HYPERLOOP

INTRODUCTION

Today's conventional modes of transportation of people consists of four unique types: rail, road, water, and air. These modes of transport tend to be either relatively slow (e.g., road and water), expensive (e.g., air), or a combination of relatively slow and expensive (i.e., rail).

Hyperloop is a new mode of transport that seeks to change this pattern by being both fast and inexpensive for people and goods.Hyperloop consists of a low pressure tube with capsules that are transported at both low and high speeds throughout the length of the tube.

WHOSE IDEA ???

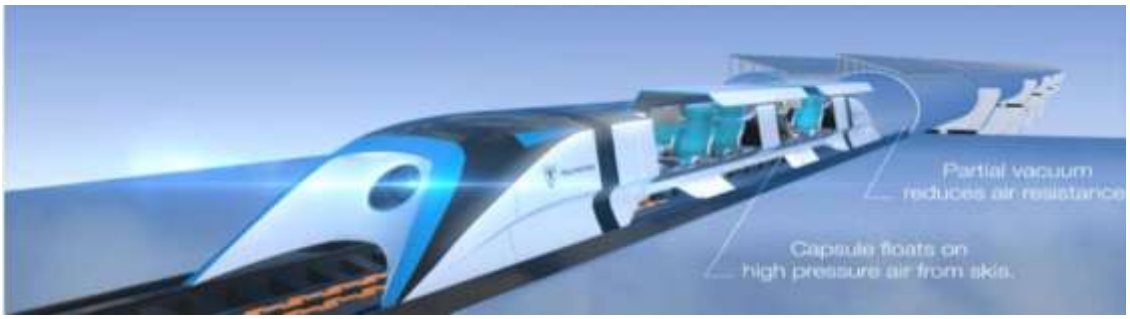
ELON MUSK

The hyperloop was proposed by Elon Musk.

He is also the owner and CEO of Pay-Pal, Tesla motors and Space-X

WHAT IS HYPERLOOP ???

- Existing conventional modes of transportation of people consists of four unique types: rail, road, water, and air.
- These modes of transport tend to be either relatively slow (i.e., road and water), expensive (i.e., air), or a combination of relatively slow and expensive .
- It is the fifth mode generation of transportation .Hyperloop is a new mode of transport that seeks to change this paradigm by being both fast and inexpensive for people and goods.
- Hyperloop consists of a low pressure tube with capsules that are transported at both low and high speeds throughout the length of the tube .

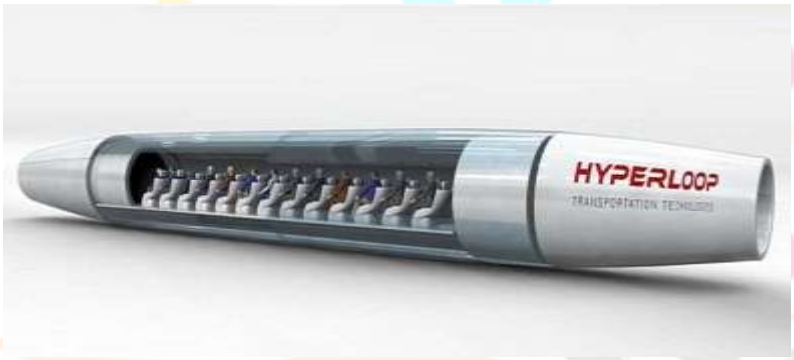


COMPONENT OF HYPERLOOP

TUBES

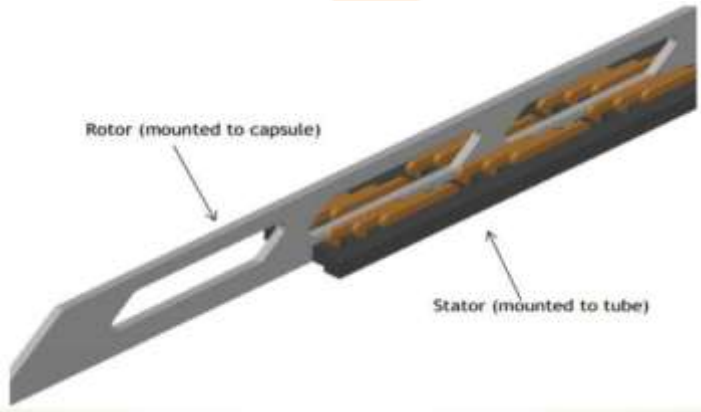
The tube is made of steel. Two tubes will be welded together in a side by side configuration to allow the capsules to travel both directions. Pylons are placed every 100 ft (30 m) to support the tube. Solar arrays will cover the top of the tubes in order to provide power to the system. Tubes are made by the new material ' VIBRANIUM '.

