

DEFENSE & INTELLIGENCE



Laser Effects Research

Ball provides expertise in the effects of lasers on space-based imaging sensors and spacecraft hardware. Our Laser Effects Lab provides unique abilities to study the phenomenology of laser jamming on a focal plane array while the focal plane array is simultaneously acquiring high-resolution scenes.

Laser Applications

With core competencies in pointing, acquisition, tracking and real-time processing, Ball is able to meet the needs of the laser application market. We have developed laser remote sensing instruments and laser communications terminals, as well as supported applications of lasers for directed energy systems.

Threat Assessment & Mitigation

Ball delivers engineering and operational support services that directly impact the U.S. space superiority mission and protect critical access to space. We provide actionable threat analyses, susceptibility and vulnerability assessments, mitigation options, training and exercises to identify and counter adversary efforts to deny, degrade, disrupt, deceive and destroy our nation's critical space infrastructure.

Cyber Security

Ball is applying leading-edge techniques and state-of-the-art tools to counter cyber security threats to our nation's military systems. Our engineers use advanced tools to model the vulnerability of complex systems and conduct comprehensive reverse engineering on avionics platforms to assess potential threats and identify possible mitigations. We are developing solutions, like our unique anti-tamper technologies, that will ensure the integrity of critical-component intellectual property.

Our cyber capabilities support Air Force Research Laboratory (AFRL) R&D in Trustworthy Complex Systems. Ball employees work hand-in-hand with government partners in shared facilities to identify and evaluate threats to complex systems and distributed net-centric architectures, ascertain trust relationships and determine the mission assurance of these systems. These facilities include our Reverse Engineering and Cyber Threat/Training/Technology Operations Room (REACTOR), which is a self-contained laboratory to develop cyber exploitation techniques and test them on representative real-world systems and networks; and the government's Avionics Vulnerability Assessment Laboratory (AVAL), which supports vulnerability assessment of complex avionics systems that discover and identify potential exploits and develop mitigations. Our cyber tools include a unique Avionics Intrusion Detection System (AVIDS) which detects unusual behavior and presents visual warnings to system operators.

Ball Aerospace helps ensure flight safety for U.S. and allied space systems and provides actionable intelligence for warfighters and senior decision makers. We deliver world-class space situational awareness and intelligence, surveillance and reconnaissance (ISR) systems and services. At the forefront of today's defense and intelligence solutions, Ball produces leading-edge sensors, affordable satellite systems, resilient architectures and intelligence analysis that turn data into knowledge. Our state-of-the-art systems offer unprecedented agility and effectiveness for today's complex missions.



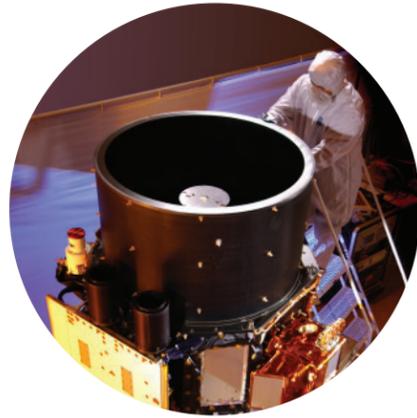
Image (Left): SBSS; Images (Right Top to Bottom): MOIRE; STP-SAT



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Advanced Imaging

For more than three decades, Ball has delivered remote sensing solutions across the electromagnetic spectrum for a wide range of military, intelligence, civil and commercial applications. Missions include: CALIPSO, with an active laser successfully firing more than 1.5 billion shots on orbit; Operational Land Imagers for Landsat 8 and 9; the visible sensor payload for the Space Force's Space Based Space Surveillance (SSBS) system that provides 24/7 space situational awareness data; GPM Microwave Imager; and NASA's Kepler Telescope, which used a 95 megapixel focal plane in a curved, two-dimensional format. These technologies are the foundation to support national remote sensing missions.

With more than 150 electro-optical systems launched, we have the people, tools, facilities, experience and knowledge needed to solve critical mission challenges. We specialize in providing advanced electro-optical, infrared and multi-spectral imaging systems to the defense and intelligence community. Products include:

- Payloads: electro-optical, infrared, active imaging, hyperspectral, hypertemporal
- Sensors and Instruments: advanced cameras, spectrometers, radiometers, spectrographs
- Optics: optical trains and telescopes

Spacecraft Solutions

The cost-effective Ball Configurable Platform (BCP) is ideally suited for ISR, space superiority and other missions, offering accuracy, agility and high collection capacity/capability in a highly affordable and reliable system. The proven, adaptable spacecraft design is ideally suited for imaging, autonomous proximity operations and specialized missions. Current BCP offerings include:

- BCP-Small: The perfect small satellite solution offering a rapid response for operational and technology demonstration missions
- BCP-Medium: The workhorse BCP that delivers quick re-targeting and greater agility for Earth remote-sensing payloads
- BCP-Large: The powerhouse BCP that offers increased power, stability, data storage and transmission, as well as control moment gyros that provide superior agility



Images (Top Left to Right): SBSS; CALIPSO; GPM Microwave Imager; Image (Right): Pluto image – Ralph

Research & Intelligence Support

Ball provides research and intelligence support for Department of Defense (e.g., National Air & Space Intelligence Center) and Intelligence Community organizations. We specialize in advanced geospatial intelligence, developing open systems and solutions to turn raw data into meaningful information. Our expertise includes advanced algorithm development, cloud-based architectures and system development, advanced mission systems on the edge, modeling and simulation and cyber vulnerability assessments and attestations. We provide direct engineering and intelligence analysis support to our customers at multiple locations around the nation. Our team develops technologies that save warfighter lives and enable the most complex and important missions.

Advanced Technologies

Ball provides state-of-the-art technologies that enable cutting-edge defense and intelligence mission capabilities. Products and services include star trackers and attitude sensors, cryogenic cooling and thermal management systems, laser applications, threat assessment and mitigation and cyber security assessments.

High Accuracy Star Trackers

Ball has delivered more than 400 stellar attitude sensors over the last 40 years to support civil, commercial and defense missions. These sensors have demonstrated exceptional lifetimes on orbit—up to 30 years—providing an unparalleled history of success in space. Our space-qualified electro-optical sensors can fly in Earth orbit and have traveled beyond to comets, asteroids and planets. We have unique capabilities for supporting space situational awareness missions.

Images (Top Left to Right): OLI; WorldView-3; High Accuracy Star Trackers; Image (Right): Cryogenic telescope for the Spitzer Space Telescope

Cryocoolers

Ball is a leading cryogenic provider for every type of space cooling system, with more than 150 cryogenic space flights on record. Our product offerings include: cryostats, cryoradiators and cryocoolers. Recent flight cryogenic systems include:

- The SBSS cryo-thermal system
- Kepler's cryoradiator
- A two-stage cryoradiator for the Ralph instrument for the New Horizons spacecraft
- The cryogenic telescope assembly for the Spitzer Space Telescope

