



UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Departament de Projectes d'Enginyeria

ETSEIAT
Departament de Projectes d'Enginyeria

CubeSats for the monitoring of space debris

DebrEyes

Deliverable 3

Cost and Procurement Management

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Summary

This document presents an estimation of the costs of the DebrEyes project. For this purpose, a division of the costs into different categories is performed. The types of costs which will be used are the following:

- Human Resources (HHRR)
- Indirect Costs (IC)
- Information Technologies (IT) – which are actually part of the IC, but considered separately for clarity
- Facilities
- Materials
- Outsources Costs

The *Cumulative Cost Curve* and *Budget at Completion* are calculated from the previous estimations and the scope and time management performed in deliverable D2.

The make or buy decisions and the Statements Of Work (SOW) of each of the outsourcing activities are also determined in the final part of this document.



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1 Cost estimating

1.1 Cost estimating

The level of accuracy of the present budget is the same used by any international or national monetary entity, up to cents of money unit (€ in our case).

In the case rounding is necessary it will follow the standard criteria described below:

$$\begin{cases} 10,000.0049 \cong 10,000.00 \\ 10,000.0050 \cong 10,000.01 \end{cases}$$

1.2 Cost estimation worksheet

In the subsections 1.2.1 to 1.2.6, all the activities, separated regarding the type of expense (i.e. Human Resources, Information Technologies, other Indirect Costs, facility costs, material costs, outsourcing costs), are presented in a list, together with their respective costs.

Each type of activity follows a different criterion for its cost computation, which is attached in its associated table.

1.2.1 Human resources

List of all human resources included in each task (Table 1). The activity cost computation method is described in section 1.3.1.

Table 1. List of HHRR activities' cost

WBS_ID	Title	Type	Activity Cost [€]
1.	PROJECT MANAGEMENT		
1.1.	<i>PM.M</i>	HHRR	4,912.79
	<i>PM.S</i>	HHRR	1,765.54
1.2.	<i>PM.M</i>	HHRR	48,770.64
	<i>PM.S</i>	HHRR	17,526.95
1.3.	<i>PM.S</i>	HHRR	1,765.54
	<i>PM.M</i>	HHRR	1,926.04
1.4.	<i>PM.S</i>	HHRR	5,359.41
	<i>PM.M</i>	HHRR	1,765.54
1.5.	<i>PM.S</i>	HHRR	2,840.21
	<i>QM.M</i>	HHRR	1,458.49
	<i>QM.S</i>	HHRR	4,912.79
	<i>PM.M</i>	HHRR	4,912.79



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WBS_ID	Title	Type	Activity Cost [€]
2.	ADMINISTRATION		
2.1	HHRR		
	HR.M	HHRR	10,844.43
2.1.1.	AS.M	HHRR	7,913.51
	AS.S	HHRR	6,741.13
	HR.M	HHRR	135,555.42
2.1.2.	AS.M	HHRR	98,918.82
	AS.S	HHRR	84,264.18
2.2.	FINANCES		
	PM.M	HHRR	9,378.97
2.2.1.	FM	HHRR	7,766.96
	AS.M	HHRR	3,956.75
	AS.S	HHRR	3,370.57
2.3.	PROCUREMENT		
2.3.1.	SD.M	HHRR	18,904.49
2.3.2.	SD.M	HHRR	21,605.13
	C.M	HHRR	18,590.46
	SD.M	HHRR	33,007.83
2.3.3.	FM	HHRR	40,684.07
	AS.M	HHRR	20,725.85
	AS.S	HHRR	17,655.35
2.4.	SALES		
2.4.1.	C.M	HHRR	16,266.65
2.4.2.	C.M	HHRR	17,041.25
4.	QUALITY		
4.1.	QM.M	HHRR	24,864.00
	QM.S	HHRR	12,768.00
4.2.	QM.M	HHRR	24,864.00
4.3.	QM.M	HHRR	28,416.00
	QM.S	HHRR	14,592.00
4.4.	QM.M	HHRR	24,787.28
	QM.S	HHRR	12,728.60
4.5.	QM.M	HHRR	2,711.11
	QM.S	HHRR	1,392.19



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WBS_ID	Title	Type	Activity Cost [€]
5.	ENGINEERING		
5.1.	DEVELOPMENT OF STATE OF THE ART		
5.1.1.	SpE2	HHRR	14,738.38
	SpE.M	HHRR	14,738.38
5.1.2.	SeE.M	HHRR	33,792.00
	TUD.EXT1	HHRR	22,528.00
	SeE	HHRR	13,376.00
5.1.3.1.	TE.M	HHRR	22,107.57
	TE1	HHRR	17,041.25
	TE2	HHRR	8,750.91
	SN.EXT	HHRR	22,107.57
5.1.3.2.	TE.M	HHRR	11,053.79
	TE1	HHRR	8,520.63
	TE2	HHRR	4,375.46
	SN.EXT	HHRR	11,053.79
5.1.3.3.	TE2	HHRR	3,646.21
5.1.4.	ACE	HHRR	4,912.79
	TUDM.EXT	HHRR	7,369.19
5.1.5.	SpE1	HHRR	5,104.70
	SpE2	HHRR	12,896.08
	SpE.M	HHRR	12,896.08
5.1.6.	EE.M	HHRR	16,580.68
	EE	HHRR	6,563.19
	I.EXT1	HHRR	16,580.68
5.1.7.	TCE.M	HHRR	22,107.57
	TCE	HHRR	8,750.91
	I.EXT2	HHRR	22,107.57
5.1.8.	StE.M	HHRR	22,107.57
	StE	HHRR	8,750.91
	SpE1	HHRR	8,750.91



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WBS_ID	Title	Type	Activity Cost [€]
5.1.9.1.	<i>SE.M</i>	HHRR	20,265.27
	<i>SE1</i>	HHRR	20,265.27
	<i>SE2</i>	HHRR	8,021.67
5.1.9.2.	<i>SE.M</i>	HHRR	33,161.36
	<i>SE2</i>	HHRR	13,126.37
	<i>TUDM.EXT</i>	HHRR	33,161.36
5.2.	DEVELOPMENT OF THE PRELIMINARY DESIGN		
5.2.1.	<i>SeE.M</i>	HHRR	36,845.95
	<i>SeE</i>	HHRR	14,584.86
	<i>TUD.EXT1</i>	HHRR	24,563.97
5.2.2.1.	<i>TE.M</i>	HHRR	22,107.57
	<i>TE2</i>	HHRR	8,750.91
	<i>SN.EXT</i>	HHRR	22,107.57
5.2.2.2.1.	<i>TE.M</i>	HHRR	11,053.79
	<i>TE2</i>	HHRR	4,375.46
	<i>SN.EXT</i>	HHRR	11,053.79
5.2.2.2.2.	<i>TE.M</i>	HHRR	16,580.68
	<i>TE1</i>	HHRR	12,780.94
	<i>TE2</i>	HHRR	6,563.19
5.2.2.3.	<i>TE.M</i>	HHRR	22,107.57
	<i>TE1</i>	HHRR	17,041.25
	<i>TE2</i>	HHRR	8,750.91
5.2.2.4.	<i>TE.M</i>	HHRR	3,684.60
5.2.3.	<i>ACE.M</i>	HHRR	11,053.79
	<i>ACE</i>	HHRR	7,369.19
	<i>TUDM.EXT</i>	HHRR	11,053.79
5.2.4.	<i>EE.M</i>	HHRR	11,053.79
	<i>EE</i>	HHRR	4,375.46
	<i>I.EXT1</i>	HHRR	11,053.79
5.2.5.	<i>TCE.M</i>	HHRR	11,053.79
	<i>TCE</i>	HHRR	4,375.46
	<i>I.EXT2</i>	HHRR	11,053.79



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WBS_ID	Title	Type	Activity Cost [€]
5.2.6.1.	SE.M	HHRR	11,053.79
	SE2	HHRR	4,375.46
	TUDM.EXT	HHRR	11,053.79
5.2.6.2.	SE.M	HHRR	7,369.19
	SE1	HHRR	7,369.19
5.2.7.	StE.M	HHRR	33,161.36
	StE	HHRR	13,126.37
	I.EXT3	HHRR	33,161.36
5.2.8.	T.M	HHRR	4,068.41
5.3.	DEVELOPMENT OF THE FINAL DESIGN		
5.3.1.	SeE.M	HHRR	21,120.00
	SeE	HHRR	8,360.00
	TUD.EXT1	HHRR	14,080.00
	TUD.EXT2	HHRR	21,120.00
5.3.2.1.	TE.M	HHRR	33,792.00
	TE2	HHRR	13,376.00
	SN.EXT	HHRR	33,792.00
5.3.2.2.	TE.M	HHRR	6,632.27
	TE2	HHRR	2,625.27
	TUDM.EXT	HHRR	6,632.27
5.3.2.3.	TE.M	HHRR	4,421.51
	TE1	HHRR	3,408.25
	TE2	HHRR	1,750.18
5.3.2.4.	TE.M	HHRR	1,842.30
5.3.3.	ACE	HHRR	3,537.21
	TUDM.EXT	HHRR	5,305.82
5.3.4.	SpE.M	HHRR	11,053.79
	SpE1	HHRR	4,375.46
	SpE2	HHRR	11,053.79
5.3.5.	EE.M	HHRR	4,421.51
	EE	HHRR	1,750.18
	I.EXT1	HHRR	4,421.51
5.3.6.	TCE.M	HHRR	3,868.82
	TCE	HHRR	1,531.41
	I.EXT2	HHRR	3,868.82



