(SSC20-P3-23) Facilitating the Development of Innovative Mission Architectures by Connecting the Global Community

Manwei Chan - *MIT (manweic@mit.edu)*
Mary Grace Kalnay - *Concordia University (marygrace.kalnay@spaceconcordia.ca)*
Joshua Schertz - *Colorado School of Mines (jschertz@mymail.mines.edu)*

Background

The introduction of CubeSats presented a revolutionary low-cost alternative to traditional spacecraft engineering, lowering the barrier to entry and allowing new players to join the space industry. Several student organizations, geographically isolated groups, and small businesses have leveraged this opportunity to launch and operate their own satellites. However, not all CubeSat projects are successful. Even with increased access to space, previously excluded groups still face significant challenges that lessen their chances of success. **Forced to focus their efforts on developing the basic skills of building a satellite, they lose the resources to innovate.** The use of the CubeSat standard is intended to promote access to space, yet the remaining challenges many teams face have prompted an evaluation of how accessible CubeSats really are.

Summary

Having sufficient money and time to build a CubeSat does not mean a project will be successful. New and experienced CubeSat developers alike will encounter challenges in their development process that prevent them from producing more innovative and successful missions. The collaborative web-platform, CubeSat Guide, allows expertise and lessons learned from around the world to be shared in a centralized location through expert reviewed technical articles and forums for FAQs and discussions. With access to global resources, all community participants can increase their chances for success.

Interviews

We interviewed 12 CubeSat developer teams of all experiences to understand the pain points and challenges they experience. The interviewees range from university CubeSat teams to experienced CubeSat labs to launch integrators and non-traditional CubeSat developers.

Most teams acknowledged that a lack of accessibility to experts and experienced CubeSat developers hampered progress. Beyond that, many teams noted that existing resources such as SMAD and technical papers were not accessible to many novices in the field. Thus unable to find resources that would allow them to better understand the subject matter, these groups were all together prevented from tackling more advanced resources or mission architectures. Lastly, many first time CubeSat developers lamented the lack of general guidance in starting a project. These interviews allowed us to better understand the issues CubeSat developers face.

Interview Quotes

"If I had a resource to direct my new team members to, I could spend 80% of my time on designing and building our satellite, and only 20% on leading and training the team - the opposite of how my time is currently divided."
- Student CubeSat Team PM

"Having a direct line to other CubeSat student teams would save time and accelerate our learning"
- Student CubeSat Team Member

"For experiential learning opportunities such as CubeSat building to be truly effective and successful long term, the end result must be an operational spacecraft."
- Satellite Parts Manufacturer

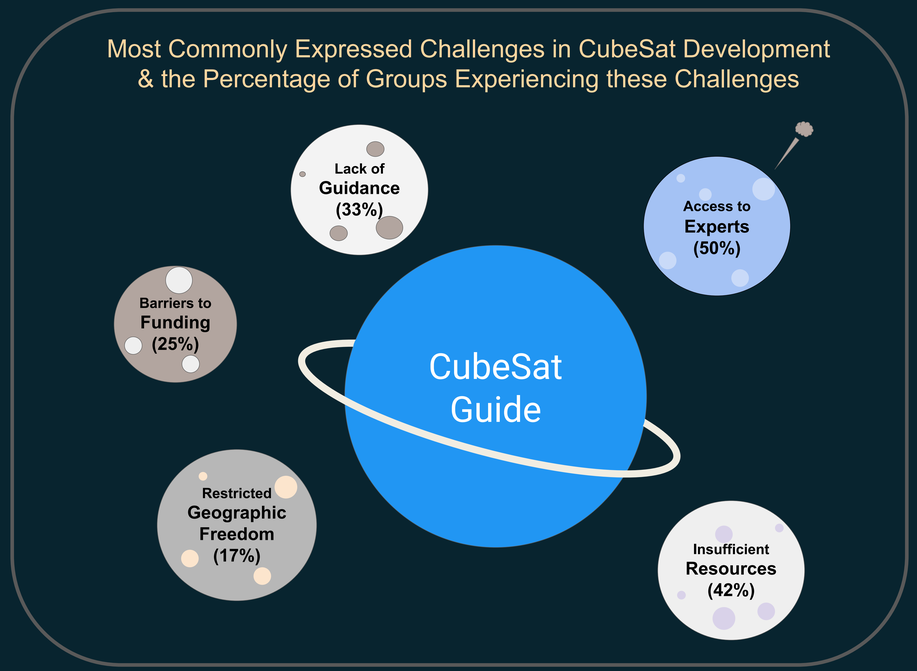
Acknowledgements

We would like to thank all the members of the CubeSat, educational, and broader space communities that took the time to let us interview them for this project. WIthout them, we would not be where we are today. We would also like to thank the MIT Spark program for providing invaluable guidance for conducting interviews. The experiences we gained through the program helped shape our research and probe deeper into existing industry issues.

Our Solution

We developed an **interactive**, **open-access** web platform of CubeSat specific information, best practices, lessons-learned, and a community forum. Evergreen content is developed and reviewed by industry experts, providing a **centralized resource** of information. The content covers both the theory and practical application, allowing users to learn the basics and then implement a particular topic. Not all topics are technical; management, team dynamics, finances, and marketing are just a few non-technical topics that every CubeSat teams will have to overcome.

A **community forum** provides users the ability to ask questions, share ideas, and become engaged with other CubeSat developers. Building an **open and inclusive community** within the CubeSat field is very important for teams with limited access to in-person knowledge resources, such as teams in regions without an established aerospace industry presence.



CubeSat Guide webpages offer high-level mission planning tools, and detailed technical explanations to serve a range of users and levels of expertise.

Conclusion

From first-time builders to experienced and well established CubeSat programs, there are common struggles that teams are likely to face during the development and operation of CubeSats. To increase knowledge sharing and promote accessibility to groups without in-house expertise, the CubeSat Guide offers benefits to all groups ultimately encouraging a perspective shift from the repeated learning of CubeSat basics, to innovative mission architectures of the future.