

ZERO EMISSIONS ELECTRIC CONTAINER MOVING SYSTEM FOR THE PORTS OF LONG BEACH/LOS ANGELES

LSM Technology Program

A Joint Proposal by
INNOVATIVE TRANSPORTATION SYSTEMS CORP.
AECOM
GENERAL ATOMICS
MACQUARIE BANK

Presentation to California Energy Commission
April 27, 2009



Innovative Transportation Systems Corp.
An affiliate of Shapery Enterprises

AECOM



 **GENERAL ATOMICS**
ELECTROMAGNETIC SYSTEMS

THE TEAM

Innovative Transportation Systems Corp.

An affiliate of the Shapery group of Companies.

The Shapery Group of Companies, a major commercial real estate and technology developer. Headquarters in San Diego, CA

General Atomics

World's leader in high power linear motors. Founded 1955; Privately owned; 5,000 employees Business Areas: Defense; Energy; Transportation

AECOM

World's largest engineering and environmental company. Representing many Ports and Railroad projects worldwide. Designed Alameda Corridor. Headquarters in Los Angeles.

Macquarie Bank

The largest infrastructure bank in the world



Innovative Transportation Systems Corp.
An affiliate of Shapery Enterprises

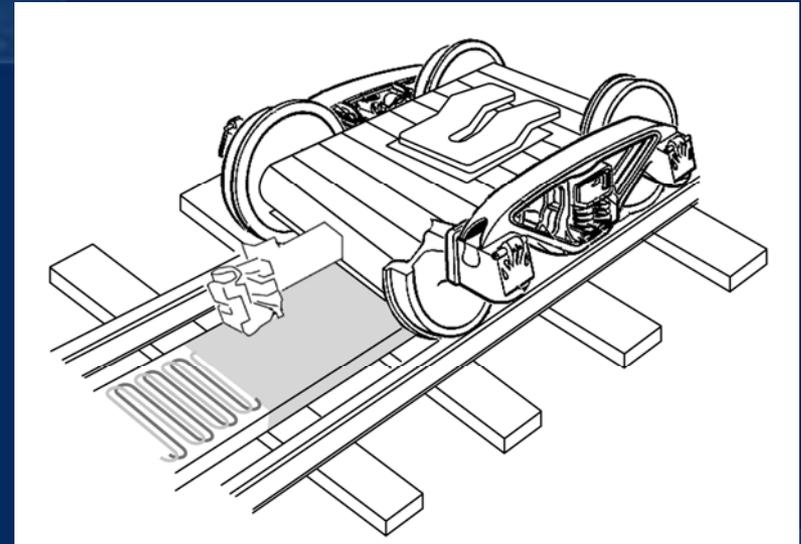
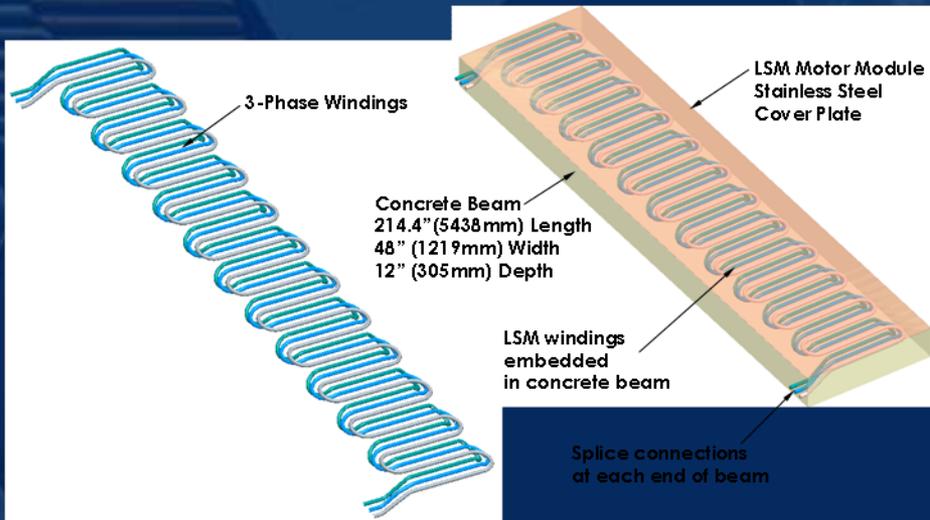
AECOM



 **GENERAL ATOMICS**
ELECTROMAGNETIC SYSTEMS

LSM-Rail Technology - MagneTrack™

- Linear motor incased in concrete
- and imbedded on railroad cross ties.



