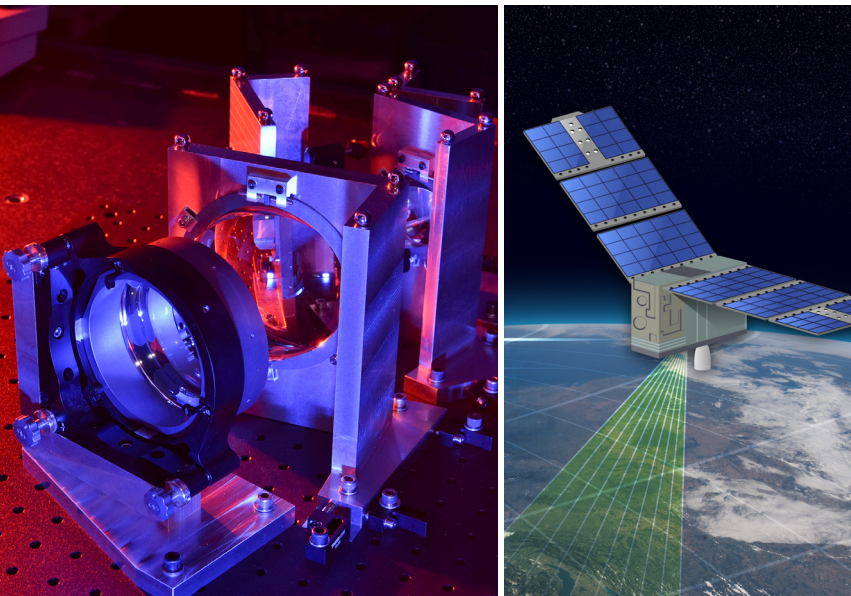


# SMALL INSTRUMENTS



*Top images: CHPS, CIRiS, lower image: OLI, right image: Landsat 8 with OLI, winds trigger pond growth in the Mississippi delta*

**GO BEYOND WITH BALL.®**

Ball Aerospace is at the forefront of miniaturizing instruments for air and space-based applications, offering new, affordable solutions to our customers while continuing to deliver the high-quality data they need to perform their missions. These instruments are small but capable.

## SMALLER SIZE, SAME RESULTS

Just as consumer technologies, such as computers and cell phones, have gotten smaller over the years, the same is happening in the aerospace industry, as customers begin to look for systems capable of delivering scientifically-significant data at a fraction of the cost and size. Leveraging our years of heritage in sensor and instrument development, Ball is working closely with our customers to develop and deliver smaller, more capable technologies that meet the needs of tomorrow's missions.

## SMALL BUT CAPABLE

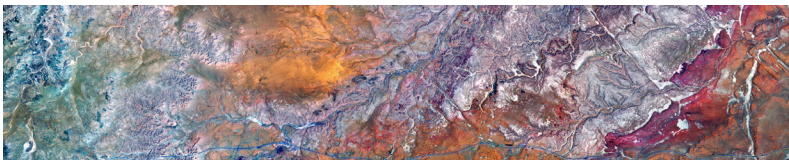
The Ball-built Compact Infrared Radiometer in Space (CIRiS) instrument will collect highly-calibrated infrared images of the Earth from a 6U spacecraft no larger than a shoebox. Funded through NASA's In-Space Validation of Earth Science (InVEST) program, CIRiS will demonstrate the ability of new Cubesat-compatible, miniaturized instruments to return highly-calibrated, scientifically significant data, enabling Earth observation for scientific and operational applications.

For on-orbit calibration, CIRiS carries two flat-panel carbon nanotube sources that replace much bulkier cavity sources, with performance that equals or exceeds the older technology. CIRiS' next-generation uncooled infrared imaging detector delivers the required sensitivity to scene radiance without need of a cryocooler, thereby reducing power draw, volume, complexity and system risk. Weighing only 1.4 kg (3LB), the instrument's small size and weight dramatically reduce the cost of launch – reducing overall mission costs for the customer.

## SUSTAINABLE LAND IMAGING FOR THE FUTURE

With study funding from NASA's Sustainable Land Imaging – Technology program, Ball is developing two land imaging technologies with significantly reduced size and mass: Compact Hyperspectral Prism Spectrometer (CHPS)

*Left image: Landsat 8 with OLI, the transformative power of water, wind, and gravity in Iraq's Ga'ara Depression, right: TotalSight™ 3D color LIDAR image of Red Rocks, CO*



## INNOVATIVE WEATHER

The Ball Operational Weather Instrument Evolution- Microwave (BOWIE-M) is a free-flyer microwave sounder mission design, that can be integrated on an ESPA-capable SmallSat. This instrument provides atmospheric temperature and moisture profile data for operational weather models. BOWIE-M, like other microwave sounders, will help enable accurate forecasts and play an important role in overall weather prediction. Using the calibration technique designed by Ball and proven on NASA's GPM mission, this instrument will return the same results as larger microwave sounders at a much smaller size and cost. The Ball mission concept also includes an option for data product delivery using existing operational algorithms.

and the Reduced Envelope Multi-Spectral Imager (REMI). Using similar calibration techniques to CIRiS, REMI and CHPS aim to maintain the quality of data currently delivered by NASA and USGS's Landsat program while reducing overall costs. As the provider of Landsat's current Operational Land Imager instruments, we are leveraging our expertise in earth observation technologies to reinvent the future of land imaging, delivering sustainable, reliable and continuous data for many years to come.

## DELIVERING CRITICAL DATA FROM ANY SIZE PLATFORM

TotalSight™ LIDAR is a full-motion 3D color, imaging system that provides warfighters and first responders critical 3D geolocated information that can easily be viewed and shared while on the move. With a platform-agnostic approach, TotalSight™ can be configured for a suite of applications, mission objectives and platforms ranging from quad copters, to UAVs to rotary and fixed wing aircraft.