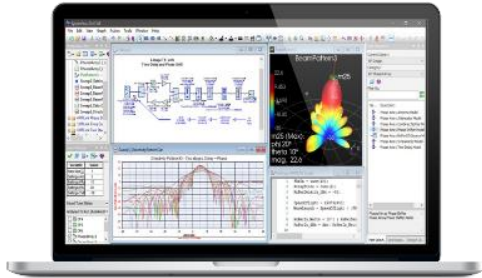


Engaging New SatCom Missions

Hit aggressive goals with PathWave System Design

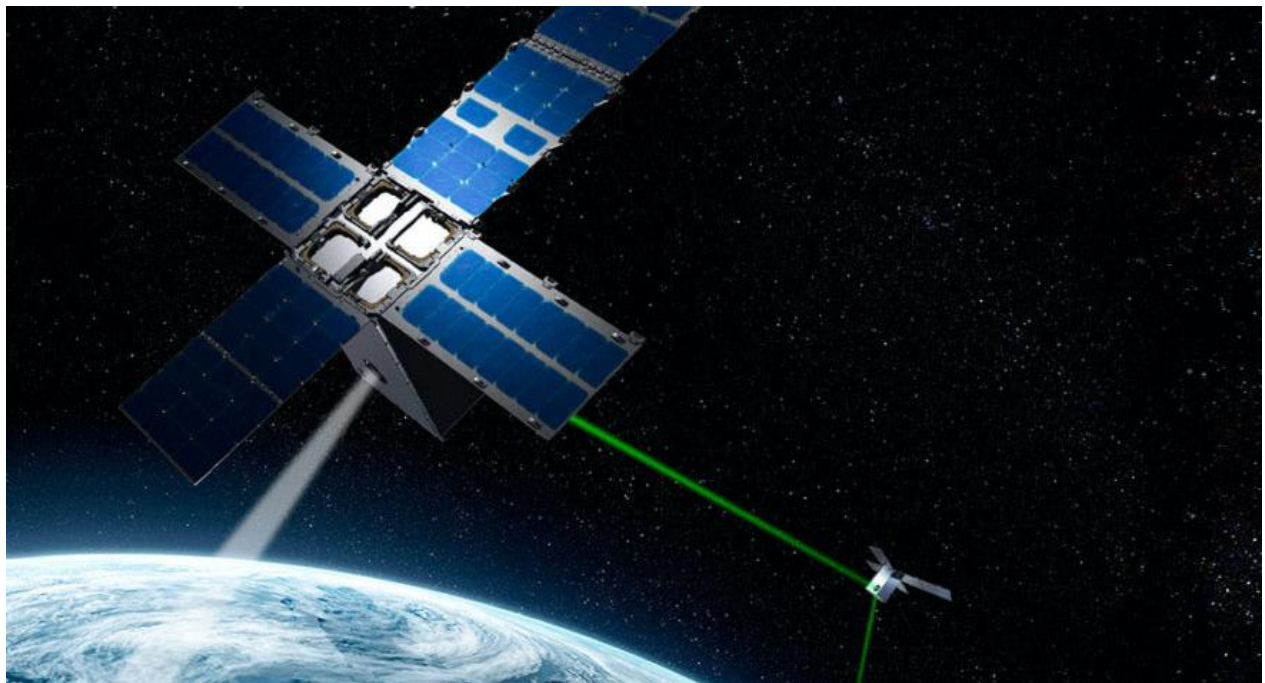
Facing Tighter Schedules, SWaP-C, and Inter-Orbital Dependencies



SatCom development teams are looking to keep pace with rapidly evolving space-based capabilities. Amid a surge in launch vehicles, satellite service providers anxious to get into orbit are putting extreme pressure on development schedules. Smaller satellites with advanced processing create aggressive SWaP-C (size, weight, power, cost) targets for RF designs.

New missions are also emerging, with two defining characteristics. First, layers of capability – ground-based, air-based, and orbital – coordinate in service delivery. Second, everything in is motion at all times, making acquiring, holding, and handing off signals much more complicated.

