Project DEOS-UD

Disruptive Earth Observation Sensing for Urban Developement

Deliverable 2
Scope, Time and Cost Management

Authors:

Calderón Rosario, Borja

De Benedicto Barba, Maria

Escartín Vivancos, Guillermo

Fontanes Molina, Pol

Franch I Ruiz, Sergi

González García, Sílvia

Herrando Moraira, Albert

Lopezbarrena Arenas, Santiago

Nachett, Hamza

Pérez Sánchez, David

Pla Olea, Laura

Pons Daza, Marina

Ramón Costa, Fernando

Sellart Combalia, Ana Maria

Serra Moncunill, Josep Maria

Urbano González, Eva María

National Contact Point: Pérez Llera, Luís Manuel

Group: G3-220310-PM-P2018

Delivery date: 30-04-2018

Contents

List of Tables

List of Figures

1 | Project scope statement

1.1 Product Scope Description

Earth observation is a field with a great potential that has not been taken into account until the last decade. Important space agencies like the European Space Agency are promoting the enhancement of capabilities with respect to Earth Observation due to the fact the society and the planet itself would benefit from the many application it has. Hence, an improvement of the state-of-the-art technologies used for EO sensing is a key factor to promote and advance in this field. In other words, this project is not in charge of developing new launching systems or designing satellites, its objective is to provide the existing and the next generation of space technologies with disruptive sensors. One of the priorities of this project is to ensure the complementarity with other activities or programs such as Copernicus funded by the EU and lead to a strengthening of Europe's position and competitiveness in this field.

To achieve the project goal and implement much better sensors than the already existing ones, a state-of-the-art of the current space requirements of several optical and radar systems will be done. The limitations and the possibilities of the different technologies such as LiDAR, RADAR, Gravimetry, Hyperspectral, Superspectral and more will be determined, and then a decision will be taken in order to work with the most promising ones. Furthermore, the preliminary design will take into account several criteria to obtain competitive sensors. Launching any payload to space has very high costs, then it is essential to ensure the endurance of the overall systems in order to maintain the payload in space for a long time and avoid any replacements. To accomplish it, the materials used to build the components of the sensor including antennas, photo-detector, optics, laser and electronics have to be accurately chosen.

Besides, Earth Observation can have many application, so it is crucial to focus on the enrichment of some of them to guarantee the development the desired sensor abilities. Indeed, as the goal is to apply EO sensing for Urban Development to integrate space in society, the abilities to enhance are the following ones:

- Detection of greenhouse gases.

- Detection of weather patterns.

- High precision performance of terrain 3D mapping.

On the one hand, systems as LiDAR, which combines technologies as laser and radar, enable to target a wide range of materials including clouds and molecules. Consequently, it is possible to develop a sensor that identifies the composition of the air to secure our environment by having a monitoring of either the greenhouse gases or the weather patterns for proper weather forecasting applications. On the other hand, 3D mapping of the terrain is useful to control the land and guarantee an optimum growth and development of the city. All in all, one of the most important aspects that have to be taken into account is that the sensors resulting from this project have to ensure at least a 15% increase of the reliability and precision compare to the current ones.

In addition, a step that is necessary in this kind of projects is the testing of the product. Once the preliminary design is finished an accomplishes all the requirements of the project, a first prototype will be build and tested in a space simulated environment to make sure that it performs as expected. Notice that the testing is not done in the space itself because launching the prototype to the space is too expensive and out of this project budget; fortunately, there are other methods that are cheaper and simulate properly the space conditions. Finally, once the prototype designed fulfil all the expectations, it is considered that the results are attained and the product design is ready for closure.

1.2   Project Deliverables

All the deliverables specified in the Table 1.2.1 will be submitted to the European Commission during the development of the project.

Deliverable Name	Description
Project Management Plan	Document with detailed explanation of the project management strategies, including the Project Charter, stakeholder register, risk, quality and financial plans.
Business Plan	Document containing the market aproach details including the selected suppliers and the potential costumers as well as the exploitation strategy.

Deliverable Name	Description
Communication Plan	Document containing all the planned dissemination strategies, such as the online communication (including website development and social media management), the offline communication (participation in meetings and conferences) and the dissemination materials (technology demonstrators).
Payload State of the Art	Report containing the state of the art of current EO remote sensors as well as the sensors to improve selection and the first requirements definition.
Modular System State of the Art	Report containing the state of the art of current modular systems with space applications and its first requirements definition.
Space Applications State of the Art	Report containing the state of the art of current urban development space applications and first interaction platforms requirements definition.
Payload Preliminary Design	Report determining the payload preliminary design. It contains the research, requirements and preliminary performances parameters of each sensor.
Modular System Preliminary Design	Report detailing the modular system preliminary design. It includes a first review of the sensors blocks physical framework and sensors data fusion software requirements as well as the initial definition of the SATCOM application domains.
Interaction Platform Preliminary Design	Report detailing the interaction platform preliminary design. It includes the predesign of data sharing servers and platforms as well as the definition of the initial implementation of data processing algorithms.
Payload Final Design	Report detailing the final design and technical specifications of each developed sensor.
Modular System Final Design	Report detailing the final design and technical specifications of the modular system.
Sensors Data Fusion Software Report	Report containing the final sensors data fusion software specifications.

Deliverable Name	Description
Interaction Platform Final Design	Report containing the final design and technical specifications of the interaction platforms.
Data Processing Software Report	Report containing the final data processing algorithms specifications which will allow to process the acquired satellite data.
Validation	Report that gathers the tests and validations with the obtained results of all the payload sensors, the modular system and the interaction platform, as well as the full system performing.
Final Report	Final document that includes all the development done through the execution of the project and proper conclusions.

Table 1.2.1: Project Deliverables

1.3   Project milestones

The milestones of the project are shown in Table 1.3.1. It is possible to see that some of them are directly related with the deliverables due to the importance of some of the tasks such as final design and validation.

Milestones Name	Description
Kick-Off Meeting	First meeting of the project, formation of the development team and first contact with the stakeholders.
Project management plan	Specification of the objectives and scope of the project, organization of the team and distribution of tasks. Stakeholders register and financial, quality and risk plans.
Business plan	Obtaining a potential suppliers list, and negotiating procurement conditions with them, as well as identify and communicate with potential customers.
Communication plan	Development of a website and a social media strategy, as well as looking into participation in meetings and conferences.
State of the art completion	Definition of requirements for the system based on the current state of the art space applications of the payload sensors.

Milestones Name	Description
Payload preliminary design	First phase of the design, an optimization of each sensor is done in order to define the preliminary minimum performance parameters.
Modular system preliminary design	Development of the initial parameters of the modular system, as well as the software that will be in charge of the fusion of the sensors data.
Interaction platform preliminary design	Preliminary implementation of the functionalities of the interaction platform.
Payload final design	Final design of the entire payload, including the specifications and estimated performance in operation of each sensor.
Modular system final design	Final design of the modular system and the software that will process and register the information received by the payload.
Interaction platform final design	Final design of the interaction platform according to the guidelines stablished on the preliminary design.
Prototype manufacturing	Manufacturing of the prototype according to the final designs, in order to test its function in the next steps.
Individual systems testing	Performance analysis of each module (payload, modular system and interaction platform) of the overall system under operational conditions.
Full system testing	Performance analysis of the overall system in operational conditions in order to test the interaction between components.
Project completion	Final report that includes the complete development of the project.

Table 1.3.1: Project Milestones

1.4   Project Acceptance Criteria

The acceptance criteria establish the requirements that must be met for the client to accept the project. These criteria are quantifiable, demonstrable and verifiable in such a way as to demonstrate that the project has been carried out properly, that is why, if these criteria are

not met, a deliverable of the project cannot be considered valid.

Item	Description
Management	
Quality	The content of the project documentation must be clear, complete and understandable. Furthermore, it must be well structured, dividing the information into approach, development and conclusions.
	All the documentation included in the project must first pass through an inspection of the quality department.
Schedule	The organization must be well structured and the deadlines must be met in a timely manner so that the development of the product is appropriate.
Clarity	The tasks of the project must be well defined, both individually and as a group, in such a way that each of the contributors knows their duty and the duty of their team.
Viability	The project must be viable economically and technically, so that its realization is possible.
	The different parts of the project must be submitted at the individual level to a study that checks if it is possible to do them and, if not, search for an alternative.
	The budget of the project must comply with the financial requirements of the European Union. Hence, a balance is to be made to ensure that the allowed limit is not exceeded.
Collaboration	It is interesting to obtain a better result to collaborate with legal entities from different countries, like universities and research groups. Moreover, some collaborations with SMEs should be tried, so that they can benefit and grow in the market.
Transparency	In case information about the project is required by part of official organisations of the European Union or by the different stakeholders that participate in it, transparency has to be considered when sharing information.

Item	Description
Legal requirements	The applications and products of this project must have, if required, the certification and approval of the different legislative and ethical frameworks.
Technical	
Research and innovation	The project must be ambitious and use all the available resources to obtain the best result. In this way, it must include the most appropriate technology that there is so far and, if it is in the development phase, add a section of research.
Test and validations	The evaluation and validation tests must be carried out periodically and be registered in the project documentation, in such a way that there is a record of the different versions of the application throughout the development.
	The information of these tests must be presented clearly and refer to the regulations concerned, in addition to be verifiable.
	The results of these tests should be used to analyze the service level of the application and improve on later versions.
Technical documents	The application must have a user manual both internally and externally and attach the necessary information for its development.
	The performance of the final product must be reflected in a data sheet. It must also be included in the documentation the datasheet of the different components that are part of the application.
Performance	
Size	The total volume of the module must not exceed the space allocated to it. Considering that the system can be integrated into several satellites, this volume should not exceed 500 dm^3.

Item	Description
Weight	The system must be light enough to allow it to be put into orbit with ease and not affect the subsequent operation of the satellite in which it will remain during the data collection. In this way and making an estimation of the density of the materials and the maximum volume of the system, a limit weight of 950 kg is defined, which must not be exceeded for the system to be accepted as valid.
Power consumption	Modular system maximum power consumption must be lower than the 50% available onboard.
Accuracy	The accuracy of the equipment should allow the samples to be taken in a way that provides discretized information in the space. Due to the homogeneity of the climatology, the precision for this will be of 1 m^3, whereas in the 3D mapping in which there can be more considerable variations, it will be of 25 cm^3.
Back-up	Back-up system prepared to handle up to two major failures in the system. A major failure can be defined as the loss of a sensor module of the same type.
Transmission velocity	Transmission velocity between modular system and the main satellite communication (SATCOM) system should be able to handle at least 250 Mbit/s of data rate.
Processing time	The time that elapses since the information is captured through the sensors until it is processed and prepared to send to the ground station to be analysed should not exceed 10 seconds.
Latency	The latency since the information is prepared in the system located on the satellite to be sent to the ground station until this station is finally processed, should not exceed 300 seconds. The information collected by the system must be available via Internet in less than 8 minutes. This means that after the processing of information it must be sent in less than 3 minutes for the system to be considered valid.
Social	

Item	Description
Sustainability	The product must be sustainable using renewable energy as much as possible and avoiding excessively polluting emissions. The materials used in the project must be reliable and guarantee the agreed useful life of the product.
Social contribution	The product must be able to solve a current problem and improve the quality of life of people using technology.
Gender equality	The selection process must be fair, based on the knowledge and personal competencies of each person regardless of gender or condition.

Table 1.4.1: Acceptance criteria

1.5 Project Exclusions

There are some facts that are out of the scope of the project which, generally, are designated as exclusions. Hence, in this section, the exclusions of the project are determined and defined.

Item	Description
Satellites design	It is out of the scope of this project to design a new satellite that will use the sensors as payload.
Launching	The objective of the project do not include neither the design of the launch system of the satellites nor the costs and scheduling of launching the satellite using the sensors designed.
Deployment	No deployment mechanism nor strategy of the satellites that integrate this new technologies are going to be developed.
Satellite monitoring	The satellite monitoring system that permits to scan different surfaces and regions of the earth is not included in this project scope.
Data transfer	Neither communication between satellites nor between the satellite and the ground station are part of this project.

Item	Description
Final production	The project will only focus on the development of prototype models in order to test the new technologies implemented. Hence, commercial production of these ones will not be carried out.

Table 1.5.1: Project Exclusions

1.6 Project Constraints

Project constraints can be defined as all the limitations that curb the action of the project team and restrict project's outcome. It is necessary to define them with caution and common sense to avoid determining constraints that lead us to an impossible project, especially in terms of cost, time and resources. They can be internal limitations (scope, budget, etc.) or external limitations (environmental impact, stakeholders, government regulations, etc.)

In this project, we have decided to adopt a classification consisting on six groups [?] where constraints can be clearly interpreted and organised.
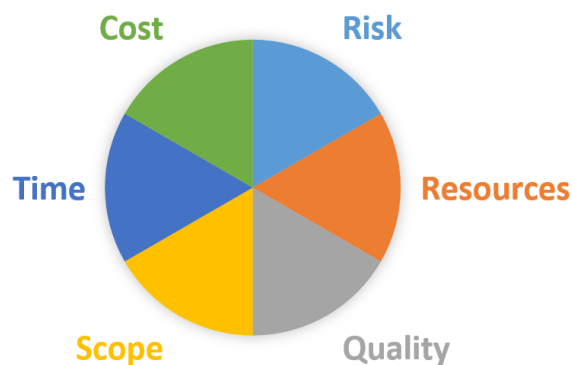
Figure 1.6.1: The 6 Project Constraints [?].

It is important to highlight that groups are interrelated in a way that if one of them changes, then, one or more of the others will be affected.

Scope

- **State of the art:** The starting point of the project has to be based on a study of the optical and radar cutting-edge technologies, not on outdated ones.

