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LEARNING TO FOLLOW: EMBRACING COMMERCIAL TECHNOLOGIES AND OPEN SOURCE FOR SPACE MISSIONS

Abstract

A large proportion of the space industry is moribund with long development cycles, high, rising costs, and an extreme aversion to risk. Meanwhile, other industries such as consumer electronics see development cycles between 3-6 months, exponentially lowering costs per unit capability and a more lenient attitude towards risk. Why aren't these trends seen more widely in the space industry?

Based on our experience with the NASA PhoneSat project and the joint SSTL and SSC STRaND-1 mission, we explore the possibilities that arise by adopting innovations from outside industries. The smartphone technology central to both our efforts is a good example, with the smartphone industry investing billions to produce robust, tightly packaged devices with very high levels of capability. Using this technology as-is offers many benefits. These include leveraging widespread open source software, the opportunity for extreme rapid prototyping, and faster, cheaper missions with potentially higher capability. Significantly, this approach dictates a new paradigm with different rules. There is room for greater risk tolerance, spacecraft can be disposable (while still being mindful of debris issues). They can be designed, built and be flight ready on very tight timescales (days or weeks), and also launched in great quantities, offering technological and responsive capabilities not feasible today.

The fast iteration time-scales of the hardware coupled with open source software and open hardware platforms also allow for the rapid prototyping and testing of spaceflight software. The capability for fast release cycles is something not typically seen in space-flight software. Smartphones in particular offer standardized platforms for software development, as well as very large communities of talented programmers. This allows the focus of innovation to ultimately shift away from the hardware, and further into the software and information technology domains.

The open source aspects of our efforts also open up the opportunity for many people to undertake their own space exploration, from high school students to hobbyists and other technology enthusiasts. While CubeSats and other opportunities have been possible for some time, it is only through this approach that we are capable of easily producing high-capability spacecraft within the means of ordinary people. This means that their efforts are also meaningful, and could provide valuable contributions to science and human wellbeing on Earth.