

Editorial

WE CANNOT think of anything quite as exciting as reaching zero in a terminal countdown sequence and hearing *lift off!* For the IEEE JOURNAL ON MINIATURIZATION FOR AIR AND SPACE SYSTEMS (J-MASS), this is that singular moment when we achieve the first issue of what promises to be the beginning of a journal devoted to one of the most rapidly emerging areas of technology and applications—the proliferation of small but highly capable platforms flying within the Earth’s atmosphere and without.

Drones or unmanned aerial vehicles (UAVs) are a nearly \$6B market expected to grow to \$12B by 2021 [item 1) in the Appendix]. There has been very rapid adoption by amateur users who use them for photographic access, racing, and general recreational sport flying under the 400’ (122 m) ceiling. The range of commercial applications also continues to grow. UAVs find uses in precision agriculture where they can image crops to identify nutrient, water, and pest stress and apply pinpoint treatments. Drones are widely used to perform surveys of hard-to-reach areas such as rooftops or for hazardous locations like HV transmission lines or to inspect wind turbines. The ability to carry small masses over short distances for package delivery has been explored with limited commercial success to convey pharmaceuticals as one example. Drones are now routine tools in the movie-making industry to provide flexibility of camera position. There are also a number of other entertainment examples, including swarms from Intel [item 2) in the Appendix] and startup Verge Aero [item 3) in the Appendix]. The latter is unique for supporting flexible payloads to allow conversion from lights for entertainment to a custom-built payload for another application. UAVs have long established themselves in defense applications where they are used for reconnaissance and as weaponized platforms. Emergency response has also benefitted from drones, which can be used to survey large areas to identify stranded people in need of rescue. It is clear that UAV evolution will continue at an accelerating pace.

The frontier above that of UAVs belongs to small satellites, variously termed smallsats, nanosats, CubeSats, or picosats. These small, standardized form factor satellites serve a wide range of uses. Initiated by pioneering work done at Cal Poly and Stanford [item 4) in the Appendix], the initial design has evolved into sizes ranging from 1U to over 6U (where 1U is a volume 10 cm × 10 cm × 10 cm). CubeSats have dramatically lowered the entrance barriers to developing a small satellite by orders of magnitude—costs as low as around \$10k/1U are available [item 5) in the Appendix]. Rideshare launch arrangements are widely available through government-sponsored space on other mission flights, and from commercial smallsat launch providers. The applications for CubeSats have

expanded from early technology demonstrators to a wide variety of scientific payloads. Commercialization includes examples such as Planet Labs [item 6) in the Appendix] whose over 150 CubeSats offer multispectral and hyperspectral imaging with resolutions ranging from 50 cm to 5 m. The elephants in the room are the many companies beginning widespread satellite Internet constellations, which means that future LEO CubeSats should have access to more flexible and higher bandwidth communication options eliminating the need for the classic RF up/downlinks. These are indeed exciting times for space-based measurement platforms.

Like anything of complexity and value, it takes a team to pull it off and sustain the effort. J-MASS is no exception. Supported by a consortium of IEEE member councils and societies, the journal was conceived as a forum for publishing the works of the growing number of contributors to the UAV and smallsat communities. There are many to thank—some at the top of the list include Bob Rassa for providing the impetus and guidance for navigating the approval process, Bill Emery for leading the Steering Committee, Alison Larkin for establishing the Scholar One portal, Peter Tuohy and Mike Spector for creating and maintaining the website, and all the others who in some measure helped with the launch and who will sustain it in the years ahead.

The success of J-MASS depends on a steady flow of high-quality papers—please continue to get the word out about this publication opportunity!

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APPENDIX RELATED WORK

- 1) *Commercial Unmanned Aerial Vehicle (UAV) Market Analysis-Industry Trends, Forecasts and Companies*. Accessed: Jun. 7, 2020. [Online]. Available: <https://www.businessinsider.com/commercial-uav-market-analysis>
- 2) *Shine Bright With Intel Drone Light Shows*. Accessed: Jun. 7, 2020. [Online]. Available: <https://www.intel.com/content/www/us/en/technology-innovation/aerial-technology-light-show.html>
- 3) *Why Fly With Verge Aero?* Accessed: Jun. 7, 2020. [Online]. Available: <https://verge.aero/>
- 4) *CubeSats in Brief*. Accessed: Jun. 7, 2020. [Online]. Available: <https://www.isispace.nl/cubesats/>
- 5) *IOS CubeSat Kits*. Accessed: Jun. 7, 2020. [Online]. Available: <https://www.interorbital.com/Cubesat%20Kits>
- 6) *Planet Imagery and Archive*. Accessed: Jun. 7, 2020. [Online]. Available: <https://www.planet.com/products/planet-imagery/>

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