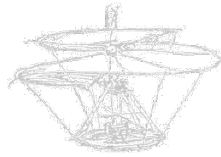


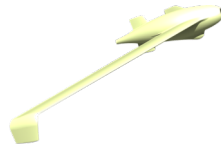
# Développement d'un drone dédié à l'exploration de nuages

Aurélien Cabarbaye

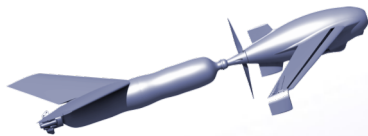
# Agenda



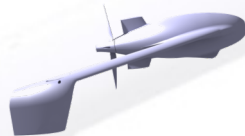
**I.UAV purpose / Requirements**



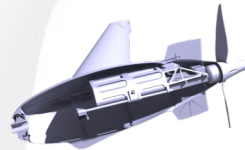
**II.« Conceptual design »**



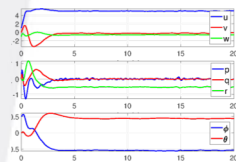
**III.Launching system**



**IV.Recovering system**

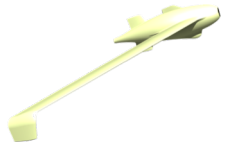


**V.Manufacturing process**



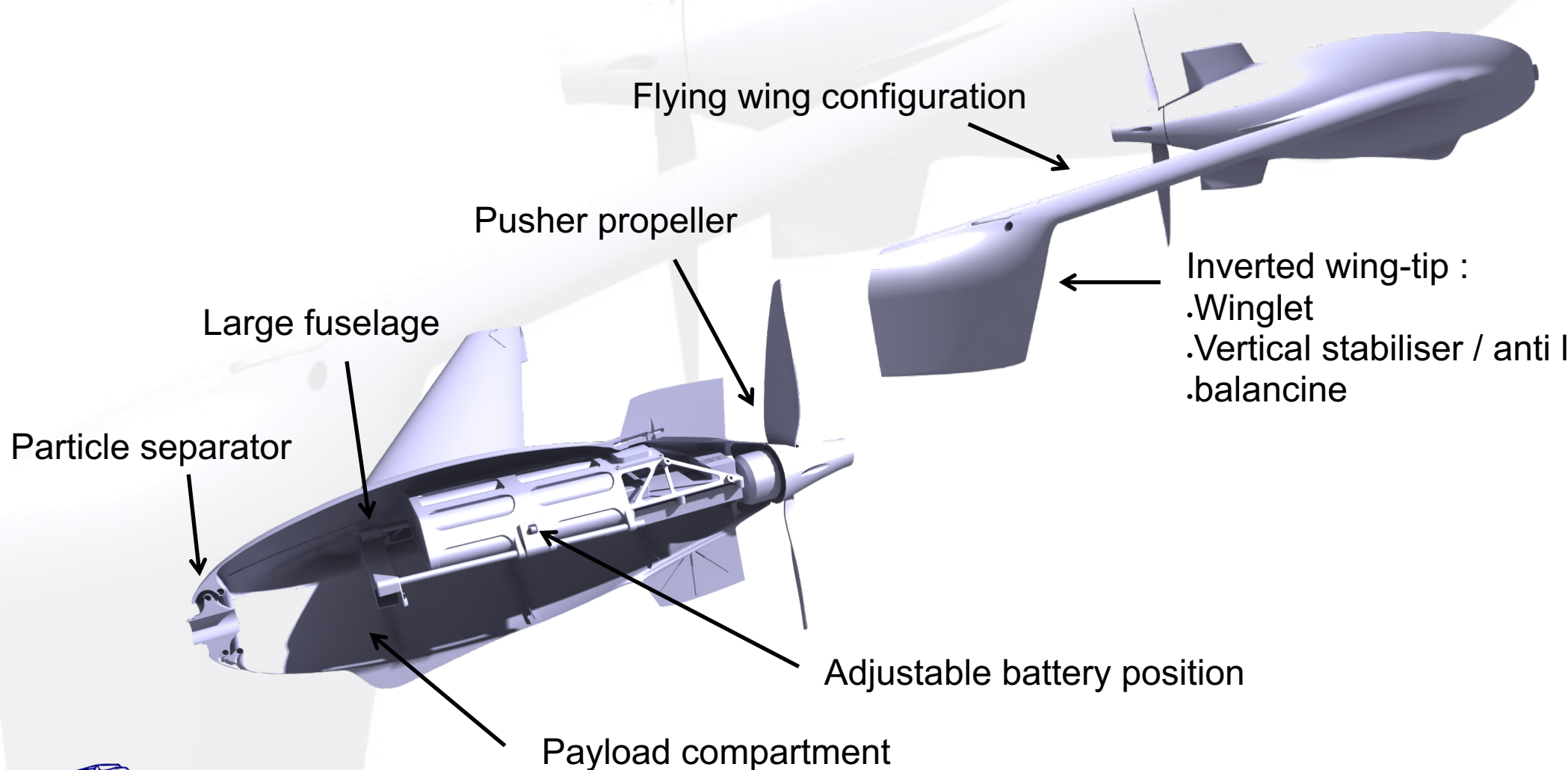
**VI.Additional studies**

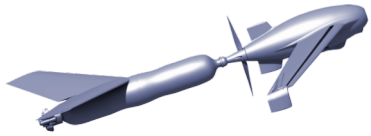
**Conclusion**



## II. « Conceptual design »

Initial design trends choice:

