OFFICINE MECCANICHE IRPINE

PROGETTO SIRIMAP

Piattaforma di Prossimità (UAV) con Campionatore Payload Sganciabile e Recuperabile per Mappatura Meso/Microplastiche

VELIVOLO AUTONOMO PER RILASCIO SENSORI

Michelangelo Giuliani

Napoli, 24 Maggio 2021

Programs

OFFICINE MECCANICHE IRPINE

PROGRAMS ACTIVITIES
- ■ DESIGN OFF LOAD
- □ TOOLING
- ■ MANUFACTURING
- ■ CERTIFICATION SUPPORT

CSVLA

P2002 ■■■

P2004 ■

P2008 CF ■■

CS23

P2010 CF ■■

P2006 ■■□

VIATOR ■□

P2012 TRAVELLER ■■□

CS25

ATR 72-500 ■□

BOMBARDIER CS100 ■■■

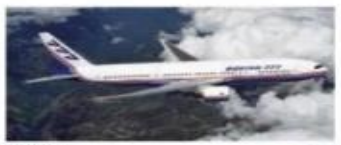
C27J ■■■

B787 DREAMLINER ■■■

BELUGA XL ■□

A380 ■□

A321 ■□


B777 ■□

B767 ■□

A350 ■□

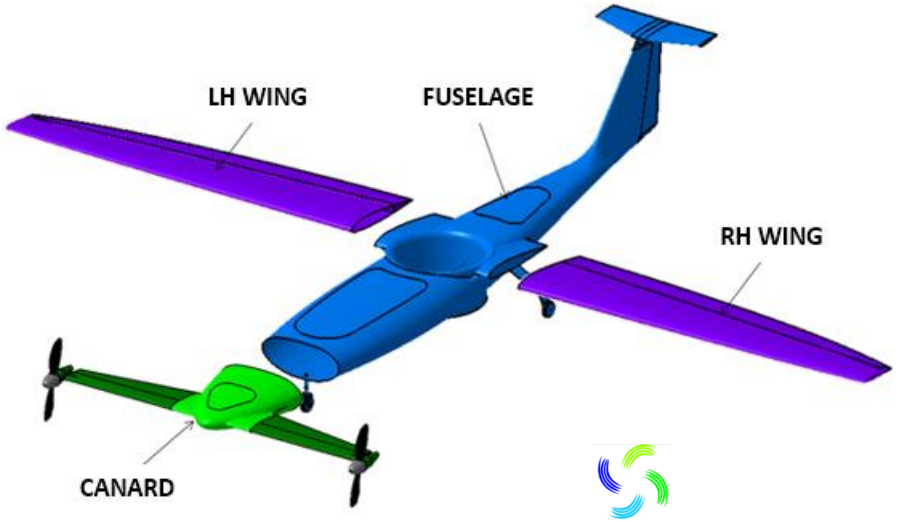
MILITARY

F35 ■□

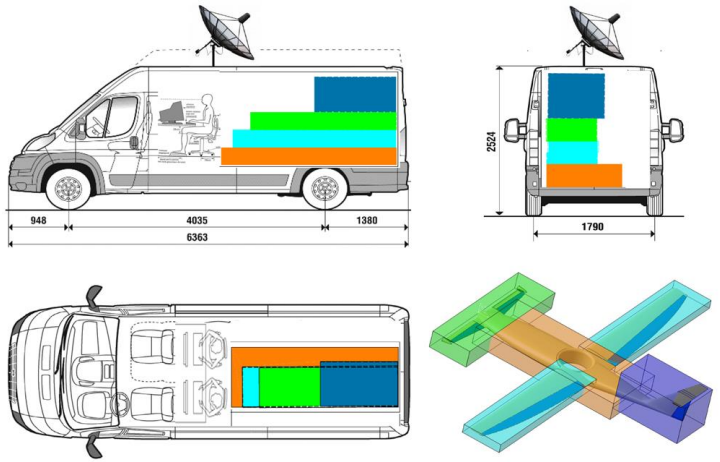
EFA ■□

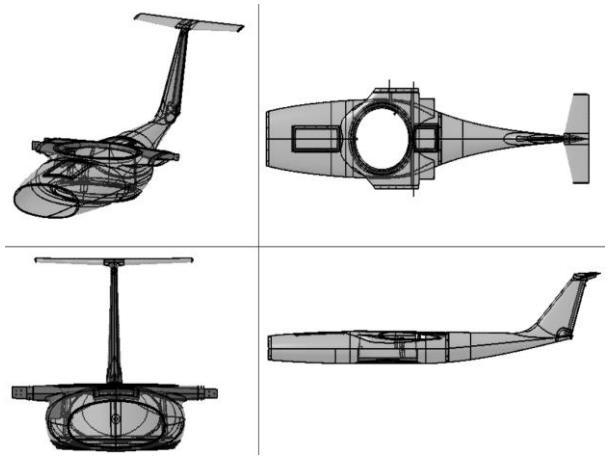
CALTEC Consortium

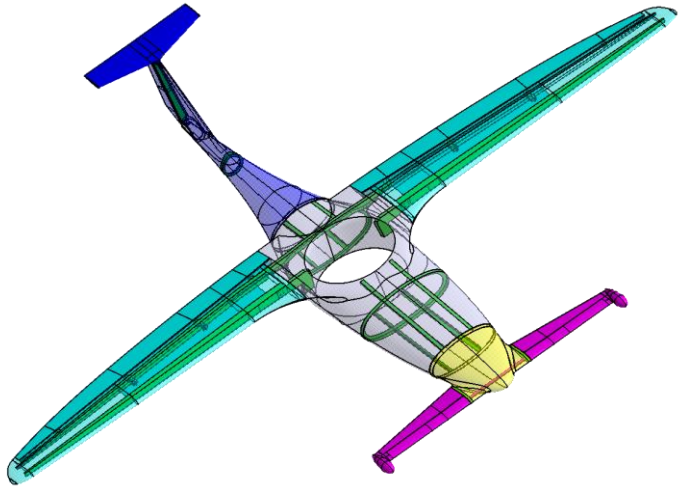
PROGETTO CONFIGURAZIONE

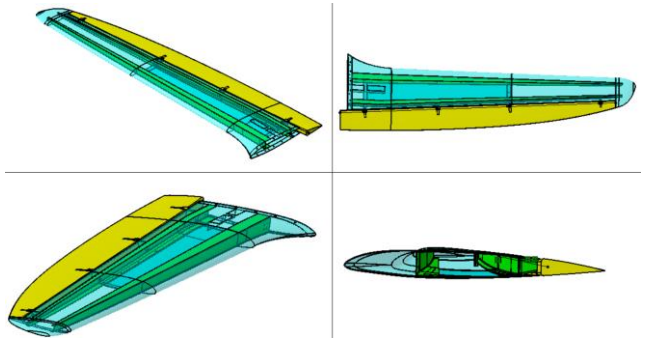


***E-Pteron* INITIAL CONFIGURATION**









***REQUISITI*:**

- *V-TOL*
- *FLESSIBILITÁ PER DROP LOAD*
- *MOTOW/PAYLOAD 10Kg*
- *LOITER & HOVERING (SGANCIO E RECUPERO)*
- *VOLUMI ED ERGONOMIA*