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WBS_ID	Title	Type	Activity Cost [€]
5.3.7.1.	SE.M	HHRR	11,053.79
	SE2	HHRR	4,375.46
	TUDM.EXT	HHRR	11,053.79
5.3.7.2.	SE.M	HHRR	5,526.89
	SE1	HHRR	5,526.89
	StE.M	HHRR	5,526.89
5.3.8.	StE	HHRR	2,187.73
	SpE1	HHRR	2,187.73
	ME.M	HHRR	5,526.89
	ME	HHRR	3,684.60
	I.EXT3	HHRR	5,526.89
	TUDM.EXT	HHRR	5,526.89
	StE.M	HHRR	22,107.57
5.3.9.	StE	HHRR	8,750.91
	I.EXT3	HHRR	22,107.57
5.4.	MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT		
5.4.1.	ME.M	HHRR	8,039.12
	ME	HHRR	5,359.41
	SpE1	HHRR	3,182.15
	I.EXT1	HHRR	8,039.12
5.4.2.	ME.M	HHRR	8,039.12
	ME	HHRR	5,359.41
	SpE1	HHRR	3,182.15
	I.EXT2	HHRR	8,039.12
5.4.3.	ME.M	HHRR	8,039.12
	ME	HHRR	5,359.41
	SpE1	HHRR	3,182.15
	I.EXT3	HHRR	8,039.12
5.4.4.	ME.M	HHRR	8,039.12
	ME	HHRR	5,359.41
	SpE1	HHRR	3,182.15
	I.EXT4	HHRR	8,039.12



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WBS_ID	Title	Type	Activity Cost [€]
5.4.6.	SE.M	HHRR	5,526.89
	SE2	HHRR	2,187.73
	SpE2	HHRR	5,526.89
	TUDM.EXT	HHRR	5,526.89
5.4.7.	ME.M	HHRR	24,117.35
	ME	HHRR	16,078.23
	SpE2	HHRR	24,117.35
5.5.6.	SE1	HHRR	6,431.29
5.5.7.	T.M	HHRR	3,883.48

1.2.2 Indirect general costs

List of all indirect costs associated with each task performed in the project (Table 2). The cost is proportional to the duration of the task by the indirect general cost per hour. Further detail about the activity cost computation method is described in section 1.3.2.

Table 2. List of Indirect costs of activities

WBS_ID	Type	Activity Cost [€]
1.	PROJECT MANAGEMENT	
1.1.	Indirect Costs	97.40
1.2.	Indirect Costs	966.96
1.3.	Indirect Costs	97.40
1.4.	Indirect Costs	106.26
1.5.	Indirect Costs	58.44
2.	ADMINISTRATION	
2.1.	HHRR	
2.1.1.	Indirect Costs	241.74
2.1.2.	Indirect Costs	7,103.46
2.2.	FINANCES	
2.2.1.	Indirect Costs	92.98
2.3.	PROCUREMENT	
2.3.1.	Indirect Costs	1,115.73
2.3.2.	Indirect Costs	637.56
2.3.3.	Indirect Costs	487.02
2.4.	SALES	
2.4.1.	Indirect Costs	1,115.73
2.4.2.	Indirect Costs	1,168.86



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WBS_ID	Type	Activity Cost [€]
4.	QUALITY	
4.1.	Indirect Costs	7,363.80
4.2.	Indirect Costs	7,270.82
4.3.	Indirect Costs	1,487.64
4.4.	Indirect Costs	850.08
4.5.	Indirect Costs	92.98
5.	ENGINEERING	
5.1.	<i>DEVELOPMENT OF STATE OF THE ART</i>	
5.1.1.	Indirect Costs	389.62
5.1.2.	Indirect Costs	487.02
5.1.3.1.	Indirect Costs	292.21
5.1.3.2.	Indirect Costs	155.85
5.1.3.3.	Indirect Costs	487.02
5.1.4.	Indirect Costs	194.81
5.1.5.	Indirect Costs	233.77
5.1.6.	Indirect Costs	292.21
5.1.7.	Indirect Costs	389.62
5.1.8.	Indirect Costs	389.62
5.1.9.1.	Indirect Costs	350.66
5.1.9.2.	Indirect Costs	584.43
5.2.	<i>DEVELOPMENT OF THE PRELIMINARY DESIGN</i>	
5.2.1.	Indirect Costs	642.87
5.2.2.1.	Indirect Costs	194.81
5.2.2.2.1.	Indirect Costs	97.40
5.2.2.2.2.	Indirect Costs	292.21
5.2.2.3.	Indirect Costs	389.62
5.2.2.4.	Indirect Costs	194.81
5.2.3.	Indirect Costs	194.81
5.2.4.	Indirect Costs	194.81
5.2.5.	Indirect Costs	194.81
5.2.6.1.	Indirect Costs	194.81
5.2.6.2.	Indirect Costs	194.81
5.2.7.	Indirect Costs	584.43
5.2.8.	Indirect Costs	194.81



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WBS_ID	Type	Activity Cost [€]
5.3.	DEVELOPMENT OF THE FINAL DESIGN	
5.3.1.	Indirect Costs	2,922.14
5.3.2.1.	Indirect Costs	389.62
5.3.2.2.	Indirect Costs	116.89
5.3.2.3.	Indirect Costs	77.92
5.3.2.4.	Indirect Costs	58.44
5.3.3.	Indirect Costs	136.37
5.3.4.	Indirect Costs	97.40
5.3.5.	Indirect Costs	77.92
5.3.6.	Indirect Costs	77.92
5.3.7.1.	Indirect Costs	194.81
5.3.7.2.	Indirect Costs	155.85
5.3.8.	Indirect Costs	38.96
5.3.9.	Indirect Costs	389.62
5.4.	MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT	
5.4.1.	Indirect Costs	106.26
5.4.2.	Indirect Costs	106.26
5.4.3.	Indirect Costs	106.26
5.4.4.	Indirect Costs	106.26
5.4.6.	Indirect Costs	77.92
5.4.7.	Indirect Costs	425.04
5.5.	DEVELOPMENT OF SIMULATION, TESTING AND VALIDATION	
5.5.6.	Indirect Costs	340.03
5.5.7.	Indirect Costs	185.95



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1.2.3 Information technology

List of all IT included in each task (Table 3). If two different software programs are necessary to perform a task there will appear two rows with the same task ID. The activity cost computation method is described in section 1.3.3.

Table 3. List of IT costs of activities

WBS_ID	Title	Type	Activity Cost [€]
1.	PROJECT MANAGEMENT		
1.1.	SOFT.5	IT	26.83
1.2.	SOFT.5	IT	266.34
1.3.	SOFT.5	IT	26.83
4.	QUALITY		
4.1.	SOFT.4	IT	4,912.79
4.2.	SOFT.4	IT	453.28
4.3.	SOFT.4	IT	447.56
4.4.	SOFT.4	IT	91.57
4.5.	SOFT.4	IT	52.33
5.	ENGINEERING		
5.2.	DEVELOPMENT OF THE PRELIMINARY DESIGN		
5.2.6.1.	SOFT.2	IT	5.72
5.2.6.2.	SOFT.2	IT	338.46
5.2.7.	SOFT.1	IT	338.46
	SOFT.4	IT	3,300.00
5.3.	DEVELOPMENT OF THE FINAL DESIGN		
5.3.3.	SOFT.2	IT	35.97
5.3.4.	SOFT.2	IT	236.92
5.3.5.	SOFT.6	IT	169.23
5.3.7.1.	SOFT.2	IT	880.00
5.3.7.2.	SOFT.2	IT	338.46
	SOFT.1	IT	270.77
5.3.8.	SOFT.2	IT	220.00
	SOFT.4	IT	67.69
5.3.9.	SOFT.1	IT	2.40
	SOFT.4	IT	2,200.00
5.5.	DEVELOPMENT OF SIMULATION, TESTING AND VALIDATION		
5.5.6.	SOFT.7	IT	23.98



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1.2.4 Facilities

List of all facilities costs associated with tasks performed in the project (Table 4). As an introductory table the product of its VC (Variable Costs) with the total usage time in days mainly determines the activity cost. Further detail about the activity cost computation method is described in section 1.3.4.

