AIDAA
ASSOCIAZIONE ITALIANA
DI AERONAUTICA E ASTRONAUTICA

EUROAVIA
NAPOLI

UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

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SEMINARI DI CULTURA AERONAUTICA

1st Seminar

The Future Air Transport

April 5, 2022

Aula “Bobbio” - Scuola Politecnica e delle Scienze di Base – P.le Tecchio - Napoli

NEW DISRUPTIVE AIRCRAFT CONFIGURATION

Leonardo Lecce

Novotech- Aerospace Advanced Technology Srl

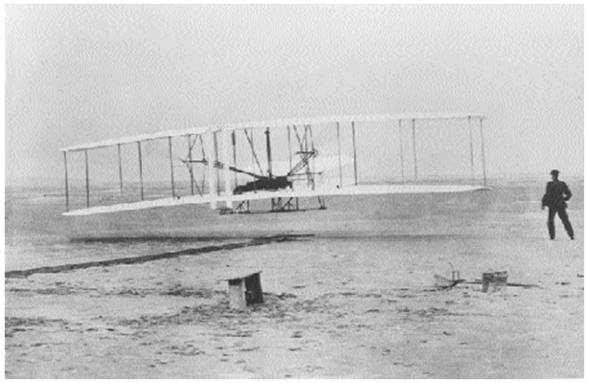
AUTOLINE

- Premessa
- Introduzione
- Evoluzioni Configurazionali Velivoli Convenzionali o Quasi
- Da dove nasce l'esigenza di Nuove Configurazioni "Disruptive"
- Pochi Esempi di Nuove Configurazioni "Disruptive"
- Qualche idea personale!!
- Ringraziamenti e Conclusioni

INTRODUZIONE

Sin dall'inizio della storia dell' Aeronautica la scelta della configurazione è stata fondamentale per il successo di un velivolo: vedi le diverse scelte di Langley e I Fratelli Wright ed il successo della configigurazione biblana su quella monoplana

Fliyer dei Fratelli Wright



Great Aerodrome di Samuel P. Langley

Questo finchè con l'impiego dell'ala metallica e skin collaborante , la configurazione monoplana non tronò al successo con le realizzazioni di Fokker

Fokker D.1 - 1912

Fokker E.III - 1916

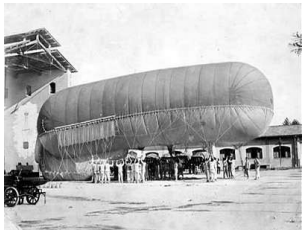
INTRODUZIONE

Cosa ha spinto a pensare e sperimentare nuove configurazioni
(in successione temporale):

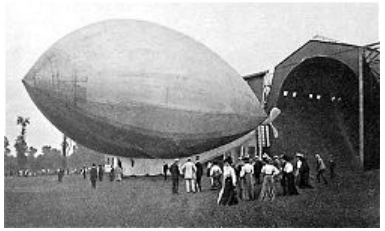
- Impiego militare del mezzo aereo
- Miglioramento delle prestazione (velocità max ; velocità di stallo; quota massima; autonomia; etc.)
- Superamento della barriera della velocità del suono
- Efficienza energetica/ Riduzione dei costi di produzione e di esercizio/ Riduzione del rumore
- Disponibilità di nuovi materiali : il composito
- Nuove applicazioni del mezzo aereo (a parte il decollo verticale , già dominio degli elicotteri) : UAM (Urban Air Mobility)

Evoluzioni Configurazionali: Velivovi Convenzionali o Quasi

Dirigibili : ieri e oggi



N1



Forlanini

Zeppelin

Il Norge di U. Nobile

Dirigibile Ibrido : Airlander 10

Idrovolanti : ieri e oggi

Dornier X10

Macchi MC 72

SIAI Marchetti S-55 X

Beriev Be -200

Dornier Seastar Cd-2

Canadair CL-415

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Evoluzioni Configurazionali: Velivoli Convenzionali o Quasi

Velivoli con ali a geometria variabile

Rockwell B-1 Lancer

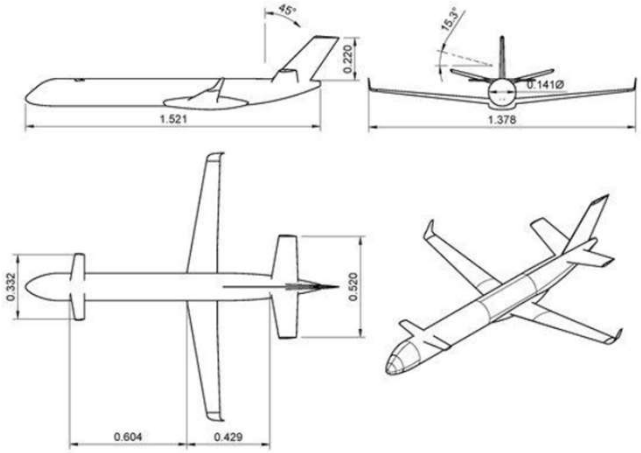
Panavia Tornado

Velivoli con ali a freccia in avanti

Grumman X-29

Velivoli con superfici portanti multiple

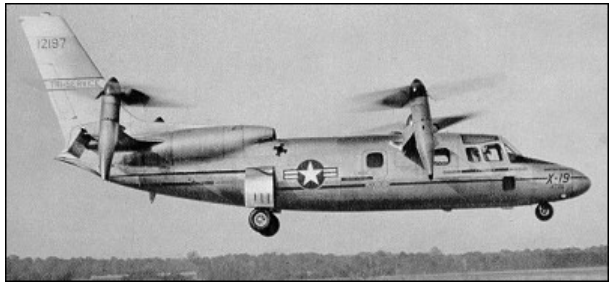
Piaggio P-180 Avanti



Studio del PhD Danilo Ciliberti

Evoluzioni Configurazionali: Velivoli Convenzionali o Quasi

Ali Rotanti & Convertiplani



Curtiss-Wright_X-19

V22 Osprey

Airbus X- 3

Sikosky-Boeing SB- 1 Defiant

Bell V-280 Valor

Evoluzioni Configurazionali: Passato Prossimo o Futuro ?

Ala di Prandtl

(Attività di ricercar del Prof. Aldo Frediani – UniPisa/ AIDAA

Progetto EU - Parsifal

WiG (Wing in Ground effect)- Ecranoplano

L'ekranoplanno Lun sulle rive del Mar Caspio (Twitter)

Regent - Seaglider

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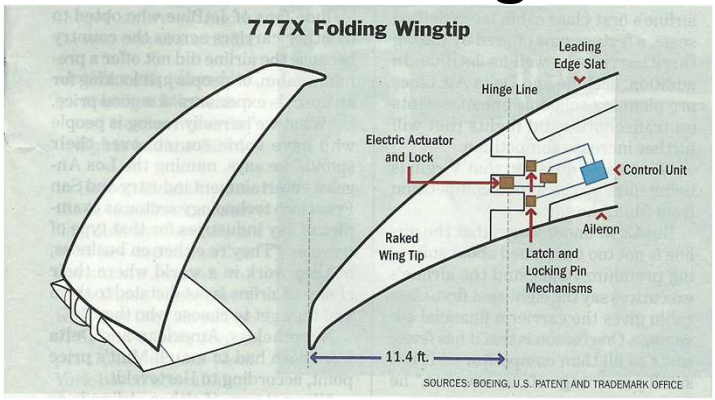
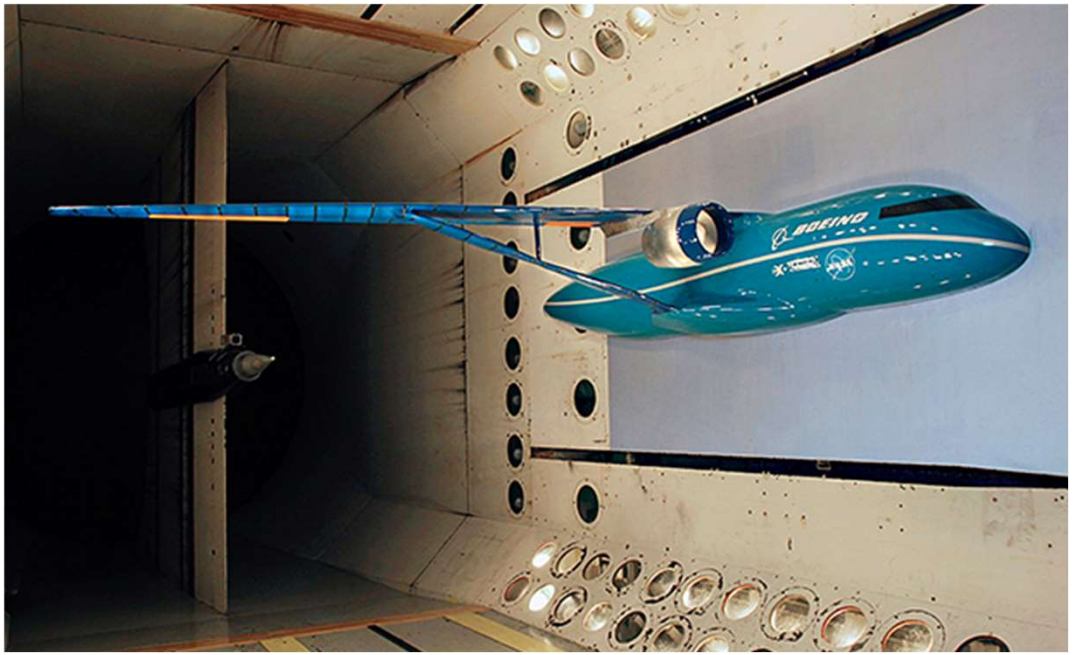
Evoluzioni Configurazionali: Passato Prossimo o Futuro ?



