EARTH CLIMATE CHANGE OBSERVATION

EO-3-2015 Proposal

Technical Annex

Technology developments for competitive imaging from space

HORIZON 2020
THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION

ecco

COVER PAGE

Title of Proposal

EARTH CLIMATE CHANGE OBSERVATION

List of participants

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1. Excellence

1.1. Objectives

The key objectives for this project are:

- Develop a fractionated satellite with high specifications sensors able to get data about the climate change in a more efficient and precisely way than the actual ones do.
- Develop a new system to enable and control the communication between each module, and the ground station.
- Use the advantages of fractionated satellites in order to improve robustness and reliability, developing new technology related to upgradability.
- Create new software to control the formation of the constellation, in order to avoid collisions and keep all modules in a specific range.
- Develop simulation software to test and validate software related to navigation control and data transmission.
- Design an innovative power transmission system that increases the power transfer efficiency.
- Set an incremental deployment of modules to be connected to the infrastructure module, reducing update and maintenance costs and allowing better flexibility for future projects.

1.2. Relation to the work programme

The ECCO project will design a new concept of fractioned satellite, more efficient and with innovative scanning/observation modes that will allow a much better study and control of the climate change.

All these features are related to the work programme part 12: 'Climate action, environment, resource efficiency and raw materials'. Moreover, it is also related to work programme 14: 'Secure societies – Protecting freedom and security of Europe and its citizens' since it is Securing the society against climate disasters.

Securing the society against disasters is one of the central elements of the functioning of any society. There is barely any societal sector which is not to some extent concerned by disasters and related resilience and security issues. Considering just the impact of climate change, there is an urgent need of reducing disruptions to economic activities caused by extreme weather events, with ever growing cost to the EU reaching already €13 billion in 2011. Environmental and socio-economic impact of disasters and crime and terrorism on the population amounts to average annual losses of roughly 25% of the global GDP and 5% of the Union's GDP respectively. The objective within this challenge is to reduce the loss of human life, environmental, economic and material damage from natural and man- made disasters, including from extreme weather events, crime and terrorism threats. This area will therefore focus on developing technologies and running large-scale demonstration with a view to: 1) strengthening prevention and preparedness against natural and man-made disasters by underpinning an all-hazard approach to risk assessment across the EU; 2) developing solutions, for climate change adaptation in areas affected by natural disasters , such as for port cities, critical infrastructures, tourism; 3) facilitating

disaster management, notably through communication technologies for crisis response actors and the linking of situational awareness centres; 4) building up community resilience and resilience of critical infrastructure, including against cyber- crime and cyber-terrorism. Actions in this area will be in line with the EU Internal Security Strategy and its Action Plan; the EU Security Industrial Policy; the EU Climate Adaptation Strategy, the EU's Civil Protection Mechanism and the European Programme for Critical Infrastructure Protection. New risk assessments will be produced, interoperable communication technology prototypes developed and a new resilience indicator will serve as a benchmark for this focus area.

1.3. Concept and approach

Nowadays we live in an industrial society which requires large amounts of resources in order to be sustainable, resulting in a global contamination of the atmosphere and oceans. It has been demonstrated that over the centuries climate changes have been produced, but today, the question is how humans are taking part of it. This impact is known as global warming and has been one of the strategic priorities for the European Union. Some initiatives have been taken by the European Union to transform Europe to a highly energy-efficient economy, reducing emissions (specified on Kyoto Protocol) and specifying targets up to 2050. In the last years, different programs have sent satellites to analyse and transmit data to study and control human impact, like A-Train constellation by NASA and JAXA or Copernicus programme (in development by the European Union).

For this purpose, we present a new revolutionary design of fractioned satellite, joining the potential of upgradability and reliability, to acquire relevant information about global warming. Fractionated satellites use the new wireless technology to transfer information and power through different modules, each one with a specific sensor. This system improves flexibility to launch independent modules (with a specific function) to upgrade or change an operative module, reducing costs and introducing the maintenance concept to satellites, increasing the useful life of the overall satellite. All the information captured would be useful to check the targets specified by the European Union for the next years, be aware of climate evolution and be able to contrast information with other programmes like Copernicus.

Throughout the necessity to study the impact of the global warming of the earth, constellations of satellites have been sent over the last years with the latest technology applied on sensors and communications. One example is the A-Train constellation, designed and launched by NASA and JAXA, which is composed by six satellites where each one has a specific role into the constellation. Since 2002 (when the first satellite was deployed), an improvement in technology has been done, and new sensors have been developed. Due to the difficulty of access to systems that are in space, there are no possibilities of maintaining or upgrading the actual satellites, making necessary to send an entire satellite to improve the sensors or to restore lost functionalities, assuming the high costs of it.

The aim of this project is to create a constellation of instruments for tracking information related to global warming, and using the new concept of fractionated satellite to enable upgradability and maintainability by modules exchanging. It means taking advantage of work with a modular satellite to replace only one module, reducing costs of launchings and enable the capacity to upgrade specific sensors. In order to achieve the objectives, control systems must be designed and improved. Few modules must be used to control the constellation behaviour, for instance the formation of all modules to avoid collisions and keep them all into a specific range, the communication between them and ground station, and the power generation and its transmission.

The results obtained through the development of the project could be applied to other satellites, taking the advantage of using fractionated designs and reducing costs related to investment.

The ultimate intended outcome of the project will be the successful testing of the hardware and software designed.

1.4. Ambition

Our vision is to be the worldwide leaders in acquiring relevant information about global warming and to be the tool to improve global economic efficiency and achieve a sustainable development of the world.

2. Impact

2.1. Expected impacts

A new revolutionary design of a constellation of fractionated satellites is proposed to help the European Community to raise awareness of global warming. While combining the best characteristics of the classical satellites, this new technology allows an unprecedented maintainability, scalability, flexibility and responsiveness among others that customers will appreciate. Before explaining the services that ECCO can provide, it is fundamental to explain why this new concept for satellites is far better than the traditional existing ones, and how it could change the future of space missions.

The main difference between traditional and fractionated satellite is the distribution of the payload and subsystems. In fractionated satellites all sub-systems are in an isolated module transmitting data and power by wireless methods, instead of being assembled together into a common structure. The most evident impact of using highly modular satellites is on the development of each module, due to the fact that modules can be developed, manufactured, integrated and tested in parallel because no highly inter-connections are needed. This allows a faster development of the satellite, and thus, a strategic strength for the company with respect to the competitors.

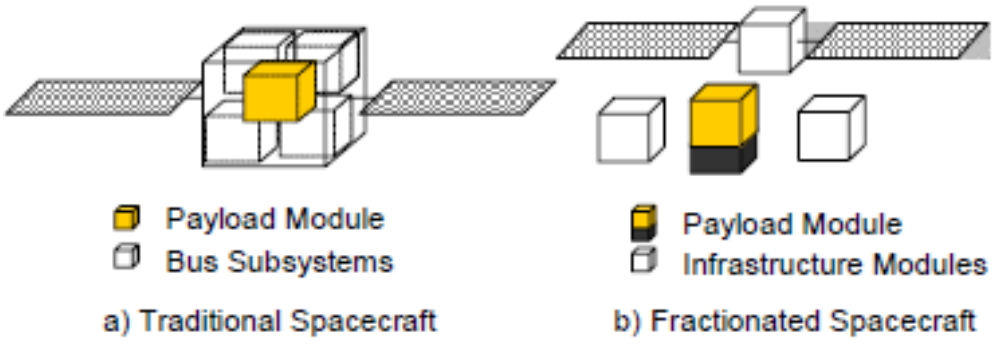

Figure 1. Traditional spacecraft versus fractionated spacecraft concepts from Fractionated Spacecraft Architectures Seeding Study

Moreover, the functional partitioning combined with the small size of modules allows reducing costs on designs and building cycles, sending leading technology to space without the high lags between design and launch. Also, an incremental deployment system leads to upgrading technology or simply to restore functionalities due to maintenance, taking profit of lower costs per module and the ease to put it into orbit due to its lower mass and volume. It must be emphasized that by using a highly modular satellite, an eventual failure of a module would not affect the others, increasing the overall robustness of the system.

There are two types of modules: infrastructure and payload modules. The payload modules include one instrument and the receptors for the communication with the infrastructure modules. The last ones are responsible for the data communication, guidance and navigation and power generation, among others.

The optimum number of infrastructure modules that will be used in the ECCO project has been obtained with the aim to minimize the overall weight of the satellite while maintaining the performance:

- Payload modules
- Communication an data handling
- Power unit supply
- Propulsion and navigation control

This configuration keeps fractionated satellite concept and join some similar sub-systems, for instance communication and data handling, or propulsion and navigation control, to reduce the overall mass. The Payload modules could be standardized, in terms of mass and power requirements, being able to launch small commercial modules with new necessities and exchange it in the future for an existing payload module, reusing the infrastructure modules. Moreover, the existence of different payload modules leads to acquire multiple data from the same objective, increasing precision of data and creating three-dimensional data maps, or from different objectives due to the different attitude control of each module. This is in fact an improvement in flexibility versus traditional satellites.

The specific sensors that ECCO will use cannot be completely specified in this phase of the project, however, there is a clear idea of the services that the ECCO satellites will be able to provide to the interested parts if the project is developed. Sensors would be integrated in three payload modules, each one containing only one of the following:

- Track temperature of the ground and ocean to determine the behaviour of the global temperature and be aware of climate changes.
- An image sensor to observe deforestation, desertification, ice melting rate, demography and water currents.
- Track principal greenhouse gasses, for instance, CO2, water vapour and methane. This information, combined with the image tracking, will be useful to determine pols of greenhouse gasses production, how it distributes over the world and the repercussion on temperature.

