Cost and Lead Time Minimization in the Production of Micro/Nano satellites

SMART SMALL SATELLITE SYSTEMS THALES IN NTU

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Introduction:

The CubeSat as a concept was introduced and targeted at University groups to allow small space missions to be implemented rapidly. Over the years, because of the relatively low cost and time it takes to develop one, the CubeSat has become a popular standardized concept for building satellites used by researchers and corporations alike.

By nature of the diverse missions of satellites, complete standardization may not be achievable, and further methods to reduce the cost and lead times of building satellites remains attractive especially as production volume increases.

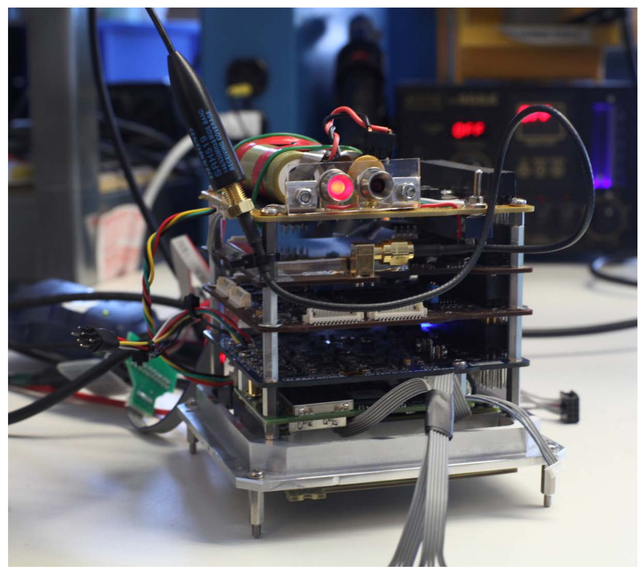

Fig 1. Testing of a 1U CubeSat
Retrieved from: https://www.nbcnews.com/technology/space-all-small-cheap-satellites-may-one-day-do-your-6c10488674

Project Objectives:

Identify major **controllable** cost factors in the development and production of multiple microsatellites (<100kg).

Develop innovative methods that reduce these costs and aid the production of microsatellites.

