



# CLIP-AIR PROJECT

a new concept for multimodal transport  
based on a modular airplane



TRACE / Transp-OR / ICOM / LIV / ENAC / EPFL

<http://clipair.epfl.ch/>

C. Leonardi

ICAO HQ, Montreal, Canada

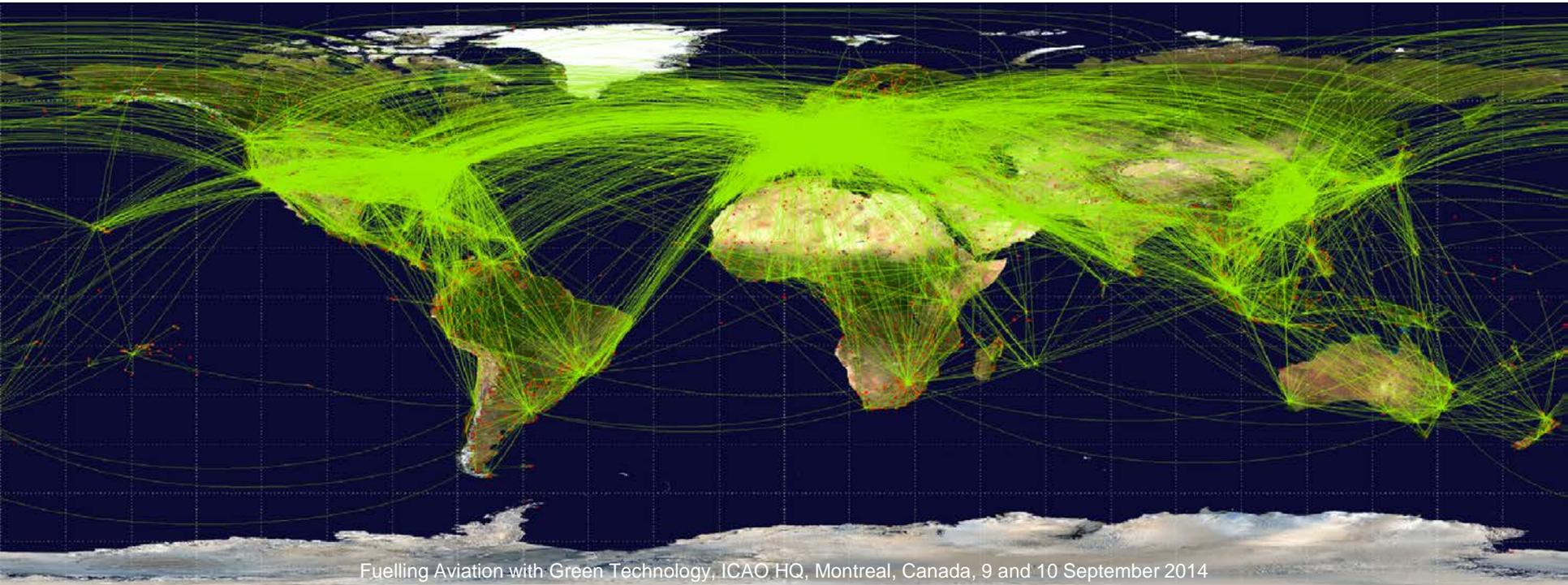
9 – 10 SEPTEMBER 2014



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80000 fly every day  
8 million people fly each day  
2.9 billion passengers flew in 2012





