Photo courtesy of Hyperloop One

“A physical version of the Internet”: How Hyperloop could be the broadband of transportation

Proponents of the high-speed technology envision an end-to-end revolution in transportation.

Nick Earle

SVP of global field operations, Hyperloop One

The topic of a well-publicized white paper by Tesla cofounder Elon Musk in 2013, the Hyperloop is a proposed mode of transportation that would use pressurized pods to move people, goods, and cars at speeds of more than 700 miles per hour through an evacuated tube system. This system would reduce the travel time between Los Angeles and San Francisco to 35 minutes—a journey that currently takes six hours by car.

While the first production system, which could be in Dubai, is a few years from full operation, Hyperloop One—a company developing this technology—has already constructed a 500-meter proof-of-concept test site in Nevada, where it ran a successful test this past May. In this interview with McKinsey, Nick Earle, senior vice president of global field operations at Hyperloop One, discusses the scale of the system's potential to collapse time and distance, as well as disrupt transportation, commerce, and housing—and the challenges of delivering on these prospects.

McKinsey: *Describe the problem that Hyperloop is trying to solve and the opportunity for disruption.*

Nick Earle: We spend a significant portion of our lives stuck in transit. And as the population grows, so do problems.

While digitization has dramatically transformed most parts of our lives, public transportation is arguably the biggest exception. Incremental improvements are not enough to solve our current and future transportation problems. We need disruptive innovation that transforms the travel experience to fit the world we live in: more connected, faster, and on demand.

I lived through the thick of the data revolution. Think of how not very long ago paper was the primary way we transported data, point to point telephone lines were the way we carried voice, and passing around physical recordings of a picture or film was the way we transported images. Thanks to digitization we can now do all three on a digital packet-switched network that can handle data, voice, and video transportation at very high speeds simultaneously. That has transformed our lives. Transport today is like human communication 20 years ago—separate slow networks incapable of seamless interoperability.

The peak speed of the Hyperloop will be twice that of today's fastest bullet train, but our true time savings will be five to six times greater compared with typical high-speed rail, depending on the route, because every journey is nonstop to your destination, and departures are continuous. What's more, Hyperloop can transport passengers, freight, and cars simultaneously. One of the big lessons of the Internet era was that open interoperability is vital. We're designing the system to accept any autonomous vehicle (AV) that is summoned to pick people up from their home or office, travel long distances, and then complete the last mile of the journey. AVs and drones could do same-day delivery across vast distances without distributed warehousing. Freight could work the

same way. One investment collapses separate networks into a single, more efficient network. That creates an explosion of productivity and mass disruption of business models.

McKinsey: *How does Hyperloop fit into a broader vision for the future of mobility and how we plan and build smart cities?*

NE: The world's largest cities grew by scaling their core transportation systems. Chelsea, Fulham, and Highgate used to be satellite towns but are now part of London itself because the expansion of the London Underground enabled people to live in one place and work in another—but it led to problems such as overcrowding, longer commuting times, pollution, and higher housing costs.

When you can travel 500 kilometers in 30 minutes, you can redraw the boundaries of your city. People can live in Leeds, where house prices are much lower, and get to work in Canary Wharf as if they were riding four stops on the tube. You can build greener cities, and you can shift manufacturing plants and warehouses far outside the city, where costs are lower. It would have dramatic effects on the way people work and their quality of life.

The value a Hyperloop system unlocks could give governments the ability to reduce their share of the cost. Consider land value capture: the differences in the cost for land and housing inside and outside the city can be up to ten times. That creates tremendous opportunities for private real estate investment (and a broader tax base) in remote locations, as well as opportunities to build smart cities from scratch, on sites that are not constrained by prior construction. The more you consider the wider economic benefits, the more you realize the significant business opportunities possible—and that attracts both public and private investment.

McKinsey: *Aside from the technology needed to make Hyperloop operational, what challenges do you foresee in asking governments and private-sector players to change the way they operate? What are the barriers to pulling Hyperloop off at scale?*

NE: First we must prove the technology works and at scale. We're working on that; we've already shown that we can achieve around 200 miles per hour in a 500-meter vacuum tube at our DevLoop test site in Nevada, and we will continue to improve on this. We've shared those results with government officials and private-sector players. We need to partner with early adopters willing to work with us to implement the first operational systems—which we'd like to have done within five years. This undertaking will require funding and construction, as well as regulatory approval, especially around safety.

There is huge value in creating the right regulation for the Hyperloop in parallel with building the systems. In Dubai, we're working with the Roads and Transport Authority to codesign the solution to meet their regulations. They benefit by becoming one of the leading world experts in creating Hyperloop regulatory frameworks, while we benefit from their input on how to design the system. This will also create a significant number of new jobs and high-tech capabilities to help transform their economy.

McKinsey: *One of the initial value propositions of Hyperloop was it would be cheaper than building a high-speed rail system. Given the R&D needed, how are you keeping costs down?*

NE: Based on the costs we have seen in building our working prototype, we expect capital expenditure per mile to be less than two-thirds that of high-speed rail—and in many cases much less than that. Operational costs will be significantly lower than high-speed rail as we only use motor power for 10 percent of a journey; after that, the vehicle glides in the near vacuum environment for the rest. And with no friction in the system, total lifetime costs, including maintenance, will be much less than that of high-speed rail.

We are also reducing our costs and increasing the speed of our innovation by using a methodology implemented by aerospace manufacturer SpaceX. Instead of working serially, we're working on different components in parallel—integrating them, testing them, tweaking them. We're doing daily iterative loops on that process: designing, building, testing, analyzing data, and then designing the component again. It's a standard methodology for accelerating software delivery; we're using it for both software and hardware.

McKinsey: *What is your long-term vision for the impact of Hyperloop?*

NE: When you think about the Hyperloop, it starts to look a lot like physical broadband. When the Internet first came out, the industry focused for the first few years on line-speed improvements. With broadband transmission rates now up to 100 gigabits and 4G going to 5G, network operators are focusing more on what new consumer experiences can be created and how they can disrupt business models to gain competitive advantage.

We have the same vision for Hyperloop. We think it will transform the lives of billions of people by giving them back time and convenience; radically disrupt supply chain models by allowing same-day delivery of goods across continents; create a new wave of high-tech companies and skills; and change where we live and where we work, triggering regional transformation in a way we can only imagine.

The fundamental question we should ask is whether we continue investing in incremental improvements on decades-old technologies or whether we embrace the possibilities of moving atoms in the same transformative ways we're now moving bits.

It's going to be an exciting next few years.