- **Technologies selection:** The technologies to be developed must be the most promising systems to profit Earth Observation, air composition and terrain analysis.

- **Technologies improvement:** The project is required to enhance the selected technologies in order to accomplish the European Commission requirements.

- **Final design:** The resulting design has to be a compact product which contains the chosen sensors, sharing a data collection software.

Time

- **Deadlines:** All deliverables have to be completed in their scheduled dates:

    - **10/09/2018 –** Kick-Off meeting
    - **05/10/2018 –** Project Management, Business and Communication Plans
    - **28/12/2018 –** State of the Art completion
    - **14/06/2019 –** Payload preliminary report
    - **06/09/2019 –** Modular system preliminary design
    - **29/11/2019 –** Interaction platform preliminary design
    - **15/05/2020 –** Mid-term project report
    - **12/06/2020 –** Payload final design
    - **04/09/2020 –** Modular system final design
    - **27/11/2020 –** Interaction platform final design
    - **16/04/2021 –** Prototype manufacturing
    - **09/07/2021 –** Individual systems testing
    - **29/10/2021 –** Full system testing
    - **21/01/2022 –** Project completion

- **Schedule:**

    - **Follow Gantt chart organization:** Tasks must be developed in the initially accorded order, avoiding undesired overlapping or delays and bringing the requirements of each task to their completion.

Cost

- **Budget:**

- All the incomes have to come from the European Commission.

- The project cannot exceed the quantity of 4 million euros.

- The money distribution must be done as it was described in the estimated budget.

Resources

- **Facilities:** No tasks will be planned without the certainty that the team (or a stakeholder) has the necessary facilities to complete it.

- **Human resources:** All the labour hours made by the staff in charge of the project must be justified. Every task will have assigned a different number of workers depending on the difficulty and duration.

- **Infrastructures:** The work to be done by the team is restricted by the capacity, limitations and efficiency of the owned infrastructures.

- **Procurement:** Goods and services will be obtained following optimized processes to achieve minimum cost while at the same time requirements are properly fulfilled.

- **Technical constraints:** The developement of the new technologies that the product will use will be restricted by technical, physical and scientific limitations.

Risks

- **Risk tolerance:** The amount of risk that the project must handle has to be low. It means that if some risky event has a low probability to happen, the impact can be low or moderate. On the other hand, if the event has a high probability to happen, the impact must be low.

- **Actions:** When some risk becomes a real problem for the project, the necessary measures have to be taken. These must affect as little as possible to the other constraints, such as cost or time.

Quality

- **Legal constraints:** All the systems developments and tests must be carried out under the corresponding standards.

- **Methodology:** The project must be developed following a methodology based on the use of state of the art technologies, research and improvement of the current capabilities of the earth observation systems.

- **Organization:** To obtain the required quality, communication between departments, communication with stakeholders, and the use of project management software assistance is a must.

- **Stakeholders' expectations:** External constraints imposed by stakeholders must be accounted in the project. In addition, the agreements with each of them must be accomplished.

- **Customer satisfaction:** The final product must fulfil the stablished requirements to obtain the customer satisfaction.

2 | Work Breakdown Structure (WBS)

In this chapter the tasks and work packages needed to perform the project will be specified. To do so, a WBS is developed.

1. PROJECT MANAGEMENT

   1.1. Development project management plan

   1.2. Monitoring of the project

      1.2.1. Meetings

      1.2.2. Task tracking and scheduling

   1.3. Annual reporting

   1.4. Project implementation of risk management

2. QUALITY AND ADMINISTRATION

   2.1. Human Resources

      2.1.1. Employment of the necessary staff

      2.1.2. Human resources management

   2.2. Financial Plan

      2.2.1. Costs

         2.2.1.1. Fix

         2.2.1.2. Variable

      2.2.2. Funding

      2.2.3. Economic feasibility

      2.2.4. Evolution monitoring

      2.2.5. Additional and follow-up funding seek

   2.3. Documentation Management

      4.2.1.1. Sensors final design

      4.2.1.2. Sensors final technical specifications

    4.2.2. Modular System

      4.2.2.1. Modular system final design

      4.2.2.2. Sensors data fusion software final design

      4.2.2.3. Modular system's final technical specifications

    4.2.3. Interaction Platform

      4.2.3.1. Web based servers for data sharing final implementation

      4.2.3.2. Processing algorithms based on applications final design

      4.2.3.3. Full services stakeholders platform implementation

      4.2.3.4. Final technical specifications

5. SIMULATION, TESTING, VALIDATION AND QUALITY

5.1. Technology Demonstrator Prototype Manufacturing

    5.1.1. Manufacturing of payload sensors

    5.1.2. Manufacturing of modular system

    5.1.3. Implementation of interaction platform

5.2. Payload Validation

5.3. Modular System Validation

5.4. Interaction Platform Validation

5.5. Full System Prototype Validation

5.6. Quality of the Product

6. BUSINESS PLANNING AND EXPLOITATION OF RESULTS

6.1. Market Approach

    6.1.1. Study of stakeholders

    6.1.2. Procurement conditions negotiation

    6.1.3. Resources purchase

6.2. Exploitation and Business Plans

7. COMMUNICATION AND DISSEMINATION STRATEGIES

7.1. Dissemination and Communication Plan

7.2. On-line Dissemination/Communication Activities

    7.2.1. Web site development

    7.2.2. Social media management

7.3. Off-line Dissemination/Communication Activities

    7.3.1. Conferences

    7.3.2. Meetings

7.4. Production of Dissemination Materials

    7.4.1. Technology demonstrators

    7.4.2. Audio visual material production

2.1 Activity list

In the following table the activities specified in the WBS will be defined in terms of the work that has to be done. With this description the objectives of each of the activities become clearer and the time and cost needed to perform them can be stated, which will be done in upcoming sections.

WBS-ID	Activity	Description of Work
1.	Project Management	All activities related with the management of the project fall under this activity.
1.1.	Development of the project management plan	Elaboration of all the documentation that states the strategy of the management and organization of the project through its duration.
1.2.	Monitoring of the project	Control of the progress of each activity of the project.
1.2.1.	Meetings	Gathering of the members of the project to inform each other of the progress.
1.2.2.	Task tracking and scheduling	Tracking of the active tasks and scheduling.
1.3.	Annual reporting	Every year that the project lasts will call for the elaboration of an internal report with the aim of keeping up to date with the progress done.
1.4.	Project implementation of risk management	Study of all the potential risks and how will they be managed so that their affectation to the project stays to a minimum.

WBS-ID	Activity	Description of Work
2.	Quality and Administration	Activities related to the administrative aspects of the project and to assure the quality of all the documents presented.
2.1.	Human resources	Administration of all the employees needed to fulfil the different tasks of the project.
2.1.1.	Employment of the necessary staff	Definition of the number of employees necessary.
2.1.2.	Human resources management	-.
2.2.	Financial plan	Lay down of all the planned costs of the project, the funding expected from the various sources, a study on the economic feasibility of the project and a plan for additional funding search.
2.3.	Documentation management	The quality of the documents that have to be delivered through all the duration of the project is guaranteed in this activity by establishing guidelines for the redaction of all the documents, their revision and posterior rectification and final approval.
2.4.	Periodic monitoring	To ensure the quality of the project, a periodic monitoring of all the activities will be carried out.
3.	State of the Art	Before starting the design and research it is key to have an accurate vision of the actual state of the technology that is going to be developed.
3.1.	Payloads	For each of the sensors that are planned to be improved there is a search of the current space applications, that help defining the requirements for these sensors.

WBS-ID	Activity	Description of Work
3.2.	Modular system	For the modular system where each sensor will be mounted on there will be a search of current similar systems in space applications and the definition of the requirements for the one developed in this project.
3.3.	Urban development applications	The search for current applications similar to those that want to be implemented with this project has to be carried out, in the weather forecast area, the urban planning area and the greenhouse emissions reduction area, thus defining the requirements for the applications.
4.	Product development	All the phases of the development of the product are included in this activity, from the research up to the final technical specifications.
4.1.	Preliminary design	This first phase of the development is meant to include all the research and definition of the initial parameters of the different components.
4.1.1.	Payloads' preliminary design	The research and initial development of each sensor that is intended to improve is carried out in this phase.
4.1.2.	Modular system's preliminary design	Includes the initial development of the physical framework for sensor blocks, of the systems' interaction and applications, of the sensors' data fusion software and the definition of the satellite communications applications domains.
4.1.3.	Interaction platform's preliminary design	Implementation of the web-based servers for sharing sensor's data, of the processing algorithms based on applications and the pre-design of a full services stakeholders platform.
4.2.	Final design	This final phase of the product's development will define the final technical specifications of each part of the product.

WBS-ID	Activity	Description of Work
4.2.1.	Payloads' final design	The design of each sensor is complete and its final technical specifications are defined.
4.2.2.	Modular system's final design	The design of the modular system and the sensors' data fusion software is complete and their final technical specifications are defined.
4.2.3.	Interaction platform's final design	The design of the interaction platform is complete, including the web based servers for data sharing, the processing algorithms based on applications and the full services stakeholders platform, and their final technical specifications are defined.
5	Simulation, testing, validation and quality	Activities regarding the simulation, testing, validation and quality control of the final product are included in this task.
5.1	Technology demonstrator prototype manufacturing	Manufacturing of the prototype of the product, including all its subsystems (payload sensors, modular system and interaction platform), in order to be tested in the following activities.
5.2	Payload validation	Validation of the performance of the sensors mounted on the system.
5.3	Modular system validation	Validation of the modular system performance, of the systems interaction, of the sensors' data fusion software, of the satellite communications applications domains and also of the physical framework for sensor blocks.
5.4	Interaction platform validation	Validation of the interaction platform to check if it develops all its functions properly.
5.5	Full system prototype validation	Validation of the whole system using the prototype in order to test its performance.
5.6	Quality of the product	Quality control of all the subsystems of the product and all the methodologies applied on its manufacturing and validation.

WBS-ID	Activity	Description of Work
6	Business planning and exploitation of results	The activities regarding the final explotation and business planning of the product are included in this task.
6.1	Market approach	Study of stakeholders, procurement conditions negotiation and purchase of the resources in order to study the feasibility of the project.
6.2	Exploitation and business plans	Includes the business plan of the product to exploit its economic potential.
7	Communication and dissemination strategies	Includes all the activities regarding the dissemination of the product inside the market.
7.1	Dissemination and communication plan	Definition of the strategies planned to the dissemination of the final product.
7.2	On-line dissemination activities	Include activities as the creation of a web site and the social media management.
7.3	Off-line dissemination activities	Participation in conferences and meetings about the field of the technology.
7.4	Dissemination materials	Production of all the materials that will help to the dissemination of the product, as technology demonstrators or audio visual productions.

Table 2.1.1: Activity list and description

2.2 Activities leadership and participants

In the following table the committee members that are leaders of tasks and activities and the ones that are expected to participate is shown. The aim of this table is to be capable of distribute human resources and time constraints of the activities. It is also useful because the most important facilities are to be provided by the committee members, so this distribution will allow the management of this facilities properly.

WBS-ID	Activity	Leadership	Participants
1.	Project Management	HIRO	-

WBS-ID	Activity	Leadership	Participants	
1.1.	Development of the project management plan	HIRO	-	
1.2.	Monitoring of the project	HIRO	-	
1.2.1.	Meetings	HIRO	-	
1.2.2.	Task tracking and scheduling	HIRO	-	
1.3.	Annual reporting	HIRO	-	
1.4.	Project implementation of risk management	HIRO	-	
2.	Quality and Administration	HIRO	BHO Rechtsanwälte Partnership	Legal
2.1.	Human resources	HIRO	BHO Rechtsanwälte Partnership	Legal
2.1.1.	Employment of the necessary staff	HIRO	BHO Rechtsanwälte Partnership	Legal
2.1.2.	Human resources management	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.	Financial plan	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.1.	Costs	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.1.1.	Fix	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.1.2.	Variable	HIRO	BHO Rechtsanwälte Partnership	Legal

WBS-ID	Activity	Leadership	Participants	
2.2.2.	Funding	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.3.	Economic feasibility	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.4	Evolution monitoring	HIRO	BHO Rechtsanwälte Partnership	Legal
2.2.4	Additional and follow-up funding seek	HIRO	BHO Rechtsanwälte Partnership	Legal
2.3.	Documentation management	HIRO	BHO Rechtsanwälte Partnership	Legal
2.3.1.	Guidelines preparation	HIRO	BHO Rechtsanwälte Partnership	Legal
2.3.2.	Document revision	HIRO	BHO Rechtsanwälte Partnership	Legal
2.3.3.	Document rectification	HIRO	BHO Rechtsanwälte Partnership	Legal
2.3.4.	Documentat approval	HIRO	BHO Rechtsanwälte Partnership	Legal
2.4.	Periodic monitoring	HIRO	-	
3.	State of the Art	HIRO	Airbus Defence and Space GmbH, VITO nv, Deimos Space S.L.U, Thales Alenia Space S.A.S, ICUBE-SERTIT,ReSAC.	

WBS-ID	Activity	Leadership	Participants
3.1.	Payloads	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
3.1.1.	Search for current space applications	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
3.1.2.	Requirements definition	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
3.2.	Modular system	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
3.2.1.	Search for current modular systems with space applications	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
3.2.2.	Requirements definition	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
3.3.	Urban development applications	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
3.3.1.	Search for current space applications	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
3.3.1.1.	Weather forecast	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
3.3.1.2.	Urban planning (3D models)	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
3.3.1.3.	Greenhouse emissions reduction (pollution)	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
3.3.2.	Requirements definition	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.	Product development	Airbus Defence and Space GmbH	HIRO, VITO nv, Deimos Space S.L.U, Thales Alenia Space S.A.S, ICUBE-SERTIT,ReSAC.

