Hyperloop: more than a pipe dream?

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In December 2018, the Port of Hamburg announced a joint venture with US-based research company Hyperloop Transportation Technologies to realise its vision of a network of tubes transporting containers at high speeds to, from and across the port. With several testing sites under construction around the world and multiple trials planned to take place this year, what exactly is hyperloop, and is it really set to change the face of logistics?

Hyperloop is a proposed transport mode that uses electrically propelled, magnetically levitated pods within near-vacuum tubes to carry goods or passengers at speeds of up to 760mph. By travelling within a sealed, low-pressure environment, and by 'floating' the vehicle above the track using the repulsion of two magnets rather than wheels, the pods travel free of air resistance and friction, and three times faster than conventional magnetic levitation (maglev) trains or high-speed rail (HSR).

The idea of increasing speed by moving within a low-pressure environment is not a new one. It was first proposed by British inventor George Medhurst as long ago as 1799. Similarly, high-speed maglev trains have been operational in Japan and China since 1969 and 2002 respectively, with the Shanghai Transrapid running between the city and its airport at a top speed of 270mph.

It was in 2013 that the concept of hyperloop was reintroduced in its modern format by Elon Musk, in a white paper which envisioned a system of tubes elevated on columns running for 350 miles between San Francisco and Los Angeles. At 700-plus miles per hour, the journey time between the two cities, he proposed, would be cut from a six-hour drive to under half an hour. Travelling from London to Birmingham at the same speed, by comparison, would take just 10 minutes.

A sustainable solution for long-distance travel…

Unsurprisingly, hyperloop has captured the imaginations of governments and businesses for the numerous opportunities it offers to the transport and logistics sectors, including improved delivery times, reduced emissions and decreased strain on road and rail networks. Many have also recognised the potential of hyperloop to stimulate a degree of societal transformation, given the drastic shortening of commute times that the technology affords.

According to Elon Musk's plans, solar panels positioned on top of all tubes in the network would generate a surplus of renewable energy in addition to powering the ultra-aerodynamic, electrically propelled pods. Hyperloop One (pictured), a research subsidiary of Richard Branson's Virgin Group, has also championed the technology's environmental benefits, estimating that the complete replacement of short-haul flights by hyperloop journeys would reduce global emissions by 58% year on year.

…or a pipe dream?

Although theoretically feasible, hyperloop faces significant challenges in its implementation, the largest of which is infrastructural cost.

While Elon Musk put the cost of his initial intercity proposal at $6bn (around $16m per mile), this number, crucially, excludes the cost of land acquisition. As the repeated difficulties around plotting the route for High Speed 2 (HS2) – Britain's second high-speed rail line, planned to connect London with Birmingham, Leeds and Manchester – illustrate, land ownership and environmental activism have the potential to massively hinder the installation of overground infrastructure in densely populated environments. Conversely, while moving underground may remove the need to take expensive detours, it dramatically increases the costs of construction.

As a means of carrying freight, the hyperloop pod would naturally be restricted by weight limits and the space restrictions imposed by the narrowness of the tube. There are currently also no means of ensuring the safety of the pod's contents in the event of fire, rapid depressurisation, capsule malfunction or natural disaster, and some have even theorised that the vulnerability of the overground pipes could make a tempting target for terrorists.

Whether the system is fit to transport passengers is a different proposition entirely. Where, for instance, would emergency exits be found in the event the capsule became stranded in the tube? Or, more pragmatically, would the journey be too loud for passengers or for the communities it passes through?

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On the one hand, the excitement that hyperloop has elicited perhaps emphasises a collective tendency to become infatuated with new technologies at the expense of less thrilling, more workable solutions, some of which may already exist.

That said, so far around six private companies and two state-owned hyperloop initiatives (in China and Korea) have emerged to take up the challenge. Most notably, a pod engineered by Virgin Hyperloop One reached a speed of 190mph during trials in 2017, a success which the company has celebrated by announcing the opening of a $500m testing facility in Spain, due to be operational by 2020.

The Port of Hamburg says it will soon begin construction of a 100m-long onsite testing terminal with the aim of building a hyperloop network that reaches multiple cities across Germany in the near future. *R&S* will continue to report on this venture as it develops.