



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Departament de Projectes d'Enginyeria

ETSEIAT

Departament de Projectes d'Enginyeria

# EARTH CLIMATE CHANGE OBSERVATION ECCO

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## Deliverable 3 Cost and Procurement Management

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## 1. Cost estimating

### 1.1. Level of accuracy

Due to the high numbers that are going to be used to estimate costs of each task, it is interesting to define how values will be rounded.


In this case is selected to round all values to tens.

### 1.2. Cost estimation worksheet


In the table below, the estimation costs for each task are exposed. A three point estimate methodology has been used.

Table 1. List of three point estimates


Three Point Estimates					
WBS ID	Optimistic cost (m.u.)	Most Likely Cost (m.u.)	Pessimistic Cost (m.u.)	Weighting Equation	Expected Cost Estimate (€)
START	3,500 €	3,730 €	3,960 €	$(o+4m+p)/4$	3,730 €
<b>PM</b>	<b>Project Management</b>				<b>439,210 €</b>
PM.1	0 €	12,030 €	24,050 €	$(o+4m+p)/5$	12,030 €
PM.2	0 €	415,150 €	830,300 €	$(o+4m+p)/6$	415,150 €
PM.3	0 €	12,030 €	24,050 €	$(o+4m+p)/6$	12,030 €
<b>AS</b>	<b>Administrative Services</b>				<b>383,760 €</b>
AS.1	1,200 €	2,700 €	4,200 €	$(o+4m+p)/6$	2,700 €
AS.2	80,000 €	189,180 €	298,360 €	$(o+4m+p)/6$	189,180 €
AS.3	2,200 €	5,400 €	8,600 €	$(o+4m+p)/6$	5,400 €
AS.4	80,000 €	186,480 €	292,960 €	$(o+4m+p)/6$	186,480 €
<b>PN</b>	<b>Partnership and Network</b>				<b>290,080 €</b>
PN.1	0 €	145,040 €	290,080 €	$(o+4m+p)/6$	145,040 €
PN.2	0 €	145,040 €	290,080 €	$(o+4m+p)/6$	145,040 €
<b>C</b>	<b>Communications</b>				<b>315,210 €</b>
C.1	0 €	64,360 €	128,710 €	$(o+4m+p)/6$	64,360 €
C.2	0 €	64,360 €	128,710 €	$(o+4m+p)/6$	64,360 €
C.3	0 €	49,700 €	99,390 €	$(o+4m+p)/6$	49,700 €
C.4	0 €	49,700 €	99,390 €	$(o+4m+p)/6$	49,700 €
C.5	0 €	49,700 €	99,390 €	$(o+4m+p)/6$	49,700 €
REP.C.1	15,200 €	16,560 €	17,910 €	$(o+4m+p)/6$	16,560 €
REP.C.2	17,500 €	20,830 €	24,150 €	$(o+4m+p)/6$	20,830 €

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Three Point Estimates					
WBS ID	Optimistic cost (m.u.)	Most Likely Cost (m.u.)	Pessimistic Cost (m.u.)	Weighting Equation	Expected Cost Estimate (€)
<b>PD</b>	<b>Preliminary Design</b>				<b>743,590 €</b>
<b>PD.M</b>	<b>Mission Design</b>				<b>68,350 €</b>
PD.M.SA.1	8,500 €	14,340 €	20,180 €	(o+4m+p)/6	14,340 €
PD.M.SA.2	6,450 €	10,760 €	15,060 €	(o+4m+p)/6	10,760 €
PD.M.1	6,300 €	10,760 €	15,210 €	(o+4m+p)/6	10,760 €
PD.M.2	13,200 €	21,510 €	29,810 €	(o+4m+p)/6	21,510 €
PD.M.3	5,100 €	10,980 €	16,860 €	(o+4m+p)/6	10,980 €
<b>PD.C</b>	<b>Communication</b>				<b>165,570 €</b>
PD.C.SA.1	3,000 €	7,510 €	12,010 €	(o+4m+p)/6	7,510 €
PD.C.SA.2	4,200 €	10,010 €	15,810 €	(o+4m+p)/6	10,010 €
PD.C.SA.3	4,100 €	10,010 €	15,910 €	(o+4m+p)/6	10,010 €
PD.C.SA.4	5,840 €	10,390 €	14,930 €	(o+4m+p)/6	10,390 €
PD.C.HW.1	6,500 €	10,870 €	15,230 €	(o+4m+p)/6	10,870 €
PD.C.HW.2	14,670 €	23,410 €	32,140 €	(o+4m+p)/6	23,410 €
PD.C.HW.3	4,900 €	10,870 €	16,830 €	(o+4m+p)/6	10,870 €
PD.C.HW.4	11,500 €	21,730 €	31,950 €	(o+4m+p)/6	21,730 €
PD.C.SW.1	19,450 €	32,550 €	45,650 €	(o+4m+p)/6	32,550 €
PD.C.SW.2	16,710 €	28,220 €	39,740 €	(o+4m+p)/6	28,220 €
<b>PD.N</b>	<b>Navigation</b>				<b>84,000 €</b>
PD.N.SA.1	3,000 €	8,400 €	13,800 €	(o+4m+p)/6	8,400 €
PD.N.SA.2	4,200 €	11,200 €	18,200 €	(o+4m+p)/6	11,200 €
PD.N.SA.3	3,000 €	8,400 €	13,800 €	(o+4m+p)/6	8,400 €
PD.N.HW.1	8,560 €	15,680 €	22,800 €	(o+4m+p)/6	15,680 €
PD.N.SW.1	24,670 €	40,320 €	55,970 €	(o+4m+p)/6	40,320 €
<b>PD.P</b>	<b>Propulsion</b>				<b>157,000 €</b>
PD.P.SA.1	3,100 €	6,580 €	10,060 €	(o+4m+p)/6	6,580 €
PD.P.SA.2	8,000 €	12,610 €	17,220 €	(o+4m+p)/6	12,610 €
PD.P.SA.3	6,200 €	10,690 €	15,180 €	(o+4m+p)/6	10,690 €
PD.P.SA.4	5,950 €	10,690 €	15,430 €	(o+4m+p)/6	10,690 €
PD.P.HW.1	6,150 €	9,940 €	13,730 €	(o+4m+p)/6	9,940 €
PD.P.HW.2	8,500 €	17,540 €	26,570 €	(o+4m+p)/6	17,540 €
PD.P.HW.3	15,670 €	25,220 €	34,760 €	(o+4m+p)/6	25,220 €
PD.P.HW.4	8,500 €	17,540 €	26,570 €	(o+4m+p)/6	17,540 €
PD.P.SW.1	17,000 €	26,270 €	35,540 €	(o+4m+p)/6	26,270 €
PD.P.SW.2	17,500 €	26,500 €	35,490 €	(o+4m+p)/6	26,500 €


