



Small satellite to monitor the Red Tide blooming on Central American coast using a High Definition Camera and two Multispectral Cameras



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### **Mission Objectives**



Acquire correctly High Definition images of the Central American Territorial Sea to monitor the blooming of the red tide during the lifetime of the mission.



### **Mission Objectives**



Acquire images in various spectrums with the Multispectral Cameras to monitor the temperature and color variation on the water during the lifetime of the mission, to predict and monitor algae blooms.







### **Mission Objectives**



Transmit the collected information to the corresponding ground station.









### RETI-Sat reaches the correct orbit.





The satellite must be pointing towards the Central American coast line.







### The ADCS must ensure the required pointing condition.







All three cameras have to turn on and work properly during the lifetime of the mission.







SWIR camera must has a resolution better than 0.2 km<sup>2</sup> per pixel.





Images must be sent correctly to our ground base station.



## **Space Segment Description**





![](_page_13_Picture_3.jpeg)

In the future the mission could be scalable to a satellite constellations.

### **Mission Payload**

![](_page_14_Picture_1.jpeg)

Data	SWIR	HD	LWIR	
Spatial Resolution (SWATH)	18362 m (Linear)	38800 m x 25800 m	37546 m (Linear)	
Spectral range	350-1000 nm	Visible Spectrum	7800-13400 nm	
Sprectral Resolution	10 nm (60 Bands)	N/A	100 nm (50 Bands)	
Area per Pixel (Imaging)	18 m (Linear)	20 m <sup>2</sup>	115 m (Linear)	
Purpose	Color variation	Observation visible spectrum	Temperature maping	

![](_page_14_Picture_3.jpeg)

### **Mechanical Subsystem**

![](_page_15_Picture_1.jpeg)

![](_page_15_Picture_2.jpeg)

![](_page_15_Picture_3.jpeg)

![](_page_15_Picture_4.jpeg)

### **Thermal Subsystem**

![](_page_16_Picture_1.jpeg)

Nombre del modella Prueba Termica Nombre de estada: Térmica 1(-Pruebeterminado-) Tipo de resultado: Térmico Termico1 Piaso de tempo: 1

![](_page_16_Picture_3.jpeg)

![](_page_16_Figure_4.jpeg)

![](_page_16_Picture_5.jpeg)

## Attitude Determination and Control System UCR

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![](_page_17_Picture_2.jpeg)

![](_page_17_Picture_3.jpeg)

## Attitude Determination and Control System UCR

Component	Model	Function	Other
IMU	MASIMU01 Micro Aeroespace	Attitude Determination	
GPS	piNAV-L1 NanoAvionics	Attitude Determination	
Reaction Wheels	CubeWorld CubeWheel (Medium)	Pointing, Stabilization	Max torque 1.0 mNm, max storage 10.8 mNms. Pointing Accuracy <1 degree RMS.
Star Tracker	Vectronic VST-41	Attitude Determination(Bac kup)	18 arcsec(x,y) 122 arcsec(z)
Thruster	Aerojet Rocketdyne MPS120	Orbit Maintenance, Momentum Dumping	lsp 217s, Total Impulse 2000 N-s.

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![](_page_18_Picture_4.jpeg)

### **Electrical Subsystem**

![](_page_19_Picture_1.jpeg)

![](_page_19_Picture_2.jpeg)

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![](_page_19_Figure_3.jpeg)

### **Electrical Subsystem**

![](_page_20_Picture_1.jpeg)

Power Specifications	Total
Safety Factor	1.5
Peak Power Consumption	245W
Average Power Consumption	150W
Solar Panel Efficiency	29%
Number of Solar Cells	130
Number of Battery Cells	10

![](_page_20_Picture_3.jpeg)

# Command and Data Handling Subsystem UCR

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Communication System:

- UHF/VHF transceiver for TT&C
- S-Band transmitter for payload images

![](_page_21_Figure_5.jpeg)

![](_page_21_Figure_6.jpeg)

![](_page_22_Figure_0.jpeg)

### **Ground Base Station**

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![](_page_23_Picture_1.jpeg)

![](_page_23_Picture_2.jpeg)

![](_page_24_Picture_0.jpeg)

### Link Budget

	S-Band	VHF	UHF	
	(Downlink)	(Downlink)	(Uplink)	
P <sub>t</sub>	2.5	0.2	0.2	w
G,	31.35	12.3	15.5	dB
Noise figure	0.9	1.6	2	dB
Height	538000	538000	538000	m
Downlink (freq)	200000000	14600000	4380000	hz
Speed B (of bits)	600000	9600	1200	bits s-1
$E_{b}/N_{0}$ in dB	10.9	28.7	70.2	>10

![](_page_24_Picture_3.jpeg)

## **Cost Table**

![](_page_25_Picture_1.jpeg)

	Component	Approximate Price (USD)	UNIVER
	Payload (Optical Subsystem)	\$85.000	
	Electrical Subsystem	\$60.000	
	Mechanical Subsystem	\$ 60.000	
	Command and Data Handling Subsystem	\$ 60.000	
	Attitude Determination and Control	\$100.000	
	Ground Base Station	\$ 40.000	
	Launch	\$160.000	
)	HR (Development, Test and Operation)	\$1.000.000	
	Total	\$1.565.000	

![](_page_25_Picture_3.jpeg)

## **Implementation Plan**

![](_page_26_Picture_1.jpeg)

![](_page_26_Figure_2.jpeg)

### **Mission Schedule**

![](_page_27_Picture_1.jpeg)

![](_page_27_Figure_2.jpeg)

![](_page_27_Picture_3.jpeg)

### **Sustainable Development Goals**

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![](_page_28_Picture_1.jpeg)

![](_page_28_Figure_2.jpeg)

![](_page_29_Picture_0.jpeg)

### Mission Overview

![](_page_29_Picture_2.jpeg)

Launching in Ariane VTwoMonitor the<br/>MultispectralHelp addressLaunching in Ariane VMultispectralRed Tide inTransmit<br/>Data to GBSHelp addressLaunching in Ariane VCameras &<br/>HD CameraCentral<br/>AmericaData to GBSHelp address<br/>the impact of<br/>Red Tide

![](_page_29_Picture_4.jpeg)

![](_page_29_Picture_5.jpeg)

![](_page_29_Picture_6.jpeg)

![](_page_29_Picture_7.jpeg)

![](_page_29_Picture_8.jpeg)

![](_page_30_Picture_0.jpeg)

### **Reference List**

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[4] DiCYT, Marea Roja. 2014.

[5] D. Payne, Thermal Analysis. 2013

[6] UTEXAS, AVIRIS hyperspectral data cube over Moffett Field

![](_page_30_Picture_8.jpeg)

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[8] Full Gorund Station Kit VHF/UHF/S-band, Innovative Solutions in Space. https://www.isispace.nl/product/full-ground-station-kit-for-vhfuhfs-band/

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![](_page_31_Picture_0.jpeg)

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![](_page_31_Picture_2.jpeg)

![](_page_31_Picture_3.jpeg)

# Thanks for your attention

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