## really more innovative?



Boeing/NASA



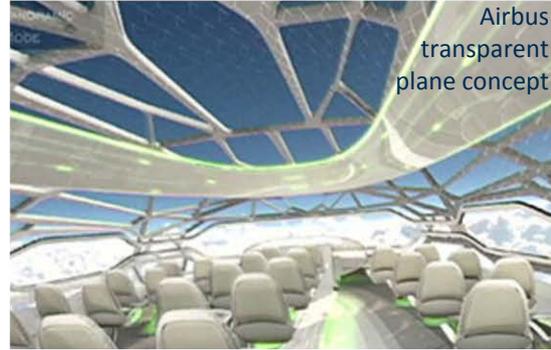
QSST



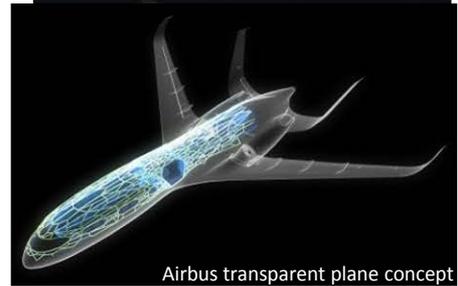
Sugar Volt of Boeing



Airbus A350



Airbus transparent plane concept

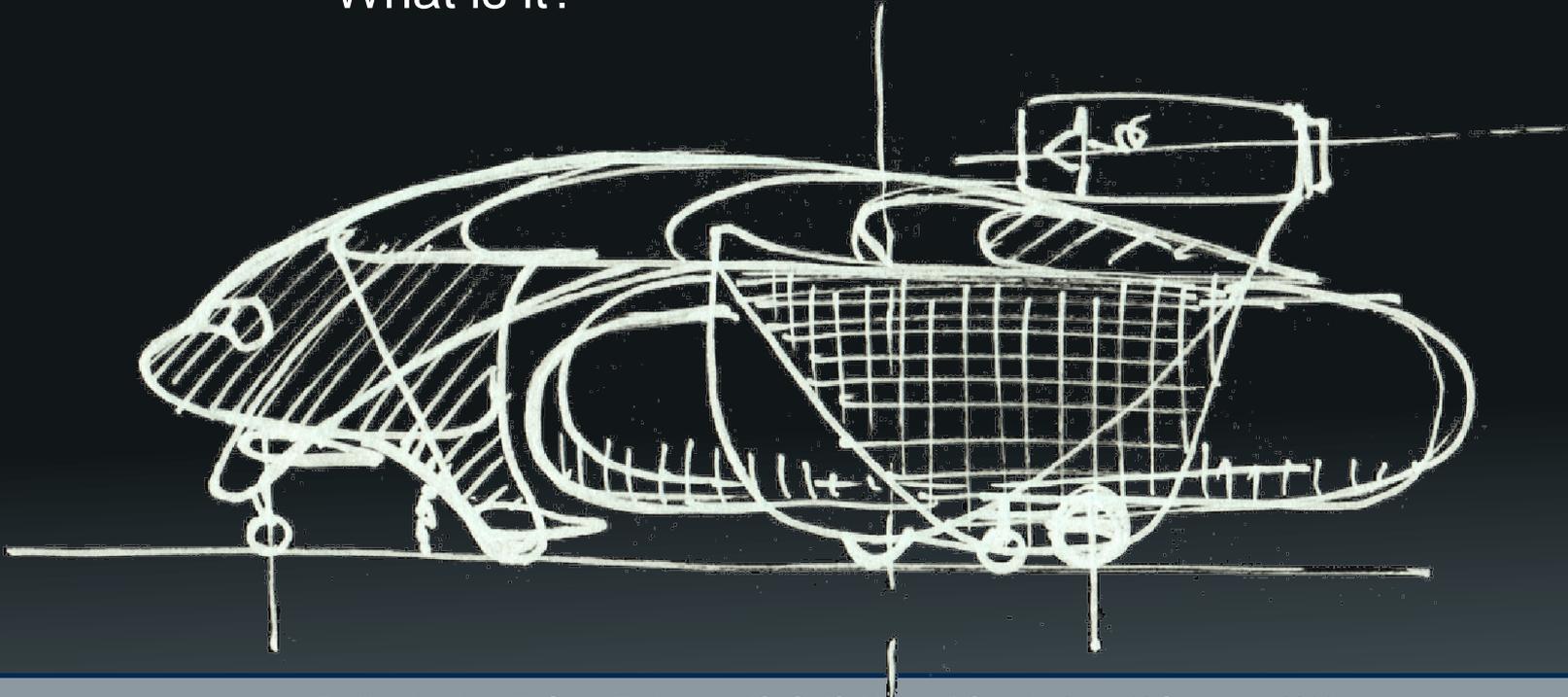


Airbus transparent plane concept



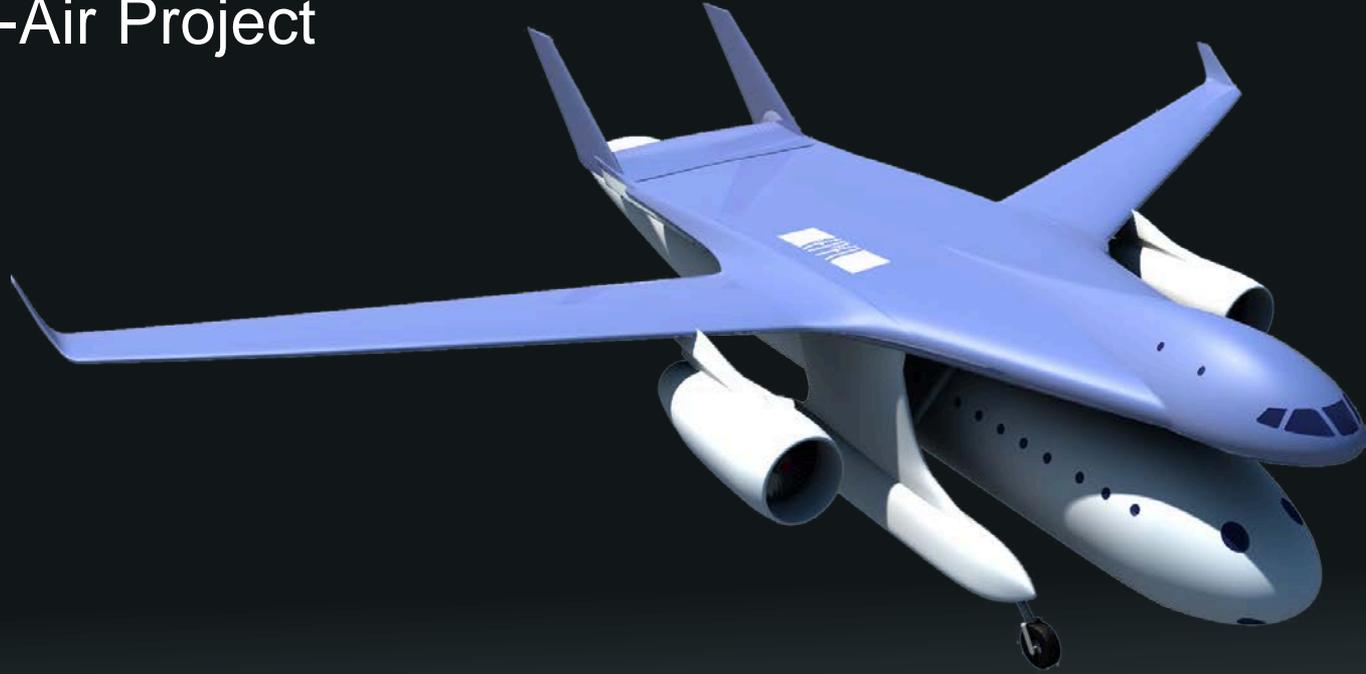
