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# Preliminary study of the effects of vortex generators in ultralight aircraft

Degree:

**Grau en Enginyeria en Tecnologies Aeroespacials (GRETA)**

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**DOCUMENT 3: BUDGET**



## Contents

1. Specifications of the budget .....	3
2. Preliminary study budget .....	4
3. Future full study budget .....	5

## 1. Specifications of the budget

The following budgets consist in a cost estimation of the different elements needed to reach the aim of the study.

The first budget describes the costs associated with the work done until the completion of this project, the preliminary study. Working hours, flight hours for the preliminary experimental tests, and cost of the software used are computed.

The second budget tries to estimate the costs associated with a deeper full analysis of vortex generators effects for a given ultralight model, which is of course the final aim of this preliminary study.

## 2. Preliminary study budget

	Amount	Units	Unit price	Total price
Hours spent searching information	100	h	9,00 €	900,00 €
Hours spent learning the software	20	h	9,00 €	180,00 €
Hours spent setting up simulations	50	h	9,00 €	450,00 €
Hours spent in meetings	10	h	9,00 €	90,00 €
Hours spent preparing the documents	200	h	10,00 €	2.000,00 €
Piloting hours for flight tests	4	h	30,00 €	120,00 €
ALTO 912 airplane renting hours	4	h	150,00 €	600,00 €
VG construction material cost	1	kit	20,00 €	20,00 €
Matlab student license cost	1	lic	80,00 €	80,00 €
ANSYS student license cost	1	lic	25,00 €	25,00 €
			<b>TOTAL</b>	<b>4.465,00 €</b>

Note that no VG kits were purchased and that VG were built by the author, so only the aluminum material cost is computed in the preliminary budget.

### 3. Future full study budget

This budget features all the necessary material to efficiently carry out 3D flow simulations and optimization of VG configurations.

Various VG kits are to be purchased to carry out experimental tests. Note that a VG kit is a more expensive option than building the devices oneself; there is also the option to build VGs using an aluminum plate, like in the preliminary study.

Note how beyond academic possibilities this study falls if one wants to perform it properly and obtain reasonable results.

	Amount	Units	Unit price	Total price
High power computer research work time	30	h	10,00 €	300,00 €
3D simulation pre-processing work time	100	h	10,00 €	1.000,00 €
Simulation stage work time	200	h	10,00 €	2.000,00 €
Result post-processing work time	150	h	10,00 €	1.500,00 €
Experimental flight tests setup work time	10	h	10,00 €	100,00 €
Result analysis and conclusions work time	40	h	10,00 €	400,00 €
VG test kits	2	kits	200,00 €	400,00 €
384GB RAM FEA Mini-Cluster	1	u	32.000,00 €	32.000,00 €
ANSYS Fluent full license cost	1	lic	40.000,00 €	40.000,00 €
Piloting hours for flight tests	40	h	30,00 €	1.200,00 €
ALTO 912 airplane renting hours	40	h	150,00 €	6.000,00 €
			<b>TOTAL</b>	<b>84.900,00 €</b>