2.2. Measures to maximise impact

2.2.1. Dissemination and exploitation of results

The ECCO Project does not simply conform to improving product and service quality, instead it is deploying extensive activities to perform the world's top quality management in order to provide the highest level of satisfaction in all aspects to our customers and stakeholders. To achieve this, the quality department deploys various quality improvement activities, with attention also given to improving quality management.

The quality assurance will be applied to products during the pre-production in order to know whether what will be made meets specifications and requirements, and during manufacturing production runs by validating samples meet specified quality controls. Quality assurance is also applied to software to verify that features and functionality meet objectives, and that code is relatively bug free prior to shipping or releasing new software products and versions.

General Quality Standards (ISO/EN) that must be followed and accomplished are, depending on the task:

- 9100- Quality System for Aerospace Manufacturers
- 9101-Checksheet for 9100
- 9110-Quality System for Aerospace Repair Stations
- 9111-Checksheet for 9110
- 9120-Quality System for Distributors
- 9121-Checksheet for 9120

2.2.2. Communication activities

The philosophy of the company is to care about the importance of having a good dissemination plan, with the objective of keeping informed not only stakeholders but also all the general public.

To achieve this aim ECCO outsources some external communication tasks to an external specialized firm.

In order to perform this dissemination, the following tasks will be developed:

- **Social Networking**

Dissemination campaign must be compatible with the current media, taking profit of new technology and reach European inhabitants. The dissemination of media, social media and a website will offer a friendly approach to the project through many channels of communication. All the non-confidential information about the development of the project and the new discoveries will be published in the webpage and social networks with an update three times a week.

- ***ECCO Day* International congress**

Two international congresses will be organized to attract possible stakeholders and keep the interest of the current ones. The ECCO stakeholders and some potential new stakeholders will be invited to attend and/or participate in the two international congresses where some conferences will be given. The first ECCO Day will be done in the 61st week of the project and the second ECCO Day will be done at the end of the project, around the 115th week.

- **Specialized journals and magazines**

In order to keep informed the interested public, ECCO will also publish articles periodically in some of the specialized journals. In the following table is mentioned the magazines in which participation is foreseen:

Table 1. List of specialized journals and magazines

Journal	Frequency	Format	Description
Space Science & Engineering International Journal	1 per year	Online magazine (Only for subscribers) Paper magazine	This journal produces 4 issues per year about original and multidisciplinary research papers in all areas of space activities. (Into the covered topics they specify earth observation from space and data processing).
CEAS Space Journal	1 per year	Online version Paper Version	The CEAS Space Journal has been created by the Space Branch of the Council of European Aerospace Societies to provide an appropriate platform for excellent scientific publications submitted by scientists and engineers.

Journal	Frequency	Format	Description
Space Science Reviews	1 per year	Online Version Paper Version	As an international key journal on scientific space research, its purpose is to provide a comprehensive synthesis of the various branches of space research. Space Science Reviews continues to boast a very strong Impact Factor, and is found in the 1st quartile of all Astronomy and Astrophysics journals by Thomson Scientific.
Aerospacio	2 per year	Online magazine Paper magazine	Spanish magazine where important aerospace discoveries are published.
Progress in Aerospace Sciences	1 per year	Online Version Paper Version	An international review journal designed to be of broad interest and use to all those concerned with research in aerospace sciences and their applications in research establishments, industry and universities.
Aerospace Science and Technology	1 per year	Online Version Paper Version	This journal publishes original papers, review articles and short communications related to all fields of aerospace research, fundamental and applied potential applications. (Into the covered topics they specify earth observation and aerospace communications, among others).
Advances in Space Research	2 per year	Online OPEN journal	The Official Journal of the Committee on Space Research (COSPAR), a Scientific Committee of the International Council for Science (ICSU).

- **Trade Fairs**

Participation in trade fairs of the sector is a very important part of the dissemination of the project. There are specialized fairs where ECCO can present the project to the public. In the following list are the trade fairs in which ECCO will participate:

ILA Berlin Air Show. ILA Berlin Air Show is not only the oldest fair in the industry but it is also considered to be the leading international aerospace trade show. Many exhibitors, among others, from the areas of commercial aviation, aerospace, defense and security, equipment, engines and materials present their new products and innovations. The fair is an industry meeting place and also a crowd puller. For example, the "International Suppliers Center ISC" offers to the international suppliers in the industry an excellent platform to present themselves in front of an international trade audience. In addition, visitors can expect an excellent conference program. The "ILA Career Center" is the ideal platform for human resources and recruiting. Here employers and future employees can meet in a relaxed environment.

Date: 31.05.2016 -05.06.2016

Location: Berlin

Contact and information: www.ila-berlin.de/ila2014/home/index.cfm

The Japan International Aerospace Exhibition in Tokyo. It is an international exhibition of aviation and space technology. Here the newest technologies, products, services and developments in the industry are presented and information is exchanged in order to contribute to the development of the aerospace industry with appropriate activities. Both the professional and the just plain interested visitors get an overview on aviation and space technology at the several stalls of the exhibitors.

Date: 12.10.2016 -15.10.2016

Location: Tokyo

Contact and information: www.japanaerospace.jp/eng/Index

Airshow China. China International Aviation & Aerospace Exhibition (namely Airshow China) is the only international aerospace trade show in China that is endorsed by the Chinese central government. It features the display of real-size products, trade talks, technological exchange and flying display. Since 1996, the show has been successfully held in Zhuhai in every even-number year for 10 sessions.

Date: 01.11.2016 -06.11.2016

Location: Zhuhai, China

Contact and information: www.airshow.com.cn/en/

International Paris Air Show Le Bourget. This fair is an international aviation and aerospace exhibition, which is organized every two years by the SIAE, a subsidiary of GIFAS, the French Aerospace Industries Association. It is one of the oldest and largest air shows in the world. Here the newest technologies of the aerospace industry and related equipment, such as aircraft engines, satellite navigation technology, aircraft cabins and seats and weapons systems will be presented. Over the years this show has become one of the most important international platforms in the industry. The first days of the fair are reserved exclusively for trade visitors, at the weekend the event will open its doors for the general public. About 150 aircrafts are presented. Many of them show their skills during the daily flying demonstrations in the afternoon which gives exhibitors the opportunity to demonstrate their technical expertise to the public. The exhibition is accompanied by a B2B meeting program where the exchange of knowledge and experiences in combination with the search for solutions in the aerospace sector is in the foreground.

Date: 20.06.2017 -20.06.2017

Location: Paris

Contact and information: http://www.siae.fr/EN

- **Other dissemination activities**

Since some part of the dissemination will be outsourced, it is expected to have modifications in this Dissemination plan. More activities that are eligible to be included in the dissemination plan are, for example, school lessons, science festivals, informative meetings, organizing sport events, leaflets, press releases and others, depending on the target group.

3. Implementation

3.1. Work plan – Work packages, deliverables and milestones

In the figure below, the work breakdown diagram structure is presented, including different work packages.