# Clip-Air Concept

What is it?





# The Clip-Air Project



Modularity and flexibility

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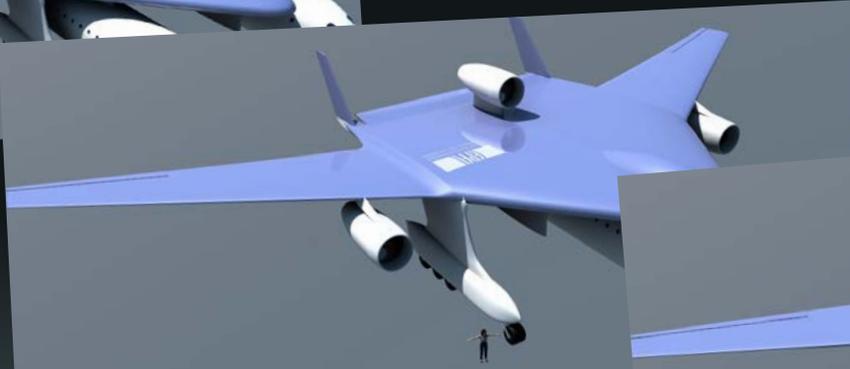
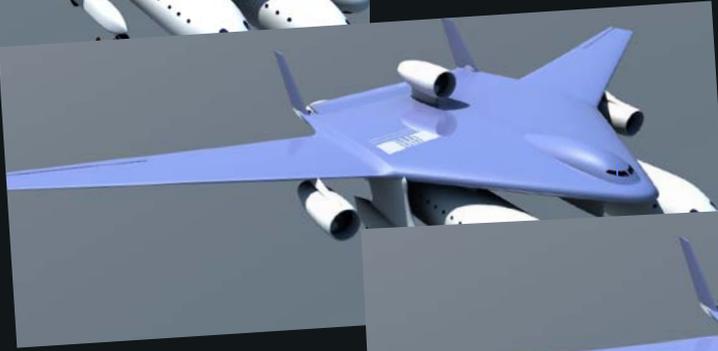
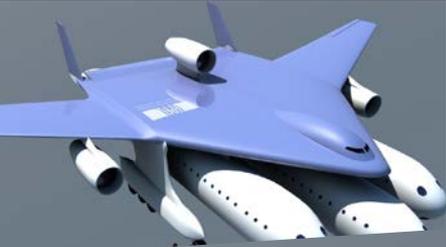
# The Clip-Air Project