SIRIMAP NEW CONFIGURATION

PROGETTO CONFIGURAZIONE

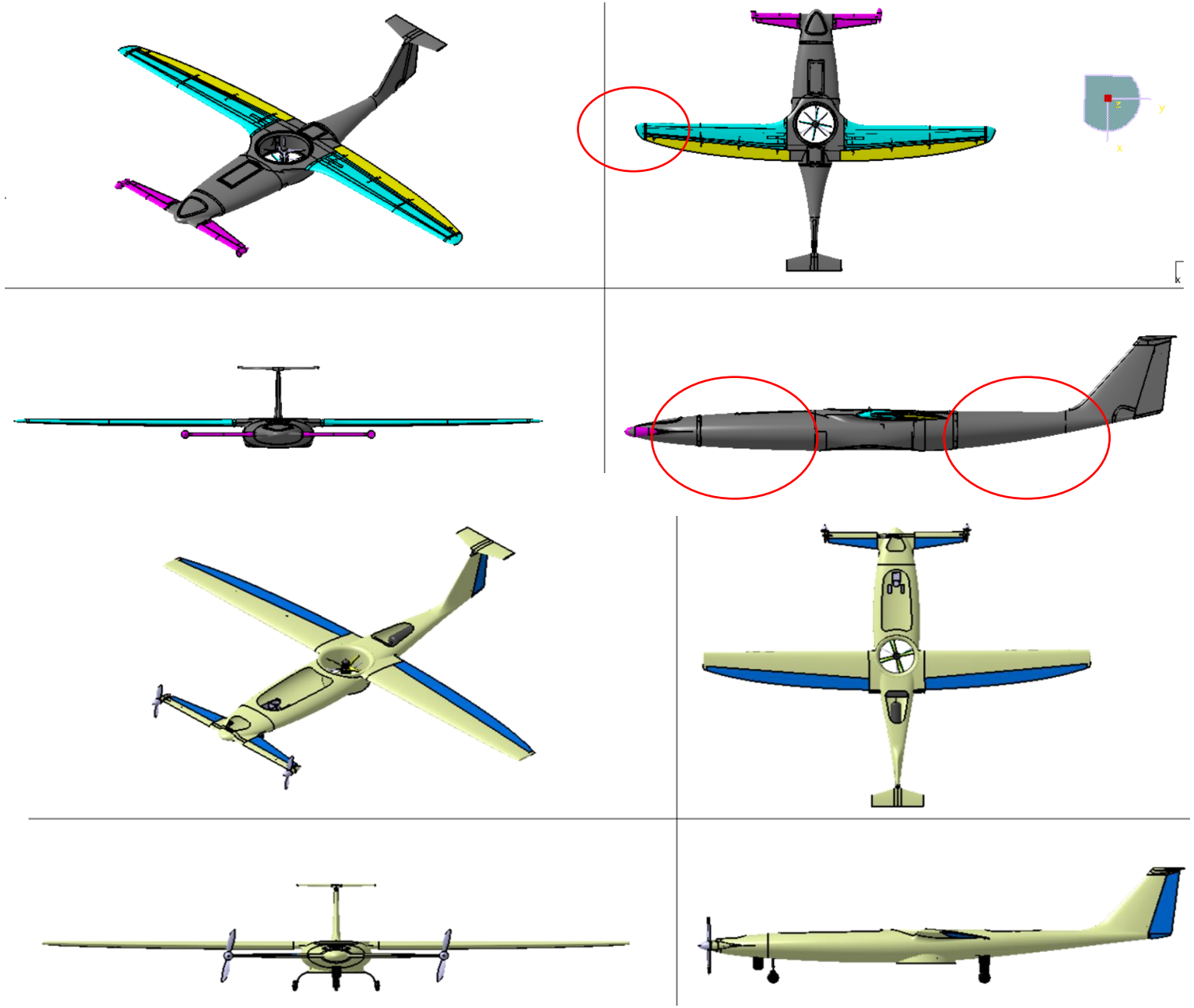
MAIN DESIGN ISSUES

- *Aerodynamic Efficiency CLmax*
  AR (Wingspan Extension)
- *Front Cameras Installation*
  AFT Fuselage Volume Extension
- *Rear Payload Deployment*
  Rear Fuselage Volume Extension