BOEING/NASA
FOLDING WING &
BRACED WING




TRUSS-BRACED WING JETLINER CONCEPT (BOEING)

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Da dove nasce l'esigenza di Nuove Configurazioni "Disruptive" ?

- Perché l'UAM (Urban Air Mobility) ?
- Cos'è l'UAM ?
- Cosa cambia nel sistema di **controllo del traffico aereo** (ATM) con l'UAM ?
- Cosa cambia in termini di **materiali, processi produttivi**, **sistemi propulsivi** e **certificazione** ?
- e-VTOL e HSTOL : due approcci in competizione o complementari ?

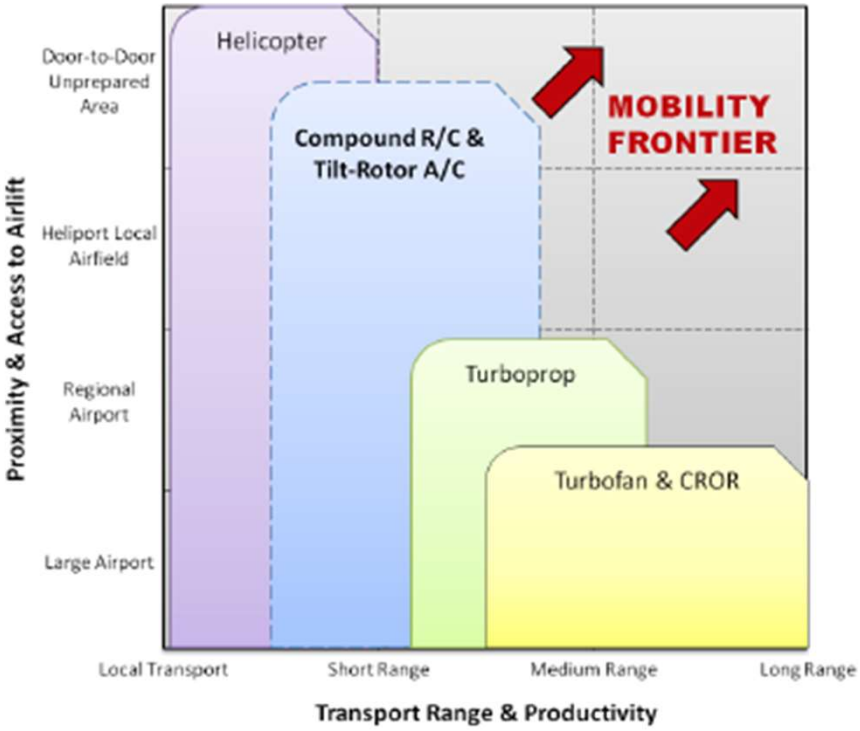


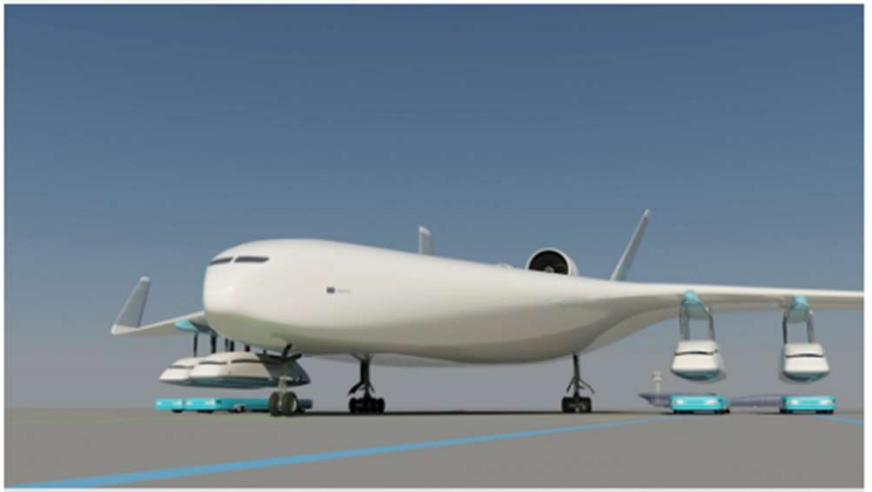
Figure 8.1 – Relationship between aircraft mobility requirements and solutions

Da dove nasce l'esigenza di Nuove Configurazioni "Disruptive" ?

Single-capsule design is envisioned as a steppingstone to the 2050-time frame Clip-Air modular aircraft. Credit: EPFL

