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## Design, analysis and testing of Aoba VELOX-IV 2U CubeSat structure subsystem

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This paper presents the design, analysis, and testing of Low Earth's Orbit (LEO) 2U CubeSat Aoba VELOX-IV structure subsystem, which ensures the survivability of the satellite during launch and orbit operation. In addition to educational objective, Aoba VELOX-IV demonstrates attitude and orbit control capability based on a pulsed plasma thruster (PPT) for further moon missions. The 2U CubeSat, jointly built by Nanyang Technological University (Singapore) and Kyutech (Japan), is targeted for launch in Q2 2018 by Japan Aerospace Exploration Agency (JAXA). Aluminium alloy Al 7075-T351 is used for the main structure to meet environment requirements from JAXA (Japan Aerospace Exploration Agency), and Al 6061-T6 is used for other structural components. The 2U CubeSat structure is designed to be simple and modular, focusing on ease of integration. The major components in the structural model are main structure, batteries, reaction wheels, PPT, Printed circuit boards (PCB), hinges, fasteners, fixed and deployable solar panels. Standard CubeSat materials were used for each components in the satellite. Finite element analysis (FEA) on the structure is performed using SOLIDWORKS Simulation to determine the stiffness and strength of the structure. In addition, bolt fail-safe analysis was carried out to confirm the integrity of the assembly at critical g-force conditions. Structural analysis showed that at peak launch environment levels, the maximum stresses developed are quite below the material's yield limit. Vibration tests including modal survey, sinusoidal, random, sine burst and shock test at qualification level with respect to the launch service provider's specifications are carried out for the structural thermal model (STM) in order to validate the structural analysis. The vibration tests results were then compared with structural analysis results and it was found that the CubeSat structure provides sufficient stiffness which is far higher than the minimum required fundamental natural frequency of 113Hz and it could withstand the loads induced by the launch vehicle. thermal cycling, thermal vacuum chamber testing (TVAC) and thermal analysis is carried out on STM to check the operational temperature range for Aoba VELOX-IV.

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