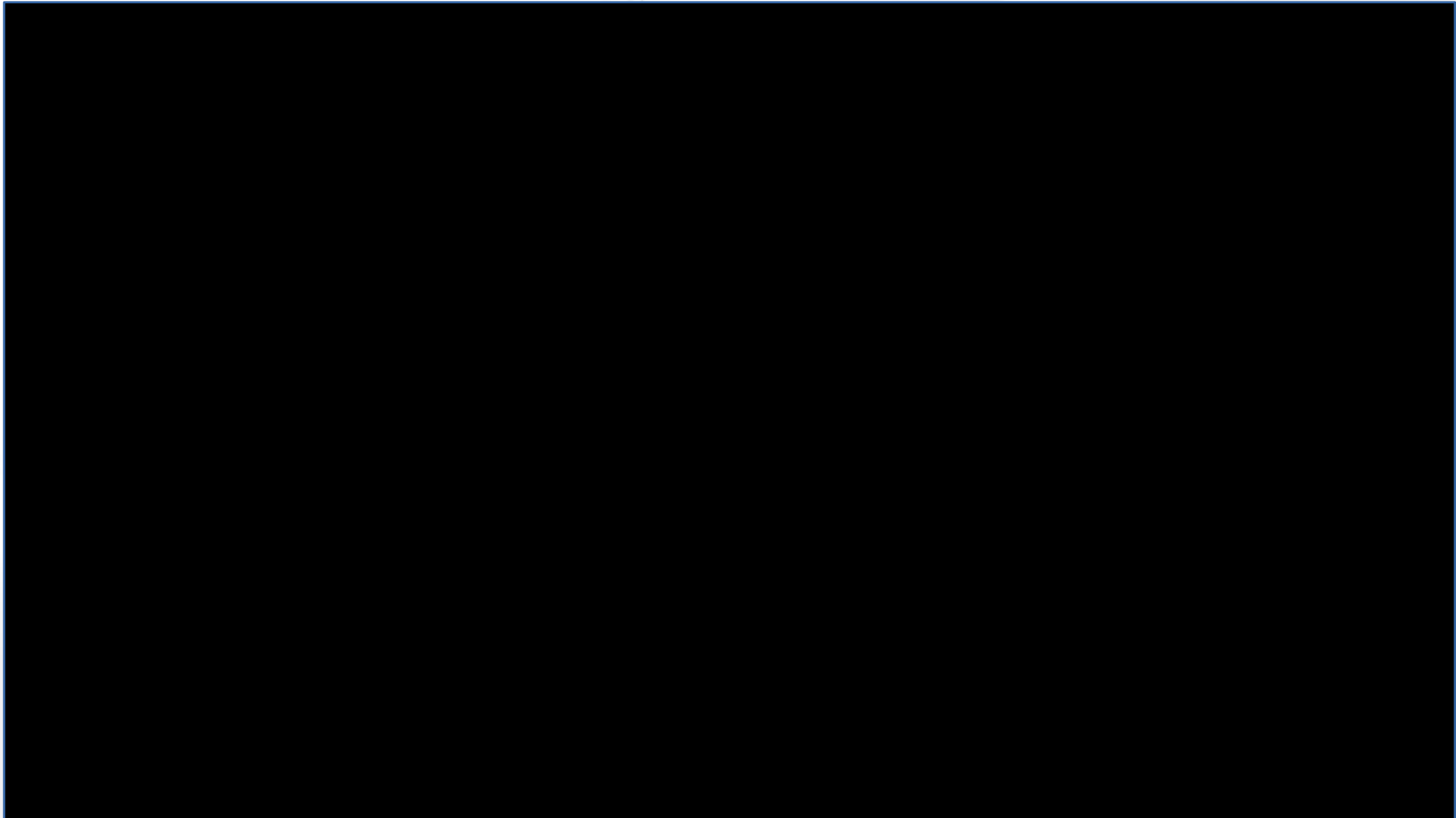




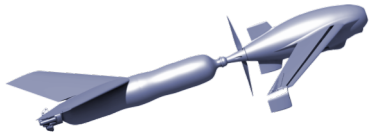
# III. Launching system

Existing systems (1/7):

Hand launch:



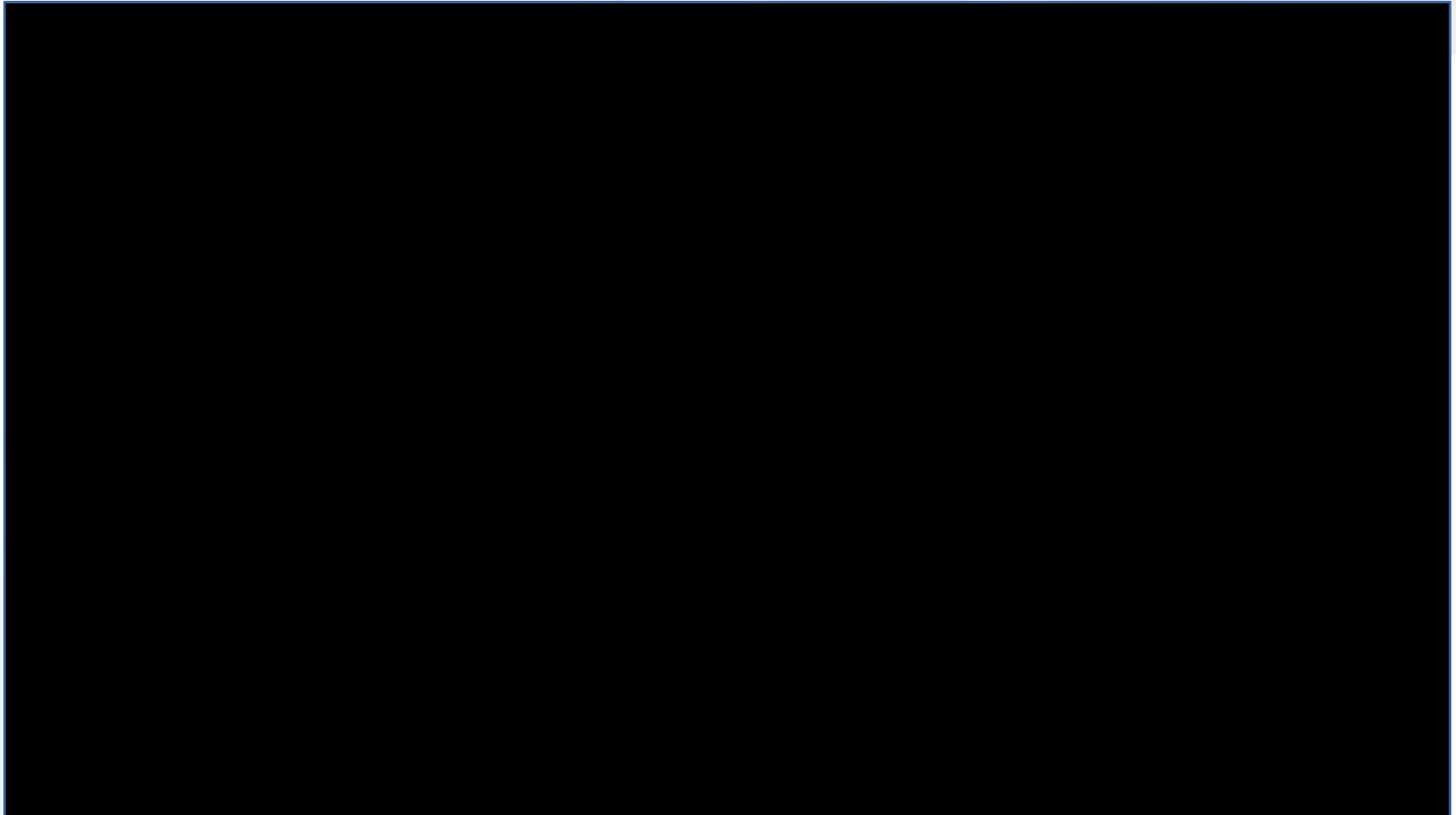


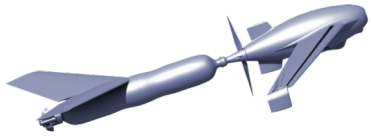


# III. Launching system

Existing systems (2/7):

Catapulte:

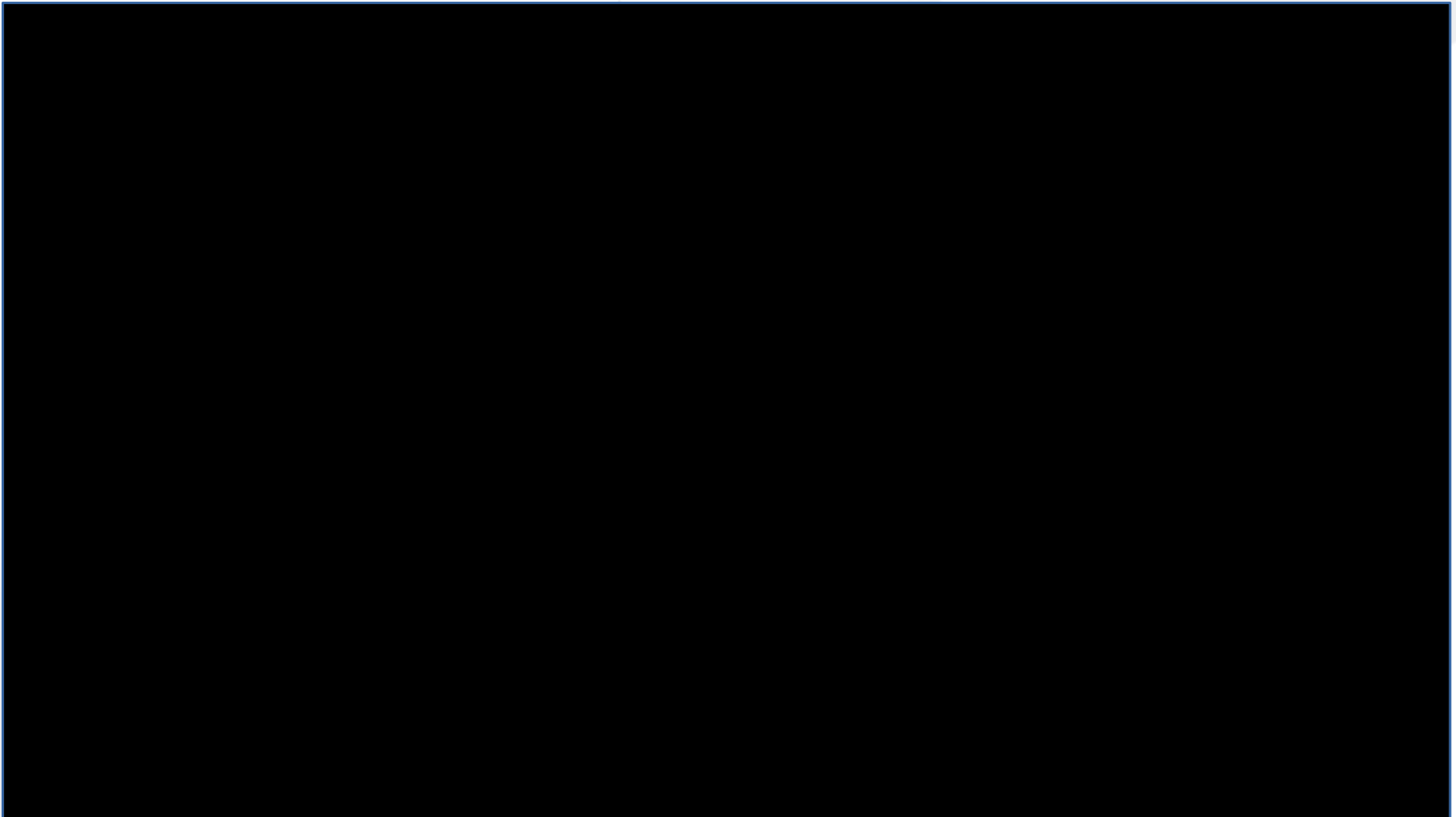


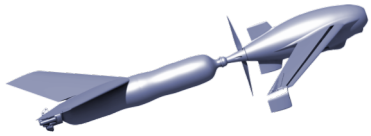


# III. Launching system

Existing systems (3/7):

Bungee:

