EXPERIMENTS & TRANSITION

URBANISM NEXT EUROPE 2021

# Disruptive mobility unlocking the creation of sustainable metropolises

4A. Disruptive new mobility innovations & fundamental human needs

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# Today

- Transport responsible for 30% GHG emissions
- Demand passenger and freight transport will grow 2.5x by 2050
- Transport infrastructure investments of € 69.000.000.000.000+ are required towards 2050

- Increasing traffic congestion
- Options to extend existing infrastructure are diminishing

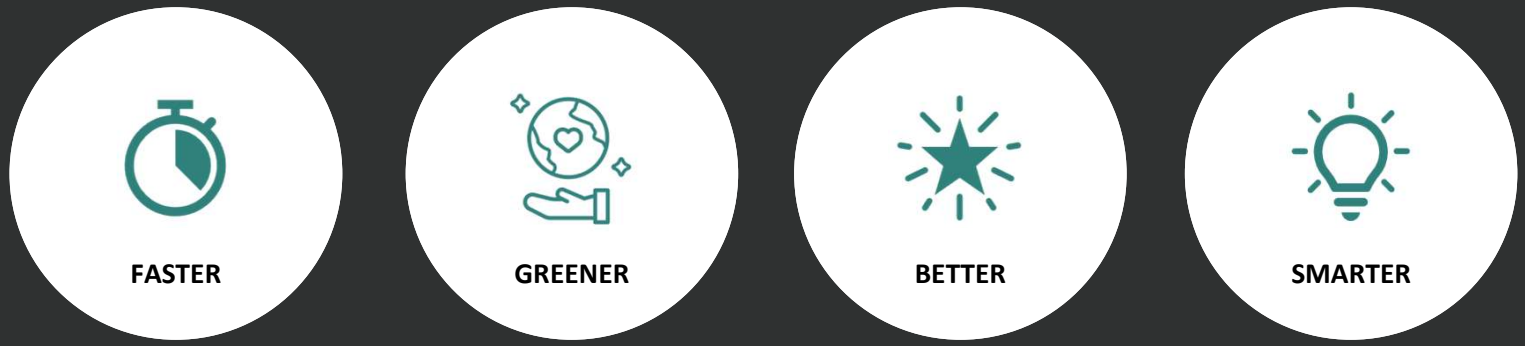
- Increasing urbanization and densification
- Lack of affordable housing
- Lack of green/healthy environments within cities


1) ITF Transport Outlook 2021 | READ online (oecd-ilibrary.org)
2) Extrapolated from https://outlook.gihub.org/
3) https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

# 2050

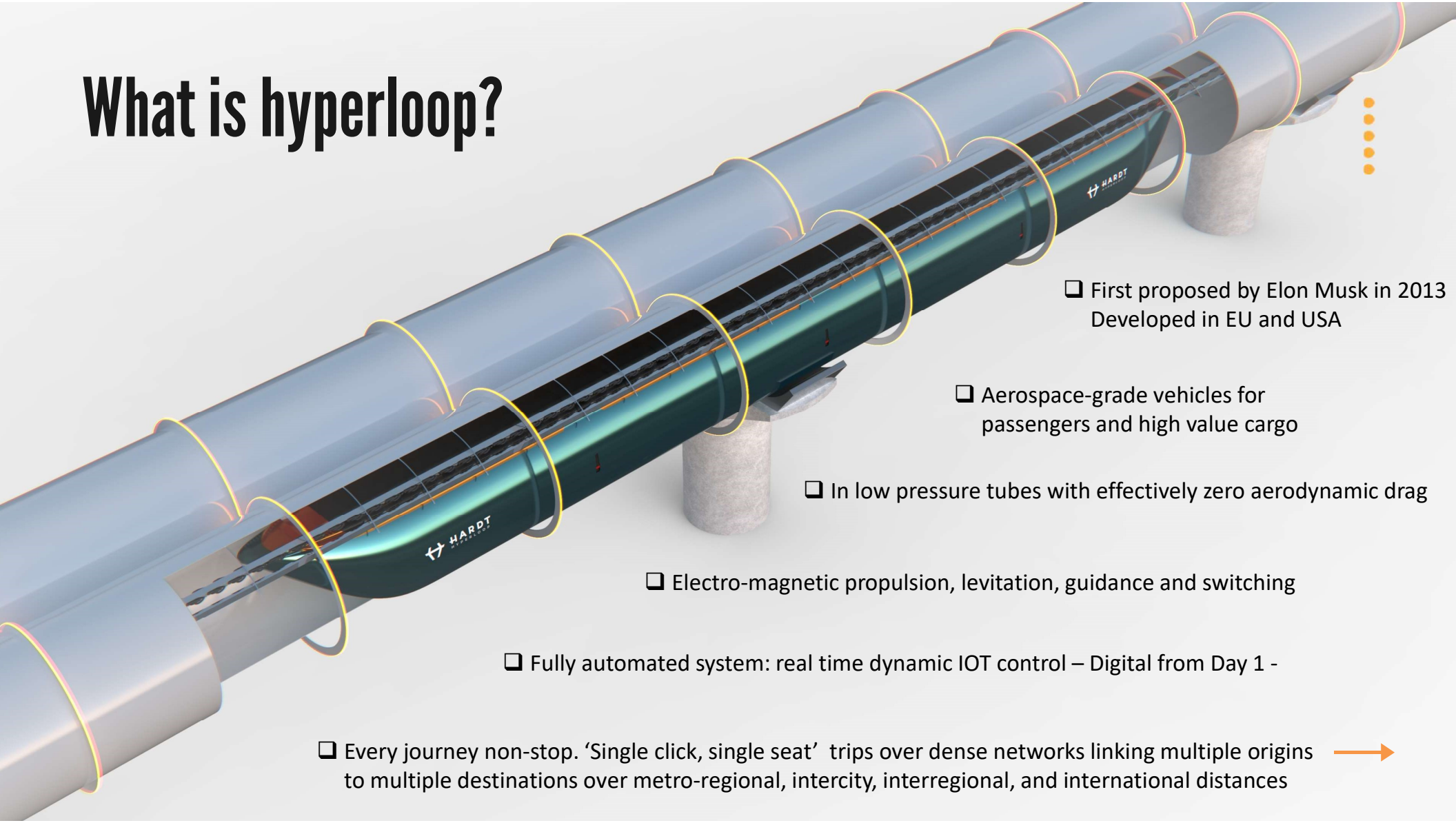
- Europe decarbonized
- Affordable, accessible, liveable sustainable cities / regions
- Travel and transport ‘ on-demand’ available and affordable for everyone
- The option to live anywhere with acceptable commuting times

