HYPERLOOP TRANSPORTATION TECHNOLOGIES

PARLIAMENT of AUSTRALIA

Ms Lynley Ducker
Committee Secretary
Standing Committee on Infrastructure
Transport and Cities
Department of the House of Representatives
PO Box 6021
Canberra ACT 2600

Dear Ms Ducker,

Hyperloop Transportation Technologies (HyperloopTT) is pleased to provide our submission to the Standing Committee on Infrastructure, Transport and Cities' inquiry into automated mass transit.

We are confident the HyperloopTT solution is a game-changer for Australian transport and can perfectly interact with other modals for both passenger and freight movement.

The Hyperloop solution has many benefits for Australian nation-building as the technology has reached the maturity for implementation. Two key points:

- We encourage the standing committee to assess this technology against other rail and road transportation solutions to determine its significant advantages in capital costs, operating costs, energy, speed and safety

- HyperloopTT advocates the setting-up of a global innovation hub in Australia to give Australia an early-mover advantage in the inevitable advance of advanced transportation solutions

The HyperloopTT solution is ready to be deployed to solve Australia's long-standing regional transport inefficiencies.

Thank you for consideration of our submission. We would be pleased to meet with the committee to further discuss HyperloopTT technology and deployment.

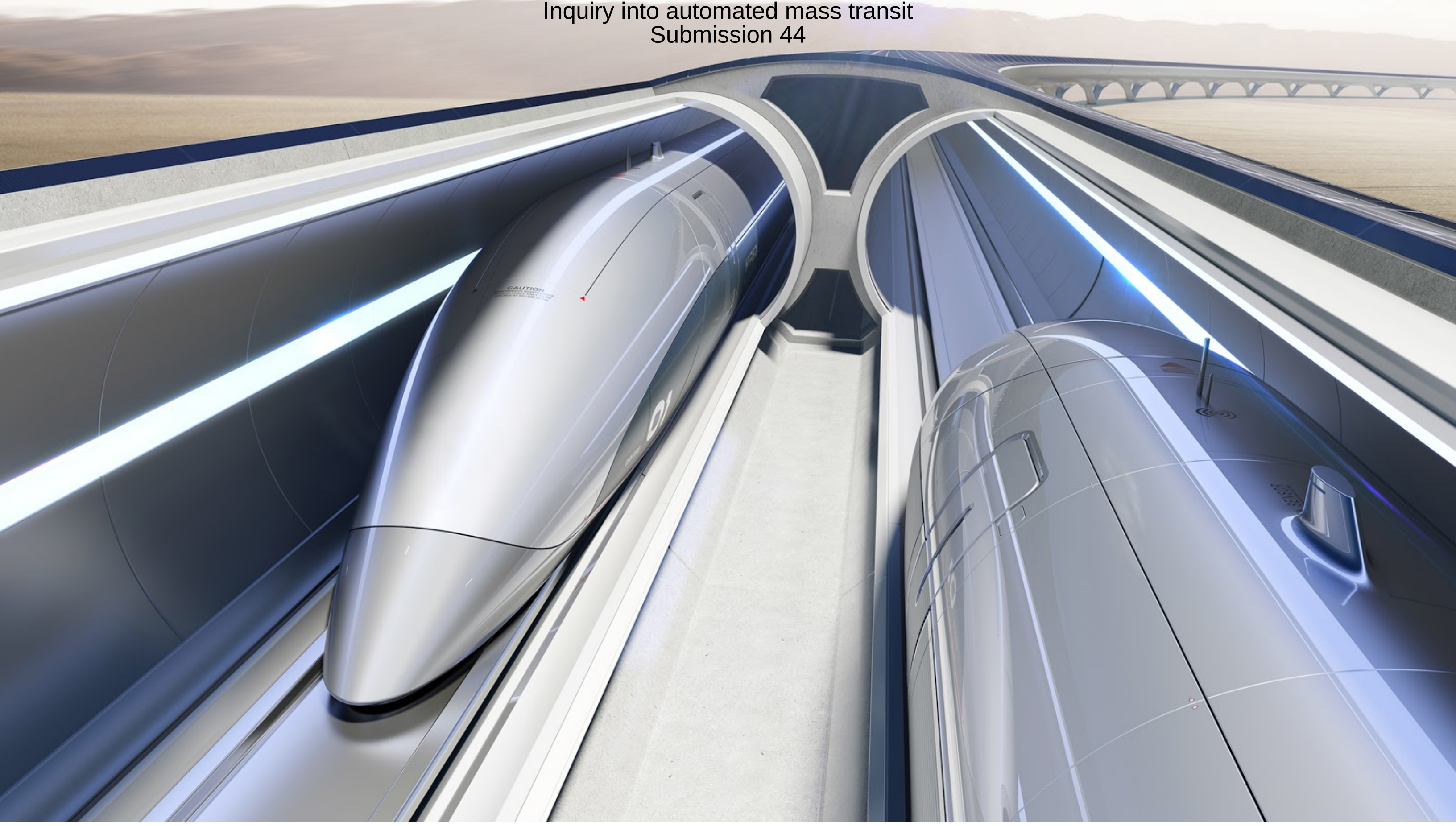
Our lead for Business Development in Australia is Mr. Wesley Heron who can be contacted on +61 437 685 882 and by email at wesley.heron@hyperloop.global.

Yours sincerely,

Bibop Gresta
Chairman and CEO

Rodrigo Sa
Head of Global Business Development

Hyperloop Transportation Technologies
21 December 2018



HYPERLOOP TRANSPORTATION TECHNOLOGIES

PARLIAMENT of AUSTRALIA

Parliamentary Inquiry into Automated Mass Transit

Prepared by:

Hyperloop Transportation Technologies

Los Angeles, California

December 2018

Table of Contents

1. Executive Summary

1.1. Purpose of this Document

As the Parliament of Australia and regional authorities continue to advance conversations around new transportation opportunities, public and private stakeholders are requesting to understand more about how a Hyperloop system will enhance mobility solutions throughout the nation. This document presents to the Australian Parliament an overview of the HyperloopTT system, its applicability to Australia and the case for why it should be considered in all future evaluation of point-to-point transport options using autonomous vehicles (Point 3, Terms of Reference).

1.2. Hyperloop Transportation Technologies

Hyperloop Transportation Technologies Inc. (HyperloopTT) is an innovative transportation and technology company focused on realizing the Hyperloop, a system that moves people and goods at unprecedented speeds safely, efficiently, and sustainably. Through the use of unique, patented technology and an advanced business model of lean collaboration, open innovation and integrated partnership, HyperloopTT is creating and licensing technologies.

Founded in 2013, HyperloopTT is a global team comprised of more than 800 engineers, creatives and technologists in 52 multidisciplinary teams, with 50 corporate and university partners. Headquartered in Los Angeles, CA, HyperloopTT has offices in Abu Dhabi and Dubai, UAE; Bratislava, Slovakia; Toulouse, France; Contagem, Brazil; and Barcelona, Spain. HyperloopTT has signed agreements in the United States, UAE, Brazil, France, Germany, India, China, Korea, Indonesia, Slovakia, Czech Republic, and Ukraine.

1.3. HyperloopTT System

Hyperloop is a tube-based inter and intra-city transportation system for passengers and goods. Proprietary passive magnetic levitation and a linear motor combined with a tube environment in which air pressure has been drastically reduced to allow the capsules to move at high speed with nearly zero friction. The HyperloopTT system is powered by a combination of alternative energy sources to ensure sustainability and low cost.

Hyperloop brings airplane speeds to ground level, safely. The advantages of Hyperloop travel are transformative, changing travel time from hours to minutes across Australia and into regional centres thereby creating decentralization and game changing economic opportunities across a properly connected Australian continent.

1.4. HyperloopTT submission summary

HyperloopTT seeks the opportunity to demonstrate the advantages of its point-to-point autonomous transport system against other transport modes in Australia in terms of capital expenditure, operating cost, speed, energy consumption and environmental impact.

HyperloopTT recommends that the Commonwealth of Australia:

1. Takes an urgent and leading role in evaluating and regulating these emerging autonomous standards (Point 4, Terms of Reference).
2. Funds a comparative study of autonomous modes (high speed and other).
3. Invests in an Innovation Hub on Australian soil, to prove that this step-change in technology is realizable, safe and efficient, and uniquely solves Australia's main transport challenges.