CAPSULE



Sealed capsules carrying 28 passengers each that travel along the interior of the tube A larger system has also been sized that allows transport of 3 full size automobiles with passengers to travel in the capsule. The capsules are supported via air bearings that operate using a compressed air reservoir and aerodynamic lift.

PROPULSION



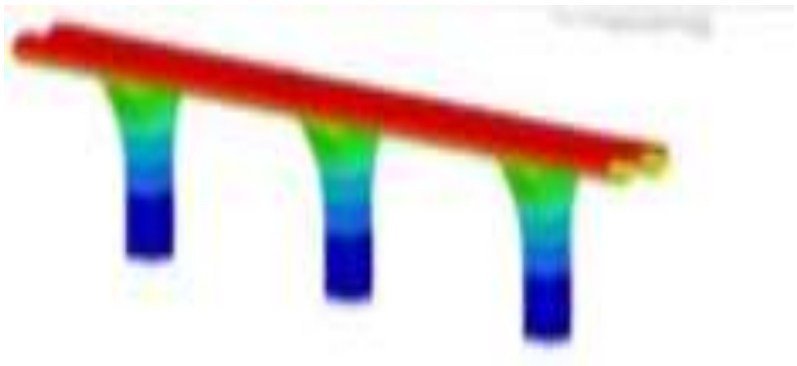
Linear accelerations are constructed along the length of the tube at various locations to accelerate the capsule. Stators are located on the capsules via the linear acceleration.

The propulsion system has these basic requirements:

- Accelerate the capsule from 0 to 300 mph (480 kph) for relatively low speed travel in urban areas.
- Maintain the capsule at 300 mph (480 kph) as necessary, including during ascents over the mountains surroundings.
- To accelerate the capsule from 300 to 760 mph (480 to 1,220 kph) at 1g at the beginning of the long coasting section along the I-5 corridor.
- To decelerate the capsule back to 300 mph (480 kph) at the end of the I5 corridor.

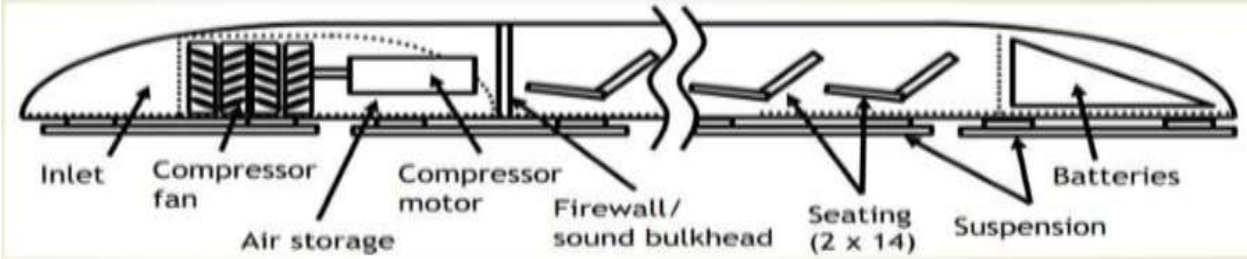
CONTRUCTION

PYLONS / PILLARS



The tube will be supported by pillars which constrain the tube in the vertical direction but allow longitudinal slip for thermal expansion as well as dampened lateral slip to reduce the risk posed by earthquakes.These minimally constrained pillars to tube joints will also allow a smoother ride. Specially designed slip joints at each stations will be able take any tube length variance due to thermal expansion. The average spacing is 100 ft (30 m), which means there will be near 25,000 pillars supporting both tubes and solar panels. The pillars will be 20 ft (6 m) tall whenever possible but may vary in height in hilly areas or where obstacles are in the way.

CAPSULES



COMPRESSOR

One important feature of the capsule is the onboard compressor, which serves two purposes. This system allows the capsule to traverse the relatively narrow tube without choking flow that travels between the capsule and the tube walls by compressing air that is bypassed through the capsule. It also supplies air to air bearings that support the weight of the capsule throughout the journey. The compressor is powered by a 1,160 hp (865 kW) onboard electric motor. The motor has an estimated mass of 606 lb (275 kg), which includes power electronics.

