



Left: GDPAA, SOTM on LAV, Abrams Tank

LAND APPLICATIONS

SATCOM-ON-THE-MOVE (SOTM)

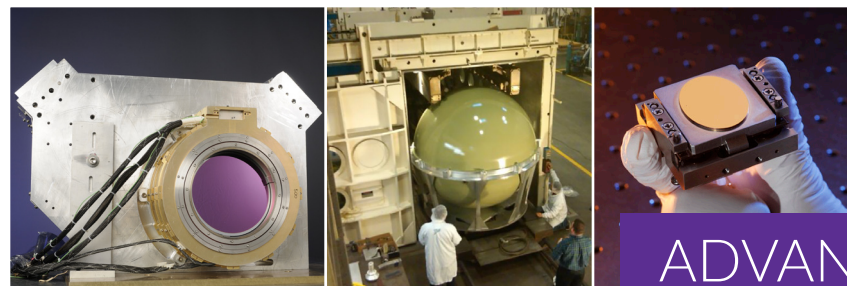
Ball provides UHF SOTM systems to U.S. military forces for installation on High Mobility Multipurpose Wheeled Vehicles, Light Armored Vehicles and a variety of naval platforms, Light Armored Vehicles, and a variety of naval platforms. The Ball SOTM antenna system is designed to provide military ground vehicles with worldwide mobile satellite communication capability while moving at speeds of 50 miles per hour or greater.

GEODESIC DOME PHASED ARRAY ANTENNA (GDPAA)

Ball and its industry partners designed the GDPAA Advanced Technology Demonstration in support of the U.S. Air Force Satellite Control Network's vision of an integrated satellite control network. Ball was tasked to develop, integrate and demonstrate technologies required to validate the GDPAA concept.

SILHOUETTE™

The Silhouette™ Low Profile UHF SATCOM/LOS/MUOS On-The-Move Antenna is designed for integration on tactical vehicles to provide a ruggedized, affordable, net-centric capability. Silhouette™ antennas feature an ultra-low profile to minimize the visual signature of a vehicle, clear the line of fire for remote controlled weapons and enable the vehicle to be easily transported by air, land or sea. Silhouette is configurable for ground and maritime platforms.



left: RBD, HALE, TFSM.

(AIR, LAND, SEA, SPACE)

ADVANCED TECHNOLOGIES

RISLEY PRISM BEAM DIRECTOR (RBD)

The Ball tactical optical RBD provides a wide field of regard, conformal and compact optical duplex aperture for aircraft laser communications and laser remote sensing applications. The RBD is qualified on military aircraft over wide temperature extremes in high vibration and shock environments.

LASER REMOTE SENSING

Ball Flash Lidar is a flight proven, real-time, full-motion, color 3-D imaging capability that provides the user with "Total Sight" of the operational area of regard with minimal latency. The Total Sight™ system provides enhanced 3-D visualization for situational awareness, precision tactical analysis, landing zone hazard detection and real-time geolocation information.

TACTICAL EO SENSORS

Ball has more than 40 years of experience in the design and production of Military Specification electro-optical equipment and other ruggedized sensors. Ball continues to develop the latest in military imaging technology, which includes Charged Coupled Devices (CCDs), Electron Multiplying CCDs and low-light, high-definition CMOS-based detectors in single and multi-band cameras

Ball equipment has been deployed on fixed-wing and rotary-wing aircraft, naval surface vessels and UAVs.

TACTICAL CRYOGENICS

Ball cryogenics technologies are being applied to tactical military intelligence, surveillance and reconnaissance missions to enhance platform and payload capabilities. These include enhanced mission duration, altitude and sensor class.

CRYOGENIC ENERGY STORAGE FOR UNMANNED UNDERSEA VEHICLES (UUV) AND HIGH ALTITUDE LONG ENDURANCE (HALE) AIRCRAFT

Ball has designed high efficiency cryogenic storage tanks to store liquid hydrogen and oxygen at cryogenic temperatures for use in large and small displacement UUVs, thereby multiplying the energy capacities of that held by batteries several times.

Ball was the responsible contractor for the design, fabrication and testing of the liquid hydrogen fuel tanks for the Boeing prototype HALE demonstration aircraft (Phantom Eye). A report on this effort has been published jointly by Ball and Boeing, located on the our website.

TACTICAL CRYOCOOLERS

Ball low temperature, high capacity mechanical cryocoolers offer an alternative method for cooling Long-Wavelength Infrared (LWIR) and Very LWIR sensors deployed aboard military platforms. Because

no replenishment of cryogenics is required, these cryocoolers allow extended mission times at temperatures below 25 Kelvin.

