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A Neon JT Cooler for ARIEL

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The Atmospheric Remote-sensing Infrared Exoplanets Large-survey (ARIEL) is the fourth medium (M4) mission selected in the ESA Cosmic Vision 2015-2025 programme, with a launch planned in 2028. The spacecraft will carry two instruments: a Fine Guidance System (FGS) and the ARIEL InfraRed Spectrometer (AIRS). AIRS requires active cooling of both its channels to below 42 K and this will be provided by a neon Joule-Thomson (JT) cooler developed by the Rutherford Appleton Laboratory. This paper describes the design of the cooler to meet the requirements of the ARIEL mission. We summarise the overall cooler architecture and design of the main sub-systems: the compressors, ancillary panel and JT heat exchanger assembly. Performance modelling of the compressors and heat exchangers – which permits system level trade-offs to be performed – is described. The outcomes of these trades are reported along with results from mechanical and thermal analyses. Preliminary tests have been performed on the heat exchanger sub-assembly and these results are presented. We conclude with a summary of the current status and future developments for the flight model cooler.