# *Cryocooler Integration, Modeling, and Testing for the Ultra Compact Imaging Spectrometer Airborne (UCIS-A) Instrument*

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Objects of interest to the DoD community require higher resolution and broader spectral range compared to typical commercial cameras. While commercially available Hyper-Spectral-Imagers (HSI) have typical spectral ranges of 500 to <1,100 nm or 1,300 to 2,000 nm, a wider spectrum of 400 to 2,500 nm is optimum for the broad range of objects of interest to the DoD community. Additionally, high Signal-to-Noise-Ratio (SNR), low scatter, and low Ground Sample Distance (GSD) are needed for desired detection properties. The Ultra Compact Imaging Spectrometer Airborne (UCIS-A), being developed by Jet Propulsion Laboratory with support from West Coast Solutions and others, embodies all of these characteristics at state-of the-art levels. The cryogenic cooling requirement on UCIS-A is met with an AIM SF070 flexure-type linear Stirling cryocooler for the lower stage (focal plane assembly) and a similar but larger SF100 cooler for the upper stage (optics). An aggressive < 2-hour cool-down time from takeoff drove the need for two cryocoolers. This paper describes how this and other unique mission requirements drove the cryocooler selection and integration, the detailed and system level thermal-cryocooler modeling approach and results, and experimental data (benchtop and in situ).