2. Problem Statement

Transportation defines our human experience: where we live, where we work, and how we connect. Over the last century, cities have evolved around transportation to meet the needs of the technology rather than the distinct needs of residents. Traffic congestion, poor air quality, and rapid urbanization are a few of the many concerns surrounding existing modes of transportation. The growth of Australian cities is no exception. More recently, this cumulative burden imposed on both individuals and governments is fueling the first major transportation revolution since the construction of the highway system.

The current interstate transportation system in Australia is broken like other parts of the world - inefficient, environmentally unfriendly and expensive.

2.1. Congestion

The high number of cars and trucks on our roads cause a high road toll, and the high numbers of cars and trucks on our roads cause inner city gridlock. The cost of road building and maintenance due to this high usage rate in Australia is prohibitive. It doesn't recoup the costs.

Congestion in airports is pronounced as more people travel interstate with no choice other than air travel. The Melbourne-Sydney corridor is regularly listed in the top three most travelled "city pairs" in the world. The airport infrastructure fails to cope with the demand. New airports and airport upgrades with high price tags are required. Meanwhile, city and interstate rail passenger numbers are low due to the lack of services, and the high infrastructure costs restrain new rail projects from being built.

2.2. Pollution

Singly occupied passenger and freight vehicles are a major contributor to greenhouse gas, flying is heavily carbon intensive and our diesel/electric rail system consumes vast amounts of fossil fuel derived electricity and produces an abundance of greenhouse gas in the process.

2.3. Cost

On the roads, trucks and cars are driving up the road toll. The cost of new infrastructure and the maintenance of an ageing road system heavily trafficked by trucks is enormous from both a construction and an operation and maintenance perspective. The cost of air infrastructure is growing as we expand airports and car parks. We are spending heavily on air infrastructure as we seek to meet demand based on the lack of viable surface transportation solutions. New rail projects demand huge spending programs by the states as we attempt to roll out new rail projects using 1800s steel on steel technology for marginal speed and performance gains.

The rail infrastructure needs vast money per km to create a High Speed Rail capability. Existing intra and interstate passenger rail is obsolete and inefficient. Existing freight services are limited. While most bulk freight is on rail, a large amount of intermodal and non-bulk freight remains on road[1]. There are no efficient surface transportation links to country areas besides roads. Regional air and rail links, where they exist, lose money and are in the most part heavily subsidized by Australian governments.

2.4. Hidden costs of infrastructure

Throughout the world, transportation infrastructure is facing challenges to properly meet the expanding capacity of urban centers while using housing and transportation infrastructure to effectively distribute and manage population density. Congestion negatively impacts affected cities with wasted time, lost productivity, increased air pollution including carbon dioxide levels, reduced predictability, increased risk of collision, additional wear on vehicles and roads as well as the psychological and social impacts like increased stress, anxiety and road rage.

This suggests that the costs of maintaining current infrastructure lead to hidden costs that are often neglected in assessments of what the optimal mobility solutions are for local or intercity transportation. HyperloopTT is building its mobility platform around removing negative economic, societal, environmental, and social impacts from transportation.

2.5. Australia's transportation dilemma

Australia is separated by long distances between capital cities. Regional centres are declining with the loss of jobs, and there are limited freight services supporting the population.

There is no High Speed Rail capability in Australia currently - the costs have always been prohibitive. Nothing has changed and HSR has become obsolete technology against Hyperloop. What has changed is that Australia has become increasingly desperate for a rapid fix.

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[1] Inquiry into National Freight and Supply Chain Priorities, Supporting Paper No. 3, Road and Rail Freight, March 2018, https://infrastructure.gov.au/transport/freight/freight-supply-chain-priorities/supporting-papers/files/Supporting_Paper_No3_Road_and_Rail.pdf

Freight and passenger services, with different requirements, compete for right-of-way and infrastructure access.

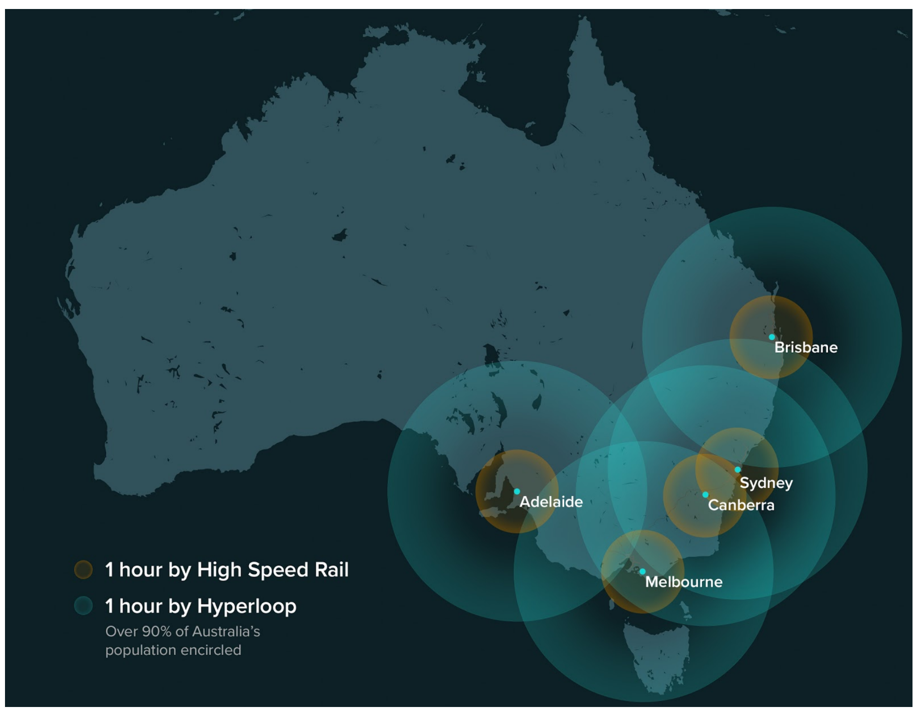
There is a huge spend underway on new passenger and freight links for marginal speed and performance gains over existing solutions. Hyperloop offers a significant step-change improvement over existing solutions.

3. The Solution | Faster than flight, cheaper than rail

3.1. Hyperloop

Hyperloop is an ultra high-speed mobility solution that connects people and cities. Pressurized capsules move through low-pressure tubes, transporting passengers and cargo through its passive magnetic levitation and propulsion system.

The HyperloopTT system operates a passively magnetically levitated capsule within a low-pressure environment. The system operates with very little aerodynamic drag and significantly reduced friction. Running on far less electricity than conventional maglev systems, the HyperloopTT system is ecologically sustainable and low impact. Renewable energy provides power to the system, which is designed to be net-energy positive over a full year of operation. The system operates autonomously, which increases safety, reduces operating costs, and creates a more profitable mobility solution.

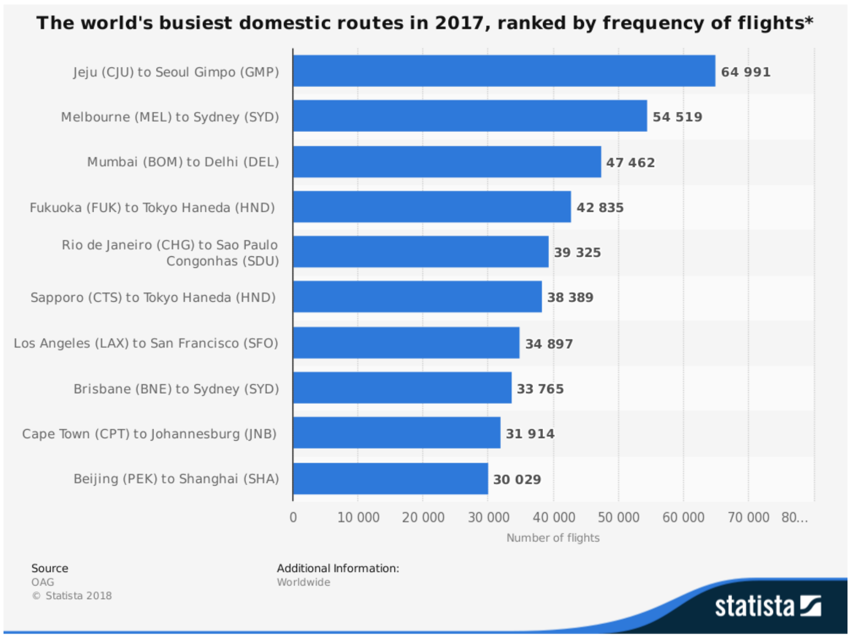


A visualisation of the comparative distances traveled in one hour, with radius as a function of speed by each mode of transport. Orange circles represent conventional high speed rail, blue circles represent Hyperloop[2,3].
A Hyperloop serving Australia's Eastern seaboard and connecting Sydney, Melbourne and Brisbane addresses a population of over 10 million people. Adding Adelaide,

[2] Based on 2013 High Speed Rail Phase 2 study (https://infrastructure.gov.au/rail/publications/high-speed-rail-study-reports/files/HSR_Phase_2_Keyfindings_ES_Booklet.pdf), Department of Infrastructure and Regional Development.
[3] In the 2013 study, average speeds were calculated to be 85% of the top speed, to account for acceleration/deceleration. For high speed rail, top speed is **350 kph**; for Hyperloop, **1223 kph**.

