



MINUTES OF THE MEETING 00

Project:	Cubesat constellation
Participants:	Joan Cebrian Galan (JC) G4/EA-T2016
	Pol Fontanes Molina (PF) G4/EA-T2016
	Lluis Foreman Campins (LF) G4/EA-T2016
	Roger Fraixedas Lucea (RF) G4/EA-T2016
	Oscar Fuentes Muñoz (OF) G4/EA-T2016
	Sílvia González García (SG) G4/EA-T2016
	Fernando Herrán Halbelda (FH) G4/EA-T2016
	Boyan Kaloyanov Naydenov (BK) G4/EA-T2016
	Victor Martinez Viol (VM) G4/EA-T2016
	David Morata Carranza (DM) G4/EA-T2016
	Laura Pla Olea (LP) G4/EA-T2016
	Marina Pons Daza (MP) G4/EA-T2016
	Josep Puig Ruiz (JP) G4/EA-T2016
	Josep Maria Serra Moncunill (JMS) G4/EA-T2016
	Sergi Tarroc Gil (ST) G4/EA-T2016
	Xavier Tió Malo (XT) G4/EA-T2016
	Eva María Urbano González (EMU) G4/EA-T2016

Date and time: 21st of September 2016, from 12:00 to 14:00

Place: S-32 TR5 ESEIAAT (UPC)

AGENDA

1. Overview of the project
2. Bibliographic research
3. Distributions of tasks
4. Next meeting

ITEMS ON THE AGENDA

1. Overview of the project

The team has to discuss about the generalities of the project. What is the scope of the project?

2. Bibliographic research

It has to be done a research of information in order to know more about the specific topic, and then watch the needs of the project and how the skill of the team can solve them.



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3. Distribution of tasks

The bibliographic research is much massive for do it all together, so it has to be defined who invest what.

4. Next meeting

It has to be defining how to share this information and taking decisions over that point.

DECISIONS MADE - ASSIGNMENTS

1. Overview of the project

After the corresponding discuss it's defined that the scope of the project is:

Design a system that allows any cube sat orbiting in LEO to communicate with ground wherever they are. This system will be a constellation of cubesats that work as signal repeaters that make as a bridge between the satellite and ground.

2. Bibliographic research

In order to archive of this scope, the first step is to invest about the details of this sector. The bibliographic research is divided in these points:

- a. CubeSat's systems
 - i. General information
 - ii. Power (EPS)
 - iii. Structure
 - iv. Ground communication
 - v. Constellation communication
 - vi. Central computer
 - vii. Attitude control
 - viii. OBDH – On Board Data Handling
 - ix. Orbit control, maintenance and deorbit
- b. Constellation
 - i. Existing constellations
 - ii. Orbit calculus
 - iii. Communication systems
 - iv. Start up
- c. Legislation
 - i. Launch
 - ii. Orbit decision
 - iii. Maintenance
 - iv. Communication protocols
- d. Launch system
 - i. Existing commercial solutions
 - ii. Owns solution
- e. Ground station
 - i. General information



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3. Distribution of tasks

It is decided to divide the team for investigating these topics. The distribution is:

- a. CubeSat's systems: LF,EMU, DM, MP, RF
- b. Constellation: JC, BK , SG, ST
- c. Legislation: XT, JP, LP
- d. Launch systems: OF, PF, FH
- e. Ground station: JMS, VM

4. Next meeting

It is decided that all these info will be shared the Thursday 22nd of September before the meeting with the costumer. Since this meeting is only for sharing information and any decision have to be taken there won't be any minutes of it.

The meeting with the costumer will be the Thursday 22nd of September from 10:00 to 12:00. The porpoise of the meeting is to take the first contact with the costumer and defining the team structure.



MINUTES OF THE MEETING 01

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
	Joan Cebrian Galan (JC)	G4/EA-T2016
	Pol Fontanes Molina (PF)	G4/EA-T2016
	Lluís Foreman Campins (LF)	G4/EA-T2016
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	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 22nd september 2016, from 10:00 to 12:00

Place: SJ INTEXTER

AGENDA

1. Team structure
2. Choice of positions
3. Next meeting

ITEMS ON THE AGENDA

1. Team structure

The structure of the entire group will be defined. It has to be discussed how to work, in order to have optimum organisation.

2. Choice of positions

It has to be decided who perform every task in the previous defined structure.

3. Next meeting

It is decided when and where is going to be the next meeting, and the agenda of it.



DECISIONS MADE - ASSIGNMENTS

1. Team structure

It is decided that the group will be divided in different work teams. The work teams will develop the technical work of the project. Every work team will have a responsible of it, who will have a global view of all the work it is being done in the team.

The management task will be done by a coordinator. The coordinator is the last responsible of all the work that the team develops. Its task consist in supervise and coordinate the work of the teams in order to ensure a good develop of the project. The figure of the team responsible would make easier the task of the coordinator; he/she only have to talk with the team responsible for supervise the work of the team.

It will be a secretary, who will write the minutes. The minutes have to synthesize the ideas discussed and the decisions taken in the meetings. They have to be signed by the coordinator and the customer.

