Student Survival Guide

Course 2023-2024

Presentation

Welcome to the Escola d'Enginyeria de Telecomunicació i Aeroespacial de Castelldefels (EETAC for short), at the Universitat Politècnica de Catalunya. BarcelonaTech (UPC for short). Thank you for your interest in taking the **Master's degree in Applications and Technologies for Unmanned Aircraft Systems (Drones)**. For us, it is a privilege to have your participation, which we hope will be an unforgettable learning experience for you.

In this document, you will find all the information you need to guide you in the program of activities. It includes a general description of the Master, a more detailed description of the different types of activities, key dates, schedules and recommendations that should help you to get the most out of your stay with us.

Please read this guide carefully. During the first days of the course, you will have the opportunity to clarify the doubts that you may have with your classmates and with the academic coordinators. Always keep the guide at hand for further consultation during the course.
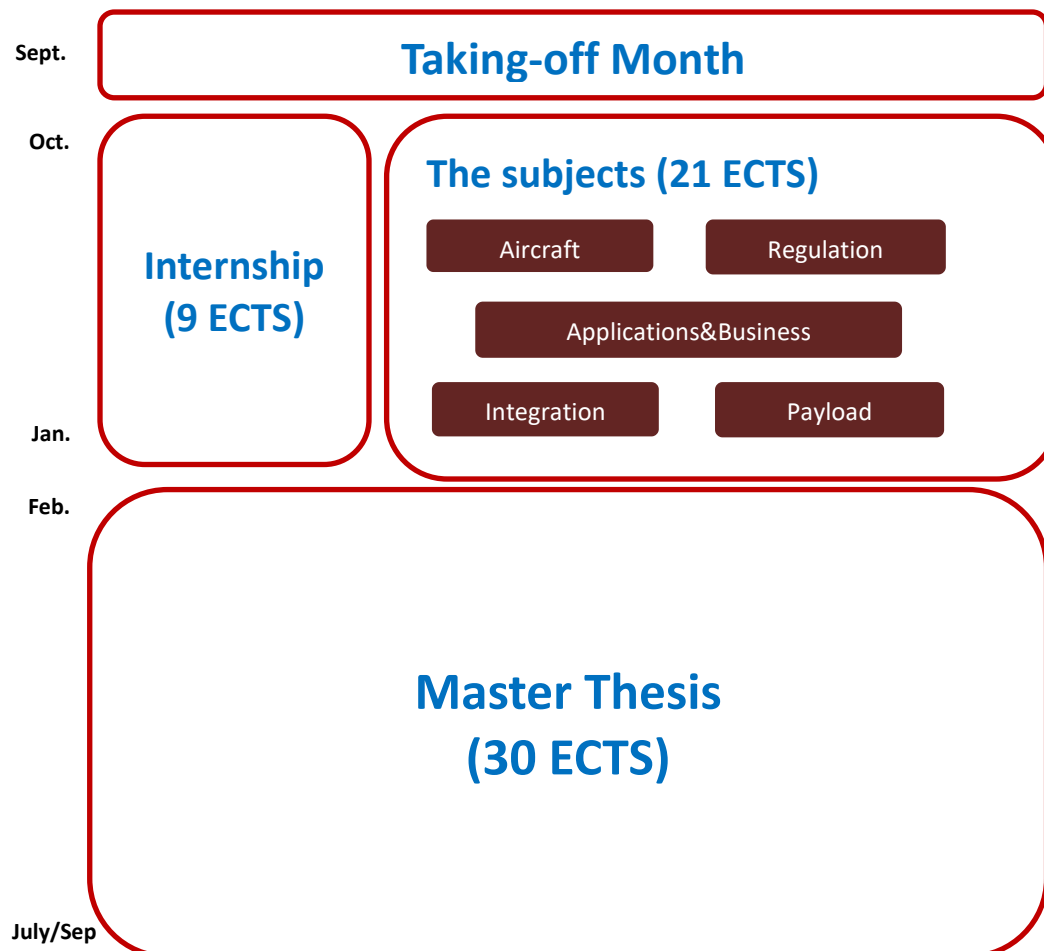
1. Master overview

The Master's objective is to help you develop your skills to:

- Devise new applications for drones;
- Choose the most suitable platforms for drones depending on their application;
- Integrate the equipment needed for a mission, such as sensors and cameras, into the platforms and to develop any other additional components required for integration; and
- Turn the applications of drones into feasible and profitable businesses.