Canberra, the Southern Highlands and extending the route to the Gold Coast increases the number to well over half of the Australian population, in a 2000 km stretch of relatively flat, seismically stable terrain, and creating new business, passenger and freight transport opportunities to millions of Australians each year.

3.2. Connecting Australia's eastern cities



In a 2017 Statista study based on data from OAG[4], two Australian flight routes were placed in the top 10 in the world based on frequency of flights. The MEL-SYD corridor at No. 2 globally is served by 54,500 flights a year; the BNE-SYD corridor by 33,700 flights.

It is generally considered that high-speed rail is most appropriate for journeys of 400-800 km. Below that range, even a good quality conventional service is competitive with air travel, whereas above 800 km, high-speed rail cannot compete in an efficient and effective manner with flying. Although Hyperloop has advantages at both shorter and longer distances, there is a particularly interesting competitive advantage for Hyperloop in the 700 to 1500 km range.

This range is well-suited for Hyperloop in Australia, with a motorway corridor distance of 898 km between Melbourne and Sydney, and a distance of 919 km between Sydney and Brisbane and 726 km between Melbourne and Adelaide.

3.3. Unlocking regional Australia

Australia's population is concentrated along the eastern seaboard. A growing urban sprawl is pushing the population further inland and into regional centres with daily migrations of people to

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[4] https://www.statista.com/statistics/794380/frequency-of-domestic-routes/

and from the capital cities for employment.

Geelong has a population of 184,000 people (2014) and is situated approximately 75 km from Melbourne, with an estimated driving time of 77 minutes.

Newcastle has a population of 547,000 people (2010) and is situated approximately 163 km from Sydney, with an estimated driving time of 126 minutes.

An estimated 30,000 people per business day commute between Melbourne and Geelong; a far higher number between Sydney and Newcastle / Wollongong. Over the course of a year, it can be easily estimated that well over 70 million unproductive hours are spent on congested roads commuting between the capital cities of Sydney and Melbourne and their regional centres.

A Hyperloop from Sydney to Canberra, Nowra, Port Macquarie and Orange would offer significant decentralization opportunities for Sydney, offering new affordable housing markets for young Australians, reducing road congestion, greenhouse gas emissions, and go some way to reducing the Australian road toll; a cost estimated at AUD$27 billion a year[5].

3.4. Providing investment returns instead of relying on subsidies

Completed and ongoing feasibility studies for implementation of Hyperloop technology around the world are demonstrating the possibility of providing a direct return on investment in the range of 10 to 20 years. In contrast, almost every high speed rail system around the world requires ongoing subsidies. In short, this seismic shift is enabled by three main concepts:

1. **Capital cost** is reduced by up to 45% compared to high-speed rail, based on system optimization towards lighter capsules with more frequent departures.
2. **Operating cost** is reduced by providing energy back to the grid, automating operations, and reducing maintenance costs because of closed environments and lack of high-speed contact between moving parts.
3. **Passenger experience** is improved and new revenue opportunities are enabled through an integrated, frictionless mobility system.

More detail on comparisons between Hyperloop technology and existing modes of transportation, and the outcomes for feasibility studies that study particular corridors and networks in feasibility studies, are presented in the following sections.

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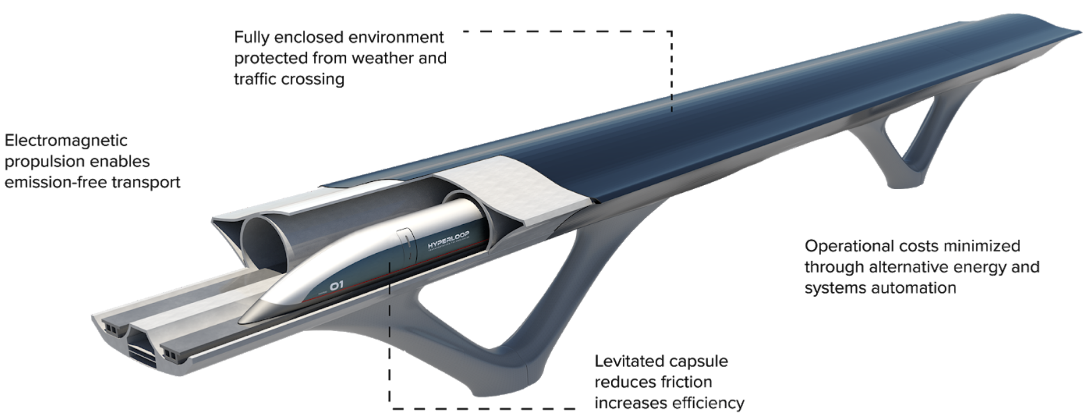
[5] https://infrastructure.gov.au/roads/safety/

4. Hyperloop

4.1. HyperloopTT Technology

The HyperloopTT system accelerates the movement of people and goods up to 760 miles per hour, drastically reducing the travel time between locations and energy required en route. The HyperloopTT system operates within an enclosed tube system to create a controlled environment where operators can optimize the system around efficiency, safety, accessibility and affordability. Using vacuum pumps to remove excess air, the enclosure enables the creation of the low-pressure environment within the system. This reduced air pressure decreases friction from aerodynamic drag applied to the capsule en route. Pressurized passenger and cargo capsules travel within the low-pressure environment, connecting people along the corridor.



The HyperloopTT propulsion and levitation system reduces mechanical friction by eliminating the use of steel wheels, instead using proprietary passive magnetic levitation, with electromagnetic propulsion using linear motors. Lawrence Livermore National Laboratory licensed its Inductrack technology exclusively to HyperloopTT for application within its system. The HyperloopTT tube and pylon system provides structural support for the tube enclosure as well as the guideway as host for the propulsion and levitation systems.

The entire system operates autonomously. Central control maintains communication between the capsules while the safety systems prevent collisions between capsules, obstructions, and changes in pressure along the tracks. The tube and pylon system provides additional functionality, including housing solar panels on the roof of the tubes. Renewable energy powers the HyperloopTT system including the propulsion, vacuum systems, and capsules to create a high-speed and resource-efficient mode of transportation. The enclosed system eliminates environmental factors and obstacles along the development corridors by removing interaction from weather, vehicular traffic, pedestrians, and wildlife.

4.1.1. Capsule

Pressurized capsules travel through the tube system, accommodating passengers and cargo. The capsule interior is pressurized to comfortable atmospheric conditions for the people and equipment onboard. The Augmented Windows enable Hyperloop passengers to see the outside world and engage with interactive content. Each trip is an opportunity to connect our passengers with the world around them. By creating a true passenger-first experience, HyperloopTT technology enables operators to pursue new business models and monetization strategies to maximize revenue streams.

4.1.2. Tube and Pylon System

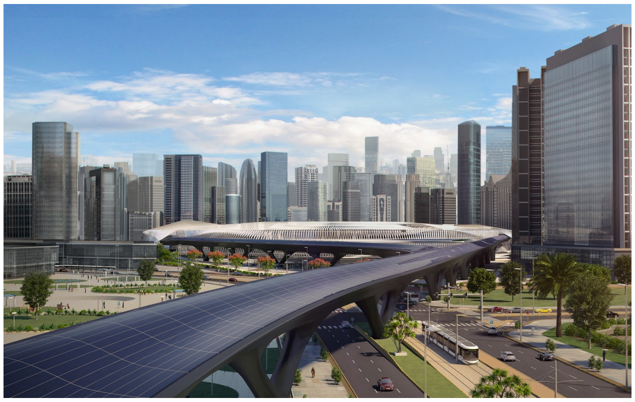
The HyperloopTT tube encloses a low-pressure environment that reduces aerodynamic drag on the capsule en route to its destination. The tube supports a straight and level guideway, provides attachment points for communications and safety systems, and serves as a structural foundation for the solar panels.