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Three Point Estimates					
WBS ID	Optimistic cost (m.u.)	Most Likely Cost (m.u.)	Pessimistic Cost (m.u.)	Weighting Equation	Expected Cost Estimate (€)
<b>PD.ME</b>	<b>Mechanical</b>				<b>128,080 €</b>
PD.ME.SA.1	4,100 €	10,390 €	16,670 €	(o+4m+p)/6	10,390 €
PD.ME.SA.2	5,000 €	12,980 €	20,960 €	(o+4m+p)/6	12,980 €
PD.ME.SA.3	6,700 €	14,440 €	22,170 €	(o+4m+p)/6	14,440 €
PD.ME.SA.4	5,150 €	12,980 €	20,810 €	(o+4m+p)/6	12,980 €
PD.ME.1	17,100 €	23,830 €	30,550 €	(o+4m+p)/6	23,830 €
PD.ME.ST.2	10,950 €	18,580 €	26,210 €	(o+4m+p)/6	18,580 €
PD.ME.ST.1	10,500 €	18,580 €	26,660 €	(o+4m+p)/6	18,580 €
PD.ME.T.1	2,150 €	8,150 €	14,140 €	(o+4m+p)/6	8,150 €
PD.ME.T.2	2,150 €	8,150 €	14,140 €	(o+4m+p)/6	8,150 €
<b>PD.E</b>	<b>Electronics</b>				<b>140,590 €</b>
PD.E.SA.1	2,000 €	8,230 €	14,450 €	(o+4m+p)/6	8,230 €
PD.E.SA.2	2,000 €	8,230 €	14,450 €	(o+4m+p)/6	8,230 €
PD.E.HW.1	8,140 €	20,930 €	33,720 €	(o+4m+p)/6	20,930 €
PD.E.HW.2	10,970 €	41,130 €	71,280 €	(o+4m+p)/6	41,130 €
PD.E.HW.3	10,970 €	41,130 €	71,280 €	(o+4m+p)/6	41,130 €
PD.E.HW.4	4,150 €	10,470 €	16,780 €	(o+4m+p)/6	10,470 €
PD.E.HW.5	4,150 €	10,470 €	16,780 €	(o+4m+p)/6	10,470 €
<b>FD</b>	<b>Final Design</b>				<b>1,154,110 €</b>
<b>FD.C</b>	<b>Communication Detailed Design</b>				<b>277,680 €</b>
FD.C.HW.1	33,560 €	46,540 €	59,520 €	(o+4m+p)/6	46,540 €
FD.C.HW.2	20,560 €	30,410 €	40,260 €	(o+4m+p)/6	30,410 €
FD.C.HW.3	21,530 €	29,840 €	38,140 €	(o+4m+p)/6	29,840 €
FD.C.SW.1	37,480 €	44,490 €	51,500 €	(o+4m+p)/6	44,490 €
FD.C.SW.2	22,560 €	34,190 €	45,810 €	(o+4m+p)/6	34,190 €
FD.C.SW.3	10,350 €	16,330 €	22,300 €	(o+4m+p)/6	16,330 €
FD.C.SW.4	58,250 €	75,880 €	93,520 €	(o+4m+p)/6	75,880 €
<b>FD.N</b>	<b>Navigation Detailed Design</b>				<b>260,820 €</b>
FD.N.HW.1	19,450 €	41,370 €	63,290 €	(o+4m+p)/6	41,370 €
FD.N.HW.2	14,240 €	27,420 €	40,590 €	(o+4m+p)/6	27,420 €
FD.N.SW.1	36,570 €	60,010 €	83,440 €	(o+4m+p)/6	60,010 €
FD.N.SW.2	38,690 €	56,580 €	74,470 €	(o+4m+p)/6	56,580 €
FD.N.SW.3	48,320 €	75,440 €	102,560 €	(o+4m+p)/6	75,440 €
<b>FD.P</b>	<b>Propulsion Detailed Design</b>				<b>197,880 €</b>
FD.P.HW.1	16,000 €	43,620 €	71,230 €	(o+4m+p)/6	43,620 €
FD.P.HW.2	29,780 €	56,100 €	82,410 €	(o+4m+p)/6	56,100 €
FD.P.HW.3	11,470 €	32,720 €	53,960 €	(o+4m+p)/6	32,720 €

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Three Point Estimates					
WBS ID	Optimistic cost (m.u.)	Most Likely Cost (m.u.)	Pessimistic Cost (m.u.)	Weighting Equation	Expected Cost Estimate (€)
FD.P.SW.1	25,350 €	32,720 €	40,080 €	(o+4m+p)/6	32,720 €
FD.P.SW.2	3,000 €	32,720 €	65,430 €	(o+4m+p)/6	32,720 €
<b>FD.M</b>	<b>Mechanical Detailed Design</b>				<b>213,960 €</b>
FD.ME.MD.1	18,460 €	28,820 €	39,170 €	(o+4m+p)/6	28,820 €
FD.ME.MD.2	5,150 €	18,430 €	31,710 €	(o+4m+p)/6	18,430 €
FD.ME.MD.3	11,380 €	20,020 €	28,660 €	(o+4m+p)/6	20,020 €
FD.ME.MD.4	26,470 €	46,110 €	65,740 €	(o+4m+p)/6	46,110 €
FD.ME.ID.1	15,430 €	23,060 €	30,680 €	(o+4m+p)/6	23,060 €
FD.ME.ID.2	14,780 €	28,190 €	41,590 €	(o+4m+p)/6	28,190 €
FD.ME.ID.3	3,140 €	11,060 €	18,980 €	(o+4m+p)/6	11,060 €
FD.ME.ID.4	26,470 €	38,270 €	50,060 €	(o+4m+p)/6	38,270 €
<b>FD.E</b>	<b>Electronic Detailed Design</b>				<b>203,770 €</b>
FD.E.HW.1	24,520 €	59,780 €	95,040 €	(o+4m+p)/6	59,780 €
FD.E.HW.2	23,420 €	59,780 €	96,140 €	(o+4m+p)/6	59,780 €
FD.E.HW.3	25,470 €	84,210 €	142,950 €	(o+4m+p)/6	84,210 €
<b>T</b>	<b>Test and Validations</b>				<b>308,910 €</b>
<b>T.C</b>	<b>Communications</b>				<b>95,620 €</b>
T.C.1	23,670 €	34,150 €	44,620 €	(o+4m+p)/6	34,150 €
T.C.2	23,670 €	34,150 €	44,620 €	(o+4m+p)/6	34,150 €
T.C.3	16,780 €	27,320 €	37,850 €	(o+4m+p)/6	27,320 €
<b>T.N</b>	<b>Navigation</b>				<b>30,360 €</b>
T.N.1	13,670 €	30,360 €	47,050 €	(o+4m+p)/6	30,360 €
<b>T.P</b>	<b>Propulsion</b>				<b>24,000 €</b>
T.P.1	10,960 €	24,000 €	37,040 €	(o+4m+p)/6	24,000 €
<b>T.ME</b>	<b>Mechanical</b>				<b>38,400 €</b>
T.ME.1	15,360 €	38,400 €	61,440 €	(o+4m+p)/6	38,400 €
<b>T.E</b>	<b>Electronics</b>				<b>56,400 €</b>
T.E.1	31,640 €	56,400 €	81,160 €	(o+4m+p)/6	56,400 €
<b>T.A</b>	<b>Data Acquisition</b>				<b>52,400 €</b>
T.A.1	9,230 €	20,240 €	31,250 €	(o+4m+p)/6	20,240 €
T.A.2	15,630 €	32,160 €	48,690 €	(o+4m+p)/6	32,160 €
FINISH	10,230 €	11,730 €	13,230 €	(o+4m+p)/6	11,730 €



