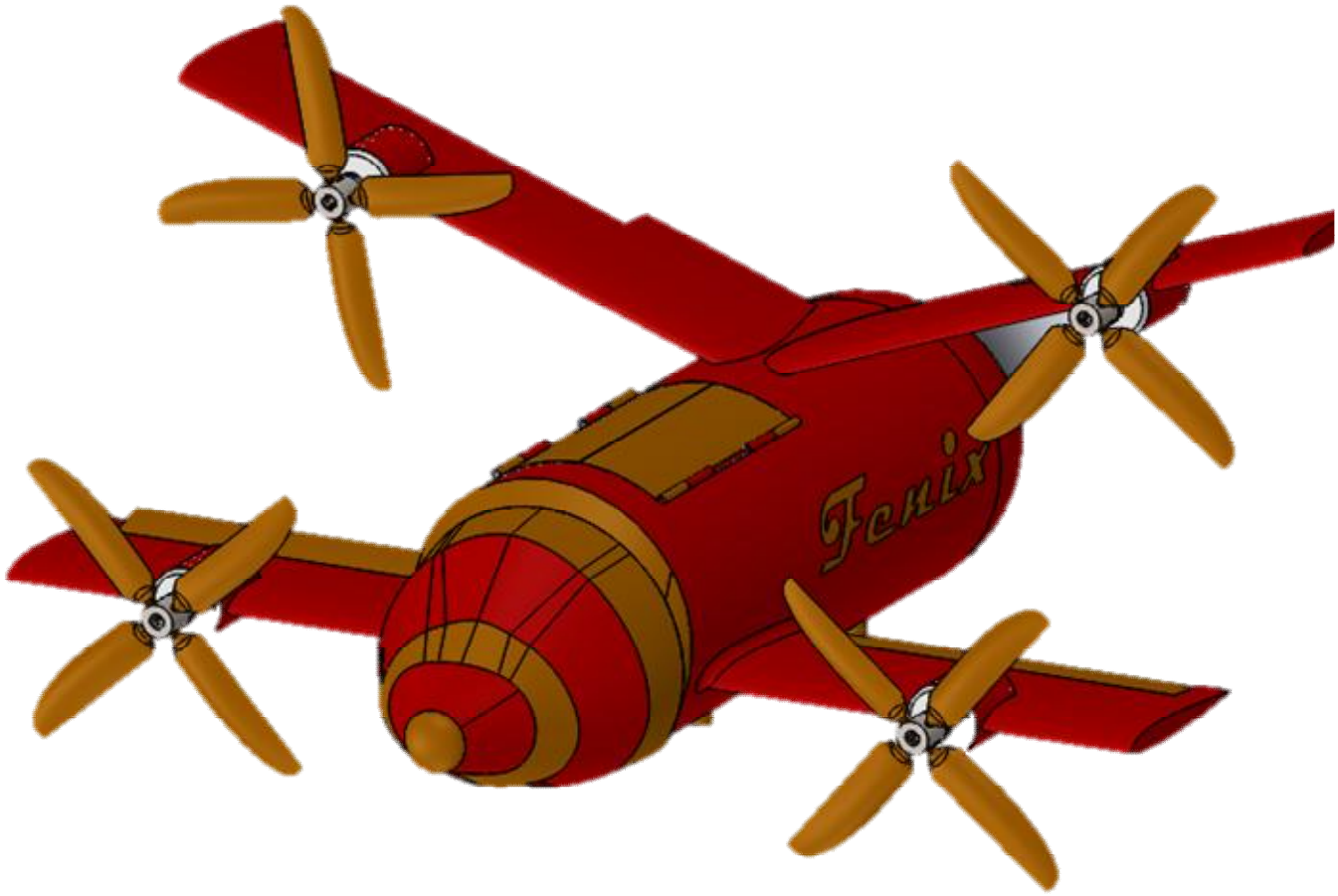
33rd Annual American Helicopter Society (AHS) International Student Design Competition Executive summary



Team Fenix

Politecnico di Milano

Team Fenix

- Rita Paolini (Team Leader)

