Lessons Learned from the Maglev Deployment Project

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THE PROMISE OF MAGLEV

This is what FRA was led to believe by advocates of maglev since the 70's:

- Maglev enables more rapid acceleration, higher speed, reduced energy and steeper grades than rail due to its lighter weight vehicles, lack of contact and use of linear motors
- Maglev's lighter vehicles and relaxed guideway alignment tolerances result in lowered guideway cost

THE PROMISE OF MAGLEV cont.

- Maglev has environmental benefits,
- is safer than other modes
- can use existing rights of way
- offers U.S. a competitive opportunity for many innovative associated technologies
- capital and O&M costs are recoverable from farebox revenue

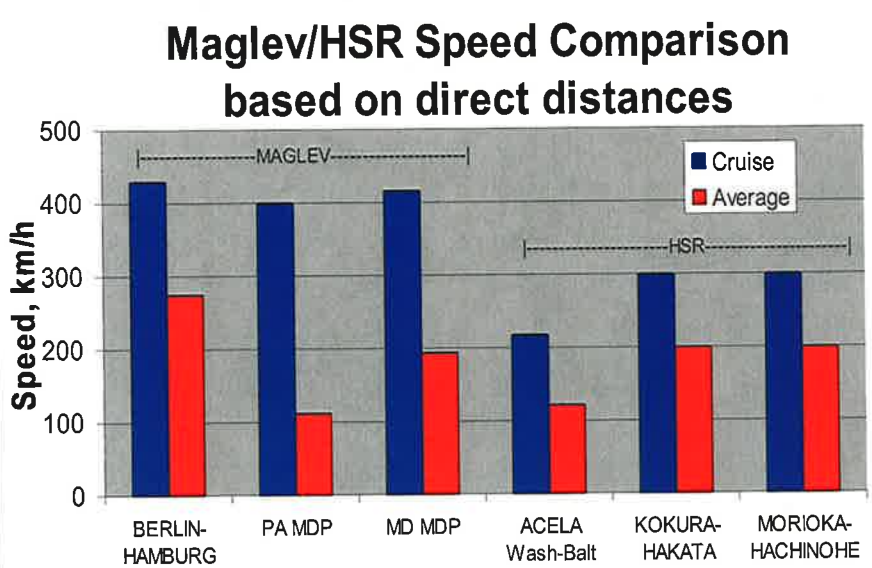
Let's examine some of these claims in the light of the MDP

❖Speed comparison (direct basis)

- Transrapid, cruising at 430 km/h, was projected to average 275 km/h, with 3 stops between Berlin and Hamburg.
- PA MDP, peaking at 400 km/h, averages 112 km/h with 3 stops between PIT and Greensburg.

❖Speed comparison, cont.

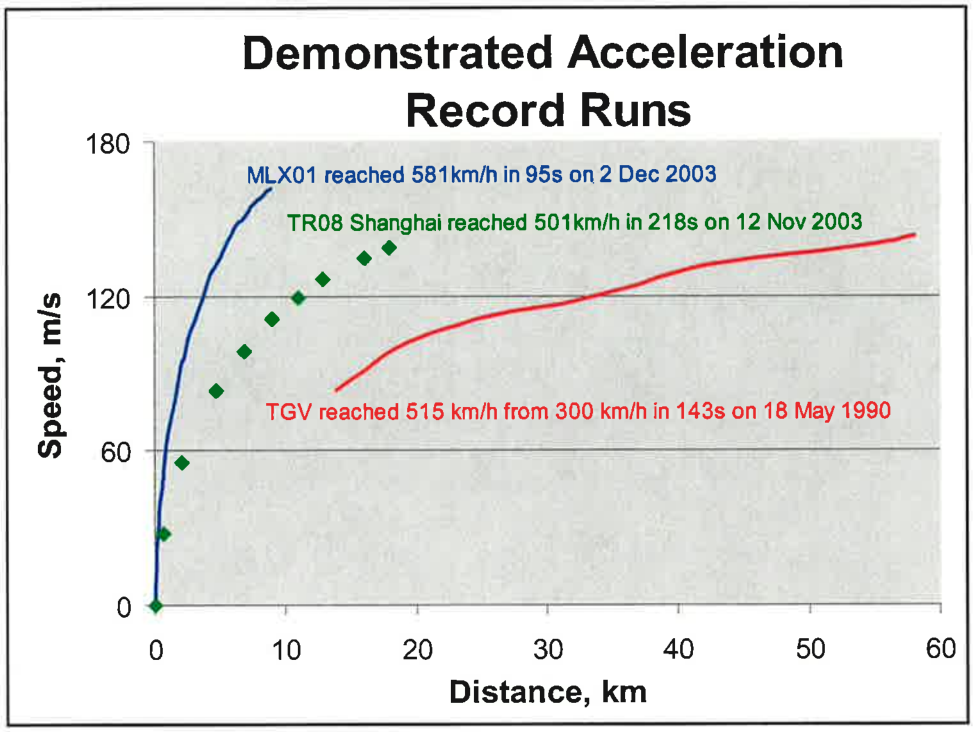
- MD MDP, peaking at 415 km/h, averages 194 km/h non-stop between Washington and Baltimore
- Over the same distance, Japan's 16 car Nozomi, cruising at 300 km/h between Kokura and Hakata, averages 200 km/h



