

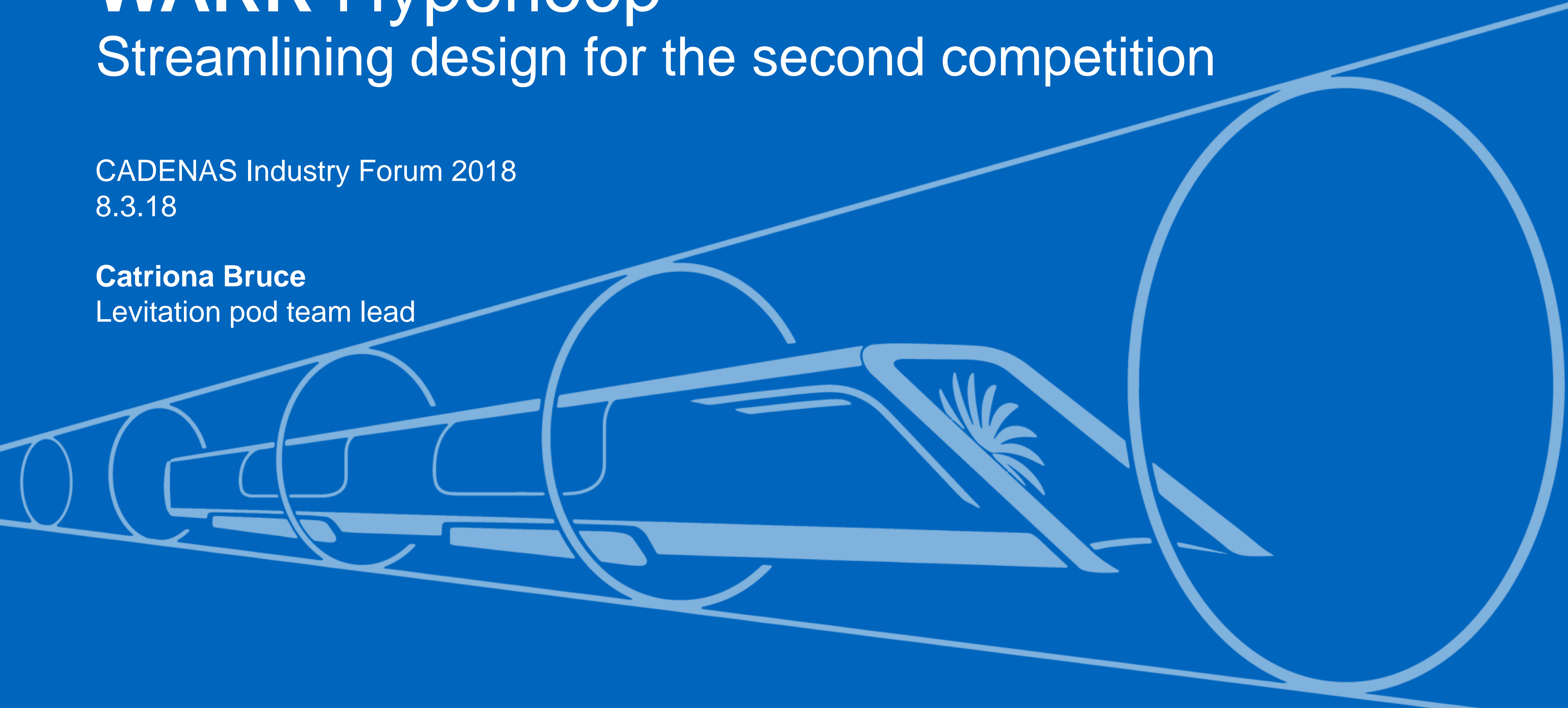


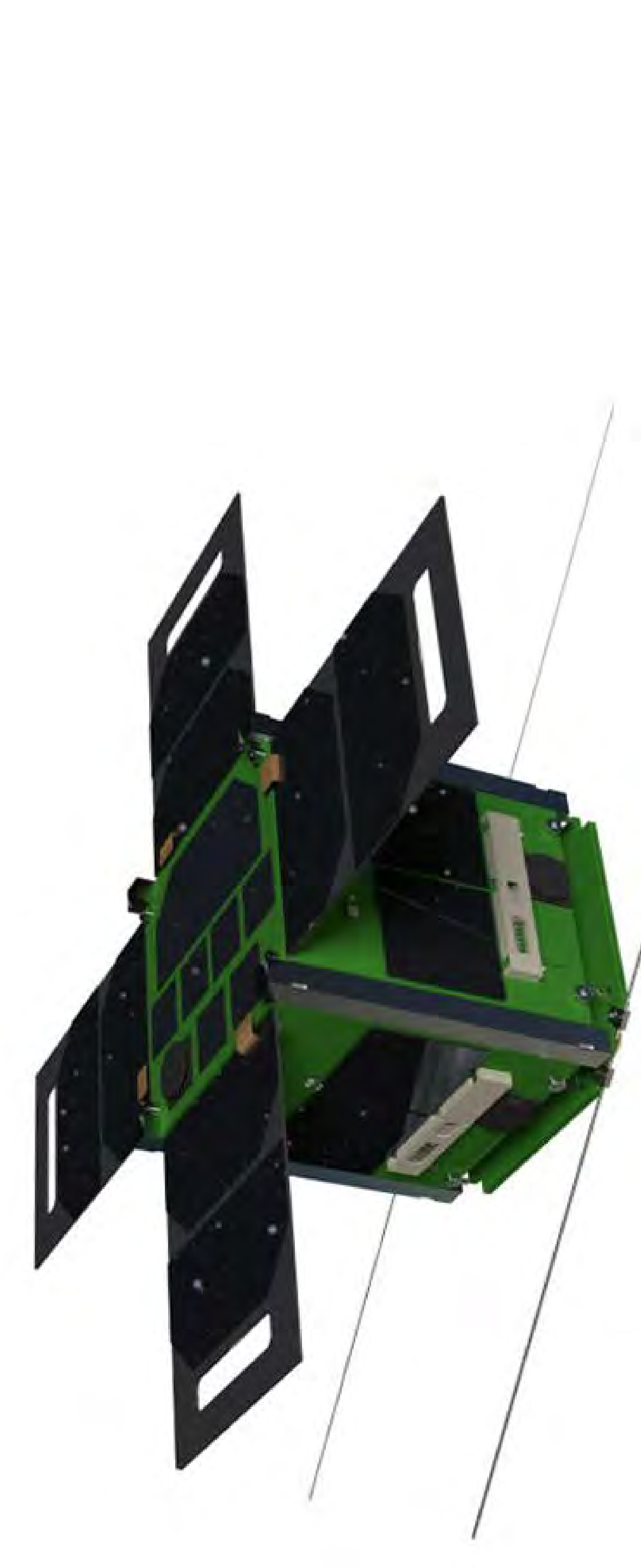
# WARR Hyperloop

## Streamlining design for the second competition

CADENAS Industry Forum 2018  
8.3.18

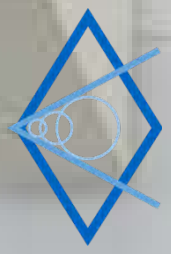
**Catriona Bruce**  
Levitation pod team lead