In addition, it will help you improve general skills such as autonomous learning, communication, teamwork, etc.

Our learning model is inspired by the following motto: "*Learning by doing with those who do*." Not in vain, the main feature of the Master is that 65% of the academic activity will be developed within a company or research group that works with drone applications, actively participating in their projects.

The course is organized into four main blocks, as you can see in the figure. Next, you have a summary of these blocks. In the remaining sections of this guide, you will find more information about each of them. Please, check the **Key Dates Sheet** for details on day/time for each activity.

Sept.	**Taking-off Month**
Oct.	**The subjects (21 ECTS)**
	Internship (9 ECTS) — Aircraft, Regulation, Applications&Business, Integration, Payload
Jan.	
Feb.	**Master Thesis (30 ECTS)**
July/Sep	

The subjects (21 ECTS)

The course has five subjects (Aircraft, Payload, Integration, Regulation and Applications&Business) that cover the fundamental aspects of drone technologies and applications. The subjects are taken during the first semester (in the afternoon). In addition to attending classes, you will have to do some homework and pass some knowledge exams.

The Internship (9 ECTS)

During the first semester (in the morning) you will take an internship in a company or research group that works on drone applications. Normally it will be the same company in which you will carry out the Master Thesis during the second semester. The purpose of the internship is to acquire knowledge of the company, its tools and work procedures and define and prepare the work for your Master Thesis. The expected workload for the internship is about 270 hours. The internship will be done under the guide of a professional supervisor in the company and an academic supervisor from EETAC assigned by the academic coordinators of the Master.

The Master Thesis (30 ECTS)

This is the most important block. You will work full-time, during the second semester, in a drone application project, in the company where you have completed the internship, still under the guide of your professional and academic supervisors. The work will result in a technical report and an oral presentation that will be evaluated by a commission to determine the grade. The expected workload for the Master Thesis is about 765 hours.

Formative complements (3 ECTS)

Students with a previous background other than aeronautic, telecommunications, computer science or electronic engineering must take a block of 3 ECTS of formative complements, with content focused on computer programming, electronics and airspace organization. This block will be taken during the first 5 weeks of the course and will help students get the most out of the most technological subjects of the program.

The taking-off month

We refer with this name to a set of activities that will take place during the first month of the course. These activities do not have an ECTS assignment, they will not be evaluated, but they are essential for the correct development of the course. The activities have different objectives:

- Getting to know your classmates quickly (group building).
- Mounting and testing the drone you will use for some practical work during the first semester.
- Help you in selecting the company in which you want to do the internships and the Master Thesis.
- Review previous knowledge that we consider necessary to successfully start the course.

2. The taking-off month

In this section you will find a short description of the different activities that we include under the name **The taking-off month**. These are a variety of activities with different objectives, as described in the previous section (group building, project selection, mounting and testing a drone system, etc.). These activities do not have ECTS assigned and will not be evaluated, but they are essential for the correct development of the course. Please check the **Key Dates Sheet** for details on day/time for each activity.

Welcome&Enrolment session

In this session you will meet your classmates and academic coordinators for the first time. Academic coordinators will give a short presentation on the Master objectives, organization, key dates, etc. They will give you also information to access to the virtual campus where there is information about the Master's activities and about the collaborating companies and the projects they propose, so that students can become familiar with these proposals during the following days. Finally, the registration of the 5 subjects is proceeded. The approximate cost of this tuition is €581,07 (€1452,57 for non-EU students) for 21 ECTS . In this session, a copy of this manual is also given so that students can read it before the start of the course.

Remember that the documentation you will need for the enrolment is the following:

- Degree certificate (original + photocopy)
    If the degree certificate is from a country that do not belong to the European Union it must be stamped and legalized by the appropriate government department.
    If the degree certificate is not written in Spanish or English, you have to provide a degree certificate translated into Catalan or Spanish.
- Academic Record (original + photocopy)
    If the academic record is from a country that do not belong to the European Union it must be stamped and legalized by the appropriate government department.
    If the academic record is not written in Spanish or English, you have to provide a degree certificate translated into Catalan or Spanish.
- Passport or NIE (original + photocopy)
- The username and password (that you will receive by email) to access UPC e-secretary (https://prisma-nou.upc.edu/apl/home_estudiants.php?idioma=3).