Rapid acceleration capability

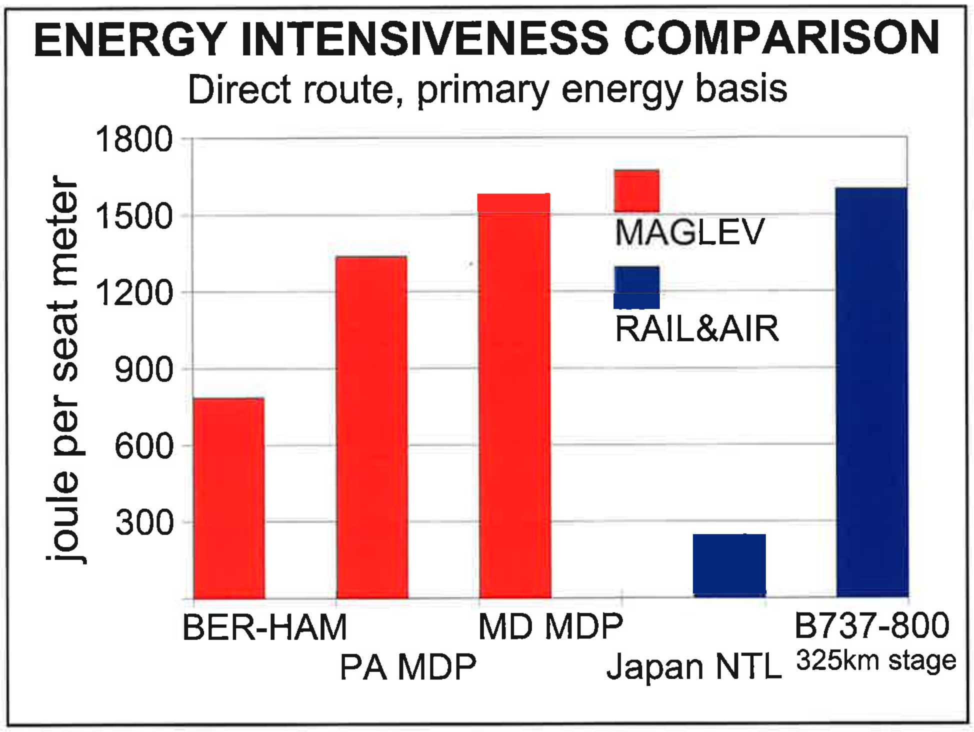
Lightweight vehicles?

	Mass Mg	Specific Mass Mg/m^2
• TR08 3 section	159	0.54
• MLX01 4 section	89	0.30
• Nozomi 16 car	688	0.50



Steeper grades

- Although maglev with LSM can negotiate 10% grades, such maneuvers add enormously to power consumption, due to resistive losses in the primary windings and feeder cables. Accelerating up 5 to 10 percent grades results in dissipation of several times the potential energy gain.