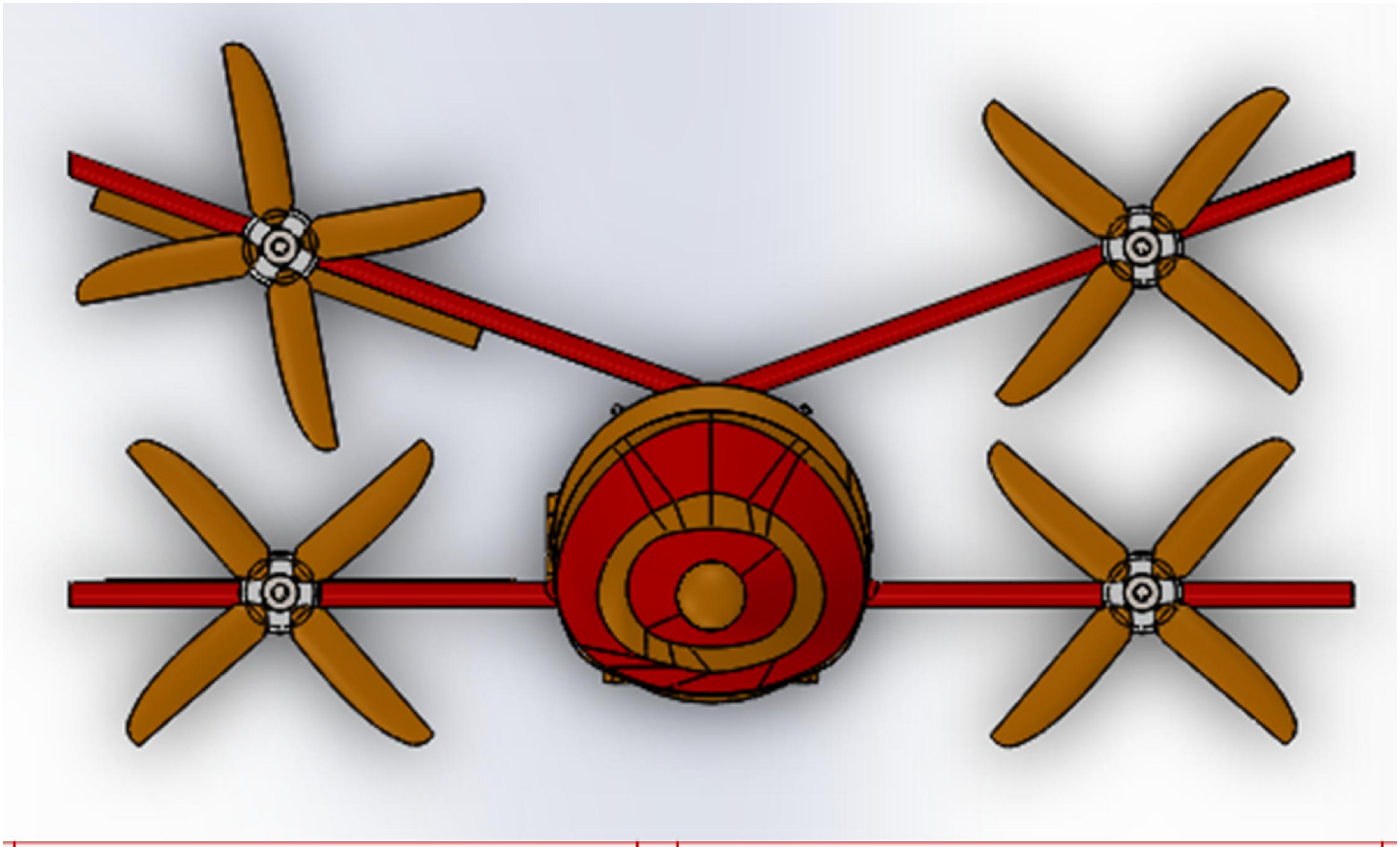
- Alaparthi Saikiran
- Niccolo Olivo
- Luca Bertoni
- Ridvan Kocaoglan
- Roberta Farinelli
- Luca Bertellini
- Prathyusha Konduru
- Hitesh Bhardwaj

Presents

A fleet of 9 UAVs for high altitude disaster relief

Market opportunities:

- Fast deliveries for commercial and medical purposes
- Inaccessible regions delivery
- Aerial fire-fighting



Fully tilting vehicles:

- easy conversion of configuration

Fleet of 9 drones:

- flexibility
- mission fulfilment
- storage and handling capabilities

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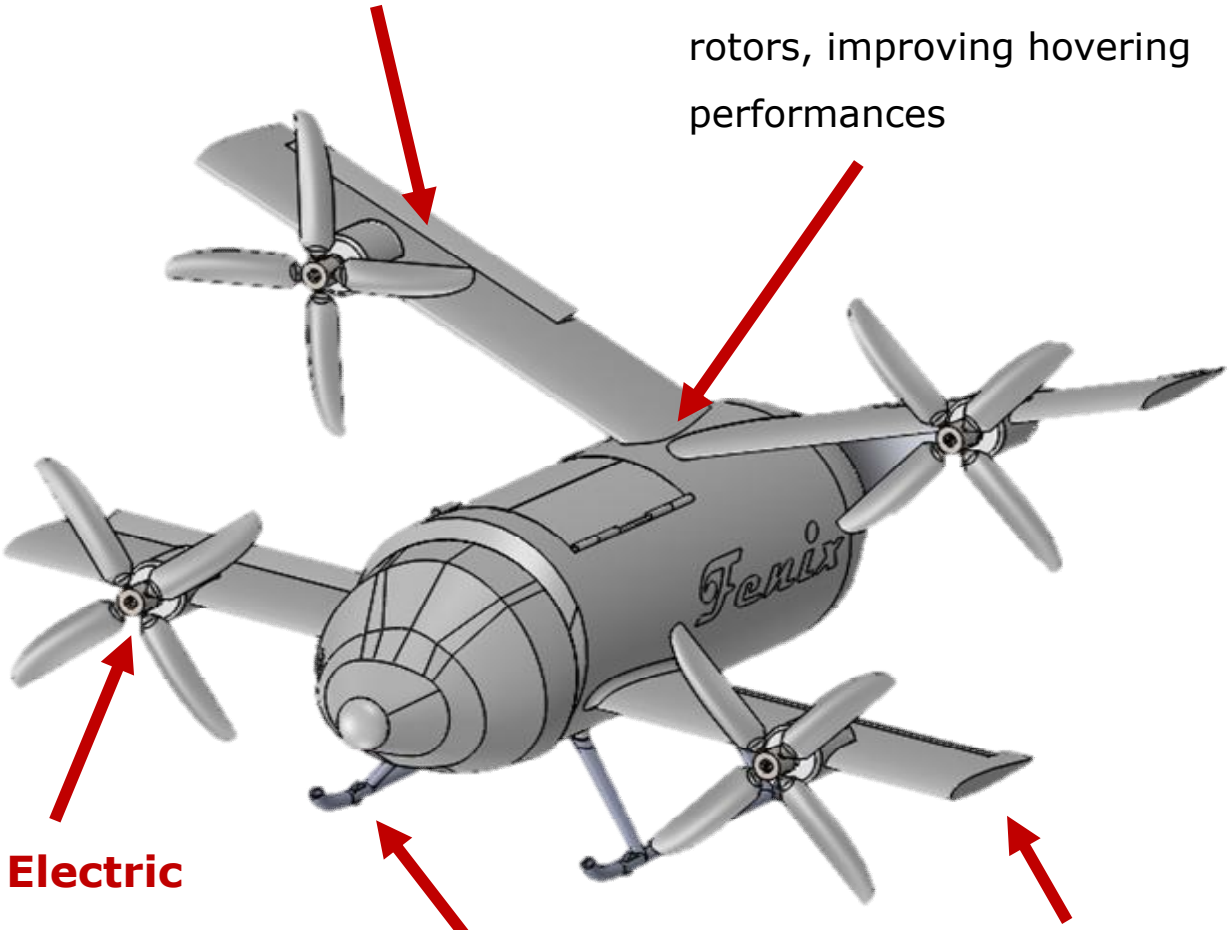
REQUIREMENTS	ACTIONS
Minimum payload of 500 lb [226.8 kg]	- **9 drones** each carrying a minimum payload of 56.4 lb [25.6 kg]
Rotorcraft to be stored in the cargo hold for C-130J	- Wingspan [2.62m], Height [1.43m], Length [1.80m]
Deployment from C-130J	- Rotorcraft capability to be launched and stabilized at the specified conditions - **Quick activation after launch**, due to the choice of electrical engines and low inertia rotors
Deliver from precision no wind hover	- Ability to **change configuration** - 4 non-aligned rotors for hovering control - **High altitude** design of rotors - **Controlled deployment** of payload
Return to base flight	- Capacity to fly **as an aircraft** - Cruise speed about 42 m/s - **Litium-Sulfure batteries** for 50 nm [92.6 km] range
Affordability, reliability, maintainability	- **Simplicity**: no folding devices - Reliable materials and technologies