# How? Disrupt the way we travel and transport.




Hyperloop

# What is hyperloop?




- First proposed by Elon Musk in 2013
  Developed in EU and USA
- Aerospace-grade vehicles for
  passengers and high value cargo
- In low pressure tubes with effectively zero aerodynamic drag
- Electro-magnetic propulsion, levitation, guidance and switching
- Fully automated system: real time dynamic IOT control – Digital from Day 1 -
- Every journey non-stop. ‘Single click, single seat’ trips over dense networks linking multiple origins to multiple destinations over metro-regional, intercity, interregional, and international distances

# Faster – Greener –Better - Smarter


- Zero drag enables 700 km/h cruising speed
- 500 km trip city centre to city centre in ~40 min, Same trip takes ~ 3 hours by air including airport access/egress and processing time


- Zero drag enables ultra-low energy consumption; can be 100% renewables powered
- 5 x- ∞ greener


- Rail-like capacity, tram-like convenience, plane-like speed
- Tube eliminates external factors, automation minimizes human errors
- Infrastructure beside/above existing transport corridors  minimizes new intrusions landscape


- Arrival prediction to ca. 1 sec
- No physical bending of tracks needed for lane switching (enables high network capacity and allows high speed lane-switching

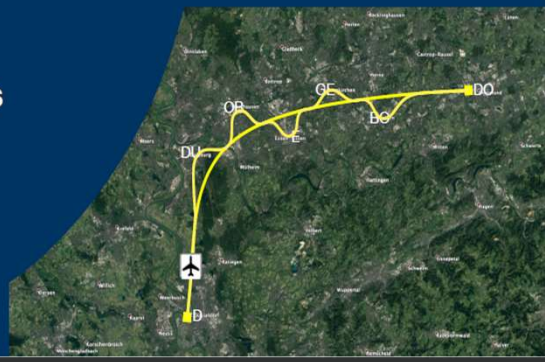
# Network effects hyperloop

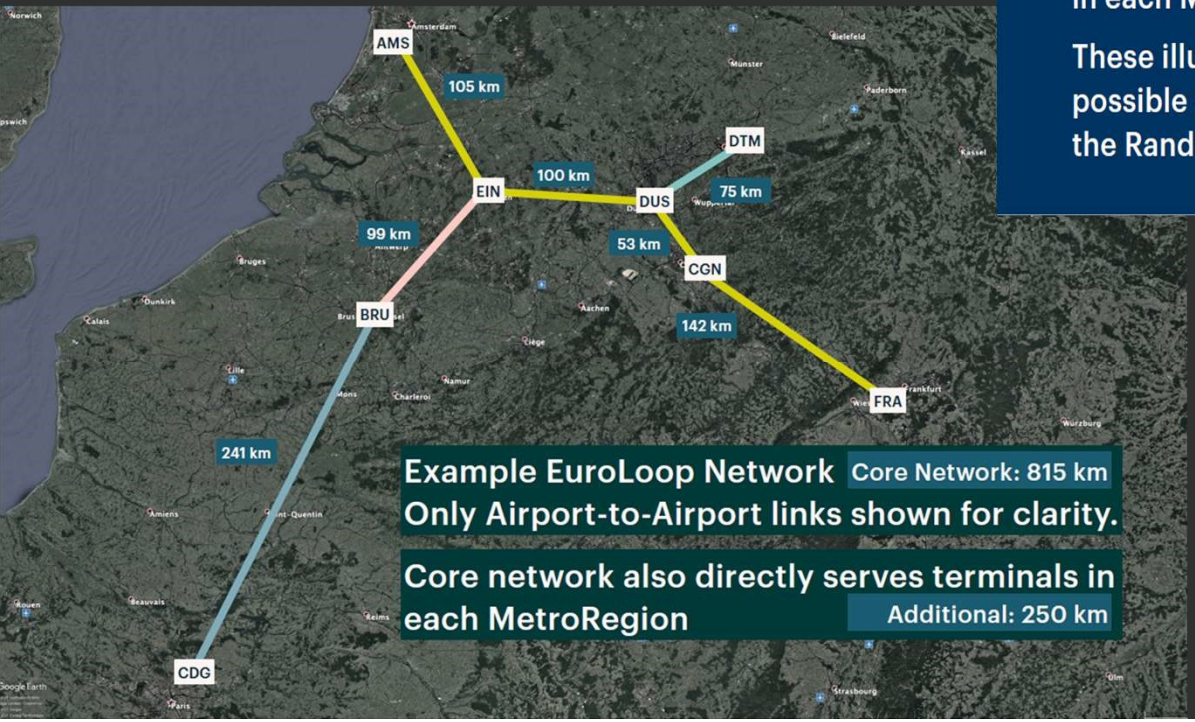
## - example network -


Each MetroRegion is assumed to be served by a number of hyperloop terminals on a Network in addition to the Airport hyperloop terminal.

These networks link the urban cores in each MetroRegion.

These illustrations show indicative possible configurations in both the Randstad and the Ruhrgebiet




- ❑ Connecting 28+ million people
- ❑ All trips non-stop and on-demand