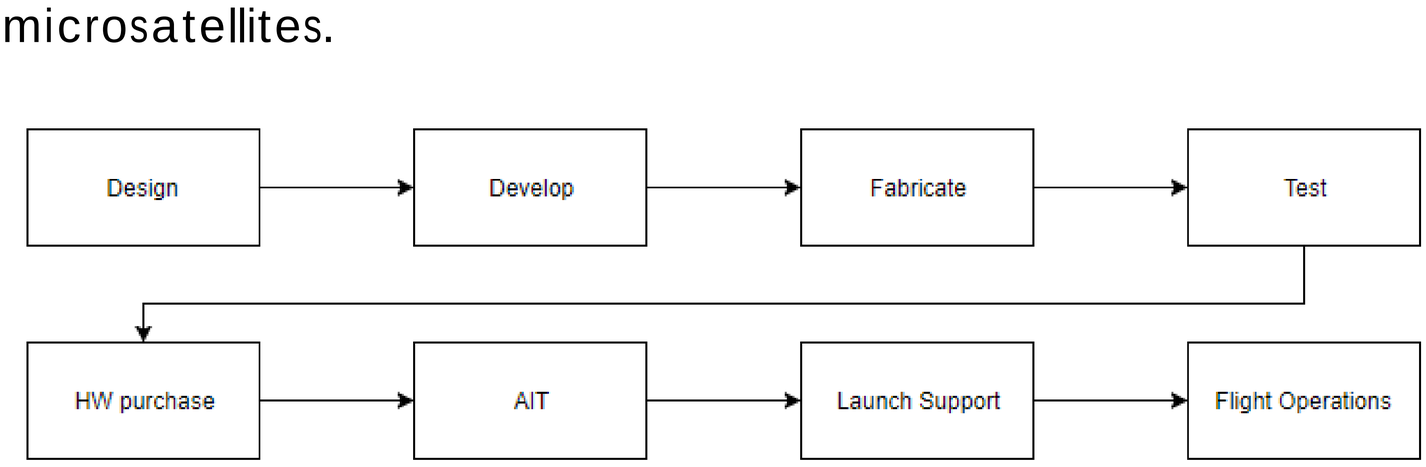

Fig 4. General activities undertaken in a satellite mission

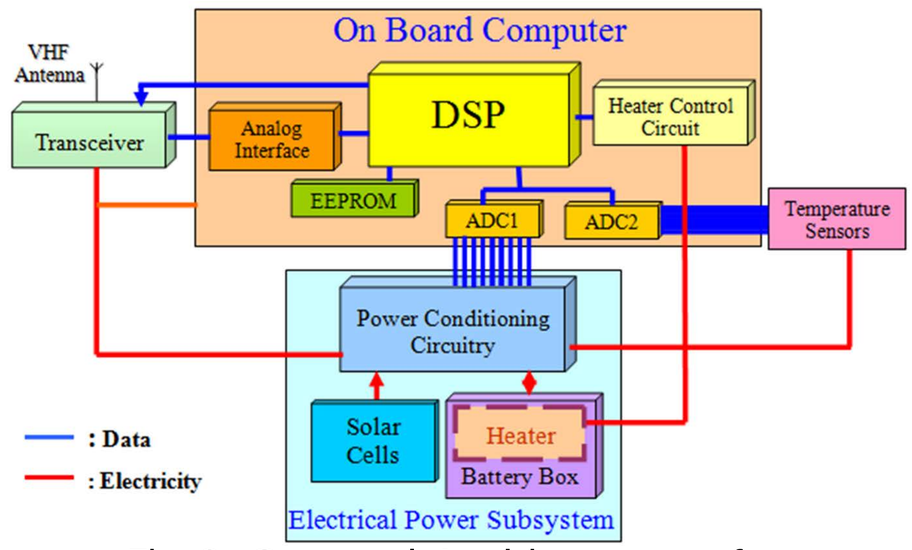

Fig 2. General Architecture of a Telecommunication Cubesat
A. Addaim, A. Kherras and El Bachir Zantou, "Design of Low-cost Telecommunications CubeSat-class Spacecraft," in *Aerospace Technologies Advancements*, Thawar T. Arif (Ed.), InTech, 2010.

$$Cost = n * \sum recurring\ cost + \sum non - recurring\ cost$$

$$NRec\ cost = f(Design, Develop, Fabricate, Test)$$
$$Rec\ cost = f(HW, AIT, Launch, Flight\ Ops)$$
$$n = f(Reliability)$$
$$Reliability = f(process)$$

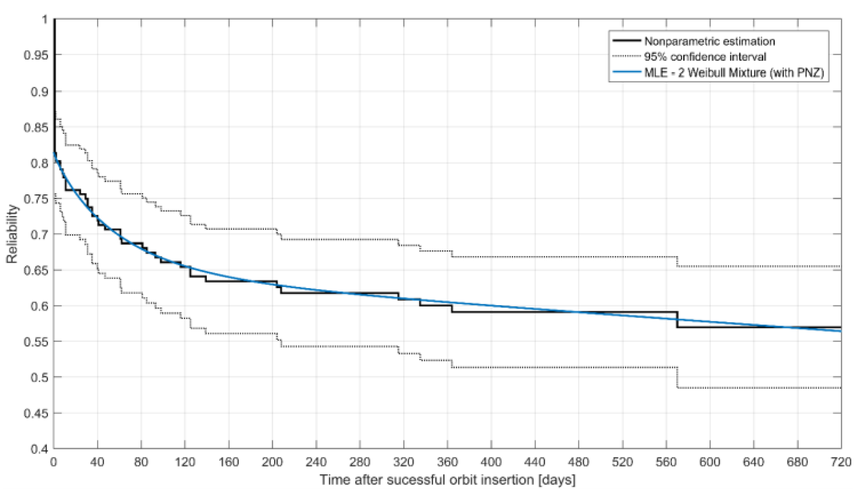

Fig 3. Reliability of CubeSats over 2 years in orbit
M. Langer and J. Bouwmeester, "Reliability of CubeSats – Statistical Data, Developers' Beliefs and the Way Forward," in *30th Annual AIAA/USU Conference on Small Satellites*, Logan, UT, USA, 2016.

Key Differentiators:

- Integration of reliability as a cost factor involved in developing satellites.

Developmental Works:

- Reliability studies of past CubeSats
- Survey of small satellite community procedures
- Investigations of assembly, integration, testing phase of small satellites

Potential Benefits:

- Reduced development costs of microsatellites
- Streamlined workflow

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