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Instrumentation for Simulation of Simultaneous Reduced Gravity and Ionizing Radiation Space Environment Effects on Biological System.[1]
ACHAL DUHOON, Physics Department, USU, LORI CALDWELL, Biological Engineering Department, USU, JR DENNISON, Physics Department, USU, ELIZABETH VARGIS, Biological Engineering Department, USU — A novel and versatile experimental apparatus has been developed to simulate the effects of simultaneous exposure to reduced gravity and ionizing radiation in cellular biological systems. The design, system capabilities, and limitations are discussed. The mini rotary cell culture system (mRCCS) is compatible with the Space Survivability Test (SST) chamber at Utah State University that has a ˜100 mCi Sr^{90} source emitting 0.2 to 2.5 MeV β radiation. The mRCCS has 5 cylindrical vessels that are synchronously rotated by a motor-driven chain. The cell clusters are suspended inside the vessels in a viscous neutral-buoyant fluid, reaching terminal velocity as they fall with near zero net forces from gravity, buoyancy, viscous drag, and vessel rotation thereby approximating a reduced gravity environment from ˜10 g to ˜20 mg as determined by the vessel rotational speed. The combined mRCCS and SST chamber system can provide average effective dose rates for the cells controlled over a broad range (>900X) from ˜3.7 mGy/day to 3.4 Gy/day. This apparatus demonstrate that it can reliably simulate ionizing radiation and g hazards of the space environment.

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