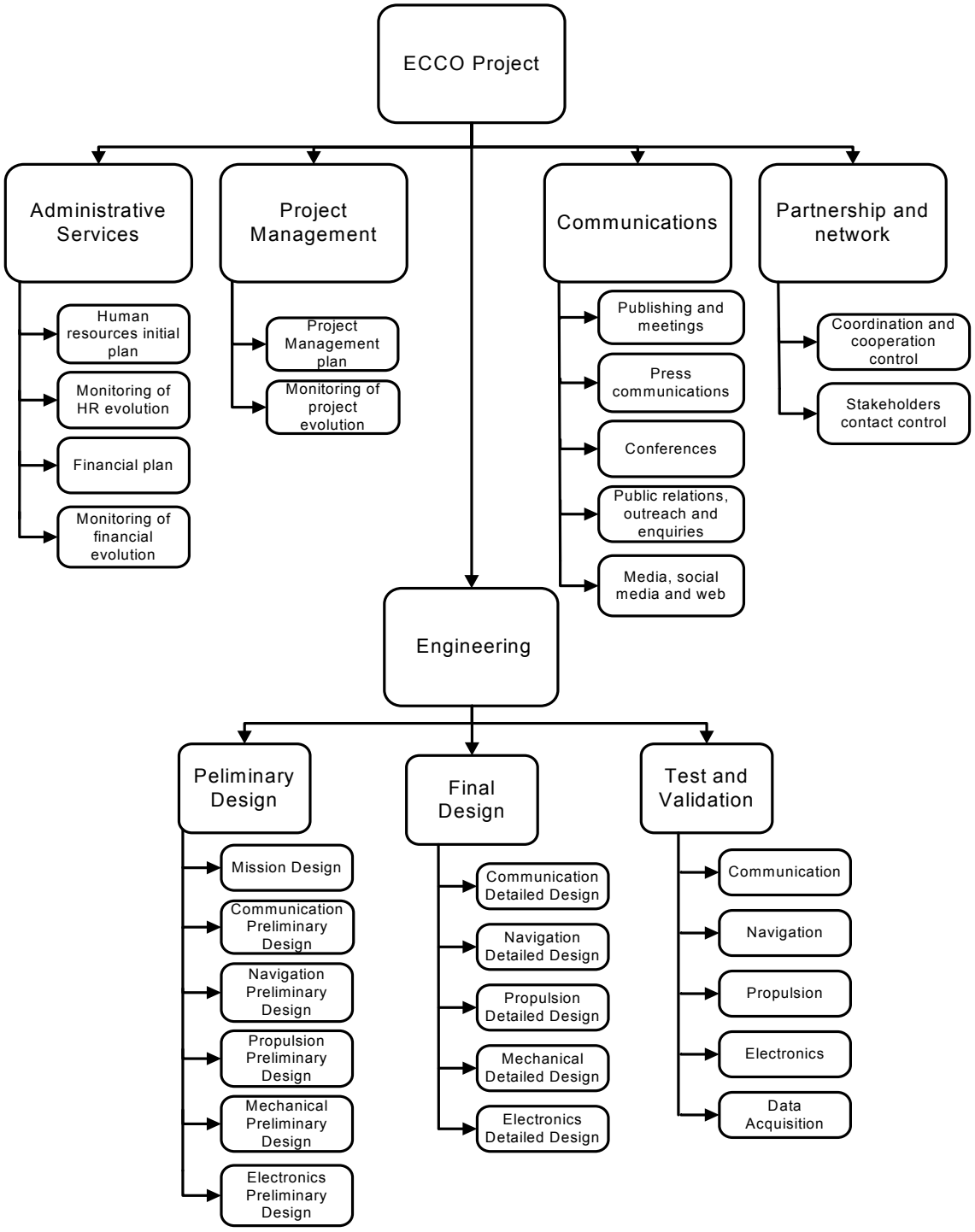

Figure 2. Work breakdown diagram structure

Table 2. List of work packages

Work Package Number	Work Package Title	Lead Participant Number	Lead Participant Short Name	Person-Months	Start Month	End Month
WP 1	Project management	1	ECCO	2.26	March 2015	April 2018
WP 2	Administrative services	1	ECCO	3.00	March 2015	April 2018
WP 3	Partnership and network	1	ECCO	2.25	May 2015	April 2018
WP 4	Dissemination	2	ECCO, BCCI	0.87	May 2015	April 2018
WP 5	Preliminary mission design	2	ECCO, Cranfield University	5.44	March 2015	May 2016
WP 6	Preliminary communication design	3	ECCO, Surrey Satellites, Orbital ATK, University of Southampton	5.55	June 2015	December 2015
WP 7	Preliminary navigation design	2	ECCO, UPC	4.07	June 2015	November 2015
WP 8	Preliminary propulsion design	3	ECCO, SILVANET, Orbital ATK	5.46	September 2015	March 2016
WP 9	Preliminary mechanical design	3	ECCO, SENER, University of Stuttgart	4.41	February 2016	May 2016
WP 10	Preliminary electronics design	3	ECCO, Amptek, ATT	4.16	July 2015	December 2015
WP 11	Communication detailed design	3	ECCO, Southampton University, Orbital ATK	11.36	April 2016	November 2016
WP 12	Navigation detailed design	2	ECCO, SENER	5.03	April 2016	January 2017
WP 13	Propulsion detailed design	2	ECCO, GISAT	5.25	November 2016	May 2017
WP 14	Mechanical detailed design	3	ECCO, Surrey Sattelites, Orbital ATK	7.75	March 2017	September 2017
WP 15	Electronic detailed design	2	ECCO, GISAT	4.50	July 2016	February 2017
WP 16	Test and validations	3	ECCO	5.61	December 2016	April 2018
				76.97		

Table 3. Work package 1 description

Work package number	1	**Start Date or Starting Event**	March 2015
Work package title	Project management		
Participant number	1		
Short name of participant	ECCO		
Person/months per participant	2.26		

Objectives:

To define a more detailed and technical vision of the project, specifying resources, their distribution in time to accomplish the project objectives, a detailed version of the project Charter, control and monitoring actions and level of implementation among others.

Description of work:

The Project Manager and its team are analysing the resources, costs, time scheduling, risks… in order to guide the project to success.

Deliverables: Project management plan.

Table 4. Work package 2 description

Work package number	2	**Start Date or Starting Event**	March 2015
Work package title	Administrative services		
Participant number	1		
Short name of participant	ECCO		
Person/months per participant	3		

Objectives: Assure a correct working of the financials of the project as well as a good developing of the Human Resources area.

Description of work: The team in charge of the financials and the human resources work in these areas making all the controls and operations needed to assure the objectives.

Deliverables: Project Management Plan

Table 5. Work package 3 description

Work package number	3	**Start Date or Starting Event**	May 2015
Work package title	Partnership and network		
Participant number	1		
Short name of participant	ECCO		
Person/months per participant	2.25		

Objectives: Establish and keeping the control with the stakeholders.

Description of work: To keep the contact via telephone, e-mail, videoconference… with all the stakeholders as well as keep a control of all the modifications or agreements done.

Deliverables: Project Management Plan

Table 6. Work package 4 description

Work package number	4	**Start Date or Starting Event**	May 2015
Work package title	Dissemination		
Participant number	2		
Short name of participant	ECCO, BCCI		
Person/months per participant	0.87		

Objectives: To spread ECCO's project aim and steps in order to keep the attention of the media and the stakeholders.

Description of work: The team involved in dissemination will organise events, manage media contact, TV interviews, web page, etc.

Deliverables: Project Communication Plan

Table 7. Work package 5 description

Work package number	5	**Start Date or Starting Event**	March 2015
Work package title	Preliminary mission design		
Participant number	2		
Short name of participant	ECCO, Cranfield University		
Person/months per participant	5.44		

Objectives: Establish all the preliminary parameters of the mission

Description of work: All the requirements of the mission are analysed and the calculation of the main mission parameters is done.

Deliverables: Intermediate report, Mission design

Table 8. Work package 6 description

Work package number	6	**Start Date or Starting Event**	June 2015
Work package title	Preliminary communication design		
Participant number	3		
Short name of participant	ECCO, Surrey Satellites, Orbital ATK, University of Southampton		
Person/months per participant	5.55		

Objectives: Search, summarize and asses specific information about the particular needs of this project in communication systems.

Description of work: Analysis and investigation about the requirements needed.

Deliverables: Intermediate report, communication preliminary design

Table 9. Work package 7 description

Work package number	7	**Start Date or Starting Event**	June 2015
Work package title	Preliminary navigation design		
Participant number	2		
Short name of participant	ECCO, UPC		
Person/months per participant	4.07		

Objectives: Search, summarize and asses specific information about the particular needs of this project in navigation systems.

Description of work: Analysis and investigation about the requirements needed.

Deliverables: Intermediate report, navigation preliminary design

Table 10. Work package 8 description

Work package number	8	**Start Date or Starting Event**	September 2015
Work package title	Preliminary propulsion design		
Participant number	3		
Short name of participant	ECCO, SILVANET, Orbital ATK		
Person/months per participant	5.46		

Objectives: Search, summarize and asses specific information about the particular needs of this project in the propulsion systems.

Description of work: Analysis and investigation about the requirements needed.

Deliverables: Intermediate report, propulsion preliminary design

Table 11. Work package 9 description

Work package number	9	**Start Date or Starting Event**	February 2016
Work package title	Preliminary mechanical design		
Participant number	3		
Short name of participant	ECCO, SENER, University of Stuttgart		
Person/months per participant	4.41		

Objectives: Search, summarize and asses specific information about the particular needs of this project in the mechanical systems.

Description of work: Analysis and investigation about the requirements needed.

Deliverables: Intermediate report, mechanical preliminary design

Table 12. Work package 10 description

Work package number	10	**Start Date or Starting Event**	July 2015
Work package title	Preliminary electronics design		
Participant number	3		
Short name of participant	ECCO, Amptek, ATT		
Person/months per participant	4.16		

Objectives: Search, summarize and asses specific information about the particular needs of this project in the electronic systems.

Description of work: Analysis and investigation about the requirements needed.

Deliverables: Intermediate report, electronics preliminary design

Table 13. Work package 11 description

Work package number	11	**Start Date or Starting Event**	April 2016
Work package title	Communication detailed design		
Participant number	3		
Short name of participant	ECCO, Southampton University, Orbital ATK		
Person/months per participant	11.36		

Objectives: The final communication system between the modules must be well defined and implemented.

Description of work: All the final analysis and calculations are done in order to converge in a final design.

Deliverables: Final report, communication detailed design

Table 14. Work package 12 description

Work package number	12	**Start Date or Starting Event**	April 2016
Work package title	Navigation detailed design		
Participant number	2		
Short name of participant	ECCO, SENER		
Person/months per participant	5.03		

Objectives: The final navigation system between the modules must be well defined and implemented.

Description of work: All the final analysis and calculations are done in order to converge in a final design.

Deliverables: Final report, navigation detailed design

Table 15. Work package 13 description

Work package number	13	**Start Date or Starting Event**	November 2016
Work package title	Propulsion detailed design		
Participant number	2		
Short name of participant	ECCO, Gisat		
Person/months per participant	5.25		

Objectives: The final propulsion system between must be well defined and implemented.

Description of work: All the final analysis and calculations are done in order to converge in a final design.

Deliverables: Final report, propulsion detailed design

Table 16. Work package 14 description

Work package number	14	**Start Date or Starting Event**	March 2017
Work package title	Mechanical detailed design		
Participant number	3		
Short name of participant	ECCO, Surrey Satellites, Orbital ATK		
Person/months per participant	7.75		

Objectives: The final mechanical system between must be well defined and implemented.

Description of work: All the final analysis and calculations are done in order to converge in a final design.

Deliverables: Final report, mechanical detailed design

Table 17. Work package 15 description

Work package number	15	**Start Date or Starting Event**	July 2016
Work package title	Electronic detailed design		
Participant number	2		
Short name of participant	ECCO, GISAT		
Person/months per participant	4.5		

Objectives: The final mechanical system between must be well defined and implemented.

Description of work: All the final analysis and calculations are done in order to converge in a final design.

Deliverables: Final report, electronic detailed design

Table 18. Work package 16 description

Work package number	16	**Start Date or Starting Event**	December 2016
Work package title	Test and validations		
Participant number	1		
Short name of participant	ECCO		
Person/months per participant	5.61		

Objectives: Test and validate the final design.

