AEROSPACE

COMMUNICATION TECHNOLOGIES AND ENGINEERING DIVISION

All spacecraft, launch vehicles, ground systems, and operators rely on successful communications. Mission communication satellites, wideband links, command and telemetry, as well as space and terrestrial communication networks and their enabling technologies are the domain of the Communication Technologies and Engineering Division (CTED). The division contains communications systems expertise across all phases of the engineering lifecycle. This includes early-stage research and development on advanced concepts and technologies and working closely with our customers to understand and define their needs and priorities. CTED expertise also spans architecture development, systems design, implementation, test, fielding, and operations to ensure robust and resilient communications.

CTED also maintains an impressive array of laboratories, software tools, and computing resources available to perform conceptional design, feasibility and trade studies, modeling and simulation, prototype construction, integration and test modeling, and anomaly investigation and resolution.

The division continues to push the boundaries via state-of-the-art efforts in advanced electronics and antenna design, digital signal processing, millimeter wave technologies, optical communications, and evolving regulatory processes employed to ensure the access of its customers to radio frequency (RF) spectrum. Division staff applies the fundamentals of communications to diverse areas such as GPS signals and receivers, including positioning, navigation, and timing (PNT) and alt-PNT, geolocation, and radar systems. An overview of CTED lines of research is given below.

Optical/Laser/Digital Communications

Optical, laser, and Digital Communications encompasses the design, analysis, simulation, and system engineering of all types of communication systems, including space-based military and commercial systems and terrestrial wireless radio systems, optical communications end-to-end systems engineering, developing and using optical communication modeling and simulation resources, applied knowledge of photonic device physics to optical communication terminal development, including laser transmitter and receiver designs, prototyping space-grade optical communication hardware, and maintaining world-class verification and validation of optical communication testbed resources.

Lines of Research

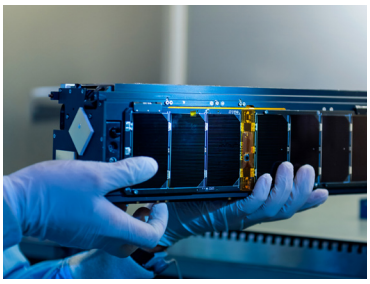
› Communication Technology
› Communication Agile Solutions
› Communication Networks

Example Research Areas and Projects

› Resilient communications
› Software-defined radios
› Space networking, including mesh networks
› Optical communications
› Signal classification
› Phased-array antennas
› Spectrum analysis

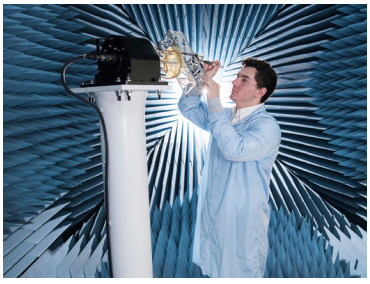
Rapid Prototyping

Rapid prototyping includes developing proof-of-concept digital communication systems in relevant mission environments using a variety of technologies including field programmable gate arrays (FPGAs), graphical processing units (GPUs), embedded processors, and developing advanced digital signal processing, geopositioning, anti-jamming, and anti-spoofing algorithms.



Radio-Frequency Electronics

Radio-frequency electronics includes working with microwave components used in RF and communication payloads, including solid-state GaN power amplifiers and traveling wave tube amplifiers; assessing high-power failure modes for receiver electronics, including RF breakdown; analyzing microwave electronic subsystems to assess receiver sensitivity, dynamic range, spur free dynamic range, and out-of-band signal rejection; designing filters and multiplexers; conceptualizing antenna design and simulation; and working with electronically steered arrays, phased arrays, nulling antennas, and adaptive beamforming.



Networking

Networking incorporates the design, analysis, and simulation of the next generation of advanced space and ground networks, communication system concepts, and architectures using the latest networking technologies and tools and the development of new resilient space networking concepts, algorithms, and protocols in the areas of low, medium, and geostationary Earth orbits (LEO/MEO/GEO) constellations, space mesh networks, 5G, Internet of Space Things, network virtualization, and software defined networks.

Machine Learning

Machine learning (ML) includes developing cutting-edge ML techniques for RF signal analysis and electronic warfare, using the latest unsupervised learning methods for clustering and data exploration of high-dimensional data, superseding best closed-form RF building blocks with streaming ML methods with the GNU radio signal processing toolkit, creating new modulations designed to evade detection and interception, and developing novel deep-learning architectures for signal processing.

The Aerospace Corporation

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