Modularity and flexibility

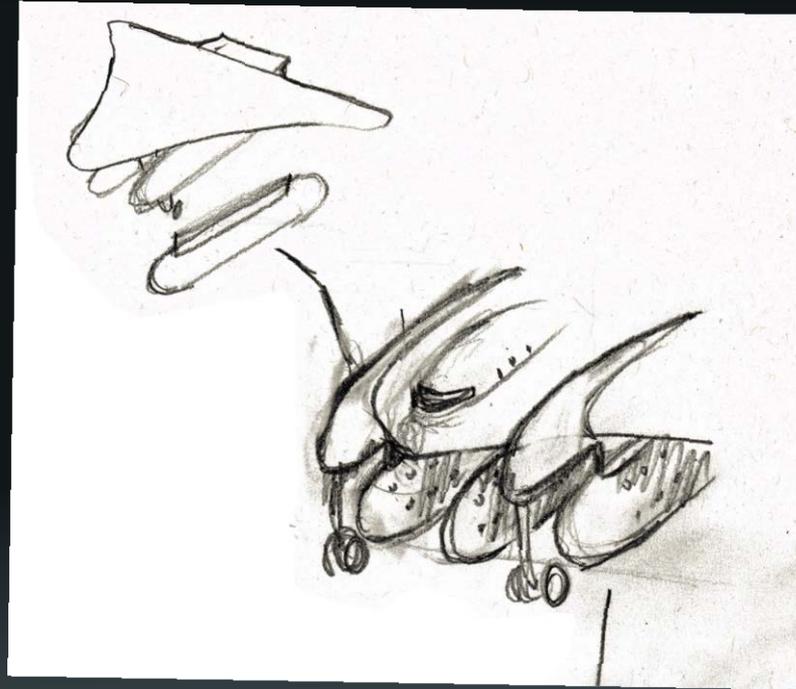


# Modularity and flexibility



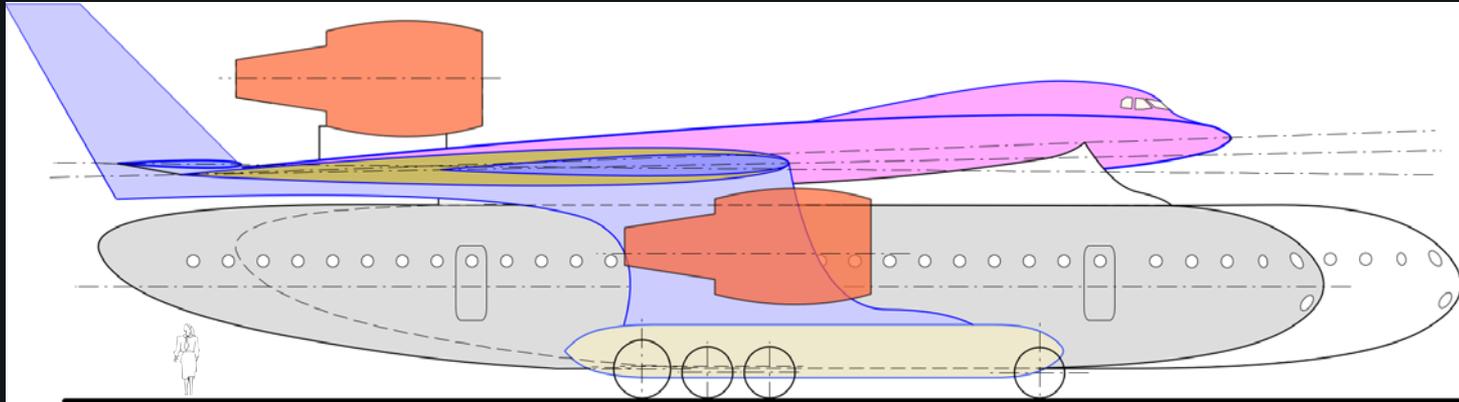


# MULTIMODALITY





# Multimodal Transport



Wagon (M6) 140 pl  
L=27.09 m; h=4.775 m; l=2.83 m; 40t



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# Multimodal Transport



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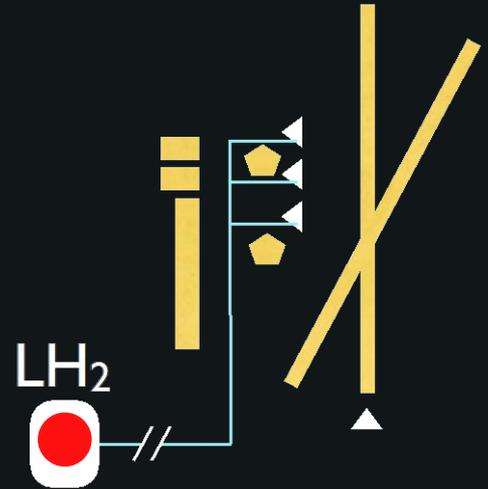
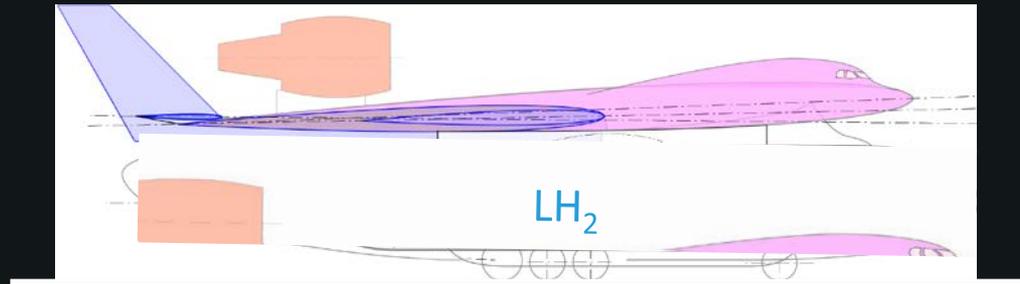
# ENERGY





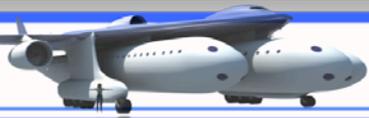
## New Energy = New Architecture

The liquid Hydrogen tank should ideally be spherical or cylindrical (at -253°C).