Description of work: Different type of destructive and non-destructive tests are done in order to guarantee and verify the reliability of the final design.

Deliverables: Tests and Validations

Table 19. List of deliverables

Deliverable	**Deliverable Name**	**WP number**	**Short Name of Lead Participants**	**Type**	**Dissemination Level**	**Delivery Date**
WP 1.1	Project Management Plan	1,2,3	ECCO, BCCI	R	CO	Month 1
WP 5.1	Mission Design	5	ECCO, Cranfield	R	CO	Month 1
WP 4.1	Project Communication Plan	4	ECCO, BCCI	R	CO	Month 3
WP 6.1	Communication Preliminary Design	6	ECCO, Surrey Satellites, Orbital ATK, University of Southampton	R	CO	Month 4
WP 7.1	Navigation Preliminary Design	7	ECCO, UPC	R	O	Month 4
WP 10.1	Electronics Preliminary Design	10	ECCO, Amptek, ATT	R	CO	Month 4
WP 8.1	Propulsion Preliminary Design	8	ECCO, SILVANET, Orbital ATK	R	CO	Month 7

Deliverable	Deliverable Name	WP number	Short Name of Lead Participants	Type	Dissemination Level	Delivery Date
WP 9.1	Mechanical Preliminary Design	9	ECCO, SENER, University of Stuttgart	R	CO	Month 12
WP 11.1	Communication Detailed Design	11	ECCO, Southampton University, Orbital ATK	R	CO	Month 13
WP 12.1	Navigation Detailed Design	12	ECCO, SENER	R	CO	Month 13
WP 10.1	Intermediate Report	5 to 10	The ones from deliv.3 to deliv.8	R	CO	Month 14
WP 13.1	Propulsion Detailed Design	13	ECCO, GISAT	R	CO	Month 20
WP 14.1	Mechanical Detailed Design	14	ECCO, Surrey Satellites, Orbital ATK	R	CO	Month 24
WP 15.1	Electronics Detailed Design	15	ECCO, GISAT	R	CO	Month 28
WP 16.1	Test and Validations	16	ECCO	R	CO	Month 33
WP 16.2	Final Report	5 to 16	The ones from deliv.3 to deliv.15	R	CO	Month 37

The milestones of the project are presented below:

Table 20. List of milestones

Milestone Number	Milestone Name	Related Work Package	Estimated Date	Means of Verification
1	Kick-Off meeting	1	Month 1	The meeting has been done successfully
2	Project Management Plan Deliverable	1	Month 3	The report is properly finished
3	Report of results and conclusions (preliminary) Mechanical	9	Month 9	The report is properly finished

4	Report of results and conclusions (preliminary) Navigation	7	Month 12	The report is properly finished
5	ECCO Day1	4	Month 15	The ECCO day 1 has finished successfully
6	The Japan International Aerospace Exhibition	4	Month 15	The exhibition has been done successfully
7	Intermediate Meeting	5 to 10	Month 16	The meeting has been done successfully
8	The Japan International Exhibition	4	Month 19	The exhibition has been done successfully
9	Air show China	4	Month 20	The exhibition has been done successfully
10	Report of results and conclusions (preliminary) Communication	6	Month 20	The report is properly finished
11	Preliminary Design Report	5 to 10	Month 20	The report is properly finished
12	Report of results and conclusions (preliminary) Mission Design	5	Month 21	The report is properly finished
13	Report of results and conclusions (detailed) Communication	11	Month 22	The report is properly finished
14	Report of results and conclusions (detailed) Mechanical	14	Month 23	The report is properly finished
15	Report of results and conclusions (detailed) Electronics	15	Month 24	The report is properly finished
16	Report of results and conclusions (test and validations) Communication	16	Month 25	The report is properly finished
17	ILA Berlin Air Show	4	Month 26	The exhibition has been done successfully
18	ECCO Day 2	4	Month 27	The ECCO day 2 has finished successfully
19	Report of results and conclusions (detailed) Navigation	12	Month 27	The report is properly finished

20	Report of results and conclusions (test and validations) Mechanical	16	Month 27	The report is properly finished
21	Report of results and conclusions (test and validations) Navigation	16	Month 29	The report is properly finished
22	International Paris Air Show Le Bourget	4	Month 30	The exhibition has been done successfully
23	Report of results and conclusions (detailed) propulsion	13	Month 30	The report is properly finished
24	Report of results and conclusions (test and validations) propulsion	16	Month 32	The report is properly finished
25	Report of results and conclusions (test and validations) Electronics	16	Month 37	The report is properly finished
26	Report of results and conclusions about possible benefits related to climate change	16	Month 37	The report is properly finished
27	Final report	5 to 16	Month 37	The report is properly finished
28	Final meeting	1 to 16	Month 37	The meeting has been done successfully

3.2. Project Schedule

The Gantt chart of the project is presented below. The Gantt chart addresses the work packages and sub-work packages defined in the previous sections.