Table 4. List of facility costs of activities

WBS_ID	Title	Type	VC [€/Day]	Units [Days]	Activity Cost [€]
5.	ENGINEERING				
<i>5.4.</i>	<i>MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT</i>				
5.4.1.	<i>F.EXT</i>	Facilities	400	20	8,374.08
5.4.2.	<i>F.EXT</i>	Facilities	400	20	8,374.08
5.4.3.	<i>F.EXT</i>	Facilities	400	20	8,374.08
5.4.4.	<i>F.EXT</i>	Facilities	400	20	8,374.08
5.4.6.	<i>F.EXT</i>	Facilities	400	15	5,757.18
5.4.7.	<i>F.EXT</i>	Facilities	400	60	25,122.24

1.2.5 Materials

List of all material costs associated with tasks performed in the project (Table 5). As an introductory table the product of its VC with the total units required mainly determines the activity cost. Further detail about the activity cost computation method is described in section 1.3.5.

Table 5. List of material costs of activities

WBS_ID	Title	Type	VC [€/unit]	Units	Activity Cost [€]
5.	ENGINEERING				
<i>5.4.</i>	<i>MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT</i>				
	<i>M.CM1</i>	Materials	8500	1	10,200.00
5.4.1.	<i>M.CM2</i>	Materials	4500	1	5,400.00
	<i>M.CM3</i>	Materials	150000	1	180,000.00
	<i>M.AT1</i>	Materials	3900	1	4,680.00
5.4.2.	<i>M.AT2</i>	Materials	8000	1	9,600.00
	<i>M.AT3</i>	Materials	12000	1	14,400.00
	<i>M.AT4</i>	Materials	18000	1	21,600.00
5.4.3.	<i>M.E1</i>	Materials	5500	1	6,600.00
	<i>M.E2</i>	Materials	2500	1	3,000.00
5.4.4.	<i>M.TC</i>	Materials	5500	1	6,600.00
5.4.6.	<i>M.SF</i>	Materials	4500	1	4,950.00



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1.2.6 Outsources costs

List of all outsourcing costs associated with tasks performed in the project (Table 6). As an introductory table the product of its VC cost with the total number of time this activity is outsourced mainly determines the activity cost. Further detail about the activity cost computation method is described in section 1.3.6.

Table 6. List of outsourcing costs of activities

WBS_ID	Title	Type	VC [€/unit]	Units	Activity Cost [€]
3.	MARKETING				
3.1.	OUT7	Outsourcing	12,500	1	13,125.00
3.2.	OUT8	Outsourcing	15,000	1	15,750.00
3.3.	OUT9	Outsourcing	10,000	1	11,000.00
5.	ENGINEERING				
5.4.	MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT				
5.4.5.	OUT6	Outsourcing	35,000	1	42,000.00
5.5.	DEVELOPMENT OF SIMULATION, TESTING AND VALIDATION				
5.5.1.	OUT1	Outsourcing	45,000	1	54,000.00
5.5.2.	OUT2	Outsourcing	35,000	1	42,000.00
5.5.3.	OUT3	Outsourcing	30,000	1	36,000.00
5.5.4.	OUT4	Outsourcing	25,000	1	30,000.00
5.5.5.	OUT5	Outsourcing	40,000	1	48,000.00

1.3 Activity cost estimation

First of all, in the subsections 1.3.1 to 1.3.6, an explanation of all the costs considered and how they are calculated is given. The costs which are taken into account are the following ones:

- Human resources (HHRR)
- Indirect general costs
- Information Technology (IT)
- Facility
- Materials
- Outsources costs

Then, in the last subsection, there is a data collection and calculation of costs for each task considering the previous costs.



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1.3.1 Human resources

Human resources are taken into account as indirect cost, because all the staff are already working in the company before DebrEyes project. In Table 7, all perceived monthly wages are contrasted with standard wages in Spain for each individual position, extracted from various job statistics sources¹. Wages are up scaled with a factor k which accounts taxes and National Insurance. This factor is typically 2, but for an SME with less intended profit, it will be 1.7. In addition, each similar related jobs have higher wages depending on the level of responsibility, for instance:

PM > TM > Expert Eng. > Senior Eng. > Junior Eng.

Table 7. Salaries per category

Description of the resource	Level of knowledge	Perceived wage per month [€/month]	Perceived wage per hour [€/h]	K factor	Average Salary [€/h]	Resource ID
Administrative Services Manager	4 - Expert	2500	15.625	1.7	27	AS.M
Communication Manager	4 - Expert	3500	21.875	1.7	37	C.M
Engineer	1 - Junior	1800	11.25	1.7	19	EE SE2 SeE SpE1 StE TCE TE2
Engineer	2 - Average	3000	18.75	1.7	32	ACE ME TUD.EXT1
Engineer	3 - Senior	3500	21.875	1.7	37	TE1
Engineer	4 - Expert	4500	28.125	1.7	48	SE1 SpE2 I.EXT1 I.EXT2 I.EXT3 I.EXT4 SN.EXT TUD.EXT2 TUDM.EXT

¹ Laboris. [Online][Cited: 07/11/2015]. <http://www.laboris.net/>



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Description of the resource	Level of knowledge	Perceived wage per month [€/month]	Perceived wage per hour [€/h]	K factor	Average Salary [€/h]	Resource ID
Engineering Manager	3 - Senior	4500	28.125	1.7	48	EE.M
						ME.M
						SE.M
						SeE.M
						SpE.M
						StE.M
						TCE.M
						TE.M
						ACE.M
Financial Manager	4 - Expert	5000	31.25	1.7	53	FM
Human Resources Manager	4 - Expert	3500	21.875	1.7	37	HR.M
Project Manager	4 - Expert	6000	37.5	1.7	64	PM.M
Quality Manager	3 - Senior	3500	21.875	1.7	37	QM.M
Sales Department Manager	4 - Expert	4000	25	1.7	43	SD.M
Secretary	1 - Junior	1800	11.25	1.7	19	QM.S
Administrative Services Manager	4 - Expert	2500	15.625	1.7	27	AS.M
Secretary	1 - Junior	1800	11.25	1.7	19	QM.S



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1.3.2 Indirect general costs

These costs are common in each task and are not only spend in DebrEyes project. Considering this project with a weight of 40% of the company activity, a factor of 0.4 is taken into account in each item. These Indirect Costs (IC) are:

- Rental of office
- Computers
- Microsoft Office
- Office materials
- Security
- Electricity
- Cleaning

The sum of the duration of all the tasks (2,321 h) is considered to calculate the cost per task's hour of each item (Table 8).

The Microsoft Office license price is obtained from the official website for SME and the office materials considering for two years is 4000€ and also one computer for worker is supposed. Security cost is extracted from average salaries in Spain². However, cleaning services are calculated from a fix amount of hours per year and a cost of 10 €/h (average salary³). Moreover, electricity considers the average cost of a SME in Spain which are 17,000 kWh⁴ per year with a cost of 0.106 €/kWh and, finally, the rental of the office is considered 2000€/month taking into account the average of office's prices⁵. In the column of cost, there are the total cost for two years of the project of each item.

² Seguridad privada. *Salarios en Seguridad Privada 2012*. [Online] [Cited: 07/11/2015] <http://www.seguridad-privada.net/seguridad-privada-salario.html>

³ Etece. *Limpeza de oficinas por horas*[Online] [Cited: 07/11/2015] <http://etece.es/limpieza-oficinas-madrid>

⁴ Territorio PYME[Online] [Cited: 07/11/2015] http://cincodias.com/cincodias/2015/03/17/pyme/1426626536_608110.html

⁵ Idealista. *Alquiler de oficinas* [Online] [Cited:11/11/2015] http://www.idealista.com/alquiler-oficinas/barcelona/baix-lobregat-sud/con-metros-cuadrados-mas-de_500,metros-cuadrados-menos-de_750/pagina-2.htm?ordenado-por=precio-asc



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Table 8. Indirect general costs calculation

	Number	Price [€/unit]	Cost [€]	€/h
Rental of Office	-	-	48,000	8.27
Office Materials	-	-	4,000	0.69
Microsoft Office	40	30	960	0.17
Computers	40	500	8,000	1.38
Security	2	14,000	11,200	1.93
	kWh per year	Price [€/kWh]	Cost [€]	€/h
Electricity	17,000	0.106	720.8	0.31
	Hours per year	Price [€/h]	Cost [€]	€/h
Cleaning	1,440	10	11,520	4.96
			Total general IC [€/h]	48,000

1.3.3 Information technology

The software needed in our company is considered. IT is considered in indirect costs, because the programs are also used in other projects of the company, so that a factor of 0.4 is applied too. The used IT are the following:

- ANSYS Workbench
- MATLAB R2015b
- SOLIDWORKS
- Project Management and Documentation
- LTspice
- Flexsim Simulation Software

The prices of their licenses are obtained from their official websites.