Environmental Benefits

- Noise is mostly aerodynamic and well below ambient urban levels at moderate speeds, unlike steel wheel on rail
- Low seismic vibration levels
- Low visual impact due to slender structures
- No emissions along route
- Petroleum independent
- Grade separated from existing modes

Comparative safety

- Maglev trains in Germany, Japan and China have accumulated 1.2 train-Gm, carrying >¾M passengers (mostly paying) in perfect safety.
- Certainly maglev would be safer than highway travel, but much more operational experience is needed to show maglev can be as safe as high speed rail or air. Japan's shinkansen has carried more passengers than there are people in the world without killing a single one. Air travel is also extremely safe. Accidents are most closely related to take-offs and landings, yet the carrier with the most of these has never had a fatality.

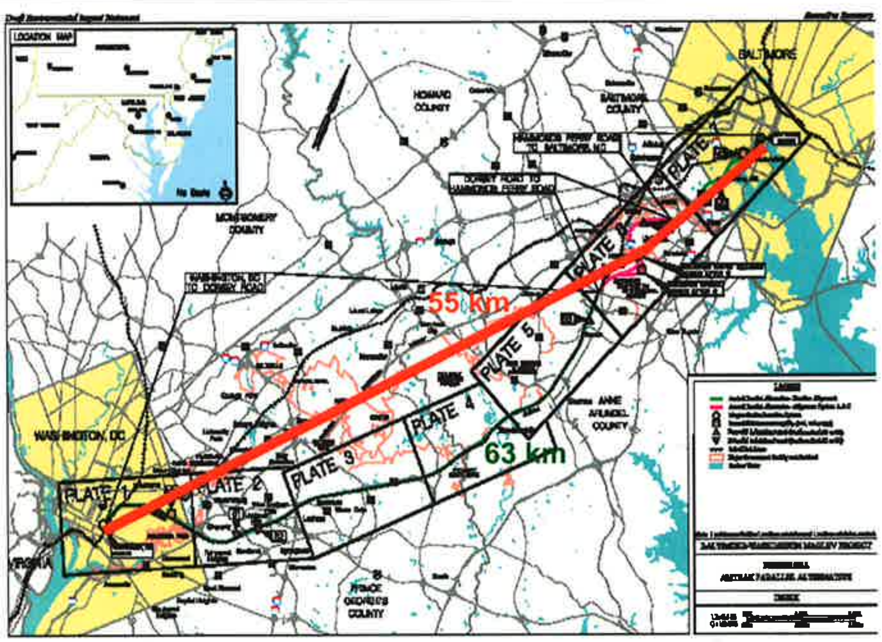
Use of Existing ROWs

- 39% of the proposed Berlin-Hamburg line was routed along Autobahn, 30% at grade
- MD MDP uses Amtrak and I-295
- PA MDP uses substantial existing ROWs

➢ However it has become clear that following ROWs can severely compromise performance, leading to poor trip times and wasted energy.

Use of existing ROWs, cont.

- Most existing ROWs are hwys. and rwys. designed for moderate speeds, and rife with restrictive horizontal and vertical curves.
- Ride comfort criteria limit acceleration, banking, sag and cresting.
- Straightening curves entails grade separation structures of prodigious length.
- Routes are circuitous
- Co-locating facilities compromises performance.

