Finding a suitable substitute for dry cleaning solvent has puzzled experts from the Naval Air Systems Command (NAVAIR) for quite some time now. But thanks to the dedication of a number of engineers and other professionals from across the Navy, with support from the Army and a joint service solvent substitution working group, the pieces are falling into place.

It is known by many names—Stoddard Solvent, P-D-680, Commercial Item Description A-A-59601, MIL-PRF-680 Type II cleaner, Varsol, dry cleaning fluid. But it comes from a family of solvents for which environmentally friendly alternatives are being sought. These products may be used as a cleaner or rinse for hydraulic system assemblies, weapons, engines, wheel wells, bearings, and more. They are also effective at cleaning parts in parts washers.

The original product line currently covered in Commercial Item Description A-A-59601, commonly known as P-D-680, is being phased out in some locations because it contains unacceptably high levels of hazardous air pollutants (HAP) and volatile organic compounds (VOC), which contribute to certain health problems and photochemical smog respectively. To reduce the toxicity and negative effects of this compound, a new specification called MIL-PRF-680 was developed. There are three types of P-D-680 solvents, and four types of MIL-PRF-680 solvents. The difference between types is basically in the flashpoint. A higher flashpoint solvent is safer but is usually a less effective cleaner, so each product is designed to be used for different applications. Ideally, maintainers can select a product with the highest flashpoint available that effectively performs a task.

A complement of environmentally friendly products must eventually be available for use in a variety of applications, in locations with differing regulatory requirements prohibiting/regulating the two existing military specifications. For example, performance can be measured by the ability to degrease or remove dirt/debris, anti-corrosive properties, residue remaining after complete drying, dry time, or other factors, which are evaluated against requirements. The performance of the cleaning product is directly related to the chemical make-up of the product. More often than not, the regulatory restrictions conflict with the performance requirements, making a solution virtually impossible.

The aircraft wheel and corrosion control manuals are being reviewed to identify all references to MIL-PRF-680 and investigate alternate non-aqueous solvents that may be used.
To baseline information about commonly used products, a contract was put in place by NAVAIR’s Aging Aircraft Integrated Product Team with Science Logistics, Inc. and Tiburon Associates, Inc., both of which are part of the San Antonio based National Sustainment Technology Center, to document the product names, their types of uses and usage amounts, and the positive and negative attributes of each.

The report was completed in the spring of 2006 with support from Eric Rasmussen at the Naval Air Warfare Center—Aircraft Division, Lakehurst, NJ. Rasmussen developed software, called HAT (for the Hazardous Materials Authorized Use List (HMAUL) Analysis Tool) that scans digital documents for various types of information, such as military specifications, National Stock Numbers, and solvents (by various names), and provides tabular output that lists the page number of each material reference and other pertinent data. The HAT software, whose development was sponsored by NAVAIR’s Program Management Competency’s Environmental Programs Department (AIR 1.6), has been vital in scanning hundreds of technical manuals during the revision process to ensure that the manuals comply with environmental regulations.

Rasmussen’s input and the HAT software allowed for the quick, efficient and comprehensive identification of MIL-PRF-680 references that would have otherwise required the review of each manual page-by-page to accurately document the specific instances of MIL-PRF-680.

Another source of data for this effort came from Eric Friedl, from the Naval Facilities Engineering Service Center (NFESC), who manages the Environmental Systems Allocation (ESA) database. ESA, developed jointly by AIR 1.6 and NFESC, tracks actual usage of hazardous materials (and generation of hazardous waste) across the naval aviation maintenance community down to the squadron level. ESA data provided a breakdown of consumption rates for each product by platform, location, activity, work center, and amount.

The results of the analyses conducted using HAT and ESA software contained great insights into the pervasiveness of references to MIL-PRF-680 in aviation maintenance manuals as well as a much better appreciation of the volume and distribution of the solvent’s use at maintenance facilities. This report plays an important part in the efforts to look at MIL-PRF-680 replacements that have been taking place for the last two years.

Dr. El Sayed Arafat from NAVAIR Patuxent River, MD, conducted laboratory tests to assess different cleaners and blends to evaluate possible alternatives. A family of chemistries classified as cyclic siloxanes, which are HAP-free and contain zero-VOCs, are showing promising results.

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For more information about ESA, contact Eric Friedl at 805-982-3688 or eric.friedl@navy.mil.
It is hopeful that these new types of cleaners, along with others, will meet the requirements of a new specification being developed. Other products are also under consideration for future laboratory and field testing.

That brings us to today and to other folks who are involved in identifying the issues and solving the problems related to this particular family of solvents. The Joint Service Solvent Substitution Working Group (JS3WG), supported by the Joint Group on Pollution Prevention and the Navy's Pollution Abatement Ashore program, promotes teaming across the Department of Defense (DoD), and the National Aeronautics and Space Administration (NASA), to ensure joint service coordination and assist in the exchange of solvent substitution information across DoD and NASA. Tom Torres from NFESC (and a co-chair of the JS3WG), has been coordinating an effort to streamline these efforts, share information, and bring about standardization of solvent substitutions. The JS3WG was engaged to address the specific challenges associated with finding a suitable replacement for MIL-PRF-680.

A matrix of data on available products, usages, potential replacements, funding, testing, and fielding is being updated and shared among the team to track progress and establish priorities. (This matrix is available for review at https://js3.ctc.com/gd.asp.) The JS3 Methodology is being used to develop the acceptance criteria for alternative cleaners for all processes. (For more insights into the JS3 Methodology, read our article entitled, “Working Group Promotes Green Cleaning; Environmentally Friendly Alternatives Captured in On-Line Database,” in this issue of Currents.)

An example of two areas with wide impact are the aircraft wheel manual (NAVAIR 04-10-1) and cleaning and corrosion control manuals (NAVAIR 01-1A-509-1 through -4). These manuals are being reviewed to identify all references to MIL-PRF-680 and investigate alternate non-aqueous solvents that may be used on board ships or in other restricted areas. It is hoped that the results of this research and testing will be the development of an alternative MIL-PRF-680 specification that incorporates newer and safer products and processes.

Wayne Zeigler from the Army (another co-chair of the JS3WG) was instrumental in adding HAP-free verbiage to the latest revision of MIL-PRF-680 (the Army is the custodian of MIL-PRF-680). Subsequently, MIL-PRF-680B has been established, which is compliant with the current National Emissions Standard for Hazardous Air Pollutants (NESHAP), but still does not meet VOC requirements.

The goal to make many processes that employ MIL-PRF-680B NESHAP- and VOC-compliant is now within reach. The puzzle is nearly solved.