Id	Modo de tarea	Task Name	Nombres de los recursos	Comienzo	Fin
0		ECCO		lun 23/03/15	mié 18/04/18
1		Kick-Off meeting	Dissemination Manager;Commur	lun 23/03/15	lun 23/03/15
2		Project Management	Project Management Secretary[!	mar 24/03/15	mar 17/04/18
3		Project Management Plan		mar 24/03/15	lun 04/05/15
4		Project Management Plan Deliverable		lun 04/05/15	lun 04/05/15
5		Monitoring of project evolution		mar 05/05/15	mar 17/04/18
6		Preliminary Design Review		mar 24/05/16	vie 01/07/16
7		Intermediate Meeting	Communications Dept. Manager;	lun 04/07/16	lun 04/07/16
8		Administrative Services	Administration Services Secretar	mar 24/03/15	mar 17/04/18
9		Human resources initial plan	Human Resources worker[50%]	mar 24/03/15	lun 13/04/15
10		Monitoring of human resources evolution	Human Resources worker[50%]	mar 14/04/15	mar 17/04/18
11		Financial plan	Financial Worker 1[50%]	mar 24/03/15	lun 04/05/15
12		Monitoring of financial evolution	Financial Worker 1[50%]	mar 05/05/15	mar 17/04/18
13		Partnership and network	Administration Services Secretar	mar 05/05/15	mar 17/04/18
14		Coordination and cooperation control		mar 05/05/15	mar 17/04/18
15		Stakeholders contact control		mar 05/05/15	mar 17/04/18
16		Dissemination	Dissemination Manager[50%];B(	mar 05/05/15	mar 17/04/18
17		Publishing and meetings		mar 05/05/15	mar 17/04/18
18		Press communications		mar 05/05/15	mar 17/04/18
19		Conferences		mié 06/01/16	lun 16/04/18
20		Public relations, outreach and enquiries		mié 06/01/16	lun 16/04/18
21		Media, social media and web		mié 06/01/16	lun 16/04/18
22		ECCO Day 1	Amptek Collaboration[4.000,00 €	lun 23/05/16	lun 23/05/16
23		ECCO Day 2	Amptek Collaboration[4.000,00 €	mié 31/05/17	mié 31/05/17
24		ILA Berlin Air Show	Amptek Collaboration[20.000,00	mar 31/05/16	dom 05/06/16
25		The Japan International Aerospace Exhibition	Amptek Collaboration[16.000,00 €];Ball Aerospace	mié 12/10/16	sáb 15/10/16
26		Airshow China	Amptek Collaboration[20.000,00	mar 01/11/16	dom 06/11/16
27		International Paris Air Show Le Bourget	Amptek Collaboration[4.000,00 €];Ball Aerospace	lun 20/06/16	lun 20/06/16
28		SPIE Remote Sensing Toulouse	Amptek Collaboration[16.000,00 €];Ball Aerospace	mié 27/09/17	vie 29/09/17
29		Engineering		mar 24/03/15	mar 17/04/18
30		Preliminary Design		mar 24/03/15	lun 23/05/16
31		Mission Design	Mission Design Dept. Manager;N	mar 24/03/15	lun 29/06/15
32		State of the art		mar 24/03/15	lun 11/05/15
33		Analyse mission requirements	Space engineer 1[50%];Space engineer 2[50%]	mar 24/03/15	lun 20/04/15
34		Research and analyse corrent earth orbit observations	Space engineer 1[50%];Space engineer 2[50%]	mar 21/04/15	lun 11/05/15
35		Select optimum orbital paràmetres	Space engineer 1;STK Software[1];Space engineer 2	mar 12/05/15	lun 01/06/15
36		Specify technological requirements	Space engineer 1;Space engineer 3;STK Software[1]	mar 02/06/15	lun 29/06/15
37		Specify incremental Deployment requirements	Space engineer 2;Space engineer 4;STK	mar 02/06/15	lun 29/06/15
38		Report of results and conclusions		lun 29/06/15	lun 29/06/15
39		Communication	Communications and Electronics	mar 30/06/15	lun 21/12/15
40		State of the art		mar 30/06/15	lun 31/08/15
41		Analyse work environament	Telecommunications engineer 1[50%];Space engineer 1[50%]	mar 30/06/15	lun 20/07/15
42		Analyse modules communication requirements	Telecommunications engineer 1[50%];Space engineer 1[50%]	mar 21/07/15	lun 10/08/15
43		Analyse ground – Space Communications requirements	Telecommunications engineer 1[50%];Space engineer 1[50%]	mar 21/07/15	lun 10/08/15
44		Analyse power transmission requirements	Orbital ATK Collaboration[4.500,00 €];Telecommunications engineer	mar 11/08/15	lun 31/08/15
45		Hardware		mar 01/09/15	lun 12/10/15
46		Select modules communication System	Space engineer 1;Telecommunications engineer	mar 01/09/15	lun 14/09/15
47		Modules communicatin System	Space engineer 1;Telecommunications engineer	mar 15/09/15	lun 12/10/15
48		Select ground – space communication system	Telecommunications engineer 2;Space engineer 2	mar 01/09/15	lun 14/09/15
49		Ground – space communication system	Telecommunications engineer 2;Space engineer 2	mar 15/09/15	lun 12/10/15
50		Software		mar 13/10/15	lun 21/12/15
51		Communication control software	Software engineer 1[50%];Space engineer	mar 13/10/15	lun 23/11/15
52		Simulation program	Software engineer 1[50%];Space engineer	mar 24/11/15	lun 21/12/15
53		Report of results and conclusions		lun 21/12/15	lun 21/12/15
54		Navigation	Mission Design and Payloads De	mar 30/06/15	vie 13/11/15
55		State of the art		mar 30/06/15	lun 31/08/15
56		Analyse work environment	Space engineer 1[50%];Telecommunications	mar 30/06/15	lun 20/07/15
57		Analyse navigation requirements	Telecommunications engineer 2[50%];Space engineer 2[50%]	mar 21/07/15	lun 10/08/15
58		Analyse attitude propulsion requirements	Space engineer 1[50%];Telecommunications	mar 11/08/15	lun 31/08/15
59		Hardware		lun 14/09/15	vie 02/10/15
60		Attitude control requirements	Space engineer 3;Telecommunications engineer	lun 14/09/15	vie 02/10/15
61		Software		lun 05/10/15	vie 13/11/15
62		Navigation and attitude control software	Software engineer 1[50%];Space engineer	lun 05/10/15	vie 13/11/15
63		Report of results and conclusions		vie 13/11/15	vie 13/11/15
64		Propulsion	Propulsion Dept. Manager;Mech	mar 01/09/15	lun 14/03/16
65		State of the art		mar 01/09/15	lun 26/10/15
66		Analyse available propulsion Systems	Space engineer 4	mar 01/09/15	lun 21/09/15
67		Analyse power unit requirements	Orbital ATK Collaboration[6.000,00 €];Space	mar 01/09/15	lun 28/09/15
68		Analyse power unit transmission requirements	Orbital ATK Collaboration[6.000,00 €];Space engineer 4	mar 29/09/15	lun 26/10/15
69		Analyse power unit receivers requirements	Orbital ATK Collaboration[6.000,00 €];Space	mar 29/09/15	lun 26/10/15
70		Hardware		mar 10/11/15	lun 01/02/16
71		Select a suitable propulsion System and its peripherals	Space engineer 2[50%];Space engineer 4[50%]	mar 10/11/15	lun 30/11/15
72		Propulsion Systems	Space engineer 4	mar 01/12/15	lun 11/01/16
73		Power unit System	Space engineer 5;Orbital ATK Col	mar 10/11/15	lun 21/12/15
74		Power storage System	Space engineer 5	mar 22/12/15	lun 01/02/16
75		Software		mar 02/02/16	lun 14/03/16
76		Power control software	Software engineer 1;Space engin	mar 02/02/16	lun 14/03/16
77		Propulsion control software	Software engineer 2;Space engineer 2	mar 02/02/16	lun 14/03/16
78		Report of results and conclusions		lun 14/03/16	lun 14/03/16
79		Mechanical	Mechanical Dept. Manager;Mec	mar 02/02/16	lun 23/05/16
80		State of the art		mar 02/02/16	lun 14/03/16
81		Analyse work environment	Space engineer 1[50%]	mar 02/02/16	lun 22/02/16
82		Analyse estructural effects on Earth observation satelites	Space engineer 1[50%]	mar 23/02/16	lun 14/03/16
83		Analyse thermal effects on Earth observation satellites	Stuttgart University Collaboration;Space engineer 1[50%]	mar 23/02/16	lun 14/03/16
84		Analyse radiation effects on Earth observation satellites	Space engineer 3[50%]	mar 23/02/16	lun 14/03/16
85		Integration of sub-systems	Catia Software[1];Space engineer	mar 15/03/16	lun 25/04/16
86		Structural Design		mar 26/04/16	lun 23/05/16
87		Structural design of insfrastructure modules	ANSYS Workbench Software[1];Catia	mar 26/04/16	lun 23/05/16
88		Structural design of payload modules	ANSYS Workbench Software[1];Catia	mar 26/04/16	lun 23/05/16
89		Thermal Design		mar 26/04/16	lun 23/05/16
90		Payload insulation	Stuttgart University Collaboratio	mar 26/04/16	lun 23/05/16
91		Infrastructure insulation	Stuttgart University Collaboratio	mar 26/04/16	lun 23/05/16
92		Report of results and conclusions		lun 23/05/16	lun 23/05/16
93		Electronics	Communications and Electronics	lun 27/07/15	lun 21/12/15
94		State of the art		lun 27/07/15	vie 21/08/15
95		Analyse work environament	Electronics engineer 1	lun 27/07/15	vie 07/08/15
96		Analyse electronic requirements	Electronics engineer 1	lun 10/08/15	vie 21/08/15
97		Hardware		lun 24/08/15	lun 21/12/15
98		Select suitable electronic components	Electronics engineer 1[50%];Electronics engineer	mar 13/10/15	lun 09/11/15
99		Payload modules electronic Systems	Electronics engineer 1[50%];Electronics engineer	mar 10/11/15	lun 21/12/15
100		Infrastructures electronic systems	Electronics engineer 1[50%];Electronics engineer	mar 10/11/15	lun 21/12/15
101		Determine the sensors requirements	Electronics engineer 1	lun 24/08/15	vie 11/09/15
102		Contact and specify sensors from developers	Electronics engineer 1	lun 14/09/15	vie 09/10/15
103		Report of results and conclusions		lun 21/12/15	lun 21/12/15
104		Preliminary Design Report		lun 23/05/16	lun 23/05/16
105		Final Design		mar 26/04/16	mié 06/09/17
106		Communication Detailed Design	Communications and Electronics Dept.	mar 26/04/16	jue 03/11/16
107		Hardware		mar 26/04/16	vie 15/07/16
108		Modules communication system	Southampton University Collaboration;Telecommunicatio	mar 26/04/16	vie 15/07/16
109		Ground-space communication System	Telecommunications engineer 2[50%];Space engineer	mar 26/04/16	vie 15/07/16
110		Power transmission system	Orbital ATK Collaboration[12.000,00	mar 26/04/16	vie 17/06/16
111		Software		lun 15/08/16	jue 03/11/16
112		Protocol Communications	Telecommunications engineer 1;Southampton University	lun 15/08/16	jue 20/10/16
113		Information control management software	Visual Studio[1];Software engineer 2;Telecommunications	lun 15/08/16	jue 03/11/16
114		Power transmission control System	Software engineer 1;Visual Studio[1];Telecommunications	lun 15/08/16	jue 20/10/16
115		Communication Simulator program	Visual Studio[1];Telecommunications	lun 15/08/16	jue 03/11/16
116		Report of results and conclusions		jue 03/11/16	jue 03/11/16
117		Navigation Detailed Design	Mission Design and Payloads De	mar 26/04/16	mié 25/01/17
118		Hardware Design		mar 26/04/16	vie 12/08/16
119		Attitude sensors	Telecommunications engineer 4[	mar 26/04/16	vie 17/06/16
120		Attitude control Systems	Telecommunications engineer 4[	lun 20/06/16	vie 12/08/16
121		Software Design		lun 15/08/16	mié 25/01/17
122		Constellation navigation control software	Telecommunications engineer 4[50%];Space engineer	lun 15/08/16	vie 07/10/16
123		Module attitude control software	Telecommunications engineer 4[50%];Space engineer	lun 15/08/16	jue 03/11/16
124		Navigation and attitude Simulator software	Telecommunications engineer 4[50%];Space engineer	vie 04/11/16	mié 25/01/17
125		Report of results and conclusions		mié 25/01/17	mié 25/01/17
126		Propulsion Detailed Design	Propulsion Dept. Manager;Mech	vie 04/11/16	mié 17/05/17
127		Hardware Design		vie 04/11/16	mié 22/03/17
128		Propulsion systems	Space engineer 1	vie 04/11/16	mié 25/01/17
129		Power unit system	Orbital ATK Collaboration[9.000,(	vie 04/11/16	mié 25/01/17
130		Power storage system	Space engineer 1	jue 26/01/17	mié 22/03/17
131		Software		jue 23/03/17	mié 17/05/17
132		Power control software	Software engineer 1;Space engin	jue 23/03/17	mié 17/05/17
133		Propulsion control software	Software engineer 2;Space engineer 1[50%]	jue 23/03/17	mié 17/05/17
134		Report of results and conclusions		mié 17/05/17	mié 17/05/17
135		Mechanical Detailed Design	Mechanical Dept. Manager;Mec	jue 23/03/17	mié 06/09/17
136		Module Design		jue 23/03/17	mié 06/09/17
137		Material selection	Ball Aerospace Collaboration;Space engineer	jue 23/03/17	mié 19/04/17
138		Module structure	ANSYS Workbench Software[1];C	jue 20/04/17	mié 12/07/17
139		Thermal insulation	ANSYS Workbench Software[1];Catia	jue 13/07/17	mié 06/09/17
140		Sub-systems Integration	Catia Software[1];Space engineer	jue 20/04/17	mié 12/07/17
141		Infrastructure Design		jue 23/03/17	mié 06/09/17
142		Material selection	Ball Aerospace Collaboration;Space engineer	jue 23/03/17	mié 19/04/17
143		Module structure	ANSYS Workbench Software[1];C	jue 20/04/17	mié 12/07/17
144		Thermal insulation	ANSYS Workbench Software[1];Catia	jue 13/07/17	mié 06/09/17
145		Sub-systems Integration	Catia Software[1];Space engineer	jue 20/04/17	mié 12/07/17
146		Report of results and conclusions		mié 06/09/17	mié 06/09/17
147		Electronic Detailed Design	Communications and Electronics	lun 18/07/16	mié 22/02/17
148		Hardware Design		lun 18/07/16	mié 22/02/17
149		Payload modules electronic Systems	Electronics engineer 1[50%];Electronics engineer	vie 04/11/16	mié 22/02/17
150		Infrastructures electronic systems	Electronics engineer 1[50%];Electronics engineer	vie 04/11/16	mié 22/02/17
151		Selection and integration of sensors	Electronics engineer 1[50%];Electronics engineer	lun 18/07/16	jue 03/11/16
152		Report of results and conclusions		mié 22/02/17	mié 22/02/17
153		Test and Validations		lun 05/12/16	mar 17/04/18
154		Communication	Communications Dept. Manager	lun 05/12/16	vie 24/03/17
155		Test and validation for communication satellite-satellite	Communication laboratory[14.545,45 €];Keysight ADS	lun 05/12/16	vie 24/03/17
156		Test and validation for communication ground-satellite	Communication laboratory[14.545,45 €];Keysight ADS	lun 05/12/16	vie 24/03/17
157		Test and validation for power transmission	Communication laboratory[10.909,10 €];Space	lun 05/12/16	vie 24/02/17
158		Report of results and conclusions		vie 24/03/17	vie 24/03/17
159		Navigation	Mission Design and Payloads De	jue 26/01/17	mié 19/04/17
160		Test and validation of the navigation, attitude and control system using computer simulated programs	Integration laboratory - ATT Collaboration[30.000,00 €];STK Software[1];Visual Studio[1];Space engineer 6	jue 26/01/17	mié 19/04/17
161		Report of results and conclusions		mié 19/04/17	mié 19/04/17
162		Propulsion	Propulsion Dept. Manager;Mech	jue 18/05/17	mié 09/08/17
163		Test and validation of the propulsion system using computer simulated programs	ANSYS Workbench Software[1];Space engineer 1	jue 18/05/17	mié 09/08/17
164		Report of results and conclusions		mié 09/08/17	mié 09/08/17
165		Mechanical	Mechanical Dept. Manager;Mec	jue 07/09/17	mar 28/11/17
166		Test and validation using computer simulation programs	ANSYS Workbench Software[1];Space engineer 1	jue 07/09/17	mar 28/11/17
167		Report of results and conclusions		mar 28/11/17	mar 28/11/17
168		Electronics	Communications and Electronics	jue 23/02/17	mié 17/05/17
169		Test and validation using computer simulation programs	Electronics laboratory - UPV Collaboration[12.000,00 €];Electronics engineer 1;Space	jue 23/02/17	mié 17/05/17
170		Report of results and conclusions		mié 17/05/17	mié 17/05/17
171		Data acquisition	Communications Dept. Manager	mié 29/11/17	mar 17/04/18
172		Validation of signal quality	Communication laboratory;Telec	mié 29/11/17	mar 23/01/18
173		Test and validation for 3D mapping and new acquisition modes developed	Matlab R2015b[1];Politechnical University of Catalonia Collaboration;Software engineer 1;Telecommunications engineer	mié 24/01/18	mar 17/04/18
174		Report of results and conclusions about possible benefits related to climate change		mar 17/04/18	mar 17/04/18
175		Final report		mar 17/04/18	mar 17/04/18
176		Final meeting	Dissemination Manager;Commur	mié 18/04/18	mié 18/04/18

