UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

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

ESEIAAT

Bachelor's Thesis

Study of the Saturn V structure and reproduction of a 1:50 scale model

Budget

Degree: Bachelor's degree in engineering of Aerospace Vehicles

Student: Contreras Benito, Luis Juan

Director: Lordan Gonzalez, Oriol

Delivery date: 10/05/2018

Contents

List of Tables

1 Budget

In this section is described the budget of the project. Manpower, software licenses, materials, procedures and hardware costs are detailed in the following lines.

To begin with, the mean salary of a qualified engineer is defined as 35€/hour. This value will be used to calculate the personnel costs of the project.

Next up, several software programs have been used during the development of this project. Names and license prices are reflected in 1.1. All those give a value of:

Software	License Cost
SolidWorks 2017	3.995 €
Adobe Illustrator CS6	579 €
Simplify3D	149 €

Table 1.1: Software license prices.

$$cost_{software} = 4723 € \tag{1.1}$$

The hardware equipment include a computer and two Wanhao 3D printers. Other mechanical tools were used during manufacture, but their use is so brief that it is not worth mentioning. The computer, when using its graphics adapter, has an electrical consumption of around 200W, and the 3D printers are powered by 250W. Computer work is the most time demanding part of the project, so about 480h computer work is considered. 3D printing time goes up to 60 days (1440h). Those figures give a total consumption of 456kWh. By using a value of 0.12€/kWh, te final electrical cost is:

$$cost_{electrical} = 54.72 € \tag{1.2}$$

The computer had a cost of 2300€. Considering a lifetime of five years, the equivalent use-cost would be a 20% of the original, giving:

$$cost_{computer} = 460 € \tag{1.3}$$

A similar approach is taken for the 3D printer. They had a cost of 370 €. Considering a lifetime of 3 years of non-continuous printing, the equivalent cost is:

$$cost_{printer} = 123.33 € \tag{1.4}$$

Regarding manpower, it is estimated that to finish the project, about 750h were needed, thus:

$$cost_{manpower} = 26,250 € \tag{1.5}$$

Table 1.2: Paid resources used in the project

Books	NASA Saturn V Manual	1	27,7	27,7
	Apollo 11 Manual	1	27,7	27,7
Documents	Official Documents	3	4	12
	Official Drawings	6	3	18

Some investigation resources had to be acquired in order to get information for developing the project, and some of those had a price. Table 1.2 shows a summary of the resource's prices. Those give a value of:

$$cost_{resources} = 85.40 \text{£} \tag{1.6}$$

Finally, for building the model, lots of materials were needed, and some of them required post-processing or special protection equipment. A summary of all the materials, processing and complements is shown in table 1.3.

The total material cost goes up to: Those give a value of:

$$cost_{material} = 474.68 \text{£} \tag{1.7}$$

With all those values in mind, the total project's budget can be calculated and its value is: Those give a value of:

$$Budget_{TOTAL} = 32,171.13 \text{£} \tag{1.8}$$

Contept	Type	Quantity	Price	Total
PVC Pipe	200x3000mm	1	30	30
Glues	PVC Welder 125ml	1	6,25	6,25
	Universal Cianoacrylate Gel	10	7,9	79
Paint	Synthetic White	1	36,8	36,8
	Synthetic Black	0,5	52	26
	Spray Primer	1	5,5	5,5
	Spray Pearl Grey	4	3,5	14
	Spray Silver Grey	1	5,5	5,5
	Spray Dark Grey	2	3,5	7
	Spray Chrome	1	4,5	4,5
	Spray White	1	6,5	6,5
Wood	2mm Circular	2	1,09	2,18
	3x3x1000mm Square (6u)	2	4,5	9
	1mx1mx3mm Planch	1	12	12
Tape	Paper 25mmx50m	1	2,15	2,15
Pen Board	1000x700x3mm	2	9,05	18,1
Printing Filament	PLA 1,75mm 1kg White	3	19,9	59,7
	PLA 1,75mm 1kg Black	2	19,9	39,8
	PLA 1,75mm 1kg Gray	3	19,9	59,7
Complements	PVC Cuts	1	25	25
	Chemical Protection Mask	1	26	26

Table 1.3: Materials and related costs