



# Project DEOS-UD

## Disruptive Earth Observation Sensing for Urban Development

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### Deliverable 2

### Scope, Time and Cost Management

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# 1 | Project scope statement

## 1.1 Product Scope Description

## 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.
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 requirement definition.

Deliverable Name			Description
Payload Design	Preliminary		Report determining the payload preliminary design. It contains the research, requirements and preliminary performances parameters of each sensor.
Modular Preliminary Design	System		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 Preliminary Design	Platform		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.
Mid-term Review			Document used to check the current state of the project, in order to inform all the participants, including the stakeholders, of the progress.
Payload Final Design			Report detailing the final design and technical specifications of each developed sensor.
Modular Design	System	Final	Report detailing the final design and technical specifications of the modular system.
Sensors Software	Data	Fusion	Final sensors data fusion software.
Interaction Final Design	Platform		Report containing the final design and technical specifications of the interaction platforms.
Data Software	Processing		Final data processing algorithms based on applications to process 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.

Table 1.2.1: Project Deliverables



### 1.3 Project Acceptance Criteria

### 1.4 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.
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 1.4.1: Project Exclusions

### 1.5 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 [1] where

constraints can be clearly interpreted and organised.

### SIX PROJECT CONSTRAINTS GROUPS

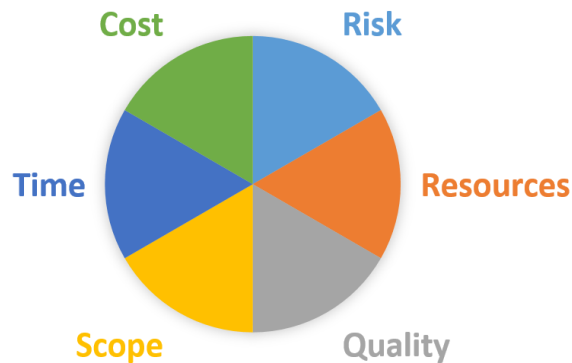


Figure 1.5.1: The 6 Project Constraints [1].

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:**
  - **Project Management, business and communication plans deadline:** Expected execution time is determined in 1 month and a maximum of 2 months is permitted within the project limitations.
  - **State of the art report deadline:** Its elaboration should last 4 months as initially foreseen and not more than six months duration will be admitted.

- **Preliminary designs deadline:** Payload, modular and interaction preliminary designs must be completed at utmost one year and a half (although forecasted to last for 16 months).
  - **Mid-term project report deadline:** Maximum duration of two years but expected to be fulfilled in 22 months.
  - **Final designs deadline:** Payload, modular and interaction final designs must be completed at utmost 30 months (although forecasted to last for 29 months).
  - **Prototype manufacturing and system testing:** Approved maximum duration of three and a half years estimated period of 41 months.
  - **Final report deadline:** Limited duration of 4 years. Expected to be delivered in 44 months.
- **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 development 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 established requirements to obtain the customer satisfaction.

## 2 | Work Breakdown Structure (WBS)

### 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
  - 2.3.1. Guidelines preparation
  - 2.3.2. Document revision
  - 2.3.3. Document rectification

2.3.4. Document approval

2.4. Periodic Monitoring

3. STATE OF THE ART

3.1. Payloads

3.1.1. Search for current space applications

3.1.2. Requirements definition

3.2. Modular System

3.2.1. Search for current modular systems with space applications

3.2.2. Requirements definition

3.3. Urban Development Applications with Space Technologies

3.3.1. Search for current space applications

3.3.1.1. Weather forecast

3.3.1.2. Urban planning (3D models)

3.3.1.3. Greenhouse emissions reduction (pollution)

3.3.2. Requirements definition

4. PRODUCT DEVELOPMENT

4.1. Preliminary Design

4.1.1. Payloads

4.1.1.1. Research

4.1.1.2. Development

4.1.2. Modular system

4.1.2.1. Development of physical framework for sensor blocks

4.1.2.2. Development of systems interaction and applications

4.1.2.3. Development of sensors' data fusion software

4.1.2.4. Definition of SATCOM applications domains

4.1.3. Interaction platform

4.1.3.1. Implement web-based servers for sharing sensors' data

4.1.3.2. Implement processing algorithms based on applications

4.1.3.3. Pre-design a full services stakeholders platform

4.2. Final design

4.2.1. Payloads

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\*(FALTA COMENTARLO)
  - 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

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.
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	-.



