



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Escola Superior d'Enginyeries Industrial,  
Aeroespacial i Audiovisual de Terrassa

# Design and Construction of a Vertical Landing Vehicle using a Cold Gas Thruster

Document:

Budget

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**BACHELOR FINAL THESIS**

ESEIAAT  
Final Bachelor Thesis



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BACHELOR IN AEROSPACE VEHICLE ENGINEERING

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Design and Construction of a Vertical Landing  
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June 22, 2021

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# Budget

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The cost to realize this project can be attributed to engineering hours, as well as material and energy costs.

## E.1 Engineering Hours

This hourly rate is determined from the average salary of an aerospace engineer in Spain [1].

**Table E.1:** Engineering hours.

<b>Item</b>	<b>Hours</b>	<b>Rate [€/h]</b>	<b>Total cost</b>
Project charter	35	18	€ 630.00
Preliminary study	40	18	€ 720.00
Algorithm development	40	18	€ 720.00
Component investigation and purchase	45	18	€ 810.00
Propulsion system troubleshooting	140	18	€ 2,520.00
CAD modelling	120	18	€ 2,160.00
Aerodynamic and structural simulations	65	18	€ 1,170.00
Construction	50	18	€ 900.00
Tests	40	18	€ 720.00
Documentation	160	18	€ 2,880.00
<b>Total</b>	<b>735</b>	<b>18</b>	<b>€ 13,230.00</b>

## E.2 Material Costs

The material costs are categorized according to the vehicle's main systems.

**Table E.2:** Material costs.

	Item	Unitary cost	QTY	Total cost	Supplier
<b>Propulsion system</b>				<b>€ 177.80</b>	
	0.21L Tank	€ 13.95	1	€ 13.95	Adrenalicia
	Regulator	€ 24.50	1	€ 24.50	Adrenalicia
	Stop valve	€ 9.45	1	€ 9.45	Adrenalicia
	Solenoid valve	€ 41.05	1	€ 41.05	G.M.G. Suministros
	HP tube Quick release	€ 1.62	4	€ 6.48	Amidata S.A.U
	HP PP tube	€ 10.42	1	€ 10.42	Amidata S.A.U
	Scuba tank refills	€ 8.00	4	€ 32.00	DiversitySub
	Scuba - paintball tank adaptor	€ 39.95	1	€ 39.95	Adrenalicia
<b>Electronics</b>				<b>€ 147.65</b>	
	Arduino	€ 18.01	1	€ 18.01	Amidata S.A.U
	0.5A SS Relay	€ 1.38	1	€ 1.38	Amidata S.A.U
	2A SS Relay	€ 2.63	2	€ 5.26	Amidata S.A.U
	Nichrome wire	€ 5.99	1	€ 5.99	Amazon
	9V Li-ION batterys + charger	€ 20.65	1	€ 20.65	Amazon
	LiDAR module	€ 29.16	1	€ 29.16	Amazon
	IMU module	€ 29.95	1	€ 29.95	Amazon
	Load cell	€ 15.98	1	€ 15.98	Amazon
	Pad board	€ 6.60	1	€ 6.60	Diotronic S.A.
	Cables	€ 5.78	1	€ 5.78	Amazon
	BOOST DC-DC converter	€ 1.40	1	€ 1.40	Amazon
	Servomotors	€ 3.75	2	€ 7.49	Amazon
<b>Structure</b>				<b>€ 49.88</b>	
	1kg PLA spool	€ 16.94	2	€ 33.88	Servei Estació S.A.
	Wood struts	€ 0.80	3	€ 2.40	Servei Estació S.A.
	Tube	€ 3.60	1	€ 3.60	Servei Estació S.A.
	PP corrugated sheets	€ 10.00	1	€ 10.00	Servei Estació S.A.
<b>Total</b>				<b>€ 375.33</b>	

### E.3 Energy Cost

The price per kWh is based on the average price in the first quarter of 2021 in Spain [2].

**Table E.3:** Energy consumption costs

Item	Unitary cost [€/kWh]	Power consumption [W]	Hours of use [h]	kWh	Cost
3D printing consumption	€ 0.15	350	180	63	€ 9.45
PC consumption	€ 0.15	200	685	137	€ 20.55
<b>Total</b>					<b>€ 30.00</b>

### E.4 Total Cost

Finally, the total cost can be determined by combining the aforementioned costs.

**Table E.4:** Total cost of the project.

Item	[€]
Engineering costs	13,230.00
Material costs	375.00
Energy costs	30.00
<b>Total</b>	<b>13,635.00</b>

# References

Listed below are the references in citation order.

- [1] PayScale. *Average Aerospace Engineer Salary in Spain*. URL: [https://www.payscale.com/research/ES/Job=Aerospace%7B%5C\\_%7DEngineer/Salary](https://www.payscale.com/research/ES/Job=Aerospace%7B%5C_%7DEngineer/Salary) (visited on 06/21/2021) (cited on page 1).
- [2] Podo. *Precio Hoy, 2021, 2020, 2019 y 2018*. URL: <https://www.mipodo.com/blog/informacion/subida-precio-de-la-luz/> (visited on 06/21/2021) (cited on page 3).