Simply automating design is no longer enough. Today's complex RF design tools are connecting in an authoritative digital 'source of truth', sharing data and measurements gathered from simulations and real-world observations. PathWave System Design brings RF modeling, simulation, connections with enterprise system engineering tools, and Keysight measurement science together for SatCom teams looking to hit aggressive mission goals with digital engineering.



Replace Real-World Activities with Digital Ones

With SatCom systems no longer self-contained, the need for a virtual digital equivalent – a digital twin – is greater than ever. Components and processes must be rendered so realistically, including RF effects and interaction between RF systems, that the virtual environment allows replacing real-world activities with digital ones.¹

Consider the vision the US Space Development Agency (SDA) has for two overarching capabilities: beyond-line-of-sight ground and maritime targeting, and targeting missiles already in-flight. The National Space Defense Architecture has seven layers of transport, battle management, tracking, custody, deterrence, navigation, and support – all working together in coordination. In a spiral development approach, successive launches of satellites add capabilities every two years.²

In commercial space, a similar change is taking place requiring coordination between layers of systems. Use cases including 5G non-terrestrial networks, SatCom-assisted aerial networks, satellite IoT networks, and earth observation data collection are appearing.³

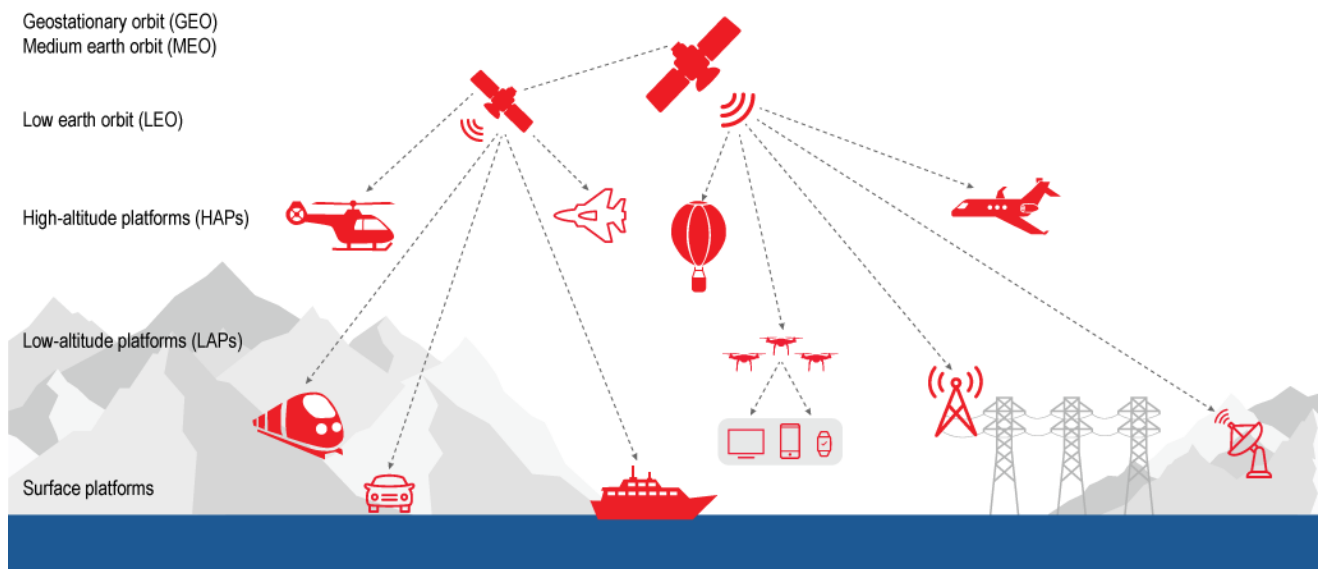


Figure 1. Layers of systems at various altitudes add network capability and flexibility

¹ "There Is No Spoon: The New Digital Acquisition Reality", Dr. Will Roper, US Dept. of the Air Force, October 7, 2020.

² " 'Warfighter Council' Guides Capability Development for Space Development Agency", C. Todd Lopez, DoD News, March 4, 2021.

³ "Satellite Communications in the New Space Era: A Survey and Future Challenges", Kodheli et al, IEEE Communications Surveys & Tutorials, March 2, 2020.