The pylon supports the HyperloopTT tubes and connects them to the ground while distributing the weight of the tubes, capsules, and other loads across the system. At regular intervals, pylons support egress for evacuation and maintenance purposes. A primary design consideration in creating the HyperloopTT system is maintaining a consistent alignment of the corridor to prevent excessive g-forces applied to passengers. Depending on the regional topography and geologic features, the route corridor and track alignment can have subterranean, at grade, and above ground applications.

4.1.3. Propulsion and Levitation System

Passive magnetic levitation, based on Inductrack technology exclusively licensed from Lawrence Livermore National Laboratories, provides lift forces when the capsule is moving, without requiring power on the track. In combination with passive magnetic levitation technology, linear motors in the HyperloopTT propulsion and levitation system move the capsule down the guideway using electric power. The capsule control/command system transmits the propulsion and braking commands while the propulsion and levitation system also provides the regenerative braking component during deceleration cycles.

4.1.4. Station



The HyperloopTT station creates a transit hub for the community and most importantly an urban center. The HyperloopTT station is designed to provide smart and smooth transit, especially in critical features, including minimum gate-to-gate time, an efficient wayfinding system, a smooth biometric check-in system, and passenger services.

Gate-to-Gate time is one of the most important features for station efficiency, which also leads to a pleasant travel experience. HyperloopTT stations are designed to minimize the circulation time through smooth check-in & security systems, passenger wayfinding, efficient circulation designs and staging strategies.

Integration with various “first and last-mile” solutions to bridge the gap between public transit stations and destinations is a key feature of the HyperloopTT system. The HyperloopTT station will facilitate and manage intermodal connections with ground transportation, including trains, buses, taxis, bicycles, ride-sharing, autonomous cars and other sharing mobility tools. The station serves as a focal point to create a comprehensive Hyperloop Oriented Development.

4.2. Cargo Operations

In addition to passenger systems, the HyperloopTT system enables the creation of two distinct types of cargo operations. Similar to adoption of internet connectivity, ultra high-speed movement of cargo will create new functionality across the cityscape, enabling the creation of business models that rely on the faster and more efficient modes of transport to provide value for customers. Shifting movement of materials through fast, safe, and efficient cargo networks will benefit transportation infrastructure along the development corridor by reducing congestion, noise, and pollution.

4.2.1. Cargo complementing passenger-centric systems

HyperloopTT is developing a cargo compatible capsule capable of moving both passenger capsules and cargo capsules in a passenger-scale tube and vacuum system. When offered in combination with the HyperloopTT passenger system, freight and cargo operations supplement the needs of regional freight systems Moving people and goods at ultra high-speed enables people to be more mobile between population centers. Operators can take advantage of variable system demand by running cargo operations in tandem with passenger traffic during lower density time periods while using capsules devoted entirely to cargo for times of day with low travel demand.

4.2.2. Cargo-centric system

The second type of operation is a cargo-dedicated or cargo-centric system design. In this service, compatibility with industry container standardization and intermodal operations is key to successful large volume commercial cargo handling and trans-shipment. Systems are designed to interface with existing port facilities for an efficient movement of goods to and from ports.

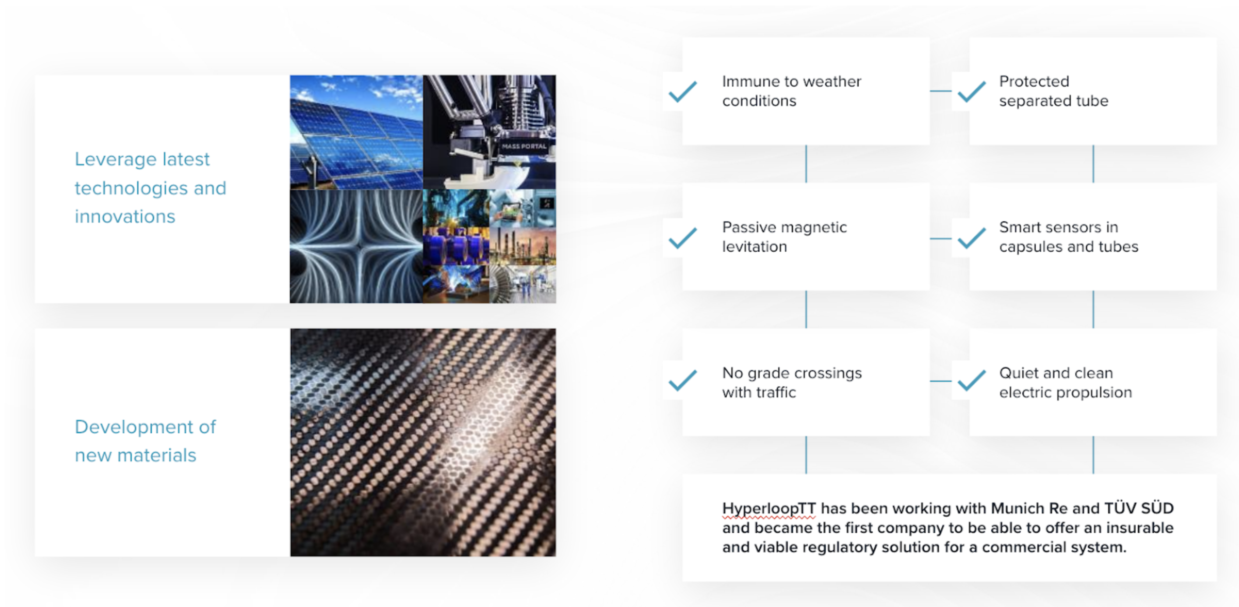
4.3. Key Technology Partnerships

While many companies implementing crowdsourcing into their business model use it for an idea generation platform, HyperloopTT's entire business model is based around accessing the intellectual resources of individual experts and partner companies. The collaborative ecosystem accelerates innovation throughout the system while yielding a diverse set of ideas and approaches integrated into the system architecture, design and business process. The HyperloopTT engineering team collaborates with individuals throughout the HyperloopTT ecosystem to advance the HyperloopTT system, drawing on the support of over 800 collaborators from around the world.

In addition, HyperloopTT partners with cutting edge companies, research laboratories, and universities to leverage their research and development along with commercial expertise. These partnerships include: Lawrence Livermore National Laboratory for the Inductrak™ passive magnetic levitation system which is the basis for the propulsion and levitation system; Leybold to create the vacuum systems; Tecnoaranda to build the tube infrastructure; Priestmangoode to design the capsule; Airtificial (previously Carbures SA) to create the capsule structure; Mad Architects to design the tube and pylon architecture; An.onymous to develop the station architecture concepts; and Dar Al-Handasah as design lead for the commercial prototype in Abu Dhabi, UAE. HyperloopTT continues to build new and innovative partnerships to synthesize the technical and business components together for the HyperloopTT system.

5. Safety, Regulation and Insurance

Transportation systems are most effective when safety is engineered at the earliest stages, and not as an afterthought in the design process. The HyperloopTT system is designed around creating the safest mode of transportation possible.



5.1. Safety by Design

5.1.1. Hazard Analysis and Risk Assessment

Working with partners TÜV-SÜD[6], HyperloopTT has performed an in-depth Hazard Analysis and Risk Assessment, a tool to identify, analyze, and evaluate risks in a structured manner. The risk assessment includes evaluation of the likelihood of a system hazard as well as the severity of the loss associated with the hazard. In cases where risks are deemed to be intolerable, mitigation strategies are identified to reduce the risk to acceptable levels. Common risk mitigation strategies include using design standards from similar industries, employing redundant systems, using appropriate safety factors and engineering design and testing tools, and developing redundant strategies for emergency response.

[6] https://www.tuv-sud.com/about-tuev-sued/about-us

5.1.2. Emergency response strategies

Different emergency response strategies are planned depending on the severity of the event. Similar to other modes of transportation, the most common strategy is to manage the event as it occurs. For example, if the system senses that the temperature of a capsule battery module is above a threshold, the battery is disconnected from the capsule power and the capsule continues to its destination. If needed, it is sent to a maintenance bay for further evaluation.

In a more severe event, it may be necessary to stop a capsule along the length of the route. Emergency braking uses a combination of normal and expanded braking systems to achieve a -0.6 g braking force, less than automobiles equipped with anti-lock braking systems (-0.78 g). This force is sufficient to prevent collisions between capsules 40 seconds apart at top speed. Once the system is stopped, capsules can be brought to emergency DockLocks nominally positioned every 10 km along the length of the route. Passengers exit the capsule directly to a controlled, outside environment in the same way that they would exit the capsule in the station.

