Loss of bone strength, mass and density are known medical complications of space flight, where the static load of gravity is no longer present. The process of bone demineralization begins almost immediately upon an astronaut's arrival into a microgravity environment and appears to continue unabated. The losses occur particularly in weight bearing bone regions of the lower spine, hip and legs. NASA will eventually require diagnostics techniques that can perform in vivo quantitative evaluations of bone mineral density (BMD) and trabecular micro-architecture (i.e., porosity, trabecular size and geometry) during manned Exploration class missions. As an incremental step toward this end, a high-resolution diagnostic or imaging device is required for performing the quantitative evaluations identified above ex vivo with a technology that shows significant promise for adaptability to long duration human space flight. The device should also demonstrate sufficient penetration depth in the body to eventually adapt the technology for in vivo evaluations of the calcaneus and lumbar spine, at a minimum. Efforts should be made to minimize the volume, mass, electromagnetic emissions and power draw of the device and its associated peripheral equipment. The use of ionizing radiation is not restricted, but its use is considered highly undesirable in a manned space flight environment and should, therefore, be minimized. This technology is desired for possible demonstration on ISS and for targeted deployment on future Exploration class vehicles supporting long duration missions.