It's becoming less feasible to field one SatCom system without knowledge of what other interconnected systems are doing. Only accessible, highly accurate digital representations can provide that knowledge – and enable sharing it with others. PathWave System Design gives SatCom teams an edge in replacing real-world activities with four key digital system engineering capabilities:

- Integrate mission planning and scenario modeling into RF system architecture
- Create virtual prototypes of RF systems, evaluating risks before developing physical prototypes
- Minimize SWaP-C issues by exploring and optimizing RF system design margins
- Model accurate real-world performance using Keysight measurement science

Enhance Digital Engineering with PathWave System Design

Integrate mission planning and scenario modeling with RF system simulation

The geostationary broadcast mission is giving way to broadband missions in Low Earth Orbit (LEO) and Medium Earth Orbit (MEO). New constellations introduce kinematics that RF systems must handle. System coexistence issues like spectrum sharing and interference between orbits complicates scenarios.

Statistical models are insufficient for these dynamic environments. Multi-domain RF system simulations in PathWave System Design can connect with accurate models of satellite orbital motion and antenna orientation in STK from AGI, an Ansys company. Architectural elements like antenna and beam steering can be fully tested in virtual prototypes with scenarios encountered during orbit.

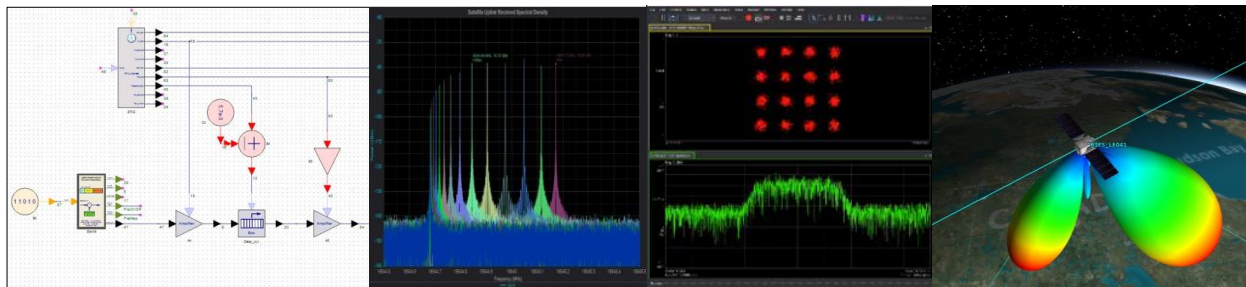


Figure 2. Modeling dynamic satellite communications with PathWave System Design and STK

Quickly create high-fidelity virtual prototypes of RF systems

SatCom system complexity is rising. Higher frequencies, multibeam architectures and clustered feeds, active electronically scanned arrays (AESAs) with distributed amplification, and more drive on-board processing demands. Simulation without real-world RF effects leads to redesign cycles.

PathWave System Design offers extensive phased array modeling and analysis, with accurate RF effects. Ready-to-use waveforms and modulation save development time, and MATLAB® algorithms and Python code can connect with PathWave System Design workspaces and libraries.

Explore more design options faster and optimize for SWaP-C

Locking in on one functional design may fall short in meeting SWaP-C goals. But, slow or inaccurate virtual prototypes make exploring and optimizing designs a tedious process teams often skip.

PathWave System Design creates time for RF design exploration with its 'best-in-class' multi-domain simulation speed at near-circuit-level fidelity. Extending the capability with connections to PathWave Advanced Design System (ADS) and PathWave RFIC Design adds co-simulation including layout and thermal effects.

Accurately model real-world RF system performance

Decades of Keysight experience in RF instrumentation puts powerful measurement science in the hands of any system architect. Stimulus used for simulations can also be used for lab testing. Measurement results can feed back into models, increasing RF fidelity and enabling hardware-in-the-loop capability.

Save time with built-in RF modeling excellence

PathWave System Design goes beyond math-based modeling with a complete RF-aware design workflow, plus decades of Keysight measurement science in RF instrumentation, ready for any system architect. Component libraries are available from Analog Devices, Mini-Circuits, Qorvo, X-Microwave, and others, and open interfaces allow building new models from datasheets. It's the most advanced solution for virtual prototyping and design of complex RF systems.

For More Information on PathWave System Design

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