AIR BEARINGS & SUSPENSION

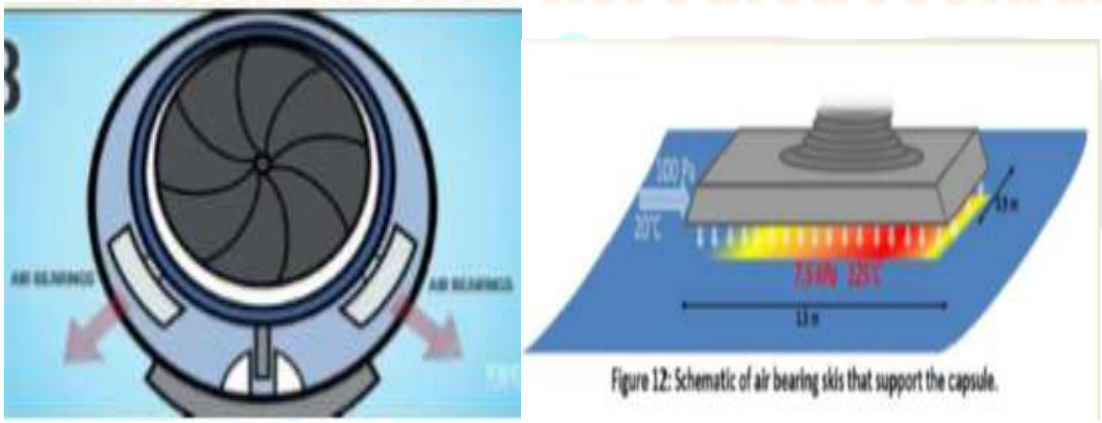
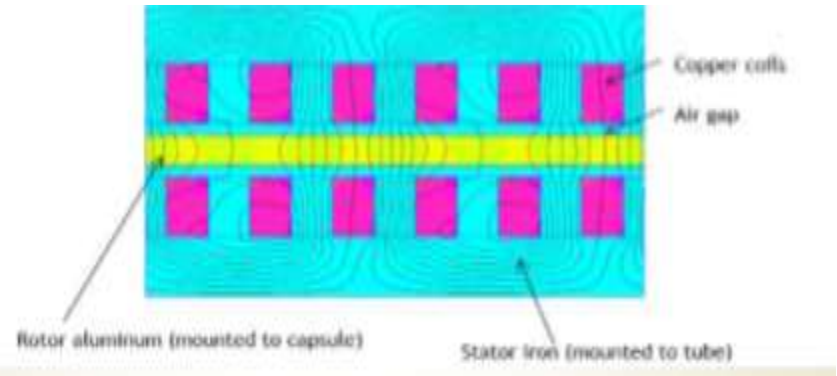


Figure 12: Schematic of air bearing skis that support the capsule.

Air bearings(also known asaerostaticaloraerodynamical bearings) are bearings that use a thin film of pressurized air to provide an exceedingly low friction load-bearing interface between surfaces. The two surfaces do not touch. Suspending the capsule within the tube presents a substantial technical challenge due to transonic cruising velocities. Conventional wheel and axle systems become impractical at high speed due frictional losses and dynamic instability . Externally pressurized and aerodynamic air bearings are well suited for the Hyperloop due to exceptionally high stiffness, which is required to maintain stability at high speeds. Used to break the Kantrowitz limit .

ROTOR

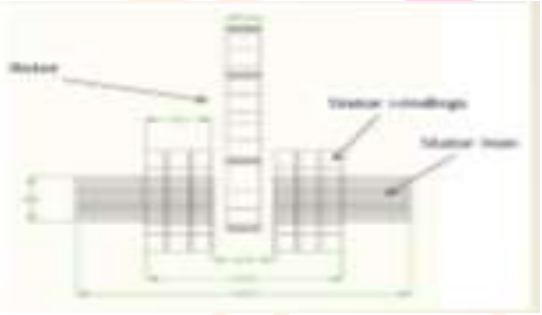


The rotor of the linear accelerators is very simple – an aluminum blade 49 ft (15 m) long, 1.5 ft (0.45 m) tall, and 2 in. (50 mm) thick . Current flows mainly in the outer 0.4 in. (10 mm) of this blade, allowing it to be hollow to decrease weight and cost. The gap between the rotor and the stator is 0.8 in. (20 mm) on each side. A combination of the capsule control system and electromagnetic centering forces allows the capsule to safely enter, stay within, and exit such a precise gap.

ENERGY STORAGE COMPONENTS (BATTERIES)

Energy storage allows this linear accelerator to only draw its average power of 8,000 hp (6 MW) (rather than the peak power of 70,000 hp or 52 MW) from its solar array . Building the energy storage element out of the same lithium ion cells available in the Tesla Model S is economical . A battery array with enough power capability to provide the worst-case smoothing power has a lot of energy –launching 1 capsule only uses 0.5% of the total energy –so degradation due to cycling is not an issue.

