7th Nano-Satellilte Symposium

# ASELSAT: High Resolution High Speed CubeSat

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# Overview

- 3u CubeSat at 500km SSO
- Main payload is miniaturized X-Band Transmitter
- Taking pictures 30m GSD
- Secondary payload is a dosimeter

# General Design

X BAND and PATCH ANTENNA

EPS and BATTERY

3 WHEEL ADCS

OBC

**NADIR FACE**

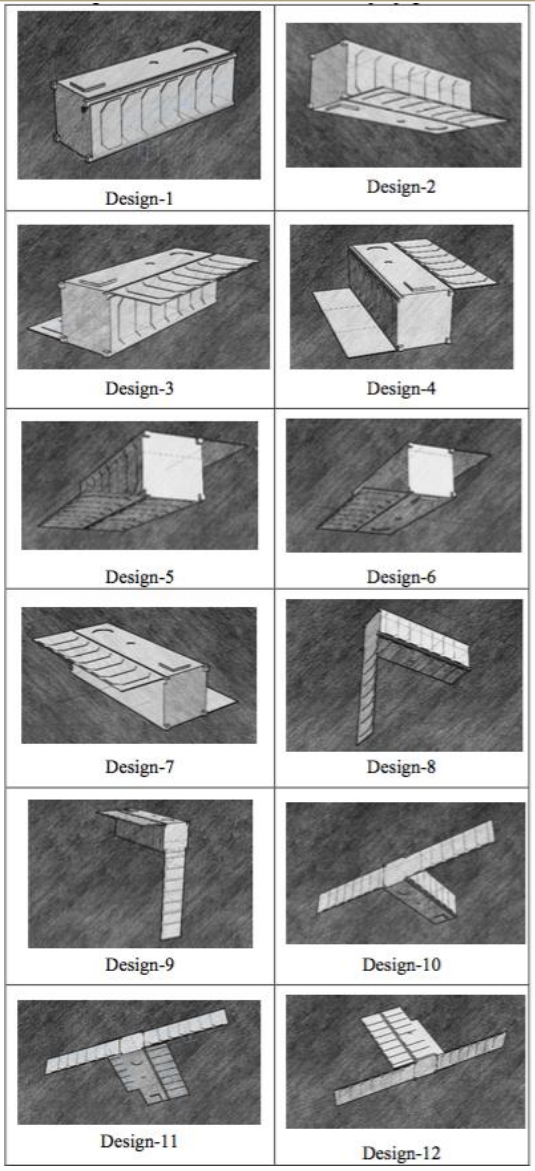
TRANSCIEVER and CAMERA

- The main mission of the satellite is to take images and transmit it to a ground station via X-Band Transmitter. For this purpose, the design is focused on
  - Command and data handling
  - Attitude control and pointing accuracy
  - Power generation

# Power Budget

| | | Assumptions | |
|---|---|---|---|
| Altitude | | 500 km SSO | |
| Albedo | | 10% | |
| Orbit Period | | 5686 sec | |
| Inclination | | 97.4 Degree | |
| | | | *Normal Mode Orbit Average* |
| | Power Req. (W) | Duty Cycle (%) | Power Consumed (W) |
| Camera | 3 | 10 | 0.3 |
| ADCS (Torquers at max) | 2.236 | 100 | 2.236 |
| X-Band | 20 | 2 | 0.4 |
| OBC | 0.1 | 100 | 0.1 |
| Modem | 4 | 10 | 0.4 |
| Beacon | 1.5 | 16.7 | 0.2505 |
| EPS | 0.1 | 100 | 0.1 |
| Total Power Consumed | | | 3.7865 |
| Average power generated per orbit | | | 5.94 |
| Margin (%) | | | 36.25420875 |