The meetings will be every Thursday at 10:00, and there will be the members of the project and the costumer. It can be also extraordinary meetings with or without the costumer. The meetings without the costumer will be only for address technical issues, and it won't be signed by the client.

2. Choice of positions

It is decided that the work teams and their responsible will be defined once the specific tasks are clear.

It is decided for consensus that for choosing the secretary and the coordinator, anyone who want this position have to present his/her candidacy. Then the candidates have to explain to the group his motivations. After that the position will be decided by vote.

There is only one candidate for secretary: ST. There is no replica, so there is no vote. ST is elected for secretary.

There are 3 candidates for coordinator: BN, OF, XT. Every one express its motivations:

-BN express that he like to manage human resources. He presents himself as a serious and rigorous.

-OF express his motivation to manage the project. He explains that he is doing a leadership course, and remarks that it would be positive for the management of the project.

-XT presents himself as a person with a good skills in human relationships and with experience in managing the UPC-SP.

There is a vote. The results are:

-BN 9 votes

-OF 6 votes

-XT 2 votes

BN is elected for coordinator of the project



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3. Next meeting

The next meeting will be at September 29th at SJ INTEXTER

The agenda will be:

1. Scheduling
2. Next meeting

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING 01.1

Project:	Cubesat constellation
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	Sergi Tarroc Gil (ST) G4/EA-T2016
	*Xavier Tió Malo (XT) G4/EA-T2016
	Eva Maria Urbano González (EMU) G4/EA-T2016

Date and time: 28th september 2016, from 12:00 to 14:00

Place: Aula 2.5 TR5 (ESEIAAT)

AGENDA

1. Minute revision
2. WBS
3. Team structure
4. Budget
5. Next meeting

ITEMS ON THE AGENDA

1. Minute revision

It has to be decided how to review and approve the minutes

2. WBS

It has to be discussed the level 2 items and then divide the tasks



DECISIONS MADE – ASSIGNMENTS

1. Minute revision

It is decided that the agendas will be uploaded at BSCW and at Slack. If anyone has any amendment he/she has to present in the next meeting. If not the agenda will be approved.

2. WBS

It is presented a first outline of the WBS.

The entire team decide the level 2 of the WBS:

- **“Satellite design”**. It defines the single vehicle
- **“Orbit design”**. It defines the mechanical work of the constellation
- Is discussed the **“Launch systems”**. It has to be studied if we contract an external company, if we need a special launcher and which ones we can adapt to our vehicle. These items will be discussed at level 3.
- It is included the point **“Operation design”**
- **“Financial plan”**. It is discussed that if we have to do a market study. It is concluded that it had been done when the team decided to start the project (meeting 1).
- It is discussed about if we will make a wallpaper, a prototype. It is concluded that these have to be at level 3 and will be discussed after. It is included all these points under the topic **“TechDemo”**

*JP leaves the meeting (13:00)

- **“Management”**

At this point it's discussed the level 3 points

- a. Satellite design
 - Payload. Here we have all the systems that execute directly the objectives of the mission (transmit between the client cubesats and ground).

*JP returns to the meeting

- Structure. Here we have the physical support that will take together all the subsystems and the payload.
- Spacecraft subsystems. All the systems that will make possible the correct work of the payload.
- b. Orbit design
 - Orbital parameters. Defining the mechanics of every single cubesat
 - Legislation. Study the legal requirements
 - Constellation architecture. The mechanical coordination between all the cubesats
- c. Launch systems.
 - Market study launcher. It has to be studied how to make arrive the cubesats to orbit.



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- Sat deployer. The sats will need a deployer vehicle to be put in orbit when the launcher place the system at the adequate altitude. We have to discuss if it will be designed by us or subcontracted.
- d. Operation design
 - Communication protocol. Every single sat communicates with cubesats, with ground and between each other.
- e. Financial plan
 - First investment
 - Manufacture budget
- f. Management
 - We will inspire us in the NASA method. It will be decided at the next meeting.
- *The accorded time for the meeting is over. It is decided to extend the meeting until 14:30. XT has to leave the meeting.
- g. TechDemo
 - Sat prototype. It has to be defined how much operative has to be
 - Constellation simulation.
 - Render of the satellite.

PENDING TASKS FOR THE NEXT MEETING

There are defined 6 teams, every team will define the work time of every task, and the budget of it. After somebody will assembly all in a Gantt's diagram. The distribution is:

WBS

Detailed Level 4

- Satellite design □ Roger + Marina + Eva María + Morata
- Orbit design □ Foreman + Laura + Sergi
- Launch system □ Josep + Xavi Tió
- Operation □ Joan + JosepMa
- Technological Demonstrators □ Silvia + Oscar
- Financial Plan □ Boyan + Nando
- Management □ Oscar

Gant □ Pol + Victor

- Information research to give proper estimates of cost + time
- Time prediction (Inside WBS)
- Prelacions

Internal structures □ Marina

- Hierarchy
- Documents organization

Ensamatge Latex □ Boyan + Silvia

Ensamatge Budget □ Boyan + Silvia



MINUTES OF THE MEETING 04 o 2

Project: Cubesat constellation

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	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 29th sept 2016, from 10:00 to 12:00

Place: SJ INTEXTER

AGENDA

1. Minute approve
2. Client requirements
3. Project charter review
4. Gantt's diagram review
5. Budget review
6. Work teams
7. Next meeting

ITEMS ON THE AGENDA

1. Minute approve

It has to be approved the last minute

2. Client requirements



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The team want to know what is going to be the role of the client in the project

3. Project charter review

The pre-delivery of the project charter it has to be checked and discussed with the client

4. Gantt's diagram review

The Gantt's diagram has to be checked and discussed with the client.