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- Cylindrical tank
- A tank can be detached and reattached
- The tank can be filled outside of the airport
- Tank volume corresponding to the operations/missions (capsule size)



**CLIP-AIR**

**STANDARD AIRCRAFT**

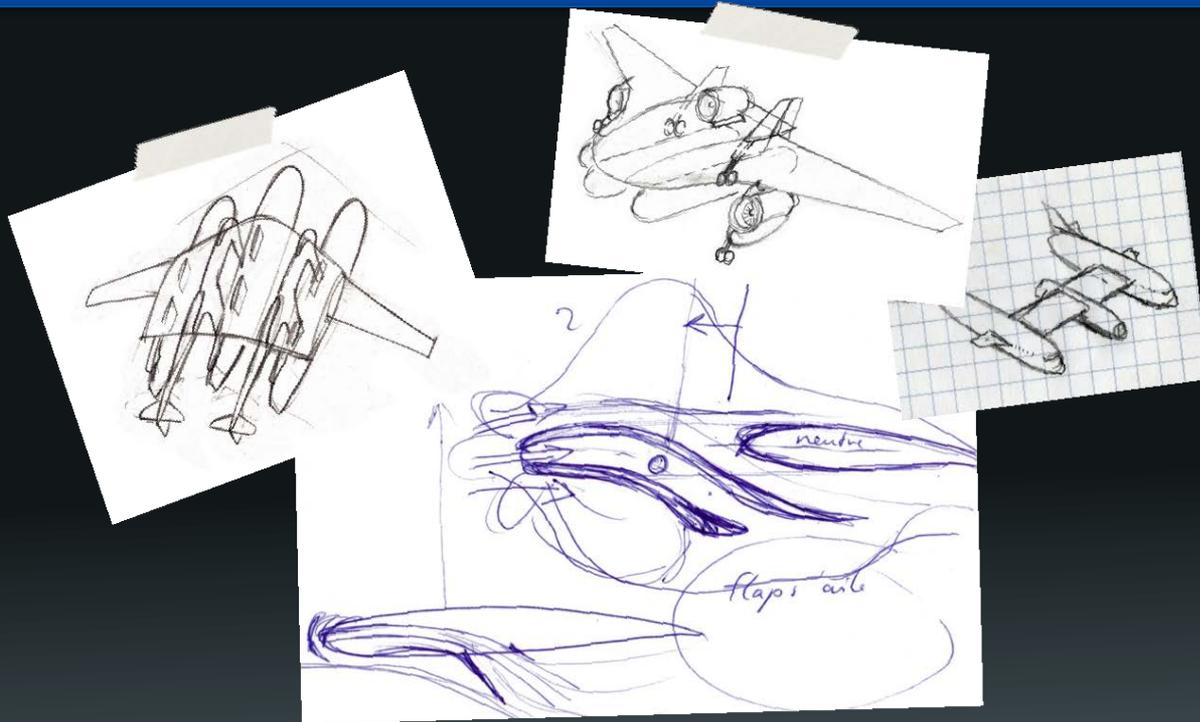
<b>MICROALGAE/ JATROPHA/</b>	✓	✓
<b>SOLAR CELLS ON THE WING</b>	○	○
<b>LNG (LIQUEFIED NATURAL GAS)</b> predominantly methane CH <sub>4</sub>	✓	// SUBJECT TO IMPORTANT CHANGE
<b>LH<sub>2</sub> (LIQUID HYDROGEN)</b>	✓	// SUBJECT TO IMPORTANT CHANGE
<b>JET-A (STANDARD AVIATION FUEL)</b>	✓	✓
<b>GAS, BIOMASS, COAL (FISCHER-TROPSCH)</b>	✓	✓



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# CLIP-AIR at EPFL





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ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE

## Transportation Research Overview of research projects

Dr. Michaël Thémans, Vice-Presidency for Innovation & Technology Transfer  
Executive Director of the Transportation Center





## TraCE



« 5 EPFL's schools are involved  
in the Transportation Center »

## 39 laboratories

- **ENAC**  
School of Architecture, Civil and Environmental Engineering
- **STI**  
School of Engineering
- **I & C**  
School of computer & communication sciences
- **CDM**  
College of Management of Technology
- **SB**  
School of basic sciences
  
- **EPFL Middle East**

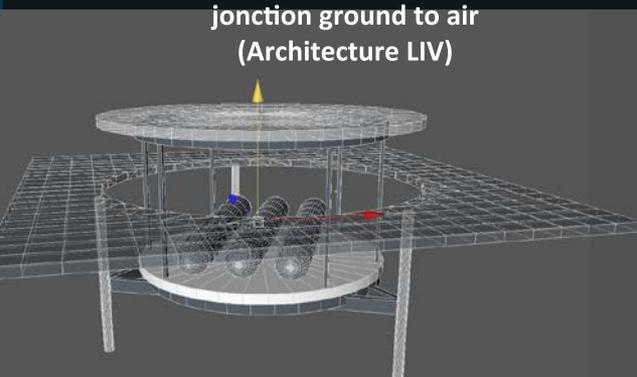


# CLIP-AIR at EPFL

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New Airport (Architecture LIV)