4 Ailerons:

- Improved controllability

Rear wing dihedral angle:

- increased distance between rotors, improving hovering performances



Electric propellers:

- Easy control both in pitch and RPM

Skids:

- Landing in semi-prepared terrains
- Low weight

Double wing:

- Reduced wing span
- non-aligned rotors

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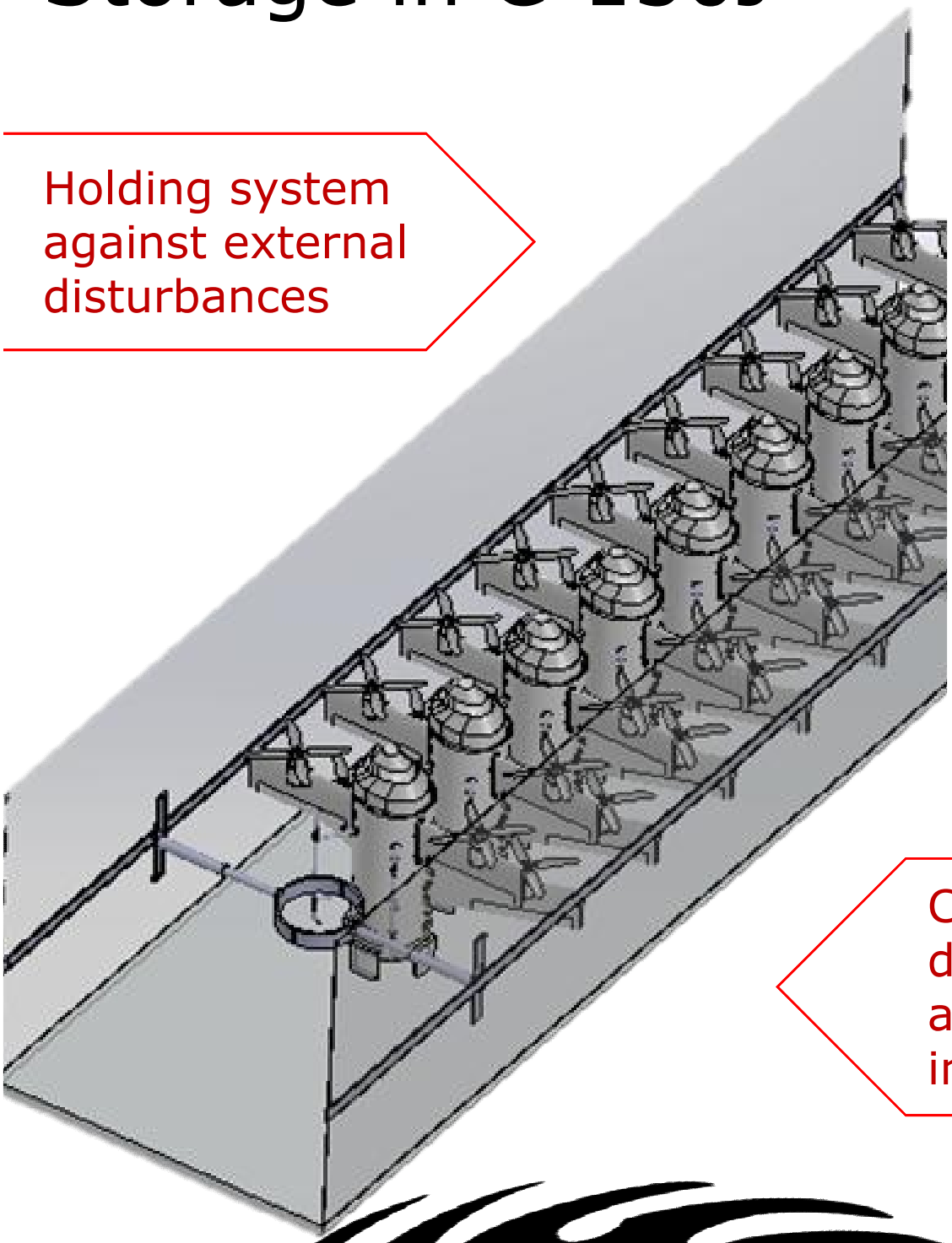
Storage in C-130J