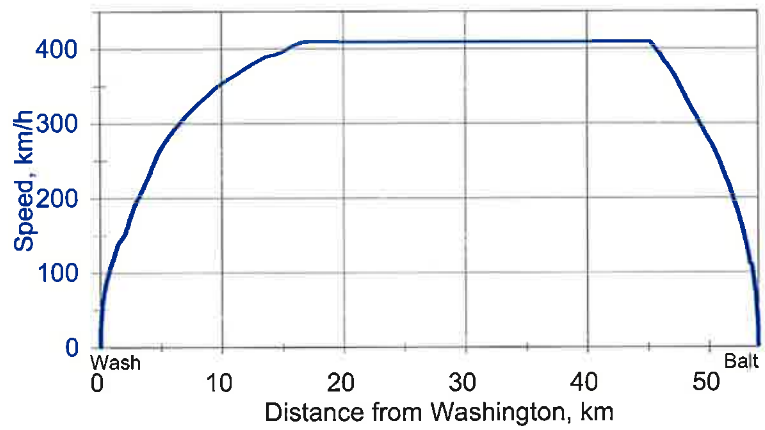


WASHINGTON-BALTIMORE MAGLEV ROUTE

Use of existing ROWs, cont.

MD MDP, no stop, direct speed profile

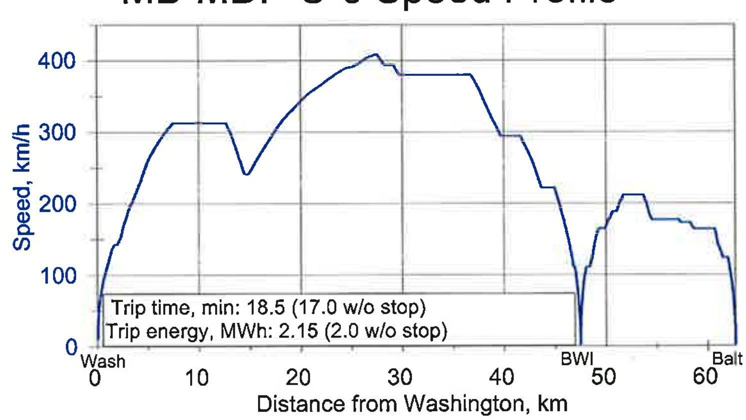
Time: 10.9 min. Energy: 1.4 MWh

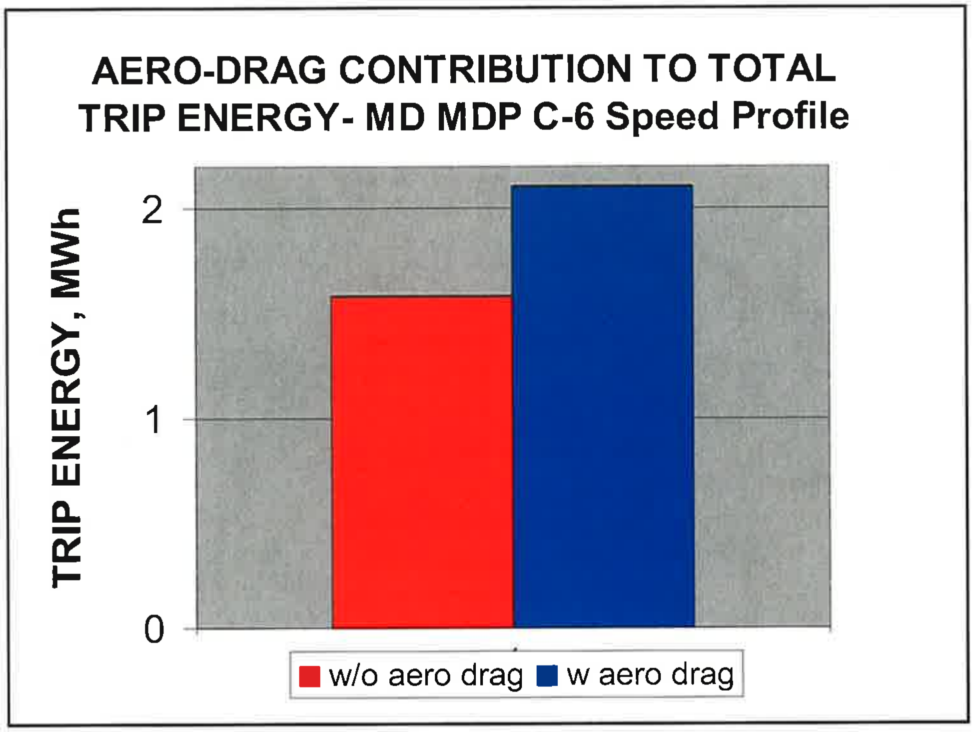


Use of existing ROWs, cont.