Companies & students presentations

In these two sessions, each of the collaborating companies will give a brief presentation of the activities of the company, the contents of the project they propose and the conditions for the work to do (including possible economic compensation). These presentations together with the information distributed in advance about the companies and their projects, should allow you to determine your preferences regarding the project to be carried out in your Master Thesis.

In these two sessions, students must also make a formal personal presentation explaining their background, their abilities and their interests (a template for this presentation will be provided). Half of the companies will be presented on the first session and the other half on the second one. The students will repeat the personal presentation in both sessions. The presentation of the students is particularly relevant because in the event that several students coincide in their preference for a company, the company will select the student, probably taking into account the presentations made by students. In both sessions there will be a time for informal interaction between companies and students.

During the days following the presentations of the companies, students must indicate their preferences regarding the projects to be carried out. To make the assignment, a mechanism that will try to maximize the satisfaction of the preferences will be used. As already indicated, in case of coincidence of preferences, the company will choose the student.

Project assignment

The final assignment of projects / companies to students will be presented in the session Project assignment (2). It will be done based on the preferences expressed by the students. In the event that several students wish to be assigned to the same company, the company will select the student they prefer. Since it is a complicated process that may require several iterations until the optimal solution is found, a first assignment attempt will be presented in the Project assignment (1) session.

In the Project assignment (2) session, in addition to assigning the project (which involves the assignment of a professional supervisor) each student will be assigned an academic supervisor. This is a professor from the EETAC who will be responsible for ensuring that the work done, both in the Internship and in the Master Thesis, satisfies the established requirements. Once your academic and professional supervisors are known, you should have an interview as soon as possible with them to agree the aspects related to the work to be done and its supervision. More on this in section 4.

Mounting and testing a drone system

This activity occupies three sessions. You will be guided to mount and test a drone system that you will use frequently during the first semester. This system is the platform you will use to apply some of the contents of the different subjects in order to plan, execute and exploit the results of the particular application, including flying the drone in the Campus DroneLab. We refer to this activity as the **Transversal Project.**

The Zero Week

In this activity, you will meet the teachers of most of the subjects in the course. They will propose you tasks to help you review some knowledge required to start the class work. They will also help you to install on your computer the software that you will need for the work of these subjects. Please check the **Key Dates Sheet** to find day/time for each of the Zero Week sessions.

Introduction to Library Services

The Campus Library should be an invaluable resource for your work. It is a modern space where you can work individually but also in teams, with a variety of services that you must know. In this session, people in charge of the Campus Library will present these services and will help you to learn how to use them.

Photogrammetry with Drones

People from Rokubun will lead a session in which they will explain their tools and technologies to perform photogrammetry using drones. This activity will help you to quickly get in touch with some applications of drones.

3. The subjects

In this Master, you will have to study five subjects that cover the fundamental aspects of drone technologies and applications. In this section, you will find a short description of the contents, organization and evaluation of these subjects. Obviously, the teachers of each subject will give you all the details.

Contents and organization

The table below describes briefly the contents of the subjects. Each of the subjects has about 10 class sessions of 3 hours each, which are taught in the afternoons, usually from 15:30 to 18:30, every day of the week except Friday. However, this rule may have exceptions. Please, check the **Key Dates Sheet** to find day/time of each one of the sessions of these subjects.

The subject Applications&Business has a different organization. It has only 5 class sessions. The classes are complemented with a series of invited talks (about 5 or 6) in which professionals from companies in the field of drone applications will explain some interesting aspects of their business. The day/time for these invited talks do not appear on the **Key Dates Sheet** and will be announced well in advance.

Evaluation

The evaluation of the subjects will be made on the basis of the homework assigned by the teachers and a knowledge exam. In the **Key Dates Sheet** you will find the dates scheduled for the exams of the different subjects. Please note that a period for remedial exams has also been scheduled in case a second opportunity is needed to pass the examination.

The subject Applications&Business has no knowledge exam. The evaluation will be carried out based on the works assigned by the teacher and the attendance to the invited talks.

In any case, the first day of class of each of the subjects, the teacher will give all the details about the evaluation method that will be used in each case.

The Transversal Project

The evaluation of the subjects will also take into account the results of the Transversal Project that you will carry out during the first semester. In the Transversal Project you will have the opportunity to learn the whole process of developing a drone mission, from mounting and testing the drone platform (you will do that during the taking-off month), to plan the mission, fly the drone in the Campus DroneLab and exploit the results. In this process, you will apply some of the knowledge acquired in the 5 subjects.

