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## **C2Or2D-01: Northrop Grumman NewATHENA 4.5K Cryocooler DM Testing**

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The NewATHENA X-ray Integral Field Unit (X-IFU) requires a cryogenic precooler capable of providing significant heat lift at both 4.5 K and 20 K. To increase the design maturity and identify key technical risks of a candidate Engineering Model (EM) and Flight Model (FM) cryocooler, a Demonstration Model (DM) phase was awarded to Northrop Grumman. Northrop Grumman's approach to providing the NewATHENA cryocooler is a modification of the Mid-InfraRed Instrument (MIRI) hybrid Pulse-Tube (PT) Joule-Thompson (JT) cryocooler design that is implemented on the James Webb Space Telescope (JWST). The Northrop Grumman cryocooler for the JWST MIRI instrument was designed for operation at 6 K with intercept loads at ~18 K and continues to operate nominally on orbit. By implementing minor modifications to the JT loop of the cryocooler, the cryocooler can achieve the required heat lift at both 4.5 K and 20 K while maximizing reuse of heritage hardware and hardware designs for reduced risk on NewATHENA. Modifications to the JT portion of the hybrid cryocooler are the focus of Northrop Grumman's DM phase testing. This paper provides our approach to the NewATHENA cryocooler, the compressor level performance requirements consistent with the heat lift required at both 4.5 K and 20 K, and the results of to-date performance tests conducted at a range of rejection temperatures and input power levels. The results of these tests demonstrate that minor modifications to Northrop Grumman's TRL-9 cryocooler yield system level performance consistent with NewATHENA cryocooler heat lift and operating temperature requirements.

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