing pressures after deregulation of the industry forced companies to consolidate, but there are several medium size companies that vie for the remaining market share. The industry also supports several thousand smaller companies supplying the global companies.

Included in the medium sized players is US based General Electric, which has more recently carved out a sizeable niche in Hybrid Diesel Locomotives. There are only two commercial maglev systems in operation today, one produced by German based Transrapid International GmbH & Co, a partnership of Siemens and ThyssenKrupp, and the other by the HSST Corporation of Japan. A few US companies are vying for maglev development platforms, including Massachusetts based MagPlane, Magma Motion, Maglev 2000 and California based General Atomics, which has the only working maglev test track in the US.

6 Next Steps

The envisioned pursuit of the MagRail™ and LIM-rail venture requires a number of steps to prepare the technologies for commercial application, covered in the following sections.

6.1 LIM-Rail Technology

Freight Rail

- Conduct a trade study including a cost/benefit analysis to determine the most advantageous system for moving the various types of vehicles – linear induction versus linear synchronous motors.
- Conduct a trade study to determine the most efficient means of moving rail cars loaded with up 75,000 lb. shipping containers including an analysis of cost/benefit to utilize helper cars on existing rails versus separately designed rail platforms for the specific Port of Los Angeles/Long Beach Near Port Facility use.
- Conduct a sizing study based upon the information gained from the above trade study.

Light Rail

- Conduct a sizing study based upon the outcome of the above described trade study to best fulfill the requirements of the Southern California light rail passenger system including San Diego's need to increase it's route and to replace it's catenary system; and the City of Irvine's light rail development requirements.
- Submit the results to the appropriate governing transportation authority for review and supportive action.
- Obtain government funding from each transportation agency for specific demonstration project.
- Assist the above specific governing transportation agencies in obtaining approval of the designated LIM-rail technology allowing funding from previously approved state and federal transportation funding sources

6.2 MagRail™ Technology

Research & Development

- The R&D for the technology, while having proven the system's technology, still needs further development in terms of three dimensional computer analysis followed by subscale testing to fine tune and maximize the effectiveness of the lifting body and sensory control system.
- Construct a full scale test lifting platform and accompanying sensory control for demonstration to the Port of Los Angeles/Long Beach Near Port Terminal project.
- Grant and Development Funding: Federal and state funding for development is a goal for initial funding of development demonstrations. The process of grant application

has begun and could greatly accelerate the process. While the venture is not contingent upon this funding, it will aid greatly with initial start-up costs and expedite logistics.

Federal and International Patents

- Resources have been and need to be expended on additional federal and foreign patents to totally control the technology field herein described. As Figure 2 shows, the railway market is larger in other regions, so international penetration is a huge potential.

7 The Team

The current team developing the LIM-Rail and MagRail™ concepts and business plan represents a diverse and comprehensive skill-set capable of taking the product from the concept phase into initial market introduction and sales. A brief biography of key players has been included as follows:

7.1 Sandor Shapery

Sandor W. Shapery is an attorney licensed to practice law in the State of California and has practiced before the Supreme Court of the United States. Mr. Shapery is also licensed by the State of California as a real estate broker. He is currently developing real estate, managing his real estate holdings, and developing a transportation infrastructure company and nonprofit transportation innovation foundation. Mr. Shapery, who is 63 years old, has been a resident of the City of San Diego for 59 years. He graduated from San Diego State University with honors in 1968, majoring in Political Science and attended law school at the University of San Diego where he graduated with honors in 1971 with a Juris Doctorate Cum Laude. While in law school, Mr. Shapery was a law clerk to Melvin Belli.

Mr. Shapery is the principal of Shapery Enterprises under which various corporations, partnerships and limited liability companies operate. Shapery Enterprises is involved in the ownership, design, and development of high-rise office buildings (Sempra Energy corporate headquarters building; Emerald Shapery Center), high-rise hotels (Wyndham Emerald Plaza; W Hotel downtown San Diego), commercial centers, historic renovations, and raw land. Shapery Enterprises is also designing, developing, and implementing technological advances in transportation including ultra-light business jets, vertical take-off aircraft, high-speed magnetic levitation trains, and electric induction powered buses and trains.

Mr. Shapery was on the president’s counsel of the La Jolla Cancer Research Foundation, a former vice-president of the San Diego chapter of the American Cancer Society, a member of Coalition for Responsible Planning, Friends of Arthritis, United Way, Diabetes Association, and American Mensa Limited.