5. Budget review

The budget has also to be checked and discussed with the client.

6. Work teams

It has to be done the work teams for developing every task.

7. Next meeting

The team has to decide when and how to meet for finishing the project charter.

DECISIONS MADE - ASSIGNMENTS

1. Minute approve

The minute is approved and signed by the client and the coordinator

2. Client requirements

Is asked to the client what role would like to develop in the project. The client want to buy the idea to commercialize it.

3. Project charter review

Scope

In general the client demand to be more concrete at the items.

- Orbit design. It has to be decided if we want to consider the gravitational pull off the moon and sun. We will do a first approximation of the influence of these bodies and then decide if it is significant.
 - Sat design. The components of hardware will be selected.
 - Launch system. It's ok at the moment. It is required to define the calendar in order to define the launch window.
 - Operation design. It has to be defined the requirements, make a market study of the ground stations and select the GS.
- The client want to notice the project to the corresponding organisations, making the project as much "legal" as we can.

Requirements

LMP demand to be more concrete and "numeric" at the requirements. It has to be quantitative.

Justification

LMP want here a historical study of the cubsats communication for foresee the trend of this sector.



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Organisation of the group

The organisation is ok for LMP. It has to be defined the work teams. It has to be defined also who takes part of every team, the responsible, the coordinator and the secretary.

It is agreed to use slack for the internal communication and to share the documents between all the project members.

4. Gantt's diagram review

We can't work without the project charter approve. It has to be included to the Gantt the reporting of the tasks.

The variable cost are defined by the number of sats (for the launching and the insurance...)

5. Budget review

LMP suggest to review the estimated work hours.

6. Work teams

The work teams defined in the last meeting are only for the project charter. The project charter has to be done at Monday 3rd oct.

7. Next meeting

It is decided that we will meet at Monday 3rd oct. for make the last review of the project charter, the Gantt's diagram and the budget

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING 02.1

Project:	CubeSat constellation
Participants:	Joan Cebrian Galan (JC) G4/EA-T2016
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	Roger Fraixedas Lucea (RF) G4/EA-T2016
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	Xavier Tió Malo (XT) G4/EA-T2016
	Eva Maria Urbano González (EMU) G4/EA-T2016

*PF leaves the meeting at 16:45

*JP leaves the meeting at 17:00

Date and time: 3 of October 2016, from 15:30 to 18:30

Place: SJ INTEXTER

AGENDA

1. Minutes of the last meeting approval (5')
2. Agendas, minutes and documentation standards (10')
3. New organization responsible (5')
4. Bibliography protocol (5')
5. Individual performance verification procedure (10')
6. Project Charter Draft (15')
7. Teams formation (45')
8. Next meeting (5')



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ITEMS ON THE AGENDA

1. Minutes of the last meeting approval
2. Agendas, minutes and documentation standards

The procedure for the meetings preparation and minutes review is going to be defined. Here you can check the proposal to be discussed:

- How to guarantee that everyone looked the Agenda
 - How to guarantee that the minutes of the last session is read
 - How to name the documents
3. New organization responsables

a) LaTeX and Github responsable

His/her duties will be:

- Defining a template document
- Ensure that Git works for everyone.
- Solve technical issues with LaTeX and Github

Assigned responsable: Boyan Naydenov

b) Meetings moderator

His/her duties will be:

- Mantain order during the meetings
 - Ensure that the debate is strictly held in the topics
 - Stablish the duration of the different topics
- (MUST BE SUBMITED IN THE AGENDA BEFORE THE MEETING)

Assigned responsable: Xavier Tió

c) BSCW and Slack responsable

His/her duties will be:

- Write notes in the BSCW platform
- Review of the users who have not seen minutes or agenda

Assigned responsable: Sílvia González

4. Bibliography protocol

Proposal of the Mendeley platform to automatically store bibliographic references. A guide will be done by BK regarding use and LaTeX compatibility.



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5. Individual performance verification procedure

BK will present his proposal to be approved

6. Project Charter Draft

The Project Charter proposal is uploaded at BSCW. The document is semi-definitive. It has to be read by the members of the group and in the meeting will be discussed, modified and approved. The most important part to be discussed will be the scope and the requirements.

7. Teams formation

It has to be defined the work teams and who enjoys every team. It also have to be decided the responsible of every team.

8. Next meeting

When and where will be the next meeting and what it is going to be discussed.



DECISIONS MADE – ASSIGNMENTS

1. Minutes of the last meeting aproval (5')

The last minutes is approved.