The Table 9 considers the price of licenses per year and the cost is the total amount spend in two years (duration of the DebrEyes project). In the following table the total amount of hours that is needed of each software is detailed and, in the final cost per hour, the factor previously explained is applied.

Table 9. Software costs calculation

Software	Resource ID	€/Year License	Cost [€]	Total task hours [h]	€/h
ANSYS Workbench	SOFT.1	6,500	13,000	52	100
MATLAB R2015b	SOFT.2	2,000	4,000	52	30.77
SOLIDWORKS	SOFT.4	1,300	2,600	954	1.09
Project Management and Documentation	SOFT.5	500	1,000	82	4.88
LTspice	SOFT.6	1,000	2,000	4	200
Flexsim Simulation Software	SOFT.7	2,000	4,000	16	100



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1.3.4 Facilities

In this case, the facility is Sener Clean-Room and is considered as a direct cost, because it is only used in DebrEyes project. It is calculate following a three point estimation. The result is obtained in euros per day of the task (Table 10).

Table 10. Facility cost calculation

	Resource ID	Optimistic cost	Most likely cost	Pessimistic cost	Weighting equation	€/DayDuration
Sener Clean-room	F.EXT	300	400	500	$(o+4m+p)/6$	400

1.3.5 Materials

In this section, the materials costs are shown. They are direct cost, because they are only used in this project. The materials considered are the following ones:

- On-board communications
 - UHF downlink
 - Deployable Antenna
 - IR Camera Prototype
- Attitude control
 - Inertia wheel
 - ISIS Magnetorquer Board
 - Digital Fine Sun Sensor
 - NSS Magnetometer
- Energy
 - Batteries
 - Solar panels
- Thermal control
- On-board software
 - On-board computer



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In Table 11 the cost of each material is shown.

Table 11. Materials costs⁶

Materials	Resource ID	Cost [€]
<i>On-board communications - UHF downlink</i>	M.CM1	8,500
<i>On-board communications - Deployable Antenna</i>	M.CM2	4,500
<i>On-board communications - IR Camera Prototype</i>	M.CM3	150,000
<i>Attitude control - Inertia wheel</i>	M.AT1	3,900
<i>Attitude control - ISIS Magnetorquer Board</i>	M.AT2	8,000
<i>Attitude control - Digital Fine Sun Sensor</i>	M.AT3	12,000
<i>Attitude control - NSS Magnetometer</i>	M.AT4	18,000
<i>Energy - Batteries</i>	M.E1	5,500
<i>Energy - Solar panels</i>	M.E2	2,500
<i>Thermal control</i>	M.TC	5,500
<i>On-board software - On Board Computer</i>	M.SF	4,500

⁶ CubeSatShop. [Online] [Cited: 07/11/2015].
<http://www.CubeSatshop.com/>



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1.3.6 Outsources costs

In this section, the outsources costs are shown, they are considered direct cost due to the fact that they are only needed in DebrEyes project and not in other company's projects (Table 12).

Table 12. Outsources costs

Outsources	Resource ID	Cost [€]
<i>Infrared Camera Testing</i> ⁷	OUT1	45,000
<i>Telecommunications ground testing</i> ⁸	OUT2	35,000
<i>Constellation simulation</i>	OUT3	30,000
<i>Energy testing</i> ⁹	OUT4	25,000
<i>Structures testing</i> ¹⁰	OUT5	40,000
<i>Manufacturing of the structure subsystem prototype</i> ¹¹	OUT6	35,000
<i>Website development</i> ¹²	OUT7	12,500
<i>Social Media management</i> ¹³	OUT8	15,000
<i>Development of the Communication plan</i>	OUT9	10,000

⁷ Optikos. *Camera Testing Services*. [Online] [Cited: 07/11/2015]. <http://www.optikos.com/camera-testing/>

⁸ Capgemini. *Testing&Quality Assurance for Telecoms*. [Online] [Cited: 07/11/2015]. <https://www.capgemini.com/testing-services/testing-quality-assurance-for-telcos>

⁹ NTS. *Energy Testing Services*. [Online] [Cited: 07/11/2015]. https://www.nts.com/services/industry_specific/energy

¹⁰ DAYTON T.BROWN. *Structural Testing and Fatigue Testing Services*. [Online] [Cited: 07/11/2015]. <http://www.dtbtest.com/structural-fatigue-testing.aspx>

¹¹ GUTMAR. *Precision machining & engineering*. [Online] [Cited: 07/11/2015]. <http://www.gutmar.com/>

¹² Cynere. *Custom Web Development*. [Online] [Cited: 07/11/2015]. http://cynere.com/ad-web-development-india?gclid=CLSak7z6_sgCFasEwwodBDQCaA

¹³ Witty Orange. *Web content & social media services*. [Online] [Cited: 07/11/2015]. http://wittyorange.com/?gclid=CN-V3uD6_sgCFSQHwwodHEUEsw



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1.3.7 Activity cost estimation table

In this section, there is a data collection and calculation for each task considering the previous costs, as well as the confidence level, which determines the reserve and the range estimation. These confidence levels are:

- For non-critical tasks such as administrative: A
- For medium critical tasks: B
- For high critical tasks, such as testing and validations: C

Moreover, the reserve and the range estimation applied in Table 14 are calculated using the criterion of Table 13. In Table 14, Direct Costs is abbreviated as DC, and Indirect Costs as IC.

Table 13. Confidence level parameters

Confidence	Reserve	Range
A	5%	±0%
B	10%	±5%
C	20%	±10%

Table 14. Activity cost estimation

WBS ID	Resources				DC [€]	IC [€]	Reserve [€]	Estimate [€]	Range Low [€]	Range High [€]	Confidence Level
	HHRR	IT	Facilities	Materials							
1. PROJECT MANAGEMENT											
1.1.	PM.M PM.S	SOFT.5 SOFT.3	-	-	0	6,184	618	6,803	6,493	7,112	B
1.2.	PM.M PM.S	SOFT.5 SOFT.3	-	-	0	64,315	3,216	67,531	67,531	67,531	A
1.3.	PM.M PM.S	SOFT.5 SOFT.3	-	-	0	6,184	618	6,803	6,493	7,112	B
1.4.	PM.M PM.S	-	-	-	0	6,160	1,232	7,392	6,776	8,008	C
1.5.	PM.M PM.S QM.M QM.S	SOFT.3	-	-	0	10,032	1,003	11,035	10,534	11,537	B
2. ADMINISTRATION											
2.1. HHRR											
2.1.1.	HR.M AS.S AS.M	-	-	-	0	24,515	1,226	25,741	25,741	25,741	A
2.1.2.	HR.M AS.S AS.M	-	-	-	0	310,326	15,516	325,842	325,842	325,842	A



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WBS ID	Resources				DC [€]	IC [€]	Reserve [€]	Estimate [€]	Range Low [€]	Range High [€]	Confidence Level
	HHRR	IT	Facilities	Materials							
2.2.	FINANCES										
2.2.1.	PM.M FM AS.S AS.M	-	-	-	0	23,396	1,170	24,566	24,566	24,566	A
2.3.	PROCUREMENT										
2.3.1.	SD.M	-	-	-	0	19,067	953	20,020	20,020	20,020	A
2.3.2.	SD.M C.M	-	-	-	0	34,028	6,806	40,833	37,430	44,236	C
2.3.3.	SD.M AS.S AS.M FM	-	-	-	0	102,327	10,233	112,560	107,444	117,676	B
2.4.	SALES										
2.4.1.	C.M	-	-	-	0	16,555	828	17,382	17,382	17,382	A
2.4.2.	C.M	-	-	-	0	16,555	1,655	18,210	17,382	19,038	B
3.	MARKETING										
3.1.	C.M	SOFT.8	-	-	12,500	0	625	13,125	13,125	13,125	A
3.2.	C.M FM	SOFT.8	-	-	15,000	0	750	15,750	15,750	15,750	A
3.3.	C.M	SOFT.5 SOFT.3	-	-	10,000	0	1,000	11,000	10,500	11,500	B
4.	QUALITY										
4.1.	QM.M QM.S	SOFT.3 SOFT.4	-	-	0	43,285	2,164	45,449	45,449	45,449	A
4.2.	QM.M	SOFT.3 SOFT.4	-	-	0	31,031	1,552	32,582	32,582	32,582	A
4.3.	QM.M QM.S	SOFT.3 SOFT.4	-	-	0	37,156	7,431	44,587	40,872	48,303	C
4.4.	QM.M QM.S	SOFT.3 SOFT.4	-	-	0	32,015	6,403	38,418	35,217	41,620	C
4.5.	QM.M QM.S	SOFT.3 SOFT.4	-	-	0	4,002	200	4,202	4,202	4,202	A



