Innovative Freight Transportation Systems
and Applications in Texas

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**Freight Growth Problem**

- 40% increase in freight transportation in the next 20 years
- Trucking is the primary mode of freight transportation.
- Trucking and rail market share drop in competition with new modes of transportation.

<table>
<thead>
<tr>
<th>Mode</th>
<th>2012</th>
<th>(in tons)</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>13.2 billion</td>
<td>+43%</td>
<td>18.8 billion</td>
</tr>
<tr>
<td>Rail</td>
<td>2.0 billion</td>
<td>+37%</td>
<td>2.8 billion</td>
</tr>
<tr>
<td>Waterborne</td>
<td>975 million</td>
<td>+10%</td>
<td>1.1 billion</td>
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<tr>
<td>Air</td>
<td>15 million</td>
<td>+250%</td>
<td>53 million</td>
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54 million tons of freight move across our nation every day.
Desperate Infrastructure

- Insufficient infrastructure for future freight transportation.

- Most of the U.S. freight transportation infrastructure dates to 1960.

- Rail lines shut-off will increase from 108 miles to almost 16,000 miles (30 percent of the national rail network) in 2035.
Texas is one of the main entrances for international freight to the U.S.

Port of Houston is the third largest port in the U.S.

The expansion of the Panama Canal allow ships of 12,600 TEU compared to the current max of 4,500 TEU.

NAFTA tonnage on Texas highways and railroads will increase by nearly 207 percent through 2040.
Freight Pipeline solution

- Need for a more reliable, safe, and environmental friendly freight transportation system.

- Pipelines and intermodal systems are the growing modes of freight transportation.

- Underground Freight Transportation (UFT) system can play a significant role in making up future capacity short fall.
Underground Passenger Transportation

- Underground has long been used for passenger transportation.

- The London Metro was first launched in 1863, and New York subway opened in 1904
In 1810 an engineer in London, suggested using pockets in tubes for delivering letters.

In 1853, the first PCP implemented between offices of Telegraph Company in London.

By 1886 London had 94 telegram tube network totaling 34.5 miles and up to 30 inches in diameter.

In 1876, first US PCP mail constructed by Western Union Telegraph Company in New York.

By 1906, a total of 63 PCP miles were in place in New York, Chicago, Philadelphia, and St. Louis.
Large Scale PCPs

• Interest in larger diameter PCPs grew again during the 1960s.

• Dr M. Carstens, working at the Georgia Institute of Technology constructed a in 1971, sponsored by TRANSCO of Houston

• First full-scale pneumatic capsule pipeline test conducted by the British Hydromechanics Research Association (BHRA) in 1977.

• First commercial pneumatic capsule pipeline launched in 1982 in Japan called “Sumitomo”.
LIM Revolution

• Invention of Linear electric motors revolutionized the design and application of UFT systems.

• LIM is a non-adhesive propulsion system which generates linear movement through induction thrust.

• Application of LIM in rail transportation is a new concept and used first time in Japan in Osaka metropolitan subway in 1990.

• LIM is used in people movers, light rails, and subways around the world.
**UFT Systems in Use**

- “CargoCap” developed in Germany and is designed accommodates pallet size loads in capsules moving in long pipelines.

- “Foodtubes” in Britain is designed to connect main food producers to large retailers so consumers.

- In the Netherlands, an underground pipeline system is designed to deliver fresh flowers to the Schiphol airport for export.
UFT Systems in Use

- “Mole” solution has been designed in the UK, uses Linear Induction Motors (LIM) and is in the laboratory test phase.

- The Underground Container Mover (UCM) is a system designed in Belgium in order to solve the freight transfer problem in Belgium ports.

- “Cargo Sous Terrain”, is a fully automated system designed in Switzerland and its first phase is expected to lunch by 2030.
Hyperloop One

• Originally designed to transport people in vacuum tubes.
• This system has lunched pilot test successfully with speed of 220 mph.
• Studies are undergoing for a full-scale system in Texas, Colorado, Florida, Chicago, Dubai,…
*Port of Houston to Dallas Route*

- Shipping Container size loads
- Starting Point: Barbour’s Cut Port, Houston
- End Point: Dallas Logistic Hub, Lancaster
- Length: 251 miles
- Mainly Below IH-45
UFT in Texas

- Port of Houston to distribution center
- Standard pallet size loads
- Starting Point: Barbour’s Cut Port
- End Point: Propose distribution center
- Length: 15 miles
UFT in Texas

- Lardo Border UFT system
- Shipping Container size loads
- Starting Point: World Trade Bridge
- End Point: Union Pacific rail station
- Length: 5 miles
UFT in Texas

- DFW Airport UFT system
- Standard air crate size loads
- Starting Point: United/Delta Cargo Terminal
- End Point: Intermodal Freight Terminal
- Length: 1.5 miles
• Load: Shipping Container, Air Crate, Pallet
• Conduit: Circular or Rectangular
• Vehicles: Closed capsule or Flat-bed Gondola
• Wheels: Steel
• Tracks: Single/Dual
• Propulsion System: LIM
Shipping Container UFT System
Shipping Container UFT System
Air Crate UFT System
Pallet UFT System
Single-Track Terminal Design

- DFW Airport
- Length: 1.5 miles
Dual-Track Terminal Design

- Port of Houston
- Houston-Dallas
- Port of Houston-Satellite Terminal
- Laredo Border