It is decided that, for the next meeting the minutes will be in BSCW and in the next meeting everyone can amend it. If any amend is presented in the 1st point of the meeting the minute will be approved.

2. Agendas, minutes and documentation standards (10')

LaTeX and Github responsible: BK

Meetings moderator responsible: XT

BSCW and Slack responsible: SG

3. New organization responsible (5')

Everyone agree with the proposal.

ST exposes that, for personal reasons, is not able to continue developing the task of secretary. The team accepts the situation and SG is proposed for the position. The team approves the change. SG is for now the secretary. ST will help her in the task.

4. Bibliography protocol (5')

Everyone agree with the proposal

5. Individual performance verification procedure (10')

In order to make the meetings more dynamic and fast, the agenda of the meeting will be prepared by the secretary before and uploaded at BSCW. The last minutes will be also uploaded. Everyone should read them before the meeting. 5 minutes before the meeting the secretary will check and note who have seen it. If anyone is not reading the agendas before the meetings repeatedly it will be advised to him/her and noticed in the minutes.

It can be also monitored the work of the members by checking their activity in BSCW.

6. Project Charter Draft (15')

The secretary will sort he folder.

In order to be coherent in the scopes of the project charter the team define the priorities in the project. It is decided what will be subcontracted to and other company.

- a. Sat. It is decided that it will be searched a company for the design and manufacturing of the CubeSat. It will be defined the specifications of the Sat (it has to measure less than..., it has to have a data handling of...). OF disagrees with the decision and wants it to be recorded.
- b. Ground Station. It will be defined what type of GS it is needed and approximately where they have to be. The exact place and all the process for emplace them will be external to this project.
- c. Constellation. The team will design it entirely.
- d. Protocol. The team will design it entirely.



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The Requirements of Project Charter proposal are adequate.

The rest of the project charter is approved. Every team will change the things of their ambit.

7. Teams formation (45')

The departments and the members' functions are defined. Everyone agrees to the following division.

- a. Orbits (5 people)
- b. Satellite (3 people)
- c. Communications (5 people)
- d. Constellation Deployment Dpt. (4 people)
- e. Management Dpt.
- f. Financial Dpt.
- g. Delivery

BK will create an Excel where the members of the group have to complete placing from 1 to 4 their preference of department (only for the first 4 departments defined). The document will be closed at 21:00 and then it will be distributed the people attending their preferences.

8. Next meeting (5')

The next meeting will be with the client at 6 of October. In the meeting will be discussed the Project Charter with the client; it will be presented the new positions, the change in the secretary and the work teams. The agenda will be uploaded by the secretary as explained at point 1.



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MINUTES OF THE MEETING 03

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
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	Pol Fontanes Molina (PF)	G4/EA-T2016
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	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 6th of October 2016, from 10:00 to 12:00

Place: SJ INTEXTER

AGENDA

1. Minutes of the last meeting approval
2. Change of secretary
3. Project Charter delivery
4. Follow-up of the project
5. Oral presentations schedule
6. New tasks assignment
7. Next meeting



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ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Change of secretary

The client must be informed about the decision of the team referring the new secretary

3. Project Charter delivery

The project charter has to be delivered to the client

4. Follow-up of the project

The team and the costumer have to be informed of the project developments

5. Oral presentations schedule

The team has to decide the schedule of the oral presentations, at least the next meeting one

6. New tasks assignment

The weekly tasks have to be assigned to the members of the team

7. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Change of secretary

The client is informed about the change of secretary. It is approved by the team and the client. It is stated than ST will provide help to SG if necessary.

3. Project Charter delivery

The project charter is delivered and approved by the client.

4. Follow-up of the project

The team decide to work during the meeting in the sub-teams of the project till 11:50.

5. Oral presentations schedule

Every member of the group has to perform a 10 min presentation about the work he/she has been doing. The team agrees to decide the member/s who do the presentations week by week.

OF and XT offer their selves to perform the first oral presentation next week. The team agrees.

6. New tasks assignment

Each sub-team decides by their own their new tasks to perform. The coordinator of each sub-group informs the team about the work they will do for the next week meeting.



**Departament de Projectes
d'Enginyeria**

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7. Next meeting

It is decided that we will meet again on Thursday 13th oct. to perform a follow-up of the team work.
Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

A handwritten signature in blue ink, appearing to read "Luis J. Gómez".

Customer:

A handwritten signature in blue ink, appearing to read "Luis J. Gómez".



MINUTES OF THE MEETING 04

Project: Cubesat constellation

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	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 13th of October 2016, from 10:00 to 12:00

Place: SJ INTEXTER

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

OF and XT have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and costumer have to be informed of the project developments

4. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

XT and OF perform their oral presentations about satellite launching and end of life strategy and orbits design respectively.

It is decided the members who will perform the next meeting orals presentations. The team agrees that it might be good that they belong to different departments to the ones OF and XT belong. Taking this into account, PF and BK are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

It is discussed the compromise between the life time of the satellite, the costs of launches and the orbits parameters. The team agrees in take into account all the subgroups suggestions if possible when developing their subgroup work.