Finally, in the event that a capsule is stranded and cannot move to the primary exit point it can stop at any point in the tube. Every 10 km section is referred to as an Isolation Zone. On each side of the zone is located a shutoff valve large enough to seal the entire 10 km section. Once a capsule is safely within the isolation zone then the isolation valves are closed and tube repressurization can begin. When the tube reaches atmospheric pressure, the capsule emergency doors can be opened (similar to aircraft evacuation doors) and passengers exit the capsule into the tube. The standard requirements for identification of exits and paths in commercial aviation are used to guide passengers to frequent situated tube exit ports. Passengers use the tube exit ports, again similar to aviation escape doors, and exit onto platforms located at pylons. The spacing of the tube exit ports will follow regulations currently used in train travel inside of tunnels and allows all passengers to safely leave the stranded capsule.

5.1.3. Intrinsic safety features

- Frictionless high speed travel, quiet and non-contact
- Negligible pressure cycles without takeoffs and landings – capsules stay under vacuum – reduced structural fatigue compared to aviation
- No fuel systems, jet engines, or control surfaces
- Passive magnetic levitation and electromagnetic propulsion, a gentle landing in case of power loss
- Operating in a protected tube provides immunity from weather
- No grade crossings with traffic, pedestrians or wildlife

- Guaranteed capsule separations
- Capsules cannot be seen while in the tube
- Fully instrumented with sensors and secure two-way communication between tubes, pylons, capsules, stations, and operation control centers

5.1.4. Wildlife

Integrating a long-haul passenger system must take into account Australia's unique fauna. In Australia, V/Line trains in the state of Victoria collided with kangaroos and other livestock on an average of 60 times per month.[7] At the relative low V/Line speeds, impacts to trains and passengers are minimal, however, in a high speed rail scenario with speeds in excess of 300 km/hr, the results could be catastrophic to livestock, the train and its passengers.

Securing an interstate high speed rail corridor against kangaroos strikes would be costly, with an approximate cost of AUD$2B simply for the fencing necessary from Melbourne to Sydney to avoid high-speed train strikes with kangaroos. A further consideration is that ground-level mass transit systems such as train and motorway corridors effectively divide the land into two, preventing animals from their natural migrations around the country.

5.1.5. Level crossings

In an ITSR New South Wales bulletin[8] studying the number of level crossing accidents over a 10-year period from 2000-2009, a total number of 695 accidents were reported, resulting in 97 fatalities. A grade-separated corridor allows full use of the covered land area for motorway corridors, median strips and pedestrian pathways.

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[7]https://www.theage.com.au/politics/victoria/kangaroos-cause-delays-on-v-line-trains-20181121-p50hdb.html

[8]https://www.onrsr.com.au/__data/assets/pdf_file/0020/2963/Transport-safety-bulletin-Issue-2-Level-crossing-accidents-in-Australia-August-20112.PDF

5.2. Insurability

In 2017, HyperloopTT initiated a partnership with Munich Re, one of the world's leading providers of reinsurance, primary insurance and insurance-related risk solutions. After analysing risks and challenges, Munich Re has created the first Hyperloop Transportation Technologies Risk Report[9]. The project team within Munich Re's Special Enterprise Risks Unit considered the risks and challenges facing HyperloopTT's technology. Risk landscapes were developed not only for HyperloopTT, but also for HyperloopTT's technology itself. These risk landscapes shed light on enterprise and technological risk and document relevant external and internal influencing variables. The risk report forms the foundation for active strategic risk management. The key conclusion of this report was "Munich Re is of the opinion that the HyperloopTT technology developed is both feasible and insurable in the medium term and that delivering the system demands a model represented by HyperloopTT's innovative approach."

In 2018, Munich Re announced that it had created the first insurance framework for HyperloopTT worldwide systems, making HyperloopTT the first and only company to have an insurable commercial system. HyperloopTT has worked from the bottom up to gain an insurable business case before bringing the solution to market.

5.3. Regulation and Certification

HyperloopTT has reached key milestones to overcome another of the biggest hurdles facing introduction of a new transportation system: regulation. In October 2018, Hyperloop Transportation Technologies announced that it had partnered with testing and inspection company TÜV SÜD to establish a set of Hyperloop core safety requirements and global certification guidelines.

At a private meeting held at TÜV SÜD's global headquarters in Munich, Germany, several of HyperloopTT's partners and stakeholders, together with government representatives, were introduced to the first set of the new guidelines and products. Additionally, a roadmap for joint creation and adoption into a final legal framework for regulating the construction and safe operation of Hyperloop systems was discussed. In attendance were representatives from Ukraine, China, France, and the United States all of whom have existing agreements with HyperloopTT.

[9]Abstract:
https://www.munichre.com/site/corporate/get/documents_E697748403/mr/assetpool.shared/Documents/0_Corporate_Website/6_Media_Relations/Company_News/MunichRe-Risk-Report-Hyperloop-L4.pdf

6. Transportation Modes Comparison

HyperloopTT aims to complement and integrate with other existing forms of transportation to develop frictionless mobility solutions for people and goods. Nonetheless, there are important comparisons to be made between the HyperloopTT and other modes of transportation. The most obvious comparisons are between the HyperloopTT system and High Speed Rail as well as short and medium distance air travel.

6.1. High-speed rail challenges

Travel between cities by train is inefficient and expensive. Trains often have delays getting between their destinations. Rail networks subsidize the less popular routes with the revenue from the more popular routes, which gives accessibility to residents along these corridors. Moreover, the stops along the corridor increase the travel time while limiting the maximum speed of the train. Rail utilizes human labor for numerous operational systems including ticket sales and verification, onboard services, and operation of the train. Reliance on human labor increases the operating cost of the rail system, while human operators also increase the safety risk from human error, which causes the majority of rail accidents.

6.2. Air transportation challenges

Travel between cities by airplane is expensive, time consuming, and also inefficient. Airports are often constructed outside of the main city requiring interface between cars or transit. In addition to access issues, security creates additional time requirements for air travel, with busy travel days increasing security time allocations. Weather conditions affect airport operations with last minute flight cancellations and air traffic control likewise imposes limitations on take off and landing for aircraft safety.

Air travel also requires large tracts of land. Airports need runways, terminals, airplane maintenance areas, parking, and loading and unloading areas. Most of these airport design features are built around accommodating the large wingspans and height of the aircrafts. Airplanes require taxi time to move through the vast network of spaces between the terminal and take-off runway. Aircraft access to the runway limits capacity at the airports and increases travel times with ascent/descent times of the plane.

6.3. HyperloopTT solutions

The HyperloopTT system achieves speeds far in excess of high-speed rail, without needing to respond to obstructions along the guideway corridor. Additionally, the HyperloopTT system does not pose risks to pedestrians or the surrounding environment, while removing the risk of human error through its automated system. The HyperloopTT system reduces ticket prices by leveraging low capital costs and low operating costs, while passing these savings along to the consumer. The distinct benefits enable connection of remote regions using the HyperloopTT system because the high efficiency and low costs reduce both fixed and variable costs from routes.

Wildlife, namely air fowl, poses safety issues for the operation of aircrafts and airports, while also increasing the ecological impact of air travel. While, the isolated design of the HyperloopTT system poses substantially fewer safety issues from its operations than air travel, the HyperloopTT system also does not create particulate pollution from the use of fuels. The HyperloopTT system eliminates noise pollution from aircrafts landing and taking off, enabling operators to offer trips at any time of day without disrupting surrounding residents.

6.3.1. HyperloopTT system capabilities

The HyperloopTT system has a projected maximum speed of about 1,223 km/h. At half that speed, it would be far faster than any ground transportation now in existence and would be faster than air travel over target routes with far less delay.

The HyperloopTT system can carry more goods and people than other forms of transportation. HyperloopTT capsules with 38 passengers, a 40-second maximum potential departure rate from the station, within a 2 tube system would yield 164,160 persons a day and nearly 60 million people a year at full capacity for one route. The pylons can be engineered to support multiple tubes. The capacity can therefore easily be doubled or tripled.

The HyperloopTT design includes multiple controls and safeguards, both computer and human-operated. HyperloopTT uses state-of-the-art technology, ensuring a comfortable and safe ride for passengers. And because the system runs in an enclosed environment, the HyperloopTT system does not face the same safety concerns of other forms of transportation. There are no concerns with car crashes, at-grade train derailments, or aircraft accidents. The HyperloopTT system was deemed insurable by one of the world's largest reinsurance companies, Munich RE.

Unlike other forms of transportation, the HyperloopTT system is virtually immune to weather conditions, making travel times reliable. The use of multiple tubes means redundancy; if one of the tubes is temporarily unavailable, the same trip can be taken in an adjacent tube.

