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## **SESSION 2: Stirling & Pulse Tube Cryocoolers - Analytical**

**Paper No. 2-2 Tuesday Morning 11:15 AM**

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### ***Low Cost Cryogenic Technology for Commercial IR Imaging***

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The recent advancement of cooled infrared vision technology has resulted in a drastic increase of operational temperatures and subsequent reduction of parasitic (conductive and radiative) heat inflows. Eventual lessening of required heat lifts initiated development of a new generation of long-life and low SWaP+C mechanical cryocoolers. In response to this challenge, the industry adopted a risk-free way of sustaining innovation, primarily focusing on gradually downscaling/improving existing technologies, aiming primarily to develop/maintain a low-volume segment military market. Because of the inherent limitations—though significantly improved—the attended reliability and cost figures still prevent the broad use of cryogenically cooled infrared imagers in the price-sensitive and highly competitive commercial market. Uncooled infrared technology, albeit inferior in performance, is more affordable and reliable and, therefore, more ubiquitous. From the very moment of its inception in 2018, CryoTech adopted an approach of disruptive innovation, not only aiming to further improve SWaP indices but first and foremost to enable essential cost reduction and higher reliability while developing new (commercial) markets and business models. In doing so, the CryoTech team revisited almost all the major technological cornerstones, including working agents, the concepts of regenerative heat exchange, electromagnetic and pneumatic actuation, magnet springs, vibration control, and more.

The authors present the outcomes of a full-scale feasibility study, prototype life testing, and performance mapping.