4. Next meeting

It is established that coordinators will have a meeting to follow-up with the project. The date of the meeting is yet to be decided.

Also, it is decided that the whole team will meet again on Thursday 20th oct. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING 05

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
	Joan Cebrian Galan (JC)	G4/EA-T2016
	Pol Fontanes Molina (PF)	G4/EA-T2016
	Lluis Foreman Campins (LF)	G4/EA-T2016
	Roger Fraixedas Lucea (RF)	G4/EA-T2016
	Oscar Fuentes Muñoz (OF)	G4/EA-T2016
	Silvia González García (SG)	G4/EA-T2016
	Fernando Herrán Halbelda (FH)	G4/EA-T2016
	Boyan Kaloyanov Naydenov (BK)	G4/EA-T2016
	Victor Martínez Viol (VM)	G4/EA-T2016
	David Morata Carranza (DM)	G4/EA-T2016
	Laura Pla Olea (LP)	G4/EA-T2016
	Marina Pons Daza (MP)	G4/EA-T2016
	Josep Puig Ruiz (JP)	G4/EA-T2016
	Josep Maria Serra Moncunill (JMS)	G4/EA-T2016
	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tjo Malo (XTN)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

(No assistió)

Date and time: 20th of October 2016, from 10:00 to 12:00

Place: SJ INTEXTER

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

BK and PF have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and customer have to be informed of the project developments

4. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

PF and BK perform their oral presentations about the preliminary satellite systems design and communications strategy respectively.

It is decided the members who will perform the next meeting orals presentations. VM and ST from orbits and communications systems respectively are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

The client states that we have to take into account all kind of public at the time of performing the final presentations of the project.

4. Next meeting

It is decided that the whole team will meet again on Thursday 27th oct. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING 06

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
	Joan Cebrian Galan (JC)	G4/EA-T2016
	Pol Fontanes Molina (PF)	G4/EA-T2016
	Lluis Foreman Campins (LF)	G4/EA-T2016
	Roger Fraixedas Lucea (RF)	G4/EA-T2016
	Oscar Fuentes Muñoz (OF)	G4/EA-T2016
	Sílvia González García (SG)	G4/EA-T2016
	Fernando Herrán Halbelda (FH)	G4/EA-T2016
	Boyan Kaloyanov Naydenov (BK)	G4/EA-T2016
	Victor Martinez Viol (VM)	G4/EA-T2016
	David Morata Carranza (DM)	G4/EA-T2016
	Laura Pla Olea (LP)	G4/EA-T2016
	Marina Pons Daza (MP)	G4/EA-T2016
	Josep Puig Ruiz (JP)	G4/EA-T2016
	Josep Maria Serra Moncunill (JMS)	G4/EA-T2016
	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 27th of October 2016, from 10:00 to 12:00

Place: SJ INTEXTER

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

VM and ST have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and costumer have to be informed of the project developments

4. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

VM and ST perform their oral presentations about orbit design developments and communications logistics and protocols respectively.

It is decided the members who will perform the next meeting orals presentations. LF, JC and DM from orbits, launching systems and satellites department respectively are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

4. Next meeting

It is decided that the whole team will meet again on Thursday 10th nov. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING – SM1 CONSULTING WITH PROFESSOR DAVID DE LA TORRE

Project: Cubesat constellation

<u>Participants:</u>	David De la Torre (DDT)	Physics Department Aero. Eng. Section
	Lluis Foreman Campins (LF)	G4/EA-T2016
	Oscar Fuentes Muñoz (OF)	G4/EA-T2016
	Laura Pla Olea (LP)	G4/EA-T2016

Date and time: 3rd November 2016, from 12:00 to 14:00

Place: TR6 Office 0.32

AGENDA

- Explanation on approach to Orbits and Orbit Perturbations, solution to our problems with direct simulations.
- Explanation on approach to Orbital Decay in detail

ITEMS ON THE AGENDA

- Explanation on approach to Orbits and Orbit Perturbations

In order to compute our satellites orbits and the perturbations there are 2 methods:

1. Numerical direct solution of the motion equation using Newton's Equations
2. Semi-analytic Method: Working with Keplerian Orbital Parameters. We look in the references for analytic solutions to the influences on keplerian orbits caused by the different perturbations. With this approach we can analyse which ones are the most significant. In addition, the computational performance is much more efficient.

- Explanation on approach to Orbital Decay in detail:

The first relevant parameter that DDT points is the influence of solar radiation on the decay. The first effect is the pressure of radiation, which is insignificant. The second, is the influence on the atmospheric thickness depending on the solar cycle.

With this solar-radiation-dependent model we can compute the Orbit Decay. DDT suggests two methods and specially the second one. The first one is the direct computation, taking into account a low-thrust thruster to integrate the trajectory. The second one is to simulate a Hohmann transfer from the decayed orbit to the previous orbit, assuming that the maneuver happened continuously during the orbit.



Secció de Terrassa

The second approach allows us to compute a Delta-V budget and a mass budget in order to do the Orbital Station-Keeping.

