Abstract |

The Preliminary Design of a Nano Satellite Engineering Model for Remote Sensing Expe

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Md. Azlin Md. Said
Assoc. Professor

Syed Idris Syed Hassan
Professor

Muhammad Shamsul Kamal Adnan and Mohd Faizal Allaudin
Lecturer

Mohd Helmi Othman and Kamal Azli Zakaria
Research Officer

School of Aerospace Engineering,
Universiti Sains Malaysia, 14300 Nibong Tebal, SPS, Pulau Pinang
Tel: 04-5937788 ext. 6500 Fax: 04-5941026
Email: aero@eng.usm.my

Introduction

Nanosatellite means small satellites where the total mass are less than 10kg incuding the main payloads an Small satellite missions was not only driven by reduction of the space budgets but it was also made possible by of the technology and miniaturization of component. The new advancement of technology trends allow the applic: sensing, communications and space science to benefit from the development of small satellites.

This paper highlights on Preliminary Design of a Nanosatellite Engineering Model for Remote Sensing Experime that it will promote the public interest in science, technology, space research, and international co-operation this | to promote the public interest in science, technology, space research, and international co-operation.

Mission Definition

The primary mission for the nanosatellite is remote sensing experiment and the secondary mission is communic naosatellite, KA band will be used. All the communication set will be developed in house. The secondary payload use only one antenna as receiver and transmitter.

Mission Analysis

The real breakthrough with nanosatellite is not in capabilities but in cost. The nanosatellite's total mass is only 1 various subsystems and payloads are given in Table 1. As it is small in size, it can be launched as a second: other missions, thus lowering the cost of launching it. Nanosatellite takes advantage of the low radiation environr earth orbit (LEO) by using commercial off-the-shelf components, which lowers non-recurring engineering costs. satellites simple command and control system requires only a basic ground station for operation, making the costs a fraction of large competing earth imaging systems.

Table1: Mass Budget

SYSTEM	MASS(kg)	MARGIN MASS(kg)	TOTAL MASS(kg)	TOTAL MASS (%)
Structure	1.5	0.5	2.0	20
Propulsion	0.6	0.2	0.8	8
ADCS	0.8	0.4	1.2	12
Thermal	0.8	0.4	1.2	12
Power	0.7	0.3	1.0	10
C&DH	0.5	0.2	0.7	7
Communication	0.5	0.2	0.7	7
Payload	1.2	0.5	1.7	17
Margin	0.5	0.2	0.7	7
TOTAL	7.1	2.9	10	100

Low earth orbit (LEO) will be used in this mission. Because of the primary mission is remote sensing, this is the b especially for small satellite. Is also low in cost but still can archive the mission. The satellite orbit is approximat polar orbit. At 10kg mass, nanosatellite is much smaller than competing Earth Imaging satellite. Refer to it small : nanosatellite can be launch as a secondary payload for a fraction of the cost a dedicated launch.

Structure
The nanaosatellite will be constructed using a cubic structure of dimensions 300mm x 300mm x 300mm as show five sides of its panel will be used to place the solar panels and the remaining facewill place the various payloads sensing camera and antenna, and the various sensors. Honeycomb structure will be used for each panel of thi inner side of the panel will be place all the main and subsystem.

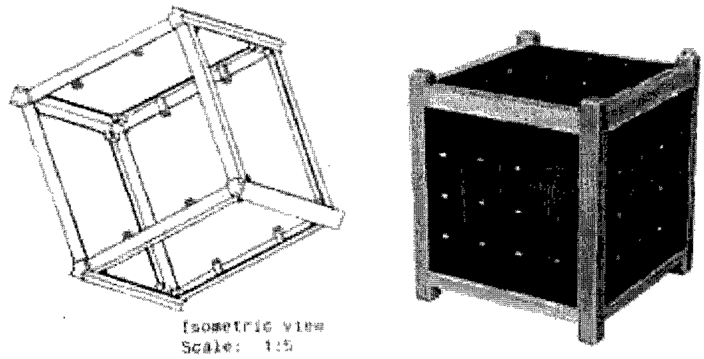

Figure 1: Nanosatellite main structure

Payload Design Analysis

Remote Sensing Payload
The remote sensing system it is a fundamental subsystem in a mission that has remote sensing as its primar imagers are commons i.e. a pan-chromatic imager and a multi spectral imager

The multi spectral imager is camera, operating in a spectral band (Cyan, Yellow and Magenta). The main sub CCD camera consist of optical system, beam splitting system, CCD devices and CCD imaging electronic c auxiliary subsystems of the CCD camera are side-looking reflector, relative calibration mechanism, fo temperature controller with their structures, control circuits, remote control and remote measurement circuits and power units etc. They are divided into four packages mounted on the interior of the satellite, which is the body of and mechanical control box, temperature controller, and CCD imaging circuit. For remote sensing system, it cons lens, frame grabber and DSP and software to support the operation as shown in Fig. 2. A simplified block diagran sensing system can be seen in Figure 3.