3.3. List of meetings and missions

Table 21. Meetings and Missions

Meetings and Missions	Date	Place	Expected Attendees
Kick Off Meeting	23/03/15	ECCO offices	ECCO Managers, directives of all the investors
ECCO day 1 meeting	23/05/16	ECCO day convention installations	ECCO managers, directives of actual and future possible investors
Intermediate meeting	04/07/16	ECCO offices	ECCO Managers, directives of all the investors
ECCO day 2 meeting	31/05/17	ECCO day convention installations	ECCO managers, directives of actual and future possible investors
Final meeting	18/04/18	ECCO offices	ECCO Managers, directives of all the investors

3.4. IPR Management

Foreground resulting from the project is owned by the project Party generating it. In order to accomplish with the obligations resulting from the work, parties shall reach an agreement with their employees and other personnel as soon as the latter may be entitled to claim rights to Foreground (subcontractors, students, end-users actively involved in the project etc.). Such agreements may include a formal transfer of ownership or granting of appropriate access rights with a right to sublicense.

When Foreground is generated jointly by Parties and their respective share cannot be ascertained they shall have jointly ownership on such Foreground, unless the Parties agree on a different solution.

Foreground capable of industrial or commercial application, shall be protected by adequate and effective means by its owner having due regard to its legitimate interest and of the other Parties, particularly those commercial. Where a Party which is not the owner of the Foreground invokes its legitimate interest, it must, in any given instance, show that it would suffer disproportionately great harm.

Each Party may transfer ownership of its own Foreground to any legal entity, subject to the following conditions:

(i) Where a Party transfers ownership of Foreground, it shall pass on its obligations regarding that Foreground to the assignee, including the obligation to pass them on to any subsequent assignee;

(ii) Subject to its obligations concerning confidentiality, as in the context of a merger or an acquisition of a large part of its assets, if a Party is required to pass on its obligations

to provide access rights, it shall give at least days prior notice to the other Parties of the envisaged transfer, together with sufficient information concerning the envisaged new owner of the Foreground to permit the other Parties to exercise their access rights;

(iii) The Parties recognise, at the same time, that in the contest of a merger or an acquisition of an important part of its assets, a Party may be subject to confidentiality obligations which do not permit it to give the full established prior notice for the transfer;

(iv) Following notification in accordance with the previous paragraph (ii), any other Party may object within days of the notification or within a different time-limit agreed in writing between all Parties, to any envisaged transfer of ownership on the grounds that it would adversely affect its access rights. If any of the other Parties demonstrate that their access rights would be adversely affected, the intended transfer shall not take place until agreement has been reached between the Parties concerned;

(v) Each Party, nonetheless, may identify specific third parties to whom it can potentially transfer the ownership of its Foreground in Attachment to this Consortium Agreement. The other Parties hereby waive their right to object to a transfer to the listed third parties.

Each Party shall ensure that the Foreground of which it has ownership is disseminated as swiftly as possible. Dissemination activities shall be compatible with intellectual property rights, confidentiality, and the legitimate interests of the owner of the Foreground. At least days prior notice of any dissemination activity shall be given to the other Parties concerned, including sufficient information concerning the planned dissemination activity and the data envisaged to be disseminated. Following notification, any of those Parties may object within days of the notification to the envisaged dissemination activity if it considers that its legitimate interests in relation to its Foreground or Background could suffer disproportionately great harm.

The objection should include a precise request for necessary modifications. In such cases, the dissemination activity may not take place unless appropriate steps are taken to safeguard these legitimate interests. However, if no objection is made within the time limit stated above, the publication is permitted. The participants may agree in writing on different time-limits to those set out in the previous paragraphs, which may include a deadline for determining the appropriate steps to be taken. In case of objection, the Parties involved should discuss how to overcome the grounds for the objection on a timely basis. If a dispute regarding a dissemination activity cannot be settled amicably within days following the first submission of the proposed dissemination activity, shall decide how to resolve the conflict. No Party shall disseminate Foreground of other Party, even if such Foreground is linked to its own Foreground, unless the other Party previously approves of such an activity in writing. For the avoidance of doubt, the rules applicable for the dissemination activities of the Party's own Foreground apply as well for the dissemination of other Party's Foreground.

3.5. Management structure and procedures

3.5.1. Quality management

ECCO project will assure that the final products fulfil the quality requirements by the Quality Control Approach.

The procedures, processes, methods and tools used in performing the quality control activities depend in which area it is being done.

Data validation:

The validation of the laboratory data is essential to assure the quality control. The following procedures will be followed:

- Proper chain-of-custody and sample handling procedures followed.
- Parametric holding times met.
- Samples prepared and analysed according to specified methods.
- Instrumentation calibrated according the specified methods.
- Calculations performed correctly and verified.
- Transcription of final data correct.

The data sheet of each laboratory test will collect all the procedures below in order to assure they have been done correctly and the data obtained is reliable. Specifically, it will collect the information below using a checklist scheme.

Software:

In order to assure the software quality control, all the standards that must be followed will be written in the documentation standards. The next documents will be elaborated:

- Coding standards: description of all the coding standards.
- Comment standards: description of all the comment standards.

It is important to assure an optimum development of the software the standards to be perfectly stablished.

During all the software development, some procedures will be done regularly in order to ensure the quality and detect possible errors:

- Check that assumptions and criteria for the selection of data and the different factors related to data are documented.
- Check for transcription errors in data input and reference.
- Check the integrity of database files.

- Check for consistency in data.
- Check that the movement of inventory data among processing steps is correct.
- Check for uncertainties in data, database files etc.
- Undertake review of internal documentation.
- Check methodological and data changes resulting in recalculations.
- Undertake completeness checks.
- Compare Results to previous Results.

Once an error is detected, the person who discovered the error is responsible for reporting it to the Task Manager. Then, the software engineers try to solve the problem and when this is already solved, all the changes and patches made are written down in a document that collects all the code modifications with the date and description of each one.

Also verification and validation procedures will be done along all the project in order to answer two main questions:

Verification: "Are we building the product right?" The software should conform to its specification.

Validation: "Are we building the right product?" The software should do what the user really requires.