CLIP AIR
EPFL Project

FANTASY PRJECT

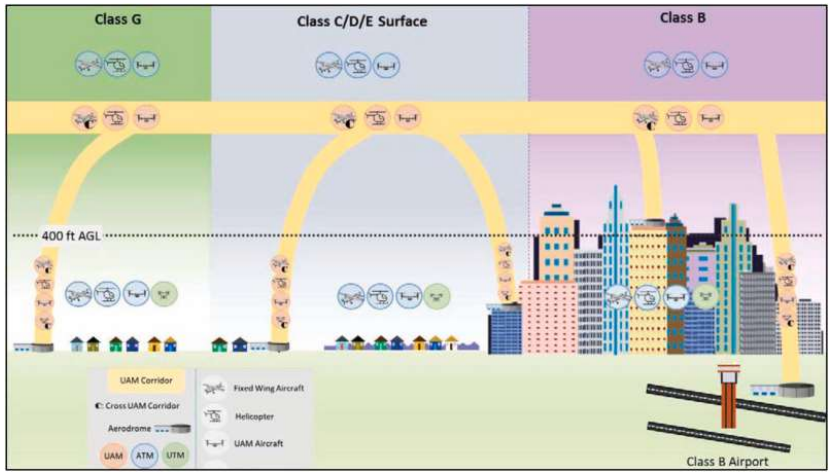


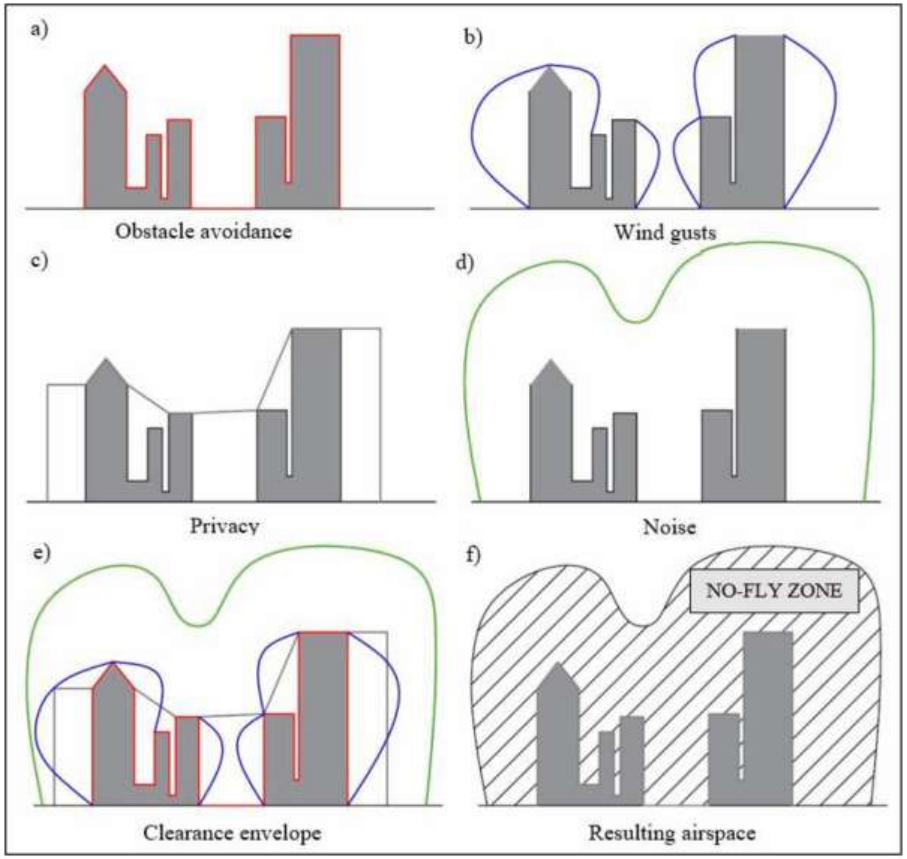
The Fantassy study looked at how aircraft could carry intermodal passenger pods between airports. Credit: Fantassy Project

Cos'è l'UAM ?

Advancements achieved in the past few years in several technological fields related to the air transportation, together with the expected changes in the airworthiness regulations and ATM, make possible to develop a new class of aircraft, designed for affordability, excellent flight qualities, easy and eventually autonomous operations. **Latest studies forecast for these new vehicles an addressable market evaluated in at least $1.5 trillion by 2040.**

Cosa cambia nel sistema di controllo del traffico aereo (ATM) con l'UAM





Designing airspace for urban air mobility: A review of concepts and approaches ; Progress in Aerospace Sciences ; Volume 125, 1 August 2021

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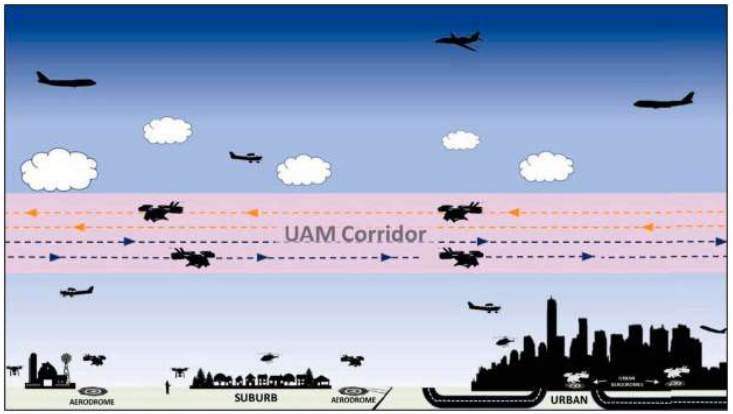
Cosa cambia nel sistema di controllo del traffico aereo (ATM) con l'UAM



Recommendations for further research on the topic of urban airspace include:

•- Research of risk, including accident scenario planning, bird strike risk, loss of control, and risk due to wind gusts.

•- Research and discussion about data usage, rights, anonymization, and de- identification of data collected by aircraft in the urban environment.

•- Research on new technologies, especially ADS-B, detect-and-avoid, technology for taking over control if the geofence is breached, and a safety protocol under which new tech can be inspected.

•- Research into psychoacoustic effects of drone noise on humans and airspace concept development that has noise at the core of its design.

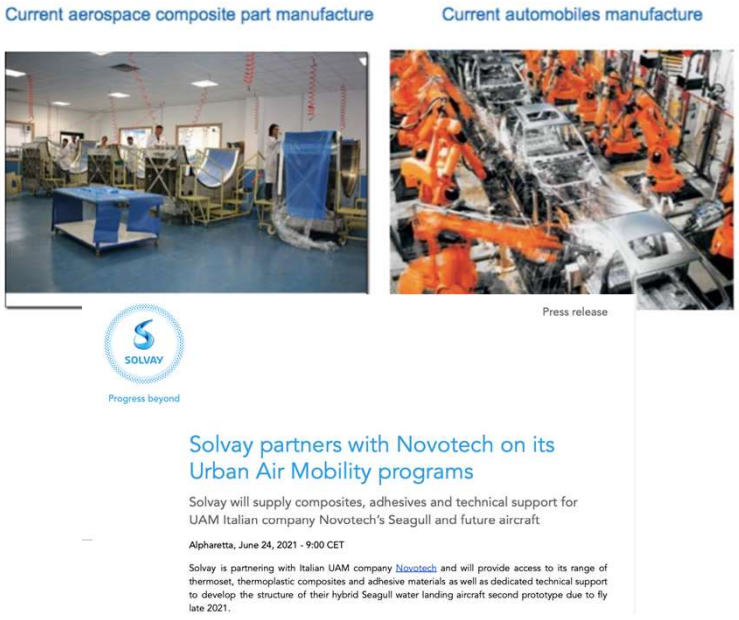
•- Research of community input and design, including visual pollution and privacy concerns.

•- Research on the impact of ground infrastructure on urban planning, including landing and take-off sites, real estate, zoning, planning issues, inequalities, and air rights.

Cosa cambia in termini di **materiali & processi produttivi** , sistema propulsivo e certificazione

Several technologies (**composite materials,** new materials, **advanced battery technologies, hybrid powerplants**, aerodynamics, noise control technologies, among others) are now available, and will improve over the years to come, permitting to realize innovative air-vehicles configurations that will be capable of sustain Urban Air Mobility in metropolitan areas as well as to enable new air transportation possibilities in remote, unstructured areas and in critical conditions like emergencies and others.

