SYSTEM DESIGN FOR '1'1 IE CONTROI . OF LIQUID HELIUM BY EI ECTROSTATI C FORCES FOR T] IE SATELI ITE TEST OF EQUIVALENCE PRINCIPLE MI SS1ON

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A precise test of the equivalence of inertial mass and gravitational mass in an orbiting spat.ccraf[has been proposed. Since the equivalence principle is a fundamental postulate used by I Einstein in for mulating the general theory of relativity, a precise test is of fundamental interest. The use of superconducting differential accelerometers in earth orbit will allow improvement in the precision by a factor of 10^6. Such a mission is being proposed to the. National Aeronautics and Space Administration, and a similar but more complex mission is also being proposed to the European Space Agency.

A liquid helium cryogen must be used to maintain the temperature of the four accelerometers at 1.8 K. Because of the extreme sensitivit y of the. measu rement, the gravitational noise **mused** by the motion of the liquid helium is of concern. It has been determined that the free surface of the liquid helium must be maintained at least 25 cm from the center Of mass of the accelerometers.

It is proposed to use elect rostat ic for ces to provide the necessary cont to]. 1 During the first half of the mission, the liquid will confined to the center of the cryostat; during the second half, it will be confined to the outside. Since the acceler ometers arc. at the center of the cryostat, dist ance between the free surface and the accelerometers will be at the maximized.

The basic principles have been demonstrated by analysis and test in zero gravity aircraft flight. A flight system is now being designed. The requirements imposed by the exper iment and a descr iption of this system and its expected performance will be presented.