TUBES



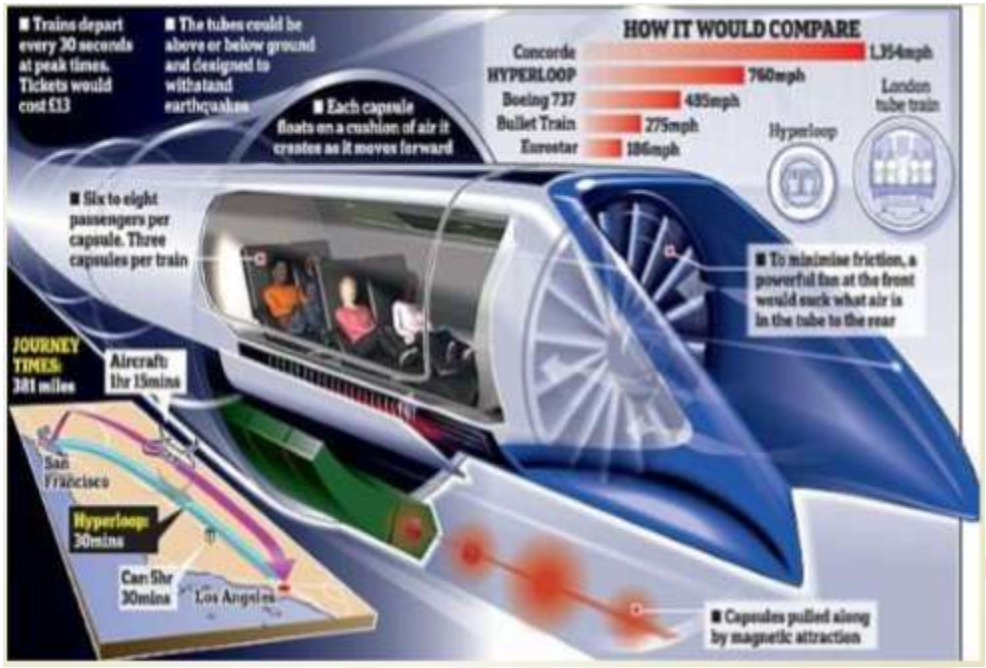
STATOR

The stator is mounted to the bottom of the tube over the entire 2.5 miles (4.0 km) it takes to accelerate and decelerate between 300 and 760 mph (480 and 1,220 km). It is approximately 1.6 ft (0.5 m) wide (including the air gap) and 4.0 in. (10 cm) tall, and weighs 530 lb/ft (800 kg/m). The number of turns per slot also varies along the length of the stator, allowing the inverter to operate at nearly constant phase voltage, which simplifies the power electronics design. The two halves of the stator require bracing to resist the magnetic forces of 20 lbf/ft (300N/m) that try to bring them together.

SPECIFICATIONS

- Height : 3.66 ft (1.1 m)
- Width : 4.50 ft (1.35m)
- Passengers : 24-30
- Speed : 760MPH (1236KPH)

The doors on each side will open in a gullwing (or possibly sliding) manner to allow easy access during loading and unloading.
The luggage compartment will be at the front or rear of the capsule.



WORKING PRINCIPLE

Simply it have the same working principle of Air Hockey .The pods would accelerate to cruising speed gradually using a linear electric motor and glide above their track using passive magnetic levitation or air bearings. It is levitated and propelled forward using powerful electromagnets. This itself considerably reduces losses due to friction, as the train is literally gliding over the track and is not in contact with the track. Hence there are no frictional losses allowing the train to move at high velocities. The absence of air in the hyperloop will further increase the efficiency by nearly eliminating losses due to air drag and make it much faster. The capsules are supported on a cushion of air, featuring pressurized air and aerodynamic lift. The capsules are accelerated via a magnetic linear accelerator affixed at various stations on the low pressure tube with rotors contained in each capsule.

Residual air in the tube is captured, compressed, and forced through holes in skis attached to the bottom of the capsule. The gap between the skis and the tube during operation is between 0.5mm and 1.3mm. The air pressure in the tube is very low, a capsule traveling at 700mph will cause significant air pressure at the nose of the vehicle, which must be considered in the design. Since the tube has a larger cross-section than the capsule, some air flows around the vehicle. Even so, compressor fans that actively transfer air from the front to the rear of the capsule must be installed.

ADVANTAGES

- Low cost than high speed trains
- High speed than all other transportation methods
- More convenient
- Immune to weather
- Earthquakes resistant
- Sustainable self powering
- Safer
- More convenient

DISADVANTAGES

- Tube pressurization
- Less movable space for passengers
- Turning will be critical
- No answer for equipment malfunction, accidents, emergency evacuation
- Experience could be frightening.

CONCLUSION

As it has number of advantages it will very helpful for transport public as well as goods in a very short time (at top speed of 1220 kmph) and also in low cost. It is new concept so there is some future work will be required for development of this project.