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For a successful space program: Quality and Safety! (1)

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## SURVEY AND ANALYSIS FOR LEANSAT MISSION ASSURANCE STRATEGY

**Abstract**

This paper discusses LeanSat mission assurance strategy based on document surveys, lessons-learned surveys, best practices interviews, and analysis of them. A "lean satellite" is another name to express less than small satellites and a satellite that utilizes a non-traditional, risk-taking development and management approach to provide value of some kind to the customer at a low cost and without taking much time to realize the satellite mission. LeanSat is changing the development philosophies in space utilization, but the mission success rate is generally low compared to traditional satellites. For example, 30% of the CubeSats failed to achieve the full mission success. It is important to overcome the situation to widen the application area of the LeanSat. In Japan, we are trying to solve the problems by making developers support systems through direct and indirect education. Direct education is performed by on-the-job training or helping with project-specific problems. Indirect education is performed by sharing educational materials to help grow the developers by themselves. Sharing a mission assurance guideline is the core part of indirect education. The guideline helps to learn the proper development methods. In the traditional development methods, the main stakeholders are the agencies and most of them have well-established guidelines and mission assurance methods based on their experiences. This is the main difference from the LeanSat applications. LeanSat is still growing up and there are no established methods and guidelines. Therefore, we have to sort out the best methods for mission assurance to make cost-effective products in a short delivery period. Here, we take two main approaches to achieve the purpose. One is the survey on the organizations' approach to support LeanSat class mission assurance. The survey consists of document surveys and on-site interviews of the stakeholders. We already performed main document surveys. In addition, on-site interviews of the ESA/ESTEC and European new space companies were also completed. We plan to perform the on-site interview in the US shortly. The other is the lessons-learned based bottom-up methods. Lessons-learned from the Japanese university projects were sorted out, analyzed the success and failure cases, and extracted the requirements for mission assurance. Further analysis of the failure cases to extract their root causes led to making a handbook for mission assurance. The suitable guideline strategy is discussed by analyzing the all gathered information in this paper.