Comparison between manufacturing of autos and aircrafts



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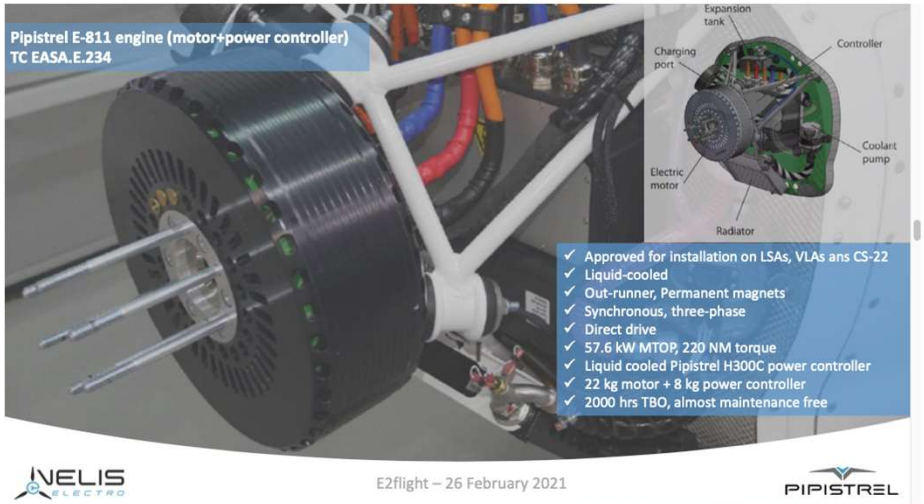
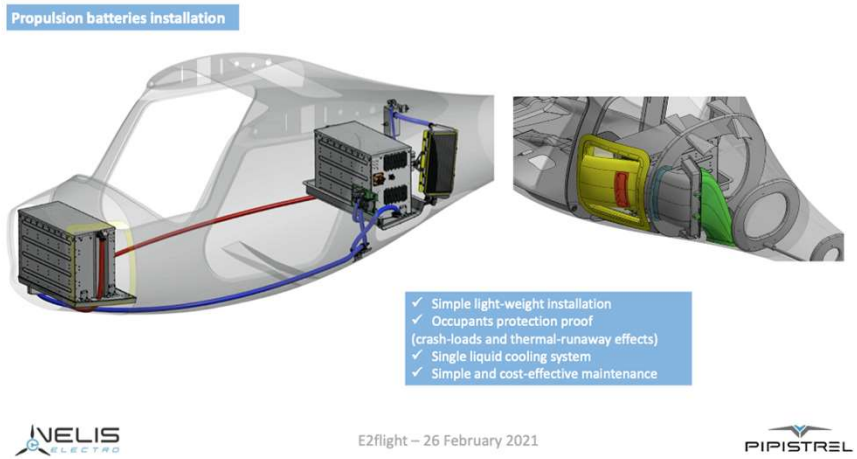
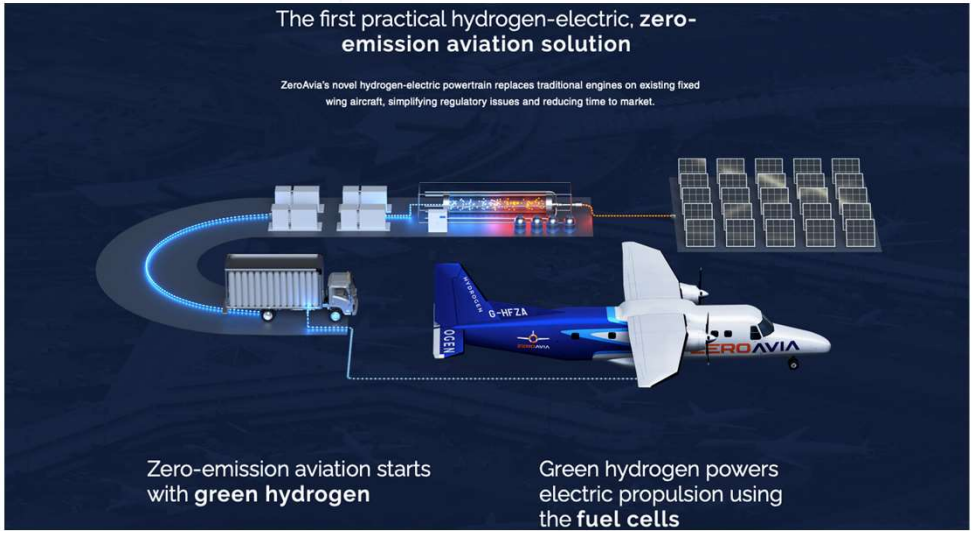
Cosa cambia in termini di materiali & processi produttivi , **sistema propulsivo** e certificazione







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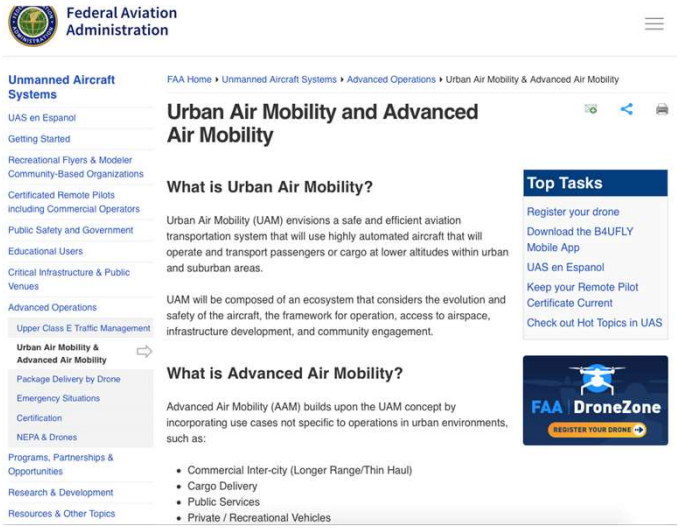
Cosa cambia in termini di materiali , sistema propulsivo e **certificazione**

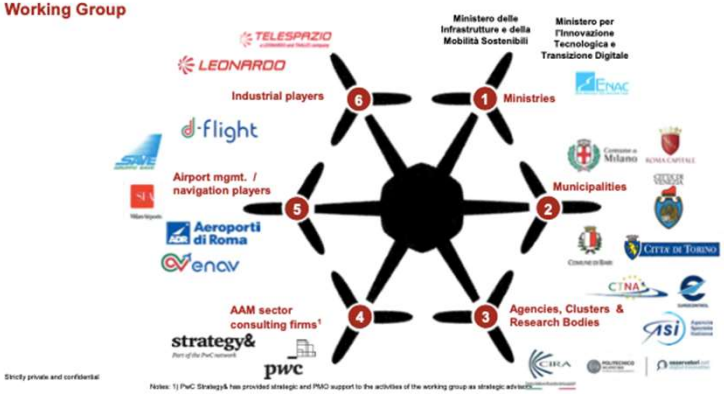


EASA regulatory activities

The Agency has started creating the UAM regulatory framework, building notably on the results of 2021 UAM study on societal acceptance. Some building blocks have already been achieved:

- **On airworthiness**, EASA has been the first in the world to publish in July 2019 a Special Condition to authorise small VTOL aircraft operations, in 2020 for Light Unmanned Aircraft Systems operating in medium risk situations, and in 2021 Guidelines on the design verification of UAS operating in the specific category
- **On operations and pilot licencing**, in early 2019 it has launched preparatory activities that will lead to rules for the pilots/remote pilots of these vehicles, their operators and for the infrastructure, e.g. vertiport operators
- **On airspace integration**, EASA has prepared a worlds-first U-Space/UTM regulatory package (Commission Implementing regulations 2021/664, 2021/665 & 2021/666, adopted by the European Commission on 22 of April 2021; this package will become applicable early 2023 and will enable the safe integration of UAS operations in urban environment

The project engaged a wide variety of experts integrating industrial, institutional and research competences