Holding system against external disturbances



Clearance distance to avoid interaction

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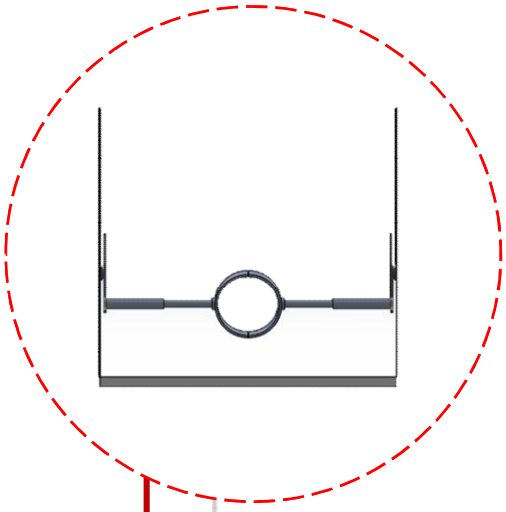
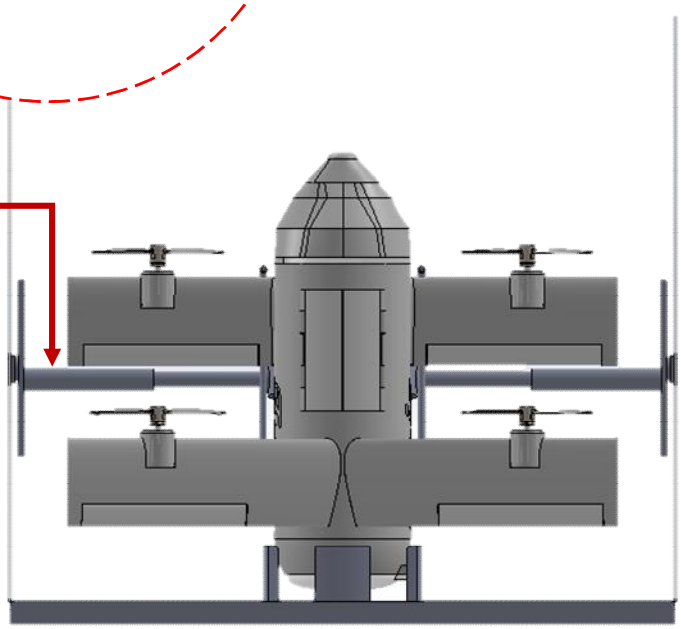
Deployment from C-130J

Automatic system



On-board computer for stabilization and engines ignition



Aircraft configuration to reach the target area

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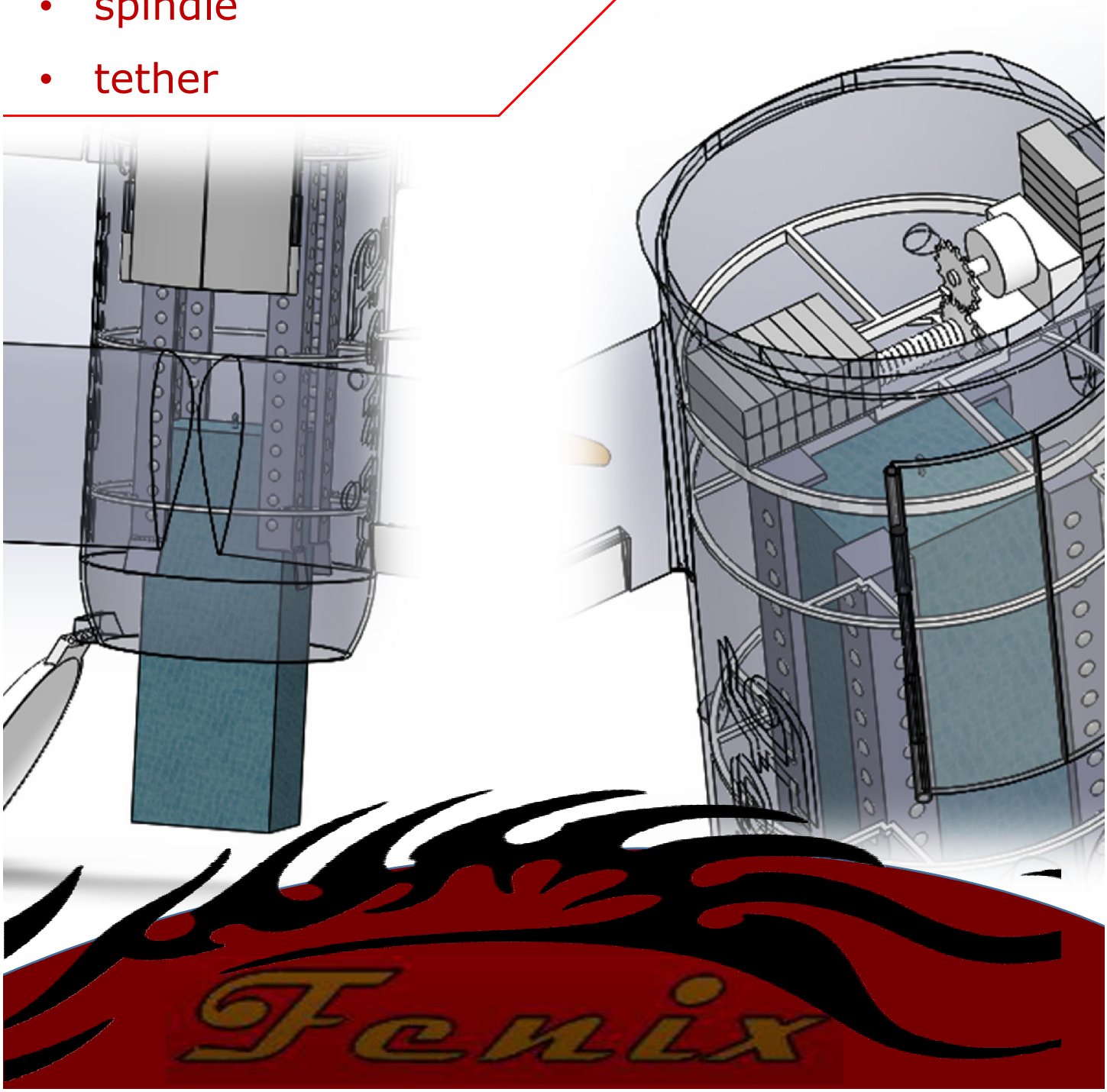
Payload deployment