SUGGESTIONS BY PROFESSOR DDT

- A comparative of the delta-v budget and the mass budget with the two mentioned methods
- A detailed analysis of the constellation lifetime using Montecarlo Analysis.

MATERIAL PROVIDED BY THE PROFESSOR

- Notes of the lectures of the course in the Master's Degree: Astrodynamics
- Notes of the lectures of the course in the Master's Degree: Space Vehicles Design
- Notes of the lectures of the course in the Master's Degree: Space Vehicles
- Reference of paper in Orbital Decay computation and MATLAB algorithms
- Miscellaneous papers of interest

Thank you Professor!



MEETING OF THE MEETING 07

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
	Joan Cebrian Galan (JC)	G4/EA-T2016
	Pol Fontanes Molina (PF)	G4/EA-T2016
	Lluís Foreman Campins (LF)	G4/EA-T2016
	Roger Fraixedas Lucea (RF)	G4/EA-T2016
	Oscar Fuentes Muñoz (OF)	G4/EA-T2016
	Sílvia González García (SG)	G4/EA-T2016
	Fernando Herrán Halbelda (FH)	G4/EA-T2016
	Boyan Kaloyanov Naydenov (BK)	G4/EA-T2016
	Victor Martínez Viol (VM)	G4/EA-T2016
	David Morata Carranza (DM)	G4/EA-T2016
	Laura Pla Olea (LP)	G4/EA-T2016
	Marina Pons Daza (MP)	G4/EA-T2016
	Josep Puig Ruiz (JP)	G4/EA-T2016
	Josep Maria Serra Moncunill (JMS)	G4/EA-T2016
	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 10th of November 2016, from 10:00 to 12:00

Place: EDIFICI TR5 – 1.2

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

JC, LF and DM have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and costumer have to be informed of the project developments

4. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

JC, DM and LF perform their oral presentations about launching systems, satellite design and orbit design respectively.

It is decided the members who will perform the next meeting orals presentations. EMG and MP from communications and launching systems department respectively are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

4. Next meeting

It is decided that the whole team will meet again on Thursday 17th nov. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING 08

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
	Joan Cebrian Galan (JC)	G4/EA-T2016
	Pol Fontanes Molina (PF)	G4/EA-T2016
	Lluis Foreman Campins (LF)	G4/EA-T2016
	Roger Fraixedas Lucea (RF)	G4/EA-T2016
	Oscar Fuentes Muñoz (OF)	G4/EA-T2016
	Sílvia González García (SG)	G4/EA-T2016
	Fernando Herrán Halbelda (FH)	G4/EA-T2016
	Boyan Kaloyanov Naydenov (BK)	G4/EA-T2016
	Victor Martinez Viol (VM)	G4/EA-T2016
	David Morata Carranza (DM)	G4/EA-T2016
	Laura Pla Olea (LP)	G4/EA-T2016
	Marina Pons Daza (MP)	G4/EA-T2016
	Josep Puig Ruiz (JP)	G4/EA-T2016
	Josep Maria Serra Moncunill (JMS)	G4/EA-T2016
	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 17th of November 2016, from 10:00 to 12:00

Place: EDIFICI TR5 – 1.2

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

EMU and MP have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and customer have to be informed of the project developments

4. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

EMU and MP perform their oral presentations about communications protocols and launching systems respectively.

It is decided the members who will perform the next meeting orals presentations. SG and FH from orbits and satellite department respectively are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

The members of launching and deploy systems department expose the launcher selected to deploy our satellites. The launcher decided is Electron from Rocket LAB. The team backs up the decision.

From communication department is exposed the definitive protocols systems. These chosen protocols are the followings:

- Transport Layer: Transmission Control Protocol (TCP)
- Network Layer:
 - Main Protocol: Internet Protocol version 6 (IPv6)
 - Routing Protocol: Open Shortest Path First (OSPF)
- Data Link Layer: TC Space Data Link Protocol

Orbit and Satellite department agree on changing the team in charge of mass budget calculation from orbits to satellite dpt. due to the correlation between the duration of the constellation and the satellites components lifetime.

It is establish that orbit department will provide a relation between the time the constellation will last in a certain height with the DeltaV budget and a relation between the height increment of the design orbit and the launching orbit with the extra lifetime of the constellation.

Constellation deployment department also is committed to provide a relation between the duration of the constellation and the DeltaV needed to reconfigure the constellation in case of satellite failure so Satellite department can have all the information to do a sizing of the total needed fuel mass.