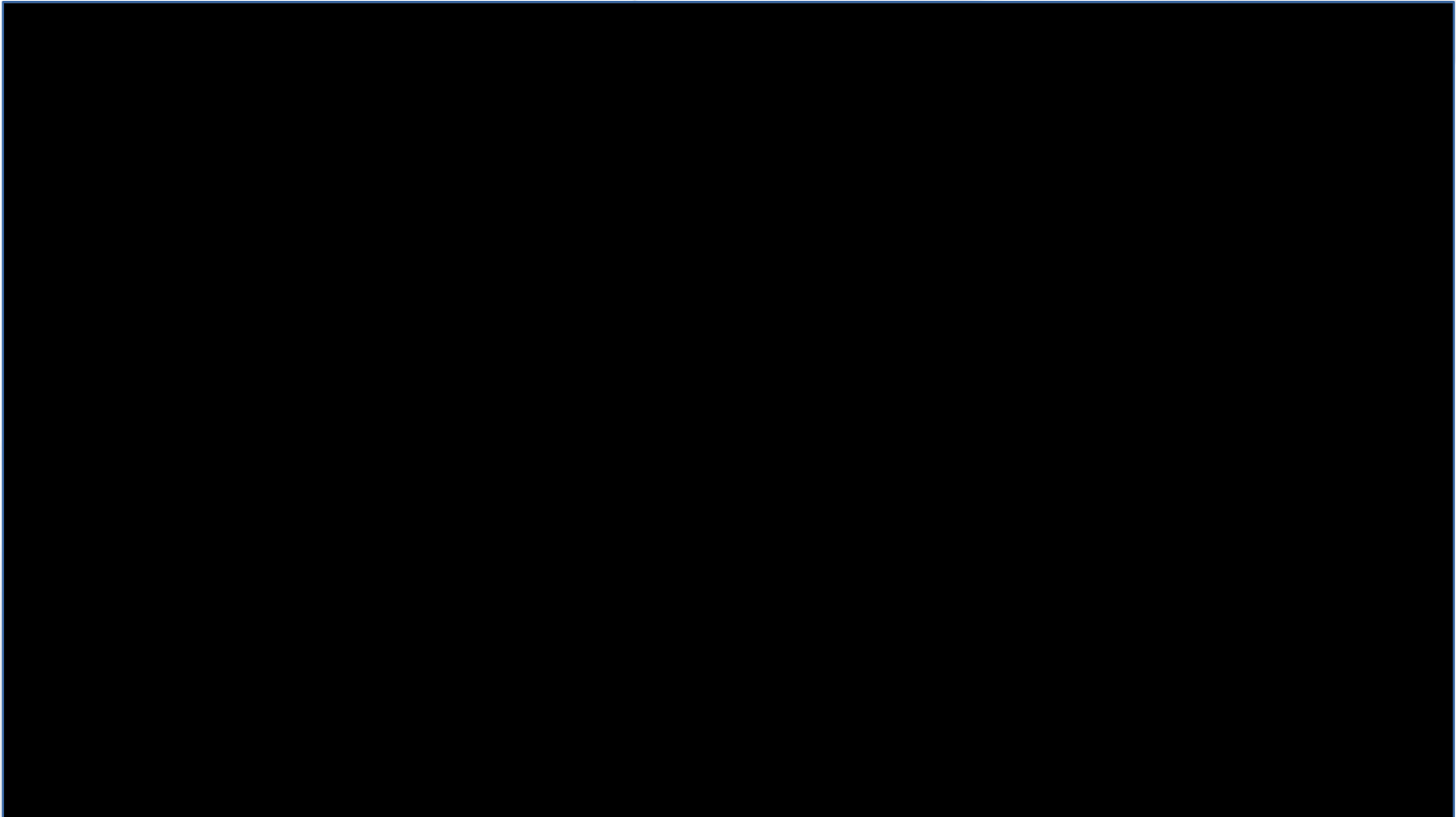


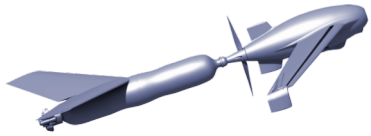


# III. Launching system

Existing systems (4/7):

Car top launch:

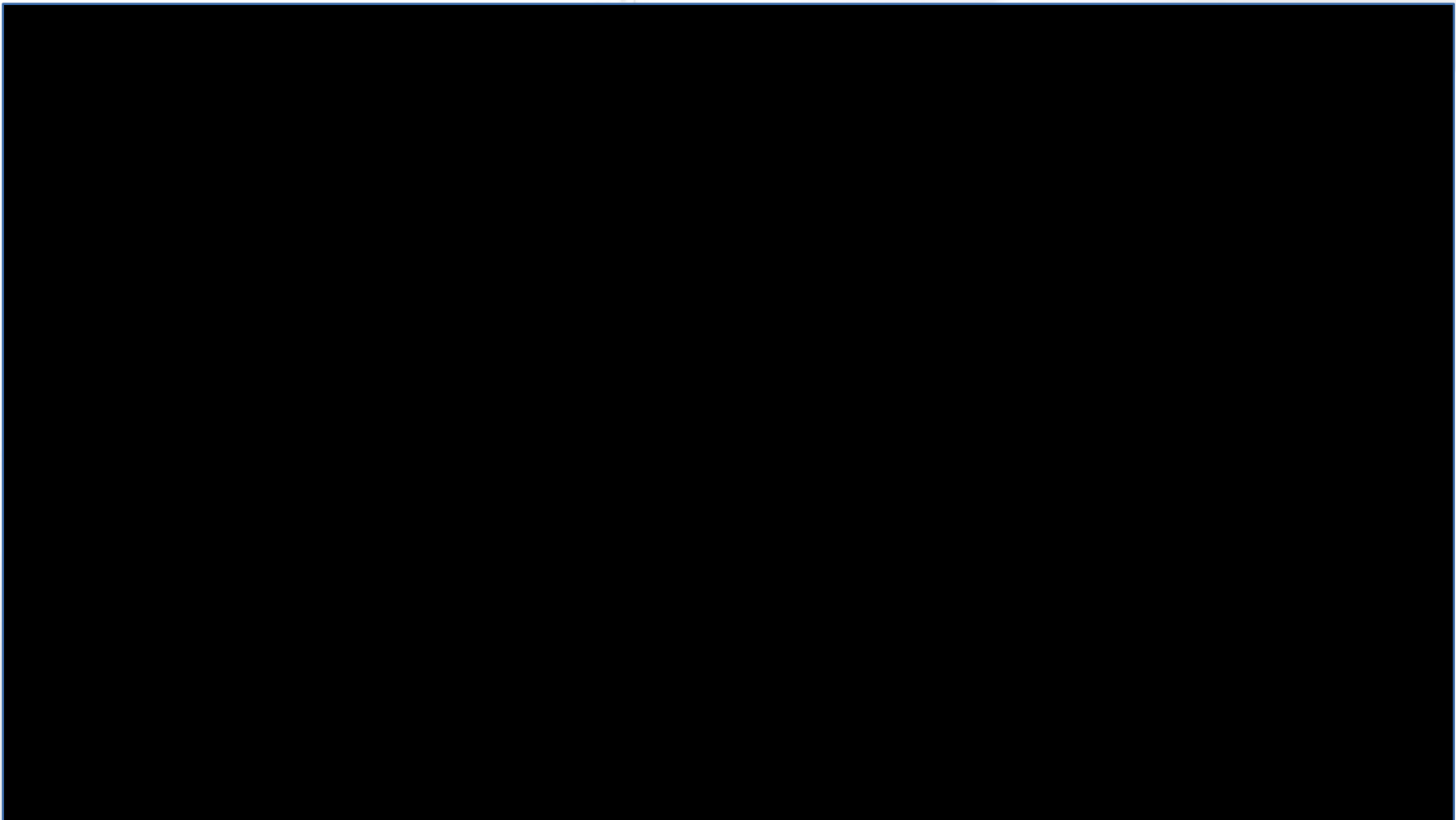


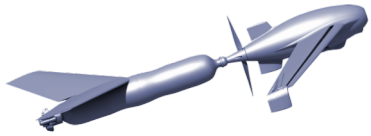


# III. Launching system

Existing systems (5/7):

Trebuchet:

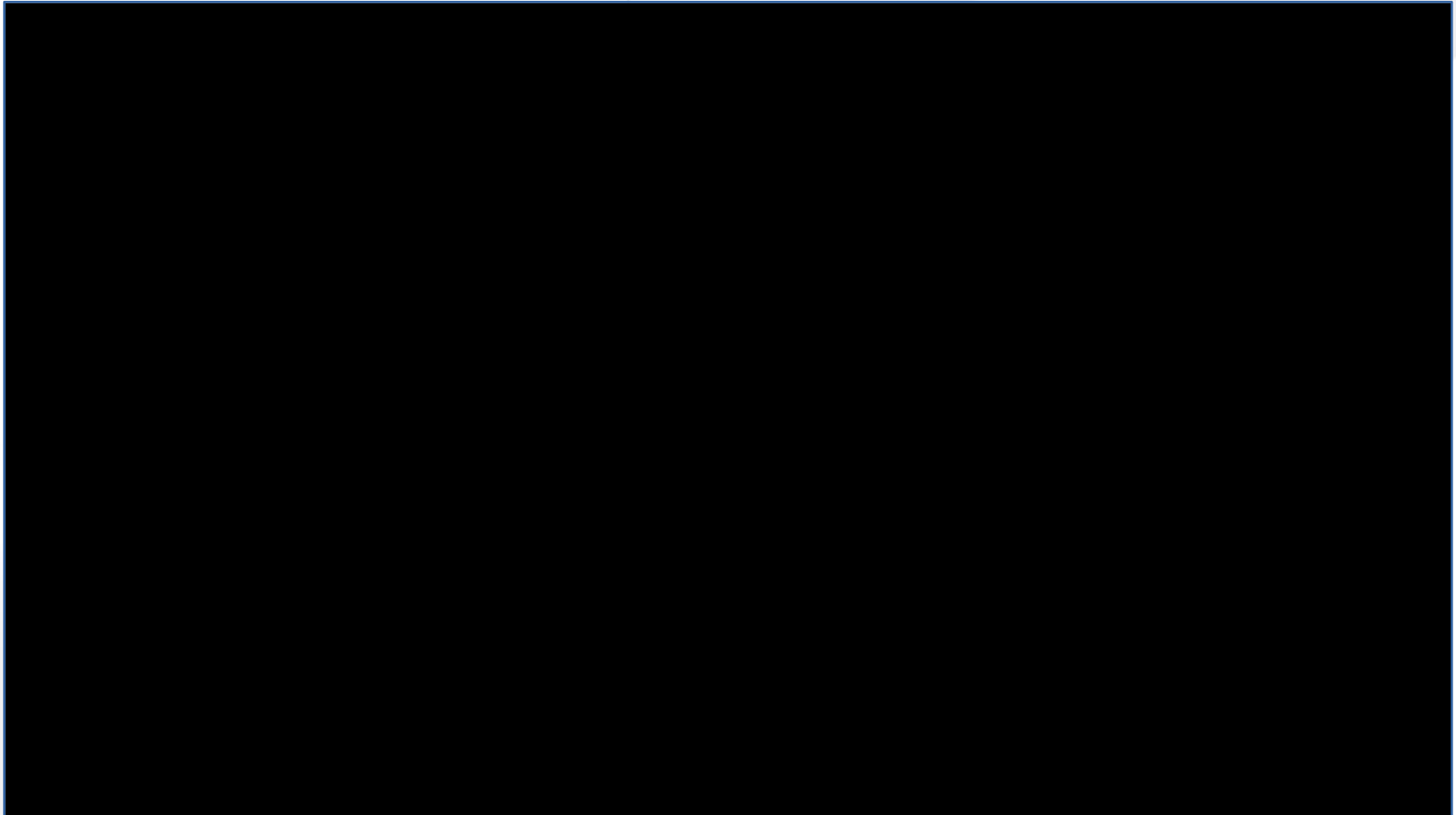


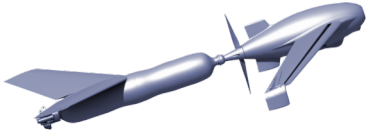


# III. Launching system

Existing systems (6/7):

Rocket :

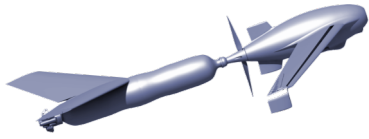




# III. Launching system

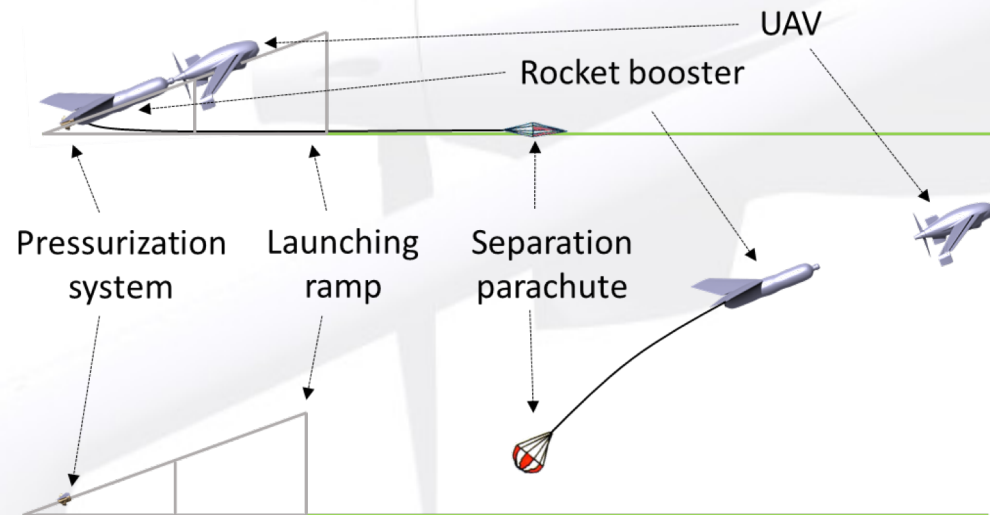
## Existing systems (7/7):

|                | Max speed         | Height top speed | Trajectory slope | Acceleration | Runway | Compact | Repeatability | Hazards         | Licence    |
|----------------|-------------------|------------------|------------------|--------------|--------|---------|---------------|-----------------|------------|
| Hand launch    | ≈10 m/s at 1,2 kg | 2 m              | Low              | Low          | No     | Yes     | Bad           | Propeller       | No         |
| Catapult       | ≈16 m/s           | ≈0,5 m           | Medium           | ≈9,4 g       | No     | Yes     | Good          | No              | No         |
| Bungee         | Adjustable        | Low              | Low              | Medium       | Yes    | Yes     | Low           | No              | No         |
| Car top launch | Adjustable        | 2 m              | Low              | Low          | Yes    | Yes     | Good          | No              | Drive      |
| Trebuchet      | ≈12 m/s at 10 kg  | 8 m              | High             | Medium       | No     | No      | Good          | No              | No         |
| Rocket         | Adjustable        | >8m              | High             | Low          | No     | Yes     | Good          | Fire Explosives | Explosives |

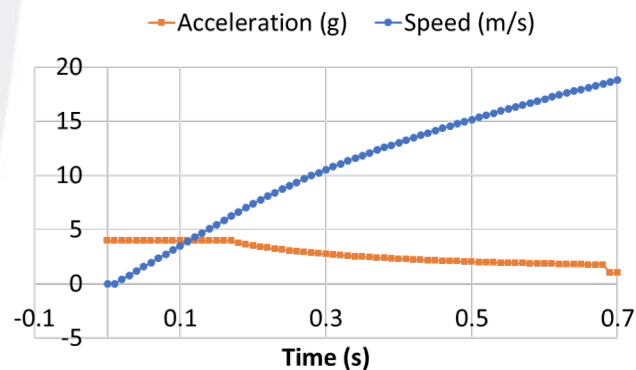


# III. Launching system

## Water rocket launch (2/3):



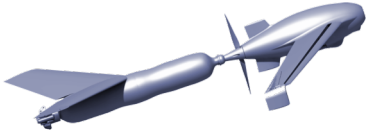
Rocket speed and acceleration



Max speed: >18 m/s

x Acceleration: <4 g

x Height top speed: >8 m

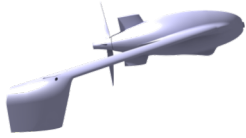


# III. Launching system

Water rocket launch (3/3):