WBS-ID	Activity	Leadership	Participants
4.1.	Preliminary design	Airbus Defence and Space GmbH	HIRO, Deimos Space S.L.U, Thales Alenia Space S.A.S.
4.1.1.	Payloads	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
4.1.1.1.	Research	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
4.1.1.2.	Development	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
4.1.2.	Modular system	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.1.2.1.	Development of physical framework for sensor blocks	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.1.2.2.	Development of system interaction and applications	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.1.2.3.	Development of sensors data fusion software	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.1.2.4.	Definition of SATCOM application domains	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.1.3.	Interaction platform's preliminary design	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.1.3.1.	Implement web-based servers for sharing sensors data	ICUBE-SERTIT	VITO nv, ReSAC,HIRO

WBS-ID	Activity	Leadership	Participants
4.1.3.2.	Implement processing algorithms based on applications	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.1.3.3.	Pre-design a full services stakeholders platform	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.2.	Final design	Airbus Defence and Space GmbH	HIRO , Deimos Space S.L.U, Thales Alenia Space S.A.S.
4.2.1.	Payloads' final design	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
4.2.1.1.	Sensors final design	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
4.2.1.2.	Sensors final technical specifications	Airbus Defence and Space GmbH	Deimos Space S.L.U,Thales Alenia Space S.A.S,HIRO
4.2.2.	Modular system	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.2.2.1.	Modular system final design	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.2.2.2.	Sensors data fusion software final design	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.2.2.3.	Modular system final technical specifications	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
4.2.3.	Interaction platform's final design	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.2.3.1.	Web based servers for data sharing final implementation	ICUBE-SERTIT	VITO nv, ReSAC,HIRO

WBS-ID	Activity	Leadership	Participants
4.2.3.2.	Processing algorithm based on applications final design	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.2.3.3.	Full services stakeholders platform implementation	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
4.2.3.4.	Final technical specifications	ICUBE-SERTIT	VITO nv, ReSAC,HIRO
5.	Simulation, testing, validation and quality	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.1.	Technology demonstrator prototype manufacturing	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.1.1.	Manufacturing of payload sensors	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.1.2.	Manufacturing of modular system	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.1.3.	Implementation of interaction platform	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.2.	Payload validation	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.3.	Modular system validation	Thales Alenia Space S.A.S	Airbus Defence and Space GmbH, Deimos Space S.L.U,HIRO
5.4.	Interaction platform validation	ReSAC	HIRO,VITO nv, ICUBE-SERTIT
5.5.	Full system prototype validation	HIRO	Airbus Defence and Space GmbH,Thales Alenia Space, ReSAC.

WBS-ID	Activity	Leadership		Participants
5.6.	Quality of the product	HIRO		Airbus Defence and Space GmbH, Thales Alenia Space, ReSAC.
6.	Business planning and exploitation of results	BHO Rechtsanwälte Partnership	Legal	HIRO
6.1.	Market approach	BHO Rechtsanwälte Partnership	Legal	HIRO
6.1.1.	Study of stakeholders	BHO Rechtsanwälte Partnership	Legal	HIRO
6.1.2.	Procurement conditions negotiation	BHO Rechtsanwälte Partnership	Legal	HIRO
6.1.3.	Resources purchase	BHO Rechtsanwälte Partnership	Legal	HIRO
6.2.	Exploitation and business plans	BHO Rechtsanwälte Partnership	Legal	HIRO
7.	Communication and dissemination strategies	HIRO		All partners
7.1.	Dissemination and communication plan	HIRO		All partners
7.2.	On-line dissemination/communication activities	HIRO		All partners
7.2.1.	Web site development	HIRO		All partners
7.2.2.	Social media management	HIRO		All partners
7.3.	Off-line dissemination/communication activities	HIRO		All partners

WBS-ID	Activity	Leadership	Participants
7.3.1.	Conferences	HIRO	All partners
7.3.2.	Meetings	HIRO	All partners
7.4.	Production of dissemination materials	HIRO	All partners
7.4.1.	Technology demonstrators	HIRO	All partners
7.4.2.	Audio visual material production	HIRO	All partners

Table 2.2.1: Activities leadership and participants

3 | Sequence activities

3.1 Dependencies or logical relationship between activities

On the following table the relationship between activities is shown. The activities with a zero on their WBS-ID (for example: 1.0.) are milestones.

Relationship types are:

- FF: Finish-to-Finish

- FS: Finish-to-Start

- SS: Start-to-Start

- SF: Start-to-Finish

WBS-ID	Activity	Predecessors	Relationship	Lag
0.	Kick-Off meeting	START	-	0
1.	**PROJECT MANAGEMENT**			
1.0.	Project management plan	0. 1.1. 2.2.5.	FS FF FF	1 month 0 0
1.1.	Development of the project management plan	0	SS	0
1.2.1.	Meetings	0.	SS	0
1.2.2.	Task tracking and scheduling	0.	SS	0
1.3.	Annual reporting	0.	SS	0
1.4.	Project implementation of risk management	0.	SS	0

WBS-ID	Activity	Predecessors	Relationship	Lag
2.	**QUALITY AND ADMINISTRATION**			
2.1.1.	Employment of the necessary staff	1.0.	FS	0
2.1.2.	Human resources management	2.1.1.	FS	0
2.2.1.1.	Fix	0.	SS	0
2.2.1.2.	Variable	2.2.1.1.	FS	0
2.2.2.	Funding	2.2.1.2.	FS	0
2.2.3.	Economic feasibility	2.2.2.	FS	0
2.2.4.	Evolution monitoring	2.2.3.	FS	0
2.2.5.	Additional and follow-up funding seek	2.2.4.	FS	0
2.3.1.	Guidelines preparation	0	SS	0
2.3.2.	Document revision	0	SS	0
2.3.3.	Document rectification	0	SS	0
2.3.4.	Document approval	0	SS	0
2.4.	Periodic monitoring	0	SS	0
3.	**STATE OF THE ART**			
3.0.	State of the Art completion	0	FS	4 months
		3.1.2.	FF	0
		3.2.2.	FF	0
		3.3.2.	FF	0
3.1.1.	Search for current space applications	1.0	FS	0
3.1.2.	Requirements definition	3.1.1.	FS	0
3.2.1.	Search for current modular systems with space applications	1.0	FS	0
3.2.2.	Requirements definition	3.2.1.	FS	0
3.3.1.1.	Weather forecast	1.0	FS	0
3.3.1.2.	Urban planning (3D models)	1.0	FS	0

WBS-ID	Activity	Predecessors	Relationship	Lag
3.3.1.3.	Greenhouse emissions reductions (pollution)	1.0	FS	0
3.3.2.	Requirements definition	3.3.1.	FS	0
4.	**PRODUCT DEVELOPMENT**			
4.1.1.0.	Payload preliminary report	0 4.1.1.2.	FS FF	10 months 0
4.1.1.1.	Research	3.0	FS	0
4.1.1.2.	Development	4.1.1.1.	FS	0
4.1.2.0.	Modular system preliminary design	0 4.1.2.1. 4.1.2.4.	FS FF FF	13 months 0 0
4.1.2.1.	Development of physical framework for sensor blocks	4.1.1.0.	FS	0
4.1.2.2.	Development of systems interaction and applications	4.1.1.0.	FS	0
4.1.2.3.	Development of sensors data fusion software	4.1.2.2.	FS	0
4.1.2.4.	Definition of SATCOM applications	4.1.2.3.	FS	0
4.1.3.0.	Interaction platform preliminary design	0 4.1.3.3.	FS FF FF	16 months 0
4.1.3.1.	Implement web-based servers for sharing sensors data	4.1.2.0.	FS	0
4.1.3.2.	Implement processing algorithms based on applications	4.1.2.0.	FS	0
4.1.3.3.	Pre-design a full services stakeholders platform	4.1.3.1. 4.1.3.2.	FS FS	0 0
4.2.1.0.	Payloads final design	0. 4.2.1.2.	FS FF	23 months 0
4.2.1.1.	Sensors final design	4.1.1.0.	FS	0

WBS-ID	Activity	Predecessors	Relationship	Lag
4.2.1.2.	Sensors final technical specifications	4.2.1.1.	FS	0
4.2.2.0.	Modular system final design - milestone	0. 4.2.2.3.	FS FF	26 months 0
4.2.2.1.	Modular system final design	4.1.2.0.	FS	0
4.2.2.2.	Sensors data fusion software final design	4.1.2.0.	FS	0
4.2.2.3.	Modular system's final technical specifications	4.2.2.1. 4.2.2.2.	FS FS	0 0
4.2.3.0.	Interaction platform final design	0. 4.2.3.4. 4.2.3.2.	FS FF FF	29 months 0 0
4.2.3.1.	Web based servers for data sharing final implementation	4.1.3.0.	FF	0
4.2.3.2.	Processing algorithms based on applications final design	4.1.3.0.	FF	0
4.2.3.3.	Full services stakeholders platform implementation	4.2.3.1.	FF	0
4.2.3.4.	Final technical specifications	4.2.3.3.	FF	0
5.	**SIMULATION, TESTING, VALIDATION AND QUALITY**			
5.0.	Prototype manufacturing	0. 5.1.1. 5.1.2. 5.1.3.	FS FF FF FF	34 months 0 0 0
5.1.1.	Manufacturing of payload sensors	4.2.1.0.	FS	0
5.1.2.	Manufacturing of modular system	4.2.2.0.	FS	0
5.1.3.	Implementation of interaction platform	4.2.3.0.	FS	0
5.2.	Payload validation	5.1.1.	FS	0
5.3.	Modular system validation	5.1.2.	FS	0

WBS-ID	Activity	Predecessors	Relationship	Lag
5.4.	Interaction platform validation	5.1.3.	FS	0
5.01.	Individual System testing	0.	FS	34 months
		5.2.	FF	0
		5.3.	FF	0
		5.4.	FF	0
5.5.	Full system prototype validation	5.01.	FS	0
5.02.	Full system testing	0.	FS	41 months
		5.5.	FF	0
5.6.	Quality of the product	5.02.	FS	0
5.03.	Project completion	0.	FS	44 months
		1.2.1.	FF	0
		1.2.2.	FF	0
		1.3.	FF	0
		1.4.	FF	0
		2.1.2.	FF	0
		2.3.1.	FF	0
		2.3.2.	FF	0
		2.3.3.	FF	0
		2.3.4.	FF	0
		2.4.	FF	0
		5.6.	FF	0
		7.2.2.	FF	0
		7.3.1.	FF	0
		7.3.2.	FF	0
		7.4.1.1.	FF	0
		7.4.2.	FF	0
6.	**BUSSINES PLANNING AND EXPLOITATION OF RESULTS**			
6.0.	Business plan	0.	FS	1 month
		6.2.	FF	0
6.1.1.	Study of stakeholders	0.	FS	0
6.1.2.	Procurement conditions negotiation	0.	FS	0
6.1.3.	Resources purchase	0.	FS	0

WBS-ID	Activity	Predecessors	Relationship	Lag
6.2	Exploitation and business plans	6.1.	FS	0
7.	**BUSSINES PLANNING AND EXPLOITATION OF RESULTS**			
7.0.	Communication plan	0. 7.1.	FS FF	1 month FF
7.1	Dissemination and communication plan	0.	FS	0
7.2.1.	Web site development	7.0.	FS	0
7.2.2.	Social media management	7.2.1.	FS	0
7.3.1.	Conferences	1.0.	FS	0
7.3.2.	Meetings	1.0.	FS	0
7.4.1.	Technology demonstrators	1.0.	FS	0
7.4.2.	Audiovisual material production	1.0.	FS	0

Table 3.1.1: Dependencies or logical relationship between activities.

3.2 Network Diagram (Precedence Diagram Method)

Two sets of diagrams have been set. A first one, in Figure 3.2.1 shows the interconnections between tasks and a brief description. And a second one, in Figure 3.2.2 in order to see interconnections betweens activities, only using the ID. This has been done in order to make easier the tasks visualization and understanding.
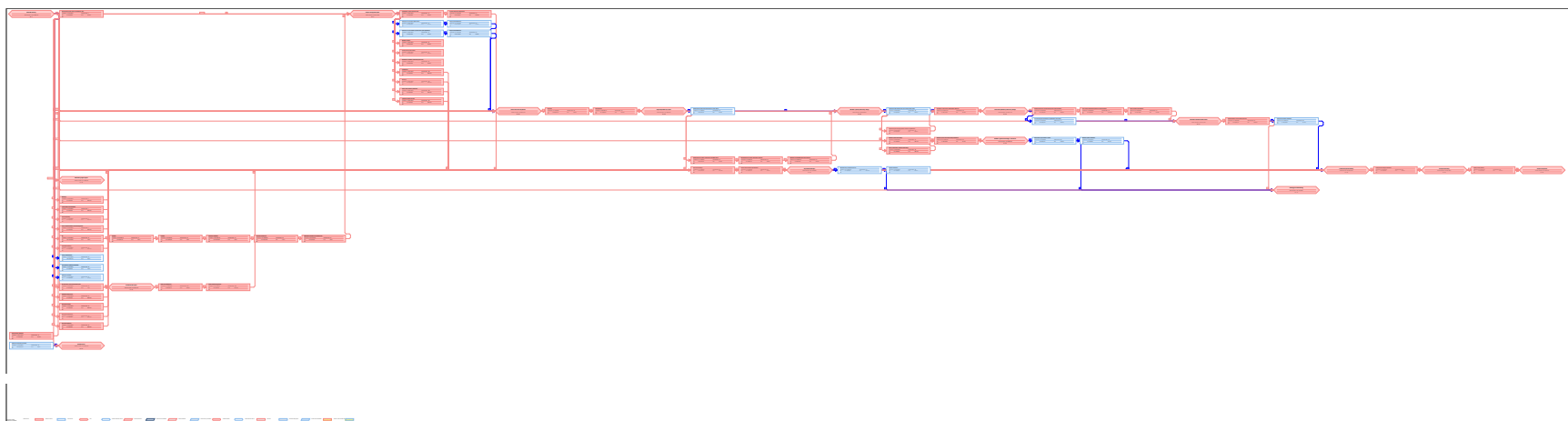
Figure 3.2.1: Network Precedence Method chart with full detail modules.