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WBS ID	Resources				DC [€]	IC [€]	Reserve [€]	Estimate [€]	Range Low [€]	Range High [€]	Confidence Level
	HHRR	IT	Facilities	Materials							
5.	ENGINEERING										
<i>5.1.</i>	<i>DEVELOPMENT OF STATE OF THE ART</i>										
5.1.1.	SpE.M SpE2	SOFT.3	-	-	0	27,151	2,715	29,866	28,509	31,224	B
5.1.2.	SeE.M SeE TUD.EXT1	SOFT.3	-	-	0	63,803	6,380	70,183	66,993	73,373	B
5.1.3.1.	TE.M TE1 TE2 SN.EXT	SOFT.3	-	-	0	63,909	6,391	70,300	67,104	73,495	B
5.1.3.2.	TE.M TE1 TE2 SN.EXT	SOFT.3	-	-	0	31,963	3,196	35,160	33,561	36,758	B
5.1.3.3.	TE2	SOFT.3	-	-	0	3,757	376	4,133	3,945	4,321	B
5.1.4.	ACE TUDM.EXT	SOFT.3	-	-	0	11,343	1,134	12,477	11,910	13,044	B
5.1.5.	SpE1 SpE2 SpE.M	SOFT.3	-	-	0	28,301	2,830	31,131	29,716	32,546	B
5.1.6.	EE.M EE I.EXT1	SOFT.3	-	-	0	36,379	3,638	40,017	38,198	41,836	B
5.1.7.	TCE.M TCE I.EXT2	SOFT.3	-	-	0	48,505	4,851	53,356	50,930	55,781	B
5.1.8.	StE.M StE SpE1	SOFT.3	-	-	0	36,363	3,636	39,999	38,181	41,817	B
5.1.9.1.	SE.M SE.1 SE.2	SOFT.3	-	-	0	44,457	4,446	48,903	46,680	51,126	B
5.1.9.2.	SE.M SE.2 TUDM.EXT	SOFT.3	-	-	0	72,758	7,276	80,034	76,396	83,671	B



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WBS ID	Resources				DC [€]	IC [€]	Reserve [€]	Estimate [€]	Range Low [€]	Range High [€]	Confidence Level
	HHRR	IT	Facilities	Materials							
5.2.	DEVELOPMENT OF THE PRELIMINARY DESIGN										
5.2.1.	SeE.M SeE TUD.EXT1	SOFT.3	-	-	0	69,671	6,967	76,638	73,154	80,121	B
5.2.2.1.	TE.M TE2 SN.EXT	SOFT.3	-	-	0	48,328	4,833	53,161	50,744	55,577	B
5.2.2.1.	TE.M TE2 SN.EXT	SOFT.3	-	-	0	24,164	2,416	26,580	25,372	27,789	B
5.2.2.2.	TE.M TE1 TE2	SOFT.3	-	-	0	32,925	3,292	36,217	34,571	37,863	B
5.2.2.3.	TE.M TE1 TE2	SOFT.3	-	-	0	43,899	4,390	48,289	46,094	50,484	B
5.2.2.4.	TE.M	SOFT.3	-	-	0	3,527	353	3,879	3,703	4,056	B
5.2.3.	ACE.M ACE TUDM.EXT	SOFT.3	-	-	0	26,974	2,697	29,672	28,323	31,020	B
5.2.4.	EE.M EE I.EXT1	SOFT.3	-	-	0	24,253	2,425	26,678	25,465	27,890	B
5.2.5.	TCE.M TCE I.EXT2	SOFT.3	-	-	0	24,253	2,425	26,678	25,465	27,890	B
5.2.6.1.	SE.M SE2 TUDM.EXT	SOFT.3 SOFT.2	-	-	0	24,560	2,456	27,016	25,788	28,244	B
5.2.6.2.	SE.M SE1	SOFT.3 SOFT.2	-	-	0	13,883	1,388	15,272	14,577	15,966	B
5.2.7.	StE.M St.E I.EXT3	SOFT.1 SOFT.3 SOFT.4	-	-	0	75,790	7,579	83,369	79,580	87,159	B
5.2.8.	T.M	SOFT.3	-	-	0	3,876	388	4,263	4,069	4,457	B



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WBS ID	Resources				DC [€]	IC [€]	Reserve [€]	Estimate [€]	Range Low [€]	Range High [€]	Confidence Level
	HHRR	IT	Facilities	Materials							
5.3. DEVELOPMENT OF THE FINAL DESIGN											
5.3.1.	SeE.M SeE TUD.EXT1 TUD.EXT2	SOFT.3	-	-	0	61,456	6,146	67,602	64,529	70,675	B
5.3.2.1.	TE.M TE2 SN.EXT	SOFT.3	-	-	0	73,954	7,395	81,350	77,652	85,047	B
5.3.2.2.	TE.M TE2 TUDM.EXT	SOFT.3	-	-	0	14,552	1,455	16,007	15,279	16,734	B
5.3.2.3.	TE.M TE1 TE2	SOFT.3	-	-	0	8,780	878	9,658	9,219	10,097	B
5.3.2.4.	TE.M	SOFT.3	-	-	0	1,728	173	1,901	1,814	1,987	B
5.3.3.	ACE TUDM.EXT	SOFT.2 SOFT.3	-	-	0	8,378	838	9,216	8,797	9,635	B
5.3.4.	SpE.M SpE1 SpE2	SOFT.2 SOFT.3	-	-	0	24,318	2,432	26,750	25,534	27,966	B
5.3.5.	EE.M EE I.EXT1	SOFT.6 SOFT.3	-	-	0	10,501	1,050	11,551	11,026	12,076	B
5.3.6.	TCE.M TCE I.EXT2	SOFT.3	-	-	0	8,497	850	9,347	8,922	9,772	B
5.3.7.1.	SE.M SE2 TUDM.EXT	SOFT.3 SOFT.2	-	-	0	24,560	2,456	27,016	25,788	28,244	B
5.3.7.2.	SE.M SE1	SOFT.3 SOFT.2	-	-	0	10,437	1,044	11,480	10,959	12,002	B
5.3.8.	StE.M StE SpE1 ME.M ME I.EXT3 TUDM.EXT	SOFT.1 SOFT.2 SOFT.3 SOFT.4	-	-	0	27,724	2,772	30,497	29,110	31,883	B
5.3.9.	StE.M St.E I.EXT3	SOFT.1 SOFT.3 SOFT.4	-	-	0	50,527	5,072	55,580	53,053	58,106	B



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WBS ID	Resources				DC [€]	IC [€]	Reserve [€]	Estimate [€]	Range Low [€]	Range High [€]	Confidence Level
	HHRR	IT	Facilities	Materials							
5.4. MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT											
5.4.1.	ME.M ME SpE1 I.EXT1	SOFT.3	F.EXT	M.CM1 M.CM2 M.CM3	169,978	20,605	38,153	228,700	209,642	247,758	C
5.4.2.	ME.M ME SpE1 I.EXT2	SOFT.3	F.EXT	M.AT1 M.AT2 M.AT3 M.AT4	48,878	20,605	13,933	83,380	76,432	90,328	C
5.4.3.	ME.M ME SpE1 I.EXT3	SOFT.3	F.EXT	M.E1 M.E2	14,978	20,605	7,153	42,700	39,142	46,258	C
5.4.4.	ME.M ME SpE1 I.EXT4	SOFT.3	F.EXT	M.TC	12,478	20,605	6,653	39,700	36,392	43,008	C
5.4.5.	ME.M ME SpE1 I.EXT1	SOFT.3	F.EXT	-	35,000	0	7,000	42,000	38,500	45,500	C
5.4.6.	SE.M SE2 SpE2 TUDM.EXT	SOFT.3	F.EXT	M.SF	9,734	17,133	2,702	29,554	28,210	30,897	B
5.4.7.	ME.M ME SpE2	SOFT.3	F.EXT	-	20,935	53,948	15,061	89,860	82,372	97,349	C
5.5. DEVELOPMENT OF SIMULATION, TESTING AND VALIDATION											
5.5.1.	SeE TUD.EXT2	SOFT.3	-	-	45,000	0	9,000	54,000	49,500	58,500	C
5.5.2.	TE1 SN.EXT	SOFT.3	-	-	35,000	0	7,000	42,000	38,500	45,500	C
5.5.3.	SE1	SOFT.3	-	-	30,000	0	6,000	36,000	33,000	39,000	C
5.5.4.	EE.M	SOFT.3	-	-	25,000	0	5,000	30,000	27,500	32,500	C
5.5.5.	StE.M	SOFT.3	-	-	40,000	0	8,000	48,000	44,000	52,000	C
5.5.6.	SE1	SOFT.3 SOFT.7	-	-	0	7,243	1,420	8,691	7,967	9,416	C
5.5.7.	T.M	SOFT.3	-	-	0	3,876	190	4,069	4,069	4,069	A



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2 Cumulative costs

2.1 Cumulative cost curve

In the two following figures, the cost baseline is shown.