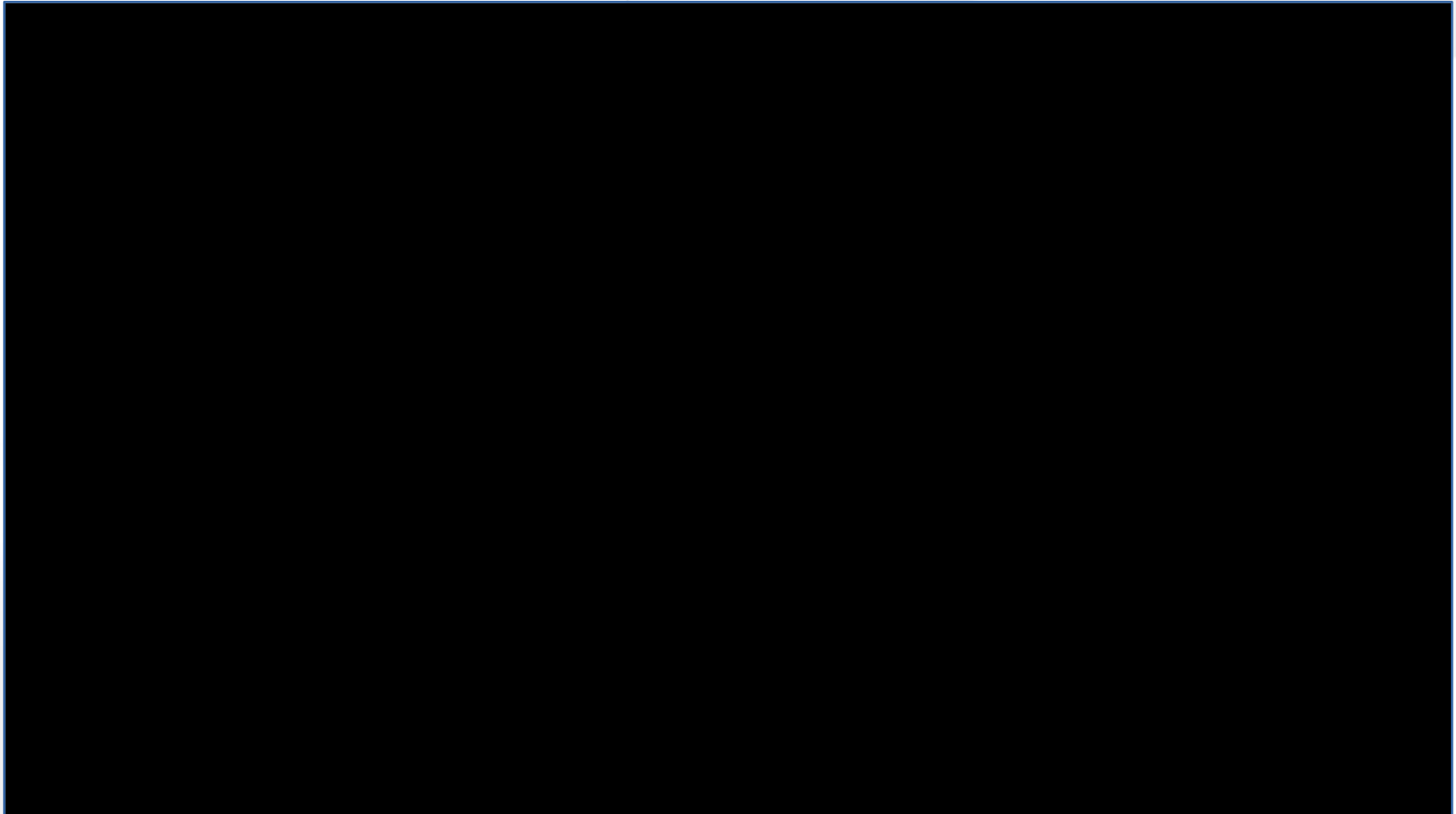


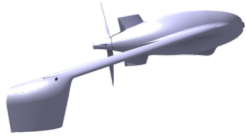


# III. Recovery system

Existing systems (1/4):

Parachute:

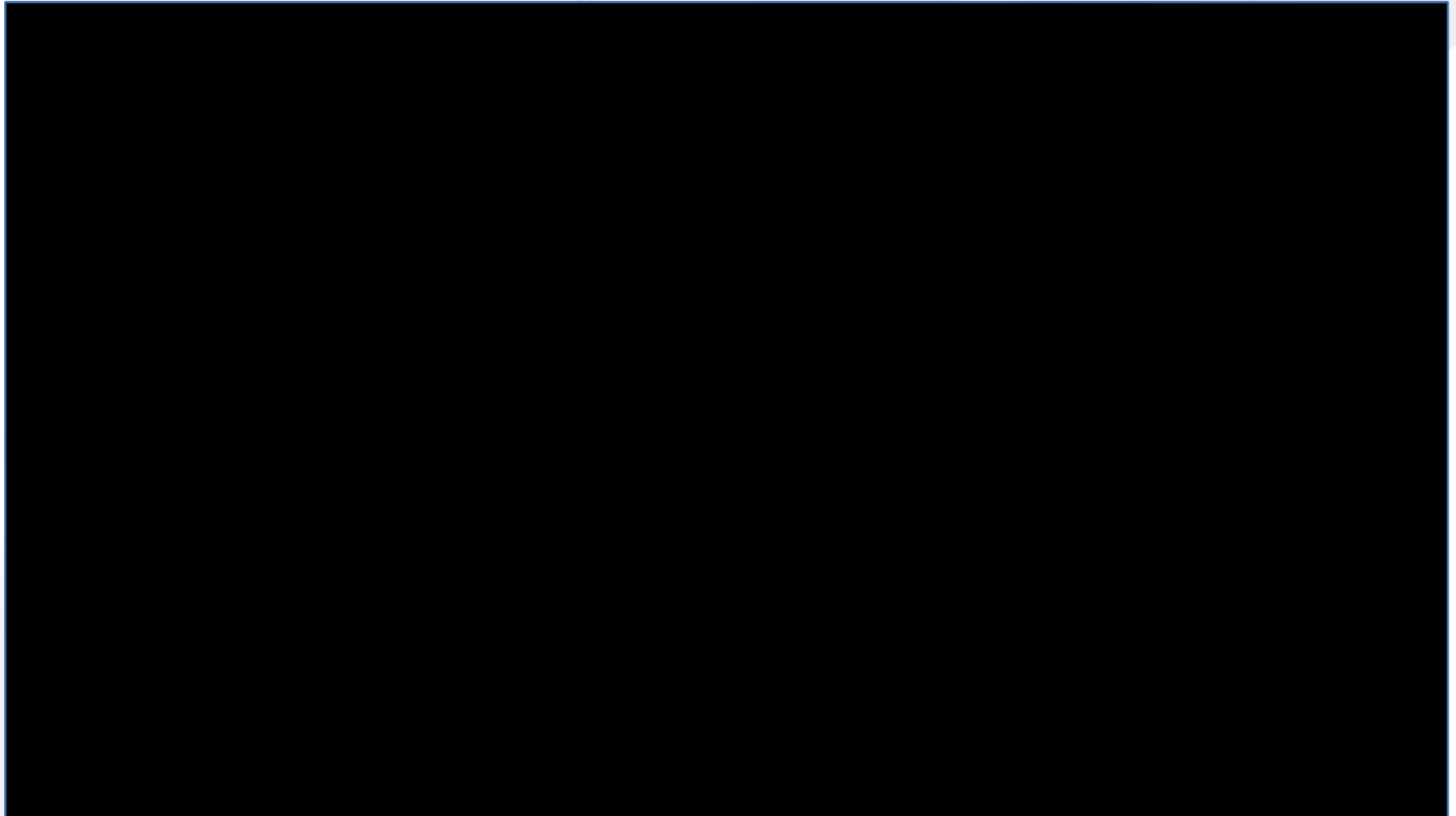


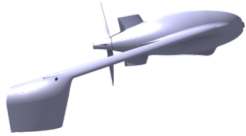


# III. Recovery system

Existing systems (1/4):

Arresting hook:

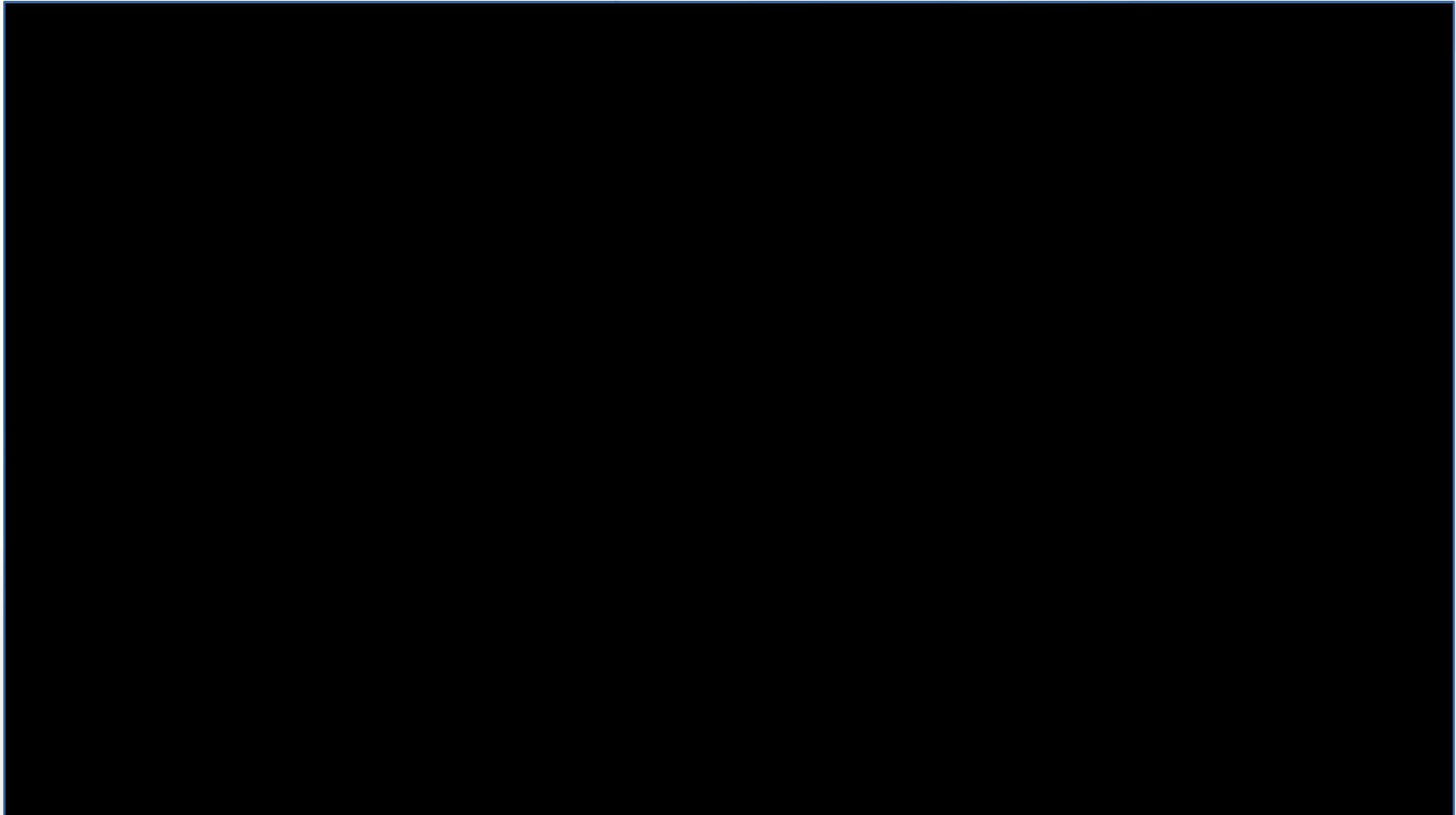


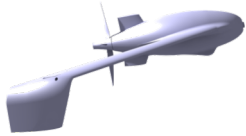


# III. Recovery system

Existing systems (1/4):

Arresting net :