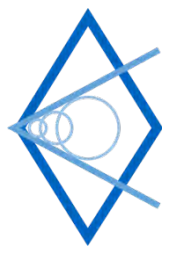




**WARR**







# Three problems



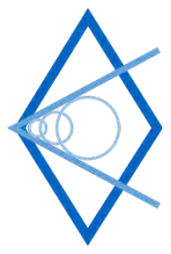
**1. EMISSIONS**



**2. NOISE**



**3. TRAFFIC**

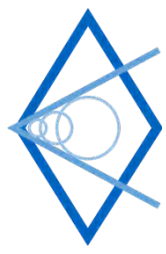


# Mid-distance aviation

Over half of border crossings made by air

4.4% global annual growth - total passenger miles

Domestic <b>India</b>	+350%
Domestic <b>China</b>	+250%
Domestic within <b>South America</b>	+150%
Domestic <b>USA</b>	+50%



**...convenient**

**...fast**

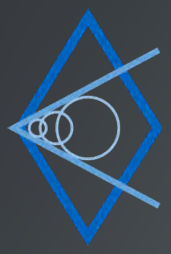
**...quiet**

**...safe**

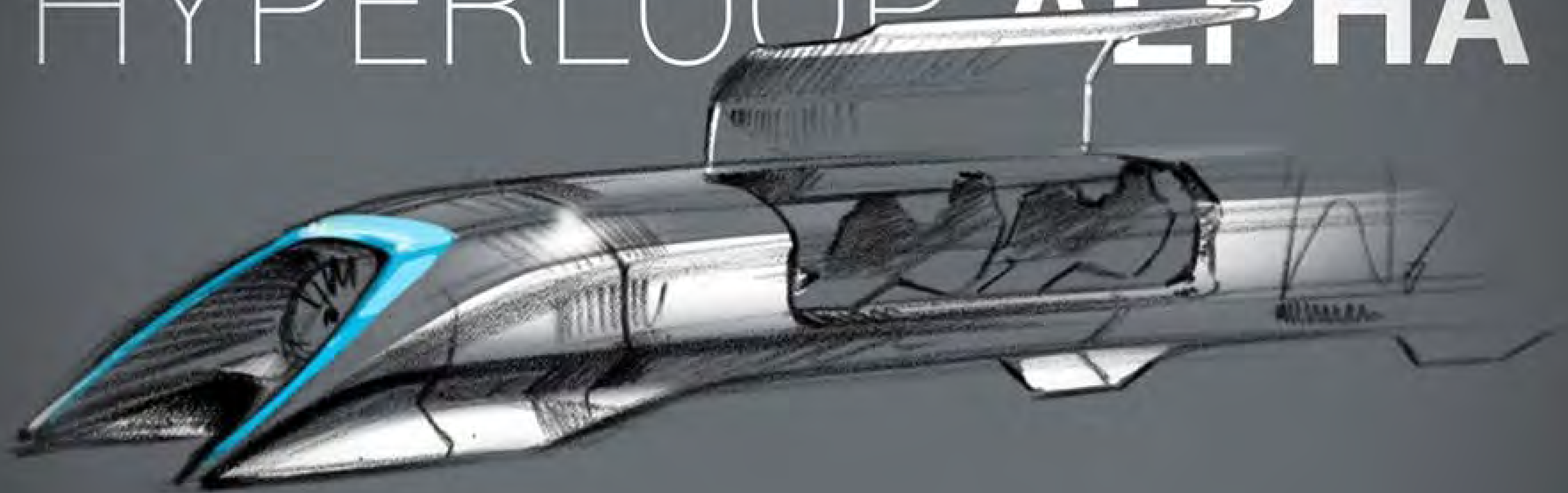
**...green**

**...weather-proof**

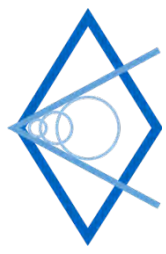




# HYPERLOOP ALPHA

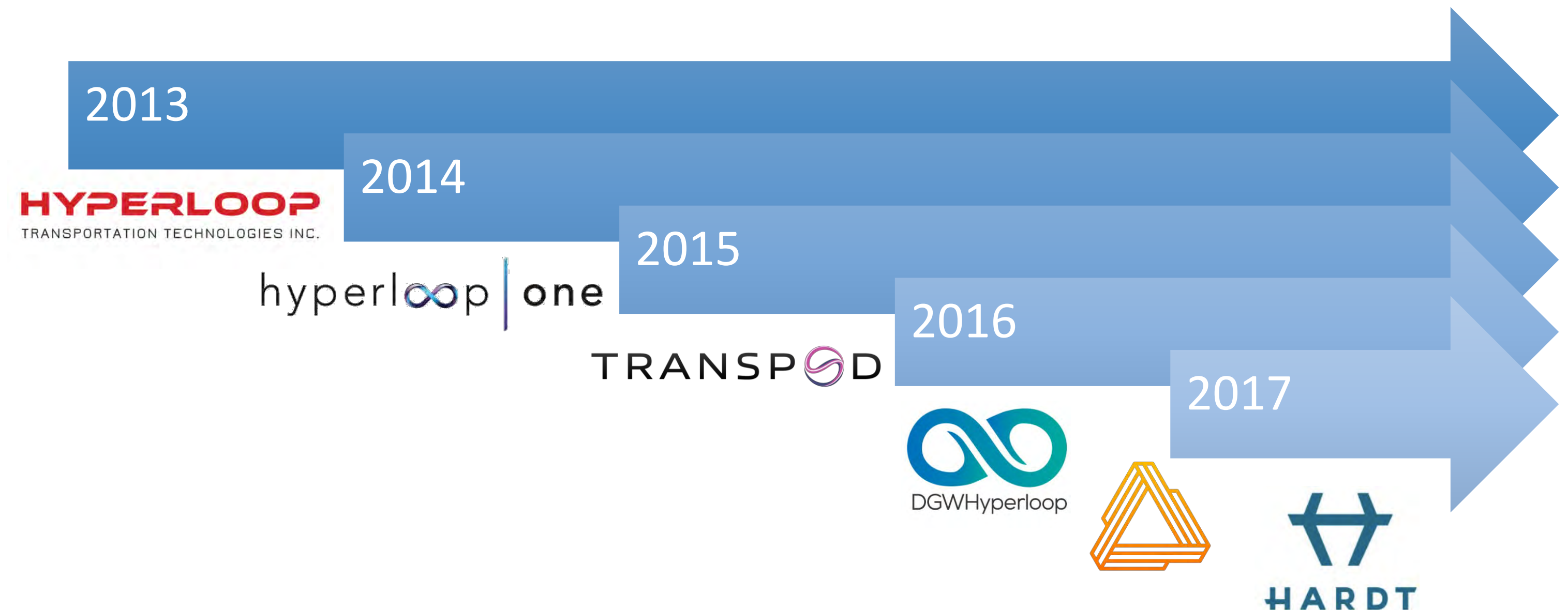


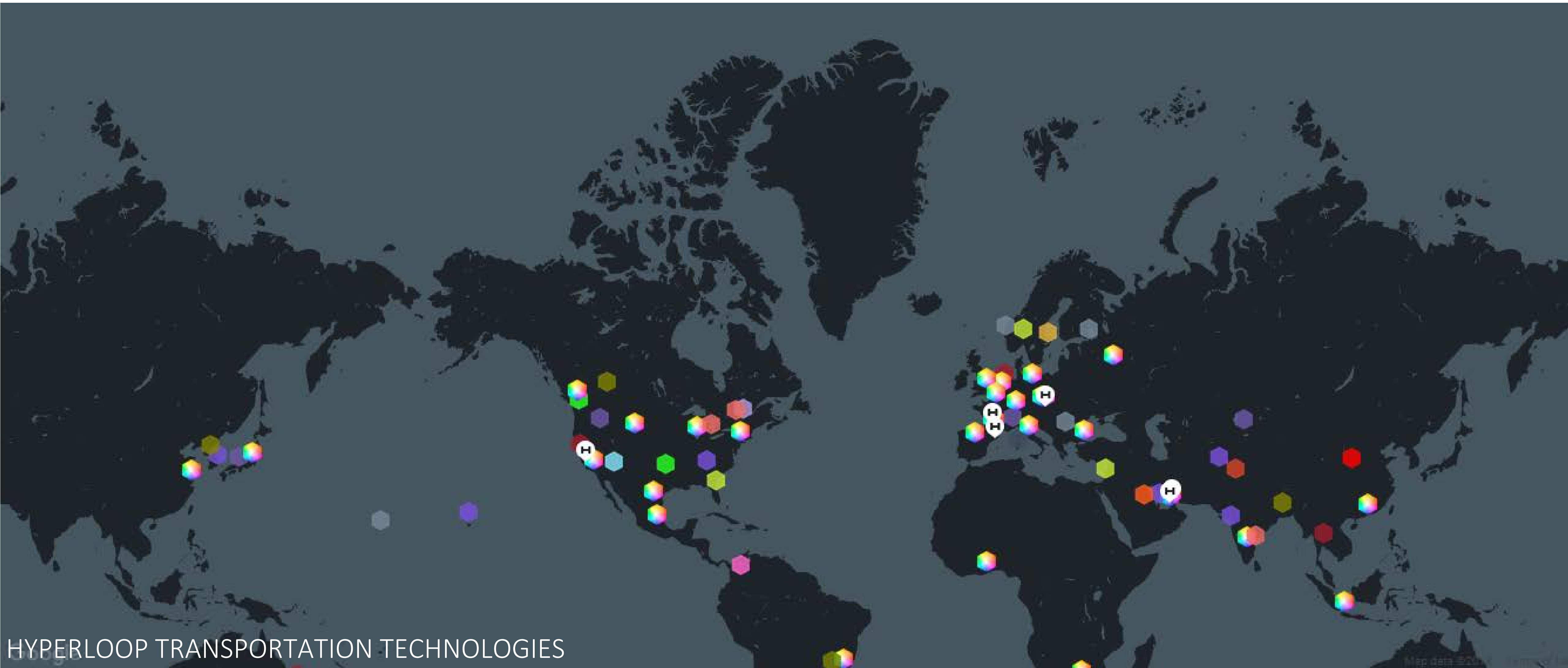
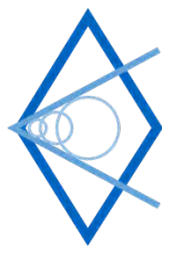




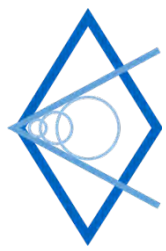
# Disrupting infrastructure

- Disruption seen in other sectors hard to translate
- Large number of small groups huddled under ‘Hyperloop’ banner
- Time the crucial factor, resources are scarce





HYPERLOOP TRANSPORTATION TECHNOLOGIES



# Disrupting infrastructure



*“What Mr Musk has done is act as our chief marketing officer.”*

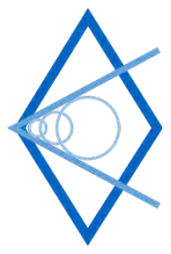


*“It’s less open-source, more like an open-air swimming pool with everyone trying to stay above water and compete. In some ways if we were all developing the concept together it may have been better.”*

