



COMMERCIAL PHASED ARRAYS



5G RAPID PROTOTYPE PHASED ARRAY

Unlocking the potential of the mmWave bands.

Ball is leveraging our Commercial SATCOM technologies and expertise to enable the future of 5G wireless connection. We developed the 5G Rapid Prototype Phased Array for Anokiwave, Inc. to improve wireless network efficiency and achieve 5G goals.

THE FUTURE OF WIRELESS

5G systems will deliver substantial improvements in capacity to accommodate rapidly increasing data demands. Data rates on the order of gigabits per second anywhere and anytime can only be achieved with additional spectrum allocations in the mmWave bands. Phased arrays are key ingredients required to unlock the potential of mmWave wider bandwidths by extending coverage, controlling interference and increasing capacity.

The 5G Rapid Prototype Phased Array is a planar phased array that enables rapid prototyping of a mmW 5G system. This antenna can be tiled together to form larger arrays with performance enhancements and synchronized to execute beam steering simultaneously. Additionally, the antenna provides multiple beam widths to support 5G beam acquisition and channel needs and is half duplex to enable the same antenna to transmit and receive.

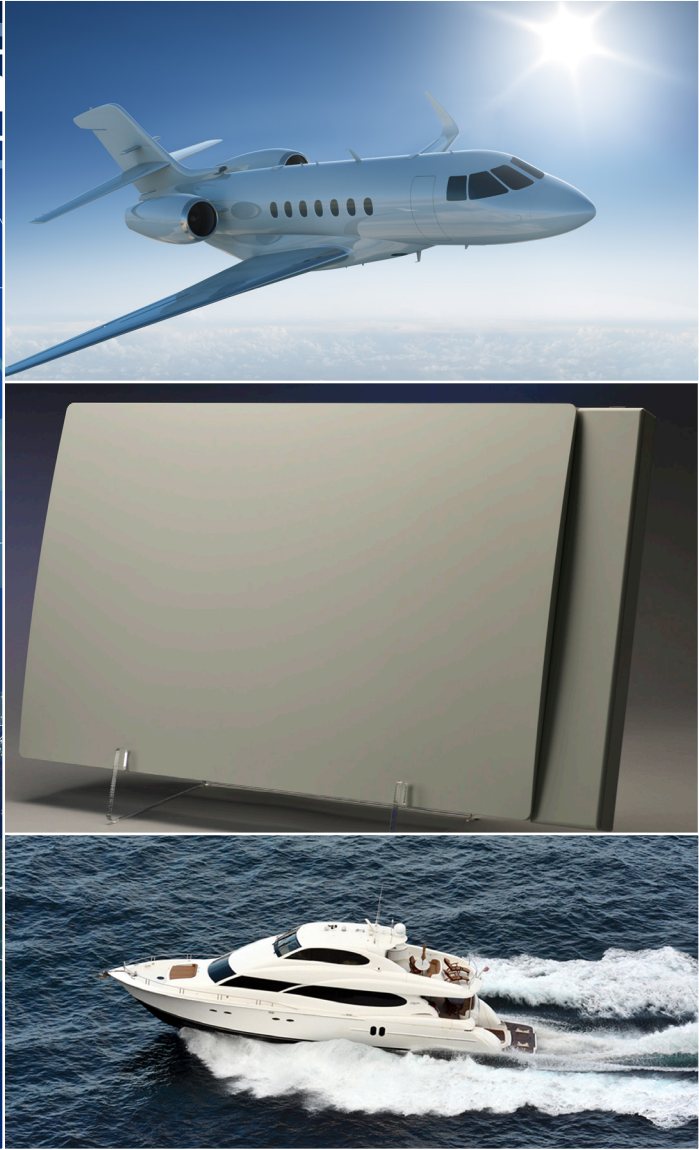
In 2017, the 5G Rapid Prototype Phased Array was used in the first ever public demonstration of a Verizon 5G prototype system. It was also named the Microwave Journal April MVP.

SYSTEM PERFORMANCE

MORE DATA, ANYTIME, ANYWHERE

Electronically steered mmWave phased arrays have numerous advantages.

