



**UNIVERSITAT POLITÈCNICA DE CATALUNYA**  
**BARCELONATECH**

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

# **STUDY AND IMPLEMENTATION OF A MIDDLE-SIZED ROCKET MOTOR BENCH TEST SYSTEM**

## **FINAL MASTER THESIS - BUDGET**

**MASTER'S DEGREE IN AEROSPACE ENGINEERING  
UNIVERSITAT POLITÈCNICA DE CATALUNYA**

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# Budget

The costs for this project can be divided mainly into two groups, the cost of the engineering and the cost of the materials. The engineering cost comprises the assets needed to develop the design, write the report and build the test stand, and the material costs would envelope those costs related to the components and materials used in the fabrication of the test stand.

The price of the working hours of the engineer has been calculated from the hypothesis that the annual salary of the engineer without accounting for taxes, is of 24.000 €. Thus, the gross salary per month would be of 2.000€ and the price per hour of 12.5€.

The costs for the engineering of the design and development of the solutions' report would be the following:

Table 1.1: Engineering costs of the design.

Asset	Duration	Price per hour	Cost
Research and investigation of current technologies	30 h	12.5 €/h	375 €
Development of the design	110 h	12.5 €/h	1375 €
Computational analysis of the structure	75 h	12.5 €/h	937.5 €
Building of the structure and assembly	100 h	12.5 €/h	1250 €
<b>Total cost:</b>			<b>3937.5 €</b>

And the materials' costs of the electronic, structural and otherwise components of the test stand would be:

Table 1.2: Material cost of the Electronics Module.

Component	Unit Cost	Quantity	Cost
Arduino Mega [1]	14 €	1	14 €
Load cell YZC-526 1T [2]	35 €	1	35 €
ADC ad7606 converter [3]	36 €	1	36 €
DAAU amplifier [4]	25 €	1	25 €
Sorted cables and electronics kit	11 €	1	11 €
<b>Total cost:</b>			<b>121 €</b>

Table 1.3: Material cost of the structure.

<b>Component</b>	<b>Quantity</b>	<b>Longitude [mm]</b>	<b>Cost/Tn [€/m]</b>	<b>Cost [€]</b>
<b>Beams</b>				
Square beam 120x120x5	1	6000	288	207
Square beam 90x90x5	2	916	288	153
Square beam 50x50x2	2	6000	288	35
L beam 60x60x6	2	6100	1050	72
<b>Plates and others</b>				
Rectangular plates 70x150x16	8			41
Rectangular plate 600x600x8	1			31
Circular plate D180x35	1			12
Circular rings D180x10x26	4			42
Hexagon head bolts A2-70	52			52
<b>Total cost:</b>				<b>645 €</b>

By adding the electronics total cost to the structural materials total cost it can be deducted the total price of the build which would be of:

**Total price of the stand: 766 €**

# Bibliography

- [1] Arduino. Arduino mega 2560 rev3. <https://store.arduino.cc/arduino-mega-2560-rev3>  
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- [3] Plexishop. 8-channel adc module for arduino, ad7606. <https://www.plexishop.it/en/robotics-and-automation/converters-for-arduino/8-channel-adc-module-for-arduino-ad7606.html> Last Accessed: 12 Sept 2019.
- [4] Yann Leidwanger. Differential amplifier shield for arduino uno. [https://www.tindie.com/products/Upsilon\\_Eng/differential-amplifier-shield-for-arduino-uno/](https://www.tindie.com/products/Upsilon_Eng/differential-amplifier-shield-for-arduino-uno/) Last Accessed: 12 Sept 2019.