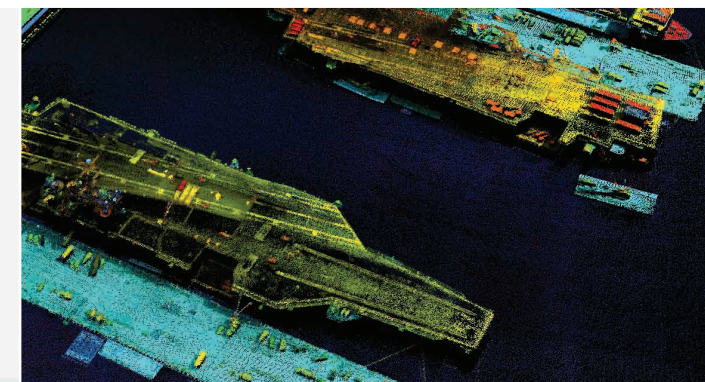
TACTICAL FAST STEERING MIRRORS (TFSM)

The Ball TFSM products are flight proven on thousands of Directed Infrared Counter Measure systems. TFSMs are qualified for extreme temperature, high vibration and shock environments on military platforms including fixed- and rotary-wing aircraft, providing precision pointing and LOS image stabilization.

MODULAR PHASED ARRAY TECHNOLOGIES

Ball is leading the industry in developing phased array architecture that delivers reliable and affordable high data rate SATCOM capabilities in a low-profile package. We've engineered unique modular, scalable sub-array building blocks to configure an aperture size that meets airborne, maritime or ground platform requirements for size, weight, power and throughput. Ball offers solutions for each of the L, X, Ku and Ka satellite frequency bands.

TACTICAL SOLUTIONS



GO BEYOND WITH BALL.®

Ball Aerospace is an internationally recognized developer and manufacturer of advanced tactical Radio Frequency antennas, microwave communication subsystems and Electro-Optics products and technologies. For more than four decades, Ball has been a leader in providing specialized antennas, cameras and electro-optical components, achieving the highest levels of performance. Our extensive capabilities in design, fabrication, test and production began in the mid-70s. Since then, we have developed technologies for various military platforms, including aircraft, missiles, land vehicles and maritime and space applications.

AIRCRAFT APPLICATIONS



left: F-35 Lightning II, E-2D Hawkeyes
Grey Eagle UAV, and AH-64 Apache

F-35 LIGHTNING II

Ball was selected to design, develop, test and manufacture the Communications, Navigation and Identification integrated body aperture suite for all three variants of the F-35 Lightning II. The F-35 antenna suite includes 15 antenna configurations operating at Ultra-High Frequency Satellite Communications (UHF SATCOM), Line of Sight (LOS), L-band, S-band, K-band and C-band.

AIRLINK®

AIRLINK® is an airborne antenna system designed to provide in-flight telephone, fax and data transmission. Using the International Maritime Satellite (INMARSAT) system, AIRLINK® provides worldwide coverage. U.S. government customers use the Ball AIRLINK® high-gain aeronautical system for reliable, secure, high-speed data voice communications on various platforms, including the C-130J, EP-3 and HC-144A. AIRLINK® is the first INMARSAT system approved for SwiftBroadband services. Ball has delivered more than 1,500 AIRLINK® systems for commercial and government use.

F-16 CONTROLLED RADIATION PATTERN ARRAY (CRPA)

The Ball F-16 CRPA is a multi-element, anti-jam antenna designed to counter GPS jamming during hostile engagements.

E2-D SATCOM

The Ball-designed, Multi-Mission Advanced Tactical Terminal (MATT) SATCOM antenna provides highly-efficient UHF satellite connectivity to the U.S. Navy's newest electronic and surveillance airborne platforms, the EA-18G Growler and the E-2D Advanced Hawkeye. The MATT antenna features state-of-the-art capabilities and also provides area surveillance, communications relay, search and rescue coordination and air traffic control.

UNMANNED SENSE, TRACK AND AVOID RADAR (USTAR)

Ball, as a major subcontractor, designed, developed and delivered the C-band Active Electronically Steered Antenna Subsystem for the USTAR program to demonstrate a radar prototype for a Sense and Avoid application for UAVs.

AIRLINK® X-1

Leveraging the modular phased array architecture, Ball developed a complete X-band SATCOM on the move terminal for a C-130 hatch-mount. The AIRLINK® X-1 antenna leaves the hatch available for an emergency exit and does not require aircraft modification. With only an adapter plate change, the antenna can be used with other platforms. Minimal system components result in a lightweight terminal with roll on/off capability to support any C-130 mission.

The AIRLINK® X-1 terminal operates with Wideband Global SATCOM (WGS) and commercial X-band satellites providing operational flexibility. Performance has been demonstrated with XTAR-LANT and has received certification for operation. Additionally, the AIRLINK® X-1 terminal is undergoing WGS certification.

Left: TACTOM, ATACMS, SM-3.



MISSILE APPLICATIONS

TACTICAL TOMAHAWK (TACTOM)

Ball brings a wealth of antenna systems design, development and production expertise and a dynamic technical and cost-competitive edge to the TACTOM Range Safety System, Satellite Data Link and Anti-jam GPS Receiver antenna programs.

ADVANCED MEDIUM-RANGE AIR-TO-AIR MISSILE (AMRAAM)

AMRAAM is the cornerstone for Ball's entry into the air-to-air missile market. Ball provides the Advanced Switch Filter Assembly Advanced Data Link for the new AIM-120D

missile. The Ball Warhead Replacement Tactical Telemetry Module antenna integrates four independent beams into a conformal wrap-around antenna that is qualified for extreme temperature, high-speed environments.