- stepper motor & gear assembly
- spindle
- tether

Controlled delivery in hovering

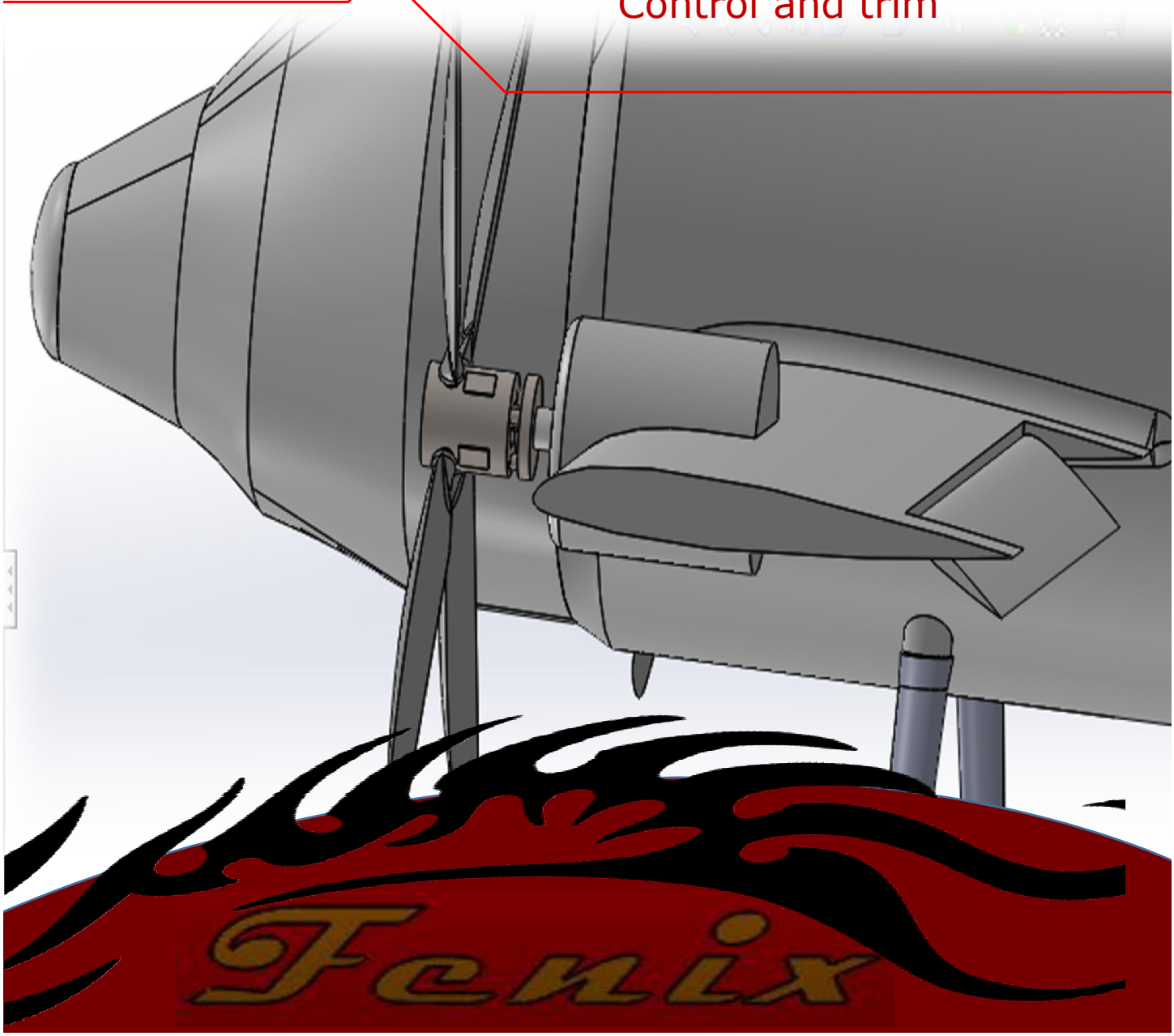


Forward Flight back to base

Change of configuration and maneuvering

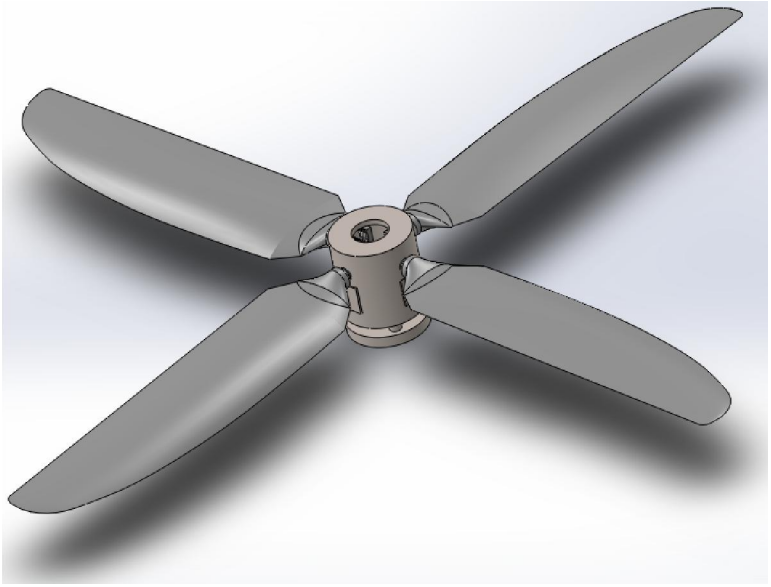
Ailerons and differential thrust for

Control and trim



Landing

Designed for semi-prepared terrain landing



Propeller for air-braking

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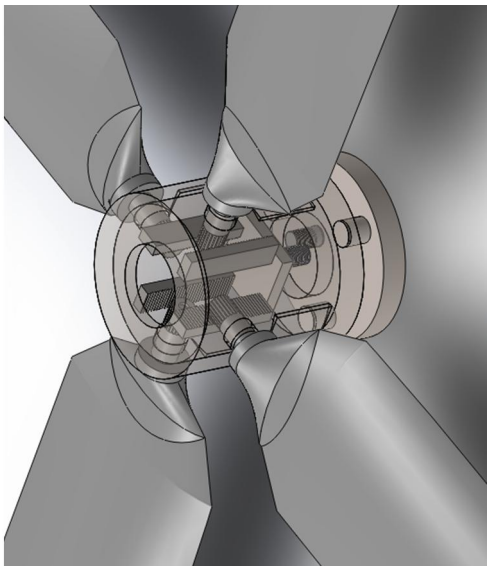
Propeller