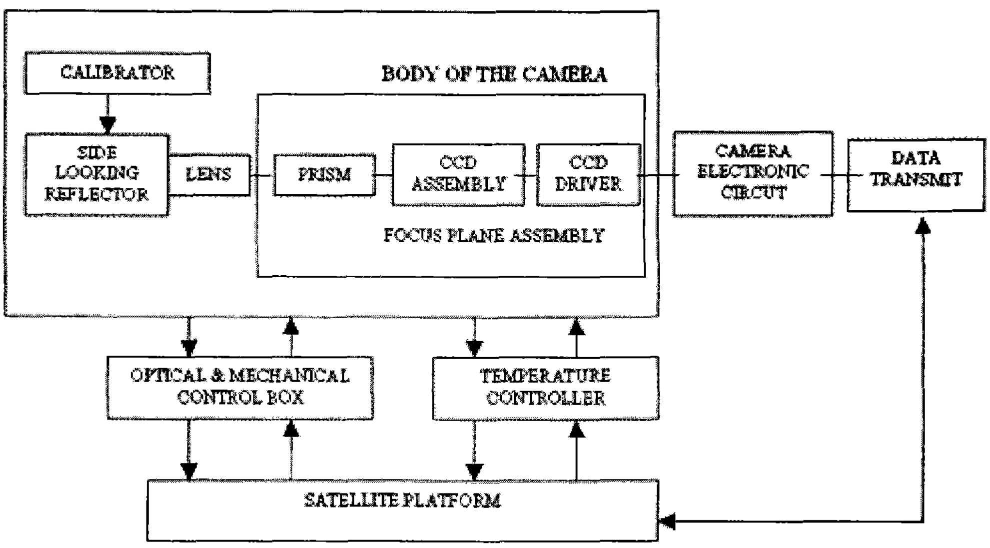

Figure 2: Block diagram of CCD Camera

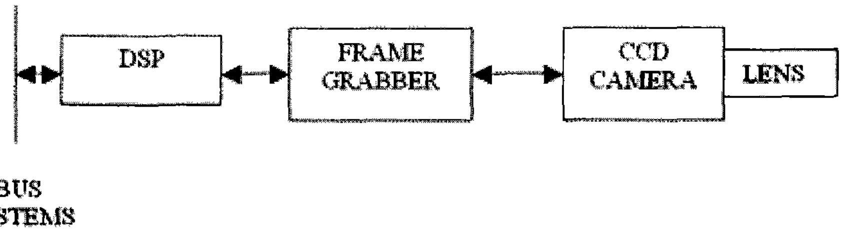

Figure 3: Remote Sensing Systems

Communication Payload

The communication system of this nanosatellite featuring a Ka-band system. The KA-band has been selected bec frequencies offer many advantages The primary advantages of KA-band operation versus KU- and C-band inc available bandwidth, reduced interference with terrestrial systems, smaller RF components (especially antennas), to provide multiple, narrow, high-gain spot beams for extensive frequency reuse. Bandwidth is the scarce reso system capacity. C- and KU-band provide allocated bandwidth of about 500 MHz each, while Ka-band Furthermore, most components limit the bandwidth that is usable in any specific application to a small percentag Since component bandwidth is generally a percentage of the absolute operating frequency, KA-band permits operating bandwidth nearly double that of KU-band.

Transmission of microwave signals to a satellite creates radiation which can also interfere with terrestrial microwa This is particularly true at C-band, where relatively small antennas create large amounts of side lobe ener terrestrial microwave equipment operates in essentially the same part of the frequency spectrum. At KA-band, be narrower, antennas are relatively larger, and there is very little terrestrial equipment with which to interfere (altho change if the 30 GHz Local Multipoint Distribution System equipment population grows). The reduction in pote interference will make it easier and less costly to locate transmit sites in populous areas.

