SCIENCE PAYLOADS AND ADVANCED CONCEPTS FOR EXPLORATION (SPACE) TOOL. P. E. Clark[1], Z. M. Himwich[2] , A. M. Natarajan[3], and H. N Vo[4]. [1]NASA Jet Propulsion Laboratory (Pamela.e.clark@jpl.nasa.gov), [2]Stanford University (zhimwich@stanford.edu), [3]University of Maryland, College Park (aparnan@terpmail.umd.edu), [4]University of Washington (huongnvo@uw.edu)

Abstract: Here at Goddard Space Flight Center, we have developed an online CubeSat design tool, geared towards deep space exploration based on a specific mission requirement – henceforth referred to as the SPACE tool. The tool is ideal for scientists and engineers who wants to draw up a complete, but preliminary system, consisting of parts that are a mixture of commercial off the shelf, as well as research innovations – making the overall cost much more manageable. SPACE walks the user through a series of questions and forms, eventually parsing these parts together for a final design consisting of seven separate subsystems. We hope that with the development of this tool, we can eventually move towards a standardization of the CubeSat paradigm, making it cheaper, faster, and easier than ever to design a CubeSat.

Introduction: CubeSats are small satellites grouped under the umbrella category of nano-satellites, coming in units that are each 10 cm x 10 cm x 10 cm, weighing about 1.33 kg [1]. A CubeSat can, and often, consists of multiple units of various configurations depending on the mission requirements. It was first introduced in 1999, by Bob Twigs (Stanford) and Jordi Purig-Suari (Cal Poly), in order to allow graduate students to develop and test small, low cost spacecraft in low earth orbit [2]. Since then, the idea of miniature, economical spacecraft has become increasingly popular, propagating CubeSat development as well as the miniaturization of existing technologies all throughout the professional market.

While CubeSats have become very ubiquitous and economically sustainable within low- earth orbit, they are not being utilized to their full potentials – i.e., beyond the low-earth orbit. We feel that this is the logical next step, based on several different facets of the CubeSat paradigm. First and foremost, if we begin to use CubeSats for deep space science missions, we can obtain a dynamic view of the target through a multi-platform approach, instead of the current, static view we are able to achieve through the use of one conventional spacecraft. Furthermore, CubeSats can be easily integrated as a secondary payload, with minimal expenditures. Its small form factor allows for a reduction of launch costs, and the standardization leads to a predictability that will reduce failure rates. With the SPACE Tool, we are encouraging the user to develop missions for targets much beyond LEO (although that will be an option), through introducing instrumentation and subsystems that were developed for use in a deep space environment.

References:

[1] "CubeSat Design Specification Rev. 13" (PDF). *California State Polytechnic University*. [2] Messier, Douglas (22 May 2015). "Tiny 'Cubesats' Gaining Bigger Role in Space". *Space.com*.