Airframe Configuration, Performance Upgrade

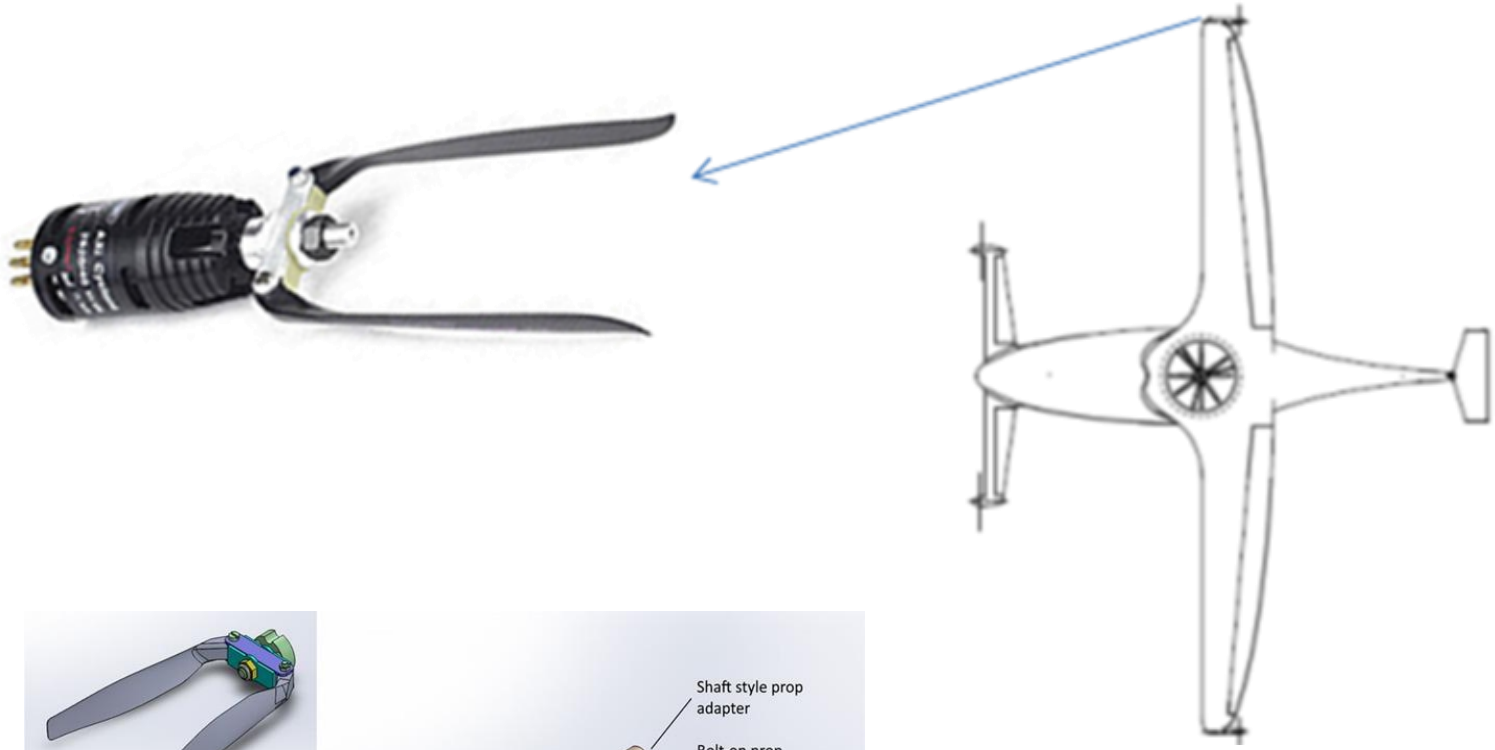
MTOW 60 Kg

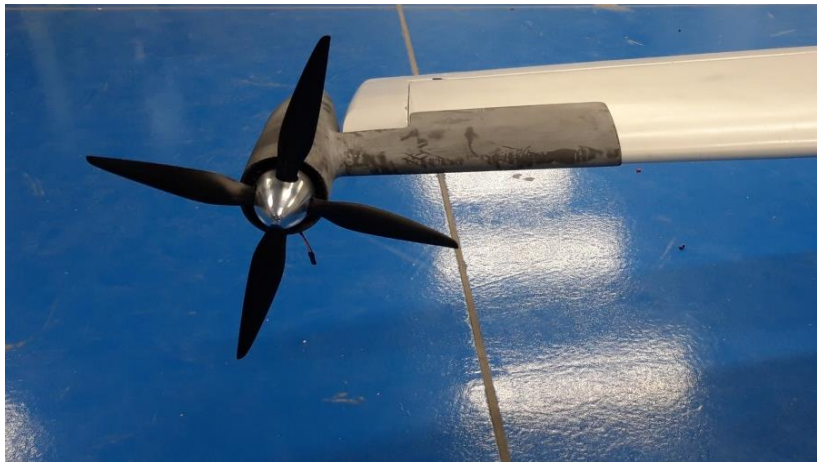
LIKELY SAVED C.G. LOCATION



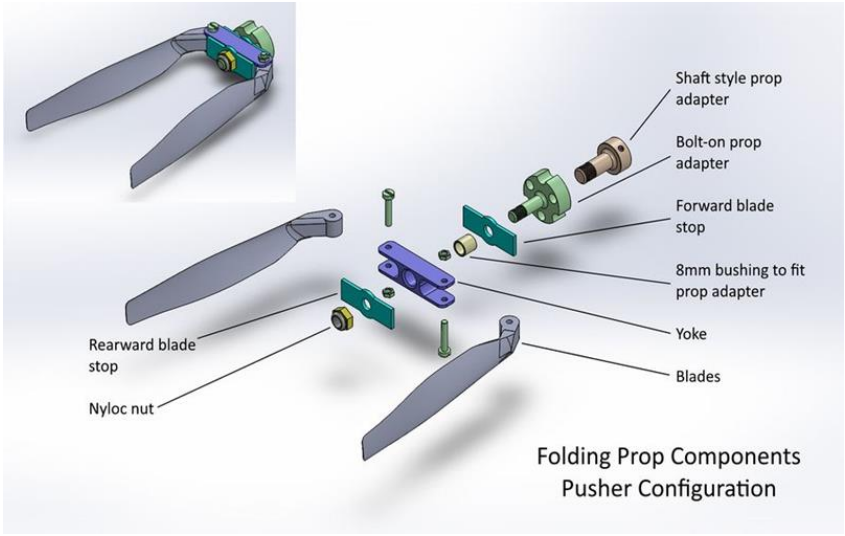
Controllo dell'Imbardata in *Hovering*

NUOVO REQUISITO
SOLUZIONE INNOVATIVA





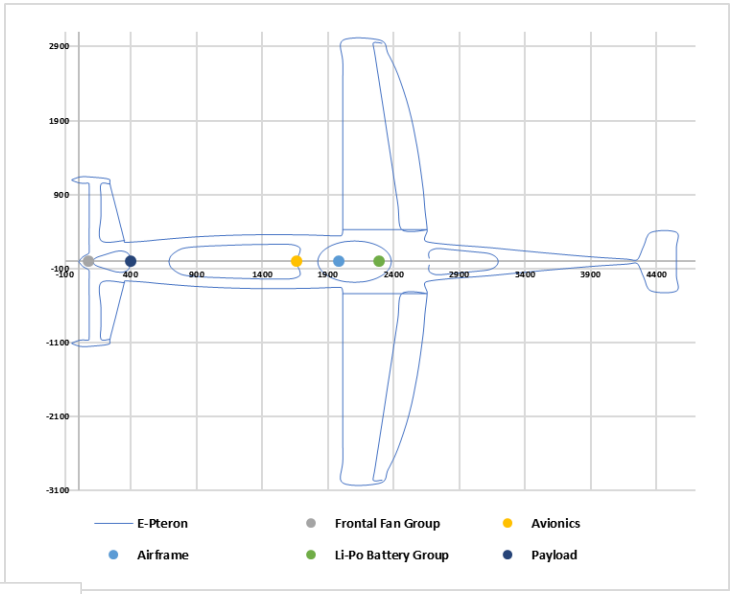
Prototipo

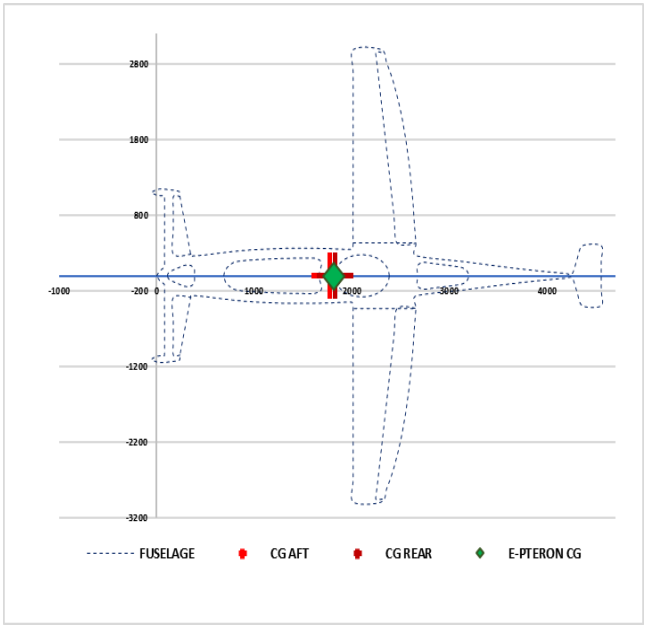


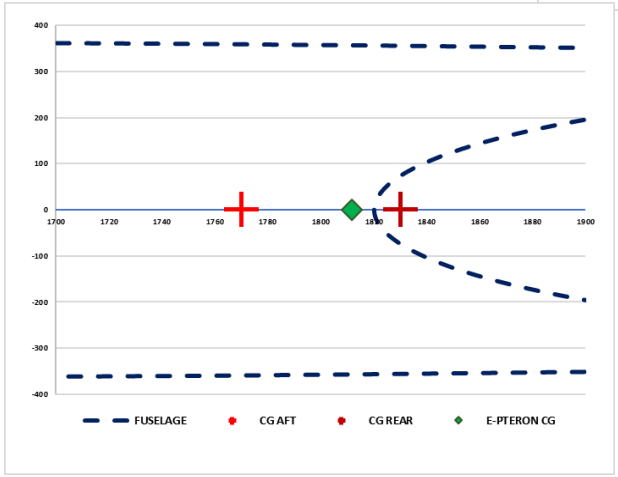
ELICHE REALIZZATE "*IN CASA*"

Weight and Balance

Assy	M	X cg	Y cg
	[kg]	[mm]	[mm]
E-PTERON Aircraft (Airframe)	**45.0**	1812	0
Frontal Propellers Group	1.6	73.1	0.0
Avionics	4.2	1661.1	0.0
Airframe	23.0	1981.5	0.0
Li-Po Battery Group	11.2	2285.7	0.0
Payload (to be Configurated)	5.0	400.0	0.0







MODULAR CONFIGURATION MANAGEMENT

ΔX +/- 5%

PAYLOAD 10 Kg + 5 Kg Interfacce

(5 Kg Statico + 5 Kg Drop Load)