First, in Figure 1, the cumulative cost is shown at each week of the project, so that at its ending (week 104), the budget at completion is reached. Budget at completion, as indicated before in the document is estimated to be 3.0M€.

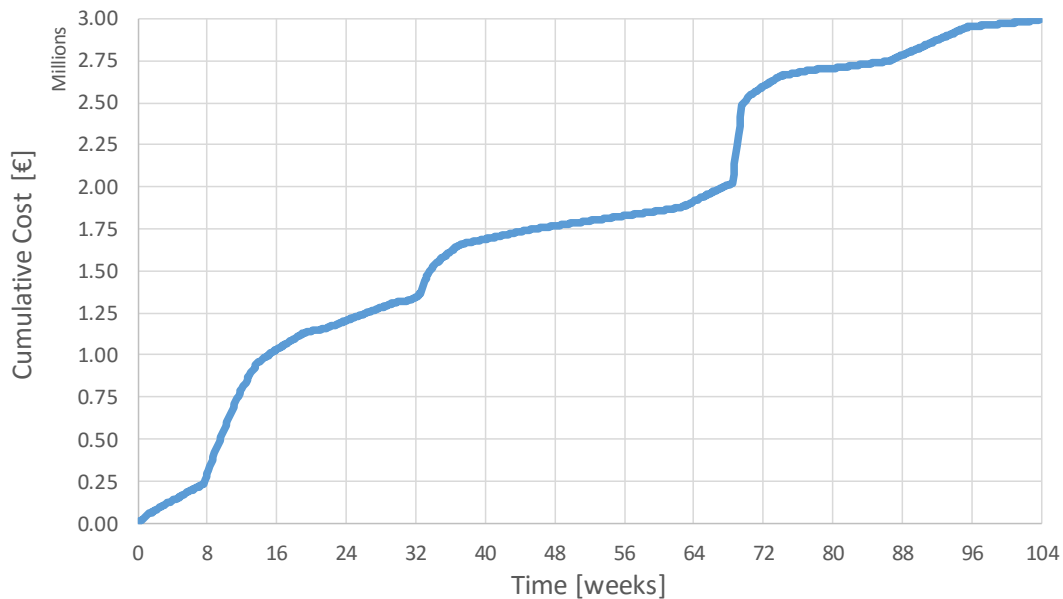


Figure 1. Cumulative cost over time



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In Figure 2, the estimated budget required for each quarter is indicated. This information is crucial in order to be able to schedule the project cash flow.

There is a meaningful amount of money expected to be required at the beginning of the project, corresponding to all tasks that have to be developed before the design phase of the project.

Also, it can clearly be seen that, at the end of the project, in quarter 6, there is a relevant amount of money that has to be spent. This situation is caused because of the production of the prototype, when all design steps are finished.

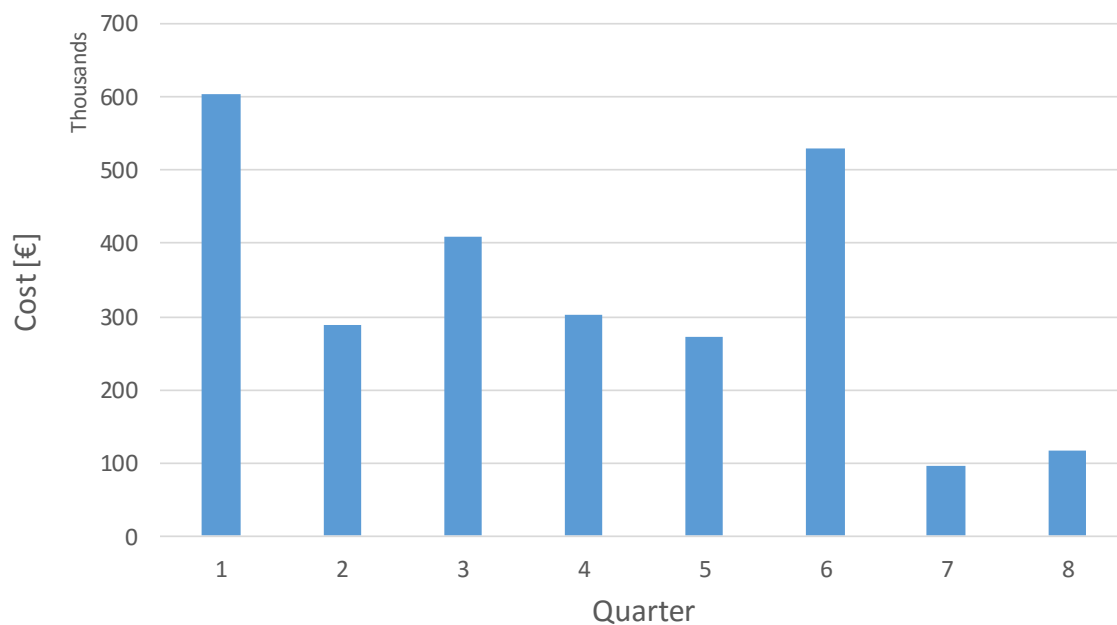


Figure 2. Activity cost estimation over time



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2.2 Budget at completion

How the budget at completion is distributed at each department is shown in Figure 3. As it can be seen, most of the budget of the project corresponds to engineering tasks. This is reasonable, since this includes all kind of costs, such as most of the HHRR, materials or facilities. Also, a big deal of money is required for administration and quality.

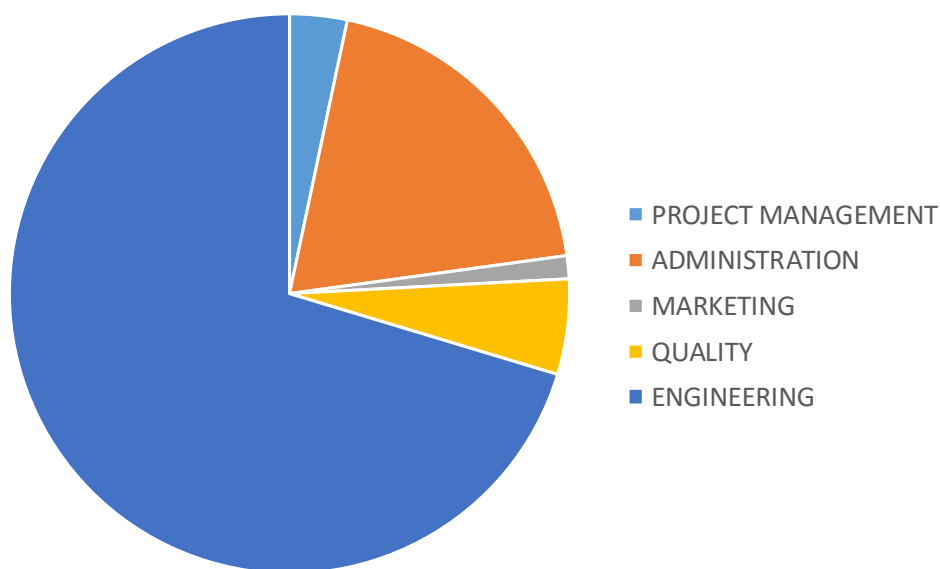


Figure 3. Distribution of the budget

In Table 15 are shown a detail of the numerical values of the previous figure.

Table 15. Distribution of the budget

Department	Budget [€]
PROJECT MANAGEMENT	99,563
ADMINISTRATION	585,155
MARKETING	39,875
QUALITY	165,239
ENGINEERING	2,109,879

In order to fully present the distribution of the costs, in Figure 4 all expenses are shown according to their purpose, independently of the department to which they correspond. More than 2.1M€ are aimed to be spent on HHRR, becoming the purpose with highest budget in the project. Also, the material required for the prototype of the CubeSat and the IR camera is a significant amount of money, similar to all the money spent in third companies which will give service to the project.



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According to the considerations explained before in the project, a reserve has been estimated in order to be able to cope with unexpected expenses or cost increases. This amount of money represents almost 313,000 €. This is approximately 10% of the BAT of the project, lower than the maximum of 20% indicated by the regulations of the grant.