The set of techniques and tools for process improvement that will be used is the Six Sigma. It seeks to improve the quality output of process identifying and removing the causes of defects and minimizing variability in manufacturing and business processes. Thus, set of quality management methods that will be used are mainly empirical and statistical. The project methodology chosen is the DMAIC.

The DMAIC project methodology has five phases:

- Define the system, the voice of the customer and their requirements, and the project goals, specifically.
- Measure key aspects of the current process and collect relevant data; calculate the 'as-is' Process Capability.
- Analyse the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.
- Improve or optimize the current process based upon data analysis using techniques such as design of experiments, poka yoke or mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish process capability.
- Control the future state process to ensure that any deviations from the target are corrected before they result in defects. Implement control systems such as statistical process control, production boards, visual workplaces, and continuously monitor the process.

The following table identifies the quality-related responsibilities of the project team and lists specific roles and quality responsibilities.

Table 22. List of quality roles and responsibilities

Role:	Responsibilities:
Project Manager	• Responsible for management, review and approval of planning, strategy and testing execution and tools. • Provide formal sign-off on all deliverables • Review of results and defects to determine/assess impact to overall project plan and implementation schedule. • Works with the all the other managers to establish timetables and agree on a Quality Assurance plan. • Assure that practice of quality control measures is documented, communicated and adequate to ensure agreed quality levels for the ECCO project. • Oversees determination of need, selection, implementation and maintenance of quality control measures and tools. • Facilitates weekly quality assurance meetings and maintains the meeting agenda. • Assure training plan addresses all project skill levels. • Assure project management gap resolution.
Administration Services Manager	• Coordinate communication about the status of quality assurance efforts to stakeholders. • Work with the Project Manager, Engineering Managers and Stakeholders to assist with the writing of use cases and test cases.

Role:	Responsibilities:
Engineering Managers	• Responsible for the design and test planning and coordination for their module. • Assure their work package is complete, trackable and on-schedule. • Provide formal sign-off on all deliverables of their module. • Primary point of communication for engineers and technicians. • Have a better understanding of the business/functional requirements for their unit. • Provide guidance and assistance on the engineering team. • Provide feedback on the design and test processes to the project manager. • Technical leadership for the project, including design and test approach. • Selectively review test and simulation results and reconciliation for completeness and accuracy. • Verifying the quality of the requirements, including requirement definition, design, and testability. • Staying current on latest design and test approaches and tools, and transferring this knowledge to the team.
Engineers	• Understand and follow design and test processes and responsibilities. • Report the work developed. • Record any new defects uncovered during their labour. • Provide comments on any defects that are discovered.

Role:	Responsibilities:
Laboratory Cooperation	• Provide training and assistance to engineers to ensure they are following agreed design and test reporting processes. • Work with the Engineering Managers to ensure that test design cases and scenarios are assigned and being tested. • Provide status reports to the module manager. • Identify and assess defects uncovered in testing. • Assist in the validation of use cases and test cases. • Create and maintain testing environments. • Migrate objects to appropriate test environments. • Allocate technical resources to address defects/issues during testing phases.

3.5.2. Production, review and approval of deliverables

All documents must be approved before the final deliberation to ensure that objectives and scope are accomplished. The following acceptance criteria are defined to check the documents:

Table 23. Acceptance criteria

Acceptance Criteria	Condition to be Accepted
Research and Innovation	The project must be ambitious, has innovation potential and beyond the state of the art, including trans-disciplinary considerations.
Quality and Presentation	All documents must be done with the highest quality, presenting all the ideas, developments and conclusions linked, explained clearly. All documents must be printable.
Performance Requirements	The efficiency and functionality of all systems designed must be enough to realise all the objectives indicated and the purpose of the proposal too.
Technical Documentation	The documentation must be complete, specifying the development procedure, the final characteristics and the method to use the hardware and software developed.
Test and Validations	All tests and validations must be indicated and successfully passed using the available regulations. All this information must be correctly written, with all the modifications done to improve functionality and allow its verification (and of course the results of the tests and validations).

3.5.3. Guidelines for meetings

Formal meetings will adhere to the following best practice guidelines.

Meeting Agenda

Meeting Agenda will be distributed 5 business days in advance of the meeting. The Agenda should identify the presenter for each topic along with a time limit for that topic. The first item in the agenda should be a review of action items from the previous meeting.

Meeting Minutes

Meeting minutes will be distributed within 2 business days following the meeting. Meeting minutes will include the status of all items from the agenda along with new action items and the Parking Lot list.

Action Items

Action Items are recorded in both the meeting agenda and minutes. Action items will include both the action item along with the owner of the action item. Meetings will start with a review of the status of all action items from previous meetings and end with a review of all new action items resulting from the meeting. The review of the new action items will include identifying the owner for each action item.

Note Taker

The Note Taker is responsible for documenting the status of all meeting items, maintaining a Parking Lot item list and taking notes of anything else of importance during the meeting.

3.5.4. Risk and Issues management

To evaluate the potential risks of the project, a definition of the probability used is necessary to quantify it correctly. A scale of 1% - 100% is used to set the probability of a risk to occur during the project. The maximum (100%) means that the risk is unavoidable, and the minimum (1%) that is very difficult to occur

Table 24. List of definitions of probability

Probability	Description	Probability Score
Very High	It is a fact and unavoidable	(81 – 100) %
High	High probability to happen	(61 – 80) %
Medium	Half probability to happen or not	(41 – 60) %
Low	Low probability to happen	(21 – 40) %
Very Low	Too difficult to happen	(1 – 20) %

To specify the effect of a risk into the overall project, a scale from 1 to 5 is set to quantify the impact. 5 means the highest impact on the project, and 1 the lowest. In the tables below, a quantification of the risks is explained, evaluating the scope and quality, schedule and costs impacts individually.

Table 25. List of scope/quality impacts

Scope/Quality Impact	Description	Scope Impact Score
Very High	Risks that produce several impact on the project and its results, been unable to achieve the desired objectives	5
High	Risks that produce important impact on the project and its results, reducing the quality of the desired objectives under the acceptance criteria	4
Medium	Risks that produce a moderate impact on the project and its results, reducing the quality of the desired objectives but still above the acceptance criteria	3
Low	Risks that produce a low impact on the project and its results, reducing the quality of the desired objectives but well enough.	2
Very Low	Risks that produce an insignificant impact on the project and its results	1

Table 26. List of schedule impacts

Schedule Impacts	Description	Schedule Impact Score
Very High	Risks that produce several impact on the project schedule, delaying the schedule more than 3 months	5
High	Risks that produce important impact on the project schedule, delaying the schedule by 2 - 3 months	4
Medium	Risks that produce a moderate impact on the project schedule, delaying the schedule by 1 - 2 months	3
Low	Risks that produce a reduced impact on the project schedule, delaying the schedule less than 1 month	2
Very Low	Risks that produce an insignificant impact on the project schedule with no delays	1

Table 27. List of cost impacts

Cost Impacts	Description	Cost Impact Score
Very High	Risks that produce several impact on the project cost, incrementing the final cost of the project greater than 20%.	5
High	Risks that produce important impact on the project cost, incrementing the final cost of the project between 16% and 20%.	4
Medium	Risks that produce a moderate impact on the project cost, incrementing the final cost of the project between 11% and 15%.	3

Low	Risks that produce a reduced impact on the project cost, incrementing the final cost of the project between 6% and 10%	2
Very Low	Risks that produce an insignificant impact on the project cost lower than 5%.	1

In the probability and impact matrix, the final evaluation of the risk is done. For each combination of probability and impact an evaluation from extreme to minimum is set. Impact for each risk is evaluated using the system exposed in the risk rating section, taking into account the scope and quality impact, schedule impact and costs impact. Risks that are evaluated as extreme risks are critical and some counter measures must be applied to prevent it, or if is not possible, to reduce its impact. The risks that are evaluated as minimum are negligible and will not be taking into account during the risk management.

Impact **Probability**	**1**	**2**	**3**	**4**	**5**
Very High	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
High	Minimum Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
Medium	Minimum Risk	Low Risk	Moderate Risk	High Risk	High Risk
Low	Minimum Risk	Low Risk	Low Risk	Moderate Risk	High Risk
Very Low	Minimum Risk	Minimum Risk	Low Risk	Moderate Risk	High Risk

Figure 3. Probability and impact matrix

Only risks that have a probability higher or equal to medium and present a probability higher or equal to 3 will have a contingency plan (including budget contingency and time for the schedule).

In order to identify the position of the probability impact matrix, risk rating should be defined to calculate the overall impact of the risk taking into account the individual impact that has been defined in the table above.

$$Impact = 5 \cdot \left(\chi_{scope} \cdot \frac{I_{scope}}{5} + \chi_{schedule} \cdot \frac{I_{schedule}}{5} + \chi_{costs} \frac{I_{costs}}{5} \right)$$

Where the variables $(\chi_{scope}, \chi_{schedule}, \chi_{costs})$ defined are the weight of each impact in parts per unit. The sum of the variables of the same risk should be equal to 1.

In this kind of project the schedule and the scope and quality are the most important factors in order to accomplish the initial scope and the desired objectives. So, the following criteria is stablished in order to compute the overall impact of each risk.

$$\chi_{scope} = 0.35 \, , \chi_{schedule} = 0.35 \, , \chi_{costs} = 0.30$$

Using all the data explained about how to identify and control the risk, a measure could be applied to the risks that using our method, seems to be more important.

