

Improving Efficiency – Applying Modularity and Interface Standards to SmallSat Missions

Carrie O'Quinn
carrie.l.oquinn@aero.org

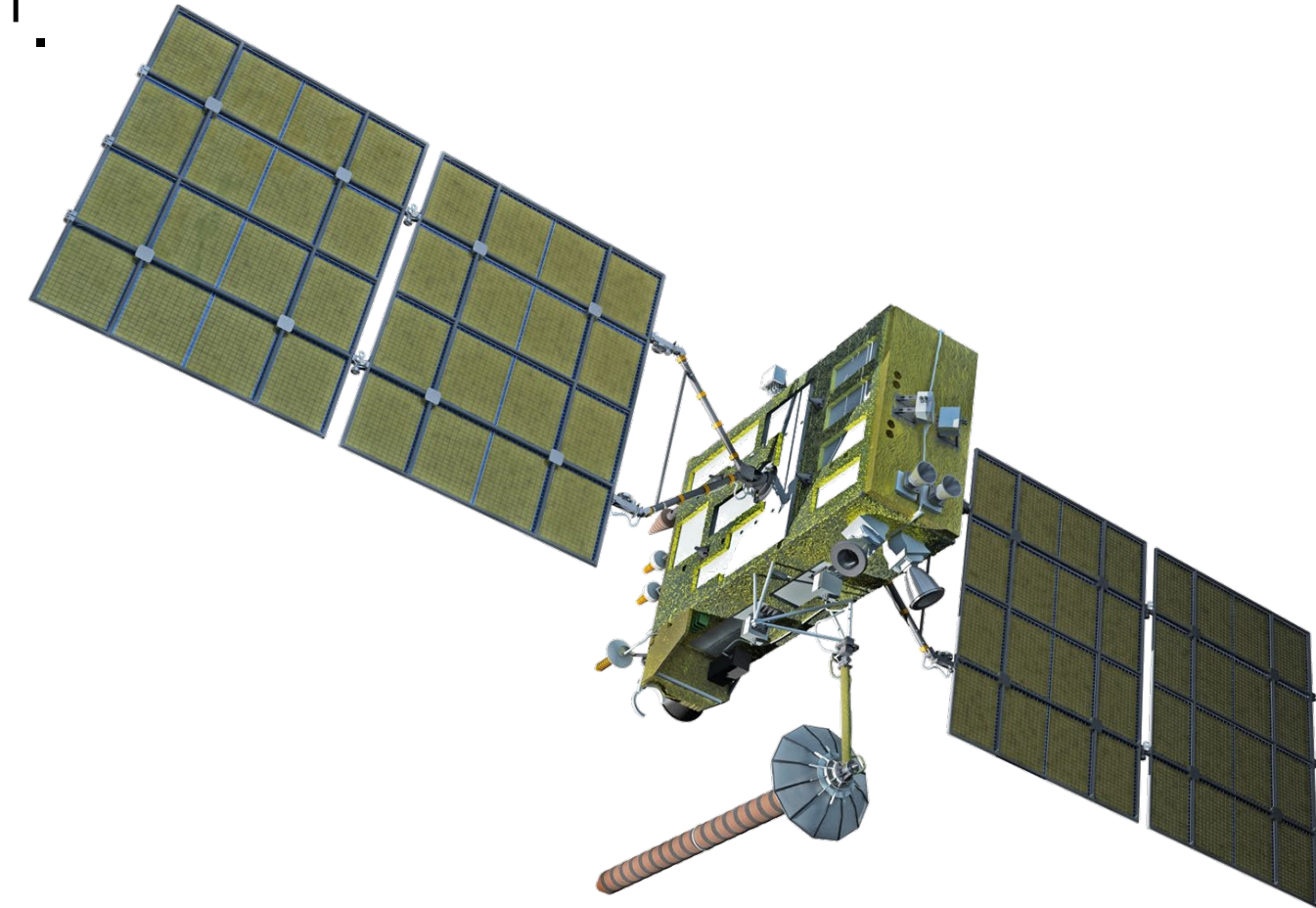
Hannah Weiher
hannah.weiher@aero.org

Kara O'Donnell
kara.a.odonnell@aero.org

Space Segment

Traditional Payload Development

Traditional payload development is tightly coupled with a proprietary spacecraft bus. These high value assets are slow paced with limited innovation opportunities. It results in a focused, targeted mission which must be highly optimized and endure for years¹.