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### 1.3. Activity cost estimation

For the activity cost estimation the model grant agreement for the Horizon 2020 projects has been followed. There are 4 different types of cost:

- Cost from direct personnel
- Cost of subcontracting
- Other direct costs
- Indirect costs

They can be ordered in two categories, direct and indirect costs. The direct costs include the personnel costs, travel costs, equipment for the project, cost of subcontracting, and other types of direct costs. The indirect costs include telephone bills, cost of renting, heating ...

For simplicity, in H2020 the European Commission decided that for the indirect costs a flat rate of 25% of the direct costs would be applied. Therefore, the direct cost has been obtained and then the indirect cost comes from taking the 25% to that value. Finally, the total cost of the activity is the sum of both quantities.

The reserve has a different percentage depending on the confidence level of the activity. The applied values are:

- For Non-critical activities: 5%
- For Semi-critical activities: 15%
- For Critical activities: 21%

These percentages have been selected to ensure that, in case of some failures, there are enough cash to solve it and continue with the expected schedule, or at least, with the minimum delay.

The critical activities are the ones found in the critical path. The semi-critical activities are close to the critical path, but without much time for delays. Finally, the rest of the activities are non-critical.

Being aware that the outsourcing of the sensors was the most critical activity, a contingency plan for this task has been planned. In order to reduce the risk and criticality of these tasks, the outsourcing of the sensors will start as soon as possible, so there is enough time in case of delays.

In the following table there is the list of the activity cost estimation.



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Table 2. List of activity cost estimation

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
START	C.M;E.CD.M;E.ED.M; E.MDD.M;E.PD.M;PM. S;PM.M;EO	2,990 €	750 €	420 €	3,730 €	4,150 €	460 €	VHC
<b>PM</b>	<b>Project Management</b>							
PM.1	SOFT.6;PM.S;PM.M;P M.EXT	9,620 €	2,410 €	1,360 €	12,030 €	13,380 €	24,050 €	MC
PM.2	SOFT.6;PM.S;PM.M;P M.EXT	332,120 €	83,030 €	46,690 €	415,150 €	461,840 €	830,300 €	MC
PM.3	SOFT.6;PM.S;PM.M;P M.EXT	9,620 €	2,410 €	1,360 €	12,030 €	13,380 €	24,050 €	MC
<b>AS</b>	<b>Administrative Services</b>							
AS.1	AS.M;AS.S; HR.W	2,160 €	540 €	310 €	2,700 €	3,010 €	3,000 €	VHC
AS.2	AS.M;AS.S; HR.W	151,350 €	37,840 €	21,280 €	189,180 €	210,460 €	218,360 €	VHC
AS.3	AS.M;AS.S; F.W1	4,320 €	1,080 €	610 €	5,400 €	6,010 €	6,400 €	MC
AS.4	AS.M;AS.S; F.W1	149,190 €	37,300 €	20,970 €	186,480 €	207,450 €	212,960 €	HC
<b>PN</b>	<b>Partnership and network</b>							
PN.1	AS.M;AS.S;HR.W	116,040 €	29,010 €	16,310 €	145,040 €	161,350 €	290,080 €	VHC
PN.2	AS.M;AS.S;HR.W	116,040 €	29,010 €	16,310 €	145,040 €	161,350 €	290,080 €	VHC
<b>C</b>	<b>Communications</b>							
C.1	C.EXT;C.M	51,490 €	12,880 €	7,240 €	64,360 €	71,600 €	128,710 €	VHC
C.2	C.EXT;C.M	51,490 €	12,880 €	7,240 €	64,360 €	71,600 €	128,710 €	VHC
C.3	C.EXT;C.M	39,760 €	9,940 €	5,590 €	49,700 €	55,290 €	99,390 €	VHC



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WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
C.4	C.EXT;C.M	39,760 €	9,940 €	5,590 €	49,700 €	55,290 €	99,390 €	VHC
C.5	C.EXT;C.M	39,760 €	9,940 €	5,590 €	49,700 €	55,290 €	99,390 €	VHC
REP.C.1	C.EXT;C.M; E.CD.M;E.ED.M;E.MD D.M;E.PD.M;PM.S;PM .M;EO	13,250 €	3,320 €	1,870 €	16,560 €	18,420 €	2,710 €	VHC
REP.C.2	C.EXT;C.M; PD.EXT 3;MD.EXT1;E.CD.M;M DD.EXT 1;E.ED.M;EO	16,660 €	4,170 €	2,350 €	20,830 €	23,170 €	6,650 €	VHC
<b>PD</b>	<b>Preliminary Design</b>							
<b>PD.M</b>	<b>Mission Design</b>							
PD.M.SA.1	E.MDD.S;E.MDD.M; SE1;SE2	11,470 €	2,870 €	1,620 €	14,340 €	15,950 €	11,680 €	HC
PD.M.SA.2	E.MDD.S;E.MDD.M; SE1;SE2	8,610 €	2,160 €	1,210 €	10,760 €	11,970 €	8,610 €	HC
PD.M.1	E.MDD.S;E.MDD.M; SE1;SE3;SOFT.7;SE4	8,610 €	2,160 €	1,210 €	10,760 €	11,970 €	8,910 €	HC
PD.M.2	E.MDD.S;E.MDD.M; SE2;SE1;SOFT.7;SE3	17,210 €	4,310 €	2,420 €	21,510 €	23,930 €	16,610 €	HC
PD.M.3	E.MDD.S;E.MDD.M; MDD.EXT 1;SOFT.7;SE4;SE1	8,790 €	2,200 €	1,240 €	10,980 €	12,220 €	11,760 €	HC
<b>PD.C</b>	<b>Communications</b>							
PD.C.SA.1	E.CD.S;E.CD.M; TE1;TE2	6,010 €	1,510 €	850 €	7,510 €	8,350 €	9,010 €	HC



