# CubeSat Configurator Report

## Introduction

The following report was created using the CubeSat Configurator KBE Application developed by Gargi Sunil Pantoji and Nicolas Oidtmann for the Master Course *AE4204 Knowledge Based Engineering (2023/24 Q3)* at Delft University of Technology.

This report was generated on 17/06/2024 by USERNAME.

## User Input

### **Mission Level Inputs:**

|  |  |  |
| --- | --- | --- |
| Input Parameter | Value | Unit |
| Mission Lifetime | 24 | Months |
| Required Ground Sampling Distance | 50 | m |
| Number of Images per day | 5 | - |
| Orbit Type | SSO | - |
| Custom Inclination | N/A | degrees |
| Ground Station Selection | [58, 53, 49] | - |
| Required pointing accuracy | 1 | degrees |

### Ground Station Selection

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Lat** | **Lon** | **Company** | **Location** | **Elevation** | **Number** |
| GS\_58 (Delft) | 51.9989 | 4.3735 | TU Delft | Delft | 90 | 58 |
| GS\_53 (Hawaii) | 19.89 | -155.7 | Estrack | Hawaii | 0 | 53 |
| GS\_49 (Kourou) | 5.0 | -52.0 | Estrack | Kourou | 0 | 49 |

### **CubeSat Design Weights**

|  |  |  |
| --- | --- | --- |
| Input Parameter | Value | Unit |
| Mass Design Weight | 0.4 | - |
| Power Design Weight | 0.3 | - |
| Cost Design Weight | 0.3 | - |

### **Instrument Specification**

|  |  |  |
| --- | --- | --- |
| Input Parameter | Value | Unit |
| Minimum Operating Temperature | -10 | °C |
| Maximum Operating Temperature | 50 | °C |
| Focal Length | 40 | mm |
| Sensor Pixel Size | 7 | µm |
| Average Power Consumption | 1 | W |
| Instrument Mass | 500 | g |
| Instrument Height | 50 | mm |
| Instrument Cost | 10000 | USD |
| Image Pixel Resolution | [1260, 1260] | - |
| Image Bit Depth | 8 | - |

## **Application Output**

### Orbit Design

|  |  |  |
| --- | --- | --- |
| Output Parameter | Value | Unit |
| Altitude | 285.71 | km |
| Semi-Major Axis | 6663851.29 | m |
| Eccentricity | 0 | - |
| Inclination | 92.73 | degree |
| RAAN | 0 | degree |
| Argument of Periapsis | 0 | degree |
| True Anomaly | 0 | degree |
| Orbital Period | 5413.759082132572 | s |
| Average Eclipse Time per Orbit | 1897.5 | s |
| Average Eclipse Time per Day | 30360.0 | s |
| Average Communication Window per Orbit | 103.125 | s |
| Average Communication Window per Day | 1650.0 | s |
| Shortest Communication Window | 60 | s |
| Longest Communication Window | 300 | s |
| Number of Contacts per Day | 7.0 | - |

Mass Budget

|  |  |
| --- | --- |
| Subsystem | Mass (g) |
| Payload | 500 |
| ADCS | 400 |
| OBC | 25 |
| Structure | 142.0 |
| Thermal | 0 |
| Communication | 190.0 |
| Power | 285.78458655154463 |
| 20 % System Margin | 308.55691731030896 |
| Total Mass | 1851.3415038618534 |

### Power Budget

|  |  |
| --- | --- |
| Subsystem | Power (W) |
| Payload | 1 |
| ADCS (10% duty cycle) | 0.14 |
| OBC | 0.1 |
| Structure | N/A |
| Thermal (orbit average) | 0.0 |
| Communication (orbit average) | 4.66 |
| Power | N/A |
| 20 % System Margin | 1.1804652777777778 |
| Average Power | 7.082791666666666 |
| Peak Power | 8.59 |

### Cost Budget

|  |  |
| --- | --- |
| Subsystem | US Dollar |
| Payload | 10000 |
| ADCS | 50000 |
| OBC | 6500 |
| Structure | 63000.0 |
| Thermal | 0 |
| Communication | 15000 |
| Power | 15178.690793956093 |
| 20 % System Margin | 31935.738158791224 |
| Total Cost | 191614.42895274732 |

## Component Selection

### Communication Requirements

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Required Downlink Data Rate | 55.56288593967627 | Kbits/s |

### Communication Selection

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Data\_Rate** | **Power\_DL** | **Power\_Nom** | **Mass** | **Height** | **Cost** | **Min\_Temp** | **Max\_Temp** | **Score** |
| Spacecom | 2000.0 | 13 | 4.5 | 190.0 | 25 | 15000 | -20 | 50 | 1.43 |

### Onboard Computer Requirements

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Required Onboard data storage | 0.006034231026542887 | Gbit |

### Onboard Computer Selection

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Storage** | **Power** | **Mass** | **Height** | **Cost** | **Min\_Temp** | **Max\_Temp** | **Score** |
| Deep Thought | 0.13 | 0.1 | 25 | 10 | 6500 | -40 | 85 | -0.93 |

### ADCS Requirements

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Required pointing accuracy | 1 | degree |

### ADCS Selection

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Pointing\_Accuracy** | **Power** | **Mass** | **Height** | **Cost** | **Min\_Temp** | **Max\_Temp** | **Score** |
| iADCS200 | 0.3 | 1.4 | 400 | 32 | 50000 | -20 | 40 | -0.26 |

### Battery Requirements

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Required battery capacity | 3.291997245848518 | Wh |

### Battery Selection

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Mass** | **Height** | **Cost** | **Min\_Temp** | **Max\_Temp** | **Capacity** | **Score** |
| CrystalSpace P1U | 130 | 12.0 | 7000 | -40 | 85 | 14 | -0.63 |

### Solar Panel Requirements

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Required solar panel power generation | 10.904921058608124 | W |

### Solar Panel Selection

|  |  |  |
| --- | --- | --- |
| Area | Cost | Mass |
| 0.03188997945116735 | 8178.690793956093 | 155.78458655154463 |

### Structure

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Form Factor | 1.5 | - |
| Structure Mass | 142.0 | g |
| Structure Cost | 63000.0 | USD |
| Distance CoM to geometric center | 0.54 | mm |

### Thermal Requirements

|  |  |  |
| --- | --- | --- |
| Max Temperature | Min Temperature | Temperature Margin |
| 50 | -10 | 5 |

### Thermal Coating Selection

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Coating** | **Absorptivity** | **Emissivity** | **Hot Case** | **Cold Case** | **Hot Margin** | **Cold Margin** |
| 1/2 mil Aluminized Kapton | 0.34 | 0.55 | 300.99 | 286.74 | 17.16 | 18.59 |

### Thermal Heater Sizing

|  |  |  |
| --- | --- | --- |
| Heater Power | Cold Case with Heater | Cold Margin with Heaters |
| 0 | 286.735896693118 | 18.585896693118002 |