Mr. Shapery, through Shapery Gyronautics Corporation, has patented and is developing a low-cost high-speed gyrostabilized computer operated vertical take-off and landing passenger vehicle that is intended to revolutionize transportation. The National Aeronautics and Space Administration (NASA), Revolutionary Aeropropulsion Concepts division has funded a joint effort with Shapery Gyronautics to develop the concept.

Mr. Shapery is currently pursuing the implementation of a supra-regional transportation plan for Southern California which will utilize a revolutionary electro-magnetic levitation and propulsion technology for the railroad systems that can move freight and people at speeds in excess of 310 miles per hour. The technology will allow the movement of goods and people for a fraction of the cost of fossil fuels, will dramatically reduce carbon emissions, and has the potential to create clean, sustainable energy. Mr. Shapery is currently working on a plan to convert existing railroad operations in high traffic urban areas to electric linear induction thus eliminating diesel pollutants and reducing operating costs. Further technological advances include the design and development of a low cost magnetic levitation train system that will operate on existing railroad tracks coexistent with current railroad operations.

Mr. Shapery is the vice-chairman of the San Diego Association of Governments (SANDAG) Stakeholders Working Group, and is an advisory member of the SANDAG Transportation Committee consisting of the 18 mayors of the cities of San Diego County. Mr. Shapery is also a member of the San Diego Regional Chamber of Commerce Infrastructure Committee. In addition, he is a member of the Southern California Leadership, a business-led-and-sponsored public policy partnership for the Southern California region. The Council is comprised of business and community leaders from throughout the 7 counties of Southern California including our four former Governors.

7.2 Philip Studer

Philip A. Studer (ret.) is the innovator and inventor of the technology that makes MagRail™ possible. Mr. Studer, who was awarded the high distinction of being NASA Scientist of the year in 1986, began his education at the University of Detroit where he earned his B.S. degree in physics in 1951. His career at the NASA Goddard Space Flight Center began in 1960 and continued until his retirement in 1987. Philip Studer's involvement at NASA included supervision of the development of the world's first electronically commutated D.C. motor, TN D 2108 & TN D 2819; supervision of the development of the world's first magnetically suspended (5DOF) rotate-able steel cylinder; assistance with a motorized (5DOF) cylinder with "ironless armature"; development of a permanent magnet biased magnetic bearing to reduce power required, B74-10254 Jan '75; design of "A Practical Magnetic Bearing" in which a SmCo5 magnet provides non-contacting suspension of an attitude control reaction wheel, in use ever since- IEEE '77; and patenting of a brushless D.C. linear motor with integrated suspension, serving as the basis of the proposed MagRail™ technology (2006).

7.3 Dr. Bruce Montgomery

Dr. Bruce Montgomery, professor emeritus Massachusetts Institute of Technology (MIT), is a recognized expert in the generation of magnetic fields for applications including magnetic levitation and propulsion, Magnetic Resonance Imaging (MRI), and nuclear fusion confinement devices. Dr. Montgomery's book on Solenoid Magnet Design, first published in 1969, remains a standard reference in the field. Dr. Montgomery is the author of more than 100 papers on magnet design, superconductivity, and a wide range of magnetic field applications. Prior to retirement from MIT in 1996, Dr. Montgomery was the Associate Director of the Plasma Science and Fusion Center - the largest interdisciplinary on-campus research center at MIT. Early in his career he worked for Arthur D. Little and Raytheon. Dr. Montgomery is currently an emeritus Senior Lecturer at MIT. He was elected to the National

Academy of Engineering in 1998. Dr. Montgomery was asked in December 2006 to be one of four outside experts to perform a six month review of the magnet systems designed for the fusion reactor to be built in Southern France. The experimental reactor, called ITER, is a multi-billion dollar joint project between seven parties that include the European Community, Japan, China and Russia. Dr. Montgomery led the US magnet design team working on ITER prior to leaving the Massachusetts Institute of Technology in 1996 to join the private sector.

Working under the direction of Dr. Montgomery is Jiarong Fang, an expert in magnetic analysis and electromagnetic modeling for maglev systems. Jiarong Fang is currently a scientist and China Interface Communication and Senior Manager with MagPlane Technology, Inc. Formerly, Jiarong Fang was a research associate for the Institute of Electrical Engineering at the Chinese Academy of Science along with the Center for Research and Development at the Beijing Automation Technology Institute.

7.4 Dr. Miroslav Krstic

Dr. Miroslav Krstic is a Harold W. Sorenson Professor in the Department of Mechanical & Aerospace Engineering at the University of California, San Diego. Dr. Krstic's primary areas of research are Control Theory, nonlinear and adaptive control, stabilization of partial differential equations. Some applications of his research include flow control (turbulence, combustion, jet engines), fusion/plasmas/magnetohydrodynamics, flexible beam control, extremum seeking, automotive engine control, minor efforts on satellites, underwater vehicles, aircraft wing rock, helicopter noise, and bio/chemical reactors.