Modular Plug-and-Play Interfaces

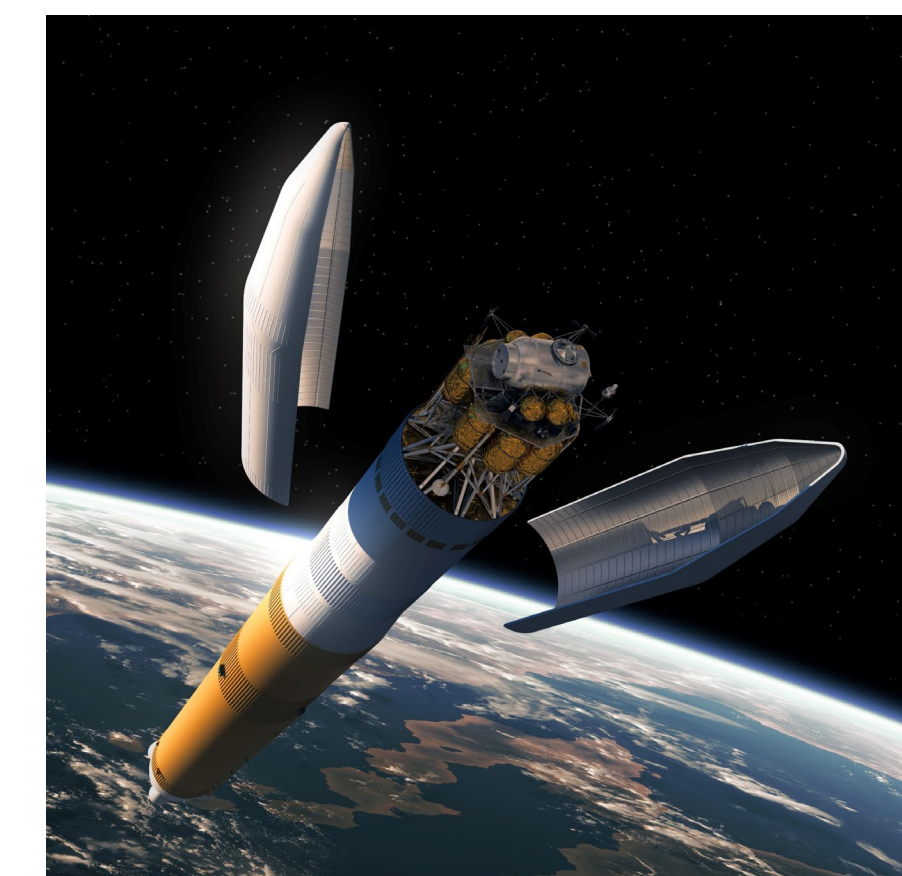
Modular plug-and-play interfaces, such as the Slingshot Handle model, offer more agility and flexibility in satellite development. The interfaces leverage open-sourced systems and standard interfaces that would not require a customized bus. The modular architecture decouples the payload development from the bus procurement. It allows flexibility to assign a payload to a specific satellite very late in the development process on both ends, thereby enabling rapid technology insertion⁴.