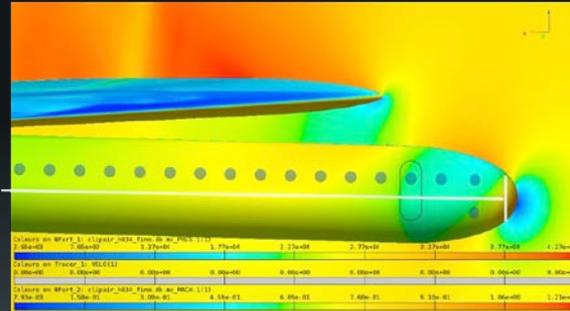


Junction ground to air (Architecture LIV)

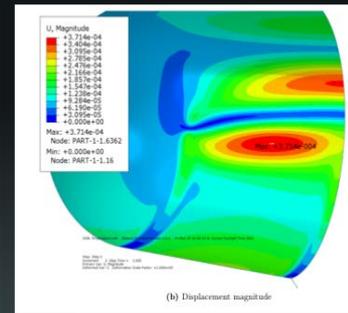


Simulation (TRANSP-OR)

Aerodynamics Simulations (TRACE+G-M)



Cryogenic fuel Tanks (G-M)



Clip-Air projects at EPFL



# To design the project

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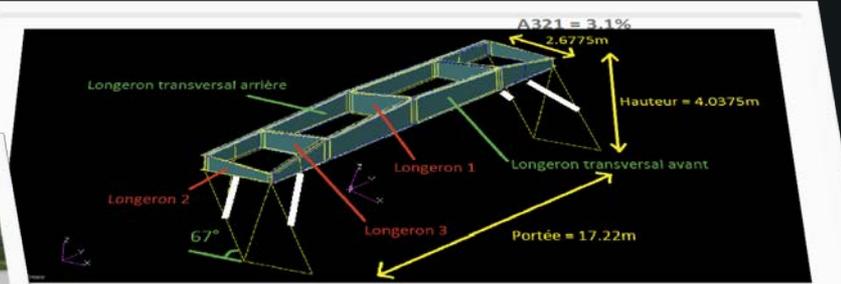
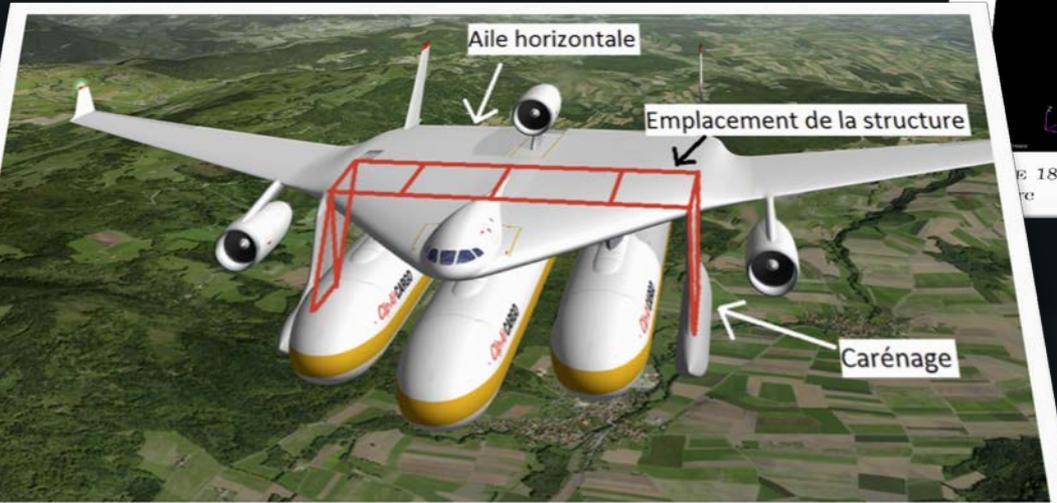
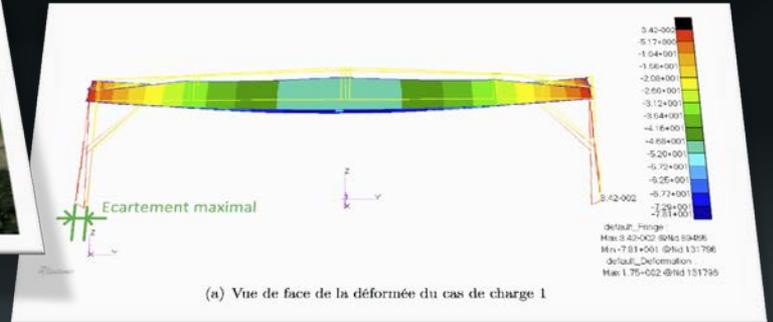