The results of the Transversal Project will be documented in the form of project blog that you will develop during the project. The blog should include descriptions of the activities, reflections about you learning, pictures and videos (maybe your drone flying).

An important part of the Transversal Project (and an important section of your blog) will be an activity to deepen your understanding of a certain aspect of the project. You may wish to learn

more about machine learning methods to exploit the data obtained by the drone or to review the regulations on different countries to analyze the viability of your mission. The teachers in each subject will propose a list of themes for this activity. You must choose one of those themes that adequately complements the knowledge that is expected to be acquired in the work carried out in the company (see the block talking about the Learning Expectations document in section 4 below). For example, if you are not going to work in the company on issues related to the design and configuration of the aircraft, one of the themes proposed in the Aircraft subject will be the most appropriate for your Transversal Project. In any case, the academic coordinators will help you to select the topic.

A preliminary version of that blog will be evaluated by classmates whose suggestions you should take into account to improve the work and present the final version. The qualification of the final version will be used in the subjects for the calculation of the final grade of each of them. Please check the **Key Dates Sheet** for the key dates related to the delivery and evaluation of the Transversal Project blog.

Contents of the subjects

Unmanned Aircraft
The central element of the drone-based system is the aircraft itself. In this subject the several existing aircraft types will be studied, including but not limited to their characteristics, feeding and propulsion systems, actuators, autopilots, etc...

The subject gives the student the adequate criteria for the accurate selection of the aircraft and its components based on the requested mission.

Payload
An unmanned system gets its value thanks to its capacity to carry on a specified work. For this purpose it'll be needed to embark several devices required to carry on such work, called payload.

In this subject the equipment that normally constitutes a drone payload will be studied, together with their correct maintenance, configuration, functioning and how to process the output data.
Remote sensing applications will be particularly focused upon, since they're the most extended.

System Integration in RPAS
An unmanned aerial system is formed by many components and systems (cameras, autopilot, electrical and propulsion systems, onboard processing, database, etc...) that need to interact between each other in a coordinated and intelligent way in order to correctly perform a mission or given task.

So we can say that we're dealing with a distributed system that needs to be managed and exploited correctly. A good coordination between all the systems will offer an important efficiency increase to the operation and a differential value to the overall system.

Airspace Structure and Regulation
Drone usage on our country is regulated by rules that, even if they may change in the future, must be known. It's also convenient to know the regulations that are being applied in other countries inside and outside the European Union, and the normative development that the EU is having in order to harmonize the regulations of several countries, so transnational applications are simpler and the sector development is quicker and orderly.

RPAS Applications & Business
The purpose of a drone system is to accomplish a mission. It's precisely in this field where an activity explosion is expected, since the application possibilities of drones are already extraordinarily numerous. With all probability, in the next years new, hard to imagine possibilities will be created.

In this subject, the students will review several of the actual applications. It'll be organized around talks given by experts in each one of their applications (ambiental protection, fire prevention, forest management, infrastructure supervision, audiovisual reportage, etc...).

The subject will cover also the basic knowledge to design plans to turn drone applications into viable and profitable business.

4. The internship

In the first semester, during the morning hours, you will have to make an internship in the company that has been assigned to you, with an associated workload of about 270 hours. The objective of the internship is that you learn the tools and work procedures of the company and that you carry out the preparatory tasks of the Master Thesis that you will develop in the company during the second semester. In this section you will get some details about the processes related to the internship.

Internship agreement

In the first meeting you have with the professional supervisor of the assigned company you must agree on some relevant aspects of the work to be done, which you will then reflect in the document called Internship agreement (in page 15 you have an example of Internship agreement). This document summarizes the tasks to be performed in the internship and the associated conditions (time, place, possible economic compensation, etc.).

In previous editions of the Master, some companies have been willing to pay to students a salary per hour worked. Other companies have preferred to offer the student a scholarship to pay for part of the Master's enrollment. Finally, other companies have not offered direct financial compensation, but have offered free training courses that under normal conditions would be paid (for example, a course to obtain the license of drone pilot).

The internship agreement must be delivered through the virtual campus on the due date so that the academic coordinators can register the work plan required to prepare the contract covering the internship, that must be signed by the company, the student and the Director of EETAC.

The Internship contract

The internship contract is an official document that covers the legal aspects related to the internship in the company. The process is managed through the academic management intranet. The key steps are the following:

1. The academic coordinators create the contract based on the data indicated in the internship agreement.
2. The student receives an automatic message with instructions to validate the work plan through the intranet (NetArea). To do this, you must enter the Social Security Number into the system. It is important to read section 6 where we explain how to obtain this number.