EARTH CLIMATE CHANGE OBSERVATION

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
PD.C.SA.2	E.CD.S;E.CD.M; TE1;TE3	8,010 €	2,010 €	1,130 €	10,010 €	11,130 €	11,610 €	HC
PD.C.SA.3	E.CD.S;E.CD.M; SE2;SE3	8,010 €	2,010 €	1,130 €	10,010 €	11,130 €	11,810 €	HC
PD.C.SA.4	E.CD.S;E.CD.M; MD.EXT 3;TE1;SE2	8,310 €	2,080 €	1,170 €	10,390 €	11,550 €	9,090 €	HC
PD.C.HW.1	E.CD.S;E.CD.M; SE1;TE2	8,690 €	2,180 €	1,680 €	10,870 €	12,540 €	8,730 €	HC
PD.C.HW.2	E.CD.S;E.CD.M; SE1;TE2;CD.EXT 2	18,730 €	4,690 €	3,600 €	23,410 €	27,010 €	17,470 €	HC
PD.C.HW.3	E.CD.S;E.CD.M; SE2;TE3	8,690 €	2,180 €	1,680 €	10,870 €	12,540 €	11,930 €	HC
PD.C.HW.4	E.CD.S;E.CD.M; SE2;TE3	17,380 €	4,350 €	3,350 €	21,730 €	25,070 €	20,450 €	HC
PD.C.SW.1	E.CD.S;E.CD.M; SE1;SOFT.5;SE3;TE2	26,040 €	6,510 €	3,670 €	32,550 €	36,210 €	26,200 €	HC
PD.C.SW.2	E.CD.S;E.CD.M; SE1;TE1;SOFT.5;SE2	22,580 €	5,650 €	3,180 €	28,220 €	31,400 €	23,030 €	HC
<b>PD.N</b>	<b>Navigation</b>							
PD.N.SA.1	E.MDD.S;E.MDD.M; SE1;TE3	6,720 €	1,680 €	950 €	8,400 €	9,350 €	10,800 €	HC
PD.N.SA.2	E.MDD.S;E.MDD.M; SE1;TE2	8,960 €	2,240 €	1,260 €	11,200 €	12,460 €	14,000 €	HC
PD.N.SA.3	E.MDD.S;E.MDD.M; SE1;TE2	6,720 €	1,680 €	950 €	8,400 €	9,350 €	10,800 €	HC



## EARTH CLIMATE CHANGE OBSERVATION

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
PD.N.HW.1	E.MDD.S;E.MDD.M; TE1;SE3	12,550 €	3,140 €	1,770 €	15,680 €	17,450 €	14,240 €	HC
PD.N.SW.1	E.MDD.S;E.MDD.M; SE1;SE2;TE1	32,260 €	8,070 €	4,540 €	40,320 €	44,860 €	31,300 €	HC
<b>PD.P</b>	<b>Propulsion</b>							
PD.P.SA.1	E.P;E.MD.S; SE3	5,270 €	1,320 €	740 €	6,580 €	7,320 €	6,960 €	HC
PD.P.SA.2	E.P;E.MD.S; MD.EXT 3;SE4	10,090 €	2,530 €	1,420 €	12,610 €	14,030 €	9,220 €	HC
PD.P.SA.3	E.P;E.MD.S; MD.EXT 3;SE3	8,550 €	2,140 €	1,210 €	10,690 €	11,890 €	8,980 €	HC
PD.P.SA.4	E.P;E.MD.S; MD.EXT 3;SE4	8,550 €	2,140 €	1,210 €	10,690 €	11,890 €	9,480 €	HC
PD.P.HW.1	E.P;E.MD.S; SE2;SE3	7,950 €	1,990 €	1,120 €	9,940 €	11,060 €	7,580 €	HC
PD.P.HW.2	E.P;E.MD.S; SE2	14,030 €	3,510 €	1,980 €	17,540 €	19,510 €	18,070 €	HC
PD.P.HW.3	E.P;E.MD.S; MD.EXT 3;SE4	20,180 €	5,050 €	5,190 €	25,220 €	30,410 €	19,090 €	HC
PD.P.HW.4	E.P;E.MD.S; SE4	14,030 €	3,510 €	3,610 €	17,540 €	21,150 €	18,070 €	HC
PD.P.SW.1	E.P;E.MD.S; SE1;SE2	21,020 €	5,260 €	2,960 €	26,270 €	29,230 €	18,540 €	HC
PD.P.SW.2	E.P;E.MD.S; SE2;SE4	21,200 €	5,300 €	2,980 €	26,500 €	29,480 €	17,990 €	HC
<b>PD.ME</b>	<b>Mechanical</b>							
PD.ME.SA.1	E.MD.M;E.MD.S ; SE3	8,310 €	2,080 €	1,170 €	10,390 €	11,550 €	12,570 €	HC
PD.ME.SA.2	E.MD.M;E.MD.S ; TE1	10,390 €	2,600 €	1,460 €	12,980 €	14,440 €	15,960 €	HC



EARTH CLIMATE CHANGE OBSERVATION

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
PD.ME.SA.3	E.MD.M;E.MD.S ; TE2;MD.EXT 2	11,550 €	2,890 €	1,630 €	14,440 €	16,060 €	15,470 €	HC
PD.ME.SA.4	E.MD.M;E.MD.S ; SE2	10,390 €	2,600 €	1,460 €	12,980 €	14,440 €	15,660 €	HC
PD.ME.1	E.MD.M;E.MD.S ; SOFT.8;SE1;SE3	19,060 €	4,770 €	2,680 €	23,830 €	26,500 €	13,450 €	HC
PD.ME.ST.2	E.MD.M;E.MD.S ; SOFT.1;SOFT.8;SE3	14,870 €	3,720 €	2,090 €	18,580 €	20,670 €	15,260 €	HC
PD.ME.ST.1	E.MD.M;E.MD.S ; SOFT.1;SOFT.8;SE4	14,870 €	3,720 €	2,090 €	18,580 €	20,670 €	16,160 €	HC
PD.ME.T.1	E.MD.M;E.MD.S ; MD.EXT 2	6,520 €	1,630 €	920 €	8,150 €	9,060 €	11,990 €	HC
PD.ME.T.2	E.MD.M;E.MD.S ; MD.EXT 2	6,520 €	1,630 €	920 €	8,150 €	9,060 €	11,990 €	HC
PD.E	Electronics							
PD.E.SA.1	E.CD.S;E.ED.M; EE1;EE2	6,580 €	1,650 €	930 €	8,230 €	9,150 €	12,450 €	HC
PD.E.SA.2	E.CD.S;E.ED.M; EE1	6,580 €	1,650 €	930 €	8,230 €	9,150 €	12,450 €	HC
PD.E.HW.1	E.CD.S;E.ED.M; EE1;EE2	16,750 €	4,190 €	2,360 €	20,930 €	23,290 €	25,580 €	HC
PD.E.HW.2	E.CD.S;E.ED.M; EE1;EE2	32,900 €	8,230 €	4,630 €	41,130 €	45,750 €	60,310 €	HC
PD.E.HW.3	E.CD.S;E.ED.M; EE1;EE2	32,900 €	8,230 €	4,630 €	41,130 €	45,750 €	60,310 €	HC
PD.E.HW.4	E.CD.S;E.ED.M; EE1;EE2	8,380 €	2,100 €	1,180 €	10,470 €	11,650 €	12,630 €	HC