Parochial design

MD MDP C-6 Speed Profile





Opportunity for U.S. Technology

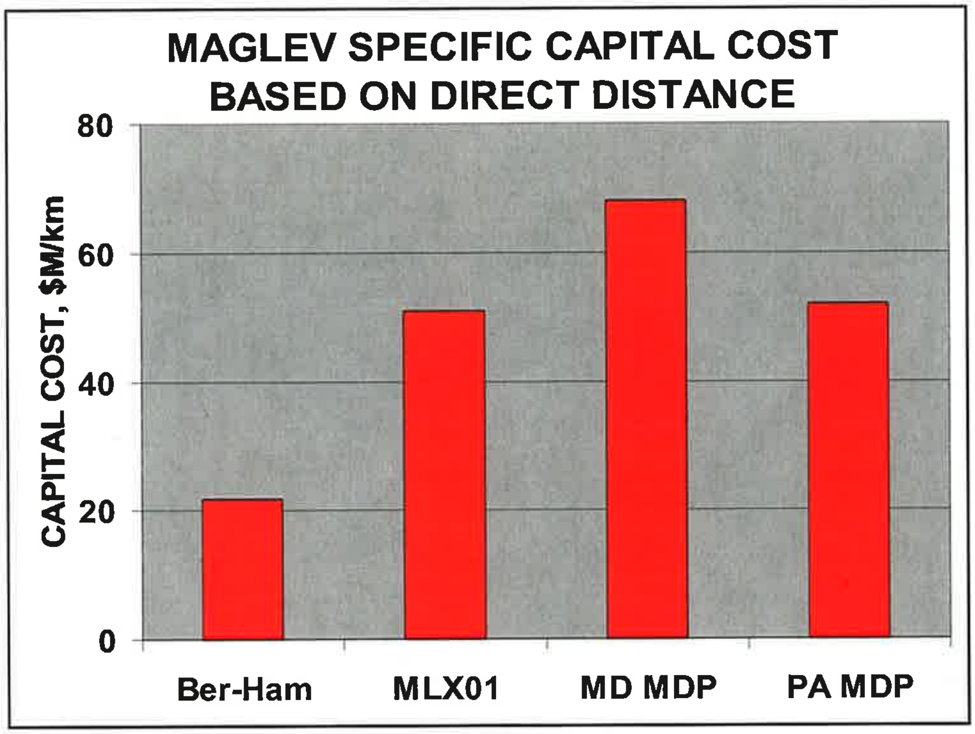
- The opportunity for United States participation in high speed maglev technology development has been largely foreclosed. Germany has deployed a revenue system in Shanghai while Japan has a system that could be deployed within a few years. The associated-technology benefits have already accrued to them.
- No U.S. maglev development, low or high speed, is anywhere near deployment readiness. The use of PMs in Inductrack, Magnemotion, and Magplane and SCMs in Maglev2000 of FL may have value in the long run.

Lower guideway cost

- High speed maglev guideway costs are dictated by alignment and deflection limits required to assure ride comfort, not by beam strength to support the load. Increased gaps do little to relax these limitations
- Lighter vehicles may reduce guideway costs, but these do not seem to have materialized.

Lower system cost?

- The MDP system capital cost estimates range from $40-60M/km, substantially more than DM41M/km projected for Ber-Ham in 1998.
- The proposed 1130 km California HSR system is projected to cost $25B (1989$) or $22M/km (CHSRA), while Florida HSR is pegged at $2.4 B or $20M/km (FLHSRA). However no true high speed rail has ever been constructed in the U.S., so estimates cannot be relied on.



Summary

- Maglev's potential not fully utilized in the U.S., but is beginning to show in Shanghai
- MDP projects have resulted in compromised speed, trip times, energy efficiency and cost
- U.S. guideway designs and costs are top priority for preparing the eventual market
- If SAFETEA funds the first demonstration project, the "Sputnik effect" might take over from there...