

CECIL, 1U Amateur Radio CubeSat

(Technical Report)

The Right Rocket for the Job:
Small Launch Providers Target Small Satellites

(STS Research Paper)

An Undergraduate Thesis Portfolio
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by

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How can we efficiently and reliably put scientific and communications equipment into orbit? The proliferation of man-made satellites in Earth's orbit, originating in the Space Race, has dramatically improved global communications and scientific investigation. Recent technological innovations in smallsats have led to the greatest increase in satellite launch rates since the mid-20th century, with extensive implications.

What is the most reliable and economic satellite design that enables communication between the global amateur radio community? To improve our satellite connectivity, educate students, and promote global interest in space exploration, the MAE 4690/4700 Spacecraft Design class has designed a communications satellite that anyone with a radio can use to communicate. This CubeSat, currently named Communication-Enabling Cubesat In Leo (CECIL), will facilitate ground communication among the amateur radio community as a repeater and intermittently broadcast live HD images of the Earth over SSTV using a transceiver provided by our partners at AMSAT. Due to the partial mission failure of UVA's first CubeSat, *Libertas*, our team has prioritized mission reliability, within obvious budgetary constraints, above all else. Preliminary computer simulation shows a high chance of success, but the task of assembling, launching, and operating CECIL will now fall to future Spacecraft Design classes.

What are the implications of the recent proliferation of smallsats within and beyond the orbital launch industry? The relative accessibility and affordability of smallsats has greatly increased the number of satellites in orbit. The data these satellites provides has noteworthy impacts on governments, businesses, universities, and individuals, but perhaps no industry is more profoundly impacted by this change than orbital launch providers. In the last decade, hundreds of new startups have been attempting to build smaller rockets to specifically target this

growing economic niche. Likely, all but a select few of these companies will go bankrupt, but the current era of uncertainty and competition is yielding technological innovations, creating jobs, and enabling more rocket launches than ever before.

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