

## **Chemical Pollution from Combustion of Modern Spacecraft Materials**

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Fire is one of the most critical contingencies in spacecraft and any closed environment including submarines. Currently, NASA uses particle based technology to detect fires and hand-held combustion product monitors to track the clean-up and restoration of habitable cabin environment after the fire is extinguished. In the future, chemical detection could augment particle detection to eliminate frequent nuisance false alarms triggered by dust. In the interest of understanding combustion from both particulate and chemical generation, NASA Centers have been collaborating on combustion studies at White Sands Test Facility using modern spacecraft materials as fuels, and both old and new technology to measure the chemical and particulate products of combustion. The tests attempted to study smoldering pyrolysis at relatively low temperatures without ignition to flaming conditions. This paper will summarize the results of two 1-week long tests undertaken in 2012, focusing on the chemical products of combustion. The results confirm the key chemical products are carbon monoxide (CO), hydrogen cyanide (HCN), hydrogen fluoride (HF) and hydrogen chloride (HCl), whose concentrations depend on the particular material and test conditions. For example, modern aerospace wire insulation produces significant concentration of HF, which persists in the test chamber longer than anticipated. These compounds are the analytical targets identified for the development of new tunable diode laser based hand-held monitors, to replace the aging electrochemical sensor based devices currently in use on the International Space Station.