

Ball Aerospace Delivers Flight Cryocooler Early for NASA's Landsat Mission

BOULDER, Colo., Feb. 14, 2018 /PRNewswire/ -- Ball Aerospace delivered the TIRS-2 Flight Cryocooler for the Landsat 9 TIRS-2 instrument ahead of schedule to NASA's Goddard Space Flight Center (GSFC). Achieving this milestone early will allow GSFC additional time and options during the instrument integration and test phase.

For more than 45 years, Landsat Earth-observing satellite missions have gathered multispectral imagery from space, helping scientists understand the impacts of human activity and natural events on our planet through constant monitoring of land changes. The TIRS-2 instrument aboard Landsat 9 will provide two-band thermal imaging data to measure surface temperature and track land and water usage. The Ball-built cryocooler on the instrument enables TIRS-2 to cool the focal plane and the surrounding enclosure to maintain the sensitivity needed for imaging.

"We are very pleased with the engineering Ball has performed on the TIRS-2 cooler system, and the early delivery provides us with additional schedule flexibility," said Theo Muench, Contracting Officer Representative, GSFC.

The TIRS-2 Flight Cryocooler is based upon a Ball family of Stirling Cryocoolers, which are the nation's largest capacity, highest efficiency cryocoolers on orbit to date. The two-stage Flight Cryocooler consists of two Cryogenic Control Electronics (CCEs), one Redundancy Switch Electronics (RSE), a Thermo Mechanical Unit (TMU) and a flight harness set. For TIRS-2, Ball developed redundant electronics and incorporated many design and manufacturing improvements to simplify the fabrication and assembly process.

"Ball has a rich heritage in remote sensing capabilities, which has aided in the development and delivery of the TIRS-2 Flight Cryocooler instrument," said Jim Oschmann, Vice President and General Manager for Civil Space, Ball Aerospace. "Our cryocooler will enable Landsat 9 to take precise and efficient imagery while maintaining stable temperatures."

Ball continues to use its heritage in remote sensing observations and scientific studies with the TIRS-2 companion instrument, the Operational Land Imager-2 (OLI-2), an advanced multispectral imager. Landsat 8 launched in 2013, equipped with Ball-built TIRS-1 Cryocooler and OLI-1. Together, TIRS-2 and OLI-2 will support the science and continue advancing remote sensing observations and technology as Landsat 9 prepares for launch in 2020.

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This release contains "forward-looking" statements concerning future events and financial performance. Words such as "expects," "anticipates," "estimates," "believes," "targets," "likely" and similar expressions typically identify forward-looking statements, which are generally any statements other than statements of historical fact. Such statements are based on current expectations or views of the future and are subject to risks and uncertainties, which could cause actual results or events to differ materially from those expressed or implied. You should therefore not place undue reliance upon any forward-looking statements and any of such statements should be read in conjunction with, and, qualified in their entirety by, the cautionary statements referenced below. The company undertakes no obligation to publicly update or revise any forward-looking statements, whether as a result of new information, future events or otherwise. Key factors, risks and uncertainties that could cause actual outcomes and results to be different are summarized in filings with the Securities and Exchange Commission, including Exhibit 99 in our Form 10-K, which are available on our website and at www.sec.gov. Additional factors that might affect: a) our packaging segments include product demand fluctuations; availability/cost of raw materials; competitive packaging, pricing and substitution; changes in



climate and weather; competitive activity; failure to achieve synergies, productivity improvements or cost reductions; mandatory deposit or other restrictive packaging laws; customer and supplier consolidation, power and supply chain influence; changes in major customer or supplier contracts or a loss of a major customer or supplier; political instability and sanctions; currency controls; and changes in foreign exchange or tax rates, including due to the effects of the 2017 U.S. Tax Cuts and Jobs Act; b) our aerospace segment include funding, authorization, availability and returns of government and commercial contracts; and delays, extensions and technical uncertainties affecting segment contracts; c) the company as a whole include those listed plus: changes in senior management; regulatory action or issues including tax, environmental, health and workplace safety, including U.S. FDA and other actions or public concerns affecting products filled in our containers, or chemicals or substances used in raw materials or in the manufacturing process; technological developments and innovations; litigation; strikes; labor cost changes; rates of return on assets of the company's defined benefit retirement plans; pension changes; uncertainties surrounding geopolitical events and governmental policies both in the U.S. and in other countries, including the U.S. government elections, budget, sequestration and debt limit; reduced cash flow; ability to achieve cost-out initiatives and synergies; interest rates affecting our debt; and successful or unsuccessful acquisitions and divestitures, including with respect to the Rexam PLC acquisition and its integration, or the associated divestiture; the effect of the acquisition or the divestiture on our business relationships, operating results and business generally.

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