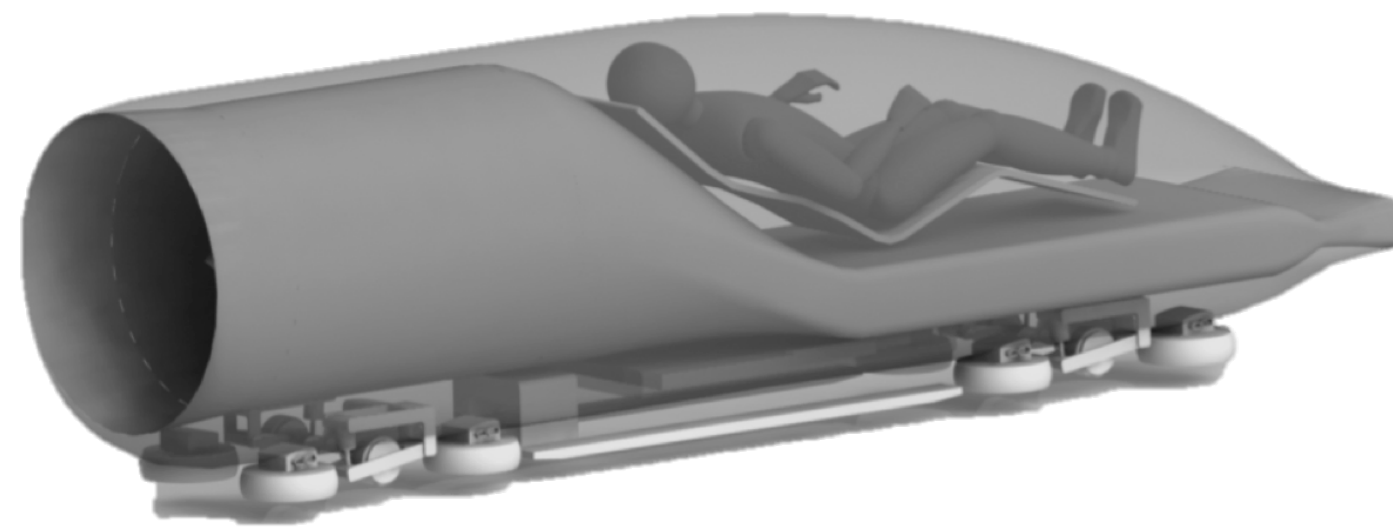
*Ryan Janzen, founder at Transpod*



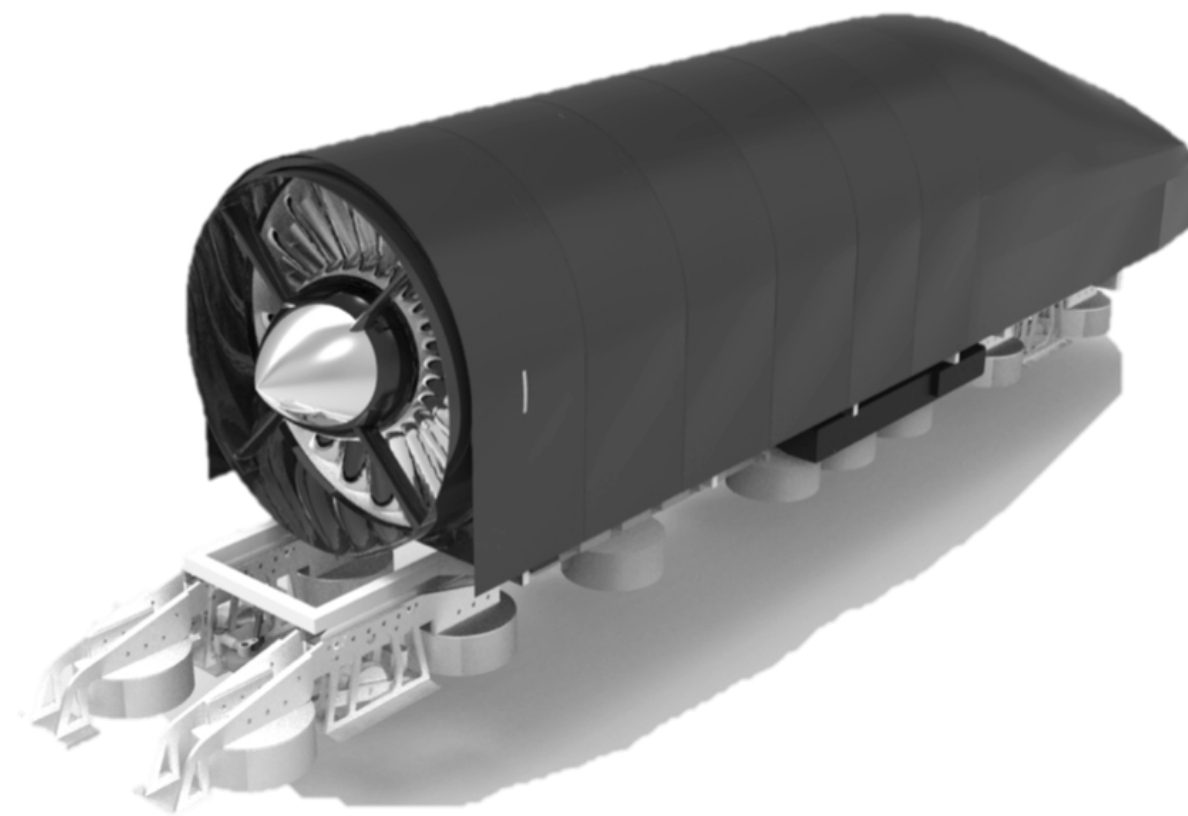
# COMPETITION I, 2016/17



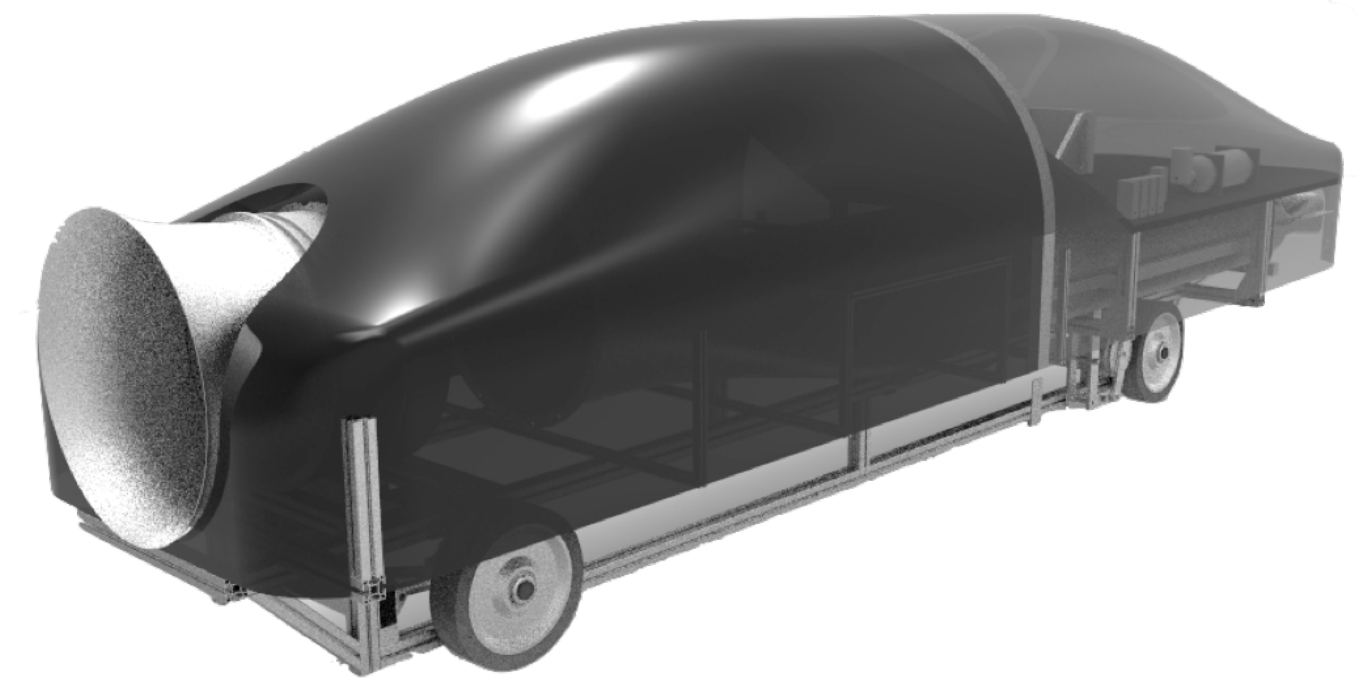
# Design development



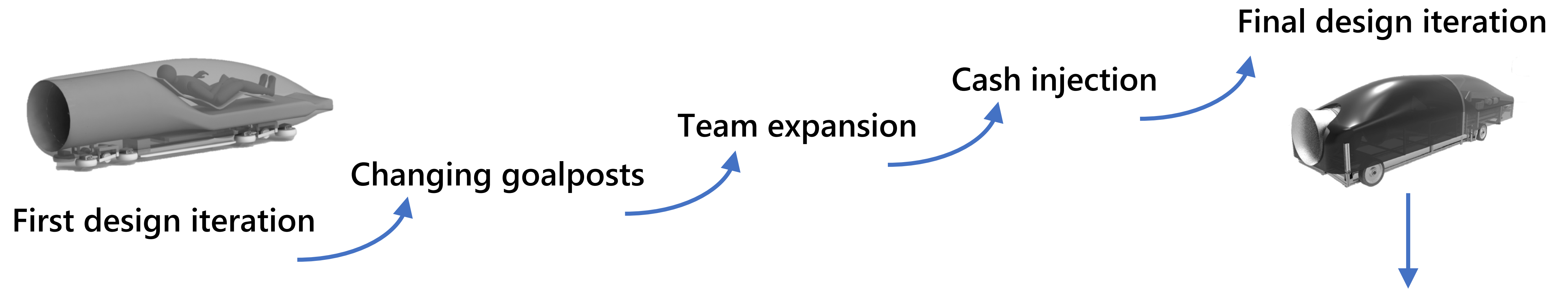
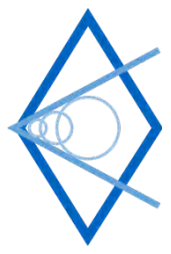
**NOV. 2015**  
**7 TEAM MEMBERS**

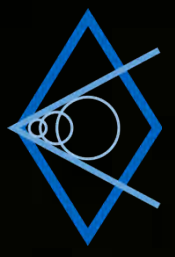


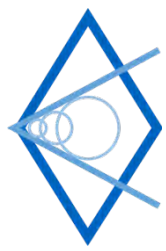
**JAN. 2016**  
**15 TEAM MEMBERS**



**MAR. 2016**  
**35 TEAM MEMBERS**







# Lessons learned

## PROJECT BOUNDARIES

- High personnel turnover
- Changing requirements

## DESIGN PROCESS

- “Majority of my time spent analyzing alternatives”
  - No design review to check for feasibility
  - Hard to determine best # of iterations

## CAD ORGANIZATION

- No revision control or meaningful CAD standard
  - Poor file organization

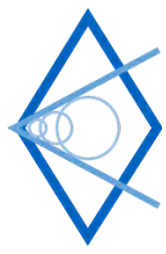
## PURCHASING & MANUFACTURING

- No centralized BOM to plan/track manufacturing
  - Lack of centralized purchasing
  - Lack of time and experience in machining