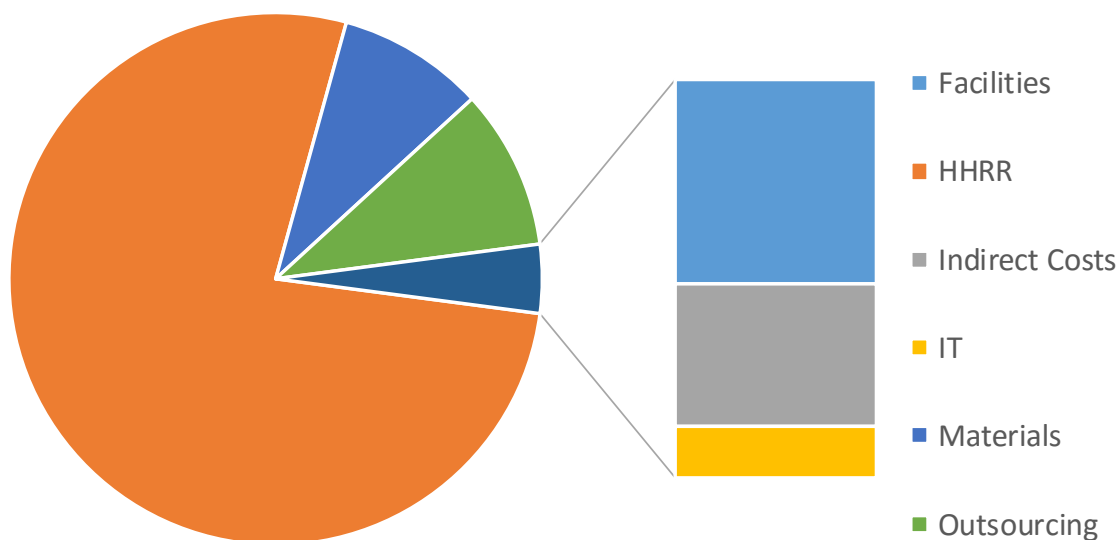


Figure 4. Distribution of the budget according to the purpose

In Table 16, the numerical values of the previous figure are shown.

Table 16. Distribution of the budget according to the purpose

Purpose	Budget [€]
Facilities	64,376
HHRR	2,315,477
Indirect Costs	44,355
IT	16,599
Materials	267,030
Outsourcing	291,875



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3 Plan procurement management

3.1 Make or Buy decisions

The WBS work-packages that will be outsourced in this project are summarized in Table 17. Acronym VAT stands for Value-Added Taxes.

Table 17. List of procurement items

WBS ID	Work Package Name	Reasons for BUY	Cost estimate [€]	Type of contract	Possible risks	List of suppliers	Special considerations or constraints
3. MARKETING							
3.1	Website development	Specialized website development company can offer better performance and extract the maximum potential from this way of communication in benefit of the project.	12,500	Firm fixed price contract (maximum price of 13,750 € including VAT)	1 -No transmission of the ideas and aims of the project. 2 -Bad appearance of the website. 3 -Inadequate language or difficult descriptions.	Detrazos	-
3.2	Social Media management	The social media management is a very important task in order to get the maximum number of supporters and show the project to the entire world, therefore this task must be done by a specialized company.	15,000	Fixed price with economic price adjustment contract (maximum price of 16,500 € including VAT)	1 -No enough followers or supporters in the main social networks. 2 -Inadequate publications or useless information. 3 -Unclear language or orthographic mistakes in the posts.	Detrazos	-
3.3	Development of the Communication plan	Specialized communication company can be more efficient.	7,500	Firm fixed price contract (maximum price of 8,250 € including VAT)	1 -Inadequate communication. 2 -Unclear messages or no transmission of the project ideas.	Detrazos	-
5. ENGINEERING							
5.4. MANUFACTURING AND ASSEMBLY OF THE PROTOTYPE OF CUBESAT							
5.4.5	Manufacturing of the structure subsystem prototype	The structure must be manufactured by a company with the necessary equipment and facilities to allow the manufacturing of the prototype.	35,000	Firm fixed price contract (maximum price of 38,500 € including VAT)	1 -Bad manufacture of the prototype. 2 -Bad integration of the structural components.	Gutmar	The schedule must be accomplished without exception.



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WBS ID	Work Package Name	Reasons for BUY	Cost estimate [€]	Type of contract	Possible risks	List of suppliers	Special considerations or constraints
5.5.	DEVELOPMENT OF SIMULATION, TESTING AND VALIDATION						
5.5.1	Infrared Camera Testing	Testing of the infrared camera must be carried out by a specialized company in order to fulfil all the necessary test conditions and make valid tests.	45,000	Fixed price with economic price adjustment contract (maximum price of 49,500 € including VAT)	1-Invalid tests. 2-Malfunction of the infrared camera. 3-Damaging the infrared camera due to a bad performance of tests. 4-Equipment in disrepair.	Gutmar	It is very important to make successful and well-performed tests in this task due to the importance of the infrared camera in this project. It is important to fulfil all the legal and security conditions when testing.
5.5.2	Telecommunications ground testing	Testing of the ground telecommunication system must be done in a company with the necessary equipment/software so as to test and validate the functionality of the system.	35,000	Firm fixed price contract (maximum price of 38,500 € including VAT)	1-Invalid tests. 2-Malfunction of the telecommunications system. 3-Equipment in disrepair.	Gutmar	It is important to fulfil all the legal and security conditions when testing.
5.5.3	Constellation simulation	Specialized company with the necessary software and the required computational power must carry out this task.	30,000	Fixed price incentive fee contract (maximum price of 33,000 € including VAT)	1-Invalid simulations. 2-Unreal simulations with useless results.	Gutmar	It is very important to carry out the simulation in the most similar conditions to reality.
5.5.4	Energy testing	This task requires thermal and electrical equipment only provided by a specialized company.	25,000	Firm fixed price contract (maximum price of 27,500 € including VAT)	1-Invalid tests. 2-Malfunction of the energy system designed. 3-Equipment in disrepair.	Gutmar	It is important to fulfil all the legal and security conditions when testing.
5.5.5	Structures testing	Testing of the structure requires technical equipment and special testing conditions, like high-security measures, provided by a specialized company.	40,000	Firm fixed price contract (maximum price of 44,000 € including VAT)	1-Invalid tests. 2-Equipment in disrepair.	Gutmar	It is important to fulfil all the legal and security conditions when testing.



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3.2 Statement Of Work

The Statements Of Work of each of the activities that are to be developed outsource in this project are presented below.

Table 18. SOW – Website Development (WBS ID 3.1)

SOW - WEBSITE DEVELOPMENT (WBS ID 3.1)	
Background	The development of a website is of paramount importance to give visibility to the DebrEyes project. It must contain all the relevant information and data to give a clear overview to both interested people and experts.
Requirements	<ol style="list-style-type: none">1. Programming the website: development of the website following the guidelines of the Communication Plan. The key messages and ideas presented in the Communication plan must be strictly followed.2. Ensuring continuous operation: regular checks must be carried out to ensure that the website is operative.3. Updating the website: All the official announcements will be reported immediately to the website.
Type of Contract	The type of contract for this work will be a Firm Fixed Price Contract of 12,500€.
Schedule	The <i>Website Development</i> will start on the day 15 and finish on the day 71.
Constraints and Assumptions	It is assumed that the <i>Communication Plan</i> gives the necessary information to perform this task.
Performance bonds and insurances	A performance bond of 1,000€ will be granted in case of finishing the task 1 week or more ahead schedule.
Form and format	Once the website is finished, it must be possible to edit it easily. The http code of the website must be also delivered.
Identification of prequalified sellers	The web hosting must be done by Alojared S.A., as it has demonstrated high reliability in previous projects.



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Table 19. SOW – Social Media Management (WBS ID 3.2)

SOW - SOCIAL MEDIA MANAGEMENT (WBS ID 3.2)	
Background	Nowadays, Social Media is a must for releasing a new idea or a project. This SOW is dedicated to give the guidelines to successfully introduce DebrEyes project into social media.
Requirements	<ol style="list-style-type: none">1. Creating profiles in social media: signing in in several social media webs and creating a profile according to the Communication Plan.2. Spreading the project: ensuring a good visibility to spread the knowledge of this project as much as possible to have the maximum number of followers.3. Updates and announces: making sure that all relevant information is posted in all social media.
Type of Contract	<p>The type of contract for this work will be a Fixed Price with an Economic Price Adjustment Contract of 15,000€. This adjustment will be the following:</p> <ul style="list-style-type: none">- In case of having more than 5,000 followers in social media, 1,000€ extra will be granted- In case of having more than 20,000 followers in social media, 5,000€ extra will be granted- In case of having more than 100,000 followers in social media, 10000€ extra will be granted
Schedule	The <i>Social Media Management</i> will start on the day 15 and finish on the day 43.
Constraints and Assumptions	It is assumed that the Communication Plan gives the necessary information to perform this task.
Performance bonds and insurances	The performance bonds are described in point in <i>Type of Contract</i> of the same table.
Form and format	The access keys to the social media accounts must be also delivered.
Identification of prequalified sellers	-
Procurement metrics	The number of followers in in <i>Type of Contract</i> of the same table, is the sum of all the followers from the different social media.