EARTH CLIMATE CHANGE OBSERVATION

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
PD.E.HW.5	E.CD.S;E.ED.M; EE1;EE2	8,380 €	2,100 €	1,180 €	10,470 €	11,650 €	12,630 €	HC
<b>FD</b>	<b>Final Design</b>							
<b>FD.C</b>	<b>Communication Detailed Design</b>							
FD.C.HW.1	E.CD.S;E.CD.M; CD.EXT 2;SE3;TE2	37,230 €	9,310 €	5,240 €	46,540 €	51,770 €	25,960 €	MC
FD.C.HW.2	E.CD.S;E.CD.M; SE3;TE3	24,330 €	6,090 €	3,420 €	30,410 €	33,830 €	19,700 €	MC
FD.C.HW.3	E.CD.S;E.CD.M; MD.EXT 3;SE2;TE3	23,870 €	5,970 €	3,360 €	29,840 €	33,190 €	16,610 €	MC
FD.C.SW.1	E.CD.S;E.CD.M; SE3;SE5;TE3;SOFT.5	35,590 €	8,900 €	5,010 €	44,490 €	49,490 €	14,020 €	MC
FD.C.SW.2	E.CD.S;E.CD.M; SE2;SE5;TE1;SOFT.5	27,350 €	6,840 €	3,850 €	34,190 €	38,030 €	23,250 €	MC
FD.C.SW.3	E.CD.S;E.CD.M; MD.EXT 3;SE3;SE2;SOFT.5	13,060 €	3,270 €	1,840 €	16,330 €	18,170 €	11,950 €	MC
FD.C.SW.4	E.CD.S;E.CD.M; SE1;SE1;TE1;SOFT.5	60,710 €	15,180 €	8,540 €	75,880 €	84,420 €	35,270 €	MC
<b>FD.N</b>	<b>Navigation Detailed Design</b>							
FD.N.HW.1	E.MDD.S;E.MDD.M; SE4;TE2	33,100 €	8,280 €	8,510 €	41,370 €	49,880 €	43,840 €	MC
FD.N.HW.2	E.MDD.S;E.MDD.M; SE1;TE3	21,940 €	5,490 €	5,640 €	27,420 €	33,060 €	26,350 €	MC
FD.N.SW.1	E.MDD.S;E.MDD.M; MDD.EXT 2;SE3;SE1	48,010 €	12,010 €	6,750 €	60,010 €	66,750 €	46,870 €	MC



## EARTH CLIMATE CHANGE OBSERVATION

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
FD.N.SW.2	E.MDD.S;E.MDD.M; SE1;SE2;TE1	45,270 €	11,320 €	6,370 €	56,580 €	62,950 €	35,780 €	MC
FD.N.SW.3	E.MDD.S;E.MDD.M; SE1;SE2;TE1	60,350 €	15,090 €	15,520 €	75,440 €	90,960 €	54,240 €	MC
<b>FD.P</b>	<b>Propulsion Detailed Design</b>							
FD.P.HW.1	E.P;E.MD.S; SE1	34,900 €	8,730 €	4,910 €	43,620 €	48,520 €	55,230 €	MC
FD.P.HW.2	E.P;E.MD.S; MD.EXT 3;SE2	44,880 €	11,220 €	11,540 €	56,100 €	67,640 €	52,630 €	MC
FD.P.HW.3	E.P;E.MD.S; SE1	26,170 €	6,550 €	3,680 €	32,720 €	36,390 €	42,490 €	MC
FD.P.SW.1	E.P;E.MD.S; SE1;SE2	26,170 €	6,550 €	3,680 €	32,720 €	36,390 €	14,730 €	MC
FD.P.SW.2	E.P;E.MD.S; SE1;SE2	26,170 €	6,550 €	3,680 €	32,720 €	36,390 €	65,430 €	MC
<b>FD.ME</b>	<b>Mechanical Detailed Design</b>							
FD.ME.MD.1	E.MD.M;E.MD.S; MD.EXT1;SE3;SE4	23,060 €	5,770 €	3,250 €	28,820 €	32,060 €	20,710 €	MC
FD.ME.MD.2	E.MD.M;E.MD.S; SOFT.1;UPV	14,750 €	3,690 €	2,080 €	18,430 €	20,510 €	26,560 €	MC
FD.ME.MD.3	E.MD.M;E.MD.S; SE3;MD.EXT 2	16,020 €	4,010 €	2,260 €	20,020 €	22,270 €	17,280 €	MC
FD.ME.MD.4	E.MD.M;E.MD.S; SOFT.8;SE3;SE4;SE5	36,890 €	9,230 €	5,190 €	46,110 €	51,290 €	39,270 €	MC
FD.ME.ID.1	E.MD.M;E.MD.S; MD.EXT1;SE2;SE5	18,450 €	4,620 €	2,600 €	23,060 €	25,650 €	15,250 €	MC
FD.ME.ID.2	E.MD.M;E.MD.S; SOFT.1;SE1	22,550 €	5,640 €	3,170 €	28,190 €	31,360 €	26,810 €	MC





EARTH CLIMATE CHANGE OBSERVATION


WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
FD.ME.ID.3	E.MD.M;E.MD.S; MD.EXT 2	8,850 €	2,220 €	1,250 €	11,060 €	12,310 €	15,840 €	MC
FD.ME.ID.4	E.MD.M;E.MD.S; SOFT.8;SE2;SE3	30,620 €	7,660 €	4,310 €	38,270 €	42,570 €	23,590 €	MC
<b>FD.E</b>	<b>Electronic Detailed Design</b>							
FD.E.HW.1	E.CD.S;E.ED.M; EE1;EE2	47,830 €	11,960 €	6,730 €	59,780 €	66,500 €	70,520 €	MC
FD.E.HW.2	E.CD.S;E.ED.M; EE1;EE2	47,830 €	11,960 €	6,730 €	59,780 €	66,500 €	72,720 €	MC
FD.E.HW.3	E.CD.S;E.ED.M; PD.EXT 3;SOFT.3;PD.EXT 1	67,370 €	16,850 €	9,470 €	84,210 €	93,680 €	117,480 €	MC
<b>T</b>	<b>Test and Validations</b>							
<b>T.C</b>	<b>Communication</b>							
T.C.1	E.CD.M; LAB.COM;SOFT.2	27,320 €	6,830 €	3,840 €	34,150 €	37,990 €	20,950 €	MC
T.C.2	E.CD.M; LAB.COM;SOFT.2	27,320 €	6,830 €	3,840 €	34,150 €	37,990 €	20,950 €	MC
T.C.3	E.CD.M; LAB.COM	21,860 €	5,470 €	3,080 €	27,320 €	30,390 €	21,070 €	MC
<b>T.N</b>	<b>Navigation</b>							
T.N.1	E.MDD.M; LAB.INT;SOFT.7;SOF T.5	24,290 €	6,080 €	3,420 €	30,360 €	33,780 €	33,380 €	MC
<b>T.P</b>	<b>Propulsion</b>							
T.P.1	E.P; SE3	19,200 €	4,800 €	2,700 €	24,000 €	26,700 €	26,080 €	MC