# COMPETITION II, 2017



# Strategy

## Clear set of goals

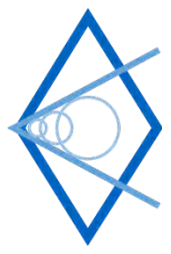
- Win competition
- Minimize design effort

## Design focus

- Lightweight and simple
- Onboard propulsion
- Gain testing week advantage

## Process improvement

- Fewer self-made parts
- Widen & standardize part searches



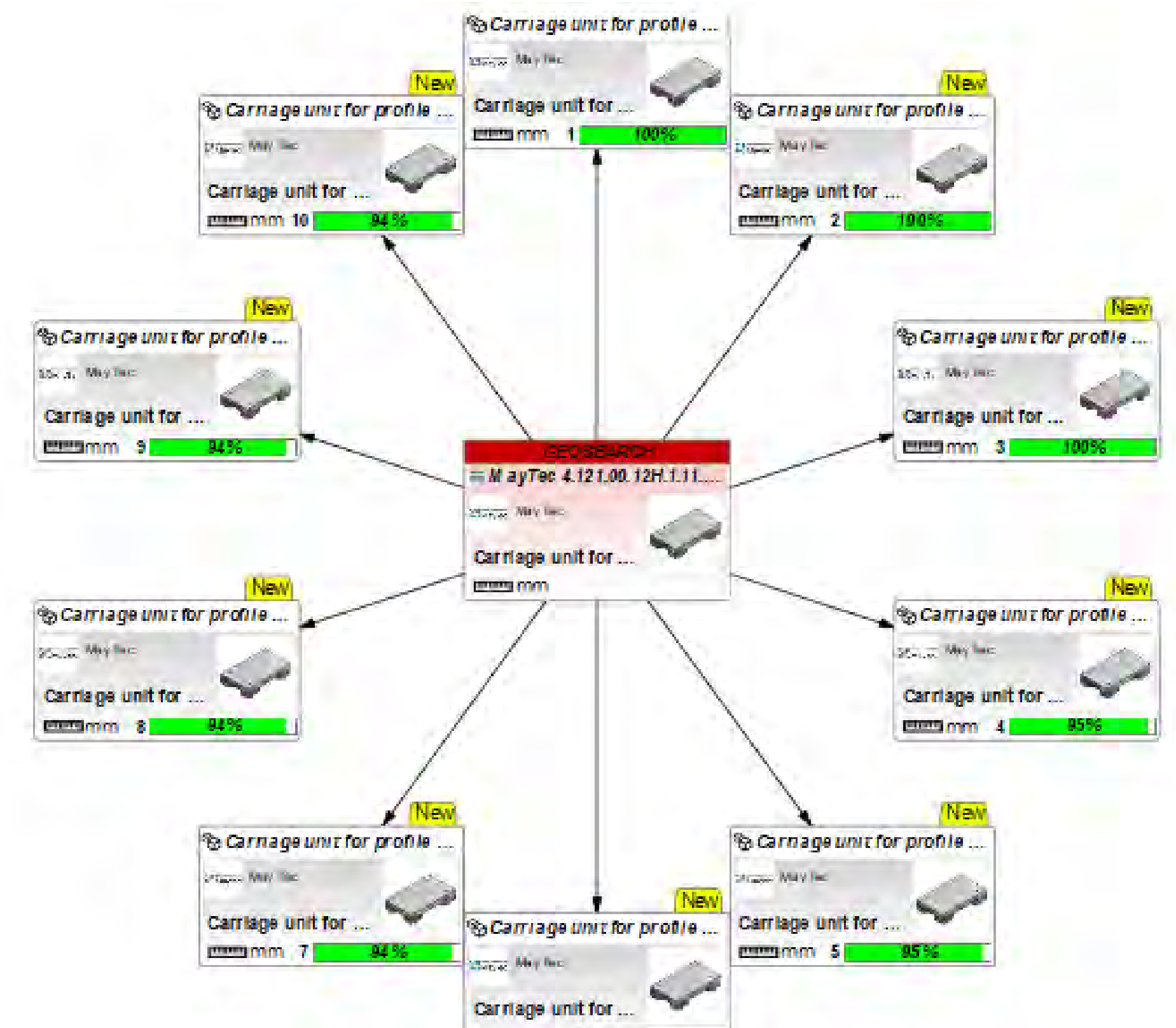
# Working with CADENAS

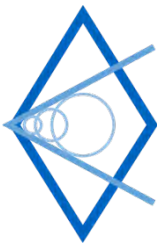
## Installed modules:

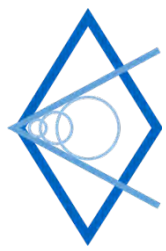
- ✓ PARTsolutions
- ✓ eCATALOGsolutions product catalogs
- ✓ PARTstatistics
- ✓ CATIA

## Web platform:

- ✓ PARTcommunity





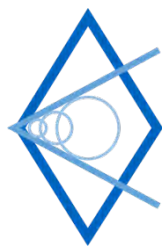


	Content: Intelligent Engineering & Procurement Data	Functionality & Search Methods	Integration in the Existing IT Environment	Graphical User Interfaces
	 <b>Standard Catalogs</b> DIN    ANSI    EN ISO    GB    GOST etc.	Automatic Master Data Creation	<b>CAD</b>	<b>Desktop Solution</b>
	 <b>Supplier Catalogs</b> Mechanical Electronics & Electrical Plant Design Architecture Ship Building Automotive	Semi-automatic Classification	CREO <b>NX</b> SOLID EDGE SOLIDWORKS	Seamless Integration
		Duplicate Control	AUTODESK INVENTOR CATIA	<b>Web Platform</b>
		Role & Rights System	PLM	App
		Parts-Tool-Connection	TEAMCENTER windchill	<b>Mobile Solution</b>
		Global Sourcing	keytech	Web Service
		Standard Parts Management & MultiCAD Data Creation	ERP	Distributed Computing
		Geometric 3D Similarity Search	SAP	
		2D Image & Sketch Search		
		Unmachined Part Search		
		Partial 3D Search		
		Topology & Feature Search		
		Parametric Full-text Search		
		Color Search		
	 <b>Company Standards and Repetitive Part Catalogs</b>			