Figure 3.2.2: Network Precedence Method chart with only the tasks identification.

4 | Estimate activity resources

4.1 Resource identification

In this section the resources available/needed to perform the project will be exposed. These resources will be classified into three different categories:

- Employees: People needed to achieve the objectives of the project. The employees will be provided by the members of the consortium.

- Materials: Hardware and software elements that will be used to achieve the project objectives.

- Facilities: Special places and services where activities take place. They will also be provided by members of the consortium.

A brief explanation of the resources needed will be done and a collection of all of them, including a Resource ID, will be shown in Table 4.1.1.
Regarding human resources, i.e. employees, these can be classified into three sub-groups as not all of them are in the same point on the learning curve.

- Senior: High on the learning curve. They are able to provide guidance on technical and management issues and offer a critical point of view of the actions of the project.

- Average: They are able to perform activities on their knowledge field and arrive to conclusions without supervision.

- Junior: Little experience in the field, the work done needs to be supervised by an average employee.

The employees will be chosen taking into account the roles and responsibilities and technical knowledge needed to perform the project.

Materials/hardware are also important in this project as a sensor and its modular system wants to be build and tested. Although not all the hardware can be clearly specified in this early stage of the project, blocks can be defined. Hardware is also needed to support the database and interaction platform in order to perform the objective of the project: urban development. The blocks are:

- Payload building blocks: Hardware needed to build the sensor itself. It will depend on the type of sensor that needs to be build.

- Hardware support system: Physical connection between the parts of the sensor and its modular system. It can consist of a multi-layer PCB.

- Controllers: Chip, expansion card or stand-alone device to interface with the sensor and the other parts of the modular system. It can be a micro controller or an hybrid technology such as the combination of logic blocks with FPGA (Field-programmable Gate Array).

- Memory modules: Additional SRAM/ROM memory blocks to complete the performance of the system.

- Hosting package: Servers needed to host the end user and stakeholder platform for urban development.

- Backup system: Archive of the interaction platform computer data.

Regarding the facilities that will be used during the project, these are:

- Office: Needed to perform desktop tasks. All stakeholders can use their own offices.

- Meeting rooms: To host meetings between the members of the consortium, employees of the same partner and between members of the consortium and clients. They will be provided by the consortium members.

- Research laboratory: Laboratories needed to do the research of the payload, modular system and interaction platform. They will be provided by the consortium members related with these tasks.

- Development centre: Centre where the development of payload, modular system and interaction platform will be carried out. They will be provided by the consortium members related with these tasks.

- Testing room: Laboratories where the testing of the system in relevant environment will be done. They will be provided by the consortium members related with the testing.

- Quality laboratory: Laboratories where the quality evaluation will be carried out. They will be provided by the consortium members related with quality assessment.

Resource ID	Resource Description	Type of resource
PM.M	Project Manager	Employee-Senior
PM.S	Project Manager Secretary	Employee-Average
FM.M	Financial Manager	Employee-Senior
FM.A	Financial Manager Assessor	Employee-Average
SPM.M	Stakeholders and Procurement Manager	Employee-Senior
SPM.A	Stakeholders and Procurement Manager Assessor	Employee-Average
ScTM.M	Scope and Time Manager	Employee-Senior
ScTM.A	Scope and Time Manager Assessor	Employee-Average
RM.M	Risk Manager	Employee-Senior
RM.A	Risk Manager Assessor	Employee-Average
QM.M	Quality Manager	Employee-Senior
QM.A	Quality Manager Assessor	Employee-Senior
MCM.M	Marketing and Communications Manager	Employee-Senior
MCM.A	Marketing and Communications Manager Assessor	Employee-Average
TM	Tecnhical Manager	Employee-Average
RD.A	Research and development assessor	Employee-Average
LB.A	Legal and Business Assessor	Employee-Average
SD.S	System development engineer	Employee-Senior
SD.A	System development engineer	Employee-Average
SD.J	System development engineer	Employee-Junior
ST.S	System testing engineer	Employee-Senior
ST.A	System testing engineer	Employee-Average
ST.J	System testing engineer	Employee-Junior
AD.S	Application development manager	Employee-Senior
AD.A	Application development technician	Employee-Average
AD.J	Application development technician	Employee-Junior
SOFT.1	Microsoft Office	Material
SOFT.2	LaTex	Material
SOFT.3	GitHub	Material
SOFT.4	Trello	Material
SOFT.5	Solidworks	Material
SOFT.6	PostgreSQL	Material
SOFT.7	Live Plan	Material
SOFT.8	Wix	Material
SOFT.9	Jitsi	Material
SOFT.10	Final Cut Pro	Material
HARDW.1	Payload building blocks	Material
HARDW.2	Hardware support system	Material
HARDW.3	Sensor interface	Material

Resource ID	Resource Description	Type of resource
HARDW.4	Controllers	Material
HARDW.5	Memory modules	Material
HARDW.6	Hosting package	Material
HARDW.7	Backup system	Material
OFF	Office	Facilities
MR	Meeting room	Facilities
CH	Conference Hall	Facilities
RL	Research laboratory	Facilities
DC	Development centre	Facilities
TR	Testing room	Facilities
QL	Quality laboratory	Facilities

Table 4.1.1: Resources identification

4.2 Activity resource requirement

WBS-ID	Resource ID	Quantity	Assumption
1.1	PM.M	1	Although only PM.M and PM.S are assigned to this activity, all partners involved in the project should give its opinion and provide necessary input if required for the elaboration of the project management plan.
	PM.S	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
1.2.1	PM.M	1	All partners and the staff considered necessary are expected to assist to the meetings.
	PM.S	1	
	ScTM.M	1	
	ScTM.A	1	
	MR	1	
	SOFT.9	1	
1.2.2	PM.M	1	All partners should contribute to the correct development of this task.
	PM.S	1	
	ScTM.M	1	
	ScTM.A	1	
	MR	1	
	SOFT.4	1	

WBS-ID	Resource ID	Quantity	Assumption
1.3	PM.M	1	All partners should contribute to the correct development of this task.
	PM.S	1	
	ScTM.M	1	
	ScTM.A	1	
	OFF	1	
	CH	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
1.4	RM.M	1	
	RM.A	1	
	OFF	1	
2.1.1	SPM.M	1	
	SPM.A	1	
	OFF	1	
2.1.2	SPM.M	1	
	SPM.A	1	
	OFF	1	
2.2.1.1	FM.M	1	
	FM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
	SOFT.7	1	
2.2.1.2	FM.M	1	
	FM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
	SOFT.7	1	
2.2.2	FM.M	1	
	FM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
	SOFT.7	1	

WBS-ID	Resource ID	Quantity	Assumption
2.2.3	FM.M	1	
	FM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
	SOFT.7	1	
2.2.4	FM.M	1	
	FM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
2.2.5	FM.M	1	
	FM.A	1	
	OFF	1	
2.3.1	QM.M	1	
	QM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
2.3.2	QM.M	1	
	QM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
2.3.3	QM.M	1	
	QM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
2.3.4	QM.M	1	
	QM.A	1	
	MR	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	

WBS-ID	Resource ID	Quantity	Assumption
2.4	ScTM.M	1	All partners should contribute in this activity if required by ScT.M or ScT.A.
	ScTM.A	1	
	MR	1	
	SOFT.4	1	
3.1.1	TM	1	
	RD.A	1	
	SD.S	1	
	SD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
3.1.2	TM	1	
	RD.A	1	
	SD.S	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
3.2.1	TM	1	
	RD.A	1	
	SD.S	1	
	SD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
3.2.2	TM	1	
	RD.A	1	
	SD.S	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	

WBS-ID	Resource ID	Quantity	Assumption
3.3.1.1	TM	1	
	RD.A	1	
	AD.S	1	
	AD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
3.3.1.2	TM	1	
	RD.A	1	
	AD.S	1	
	AD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
3.3.1.3	TM	1	
	RD.A	1	
	AD.S	1	
	AD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
3.3.2	TM	1	
	RD.A	1	
	AD.S	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	

WBS-ID	Resource ID	Quantity	Assumption
4.1.1.1	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	1	
	RL	5	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.1.1.2	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	5	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.1.2.1	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.1.2.2	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	

WBS-ID	Resource ID	Quantity	Assumption
4.1.2.3	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.1.2.4	TM	1	
	RD.A	1	
	SD.S	1	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.1.3.1	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	
4.1.3.2	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	

WBS-ID	Resource ID	Quantity	Assumption
4.1.3.3	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	
4.2.1.1	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	5	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.2.1.2	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	

WBS-ID	Resource ID	Quantity	Assumption
4.2.2.1	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.2.2.2	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	
4.2.2.3	TM	1	
	RD.A	1	
	SD.S	1	
	SD.A	2	
	SD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.5	1	

WBS-ID	Resource ID	Quantity	Assumption
4.2.3.1	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	
4.2.3.2	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	
4.2.3.3	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	DC	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	

WBS-ID	Resource ID	Quantity	Assumption
4.2.3.4	TM	1	
	RD.A	1	
	AD.S	1	
	AD.A	2	
	AD.J	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
	SOFT.6	1	
5.1.1	SD.A	1	
	SD.J	2	
	DC	1	
	HARDW.1	1	
5.1.2	SD.A	1	
	SD.J	2	
	DC	1	
	HARDW.2	1	
	HARDW.3	1	
	HARDW.4	1	
	HARDW.5	1	
5.1.3	AD.A	1	
	AD.J	2	
	DC	1	
	HARDW.6	1	
	HARDW.7	1	
5.2	ST.S	1	
	ST.A	1	
	ST.J	2	
	TR	5	
	HARDW.1	1	
5.3	ST.S	1	
	ST.A	1	
	ST.J	2	
	TR	1	
	HARDW.2	1	
	HARDW.3	1	
	HARDW.4	1	
	HARDW.5	1	

WBS-ID	Resource ID	Quantity	Assumption
5.4	AD.S	1	
	AD.A	1	
	TR	1	
	HARDW.6	1	
	HARDW.7	1	
5.5	ST.A	2	
	AD.A	2	
	SD.A	2	
	TR	1	
	HARDW.1	1	
	HARDW.2	1	
	HARDW.3	1	
	HARDW.4	1	
	HARDW.5	1	
	HARDW.6	1	
	HARDW.7	1	
5.6	QM.M	1	
	QM.A	1	
	QL	1	
	HARDW.1	1	
	HARDW.2	1	
	HARDW.3	1	
	HARDW.4	1	
	HARDW.5	1	
	HARDW.6	1	
	HARDW.7	1	
6.1.1	LB.A	1	
	SPM.M	1	
	SPM.A	2	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
6.1.2	LB.A	1	
	SPM.M	1	
	SPM.A	2	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	

WBS-ID	Resource ID	Quantity	Assumption
6.1.3	LB.A	1	
	FM.M	1	
	FM.A	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
6.2	LB.A	1	
	FM.M	1	
	FM.A	2	
	SPM.M	1	
	OFF	1	
	SOFT.1	1	
	SOFT.3	1	
	SOFT.7	1	
7.1	MCM.M	1	
	MCM.A	2	
	OFF	1	
	SOFT.1	1	
	SOFT.2	1	
	SOFT.3	1	
7.2.1	MCM.M	1	All partners should provide information
	MCM.A	2	and be able to collaborate for
	OFF	1	communication and dissemination
	SOFT.8	1	purposes.
7.2.2	MCM.M	1	All partners should provide information
	MCM.A	2	and be able to collaborate for
	OFF	1	communication and dissemination
			purposes.
7.3.1	MCM.M	1	All partners should provide information
	MCM.A	2	and be able to collaborate for
	CH	1	communication and dissemination
	SOFT.9	1	purposes.
7.3.2	MCM.M	1	All partners should provide information
	MCM.A	2	and be able to collaborate for
	MR	1	communication and dissemination
			purposes.

