



Satellite Communications Payload and System

By Teresa M. Braun

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This is the first book primarily about the satellite payload of satellite communications systems. It represents a unique combination of practical systems engineering and communications theory. It tells about the satellites in geostationary and low-earth orbits today, both the so-called bent-pipe payloads and the processing payloads. The on-orbit environment, mitigated by the spacecraft bus, is described. The payload units (e.g. antennas and amplifiers), as well as payload-integration elements (e.g. waveguide and switches) are discussed in regard to how they work, what they do to the signal, their technology, environment sensitivity, and specifications. At a higher level are discussions on the payload as an entity: architecture including redundancy; specifications--what they mean, how they relate to unit specifications, and how to verify; and specification-compliance analysis ("budgets") with uncertainty. Aspects of probability theory handy for calculating and using uncertainty and variation are presented. The highest-level discussions, on the end-to-end communications system, start with a practical introduction to physical-layer communications theory. Atmospheric effects and interference on the communications link are described. A chapter gives an example of optimizing a multibeam payload via probabilistic analysis. Finally, practical tips on system simulation and emulation are provided. The carrier frequencies treated are 1 GHz and above. Familiarity with Fourier analysis will enhance understanding of some topics. References are provided throughout the book for readers who want to dig deeper.

Payload systems engineers, payload proposal writers, satellite-communications systems designers and analysts, and satellite customers will find that the book cuts their learning time. Spacecraft-bus systems engineers, payload unit engineers, and spacecraft operators will gain insight into the overall system. Students in systems engineering, microwave engineering, communications theory, probability theory, and communications simulation and modelling will find examples to supplement theoretical texts.



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Editorial Review

From the Back Cover

Covers both payload systems engineering and applied communications theory

It takes more than ten years on the job for a communications-satellite payload engineer to "know" the payload. *Satellite Communications Payload and System* accelerates that learning. It provides the information needed to design, develop, specify, analyze, and validate a payload that will work as part of the end-to-end (that is, ground-to-space-to-ground) communications system. It explores the technology of payloads currently on orbit.

This is the only book that:

- Describes the payload units at a systems engineering level, plus tells how they work. The units are antennas, low-noise amplifiers, frequency converters, filters, high-power amplifiers, and units particular to processing payloads
- Sufficiently describes what the on-orbit environment does to payload electronics over the satellite's lifetime
- Connects communications theory to the details of payload and link behavior
- Contains a probabilistic treatment of multi-beam payload performance with atmospheric, over life
- Gives tips on how to ensure quality of end-to-end communications system simulation

Satellite Communications Payload and System is the ideal guide and reference for systems engineers of the payload or the end-to-end communications system, at all career stages. It is an important resource for satellite customers, proposal writers, payload unit engineers, spacecraft bus engineers, and control center engineers who want reliable payload information. It provides real examples for students of systems engineering, microwave engineering, space technology, communications theory, probability theory, and communications simulation.

About the Author

TERESA M. BRAUN, PhD, is President of Braun Communications Consulting GmbH. She has twenty-six years' experience in satellite and ground systems and technology, twenty-three in communications, and three in navigation, at major corporations. She earned her PhD at UCLA in electrical engineering in 1989.

Users Review

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Ron Lauer:

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