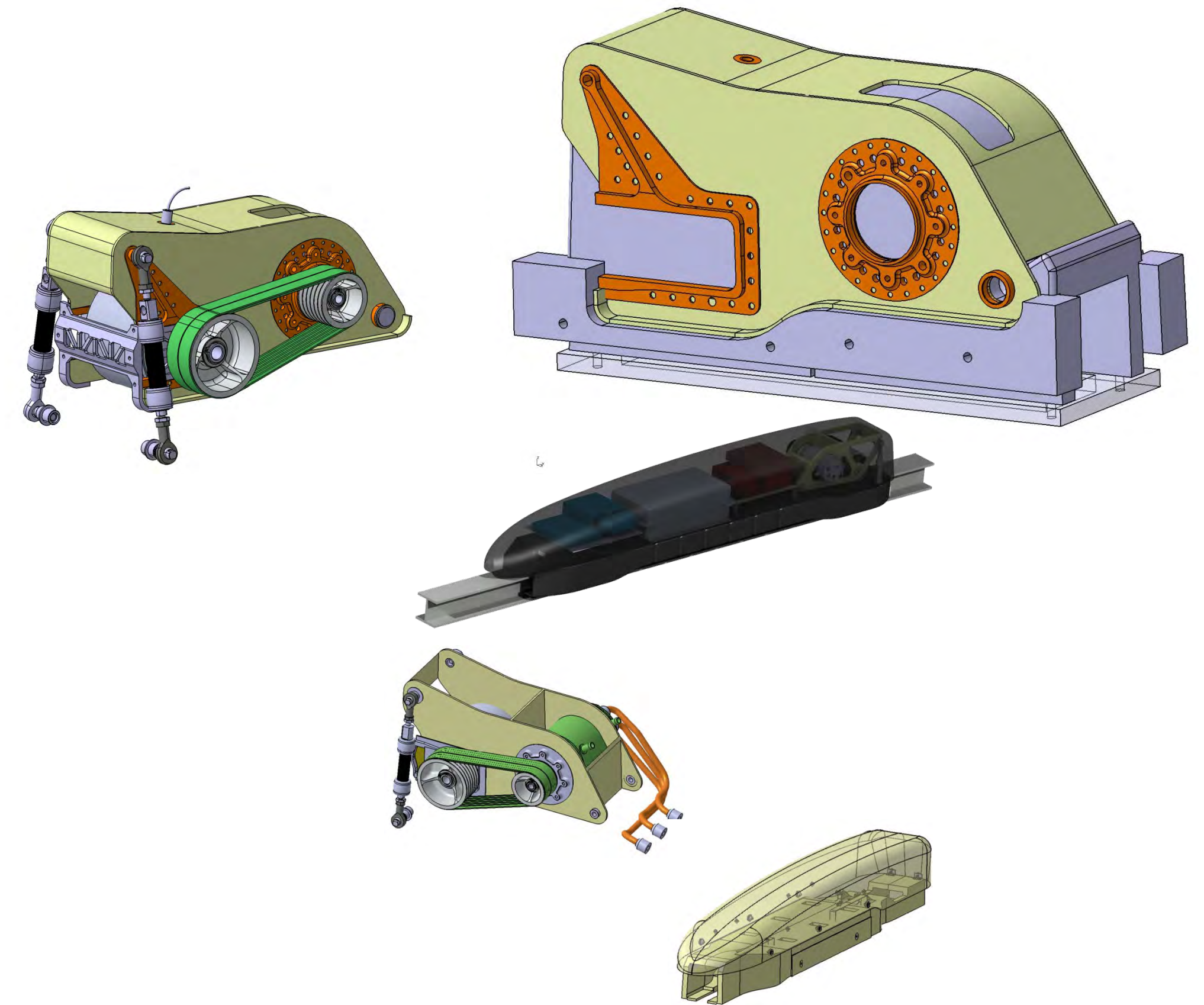


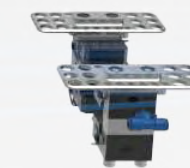
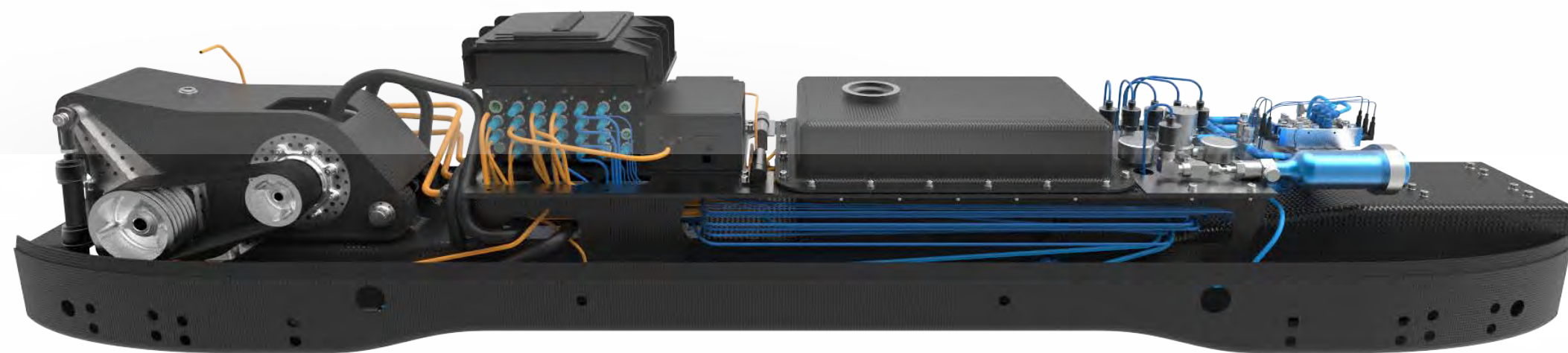
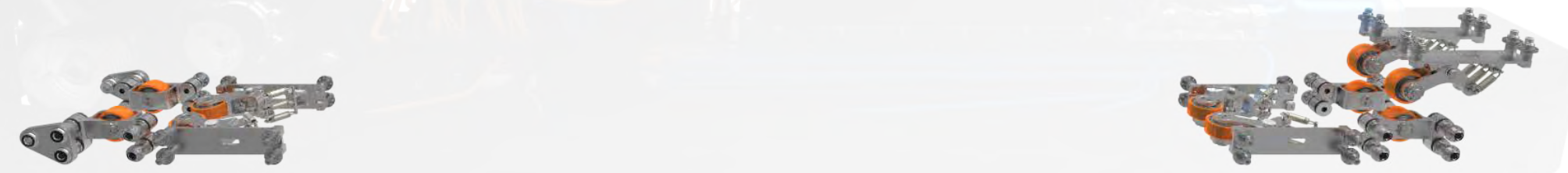
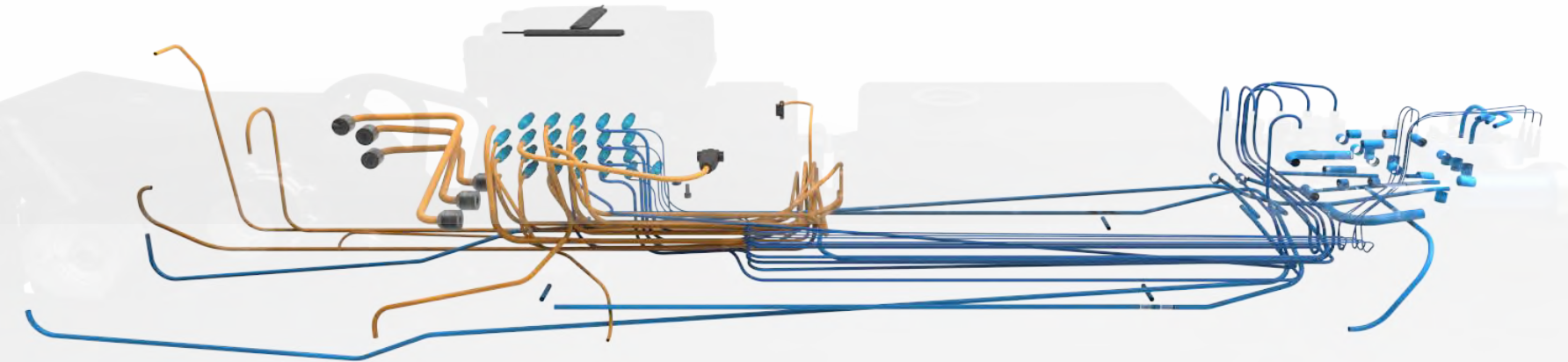
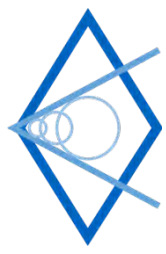
# FROM SKETCH TO REALITY WITH INTELLIGENT PART SEARCH