3. The company will receive an automatic notification indicating that it must print the contract and sign it.
4. The student must sign their copy of the contract and deliver it to the academic management office to register the corresponding credits. The cost of this tuition is €240,03 (€622,63 for non-EU students) for 9 ECTS.

Usually, the internship will formally start around mid-October and will finalize at the end of January. The expected workload is about 270 hours. Since between the start date and the end date there are about 13 working weeks, a workload of about 20 hours per week is expected, in morning time (since the afternoons will be occupied by the classes of the 5 subjects).

Academic supervision

In the first meeting with the academic supervisor, the supervision plan for the work to be carried out must be agreed upon. It is considered appropriate to plan a meeting every 15 days with the academic supervisor. You must prepare in advance for him a progress report before every meeting containing the essential data of the work done, incidents and tasks for the next period (page 16 is a template for this progress report). It will be the mission of the academic supervisor in these meetings to ensure that the work is carried out according to the plan and academic requirements.

Learning Expectations

A few week after the start of the internship (in mid November) you must have some idea about the details of the work to be done in the company, especially regarding the Master Thesis. Then you will prepare a document named Learning Expectations where you will specify these details. In this document you will also have to reflect on how much you believe the work to be done in the company (especially the Master Thesis) covers the each one of the learning goals of the MED. The information in the Learning Expectations document will be very useful to select the adequate topic for the Transversal Project (review again the block talking about the Transversal Project in section 3 of this document).

Obviously your supervisors will help you in preparing the Learning Expectations document. In page 17 you find the template for this document.

Internship evaluation

The internship ends by January 31. But the evaluation process will start two or three weeks before. The basic steps in this process are:

1. You must prepare an Internship Final Report that consists in a brief summary of the tasks performed during the internship and an assessment of the extent in which these tasks helped you to develop the learning expected in the Master. See pages 20 and 21 for the template of the Internship Final Report. You should fulfill also an evaluation questionnaire in the intranet. It is important that you meet your academic supervisor to discuss the results of this evaluation with him.
2. The professional supervisor must fulfill also an evaluation questionnaire in the intranet. His evaluation includes the proposal of a numerical qualification for your work.

3. The academic supervisor will fulfill also an evaluation questionnaire, normally corroborating the rating proposed by the company.
4. The academic coordinators will finally validate the entire process, which will be closed after their intervention.

Please check the **Key Dates Sheet** to find relevant dates related to the internship process.

5. The Master Thesis

Between February 1 and September 15 the Master Thesis work must be done, which includes the writing of a report and an oral defense. The Master Thesis must be an original work related to the applications of drones with an estimated workload of 765 hour (30 hours per week).

The scope of the Master Thesis will have been determined during the internship with the help of professional and academic supervisors.

The Master Thesis Agreement

During the second / third week of January you should discuss with your professional and academic supervisors the details of the Master Thesis. The basic data will be reflected in the Master Thesis Agreement document, which includes the description of the project and the working conditions (site, timetables and possible economic compensation). The Master Thesis Agreement document must be delivered to the virtual campus on the due date (page 22 shows an example of Master Thesis Agreement).

The Master Thesis Contract

Since the Master Thesis will be carried out in a company (normally, the same one in which the internship were carried out) it will be necessary to prepare a second contract. The key steps are similar to the case of the internship:

1. Based on the data of the Master Thesis Agreement, the academic coordinators will register the project in the computer systems of the school. They will also prepare the new contract covering the 765 hours of work in the company, normally between February 1 and September 15.
2. You will receive an automatic message with instructions to validate the work plan through the intranet (NetArea). To do this, you must enter the Social Security Number into the system.
3. The company will receive an automatic notification indicating that it must print the contract and sign it.
4. You must sign your copy of the contract and deliver it to the academic management office to register the corresponding credits. . The cost of this tuition is €830,10 (€2075,1 for non-EU students) for 30 ECTS.

These procedures must be carried out during the last two weeks of January, since the registration of the credits corresponding to the Master Thesis takes place during the first week of February.

Master Thesis Supervision

As in the case of the internship, you should meet your academic supervisor frequently during the period you are developing your Master Thesis. Again, you must prepare for him a progress report to be discussed in each meeting. The academic supervisor will help with your doubts and also in finding extra support in case you need it (for instance, facilitating the contact with other teachers that can help you with particular issues of your work).