- Improve signal-to-noise ratio
- Increase data rate
- Increase capacity
- Reduce interference
- Increase range
- Enable mmWave MU-MIMO hybrid beamforming research and development
- Support mmWave channel sounding
- Improve wireless network power efficiency



GO BEYOND WITH BALL.®

In today's world, an organization's success is directly related to its ability to connect with the people, technologies and markets that it depends on. As the need for data grows and the number of smart devices increases, these connections will need to be faster and more reliable than ever before.

Ball Aerospace's line of state-of-the-art commercial phased array antennas provide reliable, high-capacity, high-speed connections across a variety of platforms, frequencies and applications, enabling a smarter and more connected world.

GO WITH CONNECTIVITY



Ball is a market leader in affordable phased array antenna systems.

With more than five decades of phased array heritage, Ball Aerospace is an established market leader in developing low-profile, affordable phased array antenna systems for a variety of frequencies (including L, S, X, Ku, K and Ka-Band) and applications, from aviation and maritime to land and space.

Highly scalable, configurable and modular, planar phased arrays provide flexibility to meet diverse performance, operational frequency, size, weight, power and environmental requirements. Our approach to phased array design combines operational capability with affordability, leveraging commercial off-the-shelf technologies and processes. With a world-class team of engineers and high-capability manufacturing facilities, we will work with you, from design to build and integration to test, to rapidly develop a high-capability system to meet your connectivity demands.



COMMERCIAL SATCOM

Our SATCOM services can be customized to meet any mission or market.

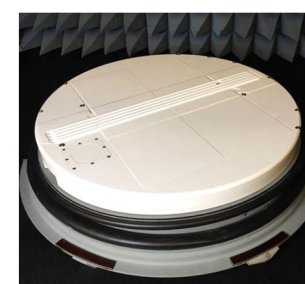
Ball's state-of-the-art phased array systems are ideally suited for a full range of global SATCOM services, from in-flight connectivity and high-speed train to maritime and backhails, to deliver broadband high-data-rate communication and video streaming. Ball's SATCOM experience covers L-, X-, Ku- and Ka-band spectrums, in-depth knowledge of regulatory standards and an understanding of a diverse range of satellite systems.

Our affordable terminals utilize cutting-edge highly-integrated semiconductor devices, advanced high-volume circuit card assembly processes and state-of-the-art automated manufacturing, enabling high volume, consumer and enterprise cost point solutions. Modular and configurable, Ball's commercial SATCOM antenna systems span implementations from fully integrated single housing terminals to distributed systems with externally mounted arrays combined with support components fitted internal to a platform.



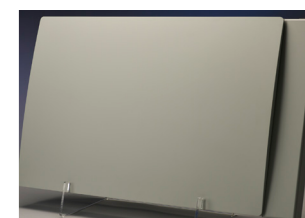
AIRLINK® SATCOM ANTENNAS

Government and commercial customers alike rely on Ball AIRLINK® high-gain phased array antenna systems for reliable, secure, high-speed data and near-toll quality digitized voice communications. Our AIRLINK® antenna systems provide in-flight telephone, fax, and data transmission using the INMARSAT system of geostationary satellites to a broad range of commercial airliners. Ball's family of AIRLINK® antennas include:



AIRLINK® X-1

- Configured for C-130 Hatch
- Approved for XTAR applications
- Air, land and sea applications
- Up to 4.5 Mbps (at scan) performance



AIRLINK® Ku

- Air, land and sea applications
- Fixed and mobile applications
- >100 Mbps performance



AIRLINK® Ka

- Air, land and sea applications
- Fixed and mobile applications
- >100 Mbps performance

SYSTEM PERFORMANCE

PROVEN. AFFORDABLE. RELIABLE.

Ball's light weight, durable and low-profile phased array SATCOM terminals provide numerous benefits:

- **Low profile** – Decreases drag on mobile platforms reducing operating costs
- **Electronically steerable; no moving parts** – Higher reliability and lower maintenance costs; enables SATCOM service for highly mobile platforms
- **Smart, software configured; automated alignment** – Easier to install and configure with lower operational cost
- **Lightweight** – Easy to transport, install and rapidly deploy
- **Fast, agile, accurate steering** – Improves satellite acquisition and tracking
- **Modular** – Rapidly enables scalable terminal solutions to meet connectivity demands
- **Distributed amplifiers** – Facilitate reliable connectivity verses mechanical dish single point amplifier failure