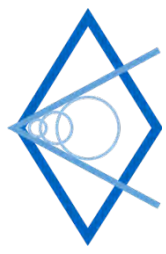
# Intelligent search – WARR style

- Identify needed component
- Search on PARTcommunity
- Rough design (typical commercial part)
- Refined design ('dream' part)
- Download appropriate eCatalogs
- 3D or 2D search on PARTsolutions
- Find 'dream' part



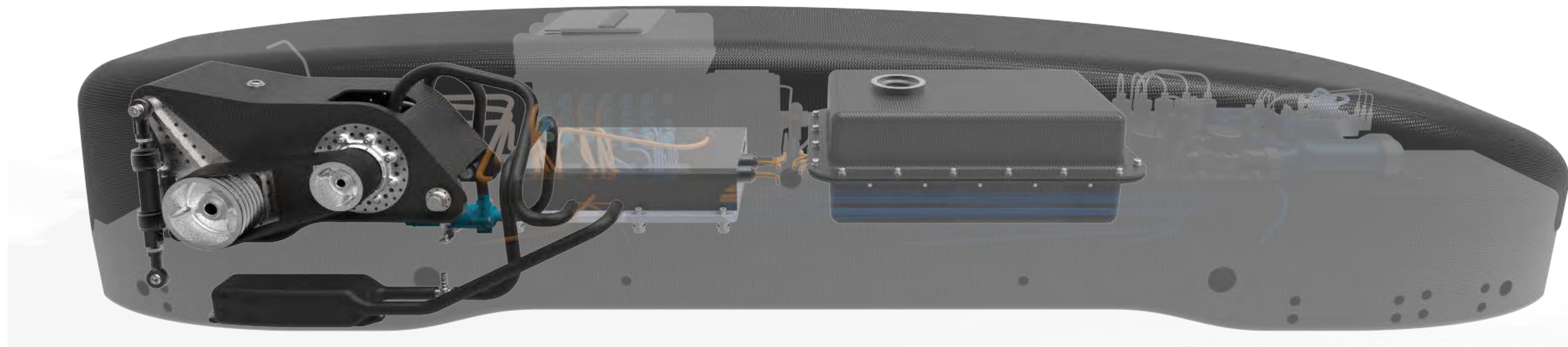






**6 subsystems**

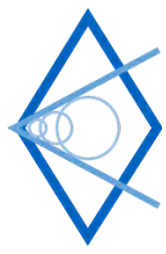
**78 parts or part assemblies**



**1 'false start'**

**Designed in 2 months**

**Finished product in 6 months**



Pod mass	80 kg
Pod size	0,4 x 0,4 x 2,3 m
Max. Velocity	360 kmh
Max. Acceleration	1.1 g
Max. Deceleration	2.4 g

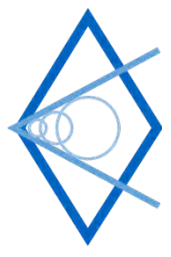




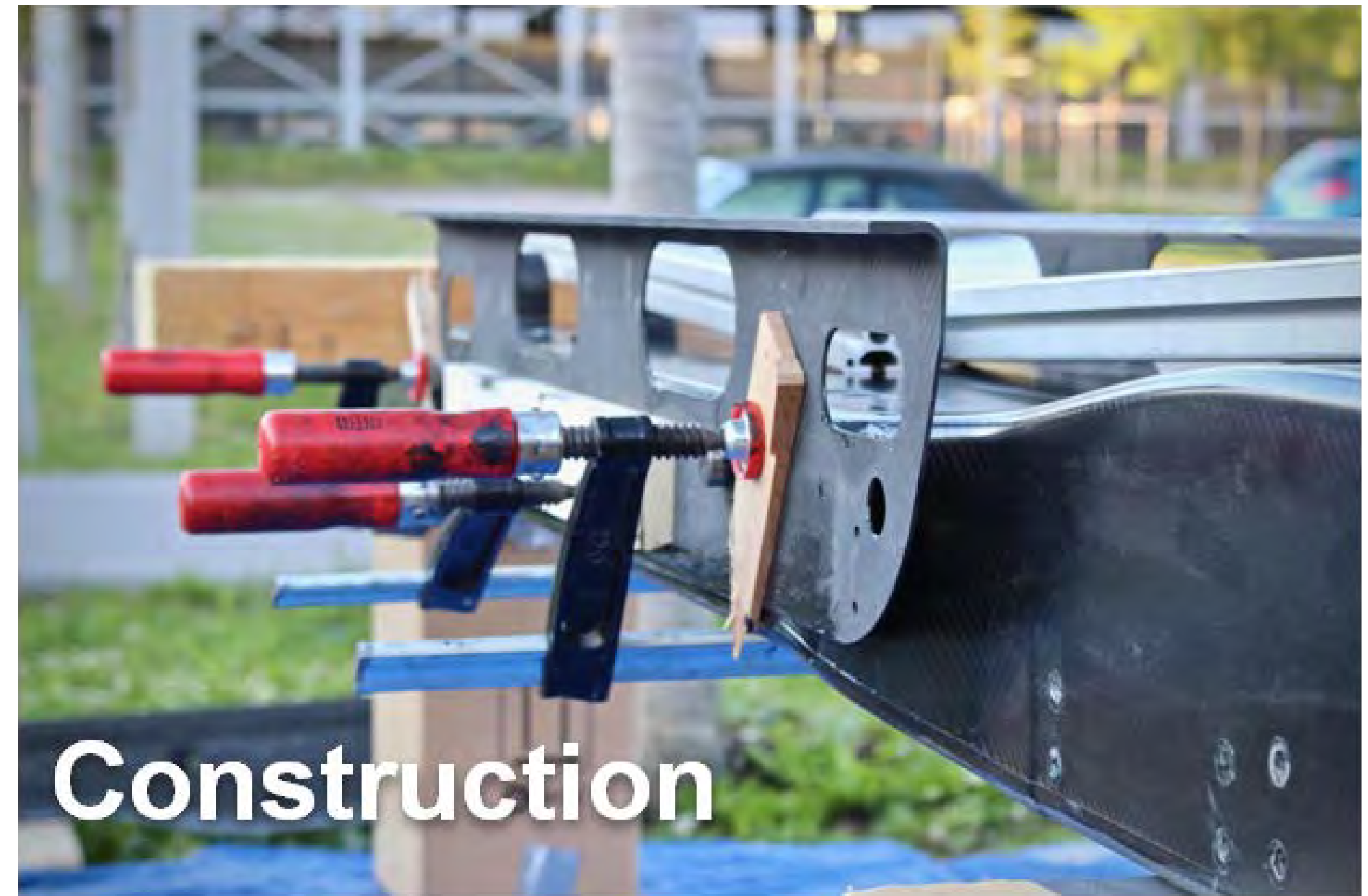
# CONCLUSIONS

“I love deadlines. I love the whooshing noise they make as they go by.”

