Ball Aerospace Infrared Technologies

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Summary

Ball Aerospace & Technologies Corp. has a long history of designing, building, and flying infrared systems. Here, we present some of our past work in infrared cryogenic systems, instrumentation, and detector technologies with a focus on the technologies we are currently advancing that have exciting potential aboard a platform like SOFIA. We are developing detector and instrument technologies through NASA study grants (i.e. ROSES) and with internal funding including through our astrophysics technology initiative. Ball Aerospace's scientist engineers design, build, and test focal plane subsystems, instruments, and spacecraft using: Philosophy of strong relationships with science investigators – a fundamental understanding of the science mission objectives; Strong systems engineering – takes the science objectives and develops technical performance metrics, budgets, and requirements; Design, analysis, and integrated system modeling – extensive codes, experience, verified models and design tools for optical, mechanical, structural, and thermal engineering as well as integrated modeling software and experience.

Existing IR Technology

Using a system level approach, Ball Aerospace has overcome significant technical challenges in designing, building, and testing IR instruments and associated hardware.

WISE Science Team

For WISE, Ball Aerospace scientist engineers designed, built, and tested the spacecraft and performed integration and testing of the flight system. The Ball Aerospace team of engineers worked closely with the WISE science team to meet the demanding pointing and thermal control requirements needed to meet the science goals.

WISE

IRAS

The porous plug used to allow superfluid He to cool the IRAS satellite by evaporation was later used on the COBE and Spitzer Space Telescope missions.

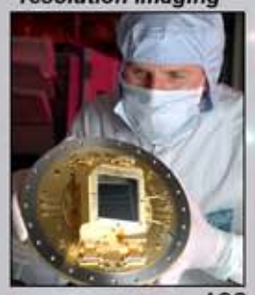
For JWST, Ball Aerospace engineers are designing and building cryogenic mechanisms (actuators), developing lubrications for use at cryogenic temperatures, and developing methods for polishing lightweight Beryllium mirrors with low thermal transport and good thermal stability over a large range of temperatures.

JWST

Ball Aerospace's Detector Technology Center will select the appropriate detectors and design the detector focal plane to meet specific mission requirements, including wavelength, pixel pitch, array size, format, flat or curved geometry, and radiometrics. The DTC can offer custom designs and new technology development when warranted or can build-to-print existing detector designs. Ball Aerospace's DTC interfaced the detectors for the ACS and NICMOS instruments on the Hubble Space Telescope and IRS and MIPS instruments on the Spitzer Space Telescope.

DTC

High spatial resolution imaging



ACS

Spectroscopy

NICMOS

IRS

IR Technology Development

Stirling Cryocooler

30K Cryocooler

Cryogenics

Ball Aerospace has 20+ years experience working with Stirling cryocoolers. Current areas of advancement:

- Loads of less than 10 K
- Cooling of large and/or remote focal planes and dewar shields. This NASA funded work resulted in a dewar with nearly zero boil-off that was enabled by very efficient heat exchangers developed at Ball Aerospace.

Ball Aerospace supports NASA with system design studies for sub 1 K cooling.

MIPS

OLI

The DTC has extensive experience and infrastructure to enable design, packaging, testing, and characterization. New technologies include detectors for low light levels, high speed data acquisition, and LIDAR applications. The DTC supports detector development from a science perspective.

JWST

Continued development of high-precision mechanisms and motors capable of operating at cryogenic temperatures and wavefront control software.

Continued development of fast-steering mirrors and target tracking software can be used for image stabilization to remove aircraft turbulence, platform vibration, and acoustic noise.

Fast-steering mirror

Ball Aerospace's experience in building and flying suborbital instrumentation can be leveraged from the Airborne Initiative work:

- Vibration Isolation – extensive integrated modeling and model validation of suborbital platforms
- Temperature Extremes – experience mitigating effects on optical bonds and mounts on aircraft
- Electrostatic Discharge (ESD) and Electromagnetic Interference/Conductivity (EMI/EMC): experience working with highly sensitive ESD equipment and mitigating EMI/EMC instrument effects on aircraft

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