Please note that in the case of the Master Thesis, the role of the academic supervisor is especially important to help you to prepare a good final report and a good oral presentation. Be sure that you discuss the report with him and that you give him enough time to read preliminary versions of the report so that he can give you feedback to improve the final version. Check the **Key Dates Sheet** to find due dates for the final version delivery.

Master Thesis Evaluation

Your Master Thesis will be evaluated taking into account the final report and the oral presentation. A template will be provided for the Master Thesis report. The oral presentation should last 30 min at most.

Check the **Key Dates Sheet** to find the periods scheduled for Master Thesis evaluation. The deadline for the Master Thesis presentation is mid September, although we expect you to present your work in July. There is an exceptional period for presentations in October, but you will be charged with extra fee (€90 approx.) if you use this period.

Your work will be evaluated by a committee consisting of three academics (including your academic supervisor). Committee members will read the report and attend the oral presentation. After the oral presentation, you will be asked questions about the work done.

6. Others

NIE and NSS numbers (extremely important for foreign students)

When getting the Visa, foreign students will get automatically an identification number that is called the NIE (Numero de Identificación de Extranjeros). This NIE will be valid for a few weeks. Then, you will have to renew the NIE and obtain the TIE ("Tarjeta de Identificación de Extranjeros"). This is the card where the renewed NIE is stated. The procedures to renew the NIE and obtain the TIE can be found here:

https://www.upc.edu/sri/en/students/students-mobility-office/incomings/legal-issues/at-your-arrival/at-your-arrival

It is also very important to obtain as soon as possible the NSS ("Numero de Seguridad Social"). This is a number that must be included in the contracts for both the Internship and the TFM. To obtain the NSS you must go to an office of Seguridad Social. You can use this link to find offices of Seguridad Social:

http://www.seg-social.es/wps/portal/wss/internet/Inicio?urile=wcm:path:&page=com.ss.internet.portlets.seguridadSocial

You can also ask for the NSS on line here:

https://w6.seg-social.es/ProsaInternetAnonimo/OnlineAccess?ARQ.SPM.ACTION=LOGIN&ARQ.SPM.APPTYPE=SERVICE&ARQ.IDAPP=FRCOGENE&ORGANISMO=T

It is extremely important that you obtain the NSS during September in order to be ready to start the work in the company in time. Students in the past had different types of difficulties to get this NSS. So, start the procedures as soon as possible and contact the academic coordinators in case you have any difficulty. In fact, during the enrollment session the academic coordinators will help you in the first steps of this process.

Other meetings

You must attend some additional meeting, especially during the second semester, just to keep in touch with your classmates and academic coordinators. In these meetings we will discuss in an informal way the progress of your work, clarify any doubt and informally assess your opinion on how things are going in the Master. Check the **Key Dates Sheet** to find day/time for these additional meetings.

Atenea

Atenea is the name of the UPC virtual campus, based on Moodle. Each of the subjects will have its own Atenea space to be used by the teachers to distribute material and for homework delivery. You will also have access to a special Atenea space with general information and materials. In this space you will find, among others, an agenda with key dates (particularly important for the case of the invited talk, that do not appear in the **Key Dates Sheet**) materials for the Taking-off month, templates for different documents (Internship agreement, progress report, Master Thesis report, etc.) and point for delivery of documents to the Master coordinators.

Internship Agreement

Name of student	

Name of Company	

Professional Supervisor	Name	email	Phone

Workplace address	

Salary	Euros/hour	Total (270 hours)

Working hours	

Short description of tasks	The activities to be performed during the internship will be twofold: (1) Develop and maintain a database of GNSS receivers to increase the coverage of the cloud service of precise positioning (Position-as-a-Service) of the company. This will allow extending drone-based photogrammetry service to areas other than Iberian Peninsula. (2) From a market standpoint, the internship will also cover the analysis of new potential case uses for the company's positioning product portfolio. This will open up market opportunities to use the company's GNSS technology in the drone-based market segment.

Master in Applications and Technologies for Unmanned Aircraft Systems (Drones)

Progress Report

Name of student	

Name of Company	

Period

Date	Date of previous progress report

Short description of tasks done in this period	

Tasks for next period	

Incidences and difficulties	

Learning Expectations

Name of student

Name of

Company

Short description of tasks to be done (Internship + Master Project)

Technologies and tools you expect to learn

Expected impact in learning objectives

The learning objectives of MED are listed below. For each of them, write a sentence that describes how much you believe the project covers the goal. Please include the technical considerations that you consider necessary. If possible, indicate "High, medium or low".