EARTH CLIMATE CHANGE OBSERVATION

WBS ID	Resources	Direct Costs	Indirect Costs	Reserve	Estimate	Estimate with Reserve	Range	Confidence Level *
<b>T.M</b>	<b>Mechanical</b>							
T.ME.1	E.MD.M; SOFT.1;SE1	30,720 €	7,680 €	4,320 €	38,400 €	42,720 €	46,080 €	MC
<b>T.E</b>	<b>Electronics</b>							
T.E.1	E.ED.M; EE1;LAB.ELE	45,120 €	11,280 €	6,350 €	56,400 €	62,750 €	49,520 €	MC
<b>T.A</b>	<b>Data acquisition</b>							
T.A.1	E.CD.M; LAB.COM	16,200 €	4,050 €	2,280 €	20,240 €	22,520 €	22,020 €	MC
T.A.2	E.CD.M; SOFT.4;UPC;SE1	25,730 €	6,440 €	3,620 €	32,160 €	35,780 €	33,060 €	MC
FINISH	C.M;E.CD.M;E.ED.M; E.MDD.M;E.PD.M;PM. S;PM.M;EO	9,390 €	2,350 €	1,320 €	11,730 €	13,050 €	3,000 €	VHC


\* MC: Medium Confidence – HC: High Confidence – VHC: Very High Confidence

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In the following table the cost of each resource is presented.

**Table 3. Assumptions for the resources**

Resource ID	Resource name	Assumptions
AS.M	Administration Services Manager	Std. Rate 36€/h, worker
AS.S	Administration Services Secretary	Std. Rate 24€/h, worker
C.EXT	BCCI Communication Outsourcing	Cost, 200k€
C.M	Communication Manager	Std. Rate 36€/h, worker
CD.EXT 2	Southampton University Collaboration	Std. Rate 48€/h, 3 workers
E.CD.M	Communications Dept. Manager	Std. Rate 42€/h, worker
E.CD.S	Communications and Electronics Dept. Secretary	Std. Rate 24€/h, worker
E.ED.M	Electronics Dept. Manager	Std. Rate 42€/h, worker
E.MD.M	Mechanical Dept. Manager	Std. Rate 42€/h, worker
E.MD.S	Mechanical and Propulsion Dept. Secretary	Std. Rate 24€/h, worker
E.MDD.M	Mission Design Dept. Manager	Std. Rate 42€/h, worker
E.MDD.S	Mission Design and Payloads Depts. Secretary	Std. Rate 24€/h, worker
E.P	Propulsion Dept. Manager	Std. Rate 42€/h, worker
E.PD.M	Payloads Dept. Manager	Std. Rate 42€/h, worker
EE1	Electronics engineer 1	Std. Rate 36€/h, worker
EE2	Electronics engineer 2	Std. Rate 36€/h, worker
EO	Event organization	Cost, 48k€
F.W1	Financial Worker 1	Std. Rate 28€/h, worker
F.W2	Financial Worker 2	Std. Rate 28€/h, worker
HR.W	Human Resources worker	Std. Rate 36€/h, worker
LAB.COM	Communication laboratory	Laboratory testing, 40k€
LAB.ELE	Electronics laboratory - UPV Collaboration	Laboratory testing, 12k€
LAB.INT	Integration laboratory - ATT Collaboration	Laboratory testing, 30k€
MD.EXT 2	Stuttgart University Collaboration	Std. Rate 48€/h, 3 workers
MD.EXT 3	Orbital ATK Collaboration	Cost, 52.5k€
MD.EXT1	Ball Aerospace Collaboration	Cost, 6k€
MDD.EXT 1	Cranfield University Collaboration	Std. Rate 48€/h, 3 workers
MDD.EXT 2	SENER Collaboration	Cost, 20k€
PD.EXT 1	Silvanet Collaboration	Collaboration free of charge
PD.EXT 2	Surrey Satellites Collaboration	Collaboration free of charge
PD.EXT 3	Amptek Collaboration	Cost, 6k€
PM.EXT	E-TIS Eurocons outsourcing	Cost, 160k€
PM.M	Project Manager	Std. Rate 50€/h, worker