6.3.2. Capital cost

HyperloopTT system is expected to be up to 45% less expensive compared to high-speed rail. The system optimization focuses on an improved passenger experience with more frequent, point-to-point departures. This leads to a solution which is significantly lighter than high speed rail, and therefore less expensive, even considering the structures required to maintain a low-pressure environment.

6.3.3. Operating cost

The HyperloopTT system is net-energy positive, over the course of a year, recapturing revenue. Labor costs are reduced through the use of automated systems. The closed environment and lack of high-speed contact between moving parts lead to a reduced maintenance cost.

6.3.4. Passenger experience

By offering on-demand trips with limited time between departures, HyperloopTT resolves many of the ticketing issues faced by airline customers. Instead of having groups of people arriving at one time for the same flight, HyperloopTT has a steady stream of passengers arriving and departing. The HyperloopTT station design limits security wait times by using biometric security systems. Given the heavy travel demand between medium distance city pairs, there is a large, unsatisfied demand for this type of speedy, low hassle service. Moreover, the travel experience between destinations is seamless by removing the need for paper ticketing systems.

6.3.5. Environmental benefits

Unlike other forms of transportation, the HyperloopTT system is designed to be environmentally friendly, producing a net environmental benefit. The key environmental feature of the HyperloopTT system is deployment of solar panels along the tube and installed on the station. The solar array virtually removes the need for fossil fuels to power the HyperloopTT system.

Because the system is generally elevated on specially built pylons, it is less disruptive to the environment, unlike tracks or roads at grade. The pylons themselves can be used as a location for plants and animals to thrive. Additionally, the HyperloopTT system is virtually silent and produces negligible ground vibration because it levitates in an enclosed tube.

6.3.6. Land use

Most transportation solutions require wide, continuous and expensive land corridors to be acquired by the government. With the use of raised pylons, the Hyperloop system in the figure above occupies minimal land area, passing along median strips and along sidewalks.

In the Australian context, such a system occupying minimal footprint could significantly reduce impact to farmland, significantly reducing the land acquisition cost and creating new revenue streams through a leasing arrangement for landowners whilst retaining full usage of the land immediately near the system corridor.

6.3.7. Enhancing Livability

HyperloopTT's objective is to revolutionize personal transportation by building its mobility solutions around the needs of people. With a broader and more accessible range of mobility services, from first-mile to last-mile, the connection of the mobility solutions along with passenger experience innovation creates a comprehensive enhancement to the users' livability within their population center and region. Ensuring that the surrounding geography of a city is accessible to the people in the city is an essential component to building livable cities. In addition, removing pollution and congestion from the connected transportation systems adds new value to the people and homes surrounding the surrounding infrastructure.

7. Company Profile

Hyperloop Transportation Technologies Inc. (HyperloopTT) is an innovative transportation and technology company focused on realizing the Hyperloop, a system that moves people and goods at unprecedented speeds safely, efficiently, and sustainably. Through the use of unique, patented technology and an advanced business model of lean collaboration, open innovation and integrated partnership, HyperloopTT is creating and licensing technologies. HyperloopTT's innovative approach is profiled in a Harvard Business Review case study[10].

Founded in 2013, HyperloopTT is a global team comprised of more than 800 engineers, creatives and technologists in 52 multidisciplinary teams, with 50 corporate and university partners. Headquartered in Los Angeles, CA, HyperloopTT has offices in Abu Dhabi and Dubai, UAE; Bratislava, Slovakia; Toulouse, France; and Barcelona, Spain. HyperloopTT has signed agreements in the United States, UAE, Brazil, France, Germany, India, China, Korea, Indonesia, Slovakia, Czech Republic, and Ukraine.

7.1. Collaborative Structure

In order to build a Hyperloop system, numerous technical pieces and components need to be created around the unique nature of this application. The collaborative ecosystem accelerates innovation throughout the system while yielding a diverse set of ideas and approaches integrated into the system architecture, design and business process.

In addition, HyperloopTT partners with cutting edge companies across industries, research laboratories, and universities to leverage their research and development along with expertise.

[10] Applegate, Lynda M., Terri L. Griffith, and Ann Majchrzak. "Hyperloop Transportation Technologies: Building Breakthrough Innovations in Crowd-Powered Ecosystems." Harvard Business School Case 817-134, May 2017. (Revised October 2017.)

https://www.hbs.edu/faculty/Pages/item.aspx?num=52627

7.2. Key Milestones

7.2.1. HyperloopTT Achievements

7.2.2. HyperloopTT Construction Milestones

Vibranium™ capsule

- Dual-layer smart sensorized composite material
- Monitor structural integrity

Vacuum by Leybold

- Joint development of HyperloopTT vacuum system with Leybold
- Detailed design and fabrication of HyperloopTT vacuum unit

Full-scale test track

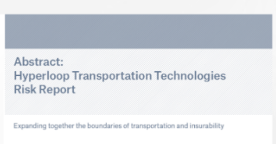
- Full-scale tube test track in Toulouse R&D Center
- Continued R&D on tube materials: Steel/concrete/carbon fiber

Inductrack™ by LLNL

- Passive magnetic levitation
- Exclusive license from Lawrence Livermore National Laboratory

Reinsurance by Munich RE

- Munich RE deemed HyperloopTT technology feasible and insurable
- First insurance framework for HyperloopTT commercial systems


Abstract:
Hyperloop Transportation Technologies
Risk Report

Expanding together the boundaries of transportation and insurability

Certification by TÜV SÜD

- First set of Hyperloop Core Safety Requirements and Certification Guidelines have been produced

7.3. Leadership and Engineering core

7.3.1. Founding Management team

Dirk Ahlborn, Co-founder and Chief Executive Officer. A German-born, American entrepreneur, Dirk Ahlborn got his professional start in Europe. He is known for his outside-the-box approach to bringing paradigm-shifting businesses to life, leveraging the full power of crowd-collaboration, the Internet, and exponential technologies at the vanguard of the global sharing economy. Dirk's interests in alternative energy are long-standing; he founded several companies in Europe in the late 1990s that focused on sustainable energy. A self-described "serial entrepreneur," he entered the startup world with the Girvan Institute, assisting NASA's Ames Research Center in the transfer of commercialized technologies and helping to start Advanced Turbine Designs, Inc. Dirk's two decades' experience have served him well as Founder and CEO of JumpStarter, Inc. (www.jumpstartfund.com), a California-based, crowd-powered online business incubator, founded in 2012 to enable communities to contribute to projects and technologies.

Bibop G. Gresta, Co-founder and Chairman. Expert in finance, transportation and media, Bibop G. Gresta is a respected activist in Transhumanism and Ethical Entrepreneurship. He is a world-renowned speaker on the topics of the future of transportation and human mobility, presenting at high-level global meetings such as the World Economic Forum and the United Nations. He founded Bibop S.p.a, a digital content firm; he sold 40% to Telecom Italia for 11bn Italian Lira, creating one of the earliest successes of the Italian New Economy. In 2004, he co-founded the influential startup incubator Digital Magics SPA, responsible for more than 70 companies, and served as venture partner. He entered into the venture capital market in 2011 with two publicly-traded companies in the United Kingdom and Germany. In 2014 Bibop partnered with CEO Dirk Ahlborn to become Chairman for Hyperloop Transportation Technologies.

Andres de Leon, Chief Operating Officer. Known worldwide for his focused management style and creating growth-oriented businesses, Andres de Leon was appointed to his role after serving as Corporate Development Officer for JumpStarter, Inc., and managing HyperloopTT's operations in Europe and South America. He brings 30 years of international experience as a senior executive in manufacturing, finance management, private/public business negotiation and tax and audit supervision to HyperloopTT, having transacted corporate affairs in Spain, Belgium, Portugal, France, Italy, Mexico, Chile and the United States. This experience is a perfect match for the globally collaborative entity, and Andres was critical to the development of HyperloopTT. He now coordinates the largest crowd-powered team of professionals ever assembled.

Andrea La Mendola, Chief Global Operating Officer & Chief Engineering Council member. Holding a Master's degree in engineering from Politecnico di Torino, Italy, one of the top universities in Europe for engineering and architecture studies, Andrea La Mendola is a co-founder and a board member of Indyca, an established Italian entertainment property creator and producer that has successfully shared product with the world for 10 years. Additionally, he is co-founder and vice president of Relov, an international brand that combines fashion, design and tech. During his tenure, he pushed forward a melding of IoT and lifestyle products. Andrea's understanding of intellectual property management and control, consumer-centric innovation and the management of personnel brings great value to HyperloopTT.