Table 28. Critical risks for implementation

Description of Risk	Work Package Involved	Proposed Risk-Mitigation Measures
Software bug detected during the test and validation phase	16	Focus on the resolution of the bug and increase the human resources if it is needed to accomplish the schedule and scope
Malfunction of the sensors selected during its integration	12,15	Develop and matching network to allow the integration and if it is not feasible contact with the company to redesign it
Simulation software not accomplish the expectations of INDRA (customer)	16	Modify the software to accomplish the requirements
Dissemination of the project is not successful and not achieved the desired objectives	4	Recall the desired objectives given to the expert company
Lack of innovation on the developed systems and software	11 to 16	Take the necessary measured to achieve to desired level of innovation including redesign and propose alternatives
Lack of communication between work-packages and project manager	1,2	Stablish more effective collective meetings and individual tracking of each work-package
Economic risk due to changes in commodity prices	1,2	Use the contingency budget to afford the new unexpected outcomes
New systems and procedures used during the development that could create operational issues	11 to 16	identify and change possible issues on the procedures and clear it to all work-packages workers
Human Resources issues due to illness, personnel reduction among others	2	Be aware of possible human resources reduction and contract if it is needed
Insufficient laboratory's facilities in order to carry out the desired tests and validations	16	Search for a certified and qualified laboratory to carry out all tests and validations

3.5.5. Communication management

Often the methods and technologies used to communicate are just as important a consideration as the information being communicated. The different technological capabilities of the stakeholders must be taken into consideration when planning the communication technologies. Some may have access to video teleconferencing and others only have telephone and email capabilities. In order to be effective, project information must be communicated to everyone involved by some method using available technology.

The ECCO Project maintains a SharePoint platform called *ECComm* which all projects use to provide updates, archive various reports, and conduct project communications. This platform enables senior management, as well as stakeholders with compatible technology, to access project data and communications at any point in time. SharePoint also provides the ability for stakeholders and project team members to collaborate on project work and communication.

For stakeholders who do not have the ability to access *ECComm SharePoint*, a web site will also be established for the project. Access to the website will be controlled with a username and password. Any stakeholders identified who are not able to access *ECComm SharePoint* will be issued a unique username and password in order to access the web site. The project manager is responsible for ensuring all project communications and documentation are copied to the web site and that the content mirrors what is contained on the *ECComm SharePoint* platform.

All project communication and documentation, in addition to being maintained on the *ECComm SharePoint* platform and project website, will be archived on the internal ECCO Project shared drive which resides in the Project Management Team program directory. Organizational naming conventions for files and folder will be applied to all archived work.

The Project Management Team will determine, the communication methods and technologies based on several factors to include: stakeholder communication requirements, available technologies (internal and external), and organisational policies and standards. Three types of communication processes are identified and explained below:

Informal communications

Informal communications serve to supplement and enhance formal communications. A number of methods of informal communication can be considered. Some examples include e-mails, phone calls or informal meetings. Due to the varied types and ad-hoc nature of informal communications, they are not discussed in this plan.

Formal communications

The ECCO Project will engage in various types of formal communication. The general types and their purpose are described below.

- **Status Meetings**

There are five basic types of status meetings for the ECCO Project:

1. Status meetings internal to the ECCO technical project team to discuss assignments, activities, and to share information.

2. Status meetings and reports between the ECCO project management team, and the project team.

3. Project management team meetings with the project stakeholders, and project manager to review progress, risks and issues.

4. Status meetings and reports between the ECCO project manager and the steering committee.

5. Status meetings and reports to stakeholders, such as external customers and outsourcing companies.

- **Status Reports**

A variety of status reports will be produced during the project. The status reports will be produced on regular intervals to provide stakeholders project information on the status and progress of the ECCO project. At a minimum the reports will contain:

- Project status on major activities
- Project schedule
- Budget and cost tracking
- Status of issues and risks
- Health status
- Status of action items, if applicable.
- Future or planned activities

The intent of the status reports is to inform stakeholders of the project's progress and keep them actively involved in the project. The information provided will contain enough detail to allow stakeholders to make informed decisions and maintain oversight of the project.

3.5.6. Handling of sensitive/confidential data

Efficient and timely communication is the key to successful project completion. As such, it is imperative that any disputes, conflicts, or discrepancies regarding project communications are resolved in a way that is conducive to maintaining the project schedule, ensuring the correct communications are distributed, and preventing any ongoing difficulties. In order to ensure projects stay on schedule and issues are resolved, the ECCO Project will use its standard escalation model to provide a framework for escalating communication issues.

The table below defines the priority levels, decision authorities, and timeframes for resolution.

Table 29. Priority levels for the escalation process

Priority	Definition	Decision Authority	Timeframe for Resolution
Priority 1	Major impact to project or business operations. If not resolved quickly there will be a significant adverse impact to revenue and/or schedule.	Steering committee	Within 4 hours
Priority 2	Medium impact to project or business operations which may result in some adverse impact to revenue and/or schedule.	Project Manager	Within one business day

Priority 3	Slight impact which may cause some minor scheduling difficulties with the project but no impact to business operations or revenue.	Department manager	Within two business days
Priority 4	Insignificant impact to project but there may be a better solution.	Team Manager	Work continues and any recommendations are submitted via the project change control process

3.5.7. Documentation management

In order to achieve consistent and effective communications, standardisation of documentation is a proven way to simplify the complexities of project management communications. The Project Management Office has developed standard templates or formats for the various communication tools used throughout the project. Standard templates and formats of font will be applied specific types of communication (i.e. emails, status reports, e-zines, bulletins etc.). By using standardisation, it can help to achieve consistent and effective communications. Formal project communications are detailed in the project's communication matrix and include:

Kick-off Meeting – project team will utilize ECCO Project standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the ECCO Project standard slideshow template.

Project Team Meetings – project team will utilize ECCO Project standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the ECCO Project standard slideshow template.

Technical Design Meetings – project team will utilize ECCO Project standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the ECCO Project standard slideshow template.

Monthly Project Status Meetings – project team will utilize ECCO Project standard templates for meeting agenda and meeting minutes. Additionally, any slides presented will use the ECCO Project standard slideshow template.

Project Status Reports – project team will utilize ECCO Project standard templates for meeting agenda and meeting minutes. Additionally the standard project status report document, available on the share drive, will be used to provide project status.

Informal project communications should be professional and effective but there is no standard template or format that must be used.

3.6. Consortium as a whole

The consortium is going to work together in order to achieve the aim of the project. Each company or entity that takes part in the consortium is helping ECCO on its specific area. This allows ECCO reaching the highest level in each area, a level that without the help of the other members of the consortium would not be possible to reach. The members of the consortium are the following, classified by the area of interest:

Dissemination: Bulgarian Chamber of Commerce and Industry (BCCI)

Engineering: Amptek, Angelantoni Test Technologies (ATT), Ball Aerospace, Epistemática, E-TIS Euroconsultores, Gisat, Orbital ATK, Politechnic University of Catalonia, Politechnic University of Valencia, SENER Ingeniería y Sistemas, SILVANET (UPC agrónomos), Technology ltd, Technical University of Stuttgart, University of Southampton.

3.7. Resources to be committed

In the following tables the resources to be committed are presented.

Table 30. Resources to be committed (1/2)

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total Person/Months per Participant
1/ECCO	2.26	3.00	2.25	0.20	2.50	2.00	3.00	3.00	18.21
2/BCCI	-	-	-	0.67	-	-	-	-	0.67
3/Cranfield University	-	-	-	-	2.94	-	-	-	2.94
4/Surrey Satellites	-	-	-	-	-	2.00	-	-	2.00
5/Orbital ATK	-	-	-	-	-	-	-	2.00	2.00
6/University of Southampton	-	-	-	-	-	1.55	-	-	1.55
7/UPC	-	-	-	-	-	-	1.07	-	1.07
8/SILVANET	-	-	-	-	-	-	-	0.46	0.46
9/SENER	-	-	-	-	-	-	-	-	-
10/University of Stuttgart	-	-	-	-	-	-	-	-	-
11/Amptek	-	-	-	-	-	-	-	-	-
12/ATT	-	-	-	-	-	-	-	-	-
13/GISAT	-	-	-	-	-	-	-	-	-
Total Person/Months	2.26	3.00	2.25	0.87	5.44	5.55	4.07	5.46	28.90

Table 31. Resources to be committed (2/2)

	WP9	WP1-	WP11	WP12	WP13	WP14	WP15	WP16	Total Person/Months per Participant
1/ECCO	2.00	2.00	5.00	3.00	2.00	4.75	2.25	5.61	26.61
2/BCCI	-	-	-	-	-	-	-	-	0.00
3/Cranfield University	-	-	-	-	-	-	-	-	0.00
4/Surrey Satellites	-	-	-	-	-	1.50	-	-	1.50
5/Orbital ATK	-	-	4.00	-	-	1.50	-	-	1.50
6/University of Southampton	-	-	2.36	-	-	-	-	-	2.36
7/UPC	-	-	-	-	-	-	-	-	0.00
8/SILVANET	-	-	-	-	-	-	-	-	0.00
9/SENER	1.41	-	2.03	-	-	-	-	-	3.44
10/University of Stuttgart	1.00	-	-	-	-	-	-	-	1.00
11/Amptek	-	1.16	-	-	-	-	-	-	1.16
12/ATT	-	1.00	-	-	-	-	-	-	1.00
13/GISAT	-	-	-	-	3.25	-	2.25	-	5.50
Total Person/Months	4.41	4.16	11.36	5.03	5.25	7.75	4.50	5.61	43.07

Table 32. Total of Resources to be committed

Participant	Total Person/Months per Participant
1/ECCO	44.82
2/BCCI	0.67
3/Cranfield University	2.94
4/Surrey Satellites	3.50
5/Orbital ATK	3.50
6/University of Southampton	3.91
7/UPC	1.07
8/SILVANET	0.46
9/SENER	3.44
10/University of Stuttgart	1.00
11/Amptek	1.16
12/ATT	1.00
13/GISAT	5.50
TOTAL	**71.97**