# Small network example

**Trip times by hyperloop in minutes between Airports connected by the hyperloop network.**

| | 1 Schiphol | 2 Eindhoven | 3 Dusseldorf | 4 Köln Bonn | 5 Frankfurt | 6 Dortmund | 7 Brussels | 8 Paris CDG |
|---|---|---|---|---|---|---|---|---|
| 1 Schiphol | | 10 | 15 | 18 | 26 | 19 | 15 | 28 |
| 2 Eindhoven | 10 | | 10 | 13 | 20 | 13 | 10 | 23 |
| 3 Dusseldorf | 15 | 10 | | 7 | 15 | 8 | 15 | 28 |
| 4 Köln Bonn | 18 | 13 | 7 | | 12 | 10 | 18 | 32 |
| 5 Frankfurt | 26 | 20 | 15 | 12 | | 18 | 26 | 40 |
| 6 Dortmund | 19 | 13 | 8 | 10 | 18 | | 19 | 32 |
| 7 Brussels | 15 | 10 | 15 | 18 | 26 | 19 | | 18 |
| 8 Paris CDG | 28 | 23 | 28 | 32 | 40 | 32 | 18 | |

**Just replacing short haul flights** (high level estimation)

- ❑ 6,656,643 daily available seat km
- ❑ 267,653 tons CO2 emissions avoided per year[1]
- ❑ 5 M€ air pollution cost per year avoided
- ❑ 1 M€ noise cost per year avoided
- ❑ 2704 years total time saving [~ 232 M€]

**Scenario analyses**

- ❑ Exceptional high Benefit to Cost ratios
- ❑ Sweet spot is ‘car-like’ pricing: highest economic and environmental impacts
- ❑ Freeing up runway capacity airports and roads

[1] Assumption powered with 100% renewables

# Additional impacts

### Create capacity at air hubs

- Freeing up air hub capacity
- Heathrow 3rd runway buys 600 km of hyperloop

### Massively increase logistics efficiency

- One hyper-hub replaces 10 local hubs
- Same day delivery across the continent

### Increase city workforce reach to 250 km

- Increasing area from which business can attract talent without moving residence by 25 times
- Alleviate housing scarcity and soaring housing prices

### City centre to city centre

- Drastically reduced first-/last-mile time

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# Thank you!

Do you have any question?

Ask Lucienne Krosse, Lucienne.Krosse@innoenergy.com

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