3D Wireless: The promise and challenges of next-generation space and airborne wireless systems

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Silicon Flatirons Center for Law, Technology and Entrepreneurship
University of Colorado Law School, Boulder, CO

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Summary

There is a wave of innovation in airborne and orbiting systems, from drones to new thousand-satellite constellations. It poses difficult questions of who's in charge, and how to coordinate increasingly complex operations to prevent harm. Experts will debate these issues in a series of panels, preceded by a primer to introduce the topic, and a keynote.

Overview

Silicon Flatirons' Fall 2017 spectrum conference will address the promise and challenges of next-generation airborne and space wireless systems the afternoon of Wednesday October 4th in Boulder, CO. A bag-lunch pre-conference session will provide an overview of the technology, business, and regulatory questions that will inform the discussion.

Communication and observation platforms are being deployed at the full range of altitudes from ground level up to and beyond geostationary orbit. The growing number of platforms poses new questions of identification and coordination to prevent harmful collisions, both physically and between communication signals. This is becoming a complex 3D problem because of new high-throughput geostationary satellites, planned constellations of low earth orbit satellites, clouds of CubeSats, high altitude broadband platforms like Facebook's Aquila and Google's Loon, and the mass deployment of small drones.

There are ongoing and emerging tussles and cooperation between terrestrial, airborne and space interests. While interference between satellite and cellular is well known, it is now occurring in new bands, and with much larger and more dynamic systems on both sides. Not only the spatial relationships but also the time dynamics of interference is changing and becoming more complex.

These systems are governed by public and private bodies with intersecting responsibilities but different interests and expertise. This wave of innovation poses engineering and policy challenges that implicate aeronautical, aviation and communications agencies at the national (e.g. FCC, FAA, NASA, DoD) and international (e.g. ITU and ICAO) levels.

There are significant differences in the governance frameworks for terrestrial and satellite systems. Terrestrial assignment mechanisms like license auctions and unlicensed use have not yet been applied to satellite systems; and international coordination plays a much larger role for satellites than for terrestrial services, where national spectrum regulations continue to dominate (especially for large countries like the US where cross-border interference and international harmonization is not a high priority).

We are building, and will soon be managing and using, a 3D wireless world. *Building* these systems encompasses the engineering challenge of creating the devices and systems to realize the vision; developing new business models and finding funding; and the policy challenge of creating a new regulatory framework, encompassing aeronautical, aviation and communications agencies. *Managing* them includes the measurements, operations, and government regulations to ensure the effective and beneficial operation of the components and systems. *Using* them covers all the applications that use the 3D wireless infrastructure, from earth science and weather forecasting to navigation to delivering broadband services in new ways, to name a few.

Topics

The conference will focus on the intersection new air and space technologies with spectrum policy. It will explore this area under three headings:

- **Innovation**. New technologies and business models are emerging, like lightweight drones, affordable flat antennas, a private spaceflight industry, and much more. What are the driving factors and critical uncertainties that will determine their maturation? Will the new approaches coexist with, or disrupt, established models? Are there techniques being developed in one sector that could accelerate deployment in another, such as millimeter-wave radio technology or automated traffic management?

- **Challenges**. Are there new hazards to contend with, or new wrinkles to old ones? For example, large-scale deployments are likely at many altitudes, e.g. low and high altitude drones, and non-geostationary satellites in low, medium, and highly elliptical orbits. What are the challenges of coordinating both the objects and their operators to avoid collisions? Are there problematic overlaps between governing institutions at the national level (e.g. FAA, FCC, NASA, DoD), and the international level (e.g. ITU, ICAO), and between national and international agencies? How will transitions play out, e.g. GSO operators transitioning to high throughput satellites, the impact of declining launch costs and new competitors, and large vs. small drones.

- **Solutions**. New technologies will both compete and cooperate with the old; how can entrepreneurs and regulators find the optimum balance? Different technologies, such as terrestrial and satellite broadband, have different value propositions and replacement timescales; how should regulators give all their due? How can regulators encourage deployment of advanced technologies (such as interference avoidance) that benefit non-deployers as much as (or more than) as deployers, in the absence of market mechanisms like auctions? What is the role of identification and databases in avoiding harmful interactions?

Schedule

12:00 – 12:45 pm:	Primer
1:00 – 1:15 pm:	Welcome and introduction
1:15 – 1:45 pm:	Keynote
1:45 – 2:45 pm:	Panel 1 – Innovation
2:45 – 3:00 pm:	Break
3:00 – 4:00 pm:	Panel 2 – Challenges
4:00 – 4:15 pm:	Break
4:15 – 5:15 pm:	Panel 3 – Solutions
5:15 – 5:45 pm:	Wrap-up