Secció de Terrassa

4. Next meeting

It is decided that the whole team will meet again on Thursday 24th nov. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:



MINUTES OF THE MEETING 09

Project: Cubesat constellation

<u>Participants:</u>		Projects Department
Luís Manuel Pérez (LMP)		G4/EA-T2016
Joan Cebrian Galan (JC)		G4/EA-T2016
Pol Fontanes Molina (PF)		G4/EA-T2016
Lluis Foreman Campins (LF)		G4/EA-T2016
Roger Fraixedas Lucea (RF)		G4/EA-T2016
Oscar Fuentes Muñoz (OF)		G4/EA-T2016
Sílvia González García (SG)		G4/EA-T2016
Fernando Herrán Halbelda (FH)		G4/EA-T2016
Boyan Kaloyanov Naydenov (BK)		G4/EA-T2016
Victor Martinez Viol (VM)		G4/EA-T2016
David Morata Carranza (DM)		G4/EA-T2016
Laura Pla Olea (LP)		G4/EA-T2016
Marina Pons Daza (MP)		G4/EA-T2016
Josep Puig Ruiz (JP)		G4/EA-T2016
Josep Maria Serra Moncunill (JMS)		G4/EA-T2016
Sergi Tarroc Gil (ST)		G4/EA-T2016
Xavier Tió Malo (XT)		G4/EA-T2016
Eva María Urbano González (EMU)		G4/EA-T2016

Date and time: 24th of November 2016, from 10:00 to 12:00

Place: EDIFICI TR5 – 1.2

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

SG and FH have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and customer have to be informed of the project developments

4. Next meeting

The place and time of the next meeting has to be decided

DECISIONS MADE - ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

FH and SG perform their oral presentations about satellites and orbit design respectively.

It is decided the members who will perform the next meeting orals presentations. JMS and RF from communications department and deployment systems respectively are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

Orbit department proposes the final constellation configuration. This configuration is yet to be accepted by all the team because orbit dpt. must consider some aspects about the need of ground global coverage suggested by the client and the team.

Constellation Configuration:

Walker-Delta 210° at a 542km with 8 planes and 21 satellites per plane.

From satellite department is exposed the definitive structure type, batteries and ADCS (Attitude Determination and Control System). The propulsion system is yet to decide. These chosen systems are the following:

- Structure: 3U CubeSat Structure ISIS
- Batteries: NanoPower BP4 (77Wh) (Number of batteries = 2)
- ADCS components:
 - Cube Computer
 - Cube Sensor
 - Cube Control
 - Cube Wheel
 - Cube Torque



Secció de Terrassa

4. Next meeting

It is decided that the whole team will meet again on Thursday 1st Dec. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:

A handwritten signature consisting of a stylized 'L' and 'u' followed by a dash and another stylized letter, likely representing the name 'Luis'.



MINUTES OF THE MEETING 10

Project: Cubesat constellation

<u>Participants:</u>	Projects Department
Luís Manuel Pérez (LMP)	G4/EA-T2016
Joan Cebrian Galan (JC)	G4/EA-T2016
Pol Fontanes Molina (PF)	G4/EA-T2016
Lluis Foreman Campins (LF)	G4/EA-T2016
Roger Fraixedas Lucea (RF)	G4/EA-T2016
Oscar Fuentes Muñoz (OF)	G4/EA-T2016
Silvia González Garcia (SG)	G4/EA-T2016
Fernando Herrán Halbelda (FH)	G4/EA-T2016
Boyan Kaloyanov Naydenov (BK)	G4/EA-T2016
Victor Martinez Viol (VM)	G4/EA-T2016
David Morata Carranza (DM)	G4/EA-T2016
Laura Pla Olea (LP)	G4/EA-T2016
Marina Pons Daza (MP)	G4/EA-T2016
Josep Puig Ruiz (JP)	G4/EA-T2016
Josep Maria Serra Moncunill (JMS)	G4/EA-T2016
Sergi Tarroc Gil (ST)	G4/EA-T2016
Xavier Tió Malo (XT)	G4/EA-T2016
Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 1st December 2016, from 10:00 to 12:00

Place: EDIFICI TR5 – 1.2

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

JMS and RF have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

The team and customer have to approve the decisions made by the coordinators of each sub team in the last coordinator meeting. They have to be informed of the project developments.

Decisions made:

- It is considered the constellation system not to be oversize.
If the number of satellites were reduced the continuous coverage of the ground stations would be compromised.
It is suggested to keep the actual configuration because it is robust, not too complex and offers the clients the possibility of having their own ground stations.
- A critical failure is defined to be when the client cannot connect with any satellite, a ground station loses its visibility or the communication route has to be reconfigured more than once due to a two consecutive satellite failure.
(The ground stations have been design to lose coverage when two satellites of two adjacent planes that arrive at the same time over the GS fail).
- Both constellation deployment and satellite department have to choose the propulsive system that guarantees the correct performance of the demanded actuations.

4. Next meeting

The place and time of the next meeting has to be decided.

DECISIONS MADE – ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

JMS and RF perform their oral presentations about communications department and deployment systems respectively.

It is decided the members who will perform the next meeting orals presentations. LP and JP from orbit department and communication department respectively are chosen to be the ones who perform next week oral presentations.

3. Follow-up of the project

Deployment systems department decisions approved by the team:

- To perform an uncontrolled de-orbiting maneuver for the end of life strategy because a controlled one will suppose high deltaV. Simultaneously the satellite can be positioned in a certain way in order to increase its drag.
- The replacement strategy is also determined. The new planes will be set in between the existing dying ones in order to avoid collisions and to keep providing service.