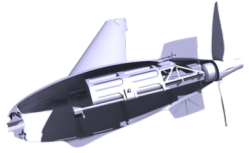




# III. Recovery system

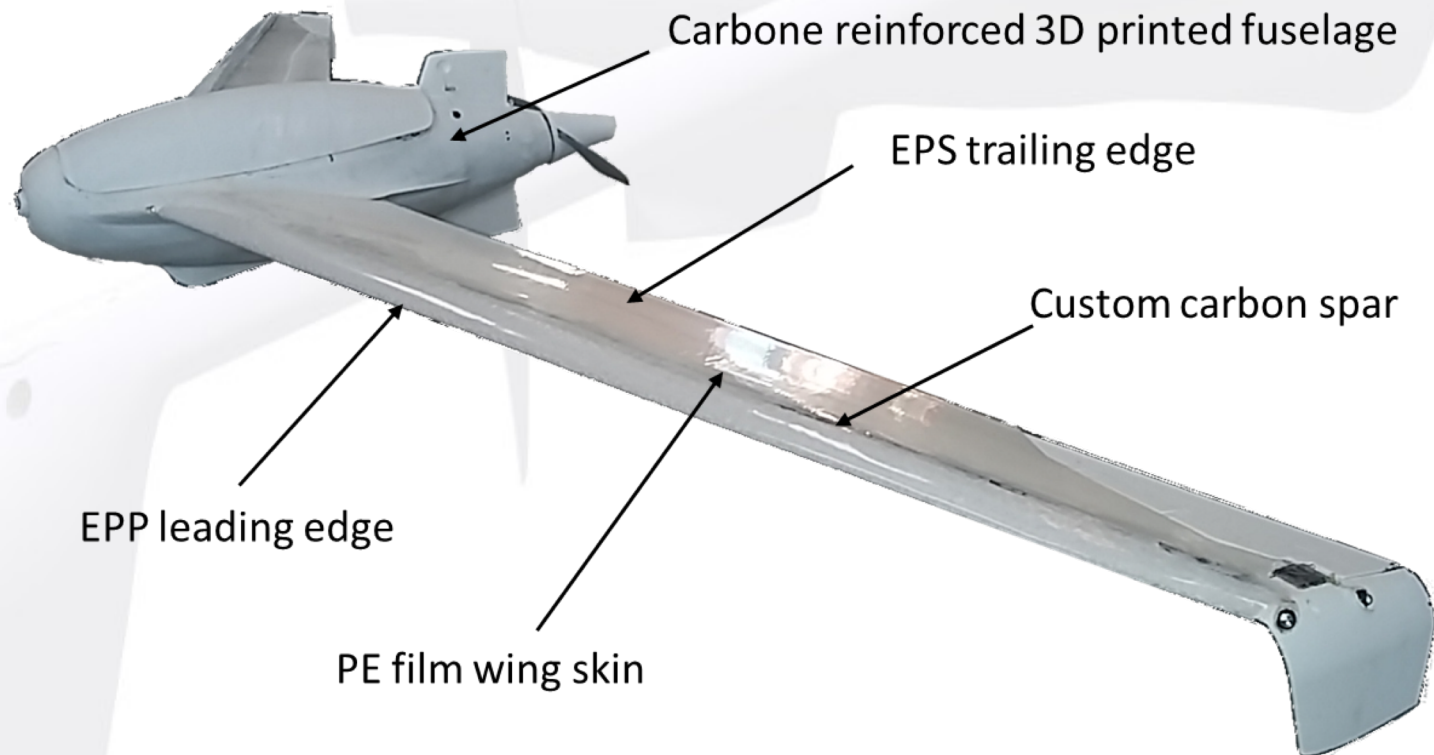
## Existing systems (4/4):

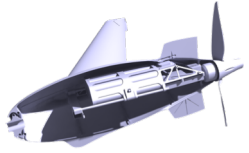
|                | Ground clearance | Embarked hardware       | Runway | Compact | Reapeatability | Hazard     |
|----------------|------------------|-------------------------|--------|---------|----------------|------------|
| Parachute      | High             | .Parachute<br>.Airbag   | No     | Yes     | Yes            | Wind       |
| Arresting hook | Low              | .Undercarriage<br>.Hook | Yes    | Yes     | Yes            | Cross wind |
| Arresting net  | Medium           | No                      | No     | Yes     | Yes            | No         |



# v. Manufacturing process

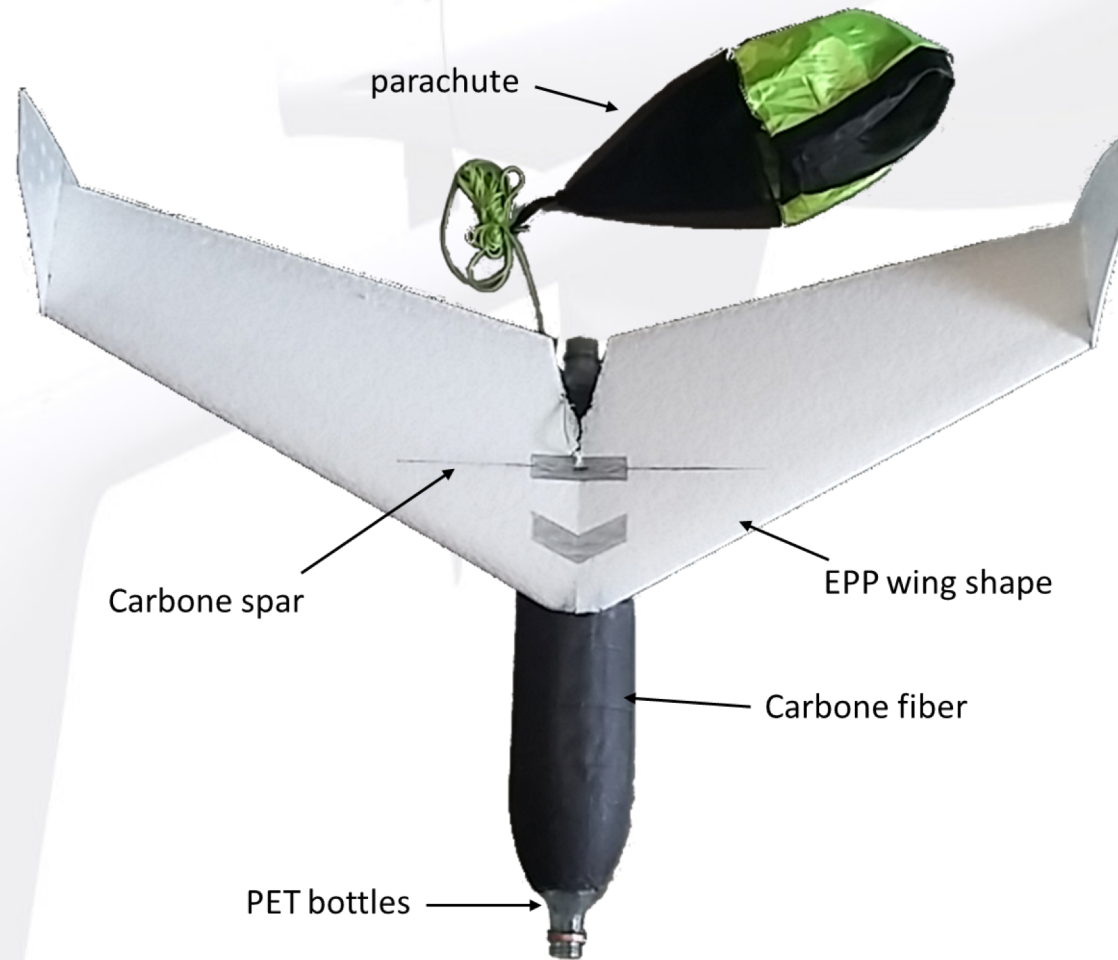
## UAV manufacturing:





# v. Manufacturing process

## Water rocket manufacturing:





# Conclusion

No crippling feasibility issue and manufacturing impossibility have been encountered throughout the whole development.

**All Meteo France requirements have been fully fulfilled!**

The design is very affordable and do not require heavy facilities to be built

Communication:

- IMAV 2018: Accurate control law for low-cost UAV
- IMAV 2019: Design of a high performance MAV for atmospheric research



For more information about present UAV sizing or MDO:

■ ISBN : 979-10-97287- 05-4 L'optimisation multidisciplinaire, l'autre enjeu du Big Data