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Table 20. SOW – Development of the Communication Plan (WBS ID 3.3)

SOW - DEVELOPMENT OF THE COMMUNICATION PLAN (WBS ID 3.3)	
Background	A good communication plan is essential for reaching target audiences and promoting the project, especially in such an unknown problem as space debris. This SOW gives the guidelines to perform this work.
Requirements	<ol style="list-style-type: none">1. Identification of target audiences: identifying the sectors, authorities, organization and influential people in which the communication campaign must be focused on.2. Identification of key messages: finding out the messages that have a deeper impact to the targets and give a clear understanding of the objectives of the DebrEyes project3. Determination of channels of communication: definition of the most appropriate channels of communication4. Development of the strategy: definition of the guidelines to be followed to carry on further actions.5. Writing of the Communication Plan: writing a document gathering all the information and conclusions acquired.
Type of Contract	The type of contract for this work will be a Firm Fixed Price Contract of 7,500€.
Schedule	The <i>Communication Plan</i> must be started by the beginning of the project and finished before the day 15.
Constraints and Assumptions	It is assumed that at least one member of Detrazos assisted to the kick-off meeting.
Performance bonds and insurances	No performance bonds are applicable.
Form and format	-
Identification of prequalified sellers	-
Procurement metrics	-



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Table 21. SOW – Manufacturing of the Structure Subsystem Prototype (WBS ID 5.4.5)

SOW – MANUFACTURING OF THE STRUCTURE SUBSYSTEM PROTOTYPE (WBS ID 5.4.5)	
Background	In order develop a CubeSat prototype, several subsystems are needed. Among them, there is the structure subsystem. In this document the Statement of Work for manufacturing the satellite structure is given.
Requirements	<ol style="list-style-type: none">1. Material used: the document <i>Structures Final Design</i> states which materials must be used for the structure.2. Drawings: the drawings to be followed to machine the structure are in the document <i>Structures Final Design</i>.3. Tolerances: all measurements must comply with the tolerances established in the drawings.
Type of Contract	The type of contract for this work will be a Firm Fixed Price Contract of 35,000€.
Schedule	The <i>Manufacture of the Structure Subsystem</i> will start on the day 480 and finish on the day 487.
Constraints and Assumptions	It is assumed that the document <i>Structures Final Design</i> gives the necessary information to perform this task.
Performance bonds and insurances	No performance bonds are associated with this task.
Form and format	The structure will be packed in a soft package to prevent it from scratches.
Identification of prequalified sellers	The measuring tools used for verifying the tolerances must be performed with equipment made by the prestigious German company Vogel®.
Evaluation of the work	The Quality Department will ensure that the structure manufactured by Gutmar fulfils the requirements established.

Table 22. SOW – Camera Testing (WBS ID 5.5.1)

SOW – CAMERA TESTING (WBS ID 5.5.1)	
Background	The testing of the infrared camera is vital in order to ensure the proper performance of the debris detection system. In this document the Statement of Work for testing the infrared camera is given.
Requirements	<ol style="list-style-type: none">1. Testing: Testing of all infrared camera's features specified by DebrEyes.2. Reporting: Keep DebrEyes updated on the testing activities by informing them after each testing step is done with both successful and failed parts of the testing.3. Ending: Provide DebrEyes with a final report of the whole testing.
Type of Contract	The type of contract for this work will be a Fixed Price with economic price adjustment Contract of 45,000€.
Schedule	The Infrared Camera Testing will start on workday 439 and finish on workday 495.
Constraints and Assumptions	It is assumed that all legal and security conditions are fulfilled when testing.
Performance bonds and insurances	No performance bonds are associated with this task.
Form and format	A printed version as well as a digital version including the data from the whole testing will be delivered to DebrEyes.
Identification of prequalified sellers	As long as DebrEyes wants a specialized company such Gutmar to test and certify this testing, there will be no recommendation on how to do their job.
Evaluation of the work	DebrEyes will inspect that the testing has been done according to all specifications and requirements to approve the results provided by Gutmar.



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Table 23. SOW – Telecommunications Ground Testing (WBS ID 5.5.2)

SOW – TELECOMMUNICATIONS GROUND TESTING (WBS ID 5.5.2)	
Background	In order to be able to guarantee DebrEyes project's functionality it is necessary to test its telecommunication systems before launching the CubeSats. In this document the Statement of Work for the telecommunications ground testing is given.
Requirements	<ol style="list-style-type: none">Testing: Testing of all telecommunication systems' features specified by DebrEyes.Reporting: Keep DebrEyes updated on the testing activities by informing them after each testing step is done with both successful and failed parts of the testing.Ending: Provide DebrEyes with a final report of the whole testing.
Type of Contract	The type of contract for this work will be a Firm Fixed Price Contract of 35,000€.
Schedule	The Telecommunications Ground Testing will start on workday 487 and finish on workday 515.
Constraints and Assumptions	It is assumed that all legal and security conditions are fulfilled when testing.
Performance bonds and insurances	No performance bonds are associated with this task.
Form and format	A printed version as well as a digital version including the data from the whole testing will be delivered to DebrEyes.
Identification of prequalified sellers	As long as DebrEyes wants a specialized company such Gutmar to test and certify this testing, there will be no recommendation on how to do their job.
Evaluation of the work	DebrEyes will inspect that the testing has been done according to all specifications and requirements to approve the results provided by Gutmar.

Table 24. SOW – Constellation Simulation (WBS ID 5.5.3)

SOW - CONSTELLATION SIMULATION (WBS ID 5.5.3)	
Background	In order to be able to guarantee DebrEyes project's functionality it is necessary to do the simulation of the networking of the CubeSats as a constellation before launching. In this document the Statement of Work for the constellation simulation is given.
Requirements	<ol style="list-style-type: none">Simulating: Simulation of all CubeSats networking features specified by DebrEyes.Reporting: Keep DebrEyes updated on the simulation activities by informing them after each simulation step is done with both successful and failed parts of the testing.Ending: Provide DebrEyes with a final report of the whole simulation.
Type of Contract	The type of contract for this work will be a Fixed Price Contract of 30,000€.
Schedule	The Constellation Simulation will start on workday 229 and finish on workday 263.
Constraints and Assumptions	It is assumed that the simulation will be carried out in conditions as similar to reality as possible agreed with DebrEyes.
Performance bonds and insurances	No performance bonds are associated with this task.
Form and format	A printed version as well as a digital version including the data from the whole simulation will be delivered to DebrEyes.
Identification of prequalified sellers	As long as DebrEyes wants a specialized company such Gutmar to simulate and certify this simulation, there will be no recommendation on how to do their job.
Evaluation of the work	DebrEyes will inspect that the simulation has been done according to all specifications and requirements to approve the results provided by Gutmar.



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Table 25. SOW – Energy Testing (WBS ID 5.5.4)

SOW – ENERGY TESTING (WBS ID 5.5.4)	
Background	The testing of the energy system is of paramount importance in order to ensure CubeSats' life. In this document the Statement of Work for testing the energy system is given.
Requirements	<ol style="list-style-type: none">1. Testing: Testing of all energy system's areas specified by DebrEyes.2. Reporting: Keep DebrEyes updated on the testing activities by informing them after each testing step is done with both successful and failed parts of the testing.3. Ending: Provide DebrEyes with a final report of the whole testing.
Type of Contract	The type of contract for this work will be a Firm fixed price Contract of 25,000€.
Schedule	The Energy Testing will start on workday 487 and finish on workday 519.
Constraints and Assumptions	It is assumed that all legal and security conditions are fulfilled when testing.
Performance bonds and insurances	No performance bonds are associated with this task.
Form and format	A printed version as well as a digital version including the data from the whole testing will be delivered to DebrEyes.
Identification of prequalified sellers	As long as DebrEyes wants a specialized company such Gutmar to test and certify this testing, there will be no recommendation on how to do their job.
Evaluation of the work	DebrEyes will inspect that the testing has been done according to all specifications and requirements to approve the results provided by Gutmar.

Table 26. SOW – Structures Testing (WBS ID 5.5.5)

SOW – STRUCTURES TESTING (WBS ID 5.5.5)	
Background	The testing of the CubeSat's structures is of paramount importance in order to guarantee its wholeness during the different stages of usage. In this document the Statement of Work for testing the energy system is given.
Requirements	<ol style="list-style-type: none">1. Testing: Testing of all CubeSat structures' aspects specified by DebrEyes.2. Reporting: Keep DebrEyes updated on the testing activities by informing them after each testing step is done with both successful and failed parts of the testing.3. Ending: Provide DebrEyes with a final report of the whole testing.
Type of Contract	The type of contract for this work will be a Firm fixed price Contract of 40,000€.
Schedule	The Energy Testing will start on workday 487 and finish on workday 519.
Constraints and Assumptions	It is assumed that all legal and security conditions are fulfilled when testing.
Performance bonds and insurances	No performance bonds are associated with this task.
Form and format	A printed version as well as a digital version including the data from the whole testing will be delivered to DebrEyes.
Identification of prequalified sellers	As long as DebrEyes wants a specialized company such Gutmar to test and certify this testing, there will be no recommendation on how to do their job.
Evaluation of the work	DebrEyes will inspect that the testing has been done according to all specifications and requirements to approve the results provided by Gutmar.