CE1 - To analyze the requirements of the mission, to select the most appropriate dron platform according to the requirements (aircraft type and energy systems, propulsion, positioning, navigation, guidance, telecommunication, safety and emergency) and perform system verification.

High ☐ Medium ☐ Low ☐

Explain here	

CE2 - Select the type of instrumentation that should constitute the payload, in accordance with the mission requirements and integrate such instrumentation in the dron platform, developing the necessary hardware and software.

High ☐ Medium ☐ Low ☐

Explain here	

CE3 - Conduct the planning and management of a mission, selecting and using appropriate techniques and support tools.

High ☐ Medium ☐ Low ☐

Explain here	

CE4 - To develop the most suitable systems for the efficient exploitation of the data obtained in the mission.

High ☐ Medium ☐ Low ☐

Explain here	

CE5 - Analyze the limitations and opportunities presented by current and future legislation on the use of drones.

High ☐   Medium ☐   Low ☐

Explain here

CE6 - Identify the particular aspects of the current legislation that may affect a particular mission and take appropriate measures to adapt to such legislation.

High ☐   Medium ☐   Low ☐

Explain here

CE7 - Explain clearly to both a specialized and non-specialized audience the most important features of current drone applications and describe areas where drones are expected to have a significant medium- and long-term impact.

High ☐   Medium ☐   Low ☐

Explain here

CE8 - Make the necessary plans to turn an application into a viable and profitable business.

High ☐   Medium ☐   Low ☐

Explain here

Internship Final Report

Name of student	

Name of Company	

Period	

Short description of tasks done in the internship	

Explain briefly to what extent the internship helped you to develop each of the learning objectives of the Master (included below)	

Additional personal comments	

LEARNING OBJECTIVES

CE1 - To analyze the requirements of the mission, to select the most appropriate dron platform according to the requirements (aircraft type and energy systems, propulsion, positioning, navigation, guidance, telecommunication, safety and emergency) and perform system verification.

CE2 - Select the type of instrumentation that should constitute the payload, in accordance with the mission requirements and integrate such instrumentation in the dron platform, developing the necessary hardware and software.

CE3 - Conduct the planning and management of a mission, selecting and using appropriate techniques and support tools.

CE4 - To develop the most suitable systems for the efficient exploitation of the data obtained in the mission.

CE5 - Analyze the limitations and opportunities presented by current and future legislation on the use of drones.

CE6 - Identify the particular aspects of the current legislation that may affect a particular mission and take appropriate measures to adapt to such legislation.

CE7 - Explain clearly to both a specialized and non-specialized audience the most important features of current drone applications and describe areas where drones are expected to have a significant medium- and long-term impact.

CE8 - Make the necessary plans to turn an application into a viable and profitable business.

Master Thesis Agreement

Name of student	

Name of Company	

Master Thesis title	

Professional Supervisor

Name	email	Phone

NIF	Academic title	

Workplace address	

Salary

Euros/hour	Total (765 hours)

Working hours	8 h/day flexible schedule

Key words	photogrammetry, drone, UAV, RPAS, UAS, GCP, ground control point, georeferencing, single frequency, GNSS,

Short description of theme and working plan	The STAMP project aims at speeding up and enhance the collection of ground control points required for any airborne photogrammetric project that needs to be georeferenced. The classic method of collecting those ground control points was to send one or more surveyors to the field with a dual frequency GNSS receiver (or sometimes with an optical "Total Station") to obtain the coordinates of singular points in the field, most often artificial targets, that could be uniquely identified in the aerial images taken by a drone and in this way georeference the images that would be used in the photogrammetric process. The STAMP system does perform the same task but instead of using a human surveyor with a dual frequency receiver it would use a "master" drone (the one taking the aerial pictures) and a set of slave drones that (the ones landing on the ground to be photographed) to avoid sending humans to collect ground control points. The master drone would carry a single frequency GNSS receiver and the slave drones would also carry a single frequency receiver (both able to output carrier phase) this is enough to obtain accurate (sub 10 centimeters) coordinates for all the drones on the ground and in the air. Isaac will be working full time (9 AM to 6 PM) mostly dedicated at writing the master thesis.