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Cold Atom Laboratory: exploring ultracold gas mixtures aboard the International Space Station DAVID AVELINE, ETHAN ELLIOTT, JASON WILLIAMS, ROBERT THOMPSON, Jet Propulsion Laboratory — We report on the current status of the Cold Atom Laboratory (CAL) mission to be operated aboard the International Space Station (ISS), with emphasis on results achieved in the CAL ground test bed (GTB) facility. Utilizing a compact atom chip trap loaded from a dual-species magneto optical trap of rubidium and potassium, CAL is a multi-user facility developed by NASA's Jet Propulsion Laboratory (JPL) to provide the first persistent quantum gas platform in the microgravity environment of space. In the unique environment of microgravity, the confining potentials necessary to the process of cooling atoms can be arbitrarily weakened, creating gases at pikoKelvin temperatures and ultra-low densities, while the complete removal of the confining potential allows for ultracold clouds that can float virtually fixed relative to the CAL apparatus. This new parameter regime enables ultracold atom research by a globe spanning group of researchers with broad applications in fundamental physics and inertial sensing. In this paper, we describe validation and development of critical technologies in the CAL GTB, including the demonstration of the first microwave evaporation and generation of dual-species quantum gas mixtures on an atom chip.

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