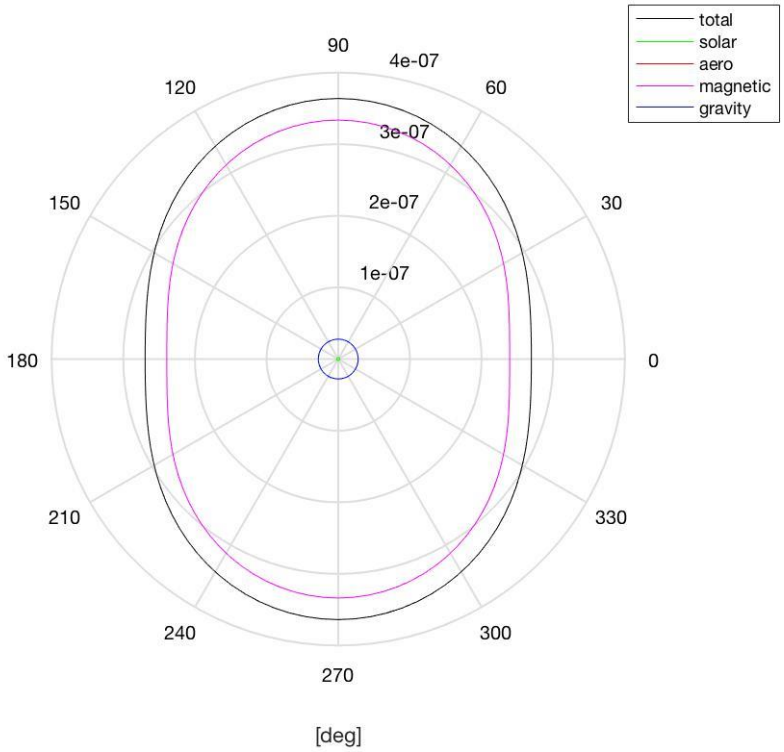
# Solar Panel Configuration Analysis

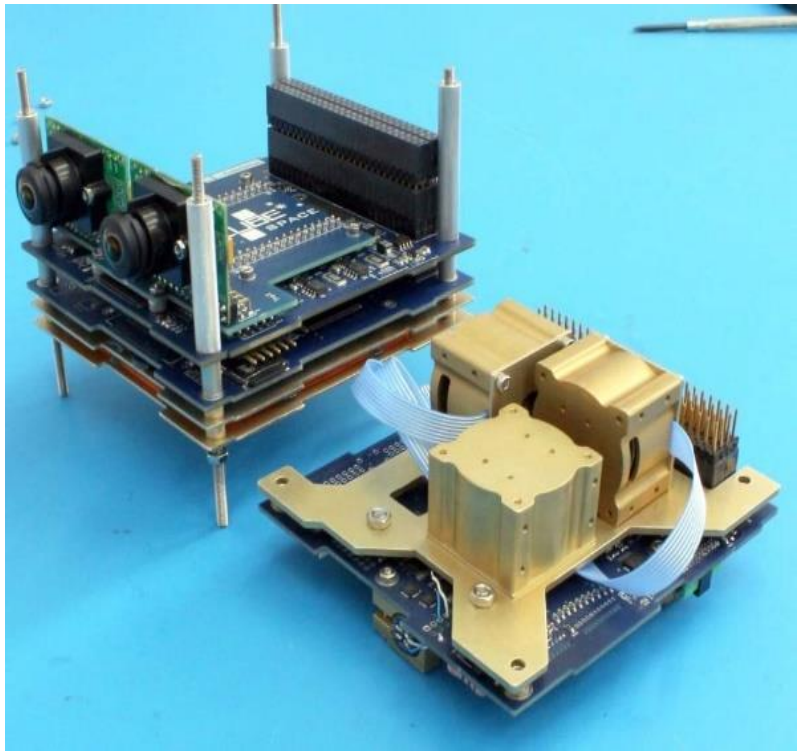



| | 12AM-12PM (Watt) | 6 AM-6 PM (Watt) | 9 AM-9 PM (Watt) |
|---|---|---|---|
| **Design-1** | 2.99 | 8.91 | 6 |
| **Design-2** | 3.2 | 9.64 | 6.3 |
| **Design-3** | 3.27 | 10.09 | 4.9 |
| **Design-4** | 5.77 | 10.09 | 6.24 |
| **Design-5** | 5.77 | 10.09 | 6.24 |
| **Design-6** | 3.15 | 2.27 | 2.58 |
| **Design-7** | 5.76 | 10.1 | 6.57 |
| **Design-8** | 4.10 | 9.63 | 7.44 |
| **Design-9** | 4.31 | **10.36** | 7.75 |
| **Design-10** | 6.68 | 9.96 | **8.42** |
| **Design-11** | 6.78 | 3.59 | 5.53 |
| **Design-12** | **9.39** | 3.61 | 7.31 |

# ADCS Calculations

- Calculation total disturbance torques
  - Atmospheric
  - Gravity gradient
  - Magnetic
- Momentum Wheel sizing
  - 80% Cyclic Angular Momentum
  - 20% Secular Angular Momentum



| | |
|---|---|
| Total Angular Momentum | 1.8 mNms |
| Cyclic Angular Momentum | 1.4 mNms |
| Secular Angular Momentum | 0.36198 mNms |

| **Small CubeWheel** | |
|---|---|
| Maximum momentum storage | 1.7 mNms |
| Maximum wheel speed | ± 8000 rpm |
| Maximum torque | 0.15 mNm |

# TMTC and Ground Station

- X-Band
- UHF-VHF
- Ax.25 Protocol
- Software for commanding satellite is being developed.

# Conclusion and Future Work

- Project is in the PDR phase.
- Challenges with subsystems
- Expected to be completed 2018

# Thank You!