— Douglas Adams



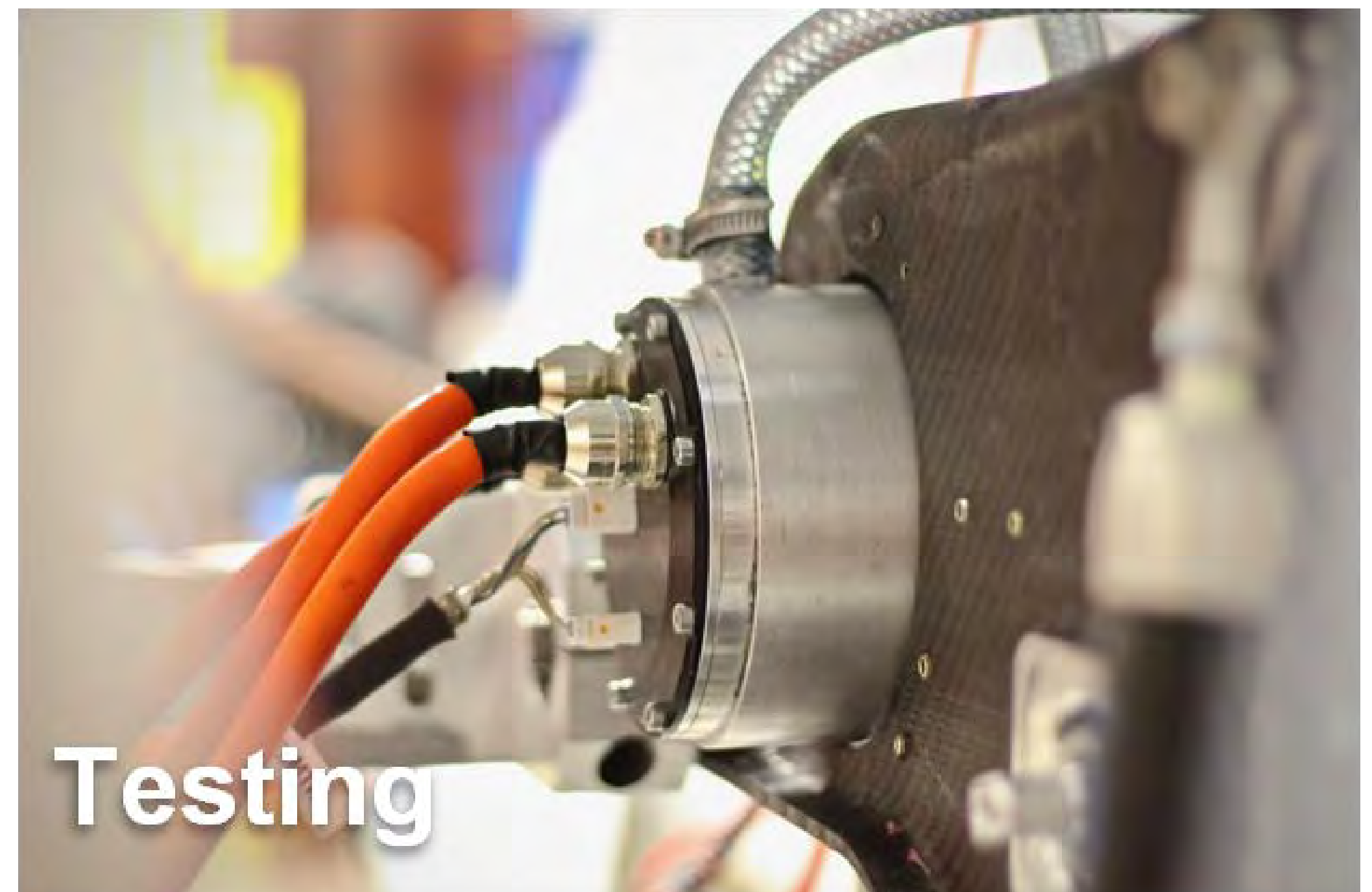
**Manufacturing**



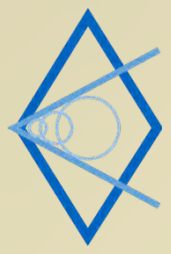
**Construction**



**Shipping**

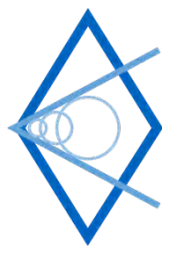


**Testing**

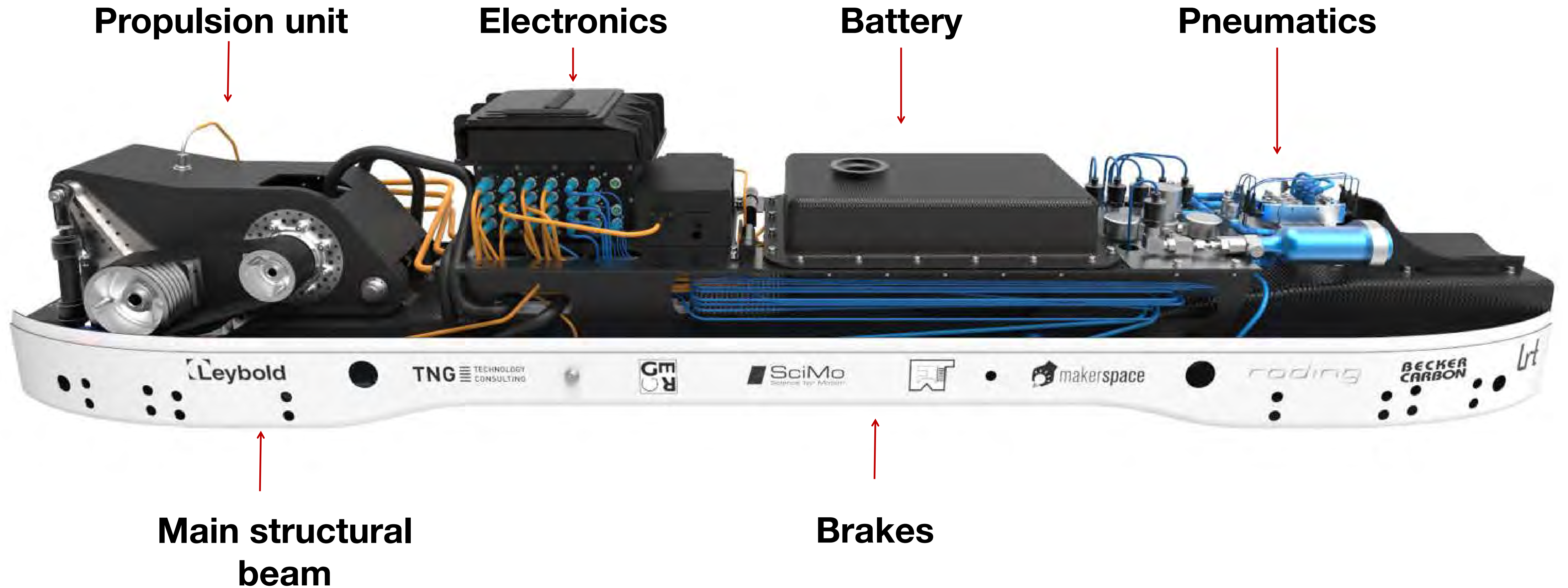




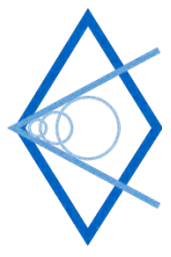




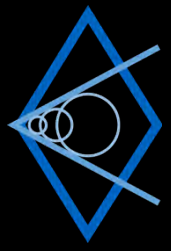
# SUBSYSTEM OVERVIEW





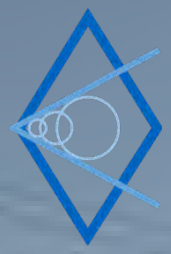







# Race video






# Thank you

 [hyperloop.warr.de](https://hyperloop.warr.de)

 WARR Hyperloop

 [hyperloop@warr.de](mailto:hyperloop@warr.de)

# WARR Hyperloop