A significant benefit of the higher operating frequencies of KA-band is the reduced size of the RF components tha The shorter wavelength of KA-band requires smaller antennas, waveguide structures, and microwave componen to obtain comparable performance to KU-band and C-band systems. KA-band very small aperture terminal (V sizes as small as 0.25 to 0.6 meters can provide the same gain, beam width and side lobe performance as 1.: systems at KU-band and 3.2- to 4.5-meter systems at C-band. RF components such as upconverters, downc noise amplifiers and solid state power amplifiers can be made small enough to install directly on these s providing highly efficient integrated RF packages.

For communication payload, it consists of modulator, demodulator, transceiver and antenna. A simplified block communication system can be seen in figure 4 below.

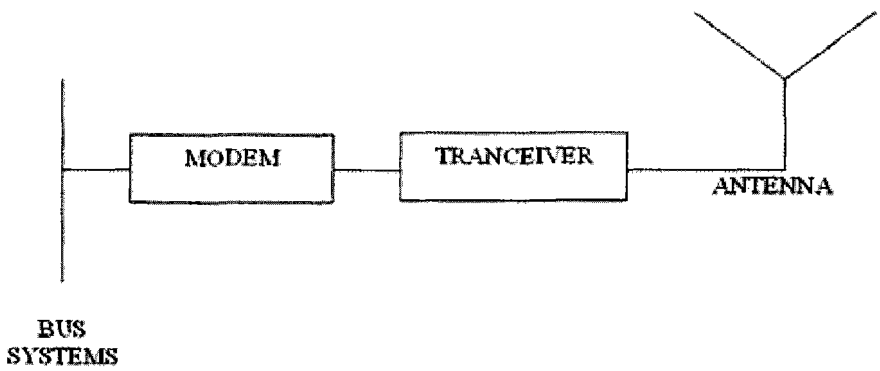

Figure 4: Communication Systems

RT/duroid 5870 glass micro fiber reinforced PTFE composites are designed for exacting strip lines and mic applications. Glass reinforcing micro fibers is randomly oriented to maximize benefits of fiber reinforcement in most valuable to circuit producers and in the final circuit application. The dielectric constant of RT/duroid 587 uniform from panel to panel and is constant over a wide frequency range. Its low dissipation factor extends the RT/duroid 5870 to KU-band and above. We choose rectangular micro strip patch antenna in our design.

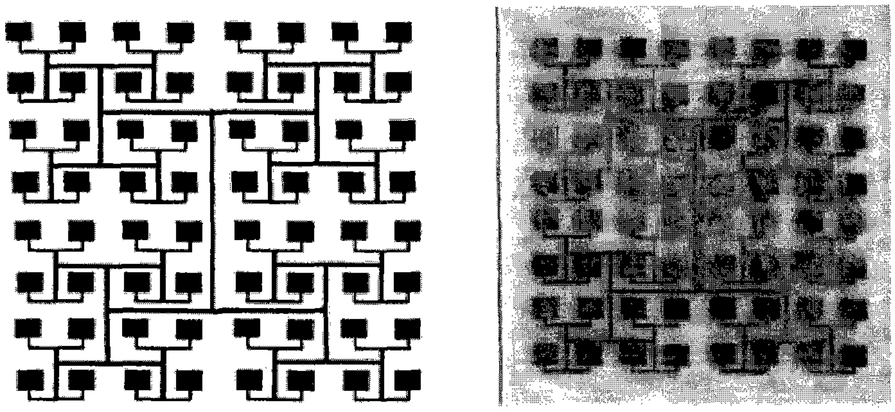

Figure 5: 8x8 Micro strip Patch Antenna before and after aching

Using ADS software, antenna is choosing to use in KA band (20 – 30 GHz). The objective with using the ADS is t strip patch antenna – corporate feed network with good accuracy and set up the frequency/reflection coefficier can be operate with ADS simulation. The reflection coefficient show that the antenna in simulated cases.

Current Status

Most of the remote sensing payload components except the DSP are determined and under procurement. software of the remote sensing payload are being developed locally. The telecommunications payload is also be since most of the components such as the patch antennas, transceiver and the modem are in the final stage of de

The main bus subsystems of the satellite such as the main structural frame, power (solar panel & batteries determincation control (ADCS), thermal control, TT&C, etc ar being finalized and developed. The ground nanosatellite is being designed. Most of the subsystems and ground station will be designed, developed anc house'.

It is expected that the engineering model for remote sensing and communication system payload will be ready wit

Conclusion

The nanosatellite will be the first small size (<10kg) national satellite using some new technologies develope design manual of the satellite development will be used for other small satellite project in the future. It is expect engineering model will be ready in a year time and the design manual soon after that. Design and develo nanosatellite engineering model is a stepping stone for USM to involve in future national and international sa program.

Acknowledgement

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