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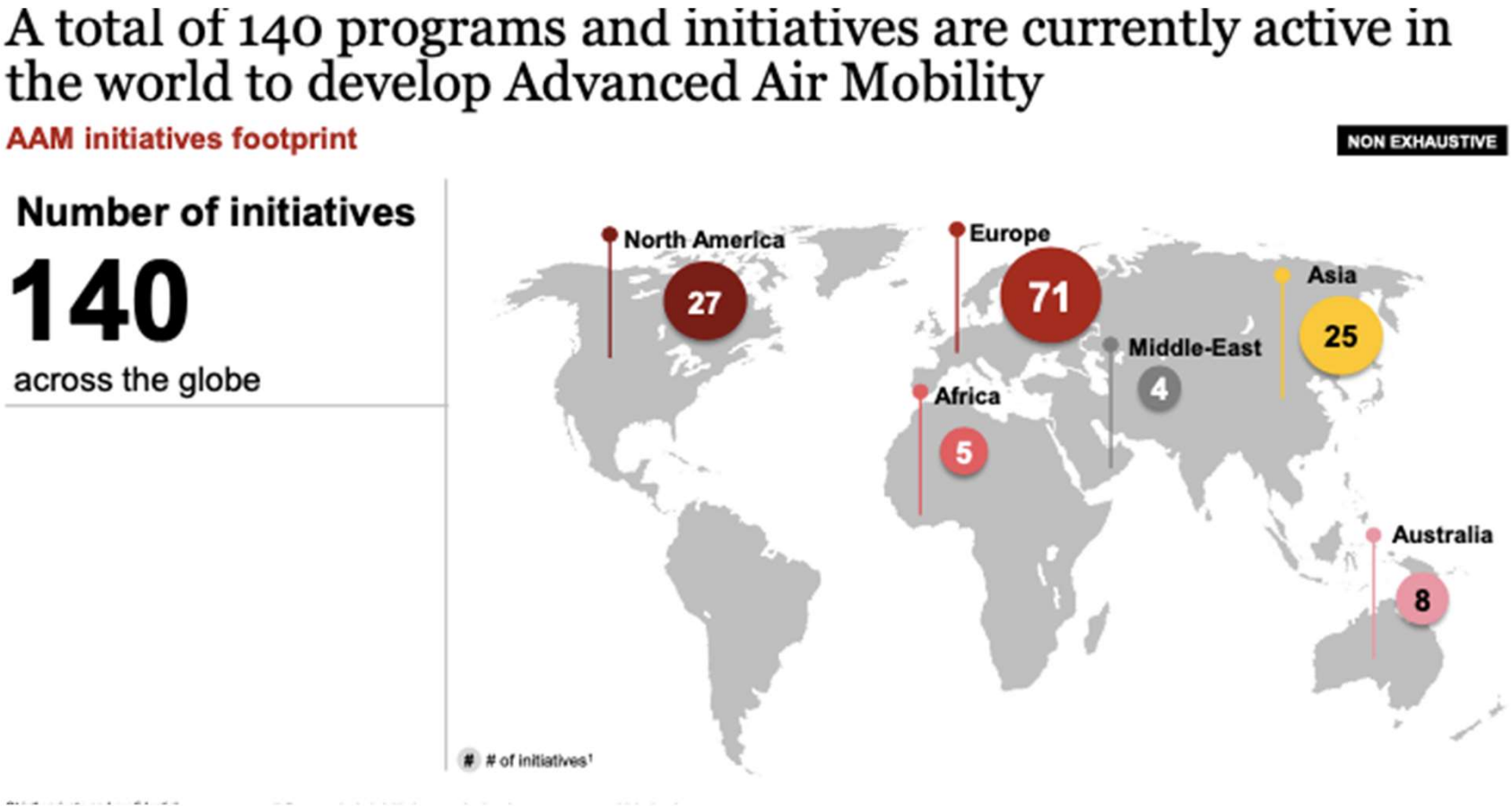
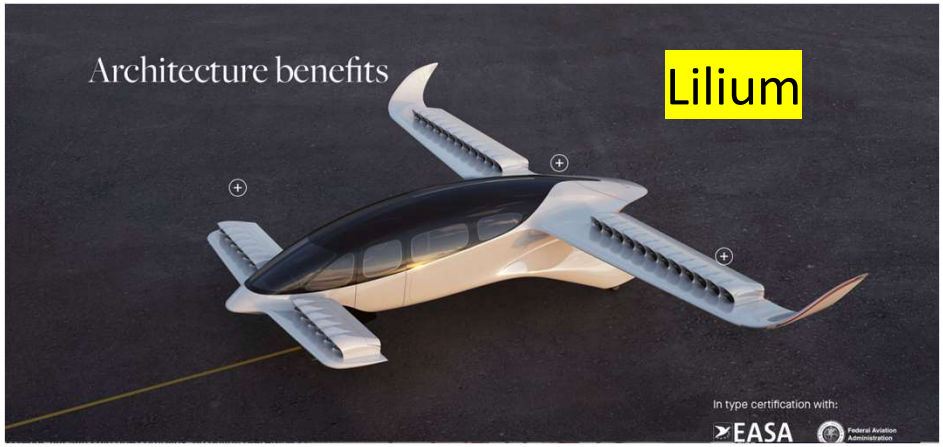
Pochi Esempi di Nuove Configurazioni “Disruptive” !!!



Pochi Esempi di Nuove Configurazioni “Disruptive”

e-VTOL e HSTOL : due approcci in competizione o complementari



Europa

Nuove soluzioni per le infrastrutture a supporto dell’UAM

Pochi Esempi di Nuove Configurazioni “Disruptive”

e-VTOL e HSTOL : due approcci in competizione o complementari

USA

Joby

Archer - Maker

Progetto di Electra scelto in ambito del bando dell’USAF: Agility Prime Soluzione HSTOL e prop. ibrida

Electra’s hybrid eSTOL technology has the potential to deliver differentiated payload and range capability to the U.S. Air Force with substantially greater access to landing zones.

Pochi Esempi di Nuove Configurazioni “Disruptive”

e-VTOL e HSTOL : due approcci in competizione o complementari

CINA

EHANG 216

Confronto in termini di prestazioni , costi e capitalizzazione

MAX Speed

Previsto Prezzo di Vendita

Capitalizzazione in Borsa

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Qualche idea personale!!

Vision

*The SEAGULL is a **breakthrough** with respect to the current transportation systems, a high performing **ultralight seaplane** , **easy** and **economical**, operating from any water infrastructure in complete **autonomy**.*

1st European Hydroaviation Congress
Pollensa/Mallorca 23-26 September 2021

Design, Manufacturing and Testing of an Innovative Small Seaplane as Personal Transportation Vehicle by **Leonardo Lecce**

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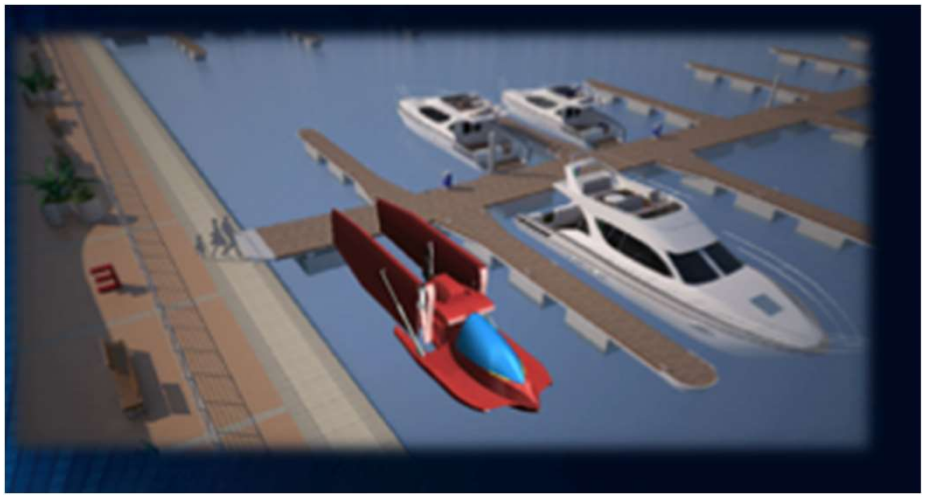
Qualche idea personale!!

Vision

SEAGULL

NOVOTECH SRL AEROSPACE ADVANCED TECHNOLOGY

- ✓ UNIQUE
- ✓ INDIPENDENT
- ✓ YOUNG
- ✓ LIGHT
- ✓ ECO-FRIENDLY



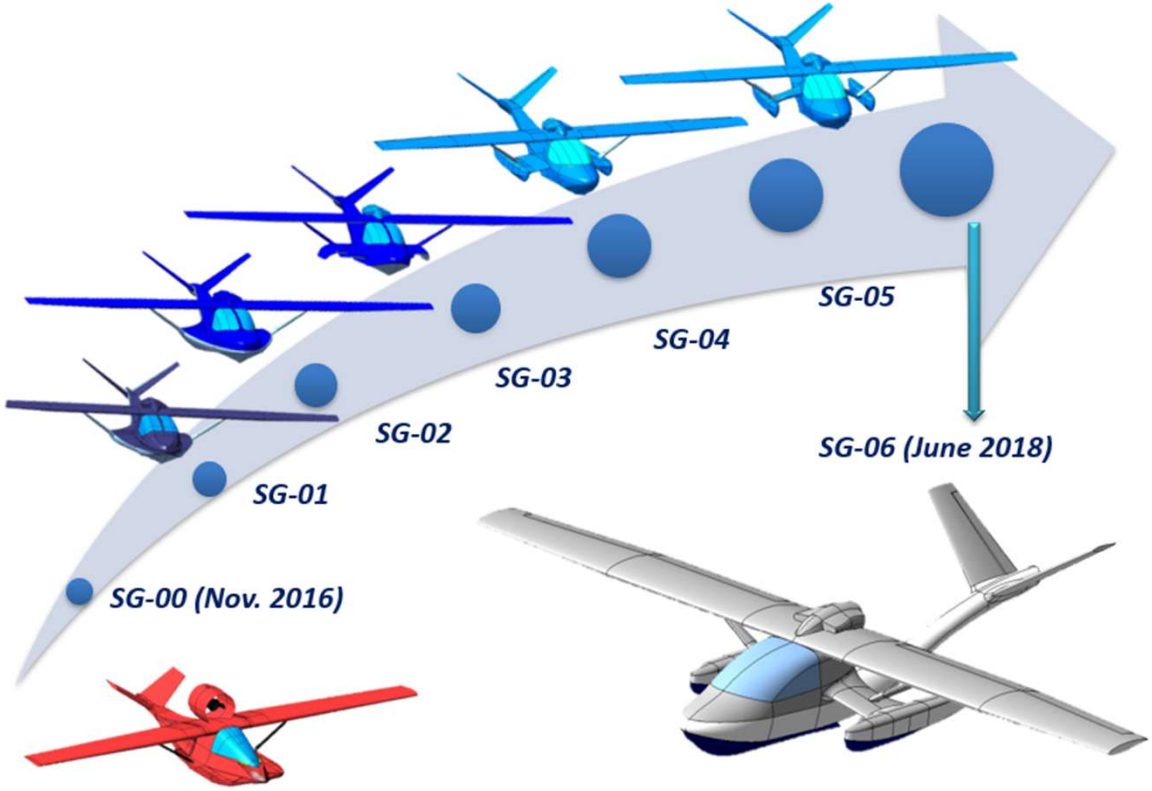
Mooring Configuration

Ultralight Aircraft configuration

EU Patent n. 102017000131163 deposited November the 16th, 2017., granted Febraury the 2nd ,2020
Patent Title: Mechanisms for transforming an ultra-light aircraft into a sailing and motor-powered vessel.

Qualche idea personale!!

Aircraft Configuration Evolution



SEAGULL Main Characteristics

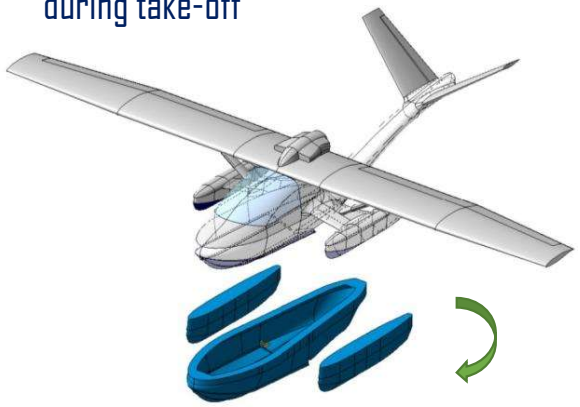
- All composite fuselage ,tail, sponsons and controls
- Metallic braced wing (through linear actuators)
- Automated Folding wing system allowing the usage:
  as classical UL seaplane
  as sailboat (we hope !!)
  as boat or for ground transport and storage (fully folded aft)
- Pushing propeller configuration
- Hybrid propulsion system (optional), can be only CI or All Electric
- Retractable landing gear (optional), we will adopt in the second prototype (31/12/2021)

Aircraft Configuration Evolution

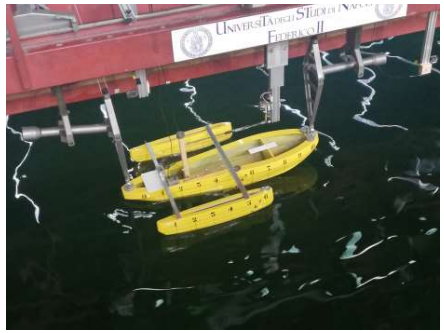
Static and Dynamic beaviour in Water (Dynamic Stability)

(towing tank tests carried out at University of Naples "Federico II")

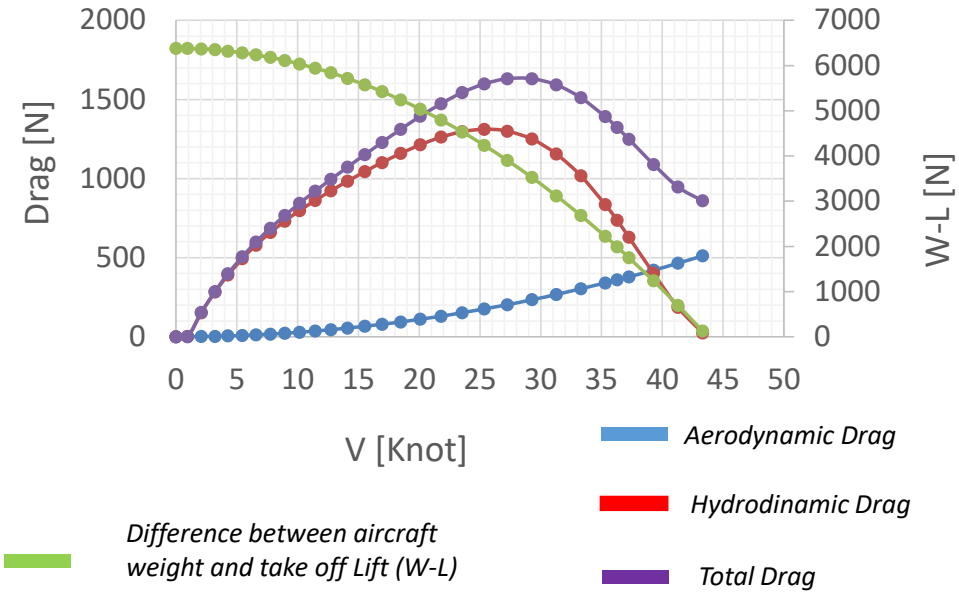
Main outputs:
- hull stability & control in maritime operations
- estimation of hydrodynamic drag during take-off



Testing Model



Scaled Model **1:3.2**



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Aircraft Configuration Evolution

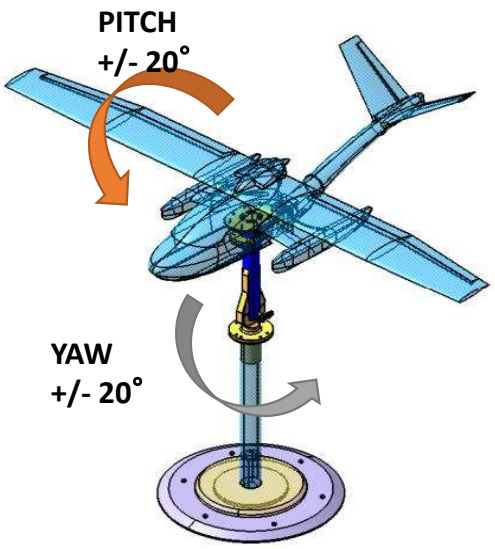
Wind Tunnel Test

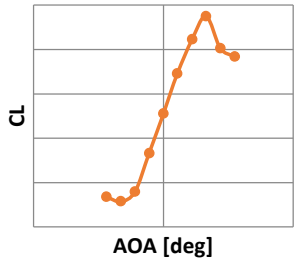
Scaled Model 1:7

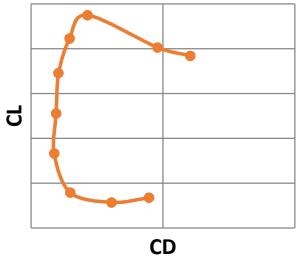
Main outputs:

- Estimation of aerodynamic performance (included stability and control)

*Wind Tunnel - Test Velocity = **30m/s***







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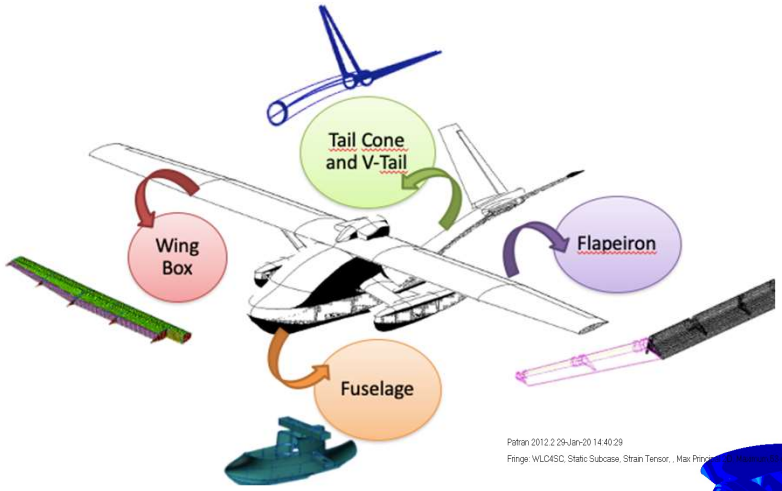
Digital Twin Based Design Approach