Working under the direction of Dr. Krstic is Nima Ghods, who has a B.S. in Mechanical Engineering and Minor in Mathematics from University of California, San Diego along with An M.S. in Aerospace Engineering from University of California, San Diego. In related experience, Nima Ghods has designed and built a magnetic levitator using microprocessor programmed with PID Feedback Control, which actuates a coil, to keep a magnet in a desired position. In addition, Nima has designed and assembled several experiments for the UCSD undergraduate laboratory that control metal or magnetic objects by manipulating the magnetic field.

7.5 Rob Searle

Rob Searle, a Systems Engineer and MBA student, is the president of Southern California Transportation Solutions, a 501c(3) Non-profit organization dedicated to implementing the best technologies and practices for improving the mobility of goods and people throughout the Southern California Region, as well as a lead engineer in the Systems Engineering, Integration, and Test division of the Northrop Grumman Corporation Unmanned Systems Division. Mr. Searle has over 12 years of experience in the aeronautical and space industry with specialties including design of control systems, avionics, and redundancy architectures, along with performing system integration, testing, and reliability/safety assessments. Among the vast variety of aerospace projects he has worked on, Mr. Searle was part of the team that accomplished the first ever vertical take-off, supersonic flight, and vertical landing of aerial vehicle, subsequently resulting in the 2001 Robert J. Collier Trophy Award given to "the greatest achievement in aeronautics or astronautics in America", as well as being the responsible engineer for the automatic landing system used in first ever hands-off take-off and landing of a unmanned aerial vehicle on a moving naval vessel, resulting in 2007 Engineers' Council Distinguished Engineering Project Achievement Award.

Attachment 1: Worldwide Accessible Rail Market

Accessible Railway Market

Market (Millions)	Infrastructure	Rolling Stock	Rail Control	Services	SUM
Western Europe	$7,491	$12,818	$4,520	$10,758	$35,587
North America	$6,778	$6,416	$994	$13,119	$27,307
Asia/Pacific	$2,895	$9,586	$2,830	$6,296	$21,607
CIS	$837	$2,793	$474	$2,586	$6,690
Eastern Europe	$964	$1,471	$582	$2,448	$5,465
South America	$261	$683	$193	$2,237	$3,374
Africa/Middle East	$383	$1,016	$250	$528	$2,178
SUM	$19,609	$34,783	$9,843	$37,973	$102,208

Growth	Infrastructure	Rolling Stock	Rail Control	Services	Weighted AVE
Western Europe	0.8%	0.0%	-0.2%	2.7%	0.9%
Eastern Europe	1.4%	8.2%	1.6%	1.8%	3.2%
CIS	1.6%	4.0%	1.6%	3.3%	3.2%
North America	0.7%	2.1%	0.9%	2.0%	1.7%
South America	3.8%	2.7%	6.9%	3.1%	3.3%
Asia/Pacific	3.5%	2.5%	3.9%	3.0%	3.0%
Africa/Middle East	4.7%	3.0%	5.0%	3.8%	3.7%
Weighted Average	1.3%	1.8%	1.4%	2.5%	

Total Railway Market

Market (Millions)	Infrastructure	Rolling Stock	Rail Control	Services	SUM
Western Europe	$8,695	$12,818	$4,678	$19,823	$46,014
Asia/Pacific	$5,155	$13,274	$2,980	$14,246	$35,655
North America	$7,389	$6,416	$1,026	$16,350	$31,181
CIS	$1,574	$4,601	$494	$9,397	$16,066
Eastern Europe	$1,638	$1,471	$582	$5,019	$8,710
South America	$370	$683	$193	$3,315	$4,560
Africa/Middle East	$672	$1,025	$247	$2,311	$4,255
SUM	$25,491	$40,287	$10,200	$70,462	$146,440

Growth	Infrastructure	Rolling Stock	Rail Control	Services	Weighted AVE
Western Europe	0.7%	0.0%	-0.2%	1.4%	0.7%
Eastern Europe	1.1%	8.2%	1.6%	1.6%	2.4%
CIS	1.4%	3.6%	1.6%	1.1%	1.8%
North America	0.6%	2.1%	0.9%	1.3%	1.3%
South America	3.5%	2.7%	6.9%	2.5%	2.8%
Asia/Pacific	3.8%	3.3%	5.0%	2.4%	3.1%
Africa/Middle East	3.2%	2.5%	3.9%	1.9%	2.4%
Weighted Average	1.4%	2.1%	1.7%	1.6%	