	CG Max Fwd [mm]	CG Max Rwd [mm]
Distanza dal Nose	1770	1830

NOTOW 60 Kg

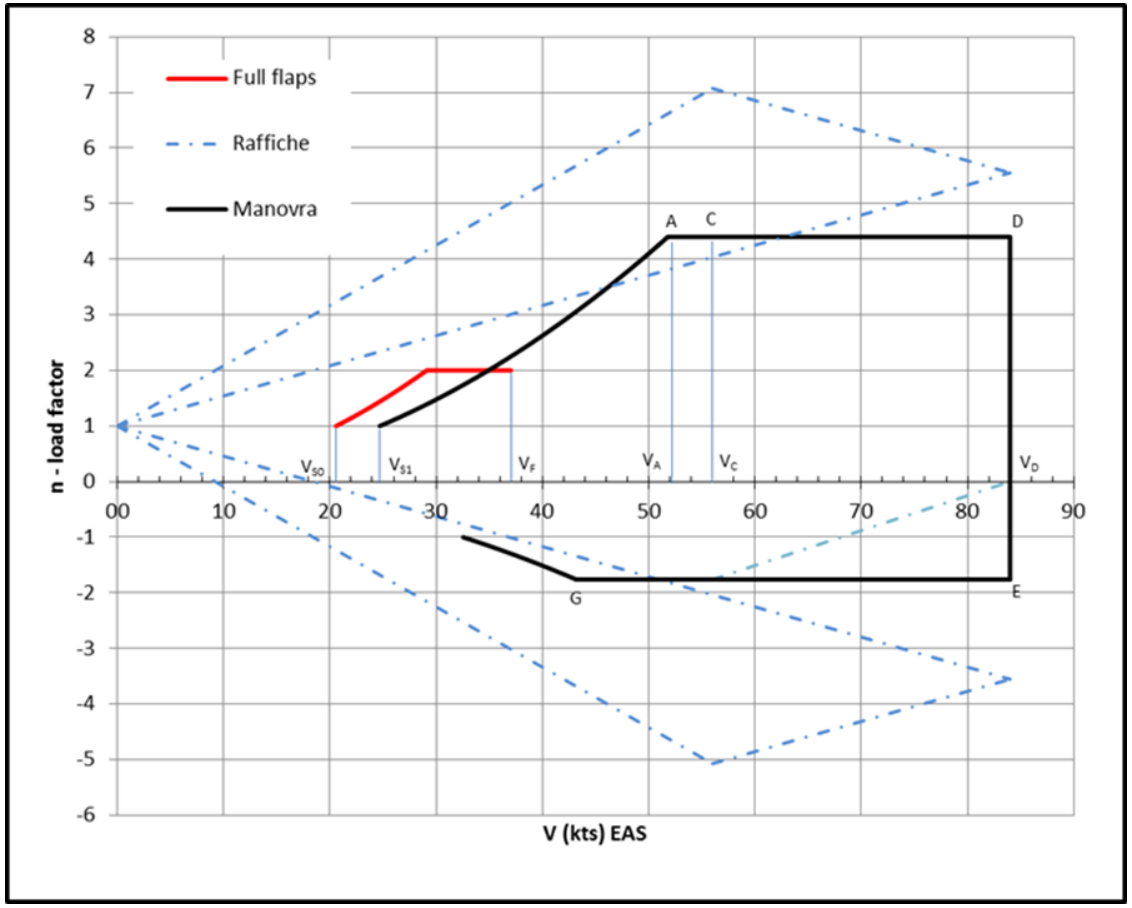
Flight Loads

WING LOAD

Carico Alare	Formula	W/S $[N/m^2]$
Carico alare in funzione della velocità di stallo	$W = L = \frac{1}{2}\rho V^2 S C_{L\,max}$	221.6
Carico alare in funzione della distanza di decollo	$\frac{W}{S} = (TOP)\sigma C_{L\,TO}(\frac{hp}{W})$	162.9
Carico alare per endurance	$\frac{W}{S} = \frac{1}{2}\rho V_{loiter}^2 \sqrt{3\pi A R e C_{D0}}$	218.53
Carico alare in fase di crociera:	$\frac{W}{S} = \frac{1}{2}\rho V_{cruise}^2 \sqrt{\pi A R e C_{D0}}$	168.2

FLIGHT ENVELOPE

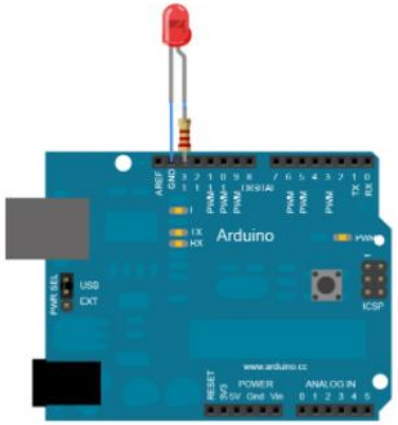
Descrizione		Valore Progetto
$C_{Lmaxclean}$	Massimo coefficiente di portanza (flap su)	1.28
$C_{Lmaxflap}$	Massimo coefficiente di portanza (flap giù)	1.9
$C_{Lmaxneg}$	Massimo coefficiente di portanza negativo	-0.75
$\bar{c}$	Corda Media Geometrica [m]	0.489
$C_{L\alpha}$	Coefficiente Retta Portanza (3D)	6.5
μg	Rapporto di Massa	6.344
kg	Fattore di Attenuazione della Raffica	0.479
V_H	Massima Velocità (Volo Orizzontale) [m/s]	35

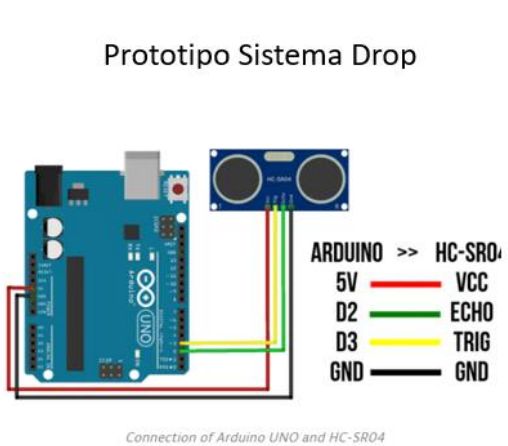


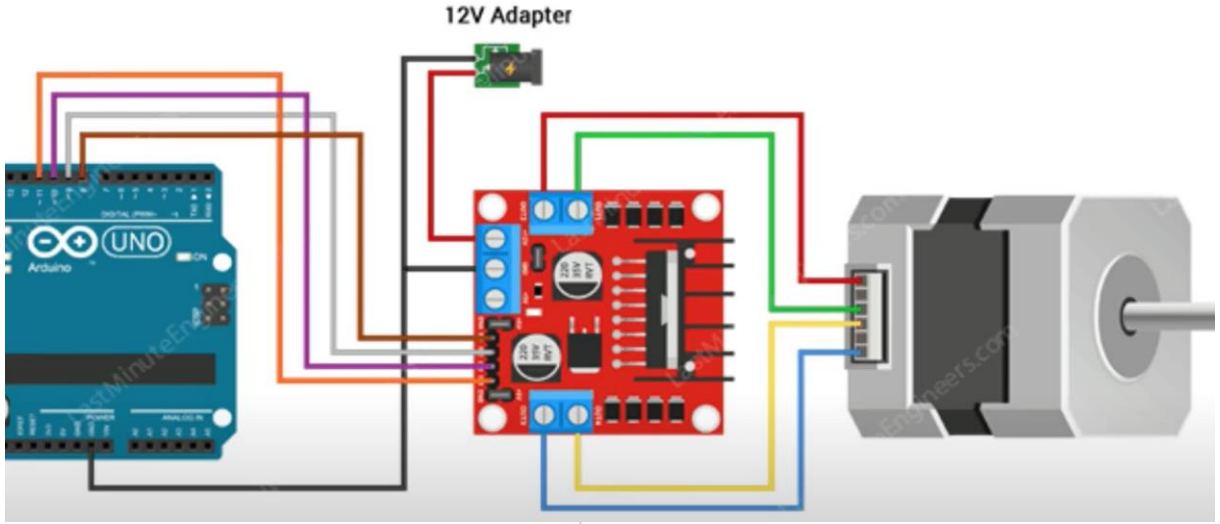
Iron Bird

Iron Bird per Sistema di Movimentazione del Baricentro.

Il sistema è azionato tramite la lettura del passaggio del drop, verificato da un Sensore IR

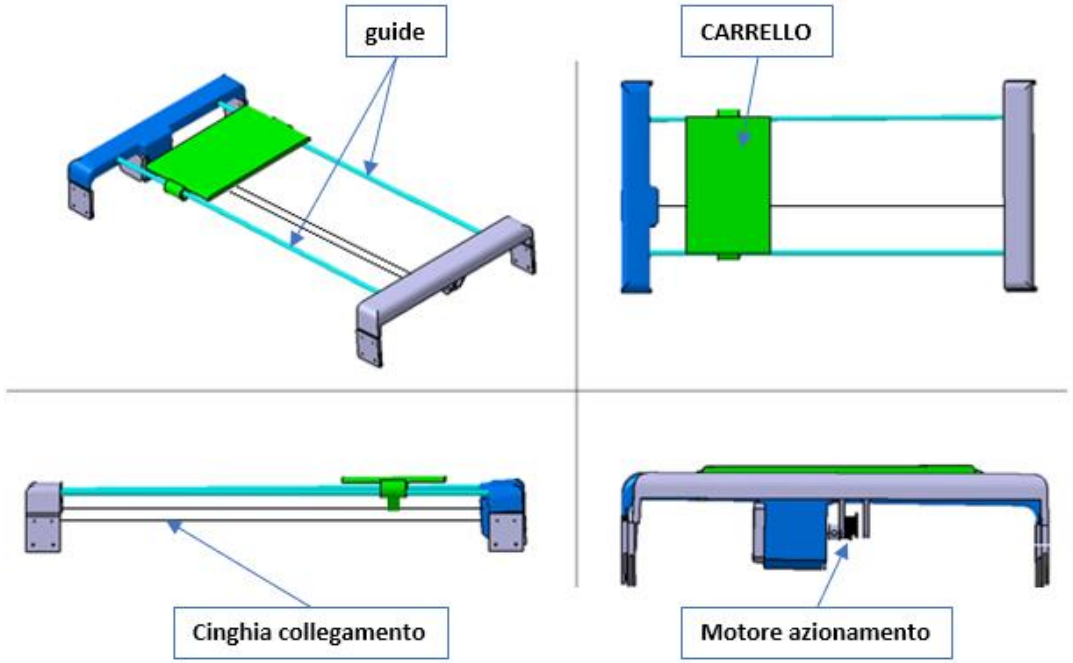


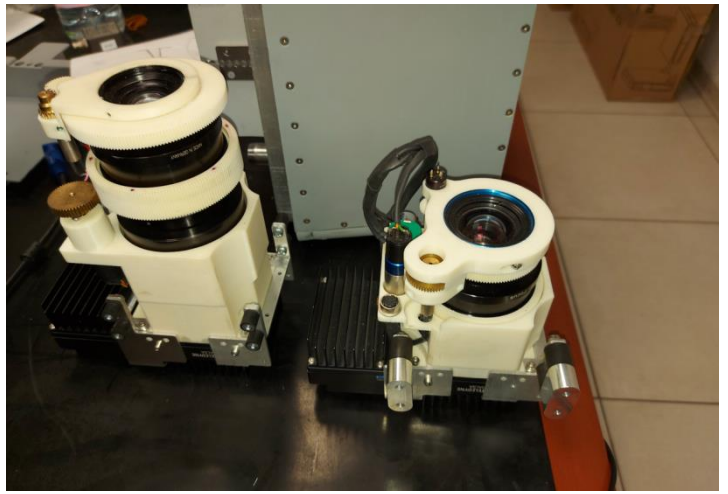




Iron Bird

Prototipo del Sistema di Movimentazione del Baricentro (***Spostamento Sensor Load Statico***)





Sensori Integrati Elettro-Ottici

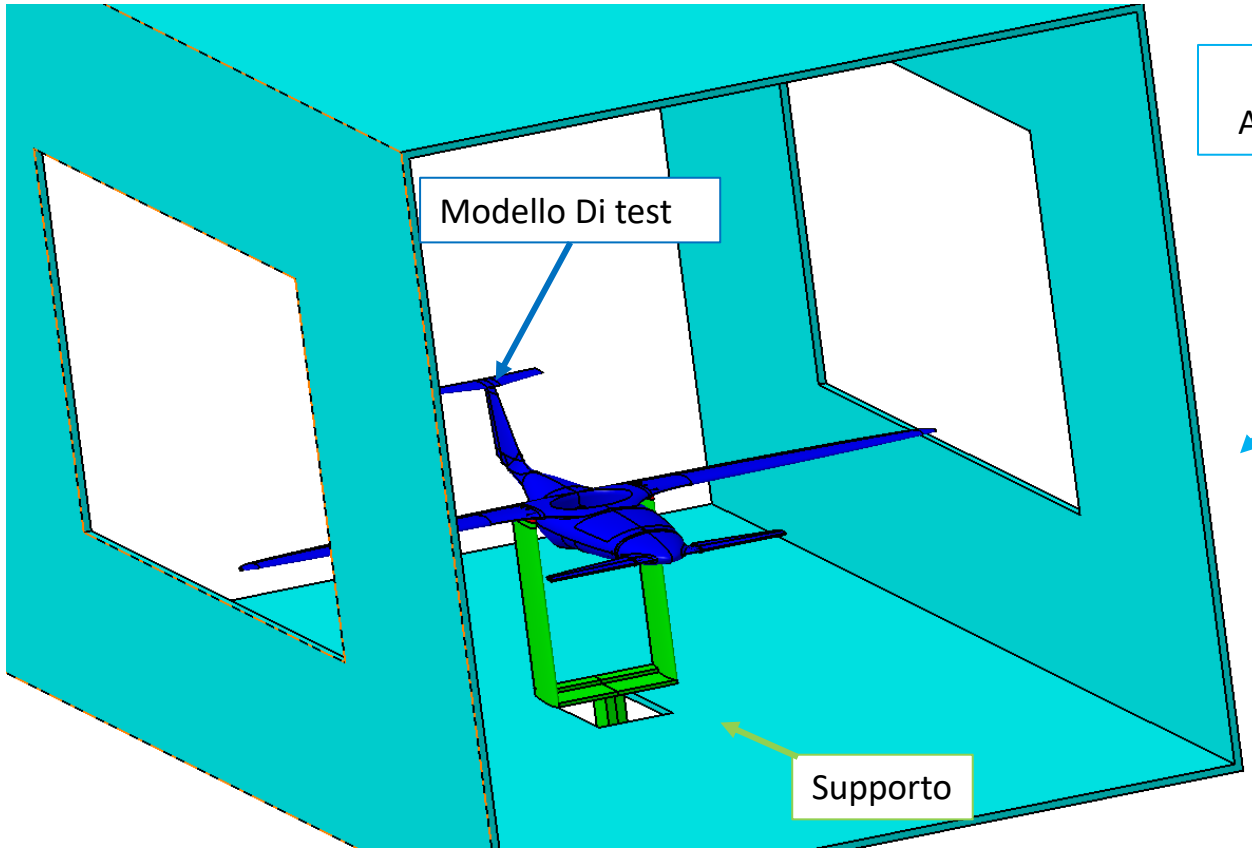
Supporti e Ghiere
Additive Manufacturing

OFFICINE MECCANICHE IRPINE

V-TOL at MTOW

MODELLAZZIONE DELLA SPERIMENTAZIONE

ANALISI AERODINAMICA DELLA CONFIGURAZIONE IN RILASCIO DROP LOAD (SENSORI)

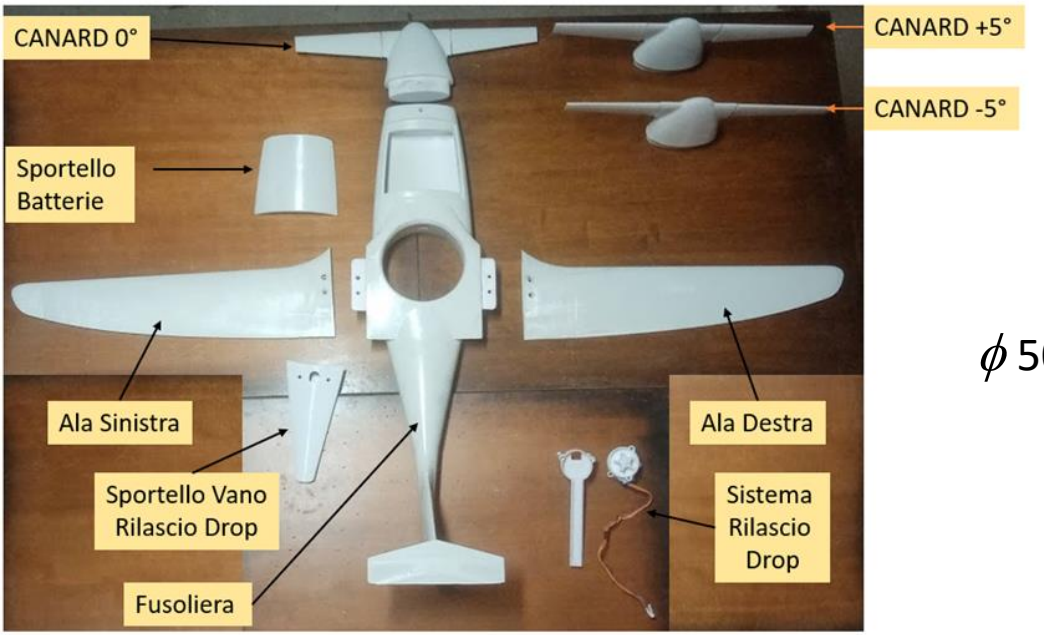


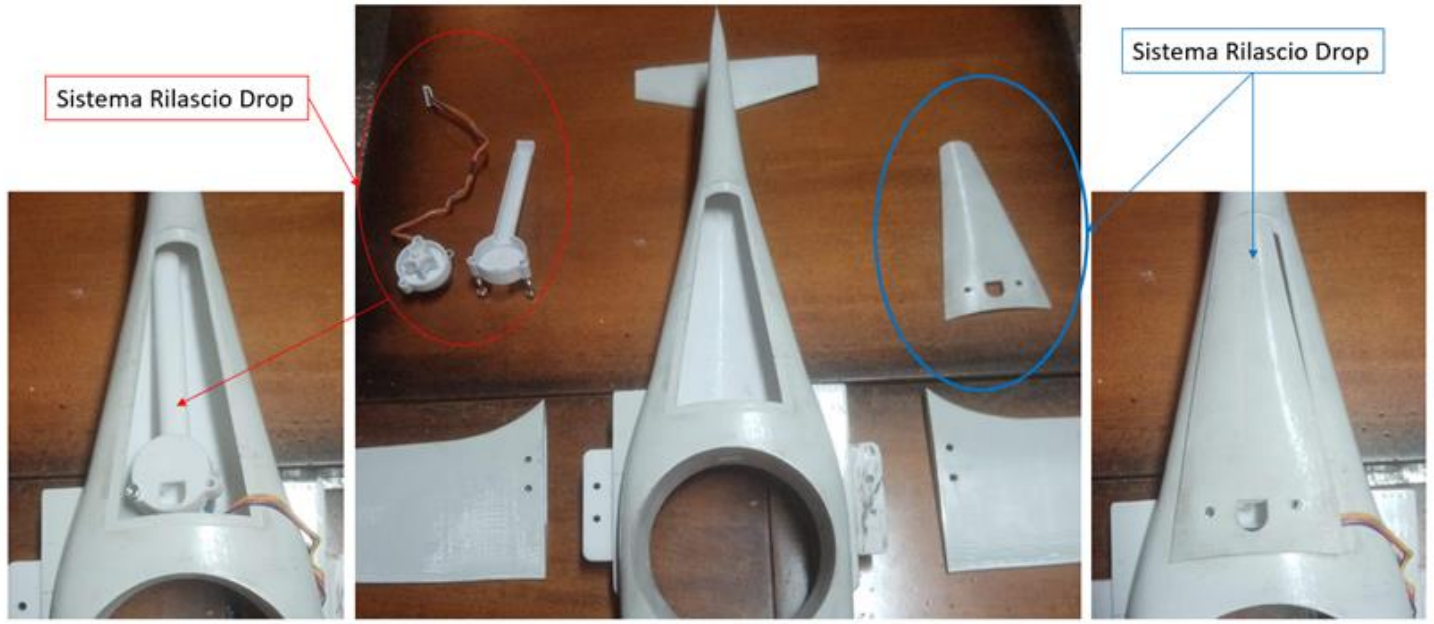
Camera di Prova Galleria Del Vento
ACCADEMIA AERONAUTICA DI POZZUOLI

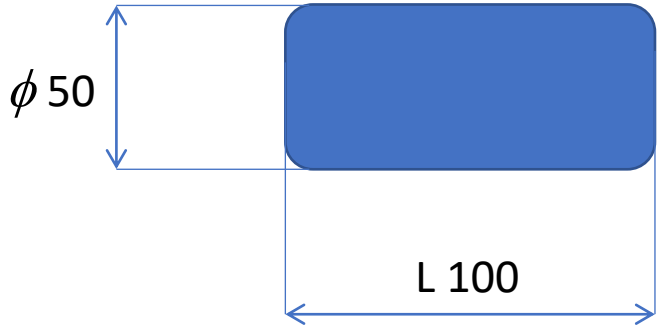
MODELLO VELIVOLO

Il modello è stato realizzato mediante tecnologia di Additive Manufacturing.

1. Canard (3 configurazioni 0°, +5°, -5°)
2. Sportello Batterie
3. Sportello Vano Drop
4. Ala Sinistra
5. Ala Destra
6. Fusoliera
7. Piano di coda a T



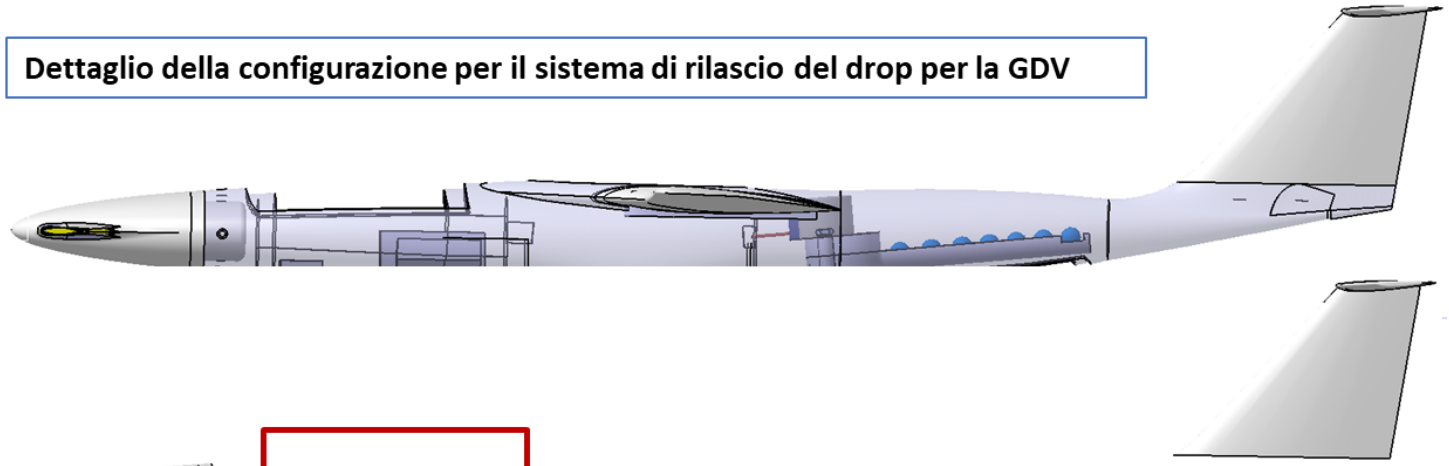


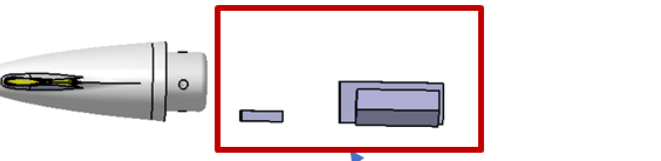


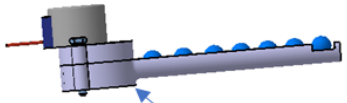
Caratteristiche Drop Load:
- Forma Assialsimmetrica
- Peso Totale 5 Kg (Rif)

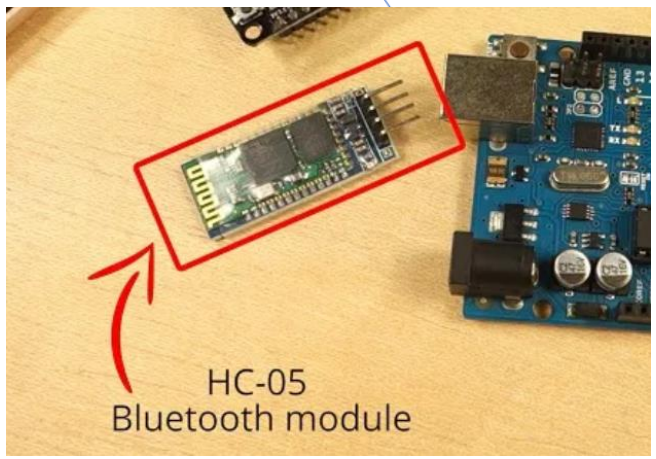
MODELLAZZIONE DELLA SPERIMENTAZIONE

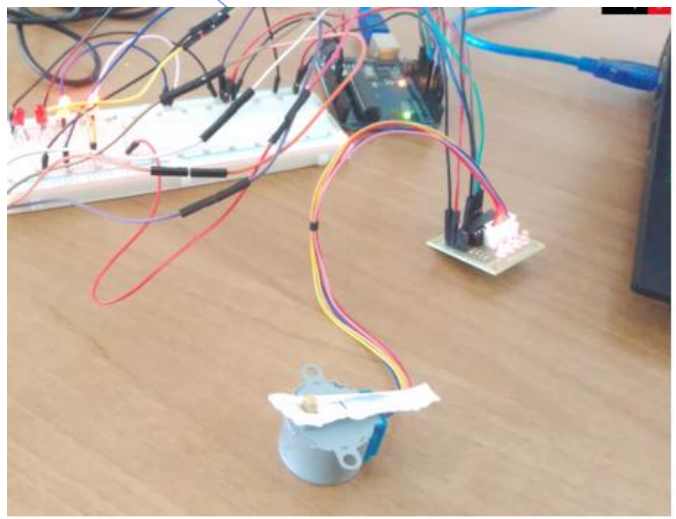
Dettaglio della configurazione per il sistema di rilascio del drop per la GDV





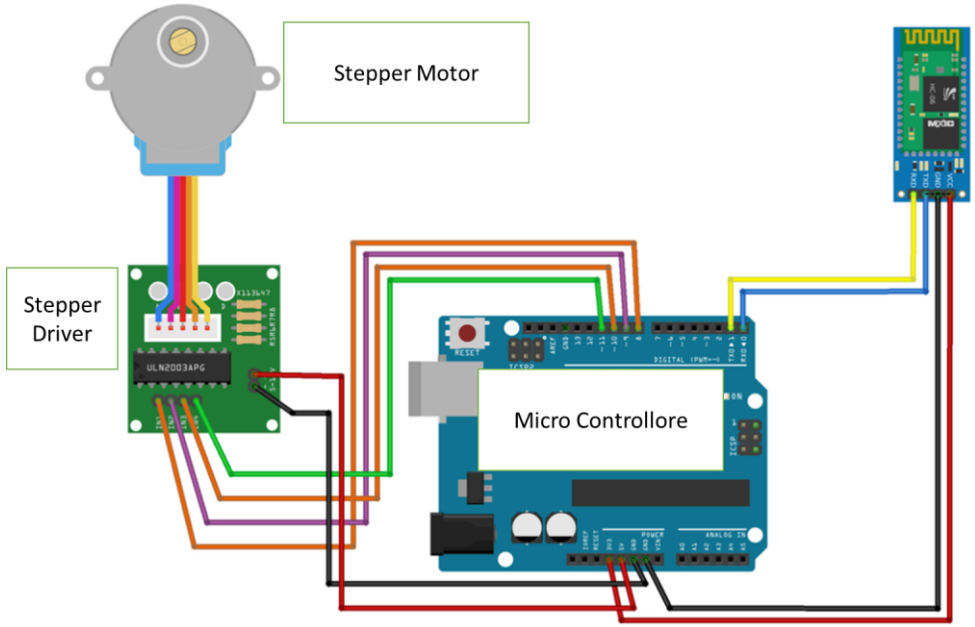






Il sistema drop è composto da:

1. Mother Board Custom x Controllore
2. Modulo Bluetooth HC-05
3. Motore Stepper 28BYJ-48
4. Driver Stepper ULN2003
5. Batteria 9V



Rilascio Drop Load con Comando Remoto RC

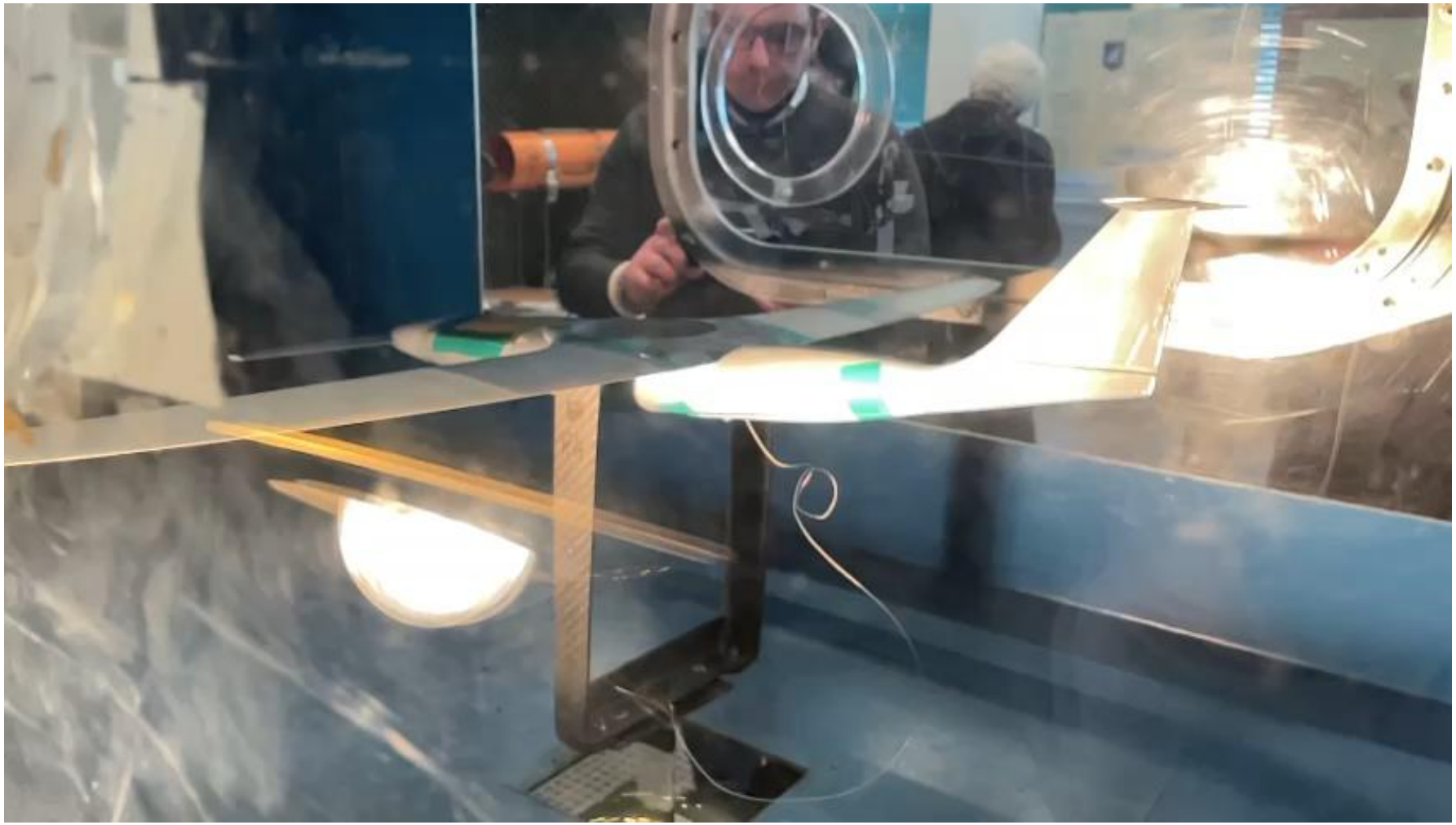
SPERIMENTAZIONE IN GALLERIA

Il modello è stato testato nella galleria del *Vento Valentino* Losito dell'Accademia Aeronautica di Pozzuoli (NA):

1. Integrità del modello in galleria per una velocità di 40 m/s
2. Funzionamento del sistema di Drop
3. Dati Aerodinamici

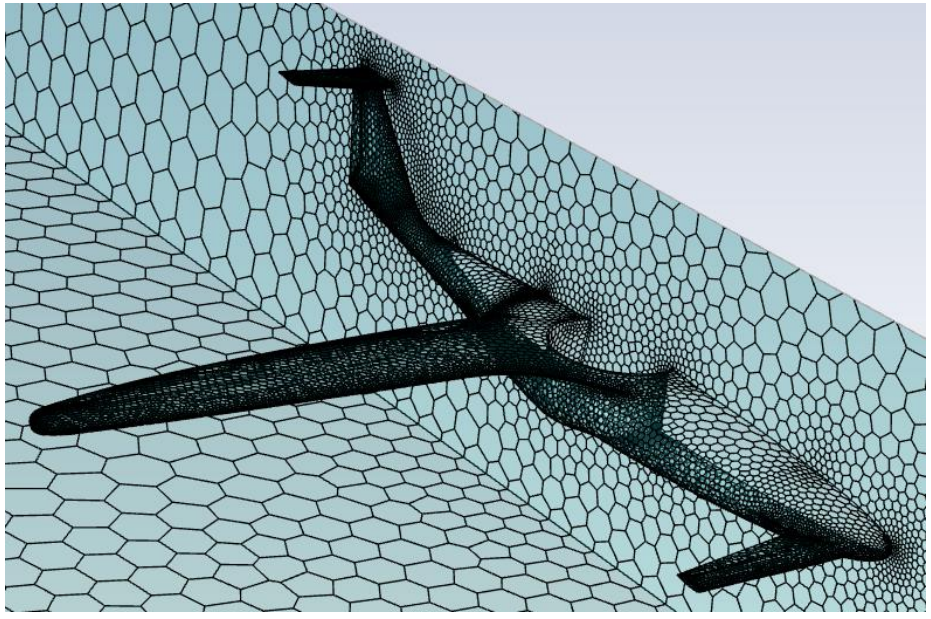
SPERIMENTAZIONE IN GALLERIA

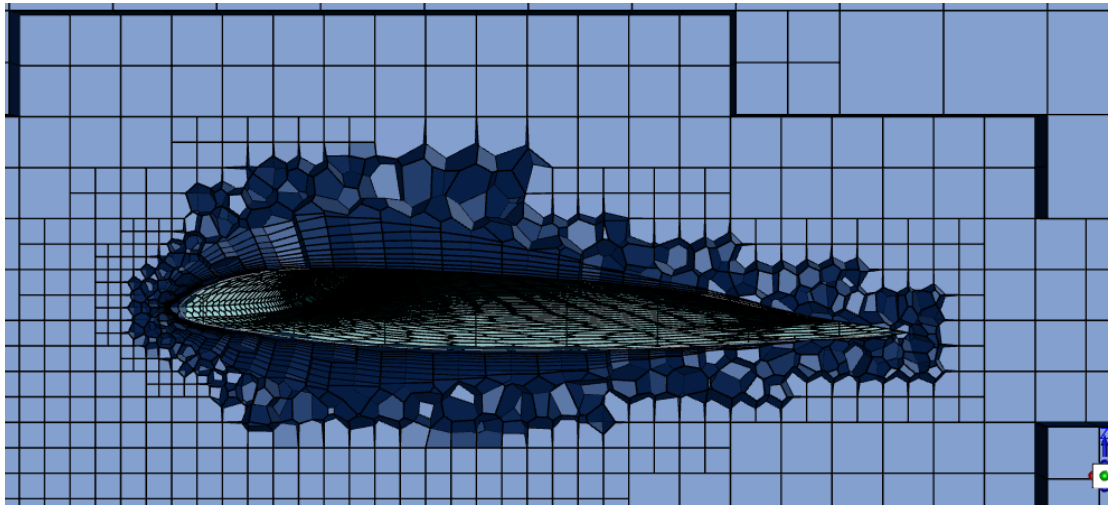
Il Drop Load viene rilasciato a circa 1’ 50‘‘ mediante controllo RC

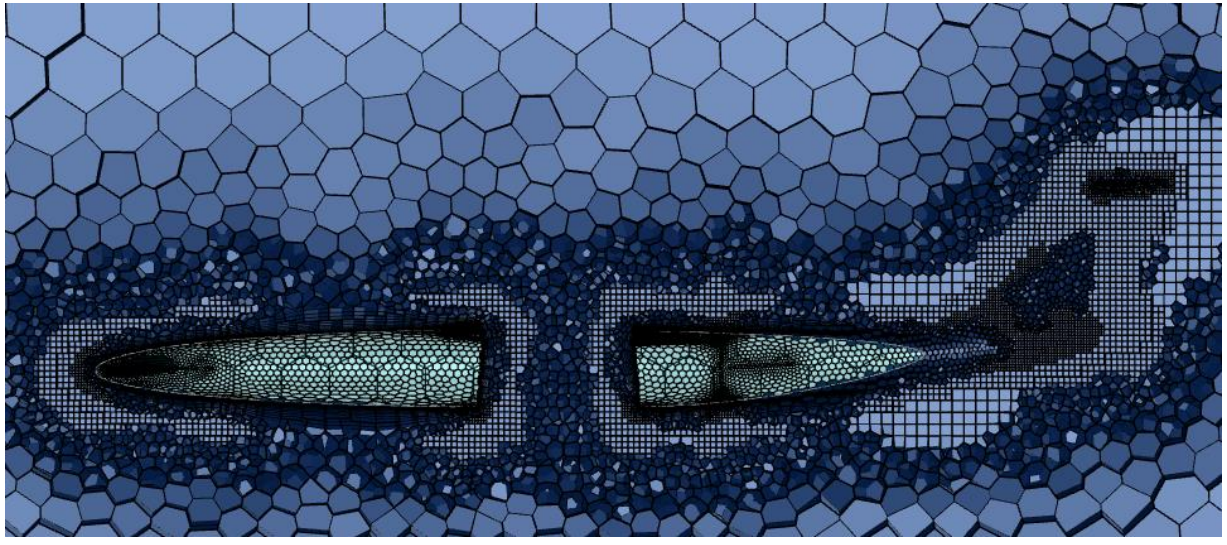


FOLLOW UP

1. Validazione di modello CFD in base ai risultati ottenuti in galleria del vento.
2. Verica Effetti di bloccaggio delle pareti della galleria
3. Estensione dei risultati ottenuti dalla galleria al caso reale







OFFICINE MECCANICHE IRPINE

CONCLUSIONI

Risultati Ottenuti

- Analizzate ed Realizzate Soluzioni Innovative Contenendo Volumi e Pesi a Parità di Prestazione

- Sviluppo **Nuova Configurazione Flessibile** per **Velivolo A-TOL** per **Rilascio Sensori**

- Soluzioni Innovativie per Prestazioni e **Modifica Configurazione Sensorizzata**

- Realizzazato Ambiente di Prova Elettromeccanico per Prototipazione Sistemi (**Iron Bird**)

- Realizzato **Ambiente di Sperimentazione Integrato** Aerodinamica-Sistemi
  (*Integrazione Elettromeccanica, Additive Manufacturing, DOE, Controllo RC*)

-Sviluppate Competenze Sistemiche Multidisciplinari