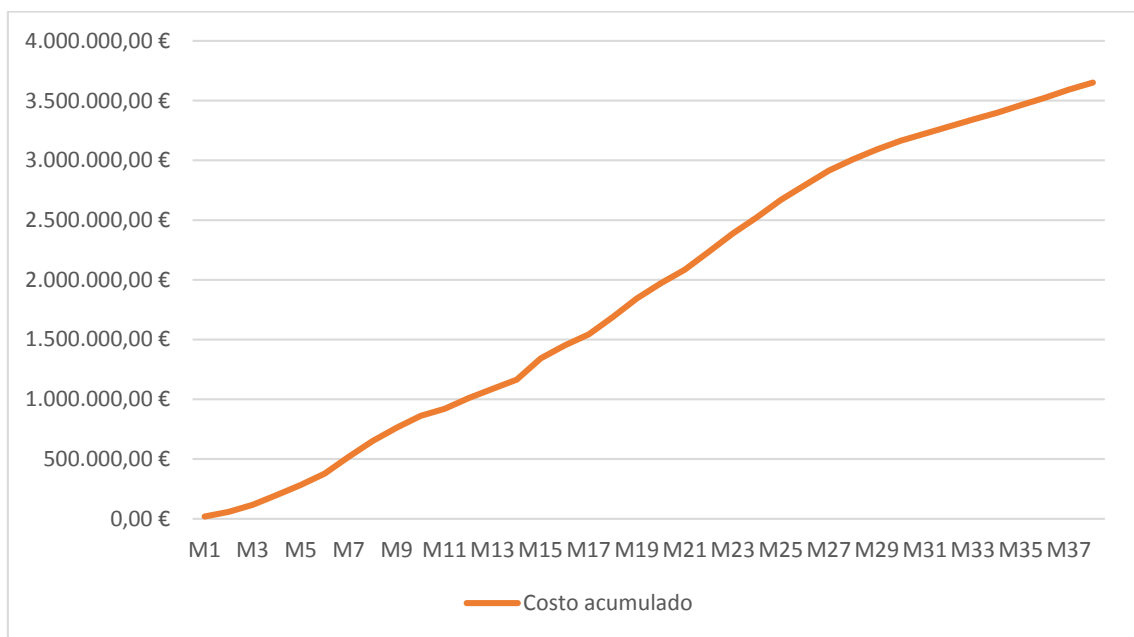
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Resource ID	Resource name	Assumptions
PM.S	Project Management Secretary	Std. Rate 24€/h, worker
SE1	Software engineer 1	Std. Rate 36€/h, worker
SE2	Software engineer 2	Std. Rate 36€/h, worker
SE3	Software engineer 3	Std. Rate 36€/h, worker
SE4	Software engineer 4	Std. Rate 36€/h, worker
SOFT.1	ANSYS Workbench Software	The license is share in the company. 5000€ / yr
SOFT.2	Keysight ADS Software	The license is shared with other projects of the company. 1000€ / yr
SOFT.3	LTSpice Software	The license is shared with other projects of the company. 1000€ / yr
SOFT.4	Matlab R2015b	The license is shared with other projects of the company. 2000€ / yr
SOFT.5	Visual Studio	The license is shared with other projects of the company. 1000€ / yr
SOFT.6	Microsoft Project	The license is shared with other projects of the company. 3000€ / yr
SOFT.7	STK Software	The license is shared with other projects of the company. 5000€ / yr
SOFT.8	Catia Software	The license is shared with other projects of the company. 4000€ / yr
SpE1	Space engineer 1	Std. Rate 36€/h, worker
SpE2	Space engineer 2	Std. Rate 36€/h, worker
SpE3	Space engineer 3	Std. Rate 36€/h, worker
SpE4	Space engineer 4	Std. Rate 36€/h, worker
SpE5	Space engineer 5	Std. Rate 36€/h, worker
SpE6	Space engineer 6	Std. Rate 36€/h, worker
TE1	Telecommunications engineer 1	Std. Rate 36€/h, worker
TE2	Telecommunications engineer 2	Std. Rate 36€/h, worker
TE3	Telecommunications engineer 3	Std. Rate 36€/h, worker
TE3	Telecommunications engineer 4	Std. Rate 36€/h, worker
UPC	Politechnical University of Catalonia Collaboration	Std. Rate 48€/h, 3 workers
UPV	Politechnical University of Valencia Collaboration	Std. Rate 48€/h, 3 workers
USDOC	Stuttgart University Collaboration Doct.	Cost, 5k€

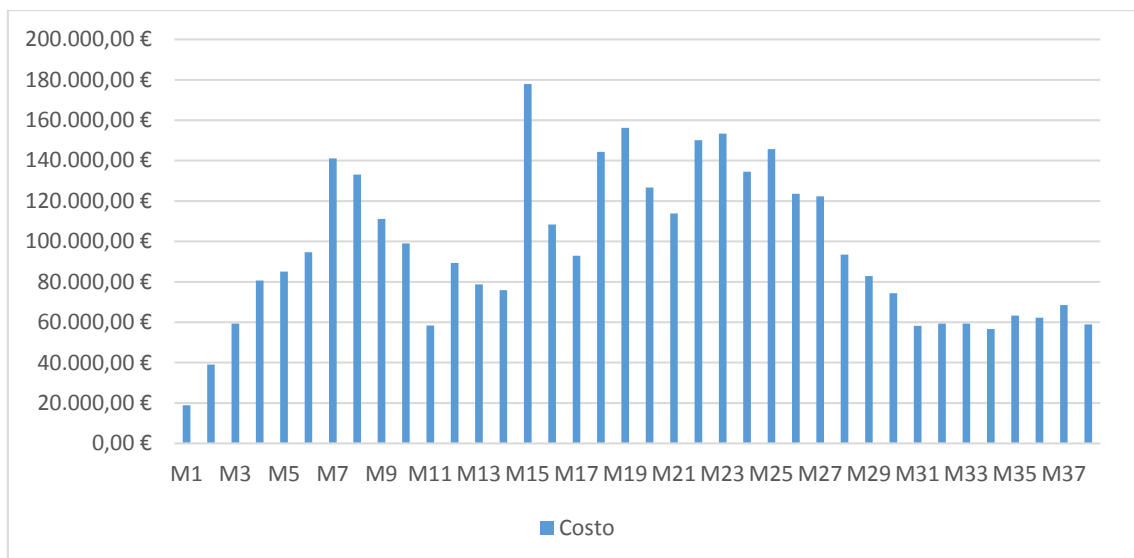
## 2. Cumulative costs

### 2.1. Cumulative cost curve

The cost baseline presented in the figure shows the evolution of the overall cost of the project per month.



**Figure 1. Cost baseline of the project**



**Figure 2. Distribution of costs per month**

There are two zones in the graph. From M0 to M17, there is a peak value in cost corresponding to the preliminary design. At M17 the preliminary design is almost finished and the final design is started, which is the zone in the right. At the beginning of the detailed design there is a lot of the cost and then it decreases until the end of the project.

## 2.2. Budget at completion

The budget of the project has been set to 3.6 M€. This amount is distributed to the different working groups of the project and to be used in the aforementioned costs. The expected amount for each package can be seen in the following table.

Table 4. Amount for each work package

Department	Amount
Project Management	439.210 €
Administrative Services	383.760 €
Partnership and Network	290.080 €
Communications	315.210 €
Engineering	2.213.190 €
Others	17.950 €
<b>Total</b>	<b>3.659.400 €</b>

