

## History of Qwik System Flush's Path from Military Development to Commercial HVAC

Another example of the HVAC industry benefiting from a product originally developed for non-HVAC applications is Qwik System Flush (QSF), which is currently used as a flushing agent for general refrigeration system burn-outs and contaminated line sets in R-22 to R410A conversions.

Mainstream Engineering, a Rockledge, Fla.-based research and development company with more than 70 patents and 30 current R&D projects with the U.S. Military and NASA, originally developed a forerunner of QSF under a multi-million dollar military contract aimed at cleaning oxygen breathing systems used in U.S. Air Force fighter jets as well as other military airplanes.

When the Environmental Protection Agency (EPA) outlawed CFC's, the Air Force solicited bids for a non-toxic replacement cleaner for R-113 and R-11, which were the non-toxic flushing agent/solvents used for flushing biological, oil, and water contaminants from on-board oxygen breathing apparatuses. Since other existing flushing agents on the market didn't clean well or were too toxic for human breathing systems, the Air Force initiated the R&D effort.

Winning a military contract is no easy task however. Before any products are literally produced, the Air Force narrowed down the large field in phases to companies with the most promising theoretical concept at the best value. Eventually Mainstream Engineering's biodegradable, non-toxic flushing agent concept won out and the product was formulated. Next, the product was tested with standard chemistry analysis procedures to prove it met all the Air Force's specifications. To determine removal efficacy, for example, a chemist records the weight of a standard test coupon and a contaminant sample, such as refrigerant oil. After adding the oil to the test coupon and flushing it, the test coupon is weighed again to determine how much oil was left behind. Similar tests were performed for water, biological growths and other oxygen system residuals.

Other tests involved compatibility with materials such as plastics and metals. The most critical test, toxicity, which requires Lethal Dose-50 and other analyses, was passed with flying colors.

As it does with all products developed for NASA and the military, Mainstream Engineering launched post-contract efforts to analyze the product's marketability for the HVAC industry. "The military and NASA are microcosms of the private sector and share many of the same technological problems," said Dr. Robert P. Scaringe, president of Mainstream Engineering.

To prepare it for HVAC applications, Mainstream Engineering also slightly reformulated the flushing agent because HVAC system burnouts and/or line set contaminants have a different ratio of water, acid and oil than Air Force jet oxygen systems.

Additionally, a new flushing agent market was emerging to combat a rash of failed R-22 to R410A conversions when HVAC technicians attempted reusing existing contaminated line sets because their inaccessibility within walls or under concrete slabs made replacement costs prohibitive. "At first we thought service contractors wouldn't see value in two-pound canisters of flushing agent at a \$70 trade price, but then we realized it wasn't expensive when considering the cost of breaking open walls or concrete slabs to replace contaminated line sets," Scaringe recalled. "Further market analysis proved \$70 was less expensive than all other flushes because we developed, manufactured and packaged it ourselves, versus competitors that were absorbing extra costs associated with buying it from a manufacturer and repackaging it. Later, when third-party tests (posted at [www.epatest.com](http://www.epatest.com)) by Florida Institute of Technology (Melbourne, Fla.) proved QSF out-cleaned all other industry flushes for oil,

water, acid and contaminants without leaving a residue, we knew we had a winner on our hands. It was a better cleaning product, at a lower cost and it was the only biodegradable flush on the market, which is a safety, health and environmental concern for service techs.”

Mainstream Engineering has several similar product development stories that have helped it achieve an impressive 100-percent Commercialization Index, which is a rating system the Department of Defense uses to rank R&D vendors’ ability to later commercialize technology. QwikShot is an acid flush that was developed under a NASA contract. The scientific challenges associated with rejecting heat in outer space cause spacecraft heat pumps to operate with a very high lift that subsequently results in a high probability of acid development. Mainstream Engineering won the NASA contract to develop an acid eliminator that accelerates the transport of acid into the filter/drier, in contrast to existing additives on the market that only neutralize acid with a base and always result in the formation of system-damaging salts and water residue. “If it worked in outer space, why not market it to service techs down here on earth that want to prevent acid burnouts,” Scaringe said.

Likewise, QwikCheck is an acid checker that simply attaches to a refrigeration system’s Schrader valve and samples the refrigerant for traces of acid. A presence of acid turns the QwikCheck’s yellow paper to red. The acid check was designed so that people without refrigeration backgrounds, such as astronauts or military machine operators, can check a system for acid. For refrigeration service technicians, it’s an early indicator of acid before it propagates into major system damage.

Thanks to government agencies that provide funding for product development to help solve their HVAC challenges, some products trickle down to commercial HVAC and make refrigeration service easier and more effective for private sector technicians.