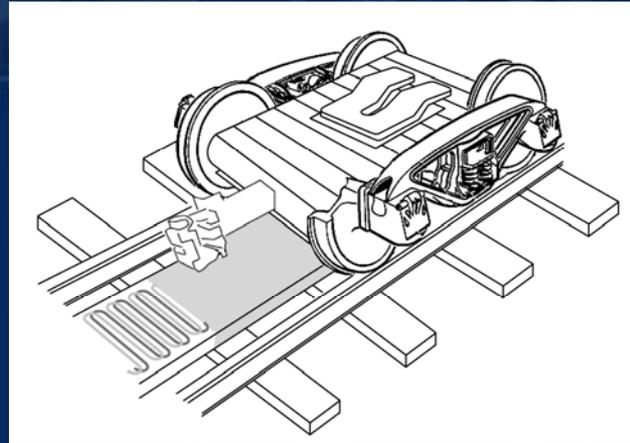
Motive force will be small bogies fitted with array of permanent magnets reacting with and running over imbedded linear motors on standard railway.



MagneTrack™ Potential Operating Modes



Transport standard rail cars

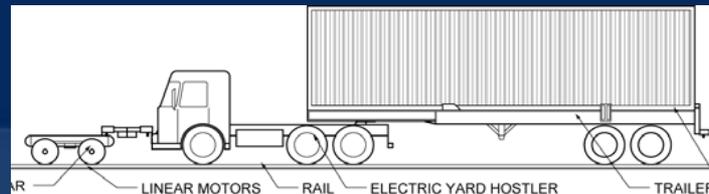


Transport standard truck trailers



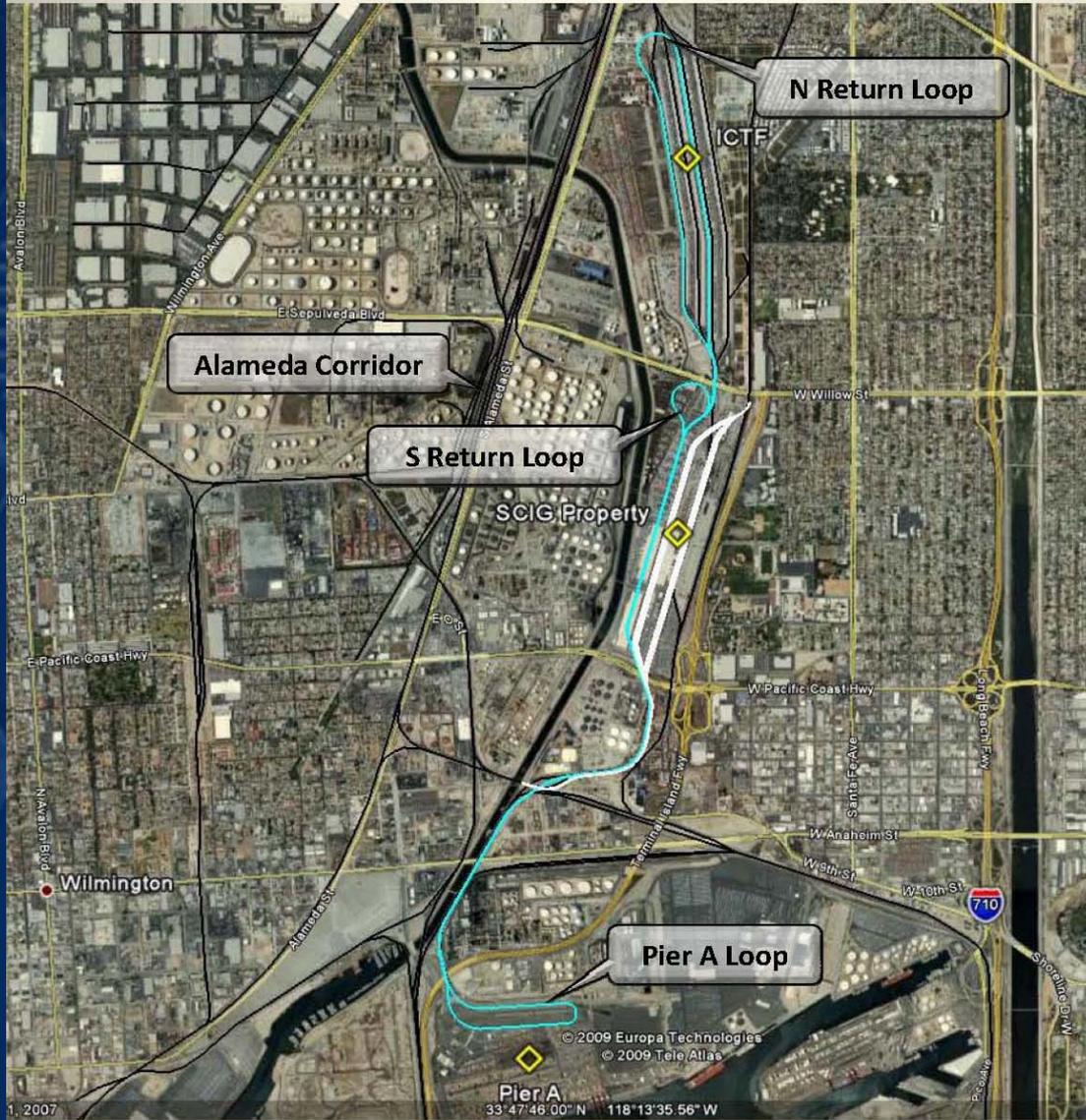
Transport entire trucks

Transport trailer consists



SCIG & ICTF Properties Route - Overview

Proprietary Information



LSM Railway Route Diagram
Connecting Port of LB –
Pier A Terminal with ICTF and
SCIG near dock terminals.

- 5 miles each direction.
- 1 mil. containers on trucks taken off local roads resulting in zero emissions.
- 1.25 Mil. gal. of diesel fuel will be saved per year resulting in less reliance on imported fuel.



Innovative Transportation Systems Corp.
An affiliate of Shapery Enterprises

AECOM



GENERAL ATOMICS
ELECTROMAGNETIC SYSTEMS

Value Proposition / Public Health-Public Safety

- Reduction of energy costs as diesel fuel is twice as costly per energy unit than electricity from a stationary power plant.
- Reduces costs to move containers out of Long Beach/LA Ports making our ports more competitive nationally creating more jobs
- Reduction of pollution as diesel engines produce 120 to 240 times more particulate pollution and NOX than a stationary power plant.
- Reduction of costs to the public of lost time, wages and health resulting from the effects of pollution, thereby increasing public health benefits.
- Low installed cost , low operating and maintenance costs

Only 1 vehicle at a time on track section: No chance of collision



Innovative Transportation Systems Corp.
An affiliate of Shapery Enterprises

AECOM



 **GENERAL ATOMICS**
ELECTROMAGNETIC SYSTEMS

Calculation of Linear Motor Fuel Savings

- Operating assumptions
 - 10-mile route with 1 million cargo cars/year