WBS-ID	Resource ID	Quantity	Assumption
7.4.1	MCM.M	1	All partners should provide information
	MCM.A	2	and be able to collaborate for
	DC	1	communication and dissemination
	SOFT.1	1	purposes.
	SOFT.10	1	
7.4.2	MCM.M	1	All partners should provide information
	MCM.A	2	and be able to collaborate for
	OFF	1	communication and dissemination
	SOFT.1	1	purposes.
	SOFT.10	1	

Table 4.2.1: List of resource requirement

4.3 Resource Breakdown Structure

1. Employees

    1.1. Project management

       1.1.1. Project Manager

       1.1.2. Project Manager Secretary

    1.2. Financial

       1.2.1. Financial Manager

       1.2.2. Financial Manager Assessor

    1.3. Stakeholders and Procurement

       1.3.1. Stakeholders and Procurement Manager

       1.3.2. Stakeholders and Procurement Manager Assessor

    1.4. Scope and Time

       1.4.1. Scope and Time Manager

       1.4.2. Scope and Time Manager Assessor

    1.5. Risk

       1.5.1. Risk Manager

       1.5.2. Risk Manager Assessor

    1.6. Quality

       1.6.1. Quality Manager

       1.6.2. Quality Manager Assessor

1.7. Marketing and Communications

    1.7.1. Marketing and Communications Manager

    1.7.2. Marketing and Communications Manager Assessor

1.8. Engineering

    1.8.1. Technical Manager

    1.8.2. Research and Development assessor

    1.8.3. Development

        1.8.3.1. System development engineer — Senior

        1.8.3.2. System development engineer — Average

        1.8.3.3. System development engineer — Junior

    1.8.4. Testing

        1.8.4.1. System testing engineer — Senior

        1.8.4.2. System testing engineer — Average

        1.8.4.3. System testing engineer — Junior

1.9. Application development

    1.9.1. Application development manager

    1.9.2. Application development technician — Average

    1.9.3. Application development technician — Junior

2. Materials

  2.1. Software

    2.1.1. Microsoft Office

    2.1.2. LaTex

    2.1.3. GitHub

    2.1.4. Trello

    2.1.5. Solidworks

    2.1.6. PostgreSQL

    2.1.7. Live Plan

    2.1.8. Wix

    2.1.9. Jitsi

    2.1.10. Final Cut Pro

  2.2. Hardware

    2.2.1. Payload building blocks

    2.2.2. Hardware support system

    2.2.3. Sensor interface

    2.2.4. Controllers

      2.2.5. Memory modules

      2.2.6. Hosting package

      2.2.7. Backup system

3. Facilities

   3.1. Office

   3.2. Meeting room

   3.3. Conference hall

   3.4. Research laboratory

   3.5. Development centre

   3.6. Testing room

   3.7. Quality laboratory

5 | Estimate activity duration

In this section an estimate activity duration is done. In order to perform the most accurate estimation possible three different methods, which are explained below, have been applied depending on the characteristics of each task.

A brief explanation of the three mentioned methods including the type of tasks that have been estimated with each one is carried out:

Parametric Estimate
This estimation technique, that has been used to estimate the duration of commercial and administration tasks, uses an algorithm based on historical data and project parameters. The algorithm used consists in:

$$\text{Duration Estimate} = \frac{\text{Effort Days}}{\text{Resource Quantity} \times \text{Available Factor} \times \text{Performance Factor}}$$

The parameters used have been established as follows:

- **Effort Days:** States the necessary days to complete the task.

- **Resource Quantity:** Determines the number of resources (people) assigned at the respective task. This parameter has been already established on section 4.2.

- **Available Factor:** Determines the availability of the resources. This parameter has been established taking into account the overlap of tasks assigned to each resource.

- **Performance Factor:** Determines the ability of the resource assigned to perform the task. This parameter is established taking into account if the resource is a Senior-Employee, an Average-Employee, a Junior-Employee or a combination of them (in section 4.1 each type of employee is defined).

Analogous Estimate

The analogous estimation technique is based on the knowledge about the activity duration of previous similar projects. Hence, the duration of the current project completely relies on the duration of the previous one and the weight this current activity has compared to the previous one.

$$\text{Duration Estimate} = \text{Previous activity Duration} \times \text{Multiplier}$$

Analogous estimating can be less accurate than other estimation methods when the previous activities are not similar enough. Therefore, it has been used to estimate the duration of the management activities because it is possible to obtain a reliable estimation from the management timings of previous projects.

Three Point Estimate

The third method used to estimate the duration of the activities is the three-point estimation. This method takes into account the uncertainties and risks in order to provide an expected duration of each activity.

The expected duration is calculated by using a Beta Distribution which gives more weight to the most likely duration of the activity than the other parameters have because it is the most realistic one.

$$\text{Beta Distribution} = \frac{\text{Optimistic} + \text{Most Likely} \times 6 + \text{Pessimistic}}{6}$$

In fact, the parameters from which each activity duration is calculated are defined as:

- **Most Likely:** this estimate is based on the duration of the activity in a realistic way, by taking into account resources available and productivity for the corresponding activity.

- **Optimistic:** this estimate is based on the best-scenario for the activity.

- **Pessimistic:** this estimate is based on the worst-case scenario for the activity.

This method has been used to estimate the duration of the activities that are technical, because there is no data about previous projects due to the fact it is a state of the art project. However, it is a good method because by knowing the resources available and the productivity of the team, realistic expectations of the availability for the activity and its workload are done.

Estimate activity duration

Parametric Estimates

WBS-ID	Effort Days	Resource Quantity	% Available	Performance Factor	Duration Estimate (days)
2.1.1	54	2	100	0.9	30
2.1.2	1500	2	100	0.9	830
2.2.1	4	2	60	0.9	4
2.2.2	3	2	60	0.9	3
2.2.3	7	2	80	0.9	5
2.2.4	6	2	70	0.9	5
2.2.5	5	2	100	0.9	3
2.3	1500	2	90	0.95	880
6.1.1	12	3	60	0.85	8
6.1.2	11	4	60	0.85	5
6.1.3	12	3	50	0.85	10
6.2	27	5	80	0.85	8
7.1	51	3	100	0.85	20
7.2.1	180	3	80	0.85	90
7.2.2	1475	3	75	0.85	770
7.3	2200	6	50	0.85	860
7.4.1	1650	3	75	0.85	860
7.4.2	1650	3	75	0.85	860

Table 5.0.1: List of Parametric Estimates

Analogous Estimates

WBS-ID	Previous Activity	Previous Duration	Current Activity	Multiplier	Duration Estimate
1.1	Previous project Management Plan	23	Project management plan	0.9	20
1.2	Previous project Monitoring	980	Monitoring of the project	0.9	880
1.3	Previous project Annual reporting	1250	Annual Reporting	0.7	880
1.4	Previous project Risk Management implementation	1100	Project implementation of risk management	0.8	880

Table 5.0.2: List of Analogous Estimates

Three Point Estimates

WBS-ID	Optimistic Duration	Most Likely Duration	Pessimistic Duration	Weighting Equation	Expected Duration Estimate
3.1.1	20	30	40	(o+4m+p)/6	30
3.1.2	15	23	40	(o+4m+p)/6	25
3.2.1	20	24	35	(o+4m+p)/6	25
3.2.2	22	28	45	(o+4m+p)/6	30
3.3.1	15	18	30	(o+4m+p)/6	20
3.3.2	32	40	50	(o+4m+p)/6	40
4.1.1.1	58	68	88	(o+4m+p)/6	70
4.1.1.2	40	48	65	(o+4m+p)/6	50
4.1.2	45	60	75	(o+4m+p)/6	60
4.1.3.1	15	18	30	(o+4m+p)/6	20
4.1.3.2	30	39	55	(o+4m+p)/6	40

		Three Point Estimates			
WBS-ID	**Optimistic Duration**	**Most Likely Duration**	**Pessimistic Duration**	**Weighting Equation**	**Expected Duration Estimate**
4.1.3.3	15	18	30	(o+4m+p)/6	20
4.2.1	230	255	310	(o+4m+p)/6	260
4.2.2	230	255	310	(o+4m+p)/6	260
4.2.3	230	255	310	(o+4m+p)/6	260
5.1.1	180	195	240	(o+4m+p)/6	200
5.1.2	130	145	185	(o+4m+p)/6	150
5.1.3	80	97	130	(o+4m+p)/6	100
5.2	40	62	72	(o+4m+p)/6	60
5.3	46	58	80	(o+4m+p)/6	60
5.4	30	45	60	(o+4m+p)/6	45
5.5	60	76	110	(o+4m+p)/6	80
5.6	45	58	80	(o+4m+p)/6	60

Table 5.0.3: List of Three Point Estimations

6 | Project Schedule

In this section the project schedule is shown. It has been implemented from a Gantt chart, attached on the next page.

Figure 6.0.1: Gantt chart
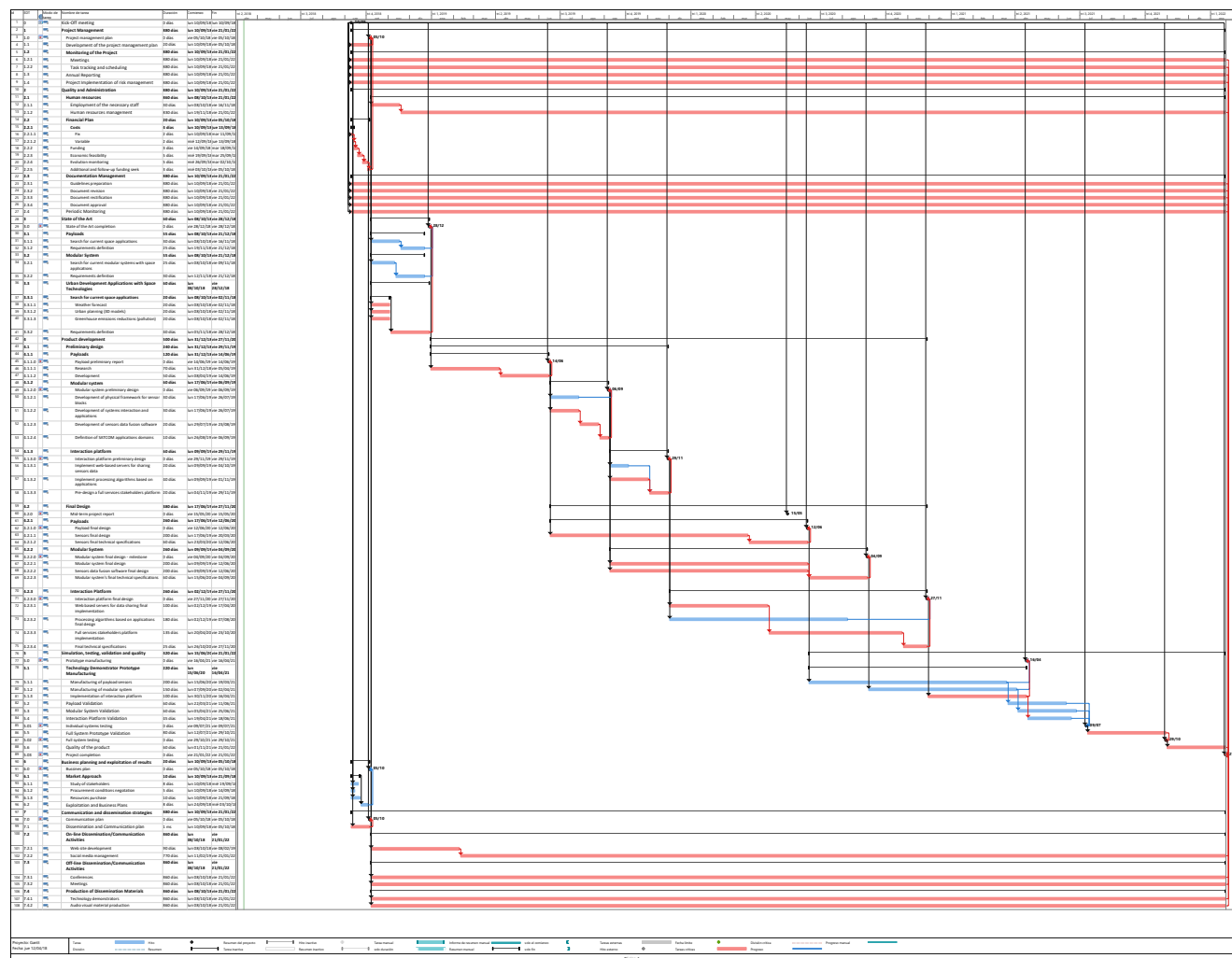
7 | Activity Attributes (at Work Package level)

This section contains an overview of the activity attributes. In the following tables the different activities are shown together with a description of the work that has to be done, their predecessors, the relationships between the activities, the resources needed to complete them, the efforts, the locations in which they are performed and the constraints that have to be taken into account.

WBS-ID: 1.1		Activity: Development of the project management plan
Description of Work: Elaboration of all the documentation that states the strategy of the management and organization of the project through its duration.		
Predecessors: Kick-Off meeting	**Relationship:** SS	**Lag:** -
Number and Type of Resources Required: 1 Project Manager 1 Project Manager Secretary	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 LaTex 1 GitHub
Type of Effort: Fixed amount of work.		
Location of Performance: Facilities of: HIRO.		
Constraints: Due date Deliverable Project Management Plan: 21/01/22 Due date Milestone Project Management Plan: 05/10/18		
Assumptions: Although only the Project Manager and the Project Manager Secretary are assigned to this activity, all partners involved in the project should give its opinion and provide necessary input if required for the elaboration of the project management plan.		

Table 7.0.1: Activity 1.1 attributes

WBS-ID:		Activity:
1.2.1		Meetings
Description of Work:		
Gathering of the members of the project to inform each other of the progress.		
Predecessors:	**Relationship:**	**Lag:**
Kick-Off meeting	SS	-
Number and Type of Resources Required: 1 Project Manager 1 Project Manager Secretary 1 Scope and Time Manager 1 Scope and Time Management Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Meeting room 1 Jitsi
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO.		
Constraints:		
Due date Deliverable Project Management Plan: 21/01/22		
Assumptions:		
All partners and the staff considered necessary are expected to assist to the meetings.		

Table 7.0.2: Activity 1.2.1 attributes

WBS-ID:		Activity:
1.2.2		Task tracking and scheduling
Description of Work:		
Tracking of the active tasks and scheduling.		

Predecessors:	Relationship:	Lag:
Kick-Off meeting	SS	-

Number and Type of Resources Required:	Skill Requirements:	Other Required Resources:
1 Project Manager 1 Project Manager Secretary 1 Scope and Time Manager 1 Scope and Time Management Assessor	Senior Average	1 Meeting room 1 Trello

Type of Effort:
Fixed amount of effort.

Location of Performance:
Facilities of: HIRO.

Constraints:
Due date Deliverable Project Management Plan: 21/01/22

Assumptions:
All partners should contribute to the correct development of this task.

