



ESEIAAT



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UNIVERSITAT POLITÈCNICA DE CATALUNYA

# Cubesat Constellation Astrea

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## Technical sheet

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## 0.1 Communication Protocols

The communication protocols are a list of rules that allow different entities to communicate between them, enabling the transference of information.

In Astrea constellation, the communication protocols are very important because are the ones that allow the constellation to work together and accomplish the function it has been designed for. The protocols used in Astrea constellation have to be:

High-speed	Reliable	Secure	Compatible with external satellites
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Table 0.1.1: Requirements of the communications protocol

In order to accomplish the requirements, the standards of the Consultative Committee for Space Data Systems (CCSDS) have been followed, together with the ISO model. Regarding the protocols of the Ground Segment, security has been the most important requirement to decide the protocol. The chosen protocols are exposed in the following table.

Space segment: CCSDS Standards		
Transport Layer	Space communication protocol specification transmission protocol: SCSP-TP	
Network layer	Main protocol	Internet Protocol version 6 (IPv6)
	Routing protocol	Open Shortest Path First (OSPF)
	Complementary protocols	IP over CCSDS
Data Link Layer	Data Link Protocol Sublayer	TC Space Data Link Protocol
	Sync and Channel Coding Sublayer	TC Sync and Channel Coding
Ground segment		
Presentation of the data to the client		Application
Protocol		Secure Shell (SSH)

Table 0.1.2: Communications protocol overview

## 0.2 Ground segment

The ground segment is composed by the Ground Stations (GS) and the Mission Control Center (MCC), that allow the receiving of the information from the constellation to the Earth.

The placement of the different nodes of the Ground Segment is shown in the following map.



Figure 0.2.1: Location of the GS and MCC

Node	Color in the map	Country
GS1	Yellow	Canada
GS2	Orange	Falkland Islands
GS3	Blue	United Kingdom
MCC	Green	Spain

Table 0.2.1: Countries of location

The MCC is composed by a set of offices with good connection to the GS. The systems that compose the GS are exposed in the following table.

System	Features	Purpose	Elements included
S-band	Half-duplex system: downlink and uplink capability	Housekeeping data/TT& C Client data upload	Transceiver LNA HPA RF Limiter RF Switch RF Fuse Rotors
X-band	X-band downlink capacity	Client data download	X-band receiver LNA RF Limiter RF Fuse Rotor

Table 0.2.2: GS's systems



### 0.3 Satellite Configuration

System	Weight/unit (g)	Sizes (mm)	N. of units
<b>STRUCTURE AND MECHANICS</b>			
Structure	304.3	100 x 100 x 300	1
Thermal protection	38	Covers all	1
<b>Total</b>	<b>342.3</b>		
<b>ELECTRIC POWER SYSTEM</b>			
Solar arrays	175	98 x 83 x 8.50	4
Batteries	155	90 x 63 x 12.02	2
Power management	126	92.0 x 88.9 x 20.5	1
<b>Total</b>	<b>1136</b>		
<b>PAYLOAD</b>			
Patch antenna	30	90 x 90 x 4.35	8
Transceiver inter-satellite	16.4	65 x 40 x 6.5	3
Transceiver space to ground	101.5	86 x 86 x 45	1
Data handling system	28.3	65 x 40 x 6.5	1
Antenna Deployable	83	100 x 83 x 6.5	1
<b>Total</b>	<b>502</b>		
<b>AOCDS</b>			
Thruster	1500	90 x 90 x 95	1
ADACS	506	90 x 90 x 58	1
<b>Total</b>	<b>2006</b>		
<b>TOTAL ESTIMATION</b>	<b>3986.3</b>		

# Chapter 1

## Bibliography