Number of blades: Nb = 4

Radius: R = 1.312 ft (0.4 m)

Chord: c = 2.76 in (0.07 m)

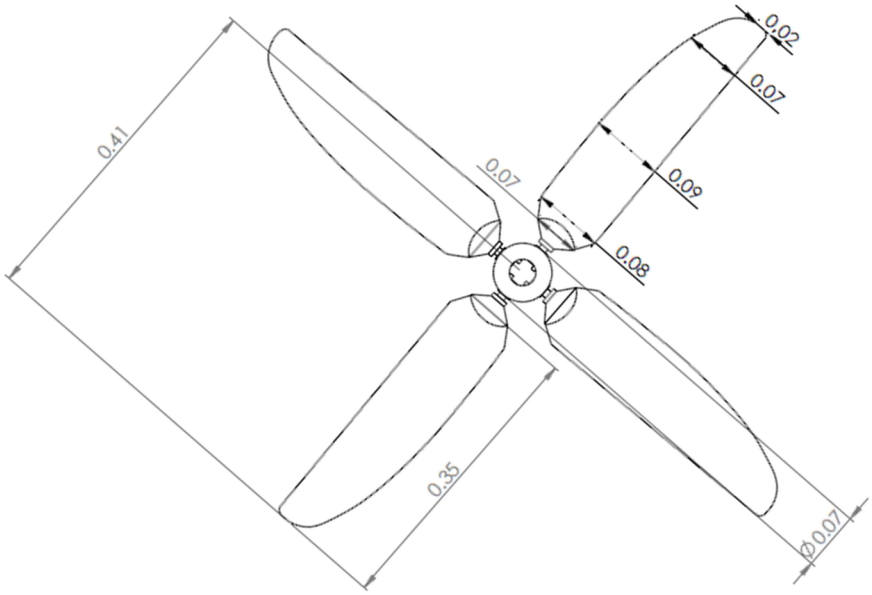
Solidity: σ = 0.22

Root-cut-out = 17.5% of R

Linear twist slope: θ_{twist} = -3.05 deg/ft (-10 deg/m)

Pitch angle range: θ_0 = 2 - 30 deg

Angular velocity range: RPM = 4000 - 6000



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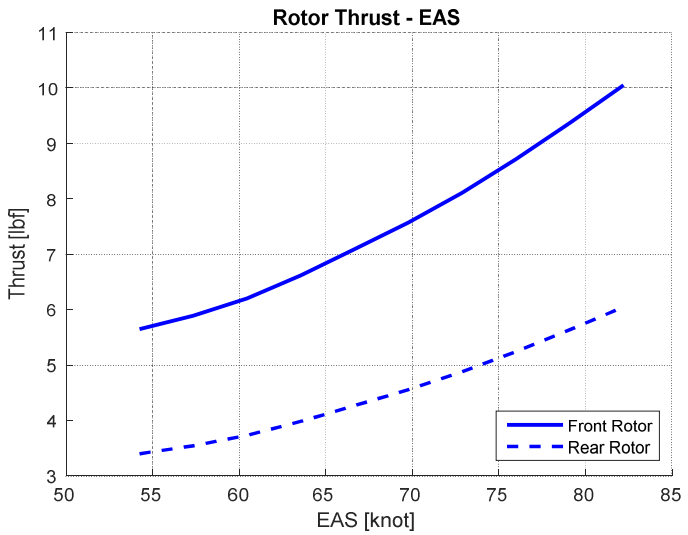
Trim:

- Differential thrust
- Ailerons deflection

Forward flight



Ailerons deflection in opposite directions for **pitch control**

Hovering

Ailerons deflection to **compensate the lift**

T_1	85.49 lbf
T_2	38.67 lbf

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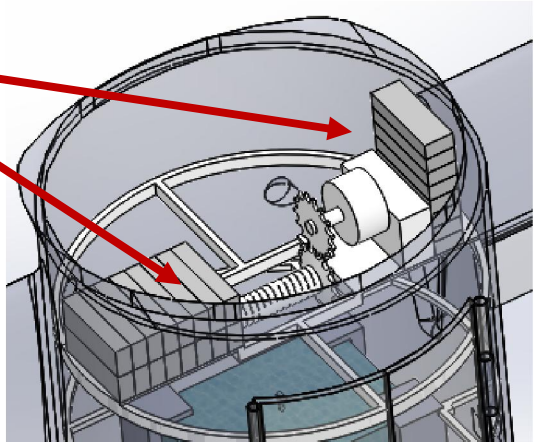
Power system

Name of Component	Weight [lb] ([kg])
4 x JM1 Electric Motor	24.25 (11)
8 x Jeti Spin Pro 300	6.349 (2.88)
24 x Li-S 6600 mAh Batteries	33.863 (15.36)
Electronics & sensors	4.409 (2)
Total Weight	68.872 (31.24)

Batteries located in the nose



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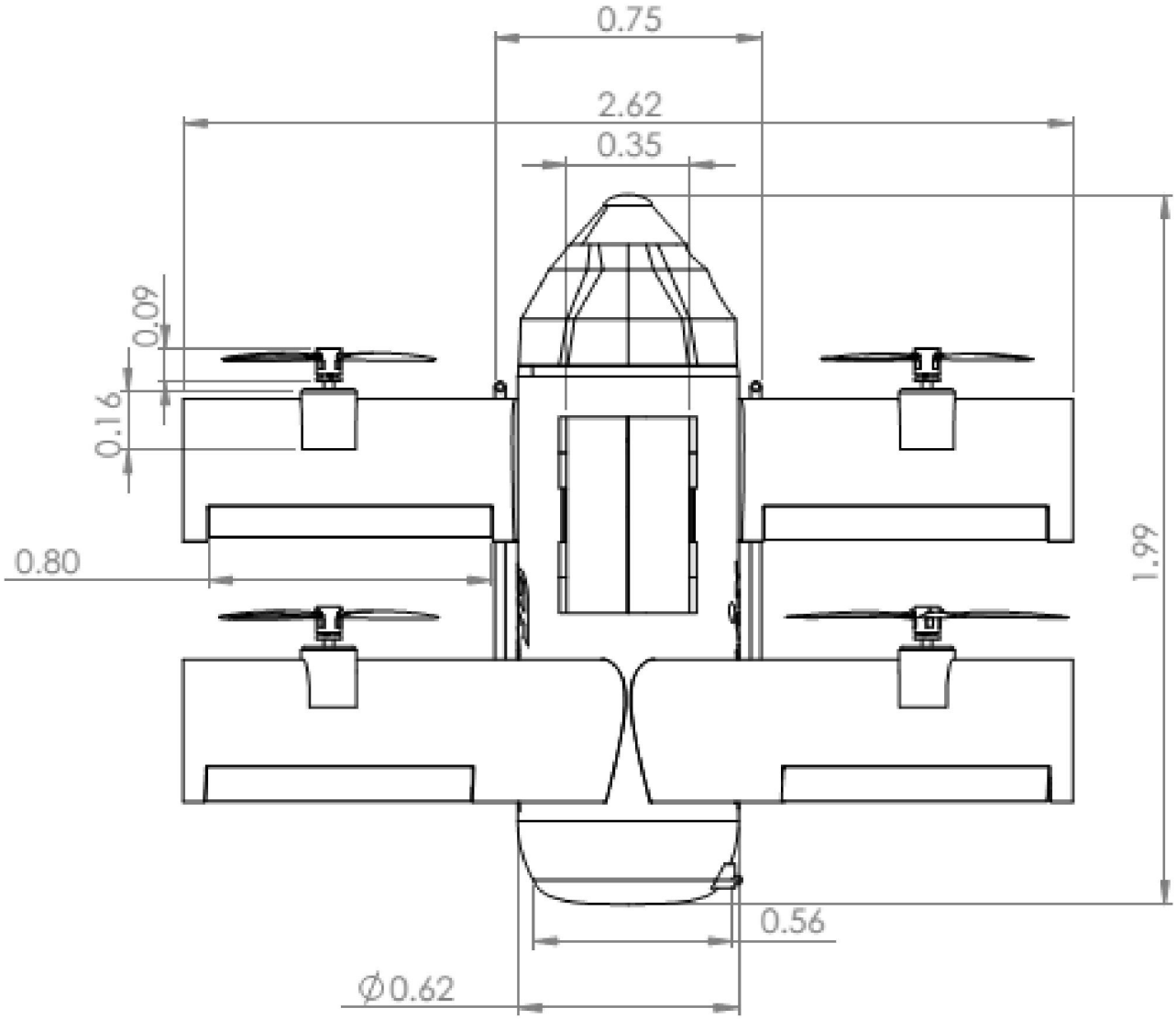
Final weight breakdown

	Individual Weight [lbs]	No. of components	Total weight [lbs]
Wings	8.82	4	35.27
Ailerons	1.10	4	4.41
Fuselage	30.86	1	30.86
Blades	1.19	16	19.05
Hub	1.65	4	6.61
Motor	8.14	4	32.54
Battery	1.41	24	33.86
Payload	56.44	1	56.44
Skids	2.34	2	4.67
Extras			24.56

	[lbs]	[kg]
Total weight	248.28	112.62

Final sizing



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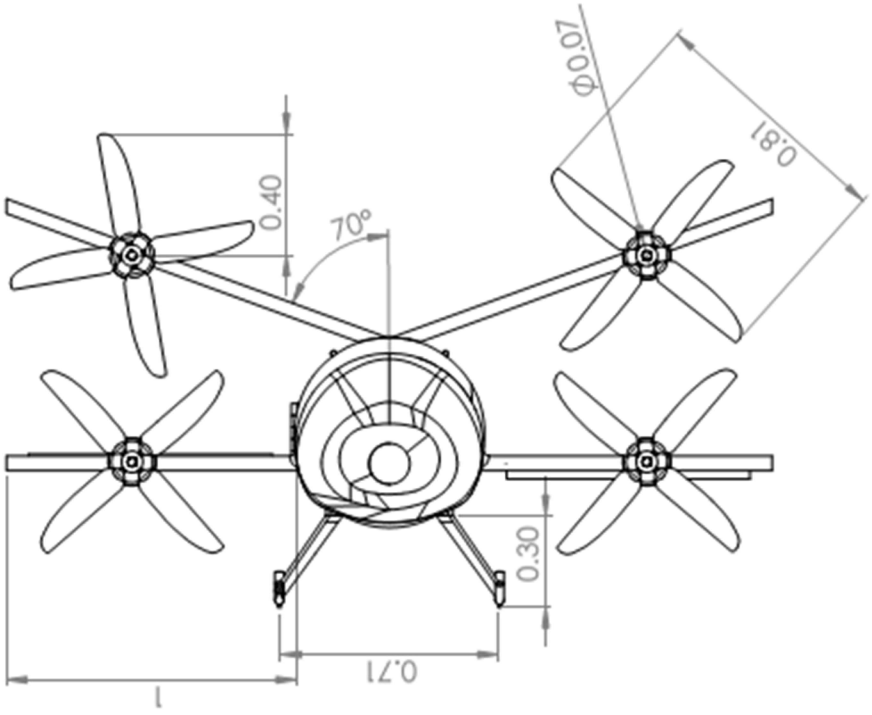

