Microorganisms present possible health and operational risks during space flight. We are developing technology to monitor and/or identify bacteria during space missions and seeking to better understand how the space environment may impact bacteria on a long-term basis. The short and long term effects of simulated microgravity on bacterial growth and gene expression are under study. Although there appears to be no direct response to gravity, there are significant indirect effects on gene expression. From the detection perspective, we previously demonstrated the existence of large numbers of signature sequences in ribosomal RNA genes. Although not necessarily unique, these sequences are highly characteristic of specific organisms or groups of organisms. During the past year, we have extended these analyses, demonstrating the potential utility of MALDI-TOF mass spectrometry of oligonucleotides released by ribonuclease T₁ digestion as an identification tool. Separately we have also developed novel search strategies to locate appropriate signature sequences in order to design a single universal microarray that can provide useful information about the genetic affinity of any unknown organism whether its presence was anticipated or not. Initial experimental arrays have been run with success. In addition, we have continued our efforts to develop organism-specific homogenous solution detection methods based on molecular beacons as well as novel methods of sample preparation minimal requiring minimal inputs of crew labor, consumables, and energy.