ARMY TACTICAL MISSILE SYSTEMS (ATACMS)

Ball provides the GPS antenna system integrated on ATACMS. Ball designed, developed, qualified and delivered an active GPS antenna array utilizing a switched-beam antenna system.

STANDARD MISSILE (SM-3)

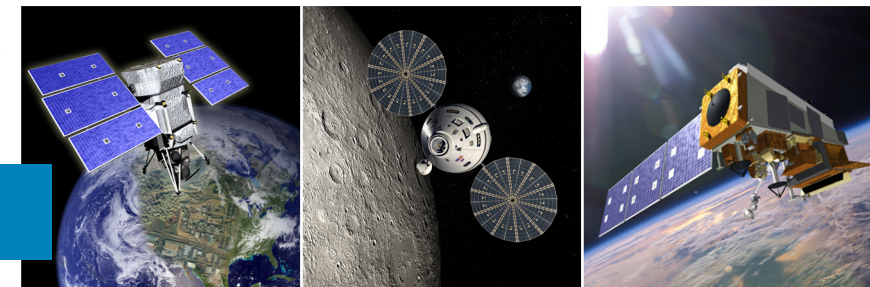
The SM-3, launched from the U.S. Navy's Aegis-class vessels, performs exoatmospheric intercept of short- and medium-range ballistic missiles. Ball designed the telemetry antenna to transmit intercept or "kill" confirmation back to battle command authorities.

JOINT AIR-TO-SURFACE STANDOFF MISSILE (JASSM)

JASSM is employed by U.S. Air Force and U.S. Navy aircraft for land- and carrier-based operations. Ball provides anti-jam GPS antennas for this next-generation cruise missile.

SPACE APPLICATIONS

left: WorldView-1, Orion, JPSS-1.



WORLDVIEW-1, -2 AND -3

Ball has built three WorldView next-generation commercial remote sensing satellites for DigitalGlobe. These spacecraft have provided 200,000 square miles of half-meter imagery for DigitalGlobe customers, including the U.S. National Geospatial Agency and numerous international customers. As part of this effort, Ball developed two low-gain antennas for telemetry and control and two high-gain antennas for imagery downlink for each spacecraft.

ORION

Ball is contracted to design phased array antennas (PAA) for the Orion Multi-Purpose Crew Vehicle fleet and its service modules. Our Orion PAA design uses proven S-band phased array technology to meet the Orion RF performance and environmental requirements for critical land, air, marine, entry and space environments. It is derived from highly successful programs like the F-35 Lightning II, the Navy S-band shipboard antenna, the Shuttle Radar Topography Mission and the Shuttle Imaging Radar series of shuttle payloads and reentry systems.

SUOMI NATIONAL POLAR-ORBITING PARTNERSHIP (NPP)

The Suomi NPP mission is the bridge between the nation's Earth Observing System satellites and the next generation Joint Polar Satellite System-1.

The Suomi NPP spacecraft bus is the eighth spacecraft built by Ball on the same Ball Configurable Platform core architecture. Ball's Tactical Solutions provided two Earth coverage antennas and two Telemetry, Tracking and Control (TT&C) antennas for the Suomi missions.

JPSS-1

As the next-generation polar orbiting satellite, the JPSS mission builds upon Ball's successful Suomi NPP spacecraft by providing essential data for civil and military weather-forecasting, storm tracking and climate-monitoring. Ball is currently fabricating one Earth coverage antenna, two TT&C antennas and two Ka-band high data rate antennas for the JPSS mission.

SHIPBOARD APPLICATIONS



Left: Stalker,
S-band Arrays,
ACRA.

SEASPARROW/STALKER

Ball's longest-running program, SeaSparrow, has served maritime imaging needs for nearly 40 years. Part of the North Atlantic Treaty Organization (NATO) Seasparrow surface-to-air missile system, the Ball MK 6 Mod 2 Low-Light-Level Television camera provides day and night imaging for search, surveillance, target identification and acquisition, fire control and navigation for the naval ships of 58 countries. Our Seasparrow Long Range Electro Optical Sensor System (LREOSS), known by the U.S. Navy as "Stalker," is designed to provide long-range visual detection and tracking of very small or fast-flying airborne targets and small surface boats. The LREOSS will provide U.S. Navy warships a greater capability to detect, track and engage both conventional and unconventional anti-ship threats.

AFFORDABLE COMMON RADAR ARCHITECTURE (ACRA)

Ball designed, developed, and integrated phased array radar subsystems for the ACRA system developed for the ONR Future Naval Capabilities program. An affordable, modular, scalable naval surveillance radar system based on common architecture and technologies, the Ball ACRA design can provide improved littoral and Electronic Counter Countermeasure surveillance performance for both rotating and fixed faced applications

S-BAND PHASED ARRAYS

Ball was awarded an ONR contract for an LO, multi-beam, S-band phased-array antenna demonstration. This antenna supports multiple applications and provides the U.S. Navy with new capabilities, while dramatically reducing the maintenance and support required of traditional antennas.