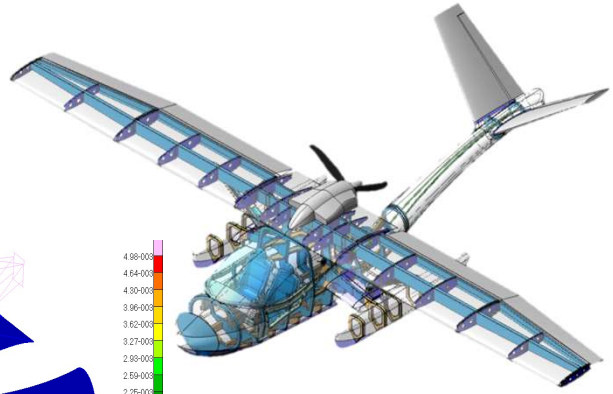
SEAGULL

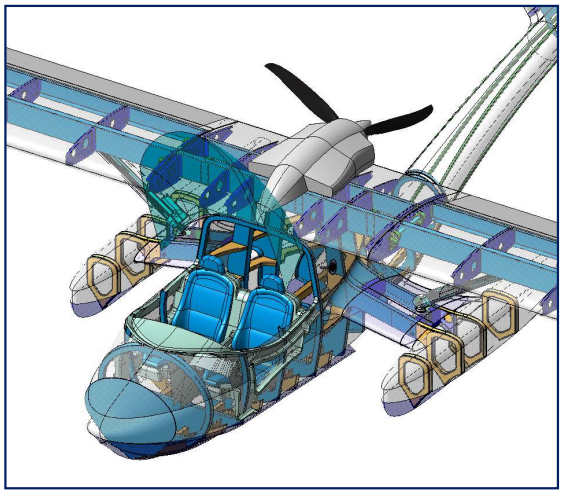
NOVOTECH SRL
AEROSPACE ADVANCED TECHNOLOGY

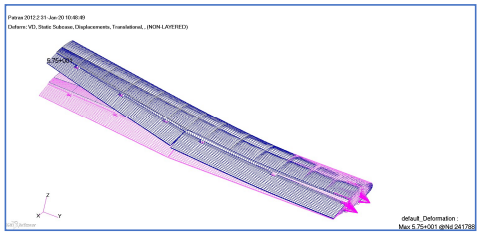
FULL SEAPLANE DESIGNED with 3D CATIA

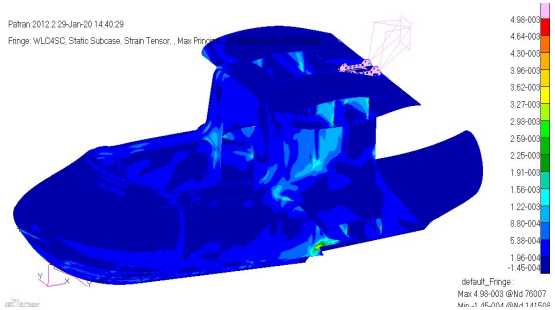
Integration for G-FEM (GLOBAL AIRCRAFT FEM)











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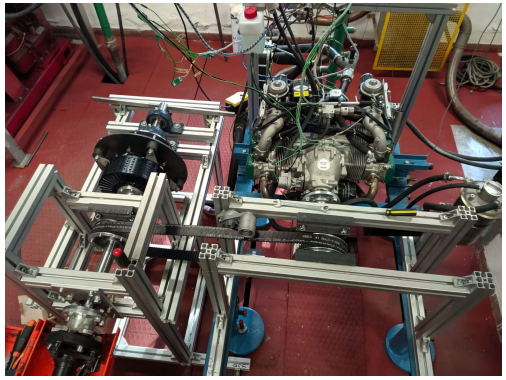
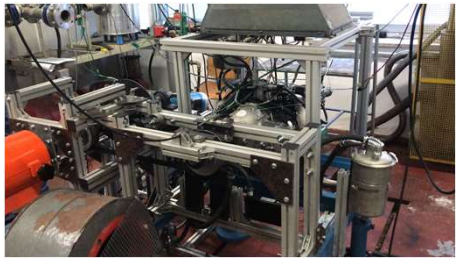
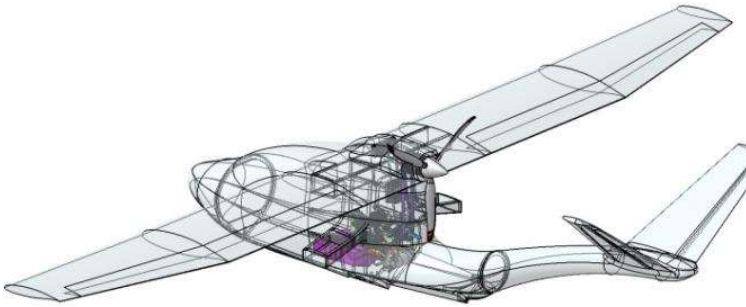
Hybrid-Electric Propulsion System Setup in parallel and serial configuration

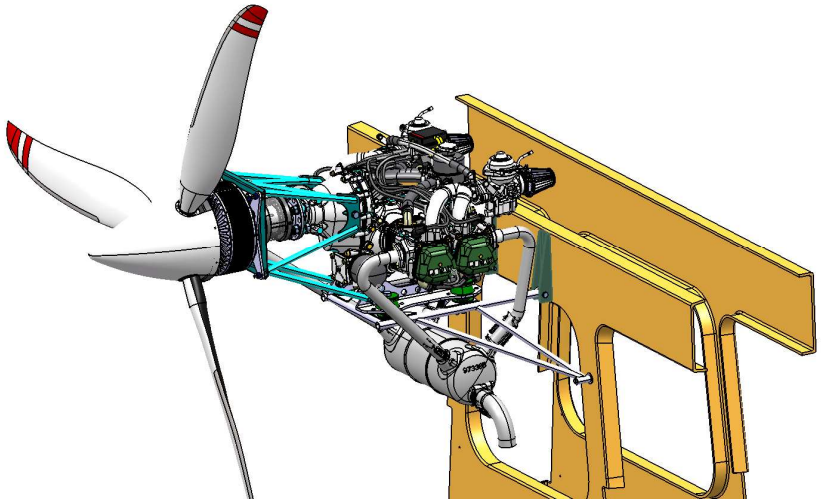


Test performed at Lab of
University of Napoli
“Federico II



Movie





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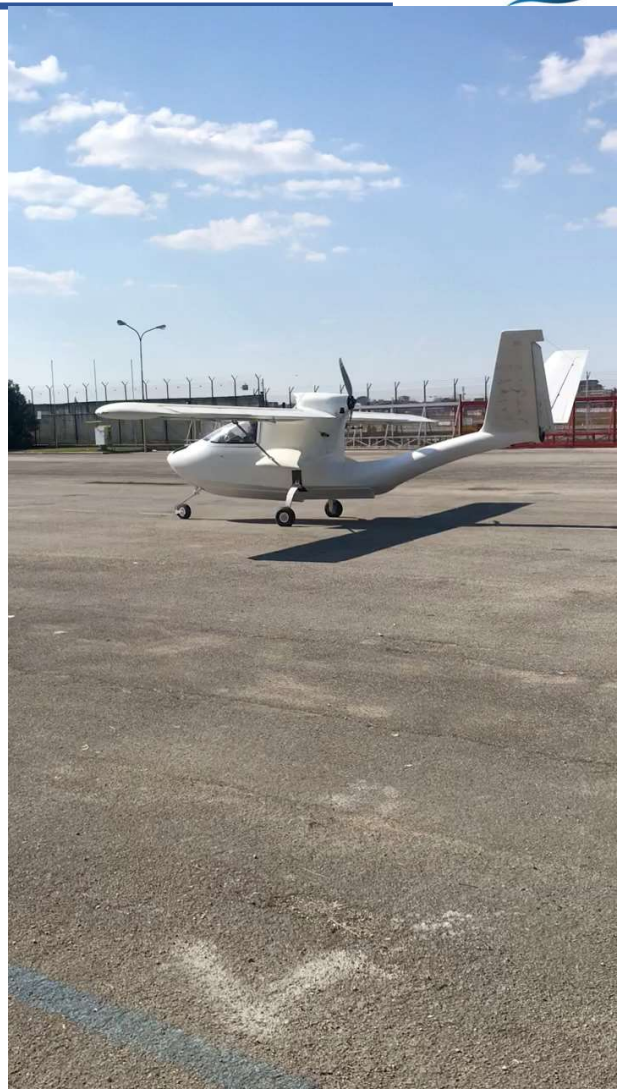
Prototype Manufacturing

1st Prototype Seagull
18/12/2020

Prove preliminari sui due prototipi

Primo Prototipo : Idrovolante : Ibrido e Ala rettratile
Lago Miseno , Febbraio 2021



Secondo Prototipo:
Ala fissa, Anfibio & Terrestre con carrello retrattile.