Table 7.0.3: Activity 1.2.2 attributes

WBS-ID:		Activity:
1.3		Annual reporting
Description of Work:		
Every year that the project lasts will call for the elaboration of an internal report with the aim of keeping up to date with the progress done.		
Predecessors:	**Relationship:**	**Lag:**
Kick-Off meeting	SS	-
Number and Type of Resources Required: 1 Project Manager 1 Project Manager Secretary 1 Scope and Time Manager 1 Scope and Time Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Conference Hall 1 Microsoft Office 1 LaTex 1 GitHub
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO.		
Constraints:		
Due date Deliverable Project Management Plan: 21/01/22		
Assumptions:		
All partners should contribute to the correct development of this task.		

Table 7.0.4: Activity 1.3 attributes

WBS-ID: 1.4	Activity: Project implementation of risk management
Description of Work: Study of all the potential risks and how they will be managed so that their affectation to the project stays to a minimum.	

Predecessors: Kick-Off meeting	Relationship: SS	Lag: -
Number and Type of Resources Required: 1 Risk Manager 1 Risk Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office

Type of Effort: Fixed amount of work.
Location of Performance: Facilities of: HIRO.
Constraints: Due date Deliverable Project Management Plan: 21/01/22
Assumptions: -

Table 7.0.5: Activity 1.4 attributes

WBS-ID:		Activity:
2.1.1		Employment of the necessary staff
Description of Work:		
Definition of the number of employees necessary.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required: 1 Stakeholders and Procurement Manager 1 Stakeholders and Procurement Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Employment of the necessary staff has to be delivered at $t_0 + 2$ month.		
Assumptions:		
-		

Table 7.0.6: Activity 2.1.1 attributes

WBS-ID:		Activity:
2.1.2		Human resources management
Description of Work:		
Administration of all the employees needed to fulfil the different tasks of the project.		
Predecessors:	**Relationship:**	**Lag:**
2.1.1	FS	-
Number and Type of Resources Required: 1 Stakeholders and Procurement Manager 1 Stakeholders and Procurement Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Human resources management has to be delivered at $t_0 + 40$ months.		
Assumptions:		
-		

Table 7.0.7: Activity 2.1.2 attributes

WBS-ID:		Activity:
2.2.1.1		Fix costs
Description of Work:		
Lay down of all the fix costs of the project.		
Predecessors:	**Relationship:**	**Lag:**
0	SS	-
Number and Type of Resources Required: 1 Financial Manager 1 Financial Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 GitHub 1 Live Plan
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Fix costs has to be delivered at $t_0 + 1$ month.		
Assumptions:		
-		

Table 7.0.8: Activity 2.2.1.1 attributes

WBS-ID:		Activity:	
2.2.1.2		Variable costs	
Description of Work:			
Lay down of all the variable costs of the project.			
Predecessors:	**Relationship:**	**Lag:**	
2.2.1.1	FS	-	
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**	
1 Financial Manager	Senior	1 Office	
1 Financial Manager Assessor	Average	1 Microsoft Office	
		1 GitHub	
		1 Live Plan	
Type of Effort:			
Fixed amount of work.			
Location of Performance:			
Facilities of: HIRO			
Constraints:			
The Variable costs has to be delivered at $t_0 + 1$ month.			
Assumptions:			
-			

Table 7.0.9: Activity 2.2.1.2 attributes

WBS-ID:		Activity:
2.2.2		Funding
Description of Work:		
Lay down of the expected funding of the project.		
Predecessors:	**Relationship:**	**Lag:**
2.2.1.2	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Financial Manager	Senior	1 Office
1 Financial Manager Assessor	Average	1 Microsoft Office
		1 GitHub
		1 Live Plan
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Funding has to be delivered at $t_0 + 1$ month.		
Assumptions:		
-		

Table 7.0.10: Activity 2.2.2 attributes

WBS-ID:		Activity:
2.2.3		Economic feasibility
Description of Work:		
Study on the economic feasibility of the project.		
Predecessors:	**Relationship:**	**Lag:**
2.2.2	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Financial Manager	Senior	1 Office
1 Financial Manager	Average	1 Microsoft Office
Assessor		1 GitHub
		1 Live Plan
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Economic feasibility has to be delivered at $t_0 + 1$ month.		
Assumptions:		
-		

Table 7.0.11: Activity 2.2.3 attributes

WBS-ID:		Activity:
2.2.4		Evolution monitoring
Description of Work:		
Monitoring of the evolution of the project finances.		
Predecessors:	**Relationship:**	**Lag:**
2.2.3	FS	-
Number and Type of Resources Required: 1 Financial Manager 1 Financial Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 GitHub
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Evolution monitoring has to be delivered at $t_0 + 1$ month.		
Assumptions:		
-		

Table 7.0.12: Activity 2.2.4 attributes

WBS-ID:		Activity:
2.2.5		Additional and follow-up funding seek
Description of Work:		
Search for additional funding for the project.		
Predecessors:	**Relationship:**	**Lag:**
2.2.4	FS	-
Number and Type of Resources Required: 1 Financial Manager 1 Financial Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Additional and follow-up funding seek has to be delivered at $t_0 + 1$ month.		
Assumptions:		
-		

Table 7.0.13: Activity 2.2.5 attributes

WBS-ID:		Activity:
2.3.1		Guidelines preparation
Description of Work:		
Establishment of the guidelines for the redaction of all documents.		
Predecessors:	**Relationship:**	**Lag:**
0	SS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Quality Manager	Senior	1 Office
1 Quality Manager	Average	1 Microsoft Office
Assessor		1 LaTex
		1 GitHub
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Guidelines preparation has to be delivered at $t_0 + 40$ months.		
Assumptions:		
-		

Table 7.0.14: Activity 2.3.1 attributes

WBS-ID:		Activity:
2.3.2		Documented revision
Description of Work:		
Revision of all the documents of the project.		
Predecessors:	**Relationship:**	**Lag:**
0	SS	-
Number and Type of Resources Required: 1 Quality Manager 1 Quality Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 LaTex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Documented revision has to be delivered at $t_0 + 40$ months.		
Assumptions:		
-		

Table 7.0.15: Activity 2.3.2 attributes

WBS-ID:		Activity:
2.3.3		Documented rectification
Description of Work:		
Rectification of the documents that do not meet the project requirements.		
Predecessors:	**Relationship:**	**Lag:**
0	SS	-
Number and Type of Resources Required: 1 Quality Manager 1 Quality Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 LaTex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Documented rectification has to be delivered at $t_0 + 40$ months.		
Assumptions:		
-		

Table 7.0.16: Activity 2.3.3 attributes

WBS-ID:		Activity:
2.3.4		Document approval
Description of Work:		
Approval of the reviewed and rectified documents		
Predecessors:	**Relationship:**	**Lag:**
0	SS	-
Number and Type of Resources Required: 1 Quality Manager 1 Quality Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Meeting Room 1 Microsoft Office 1 LaTex 1 GitHub
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Document approval has to be delivered at $t_0 + 40$- months.		
Assumptions:		
-		

Table 7.0.17: Activity 2.3.4 attributes

WBS-ID:		Activity:
2.4		Periodic monitoring
Description of Work:		
To ensure the quality of the project, a periodic monitoring of all the activities will be carried out.		
Predecessors:	**Relationship:**	**Lag:**
0	SS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Scope and Time Manager 1 Scope and Time Manager Assessor	Senior Average	1 Meeting Room 1 Trello
Type of Effort:		
Fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
The Periodic monitoring has to be delivered at $t_0 + 40$ months.		
Assumptions:		
All partners should contribute in this activity if required by Scope and Time Manager or Scope and Time Manager Assessor		

Table 7.0.18: Activity 2.4 attributes

WBS-ID:		Activity:
3.1.1		Search for current space applications
Description of Work:		
Research for the current space applications.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Technical Manager	Senior	1 Office
1 Research and	Average	1 Microsoft Office
Development Assessor	Junior	1 Latex
1 System Development		1 GitHub
Engineer		
2 System Development		
Engineer		
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Deimos Space S.L.U, Thales Alenia Space, S.A.S and HIRO.		
Constraints:		
Due date Deliverable Payload state of the art: 14/06/19.		
Due date Milestone Payload state of the art: 14/06/19.		
Assumptions:		
-		

<div align="center">Table 7.0.19: Activity 3.1.1 attributes</div>

WBS-ID:		Activity:
3.1.2		Requirements definition
Description of Work:		
Research for the current space applications.		
Predecessors:	**Relationship:**	**Lag:**
3.1.1	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Technical Manager Research and Development Assessor 1 System Development Engineer	Senior Average	1 Office 1 Microsoft Office 1 Latex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Deimos Space S.L.U, Thales Alenia Space, S.A.S and HIRO.		
Constraints:		
Due date Deliverable Payload state of the art: 14/06/19. Due date Milestone Payload state of the art: 14/06/19.		
Assumptions:		
-		

Table 7.0.20: Activity 3.1.2 attributes

WBS-ID:		Activity:
3.2.1		Search for current modular systems with space applications
Description of Work:		
Search for current modular systems with space applications.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required: 1 Technical Manager 1 Research and Development Assessor 1 System Development Engineer 2 System Development Engineer	**Skill Requirements:** Senior Average Junior	**Other Required Resources:** 1 Office 1 Microsoft Office 1 Latex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		
Constraints:		
Due date Deliverable Modular system state of the art: 21/12/18. Due date Milestone Modular system state of the art: 21/12/18.		
Assumptions:		
-		

Table 7.0.21: Activity 3.2.1 attributes

WBS-ID:		Activity:
3.2.2		Requirements definition
Description of Work:		
Definition of the requirements for modular system developed in this project..		
Predecessors:	**Relationship:**	**Lag:**
3.2.1	FS	-
Number and Type of Resources Required: 1 Technical Manager 1 Research and Development Assessor 1 System Development Engineer	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 Latex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		
Constraints:		
Due date Deliverable Modular system state of the art: 21/12/18. Due date Milestone Modular system state of the art: 21/12/18.		
Assumptions:		
-		

Table 7.0.22: Activity 3.2.2 attributes

WBS-ID:		Activity:
3.3.1.1		Weather forecast
Description of Work:		
Search for current applications similar to those that want to be implemented with this project in the weather forecast area.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Technical Manager	Senior	1 Office
1 Research and Development Assessor	Average	1 Microsoft Office
1 Application Development Manager	Junior	1 Latex
2 Application Development		1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilites of: VITO nv, ReSAC and HIRO.		
Constraints:		
Due date Deliverable Space Applications State of the Art: 28/12/18.		
Due date Milestone Space Applications State of the Art: 28/12/18.		
Assumptions:		
-		

Table 7.0.23: Activity 3.3.1.1 attributes

WBS-ID:		Activity:
3.3.1.2		Urban planning (3D models)
Description of Work:		
Search for current applications similar to those that want to be implemented with this project in the urban planning area.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required: 1 Technical Manager 1 Research and Development Assessor 1 Application Development Manager 2 Application Development	**Skill Requirements:** Senior Average Junior	**Other Required Resources:** 1 Office 1 Microsoft Office 1 Latex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilites of: VITO nv, ReSAC and HIRO.		
Constraints:		
Due date Deliverable Space Applications State of the Art: 28/12/18. Due date Milestone Space Applications State of the Art: 28/12/18.		
Assumptions:		
-		

Table 7.0.24: Activity 3.3.1.2 attributes

WBS-ID:		Activity:
3.3.1.3		Greenhouse emissions reduction (pollution)
Description of Work:		
Search for current applications similar to those that want to be implemented with this project in the greenhouse emissions reduction area.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required: 1 Technical Manager 1 Research and Development Assessor 1 Application Development Manager 2 Application Development	**Skill Requirements:** Senior Average Junior	**Other Required Resources:** 1 Office 1 Microsoft Office 1 Latex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilites of: VITO nv, ReSAC and HIRO.		
Constraints:		
Due date Deliverable Space Applications State of the Art: 28/12/18. Due date Milestone Space Applications State of the Art: 28/12/18.		
Assumptions:		
-		

Table 7.0.25: Activity 3.3.1.3 attributes

WBS-ID:		Activity:
3.3.2		Requirements definition
Description of Work:		
Definition of the requirements for the applications.		
Predecessors:	**Relationship:**	**Lag:**
3.3.1	FS	-
Number and Type of Resources Required: 1 Technical Manager 1 Research and Development Assessor 1 Application Development Manager	**Skill Requirements:** Senior Average	**Other Required Resources:** 1 Office 1 Microsoft Office 1 Latex 1 GitHub
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilites of: VITO nv, ReSAC and HIRO.		
Constraints:		
Due date Deliverable Space Applications State of the Art: 28/12/18. Due date Milestone Space Applications State of the Art: 28/12/18.		
Assumptions:		
-		

Table 7.0.26: Activity 3.3.2 attributes

WBS-ID:		Activity:
4.1.1.1		Research
Description of Work:		
Research for the payloads preliminary design.		
Predecessors:	**Relationship:**	**Lag:**
3.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager 1 Research and development assessor 1 System development engineers (expert) 1 System development engineer (average)	Senior Average	5 Research laboratory 1 Microsoft Office 1 LaTex 1 GitHub 1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Airbus Defence and Space, Deimos Space, Thales Alenia Space and HIRO		
Constraints:		
Due date Deliverable payload preliminary design: 14/06/19 Due date Milestone payload preliminary design 14/06/19		
Assumptions:		
-		

Table 7.0.27: Activity 4.1.1.1 attributes

WBS-ID:		Activity:
4.1.1.2		Development
Description of Work:		
Development of the payloads preliminary design.		

Predecessors:	Relationship:	Lag:
4.1.1.1	FS	-

Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	5 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 System development engineers (expert)	Junior	1 LaTex
2 System development engineer (average)		1 GitHub
2 System development engineer (junior)		1 Solidworks

Type of Effort:
Fixed amount of work.