Bernd Stephan, Chief Financial Officer. An experienced financial executive with an extensive U.S. and international resume in one of the most challenging business arenas on the globe -- media and entertainment, Bernd Stephan brings the invaluable asset of a firm hand and years of wisdom with corporate startups, corporate finance into the billions of dollars, and an accounting background that has allowed him to sit with several corporations as CFO or Senior VP of Finance. Bernd's extensive experience in operations, accounting, international tax consulting, start-up consulting and international cross-border business relations and unwavering focus gives strong support to the present and future of HyperloopTT, especially in the area of international business. His extensive experience has helped fuel the robust development of HyperloopTT.

Robert Miller, Chief Marketing Officer. A multi-lingual neuroscientist with more than 15 years of international experience in global marketing and operations, Rob Miller began with HyperloopTT as the Head of Marketing, rising quickly to Chief Marketing Officer due to his experience and insight. Prior to joining HyperloopTT, Rob spent more than a decade at Cotton USA, responsible for marketing in South America and northeastern Asia, before assuming the role of Head of Marketing. In this role, he led a team that spanned 17 offices in over 50 countries, repositioning and relaunching the brand to a modern, digitally-minded, always-connected consumer. He has brought this international experience and expertise to HyperloopTT to provide the steady drive needed to ensure the growth of the projects and image worldwide.

7.3.2. Engineering Council Chiefs

Jose Morey, MD. Physician, innovator, entrepreneur and futurist, he is engaged in leveraging big data to help humanity work smarter. His research includes informatics, radiology, business intelligence, predictive analytics, sports medicine, advanced 3D printing. Dr. Jose Morey is Medical Technology and Artificial Intelligence Advisor for NASA iTech/National Institute of Aerospace, and a Senior Medical Scientist on the ambitious IBM Watson Medical Sieve Project.

David Doll. Expert in mechanical and nuclear engineering, he is one of the pre-eminent scientists in the world for MagLev, and a resident expert for MagLev at HyperloopTT. He spent 37 years at General Atomics on highly-classified defense systems. David modeled and developed the Inductrack™ system with the team at Lawrence Livermore National Laboratory. His foremost expertise is in the stability of MagLev systems at varied speeds.

Lan Saadatnejadi. Civil engineer and expert in the management of private/public partnerships, and a high impact solution provider skilled at forging strategic partnerships. She made it possible to deliver transportation improvement programs and develop multi-billion-dollar public works infrastructure projects with innovation and ingenuity. Lan leverages a vast network spanning federal to local governments.

Derya Thompson. Civil engineer specializing in bridge and structural engineering. She is Director of Complex Bridges and Structures, and the Bridges Lead in the state of California for Jacobs, and responsible for the development of the bridges and structures teams. Derya was also the creative force at the heart of many of the world's most prominent projects, specializing in structural engineering, carbon management, sustainability consulting and infrastructure.

Michael Smayda. Former Senior Aerodynamics Engineer at SpaceX. Michael was one of the original SpaceX team members who worked on the original Hyperloop™ concept with Elon Musk. Michael was the responsible design engineer for critical parts of the SpaceX Falcon Heavy, the most powerful operational rocket in the world. His work also led directly to the first successful reentry, vertical landing, and recovery of an orbital booster.

7.3.3. Head Engineering Function

Michael Sarin. Head of Safety, is President and Chief Engineer for Empower Tech, Inc., and manages a pool of international transportation safety experts, defining project safety issues and solutions. Sarin was responsible for the initial creation of safety documentation for HyperloopTT, directing the team in identifying safety events, causes, responses and the necessary designs for mitigation. He also leads the partnership with TÜV-SÜD for hazard and risk assessment and guidelines for certification and regulation of Hyperloop systems. In his leadership role at Empower Tech, Inc., Sarin provides complete engineering services for equipment design, prototype assembly, documentation and project commercialization.

Chris Bobko, Ph.D. Head of Engineering Integration, received his doctorate from MIT in Civil and Environmental Engineering. He specializes in research, development, and forensic engineering work. As a professor at North Carolina State University, he gained significant experimental and analytical experience in mechanics of materials for civil engineering applications. Bobko exercises significant leadership in system engineering at HyperloopTT, bringing together structural systems, power systems, propulsion systems, and control systems.

8. HyperloopTT Global Projects

Abu Dhabi, UAE
- Feasibility Study completed
- Construction in 2019 of the first commercial Hyperloop system

Great Lakes, United States
- Public-Private Partnership agreement with broad industry consortium
- Multi-state feasibility study

Minas Gerais, Brazil
- XO Square, Global Logistics Innovation Center
- Public-Private Partnership model

Toulouse, France
- R&D facility for developing and testing related technologies
- Started construction of first full-scale Passenger & Freight prototype

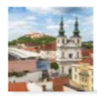
Andhra Pradesh, India
- Pre-feasibility Study completed
- Public-Private Partnership model with initial focus on Andhra Pradesh

Tongren, China
- Joint Venture agreement with Tongren Government
- Agreement for commercial Hyperloop system

KICT, South Korea
- Co-development agreement
- Infrastructure R&D collaboration

Jakarta, Indonesia
- Feasibility Study agreement
- First agreement in Southeast Asia with initial focus on Jakarta

Bratislava, Slovakia
- Pre-feasibility Study completed
- Explore building a local Hyperloop



Brno, Czech Republic
- Feasibility study agreement
- Exploration for Hyperloop connecting Brno and Bratislava, Slovakia

Kiev, Ukraine
- Infrastructure Ministry agreement to start building a commercial line
- Planning the new Silk Road transportation corridor

Hamburg, Germany
- Joint Venture with HHLA, Port of Hamburg Operator
- Using Hyperloop technology to solve shipping industry challenges

8.1. Feasibility Studies and Related Agreements

8.1.1. Abu Dhabi, UAE

HyperloopTT conducted the world's first comprehensive Hyperloop Feasibility Study with the Department of Transport in Abu Dhabi, UAE. The study was conducted as a collaboration between HyperloopTT and ATKINS. The project studied the development of high-speed transportation system between Abu Dhabi and Al Ain.

8.1.2. Great Lakes, United States

First US interstate agreement with the Northeast Ohio Areawide Coordinating Agency (NOACA) who is teaming with the Illinois' Department of Transportation (IDOT) to begin a feasibility study. HyperloopTT is leading a consortium to create a network of routes throughout the Great Lakes megaregion. Cleveland-Chicago feasibility study in progress and expected to be completed Q1 2019.

8.1.3. Andhra Pradesh, India

Agreement with the Government of the Indian State of Andhra Pradesh to connect the city centers of Amaravati and Vijaywada. The project will use a Public Private Partnership model. The pre-feasibility study has been successfully completed.

8.1.4. KICT (Government-sponsored Research Institute), South Korea

Agreement with the Korea Institute of Civil Engineering and Building Technology (KICT) and Hanyang University to co-develop a full scale Hyperloop system, called HyperTube Express (HTX), within the Republic of Korea.

8.1.5. Jakarta, Indonesia

Agreement for a feasibility study to explore building a Hyperloop system for Indonesia, with an initial focus on Jakarta.

8.1.6. Bratislava, Slovakia

Agreement signed with the government of Slovakia to explore building a local Hyperloop system, with the vision of creating future routes connecting Bratislava with Vienna, Austria; and Budapest, Hungary.

8.1.7. Czech Republic

Agreement for exploration of feasibility for a Hyperloop system for Brno, with a focus on connecting Brno and Bratislava, Slovakia. Vision towards also connecting to Czech capital of Prague.

8.1.8. Kiev, Ukraine

HyperloopTT will work with the Ministry of Infrastructure of Ukraine on planning Europe's first commercial system while creating the legal and regulatory framework for the nation. The first phase will consist of a 10 km track to certify the system before being extended out into a broader Hyperloop network.

8.1.9. Hamburg Port, Germany

Joint Venture with the Port of Hamburg terminal operator Hamburger Hafen und Logistik Aktiengesellschaft (HHLA) focused on using Hyperloop technology and innovation to solve the shipping industry's most pressing issues.

8.2. Commercial Projects

8.2.1. Abu Dhabi, UAE

An agreement with Aldar Properties PJSC, the leading real estate developer in Abu Dhabi, which will allow HyperloopTT to start construction of a Hyperloop system as well as HyperloopTT's XO Square Innovation Center, and a Hyperloop Visitor Center. The construction site is located in Aldar's Seih Al Sdeirah landbank in Abu Dhabi and in close proximity to the residential development Alghadeer. It is conveniently located on the border of the Emirates of Abu Dhabi and Dubai, close to the Expo 2020 site and Al Maktoum International Airport. The project will shed light on advanced technologies and the future of mobility.