Fig. 18 – Modèle définitif avec différentes appellations de différents composants de la structure



## Clip-Air projects at EPFL



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# To design the project

LIV / ENAC / EPFL



Clip-Air projects at EPFL



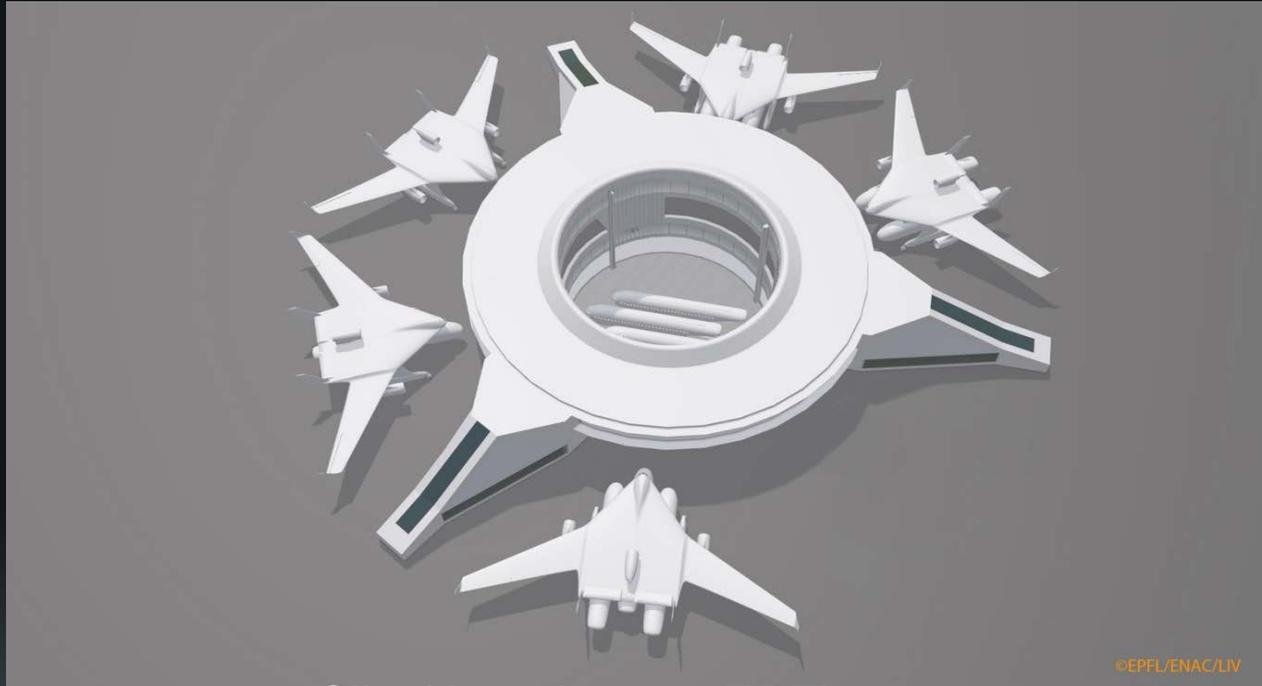
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# To design the project

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## Clip-Air projects at EPFL



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# Clip-Air Strategy 2015-2022 2050