WBS-ID	Activity	Description of Work
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.
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.

WBS-ID	Activity	Description of Work
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.
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.

WBS-ID	Activity	Description of Work
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.
6	Business planning and exploitation of results	The activities regarding the final exploitation 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.

WBS-ID	Activity	Description of Work
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.

## **3 | Sequence activities**

**3.1 Dependencies or logical relationship between activities**

**3.2 Network Diagram (Precedence Diagram Method)**

## 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. As not all employees are in the same point on the learning curve, they will be classified into three sub-groups:
  - **Senior:** High on the learning curve. Is able to provide guidance on technical and management issues and offers a critical point of view of the actions of the project.
  - **Average:** Is able to perform activities on its knowledge field and arrive to conclusions without supervision.
  - **Junior:** Little experience in the field, the work done need to be supervised by an average employee.
- **Materials:** Hardware and software elements that will be used to achieve the project objectives.
- **Facilities:** Special places and services (such as the testing room).

The resources are exposed in Table 4.1.1.

Resource ID	Resource Description	Type of resource
PM.M	Project Manager	Employee-Senior
PM.S	Project Manager Secretary	Employee-Average
F.M	Financial Manager	Employee-Senior
F.A	Financial Manager Assessor	Employee-Average
SP.M	Stakeholders and Procurement Manager	Employee-Senior
SP.A	Stakeholders and Procurement Manager Assessor	Employee-Average

ST.M	Scope and Time Manager	Employee-Senior
ST.A	Scope and Time Manager Assessor	Employee-Average
R.M	Risk Manager	Employee-Senior
R.A	Risk Manager Assessor	Employee-Average
QM.M	Quality Manager	Employee-Senior
QM.A	Quality Manager Assessor	Employee-Senior
MC.M	Marketing and Communications Manager	Employee-Senior
MC.A	Marketing and Communications Manager Assessor	Employee-Average
TM	Technical 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

Table 4.1.1: Resources identification

## 4.2 Activity resource requirement

## 4.3 Resource Breakdown Structure

## 5 | Estimate activity duration



## 6 | Project Schedule

Gantt chart

## 7 | Activity Attributes (at Work Package level)

Table 7.0.1: Activity X attributes

<b>WBS-ID:</b> This identifies where this activity can be found in the WBS.		<b>Activity:</b> This is the name of the activity from the project activity list.
<b>Description of Work:</b> This information includes a detailed description of the work to be performed for this activity and should be consistent with what is provided in the project activity list.		
<b>Predecessors:</b> This section lists other activities which must occur before this activity.	<b>Relationship:</b> This describes if the predecessor has a start-start, start-finish or other type of scheduling relationship.	<b>Lag:</b> This section describes any dependencies on predecessor activities like lead times, lag times or other requirements.
<b>Number and Type of Resources Required:</b> The number and roles of people to complete the work	<b>Skill Requirements:</b> The level of skill necessary to complete the work (expert, average, novice or applicable job level)	<b>Other Required Resources:</b> Any equipment, supplies, or other type of resources needed to complete the work
<b>Type of Effort:</b> Indicate if the work is fixed duration, fixed amount of work or fixed amount of effort		
<b>Location of Performance:</b> If the work is to be completed somewhere other than at the performing organization site, indicate location		
<b>Constraints:</b> Indicate any fixed delivery dates, milestones or other constraints		
<b>Assumptions:</b> List any assumption about resources availability, skill sets, or other assumptions that impact activity		

## **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

### 9.2 Budget at completion

## 10 | Bibliography

[1] Workfront. The 6 Project Constraints, 2017.