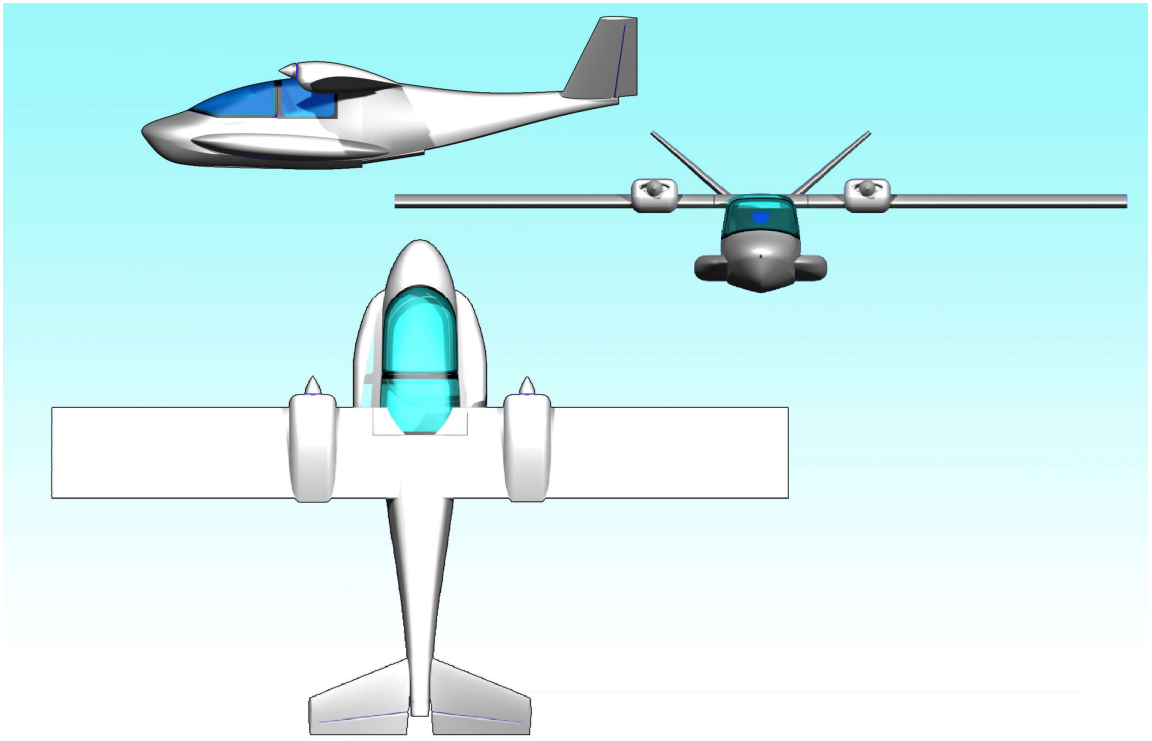
Piazzale Vulcanair, Febbraio 2022

SEAGULL Future Platform Development

SEAGULL

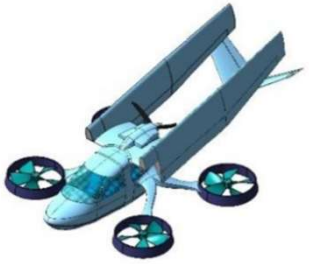
NOVOTECH SRL AEROSPACE ADVANCED TECHNOLOGY

SEAGULL EXTRA E-STOL (4 pax)



E-VTOL Platform for Personal transport (4 pax)

(a) Velivolo



(c) da Ormeggio

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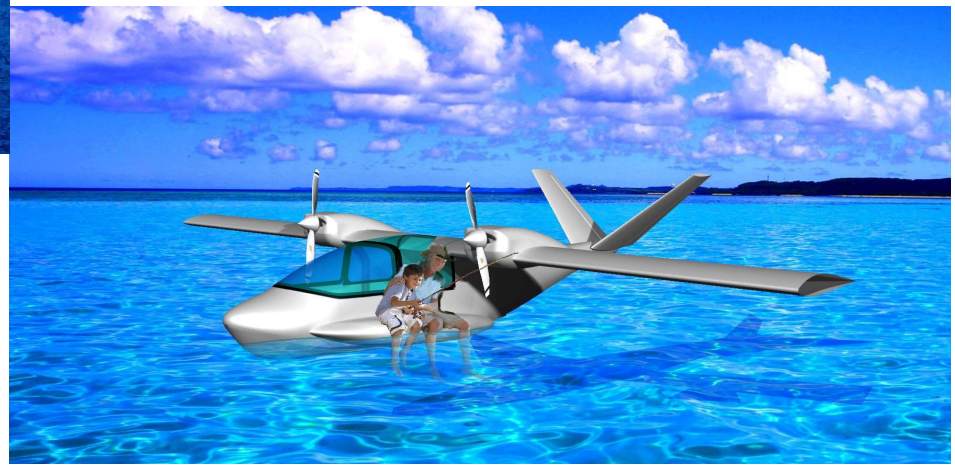
SEAGULL Future Platform Development

SEAGULL EXTRA E-STOL (4 pax)



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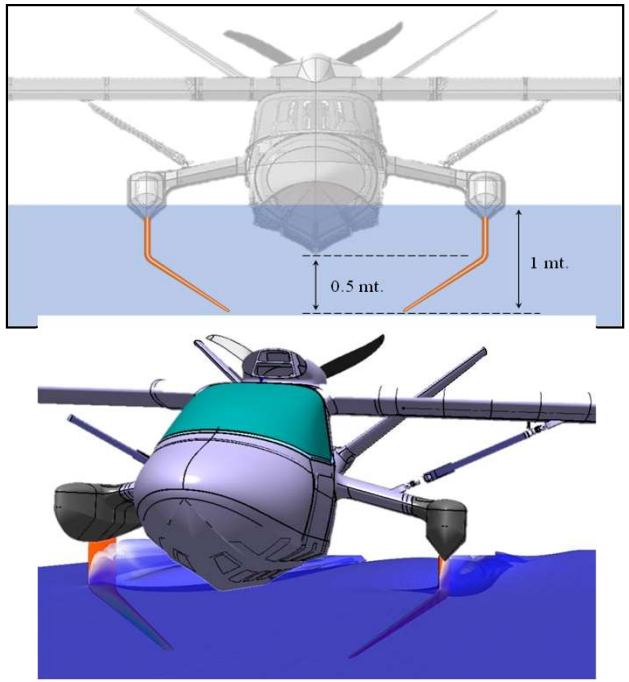
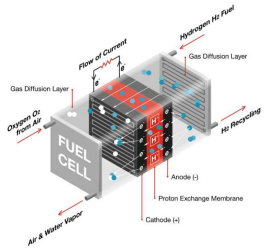
SEAGULL Future Platform Development

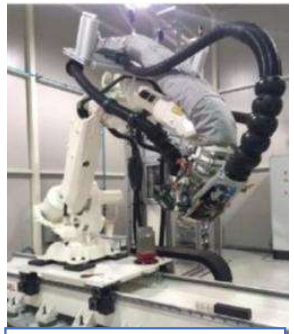
Implementation of an Hydrofoils Systems



Hydrogen Fuel Cell Technology



Aerostructures produced by Automated and OoA technologies



Automated Fiber Placement

Hot Press for Continuous Forming

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Thank you

for your attention

If You Want To Go Fast, Go Alone.
If You Want To Go Far, Go Together.