Location of Performance:
Facilities of: Airbus Defence and Space, Deimos Space, Thales Alenia Space and HIRO

Constraints:
Due date Deliverable payload preliminary design: 14/06/19
Due date Milestone payload preliminary design 14/06/19

Assumptions:
-

Table 7.0.28: Activity 4.1.1.2 attributes

WBS-ID:		Activity:
4.1.2.1		Development of physical framework for sensor block
Description of Work:		
Modular system preliminary design and development of physical framework for sensor block.		
Predecessors:	**Relationship:**	**Lag:**
4.1.1.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager 1 Research and development assessor 1 System development engineers (expert) 2 System development engineer (average) 2 System development engineer (junior)	Senior Average Junior	1 Development center 1 Microsoft Office 1 LaTex 1 GitHub 1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space, Airbus Defence and Space, Deimos Space and HIRO		
Constraints:		
Due date Deliverable Modular system preliminary design: 06/09/19 Due date Milestone Modular system preliminary design: 06/09/2019		
Assumptions:		
-		

Table 7.0.29: Activity 4.1.2.1 attributes

WBS-ID:		Activity:
4.1.2.2		Development of systems interaction and applications
Description of Work:		
Modular system preliminary design and development of systems interactions and applications.		
Predecessors:	**Relationship:**	**Lag:**
4.1.1.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager 1 Research and development assessor 1 System development engineers (expert) 2 System development engineer (average) 2 System development engineer (junior)	Senior Average Junior	1 Development center 1 Microsoft Office 1 LaTex 1 GitHub 1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space, Airbus Defence and Space, Deimos Space and HIRO		
Constraints:		
Due date Deliverable Modular system preliminary design: 06/09/19 Due date Milestone Modular system preliminary design: 06/09/2019		
Assumptions:		
-		

Table 7.0.30: Activity 4.1.2.2 attributes

WBS-ID:		Activity:
4.1.2.3		Development of sensors data fusion software
Description of Work:		
Modular system preliminary design and development of sensors data fusion software.		
Predecessors:	**Relationship:**	**Lag:**
4.1.2.2.	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 System development engineers (expert)	Junior	1 LaTex
2 System development engineer (average)		1 GitHub
2 System development engineer (junior)		1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space, Airbus Defence and Space, Deimos Space and HIRO		
Constraints:		
Due date Deliverable Modular system preliminary design: 06/09/19		
Due date Milestone Modular system preliminary design: 06/09/19		
Assumptions:		
-		

Table 7.0.31: Activity 4.1.2.3 attributes

WBS-ID:		Activity:
4.1.2.4		Definition of SATCOM applications domains
Description of Work:		
Modular system preliminary design and definition of SATCOM application domains.		
Predecessors:	**Relationship:**	**Lag:**
4.1.2.3.	TFS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Office
1 Research and development assessor		1 Microsoft Office
1 System development engineers		1 LaTex 1 GitHub 1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space, Airbus Defence and Space, Deimos Space and HIRO		
Constraints:		
Due date Deliverable Modular system preliminary design: 06/09/19 Due date Milestone Modular system preliminary design: 06/09/2019		
Assumptions:		
-		

Table 7.0.32: Activity 4.1.2.4 attributes

WBS-ID:		Activity:
4.1.3.1		Implement web-based servers for sharing sensors data
Description of Work:		
Preliminary design of the interaction platform. Implement web-based servers for sharing sensors data.		
Predecessors:	**Relationship:**	**Lag:**
4.1.2.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 Application development engineers (expert)	Junior	1 LaTex
2 Application development engineer (average)		1 GitHub
2 Application development engineer (junior)		1 PostgreSQL
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: ICUBE-ISERTIT, VITO, ReSAC and HIRO		
Constraints:		
Due date Deliverable Interaction platform preliminary design:29/11/19		
Due date Milestone Interaction platform preliminary design: 29/11/19		
Assumptions:		
-		

Table 7.0.33: Activity 4.1.3.1 attributes

WBS-ID:		Activity:
4.1.3.2		Implement processing algorithms based on applications

Description of Work:		
Preliminary design of the interaction platform. Implement processing algorithms based on applications.		

Predecessors:	Relationship:	Lag:
4.1.2.0	FS	-

Number and Type of Resources Required:	Skill Requirements:	Other Required Resources:
1 Techical Manager 1 Research and development assessor 1 Application development engineers (expert) 2 Application development engineer (average) 2 Application development engineer (junior)	Senior Average Junior	1 Development center 1 Microsoft Office 1 LaTex 1 GitHub 1 PostgreSQL

Type of Effort:		
Fixed amount of work.		

Location of Performance:		
Facilities of: ICUBE-ISERTIT, VITO, ReSAC and HIRO		

Constraints:		
Due date Deliverable Interaction platform preliminary design:29/11/19 Due date Milestone Interaction platform preliminary design: 29/11/19		

Assumptions:		
-		

Table 7.0.34: Activity 4.1.3.2 attributes

WBS-ID:		Activity:
4.1.3.3		Pre-design a full services stakeholders platform

Description of Work:

Pre-design of interaction platform.

Predecessors:	Relationship:	Lag:
4.1.3.1	FS	-
4.1.3.2	FS	

Number and Type of Resources Required:	Skill Requirements:	Other Required Resources:
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 Application development engineers (expert)	Junior	1 LaTex
2 Application development engineer (average)		1 GitHub
2 Application development engineer (junior)		1 PostgreSQL

Type of Effort:

Fixed amount of work.

Location of Performance:

Facilities of: ICUBE-ISERTIT, VITO, ReSAC and HIRO

Constraints:

Due date Deliverable Interaction platform preliminary design: 29/11/19

Due date Milestone Interaction platform preliminary design: 29/11/19

Assumptions:

-

Table 7.0.35: Activity 4.1.3.3 attributes

WBS-ID:		Activity:
4.2.1.1		Sensor final design
Description of Work:		
Final design of the payload sensor.		
Predecessors:	**Relationship:**	**Lag:**
4.1.1.0.	FS	-
Number and Type of Resources Required: 1 Techical Manager 1 Research and development assessor 1 System development engineers (expert) 2 System development engineer (average) 2 System development engineer (junior)	**Skill Requirements:** Senior Average Junior	**Other Required Resources:** 5 Development center 1 Microsoft Office 1 LaTex 1 GitHub 1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Airbus Defence and Space, Deimos Space, Thales Alenia Space and HIRO		
Constraints:		
Due date Deliverable Payload final design: 12/06/20 Due date Milestone Payload final design: 12/06/20		
Assumptions:		
-		

Table 7.0.36: Activity 4.2.1.1 attributes

WBS-ID:		Activity:
4.2.1.2		Sensor final technical specifications
Description of Work:		
Final decision of the technical specifications of the payload sensor.		
Predecessors:	**Relationship:**	**Lag:**
4.2.1.1	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Office
1 Research and development assessor	Average	1 Microsoft Office
1 System development engineers (expert)	Junior	1 LaTex
2 System development engineer (average)		1 GitHub
2 System development engineer (junior)		1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities: Airbus Defence and Space, Deimos Space, Thales Alenia Space and HIRO		
Constraints:		
Due date Deliverable Payload final design: 12/06/20		
Due date Milestone Payload final design: 12/06/20		
Assumptions:		
-		

Table 7.0.37: Activity 4.2.1.2 attributes

WBS-ID:		Activity:
4.2.2.1		Modular system final design
Description of Work:		
Final design of the modular system.		

Predecessors:	Relationship:	Lag:
4.1.2.0	FS	-

Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 System development engineers (expert)	Junior	1 LaTex
2 System development engineer (average)		1 GitHub
2 System development engineer (junior)		1 Solidworks

Type of Effort:
Fixed amount of work.

Location of Performance:
Facilities of: Airbus Defence and Space, Deimos Space, Thales Alenia Space and HIRO

Constraints:
Due date Deliverable Modular system final design: 04/09/20
Due date Deliverable Sensor data fusion software report: 04/09/20
Due date Milestone Modular system final design: 04/09/20

Assumptions:
-

Table 7.0.38: Activity 4.2.2.1 attributes

WBS-ID:		Activity:
4.2.2.2		Sensor data fusion software final design.

Description of Work:

Final design of the modular system, specifically of the sensor data fusion software.

Predecessors:	Relationship:	Lag:
4.1.2.0	FS	-

Number and Type of Resources Required:	Skill Requirements:	Other Required Resources:
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 System development engineers (expert)	Junior	1 LaTex
2 System development engineer (average)		1 GitHub
2 System development engineer (junior)		1 Solidworks

Type of Effort:

Fixed amount of work.

Location of Performance:

Facilities of:Airbus Defence and Space, Thales Alenia Space, Deimos Space and HIRO

Constraints:

Due date Deliverable Modular system final design: 04/09/20

Due date Deliverable Sensor data fusion software report: 04/09/20

Due date Milestone Modular system final design: 04/09/20

Assumptions:

-

<div align="center">Table 7.0.39: Activity 4.2.2.2 attributes</div>

WBS-ID:		Activity:
4.2.2.3		Modular system final technical specifications
Description of Work:		
Final decision of technical specifications of the modular system.		
Predecessors:	**Relationship:**	**Lag:**
4.2.2.1	FS	-
4.2.2.2	FS	
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Office
1 Research and development assessor	Average	1 Microsoft Office
1 System development engineers (expert)	Junior	1 LaTex
2 System development engineer (average)		1 GitHub
2 System development engineer (junior)		1 Solidworks
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of:Airbus Defence and Space, Thales Alenia Space, Deimos Space and HIRO		
Constraints:		
Due date Deliverable Modular system final design: 04/09/20		
Due date Deliverable Sensor data fusion software report: 04/09/20		
Due date Milestone Modular system final design: 04/09/20		
Assumptions:		
-		

Table 7.0.40: Activity 4.2.2.3 attributes

WBS-ID:		Activity:
4.2.3.1		Web based servers for data sharing final implementation

Description of Work:

Final design and implementation of the interaction platform, specifically the web servers for data sharing.

Predecessors:	Relationship:	Lag:
4.1.3.0	FF	-

Number and Type of Resources Required:	Skill Requirements:	Other Required Resources:
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 Application development engineers (expert)	Junior	1 LaTex
2 Application development engineer (average)		1 GitHub
2 Application development engineer (junior)		1 PostgreSQL

Type of Effort:

Fixed amount of work.

Location of Performance:

Facilities: ICUBE-ISERTIT,VITO, ReSAC and HIRO

Constraints:

Due date Deliverable Interaction platform final design: 27/11/20

Due date Deliverable Data processing software report: 27/11/20

Due date Milestone Interaction platform final design: 27/11/20

Assumptions:

-

Table 7.0.41: Activity 4.2.3.1 attributes

WBS-ID:		Activity:
4.2.3.2		Processing algorithms based on applications final design
Description of Work:		
Final design and implementation of the interaction platform, specifically the processing algorithms.		
Predecessors:	**Relationship:**	**Lag:**
4.1.3.0	FF	-
Number and Type of Resources Required: 1 Techical Manager 1 Research and development assessor 1 Application development engineers (expert) 2 Application development engineer (average) 2 Application development engineer (junior)	**Skill Requirements:** Senior Average Junior	**Other Required Resources:** 1 Development center 1 Microsoft Office 1 LaTex 1 GitHub 1 PostgreSQL
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: ICUBE-ISERTIT, VITO, ReSAC and HIRO		
Constraints:		
Due date Deliverable Interaction platform final design: 27/11/20 Due date Deliverable Data processing software report: 27/11/20 Due date Milestone Interaction platform final design: 27/11/20		
Assumptions:		
-		

<div align="center">Table 7.0.42: Activity 4.2.3.2 attributes</div>

WBS-ID:		Activity:
4.2.3.3		Full services stakeholders platform implementation
Description of Work:		
Final design and implementation of the interaction platform.		
Predecessors:	**Relationship:**	**Lag:**
4.2.3.1	FF	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Techical Manager	Senior	1 Development center
1 Research and development assessor	Average	1 Microsoft Office
1 Application development engineers (expert)	Junior	1 LaTex
2 Application development engineer (average)		1 GitHub
2 Application development engineer (junior)		1 PostgreSQL
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: ICUBE-ISERTIT, VITO, ReSAC and HIRO		
Constraints:		
Due date Deliverable Interaction platform final design: 27/11/20		
Due date Deliverable Data processing software report: 27/11/20		
Due date Milestone Interaction platform final design: 27/11/20		
Assumptions:		
-		

Table 7.0.43: Activity 4.2.3.3 attributes

WBS-ID:		Activity:
4.2.3.4		Final technical specifications
Description of Work:		
Decision of the final technical specifications of the interaction (stakeholders) platform.		
Predecessors:	**Relationship:**	**Lag:**
4.2.3.3	FF	-
textbfNumber and Type of Resources Required: 1 Techical Manager 1 Research and development assessor 1 Application development engineers (expert) 2 Application development engineer (average) 2 Application development engineer (junior)	**Skill Requirements:** Senior Average Junior	**Other Required Resources:** 1 Development center 1 Microsoft Office 1 LaTex 1 GitHub 1 PostgreSQL
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: ICUBE-ISERTIT, VITO, ReSAC and HIRO		
Constraints:		
Due date Deliverable Interaction platform final design: 27/11/20 Due date Deliverable Data processing software report: 27/11/20 Due date Milestone Interaction platform final design: 27/11/20		
Assumptions:		
-		

Table 7.0.44: Activity 4.2.3.4 attributes

WBS-ID:		Activity:
5.1.1		Manufacturing of payload sensors
Description of Work:		
Manufacturing of the sensors of the prototype, in order to be tested in the following activities.		
Predecessors:	**Relationship:**	**Lag:**
4.2.1.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 System development engineer (average)	Average	1 Development centre
2 System development engineers (junior)	Junior	1 Payload building block
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space S.A.S, Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		
Constraints:		
Due date Milestone Prototype manufacturing: 16/04/21		
Assumptions:		
-		