HyperloopTT plans construction of the line in several phases starting within the five kilometer allocation. Construction is scheduled to begin in Q3 of 2019, with further developments aimed at creating a commercial Hyperloop network across the Emirates and beyond.

8.2.2. Tongren, China

In July 2018, Hyperloop Transportation Technologies signed an agreement in the People's Republic of China. The first project in China will be in Tongren in Guizhou Province. HyperloopTT will be responsible for providing technology, engineering expertise, and essential equipment. Tongren will be responsible for certification, regulatory framework, and construction of the system. HyperloopTT will work in partnership with the government of Tongren in defining the route for the system. Financing will be done through a public private partnership with 50% of the funds coming directly from Tongren.

8.3. Innovation Hubs

- Centers of excellence with core competencies
- Platform for innovation
- Ecosystem of global industry hubs and experts
- Bridge between innovation and policy

XO Square Brazil

- Global Center for Freight and Cargo Solutions
- Partnering with innovative companies to develop solutions for efficient movement and digitization of transportation

XO Square France

- Research and Development around Hyperloop for passenger systems with 320m and 1km test track
- Solutions for mobility with R&D center, accelerator, and FabLab

8.3.1. Contagem, Minas Gerais, Brazil: Cargo and Logistics

In April 2018, HyperloopTT announced the establishment of HyperloopTT's XO Square as part of a new multi-million dollar agreement with Brazil in Contagem, Minas Gerais. Located on 5.4 acres, the 43,000 sq/ft XO Square will house the company's new HyperloopTT logistics research division, a fabrication lab, and an ecosystem of leading global companies, startups, universities, innovators, scientists, and governments from all around the world focused on solving growing issues in logistics.

The center is officially supported by the Government of the State of Minas Gerais, the State of Minas Gerais Research Foundation (FAPEMIG), the Federation of Industries of the State of Minas Gerais (FIEMG), and the Municipality of Contagem. The agreement was made through a public-private partnership (PPP) with an investment of approximately $7.85 million in its first phase, which includes contributions from HyperloopTT, the Secretariat of Economic Development, Science, Technology and Higher Education (SEDECTES), and private investors. In addition, the physical space of 5.4 acres and 43,000 square feet of constructed space has been provided by the Municipality of Contagem.

8.3.2. Toulouse France: System Testbeds and Capsule Innovation

Agreement with the city of Toulouse, France to open a facility for the development and testing of Hyperloop-related technologies. As part of this agreement the city, known worldwide as

"Aerospace Valley," is providing a 3,000 square meter facility along with outdoor terrain. Spring of 2018 marked the arrival of the first set of tubes designed to move both people and freight.

The first phase includes a 320-meter system (in progress). A second full-scale system of 1 km elevated on pylons will be built in 2019.

9. Proposed Way Forward for Australia

9.1. Feasibility Studies

9.1.1. Feasibility study components

In collaboration with its local partners, HyperloopTT would provide a multifactor evaluation of an ultra high-speed connection between two or more city pairs. In addition to identifying optimum route corridors, the Feasibility Study would also provide a thorough economic analysis, high-level ecological assessment, and a plan for public outreach and support.

As a result of defining the technical components for development and evaluating order of magnitude assessments for cost, schedule and risk impacts, the study will provide conceptual engineering on potential alignments, location of major structures, and system requirements. It will also impart an understanding of construction, operation and maintenance, and interface with existing systems. The study will also outline the resources necessary to identify additional regional pairings creating added functionality to an ultra high-speed network that has the potential to enhance and improve economic opportunities through transformed mobility.

Outcomes of feasibility studies may include:

- An analysis of the regulatory, design, operational, and environmental requirements associated with the project;
- Analyses of economic benefits from construction of the transportation facility and the corresponding equity of the impacted corridor;
- Modeling of projected demand for the proposed system along its corridor and economic sensitivity analyses for revenue projections from ticket sales;
- A conceptual estimate of the capital costs of the project and financial projections for potential return on investment;
- High-level recommendations for advancing critical path items.

9.1.2. Potential study options | Australian corridors

1. Connecting the Eastern intercity corridor:

The 2013 high speed rail Phase 2 study between Melbourne - Canberra - Sydney - Brisbane was considered on the basis of existing technology with a maximum speed of 350 kph. Hyperloop offers a significant cost, time and speed advantage.

The HyperloopTT station locations, routes and timings are for illustrative purposes only. The times shown may vary slightly between Hyperloop routes, which can be determined only after conducting a comprehensive feasibility study of potential corridors.

2. Intracity/Intrastate options:

Connecting regional centres of the state of Victoria to its capital city of Melbourne, and regional cities to Sydney in the state of New South Wales. Both routes have been recently announced as priority projects for evaluation of HSR by their respective state governments.

Two case studies include:

1. Melbourne + Geelong (30,000 commuters per day).
2. The Sydney + Newcastle + Wollongong mega-region[11] (100,000+ commuters per day).

3. Multimodal East/West and North/South Options:

Connecting freight and passengers across Australia.

[11] https://www.abc.net.au/news/2018-06-05/fast-rail-the-key-to-mega-sydney/9833800

9.2. Innovation Hubs

The HyperloopTT Innovation Hubs advance the company's geographic reach as well as intellectual influence within the operating region. While developing technical components for the HyperloopTT system, including system prototypes, the Innovation Hubs enable additional opportunities for collaboration with regional partners along with local governments. In advancing comprehensive mobility solutions, development of system prototypes at Innovation Hubs creates the opportunity to integrate emerging solutions into the HyperloopTT system.

As part of its dynamic ecosystem, HyperloopTT attracts people and businesses who are passionate about redefining the next generation of mobility. The Innovation Hubs are a co-innovation initiative to build mutually beneficial relationships between governments, R&D centers, startups, companies, and academic institutions. These centers are a hub for innovation, providing unique facilities and services to support nascent industries and bolster global competitiveness throughout the region.

The Innovation Hubs are a bridge between the academic sector, government, and private industry. HyperloopTT leverages its collaborative infrastructure and industry expertise to attract people who are passionate about co-innovation. In close collaboration with local partners, HyperloopTT forms innovation hubs from the ground up to facilitate cooperation between emerging industries, experts, and local talent. Each hub is a platform for innovation that bridges the gap between innovation and policy while providing human capital and access to financial resources. By investing in industry creation, innovation hubs distribute investment capital throughout the region, which strengthens local economies, creates secure employment opportunities, facilitates stronger regional growth, and establishes a global presence.

9.3. Commercial Implementation

As a technology licensing company and network orchestrator, HyperloopTT is flexible in how it can work with partners for commercial implementation of Hyperloop systems. During the feasibility study phase, HyperloopTT builds out partnership consortia through private companies, political advocacy groups, universities, and public institutions. As the HyperloopTT platform matures, creating partnerships among the various design, engineering, manufacturing, construction, architectural, and educational users of the HyperloopTT system will be essential for integrating vertically across the supply chain while building a user base for the development platform.

While some governments may prefer the private model of infrastructure development, or the hybrid approach of public-private partnerships, others wish to maintain control over their infrastructure including in the subsidization and operation of the system. Additionally, some local governments may want to use tickets for their system, others may rather incentivize sustainable regional travel through the free or reduced cost access to Hyperloop systems. HyperloopTT maintains flexibility in implementation of the individual route corridors, which allows the company as well as operators to tailor the monetization around the objectives of the project.

10. Conclusion

Hyperloop represents a step-change solution to Australia's urban growth and congestion challenges.

HyperloopTT recommends to the Australian Parliament that its technology is included as a central plan in a detailed study assessing the capability of competing ultra high speed transport options, using autonomous vehicles (AVs).

In addition, HyperloopTT recommends the Commonwealth of Australia takes an urgent and leading role in devising operating and governance standards for autonomous vehicles. These standards are a prescribed minimum requirement before any AV technology can move to pilot stage on Australian soil.

HyperloopTT also recommends the Commonwealth in Australia directly invests in an Innovation Hub, in partnership with an Australian state, to adapt Hyperloop technology for an Australian application.

With its speed and efficiency, Hyperloop connectivity will redefine the rules of travel and mobility. So we can travel between distant cities in just a matter of minutes. So cargo can ship in hours and not days. And so countries become neighborhoods.