Launch Segment

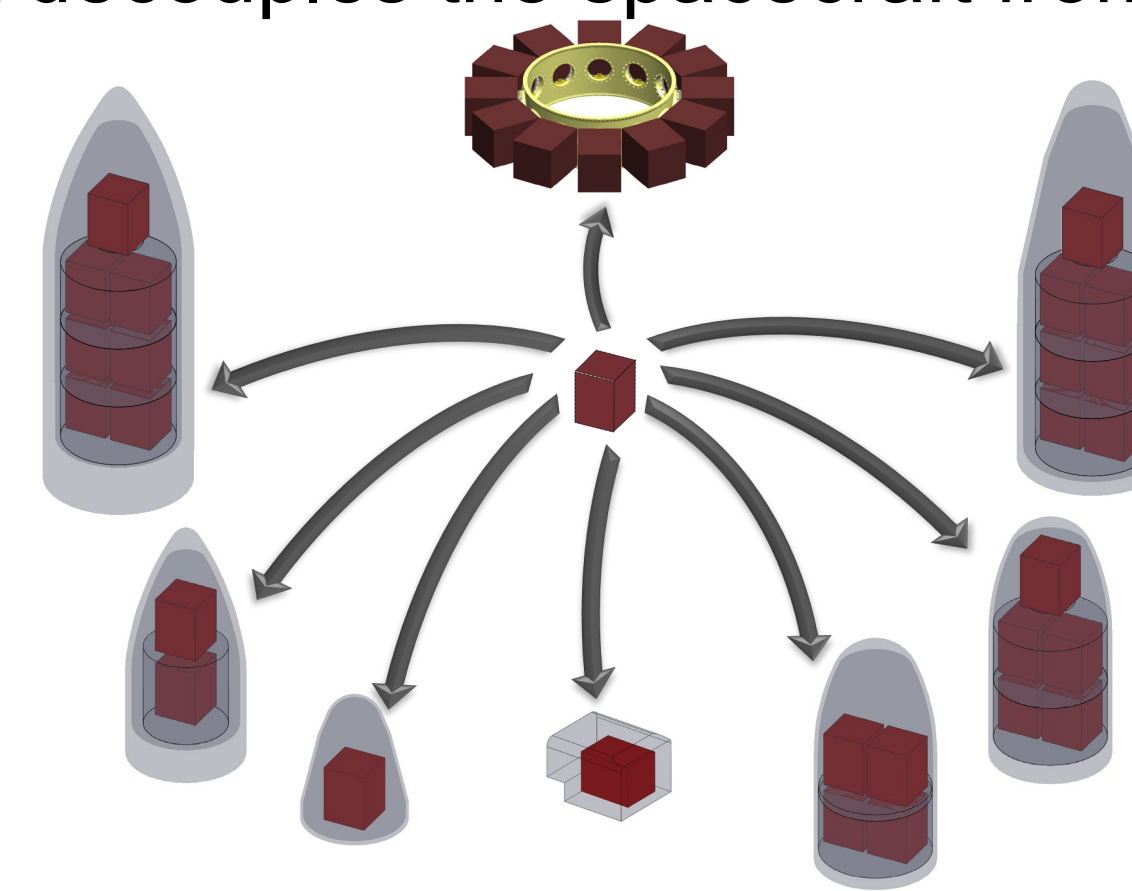
Traditional Launch Interfaces

Launch vehicle to spacecraft interfaces have traditionally involved defining the specific launch vehicle early in the spacecraft development. In some cases, the mass, dynamic properties, and volume must be defined two or more years before launch, thereby committing the spacecraft design early in the development and offering little room to change launch options as the spacecraft matures².



Interchangeable Launch Interfaces

Developing and implementing standard spacecraft to launch vehicle interfaces increases the launch flexibility for spacecraft. Specifically, the Aerospace led LaunchU standard allows swapping mid-sized SmallSats late in the launch flow without impacting launch vehicle analyses, such as coupled loads analyses or mass properties analyses. It decouples the spacecraft from a specific launch vehicle, permitting the launch vehicle and spacecraft manufacturers to develop independently from one another⁵.



Ground Segment

Traditional Ground Segment

Conventionally, sophisticated spacecraft require a dedicated ground segment. The challenges with developing a dedicated ground segment include the large cost, timeline for development, and fixed locations for the ground stations³.



Ground Segment as a Service (GSaaS)

Ground Segment as a Service (GSaaS) offers a turnkey end-to-end solution for the ground segment. This enables the satellite manufacturer and operator to focus on the mission and not development of a ground segment. It also leverages the large set of ground stations GSaaS companies already have deployed and proven⁶.



Capitalize on modularity and interface standards to enable faster access to space for new technologies

References:

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²D. Pignatelli, R. Nugent, A. Johnstone, P. Faure and J. Bellardo, "Leveraging the Success of the CubeSat Standard to Create a SmallSat Standard for ESPA," August 2020. [Online]. Available: <https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=4751&context=smallsat>. [Accessed 26 October 2021]

³U. Ukommi, E. Ubom, and I. Ikpaya, "Ground Station Design for Satellite and Space Technology Development," Am. J. Eng. Res. 2022;10:12-19.
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