 - 50 tons/car → 500 million ton-miles of traffic per year
- Diesel fuel cost (conventional locomotives)
 - 400 ton-miles/gallon fuel over 500 million miles = 1.25m gal/yr
 - 1.25 million gal/year x \$2.30/gal = \$2.87M/year diesel fuel cost
- Electricity cost (LIM/LSM)
 - 0.5 lb diesel/Hp-hr → 14 Hp-hr.gal → 10.6 kWhr/gal
 - 400 ton-miles/gal over 500 million miles = 13.3m kWhr
 - 13.3M kWhr x \$0.12/kWhr = \$1.596M/year electricity cost



Calculation of Linear Motor NOx Reduction

- Same operating assumptions (500 million ton-miles/year of traffic)
- NOx emissions (conventional locomotives)
 - $202 \text{ g NOx/gallon fuel} \times 1.25 \text{ m gal/yr} = 252.5\text{m g NOx/yr}$
 - $252.5\text{M g NOx/year} = 278 \text{ tons NOx/year}$
- NOx emissions (Linear Motor Rail)
 - 0.15 lb NOx/MWhr (2000 SCE power plant rule)
 - $0.15 \text{ lb NOx/MWhr} \times 13,300 \text{ MWhr/year} = 1,995 \text{ lb NOx/year}$
 - $1,995 \text{ lb NOx/year} = 1 \text{ ton NOx/year}$
- That's 278 Tons vs. 1 Ton over a single 10 mile stretch of rail



Market Potential

- **Freight**
 - Railroads
 - Trucks
 - Port terminals
 - Intermodal railyards
- **Passenger Rail**
 - Metro
 - Light Rail
 - Commuter Rail
- **Autos / Trucks / Buses**
 - Auto lanes
 - Truck lanes
 - Bus lanes



LSM Drive Characteristics

Preliminary Analysis - The Virtual train

- Independent remote or on board control of each vehicle
- Magnetic propulsion and regenerative braking reduces energy cost by as much as 75% under certain operating conditions.
- Only one vehicle allowed per track section – collisions impossible.
- **Reliable**
 - No moving parts – Reduced maintenance, energy and operating costs.
- **Force is applied directly to vehicle**
 - Reduces wear on wheels and rails
 - High performance (acceleration, velocity) → High Throughput
- Complete control over acceleration and velocity
- Quiet – no engine noise.
- Capital cost comparable to electric overhead conversion

