



Design of a European Hyperloop Large Scale Technology and Research Infrastructure

- The nub of Hyperloop
- LSRI Lathen TVE
- HYPERION Framework
- Best practise approach

1st International Conference on Ultra-High-Speed Transportation -Research meets Industry

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Hyperloop - the nub of the matter





https://www.tec-science.com/mechanics/gases-and-liquids/flow-separation-boundary-layer-separation/

 $F_D = \frac{1}{2} \rho C_D A \cdot v^2$

$$P_D = F_D \cdot v$$
$$= \frac{1}{2}\rho C_D A \cdot v^3$$

$$v > 400 \ ^{km}/_{h} \Rightarrow E_{loss} > 83\%$$
 due to air friction

Hyperloop evolution

 $v_{max} = 603 \frac{km}{h}$ Shinkansen L0 (jap. 新幹線L0系電車)



https://www.youtube.com/watch?v=ElUE5T-siWg

Supersonic, i.e. $v_{max} > 1080 \ ^{km}/_{h}$ Hyperloop Tube Transport



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Challenges for EU Hyperloop

- Superstructure and Civil Engineering
- Low pressure environment
- Fluid dynamics
- Propulsion & braking
- Levitation & suspension
- Guidance & switching
- Pod motion physics

- Power generation & supply
- Airlocks & transfer
- Environmental control & life support systems (ECLSS)
- Network communication & control systems
- Safety & emergency management



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Facilities at LSRI - HUB

- Full scale superstructure and tube
- Modular compartments
- Power supply
- Vacuum equipment and handling
- Network, control systems, and communication
- Environmental control & life support

Research & Development - Satellites

- Propulsion & braking
- Levitation and guiding
- Vehicle & pod motion physics
- Switching technologies
- Fluid dynamics
- Thermodynamics & energy dissipation
- Control systems, operations and approval

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Tube technology

- Civil engineering
- Superstructure
 - Concrete tube
 - Steel tube
 - Composite materials
- Design & evaluation
 - Track segments
 - Loading
 - Expansion
 - Real life conditions



Vacuum technology

- Size and volume
- Vacuum pump technology
 - Volume rate
 - Leakage rate
 - Maintenance
- Airlock and valve design
- Thermodynamics and heat dissipation
- Fluid dynamics + shocks



www.vacuumscienceworld.com/blog/hyperloop-mass-transit-within-a-vacuum



www.kcra.com/article//3549208it-will-change-the-way-we-travel-elk-grove-company-builds-hyperloop-components5



www.vatvalve.com/business/valves/catalog/A

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MagLev technology

• Competing Technology

- Electromagnetic Suspension
- Electrodynamic Suspension
- Superconductor Magnetic Suspension
- Research evaluation
 - Magnetic drag
 - Stability
 - Power consumption
 - High-Speed switch

March 2nd, 2021



Guid

Levitation

Propulsion coil

Levitation and guidance coil

Propulsion

ieeexplore.ieee.org/document/1222045

Levitation

Lateral guidance electromagnets









Hub & Satellites

- Hub:
 - LSRI at Lathen, Germany



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Hub & Satellites

• Hub:

• LSRI at Lathen, Germany

• Satellites

- EHC Groningen, Netherlands
- EuroTube Valais, Switzerland
- Hardt Delft, Netherlands
- HTT Toulouse, France
- Nevomo Warsaw, Poland
- TransPod Droux, France
- TUM München, Germany
- Virgin Hyperloop Spain
- Zeleros Valencia, Spain



HYPERION Framework

- LSRI Open Ker
 - Hubs and Satell
 - cross domain n
 - Design of a noverace sharing infrastructure
- Users / Stakeholders
 - Academia / Universit
 - Industry, SMEs
 - Public stakeholders
 - EU platforms and project
 - Standardization + Certification

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HYPERION Framework

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Facility	Location	Country	Continen t	Operator	Status	Domain	Access
Hyperloop Test Facility: 30m length, 3m diameter	Delft	Netherlands	Europe	Hardt Hyperloop (Netherlands)	Operational	Private	Not Possible
Hyperloop Test Facility: 3km length	Undisclos ed	Undisclosed	Europe	Hardt Hyperloop (Netherlands)	Planned	Private	N/A
Hyperloop Test Facility: 320m length, 4m diameter	Toulouse	France	Europe	Hyperloop Transportation Technologies (USA)	Construction	Private	N/A
Hyperloop Test Facility: 10km length	Tongren	China	Asia	Hyperloop Transportation Technologies (USA)	Planned	Private	N/A
Hyperloop Test Facility: 3km length, 2m diameter	Limoges	France	Europe	Transpod (Canada)	Planned	Private	N/A
Hyperloop Test Facility: 2km length	Unknown	Spain	Europe	Zeleros (Spain)	Planned	Private	N/A
Hyperloop Test Facility: 3km length, 2.2m diameter	Valais	Switzerland	Europe	EuroTube	Planned	Foundation	N/A
Hyperloop Test Facility: 1.2km length, 1.8m diameter	Hawthorne	USA	North America	SpaceX (USA)	Operational	Private	Limited
Hyperloop Test Facility: 9.6km in length	Unknown	USA	North America	SpaceX (USA)	Planned	Private	N/A
Hyperloop Test Facility: 500m length, 3.3m diameter	Nevada	USA	North America	Virgin Hyperloop One (USA)	Operational	Private	Not Possible
Hyperloop Test Facility	Malaga	Spain	Europe	Virgin Hyperloop One (USA)	Planned	Private	N/A
Hyperloop Test Facility: 35km length	King Abdullah Economic City	Saudi Arabia	Asia	Virgin Hyperloop One (USA)	Planned	Private	N/A
Magnetic Levitation on Rail Test Track: 50m length	Warsaw	Poland	Europe	HyperPoland (Poland)	Operational	Private	Not Possible
High-Speed Maglev Test Line: 200km	Hubei	China	Asia	CRRC Qingdao	Planned	Private	N/A

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© HYPERION Proposal

Best practice approach







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Lathen - the cradle of EU Hyperloop

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ONE MORE THING ...

The IHT has openings to be filled as of now 2 PhD positions Artificial Intelligence & Optimization of Logistics Tools



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