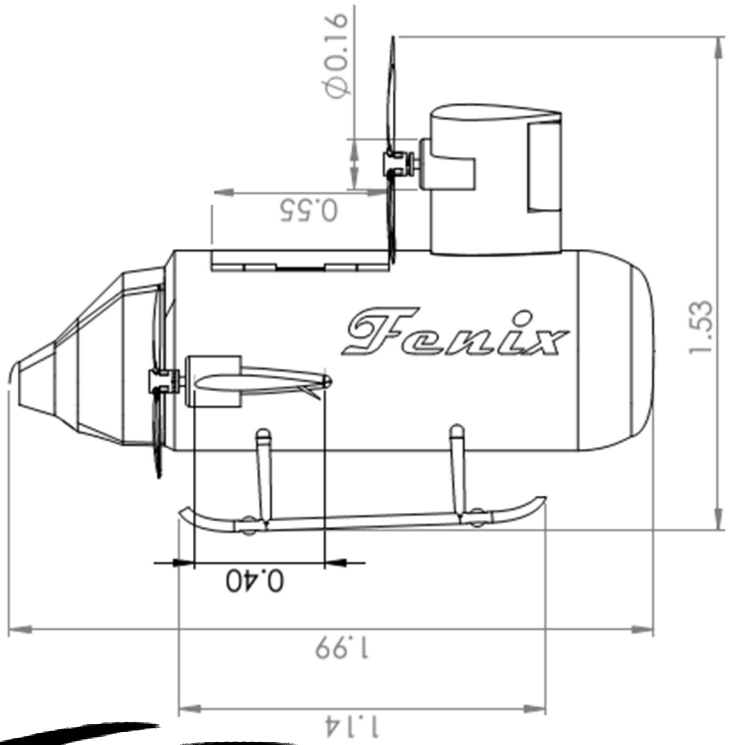

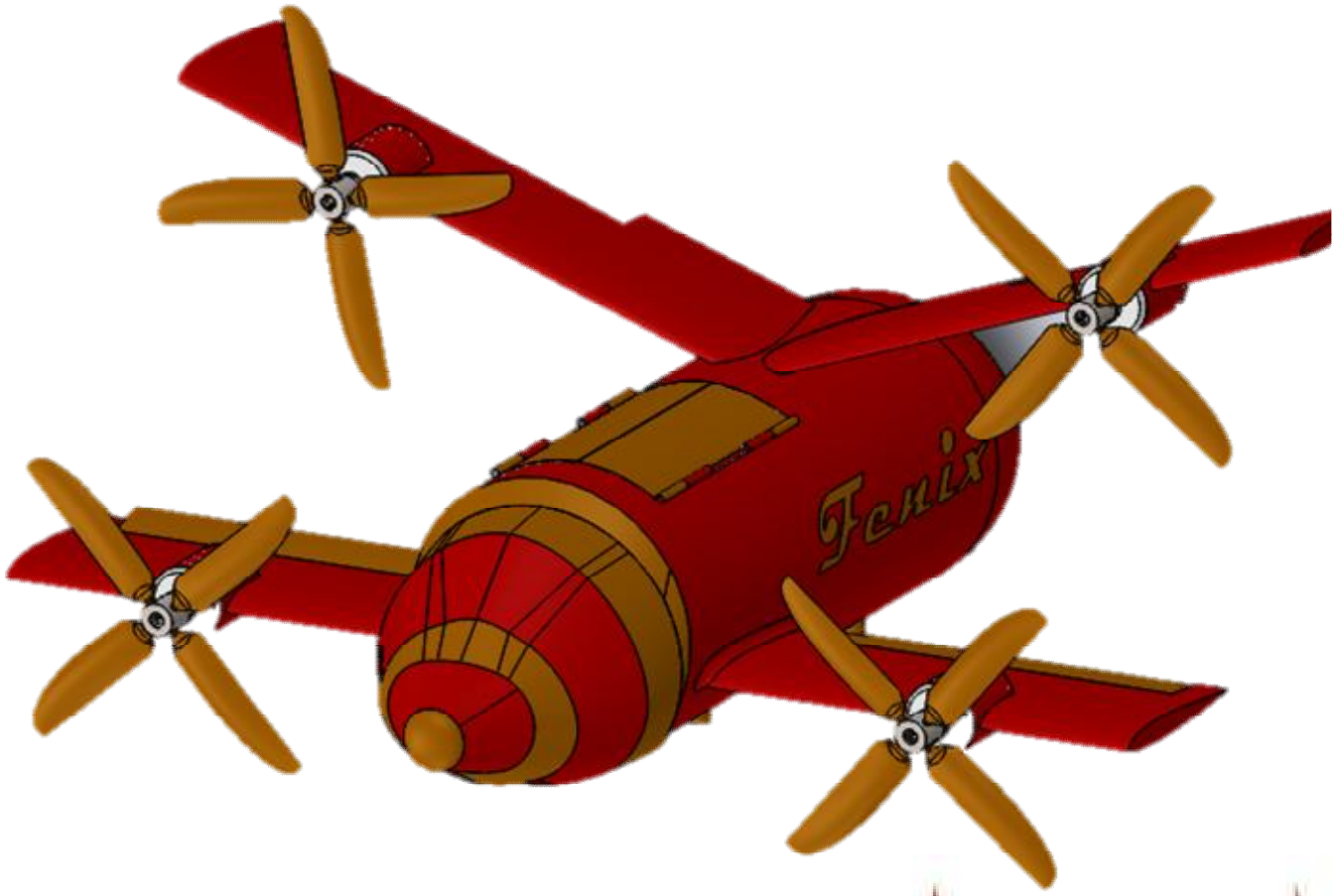

Team

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