Table 7.0.45: Activity 5.1.1 attributes

WBS-ID:		Activity:
5.1.2		Manufacturing of modular system
Description of Work:		
Manufacturing of the module of the prototype, in order to be tested in the following activities.		
Predecessors:	**Relationship:**	**Lag:**
4.2.2.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 System development engineer (average) 2 System development engineers (junior)	Average Junior	1 Development centre 1 Hardware support system 1 Sensor interface 1 Controllers 1 Memory modules
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space S.A.S, Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		
Constraints:		
Due date Milestone Prototype manufacturing: 16/04/21		
Assumptions:		
-		

Table 7.0.46: Activity 5.1.2 attributes

WBS-ID:		Activity:
5.1.3		Implementation of interaction platform
Description of Work:		
Manufacturing of the interaction platform of the prototype, in order to be tested in the following activities.		
Predecessors:	**Relationship:**	**Lag:**
4.2.3.0	FS	-
Number and Type of Resources Required: 1 Application development technician (average) 2 Application development technicians (junior)	**Skill Requirements:** Average Novice	**Other Required Resources:** 1 Development centre 1 Hosting package 1 Backup system
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: Thales Alenia Space S.A.S, Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		
Constraints:		
Due date Milestone Prototype manufacturing: 16/04/21		
Assumptions:		
-		

Table 7.0.47: Activity 5.1.3 attributes

WBS-ID:		Activity:
5.2		Payload Validation
Description of Work:		
Validation of the performance of the sensors mounted on the system.		
Predecessors:	**Relationship:**	**Lag:**
5.1.1	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 System testing engineer (senior) 1 System testing engineer (average) 2 System testing engineers (junior)	Senior Average Junior	5 Testing room 1 Payload building block
Type of Effort:		
Fixed duration.		
Location of Performance:		
Facilities of: Thales Alenia Space S.A.S, Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		
Constraints:		
Due date Deliverable Validation: 11/06/21		
Due date Milestone Individual systems testing: 09/07/21		
Assumptions:		
-		

Table 7.0.48: Activity 5.2 attributes

WBS-ID:		Activity:
5.3		Modular System Validation

Description of Work:		
Validation of the modular system performance, of the systems interaction, of the sensors' data fusion software, of the satellite communications applications domains and also of the physical framework for sensor blocks.		

Predecessors:	Relationship:	Lag:
5.1.2	FS	-

Number and Type of Resources Required:	Skill Requirements:	Other Required Resources:
1 System testing engineer (senior)	Senior	1 Testing room
1 System testing engineer (average)	Average	1 Hardware support system
2 System testing engineers (junior)	Junior	1 Sensor interface
		1 Controllers
		1 Memory modules

Type of Effort:		
Fixed duration.		

Location of Performance:		
Facilities of: Thales Alenia Space S.A.S, Airbus Defence and Space GmbH, Deimos Space S.L.U and HIRO.		

Constraints:		
Due date Deliverable Validation: 25/06/21		
Due date Milestone Individual systems testing: 09/07/21		

Assumptions:		
-		

Table 7.0.49: Activity 5.3 attributes

WBS-ID:		Activity:
5.4		Interaction Platform Validation
Description of Work:		
Validation of the interaction platform to check if it develops all its functions properly.		
Predecessors:	**Relationship:**	**Lag:**
5.1.3	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Application development manager	Senior	1 Testing room
	Average	1 Hosting package
1 Application development technician (average)		1 Backup system
Type of Effort:		
Fixed duration.		
Location of Performance:		
Facilities of: ReSAC, HIRO, VITO nv and ICUBE-SERTIT.		
Constraints:		
Due date Deliverable Validation: 18/06/21		
Due date Milestone Individual systems testing: 09/07/21		
Assumptions:		
-		

Table 7.0.50: Activity 5.4 attributes

WBS-ID:		Activity:
5.5		Full System Prototype Validation
Description of Work:		
Validation of the whole system using the prototype in order to test its performance.		
Predecessors:	**Relationship:**	**Lag:**
5.01	FS	-
Number and Type of Resources Required: 2 System testing engineer (average) 2 Application development technicians (average) 2 System development engineers (average)	**Skill Requirements:** Average	**Other Required Resources:** 1 Testing room 1 Payload building block 1 Hardware support system 1 Sensor interface 1 Controllers 1 Memory modules 1 Hosting package 1 Backup system
Type of Effort: Fixed duration.		
Location of Performance: Facilities of: HIRO, Airbus Defence and Space GmbH, Thales Alenia Space and ReSAC.		
Constraints: Due date Deliverable Validation: 29/10/21 Due date Final report: 21/01/22 Due date Milestone Full system testing: 29/10/21		
Assumptions: -		

Table 7.0.51: Activity 5.5 attributes

WBS-ID:		Activity:
5.6		Quality of the Product
Description of Work:		
Quality control of all the subsystems of the product and all the methodologies applied on its manufacturing and validation.		
Predecessors:	**Relationship:**	**Lag:**
5.02	FS	-
Number and Type of Resources Required: 1 Quality Manager 1 Quality Manager Assessor	**Skill Requirements:** Senior	**Other Required Resources:** 1 Quality laboratory 1 Payload building block 1 Hardware support system 1 Sensor interface 1 Controllers 1 Memory modules 1 Hosting package 1 Backup system
Type of Effort:		
Fixed amount of work.		
Location of Performance:		
Facilities of: HIRO, Airbus Defence and Space GmbH, Thales Alenia Space and ReSAC.		
Constraints:		
Due date Deliverable Validation: 29/10/21 Due date Final report: 21/01/22		
Assumptions:		
-		

Table 7.0.52: Activity 5.6 attributes

WBS-ID:		Activity:
6.1.1.		Study of stakeholders
Description of Work:		
Study of the possible companies interested on the project.		
Predecessors:	**Relationship:**	**Lag:**
0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Legal and Business Assessor 1 Stakeholders and Procurement Manager 2 Stakeholders and Procurement Assessor	Average Senior	Office Microsoft Office GitHub
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of: BHO Leal, Rechtsanwälte, Partnership and HIRO		
Constraints:		
-		
Assumptions:		
-		

<div align="center">Table 7.0.53: Activity 6.1.1. attributes</div>

WBS-ID:		Activity:
6.1.2.		Procurement conditions negotiation
Description of Work:		
Negotiation of the conditions of the procurement of the resources.		
Predecessors:	**Relationship:**	**Lag:**
0	FS	-
Number and Type of Resources Required: 1 Legal and Business Assessor 1 Stakeholders and Procurement Manager 2 Stakeholders and Procurement Assessor	**Skill Requirements:** Average Senior Average	**Other Required Resources:** Office Microsoft Office GitHub
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of: BHO Leal, Rechtsanwälte, Partnership and HIRO		
Constraints:		
-		
Assumptions:		
-		

Table 7.0.54: Activity 6.1.2. attributes

WBS-ID:		Activity:
6.1.3.		Resources purchase
Description of Work:		
Purchase of the resources required in the project.		
Predecessors:	**Relationship:**	**Lag:**
0	FS	-
Number and Type of Resources Required: 1 Legal and Business Assessor 1 Financial Manager 1 Financial Manager Assessor	**Skill Requirements:** Average Senior	**Other Required Resources:** Office Microsoft Office GitHub
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of: BHO Leal, Rechtsanwälte, Partnership and HIRO		
Constraints:		
-		
Assumptions:		
-		

Table 7.0.55: Activity 6.1.3. attributes

WBS-ID:		Activity:	
6.2.		Exploitation and Business Plan	
Description of Work:			
Business plan of the product to exploit its economic potential.			
Predecessors:	**Relationship:**	**Lag:**	
6.1.	FS	-	
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**	
1 Legal and Business Assessor	Average	Office	
	Senior	Microsoft Office	
1 Financial Manager		GitHub	
2 Financial Manager Assessor		Live Plan	
1 Stakeholders and Procurement Manager			
Type of Effort:			
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.			
Location of Performance:			
Facilities of: BHO Leal, Rechtsanwälte, Partnership and HIRO			
Constraints:			
-			
Assumptions:			
-			

Table 7.0.56: Activity 6.2 attributes

WBS-ID:		Activity:
7.1		Dissemination and Communication Plan
Description of Work:		
Definition of the strategies planned to the dissemination of the final product.		
Predecessors:	**Relationship:**	**Lag:**
0	FS	-
Number and Type of Resources Required: 1 Marketing and Communications Manager 2 Marketing and Communications Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** Office Microsoft Office LaTeX Github
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of HIRO		
Constraints:		
-		
Assumptions:		
-		

Table 7.0.57: Activity 7.1 attributes

WBS-ID:		Activity:
7.2.1		Web site development
Description of Work:		
Development of the web site to promote the product.		
Predecessors:	**Relationship:**	**Lag:**
7.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Marketing and Communications Manager 2 Marketing and Communications Manager Assessor	Senior Average	Office Wix
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of HIRO		
Constraints:		
-		
Assumptions:		
All partners should provide information and be able to collaborate for communication and dissemination purposes.		

Table 7.0.58: Activity 7.2.1 attributes

WBS-ID:		Activity:
7.2.2		Social media management
Description of Work:		
Management of the social media used in the dissemination plan of the project.		
Predecessors:	**Relationship:**	**Lag:**
7.2.1	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Marketing and Communications Manager 2 Marketing and Communications Manager Assessor	Senior Average	Office
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of HIRO		
Constraints:		
-		
Assumptions:		
All partners should provide information and be able to collaborate for communication and dissemination purposes.		

Table 7.0.59: Activity 7.2.2 attributes

WBS-ID:		Activity:
7.3.1		Conferences
Description of Work:		
Attendance to conferences in order to disseminate to possible stakeholders the product.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required: 1 Marketing and Communications Manager 2 Marketing and Communications Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** Conference Hall Jitsi
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of HIRO		
Constraints:		
-		
Assumptions:		
All partners should provide information and be able to collaborate for communication and dissemination purposes.		

Table 7.0.60: Activity 7.3.1 attributes

WBS-ID:		Activity:
7.3.2		Meetings
Description of Work:		
Meetings to promote the product inside the market.		
Predecessors:	**Relationship:**	**Lag:**
1.0.	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Marketing and Communications Manager 2 Marketing and Communications Manager Assessor	Senior Average	Meeting Room
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
-		
Assumptions:		
All partners should provide information and be able to collaborate for communication and dissemination purposes.		

Table 7.0.61: Activity 7.3.2 attributes

WBS-ID:		Activity:
7.4.1		Technology demonstrators
Description of Work:		
Production of technology demonstrators needed to the dissemination of the product.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required:	**Skill Requirements:**	**Other Required Resources:**
1 Marketing and Communications Manager	Senior	Development Centre
2 Marketing and Communications Manager Assessor	Average	Microsoft Office
		Final Cut Pro
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
-		
Assumptions:		
All partners should provide information and be able to collaborate for communication and dissemination purposes.		

Table 7.0.62: Activity 7.4.1 attributes

WBS-ID:		Activity:
7.4.2		Audio visual material production
Description of Work:		
Production of all the visual material needed to the promotion of the product.		
Predecessors:	**Relationship:**	**Lag:**
1.0	FS	-
Number and Type of Resources Required: 1 Marketing and Communications Manager 2 Marketing and Communications Manager Assessor	**Skill Requirements:** Senior Average	**Other Required Resources:** Office Microsoft Office Final Cut Pro
Type of Effort:		
Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort.		
Location of Performance:		
Facilities of: HIRO		
Constraints:		
-		
Assumptions:		
All partners should provide information and be able to collaborate for communication and dissemination purposes.		

Table 7.0.63: Activity 7.4.2 attributes

8 | Cost estimating

8.1 Level of accuracy

8.2 Cost estimation worksheet

8.3 Activity cost estimation

9 | Cumulative costs

9.1 Cumulative cost curve

The cumulative cost curve shows the added costs of the project along its duration. The following graph has been done taking into account the daily salary of the workers as well as the daily cost of the facilities. To main steps can be appreciate which represents the investment in hardware in order to do the prototypes and the validations. Moreover, notice that by day 1 the costs are of around 42000€, which represent the initial expenses to pay the software of the project.
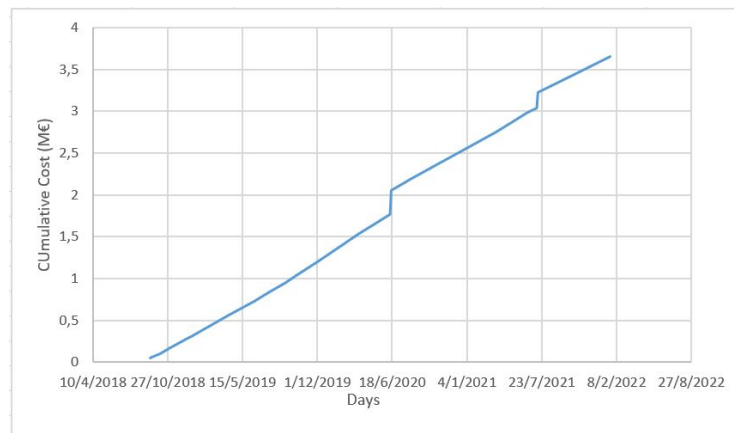

Figure 9.1.1: Cumulative Cost Cuver over time [**?**].

The information that this curve gives is crucial in order to be able to schedule the project cash flow. Indeed, it is a perfect reference to avoid budget overrun along the follow up of the project. Finally, budget at completion, as indicated before is estimated to be around 3.65M€.

9.2 Budget at completion