Secció de Terrassa

From communications department is exposed:

- The Mission Control Centre is located in Terrassa. It will be in charge of handle the data and check the constellation status.
- The Ground Stations are decided to be three and are located in:

- Canada
- Scotland
- Falkland Islands

They receive TT&C, HK and the client's data and send it to the Mission Control Centre.

The team approves the ground stations locations and their roles.

About the decisions made by the coordinators of each sub team in the last coordinator meeting:

- The definition of a critical failure is approved by the team.
- The constellation system is considered no to be oversize by the team, but the suggestion of keeping the actual configuration is rejected. The team agrees on studying some more configurations from the point of view of just ground stations total coverage besides the ones of global coverage. It is agreed to perform an OWA to make the final decision.

4. Next meeting

It is decided that the whole team will meet again on Thursday 15th Dec. to perform a follow-up of the team work. Every sub-team will organise themselves during the week.

SIGNATURES

Coordinator:

Customer:

A handwritten signature consisting of several loops and strokes, enclosed within a large, roughly drawn oval border.



MINUTES OF THE MEETING 11

Project: Cubesat constellation

<u>Participants:</u>	Luís Manuel Pérez (LMP)	Projects Department
	Joan Cebrian Galan (JC)	G4/EA-T2016
	Pol Fontanes Molina (PF)	G4/EA-T2016
	Lluis Foreman Campins (LF)	G4/EA-T2016
	Roger Fraixedas Lucea (RF)	G4/EA-T2016
	Oscar Fuentes Muñoz (OF)	G4/EA-T2016
	Sílvia González García (SG)	G4/EA-T2016
	Fernando Herrán Halbelda (FH)	G4/EA-T2016
	Boyan Kaloyanov Naydenov (BK)	G4/EA-T2016
	Victor Martinez Viol (VM)	G4/EA-T2016
	David Morata Carranza (DM)	G4/EA-T2016
	Laura Pla Olea (LP)	G4/EA-T2016
	Marina Pons Daza (MP)	G4/EA-T2016
	Josep Puig Ruiz (JP)	G4/EA-T2016
	Josep Maria Serra Moncunill (JMS)	G4/EA-T2016
	Sergi Tarroc Gil (ST)	G4/EA-T2016
	Xavier Tió Malo (XT)	G4/EA-T2016
	Eva María Urbano González (EMU)	G4/EA-T2016

Date and time: 15th December 2016, from 10:00 to 12:00

Place: EDIFICI TR5 – 1.2

AGENDA

1. Minutes of the last meeting approval
2. Oral presentations
3. Follow-up of the project
4. Next meeting

ITEMS ON THE AGENDA

1. Minutes of the last meeting approval

The last minute has to be approved

2. Oral presentations

LP and JP have to perform the oral presentation they agreed on doing last meeting.



Secció de Terrassa

3. Follow-up of the project

- a) The team and costumer have to be informed of the project developments both in final developments on the Astrea constellation and in the fulfilment of the final report.
- b) The members who will perform the final presentation have to be chosen.
- c) The remaining tasks have to be distributed.

4. Next meeting

The team has to decide the place and time of the next meeting to prepare the final project presentation.

DECISIONS MADE – ASSIGNMENTS

1. Minutes of the last meeting approval

The minute is approved and signed by the client and the coordinator.

2. Oral presentations

LP and JP perform their oral presentations about orbit and financial department and others considerations.

3. Follow-up of the project

a) Project Developments

Orbits design department informs about the decision of the final constellation. This decision has been made through the performance of an OWA. The final constellation is the following:

Walker-Delta 225° at a 542km with 9 planes and 21 satellites per plane at an inclination fo 70°.

The costumer states that in order to decide we also should take into account the accuracy of the presented numbers. Considering this and after some team explanations, the whole team and the costumer agree on the final constellation decision.

The team and costumer are informed about environment control, legislation and feasibility of Astrea project.

The costumer makes some comments:

- Environment control: The environmental effect of the materials and fuel used has to be determined.



Secció de Terrassa

• Feasibility:

- The table presented has to be improved.
- The data presented should be in GBytes instead of Mega.
- The analysis made should better be in 12 years in order to be representative.
- The calculations done should be divided in existents satellites and new satellites considering the last group will be the target of our services.

b) Election of the members who will perform the final presentation

- First the team decide how many members will perform the final presentation

In order to make a decision, the team agrees on voting. The results are the following:

1 pers: 0 votes

2 pers: 2 votes

3pers: 12 votes

4 pers: 3 votes

5 or more pers: 0 votes

According to the vote, 3 members will perform the final presentation.

- Election of the 3 members who will perform the final project presentation

A vote is made in order to take the decision. The members selected due to the vote are:

Oscar Fuentes: 13 votes

LLuis Foreman: 14 votes

Boyan Kaloyanov: 12 votes

c) Remaining tasks assignation

- Academic Poster: Assigned to XT and MP.
- Video: Assigned to RF, VM and PF.



Secció de Terrassa

4. Next meeting

It is decided that the whole team will meet again on Tuesday 20th Dec and on Wednesday 21st Dec to prepare the final project presentation.

SIGNATURES

Coordinator:

Customer: