

How Space Technology Was Adapted for Carpet Cleaning

Carpet cleaning is rocket science

The Carpet and Rug Institute has long been interested in understanding how well vacuum cleaners and hot water extraction units clean carpet. Since 2000, CRI has worked closely with an independent laboratory to evaluate carpet cleaning machines and cleaning materials. The standard test involves applying a simulated soil mixture to specified cut- and loop-pile test carpets, cleaning them using a standard procedure and then determining how much material was removed by comparing the weight of the carpet/soil mixture before cleaning with its weight after cleaning. This test provides sound guidance for consumers looking to buy new vacuum cleaners or wanting to have their carpets professionally cleaned.

Although this test identifies the total weight of soil removed, it doesn't tell how different types of soil particles respond to the cleaning process. That is important so that manufacturers of vacuum cleaners and extractors can know how to modify their units to achieve even better performance. To gain more insight about the cleaning process, CRI partnered with a company making special analyzers for the US Space Program.

Private Industry Partners with NASA

In 2001 NASA was investigating a way to conduct quality control for critical aluminum alloy parts used in the Space Shuttle Program. Representatives of KeyMaster Technologies, Inc. in Kennewick, WA, visited NASA Marshall Space Flight Center to demonstrate its XRF (X-Ray Fluorescence) analyzer. The instrument, which was about the size of an electric drill, quickly determined the identity and amount of chemical elements in many materials. The XRF unit bombarded the material with X-rays and analyzed the radiation emitted from the sample. Since each element produces emissions with a specific wavelength and intensity, the analyzer determined the identity and amount of each element in the sample.

Marshall engineers recognized the device could have an immediate benefit if the range of elements detected were expanded. NASA and KeyMaster worked together to create a portable vacuum x-ray fluorescent analyzer that performs on-the-spot chemical analyses — a task previously only possible in a chemical laboratory. The first application for NASA involved the Shuttle's Return to Flight activities.

Transitioning from Spaceflight to Carpets

In June 2002 KeyMaster demonstrated its XRF analyzer to personnel from NASA's Reusable Solid Rocket Motor Project Office. The instrument successfully identified and matched six samples of Marshall welding rods. It was then demonstrated on bolts, fasteners, and other items that had been the subjects of materials problems. In only a few seconds, the instrument accurately determined the composition of these steel parts. But steel alloy composition was only one field of need. NASA engineers wanted to analyze aluminum alloys because vast amounts of high-strength aluminum alloys are used in the Space Shuttle propulsion system — the external tank, main engine and solid rocket boosters. Just as KeyMaster and NASA engineers theorized, subsequent tests showed that when the XRF analyzer was operated in a vacuum, aluminum alloys were easily analyzed.

According to NASA, the ability to quickly and accurately determine composition on large objects such as a rocket motor case was a major breakthrough.

A New, More Powerful Carpet Cleaning Test

In 2005, under The Carpet and Rug Institute's Seal of Approval program, a new test to measure cleaning effectiveness was developed by applying the KeyMaster's XRF analyzer technology to carpets. Scientists from KeyMaster Technologies worked with Professional Testing Laboratory to design a special "soil" mixture that mimics actual soil found in carpet. The designer soil contains particles of five different types, each with a unique elemental composition. The range of particle types reflects the fact that soil composition differs in various parts of the country. Under carefully controlled conditions, laboratory testing staff use the XRF analyzer to measure the amount of soil in the carpet before and after cleaning with a vacuum or extractor. The test report presents the precise amounts and types of soil removed.

The results from this new test are being used today to rate the performance of extraction machines. They provide important insights about the types and amounts of soil that are removed. For vacuums, the results are being compared to the weight loss data in the previous test, and it is expected that the XRF test will soon become the new standard method to rate vacuums as well.

This new adaptation of space technology to carpets is just one more way that the Carpet and Rug Institute is working to make your carpet purchase an even greater value.