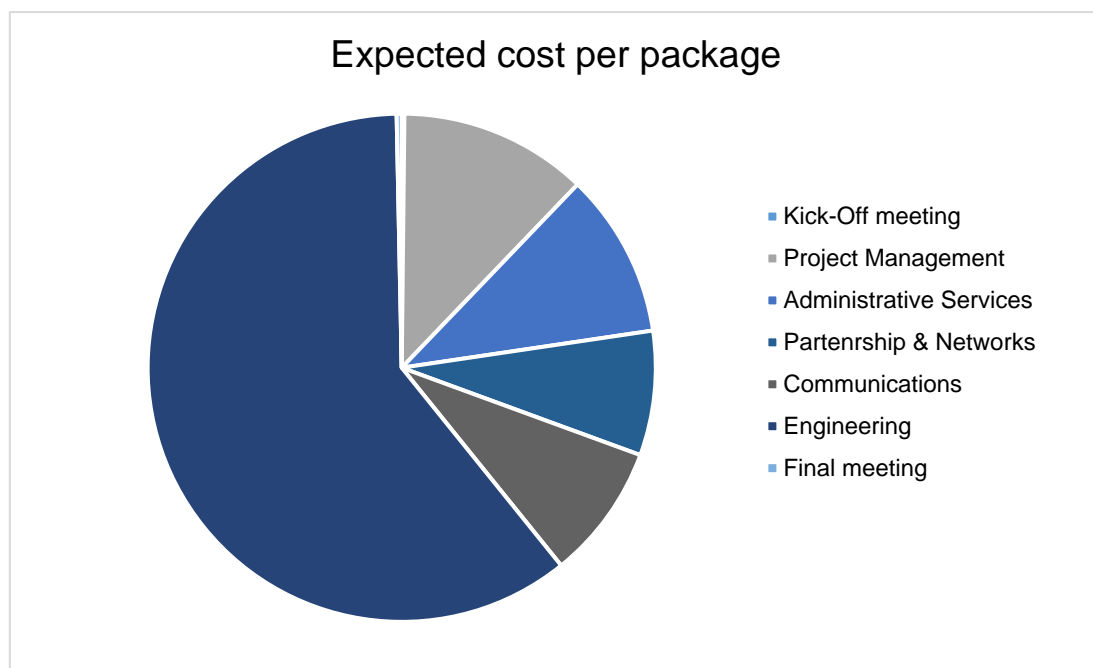
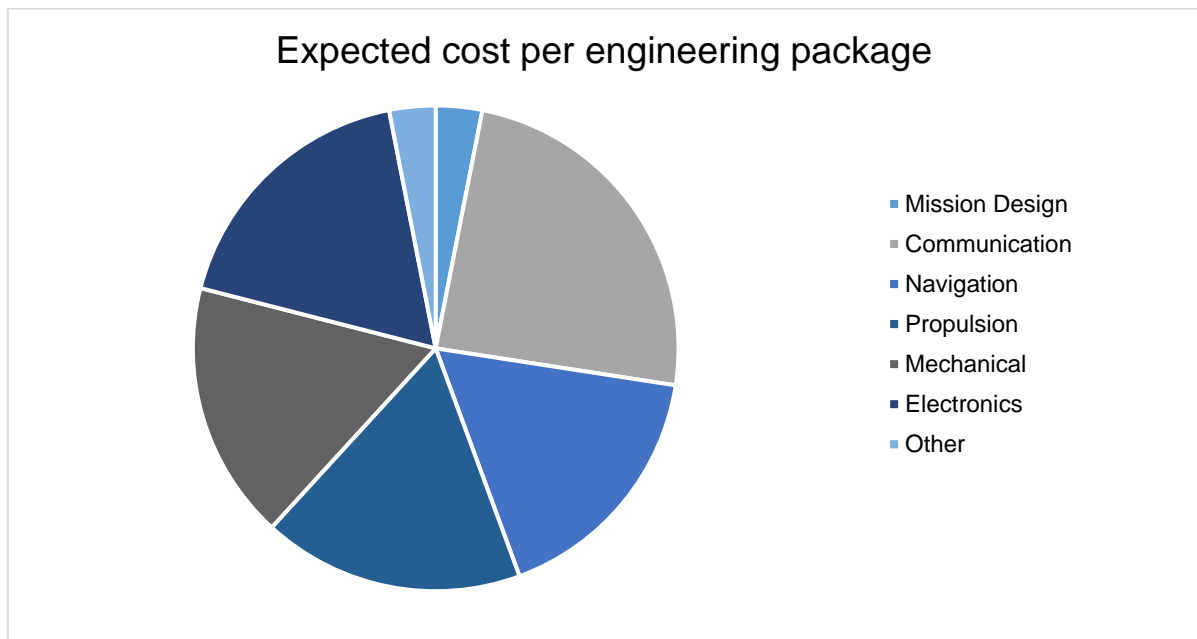


Figure 3. Sector diagram of the distribution of the amount per work package

Due to its large implication in the project, the engineering department has been separated into different expertise sub-departments.


**Table 5. Amount for each sub-department**

Department	Amount
Mission Design	68320 €
Communication	538870 €
Navigation	375180 €
Propulsion	385460 €
Mechanical	380440 €
Electronics	396760 €
Others	68160 €
<b>TOTAL</b>	<b>2.213.190 €</b>



**Figure 4. Sector diagram of the distribution of amount in the engineering department**


Although a certain amount of the budget has been assigned for possible casualties for each activity, in case of further problems (up to a 20% increase in the European Commission funding is allowed). For this project, a contingency of 420.600 € has been specified for further unexpected incidents (lower than the maximum of 500.000 € set by the European Commission).

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**Table 6. Expected Budget**

Department	Amount
Project Budget	3.659.400 €
Contingency	420.600 €
<b>Expected Budget</b>	<b>4.080.000 €</b>




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### 3. Plan procurement management

#### 3.1. Make or Buy decisions

Table 7. List of procurement items

WBS ID	Work Package Name	Reason for BUY	Cost Estimate	Type of Contract	Possible Risks	List of Suppliers	Special Considerations or Constraints
PD.E.HW.5	Contact and specify sensors from developers	Requires high tech and specialized workers, been not affordable to produce three sensors.	84.210 €	Fixed Lump Contract (maximum price of 93.680 € including VAT)	1. Inadequate specifications of the sensor. 2. Malfunction of an internal subsystem. 3. Difficulties to integrate sensor into the ECCO module.	1. e2V 2. SIC 3. HeadWall	The schedule must be accomplished without exception
C	Dissemination	Specialized marketing companies could offer best prices and more efficiency.	315.210 €	Fixed Lump Contract (maximum price of 350.660 € including VAT)	1. Copyright violation. 2. Inadequate press and communication. 3. No transmission of the ECCO ideas.	1. BCCI 2. newsfile 3. Research Media	Due the objective of ECCO project, the EU criteria referred to sustainability must be accomplished
T.E	Electronics tests and validations	Collaboration with UPV university leads us to reduce costs and use specialized laboratories.	56.400 €	Fixed Lump Contract (maximum price of 62.750 € including VAT)	1. Invalid tests. 2. Nonqualified students.	1. UPV 2. UPM 3. UPC	Collaboration contract

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To obtain a balanced Evaluation SOW there should be appropriate questions, time and resources. That is why the following parameters will be taken into account:

- Description of Program/Project/Activity to be evaluated
- Background on the project/program to be evaluated
- Evaluation Purpose
- Evaluation Questions
- Evaluation Methods including data analysis plan
- Deliverables and Timeline
- Team Composition
- Schedule and Logistics
- Evaluation Budget

Generally, SOWs are important for Performance Evaluations as well as for Impact Evaluations. For this reason, Evaluation SOW expect clear answers to the set of questions that have been asked. What is more, gender should be considered and integrated into an evaluation plan. In addition to this, it has been suggested that some of the most challenging aspects to develop are the section on evaluation methods (takes into account appropriated approaches for collecting and analysing data on an evaluation question by evaluation questions basis) and the section on evaluation budget.