# Clip-Air Strategy

2018 - 2025



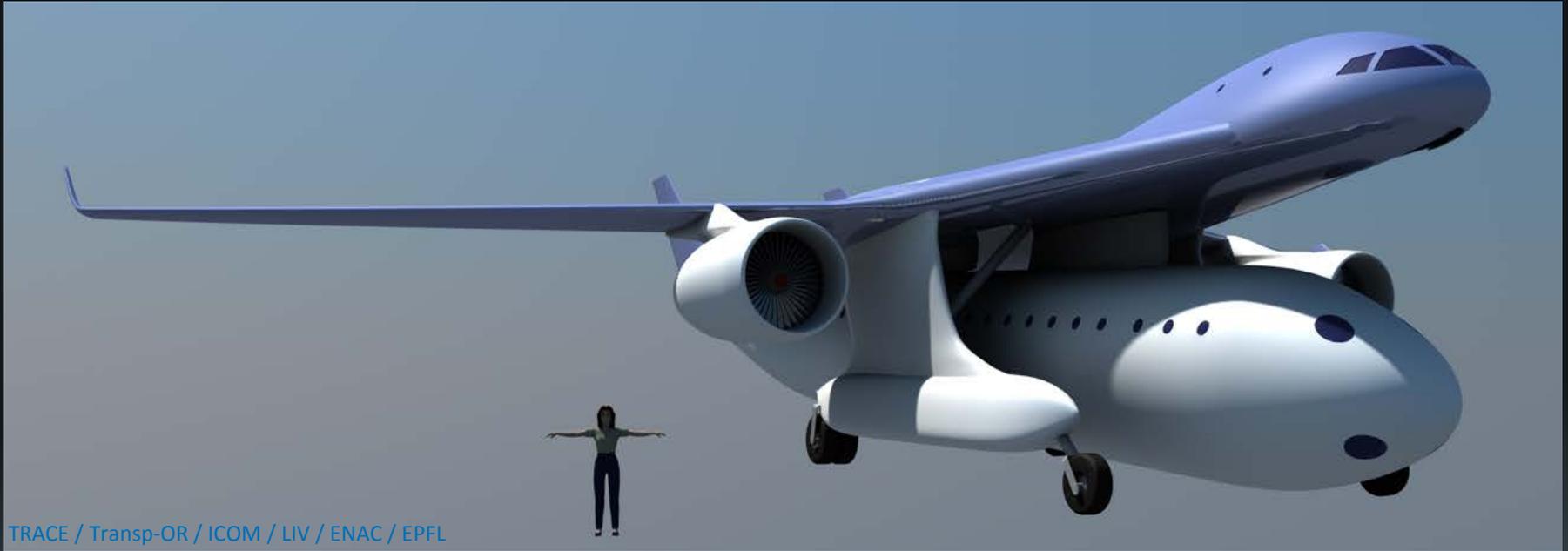


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# Clip-Air Strategy

2025 - 2030



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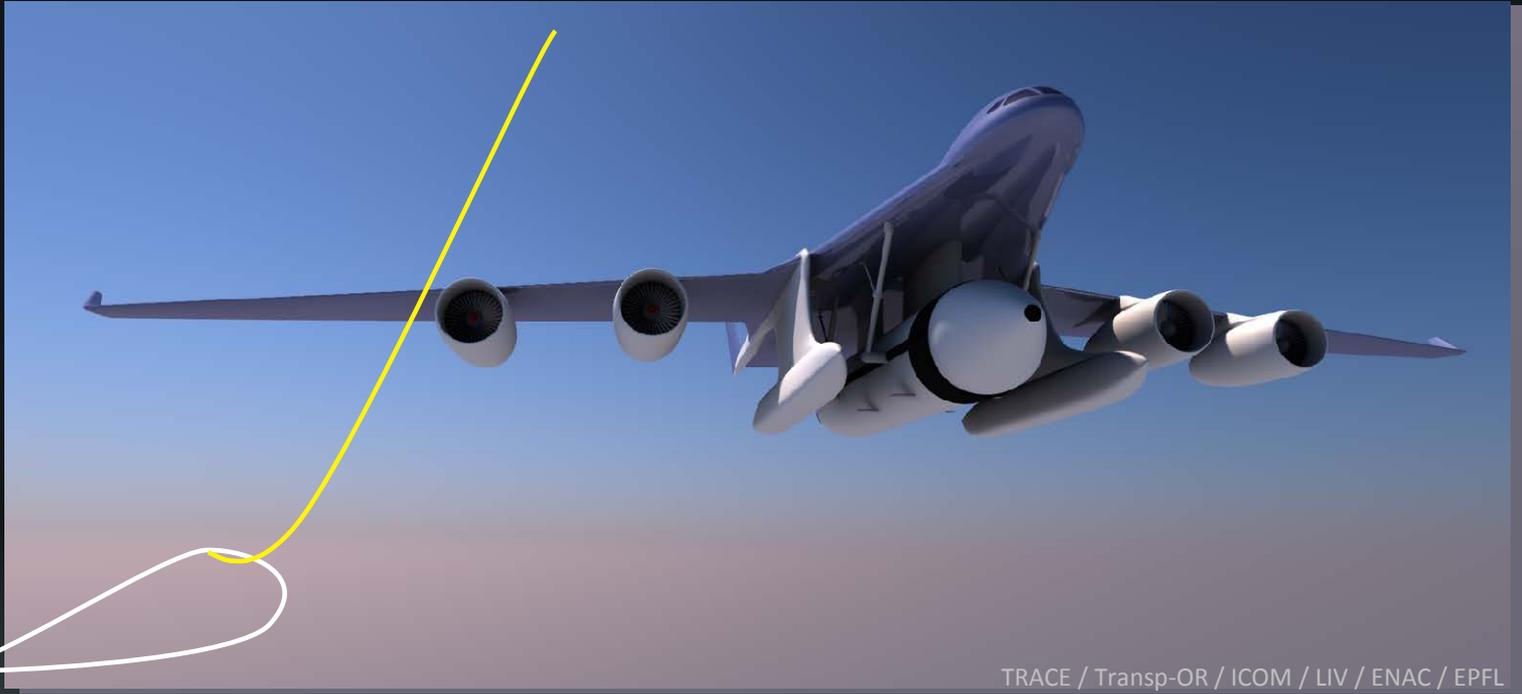
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# Clip-Air Strategy

2030



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## Conclusion



The Clip-Air concept opens the door to a wide range of new research opportunities

The presented analysis is a promising step towards the new flexibility concepts without being confined in the boundaries of the existing systems.



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