

# **Cleaning Solvents for the 21st Century**

**Y0817 Pollution Abatement Ashore Program**

**23 March 2004**

**Technical POC**

**NFESC, Code 421**

**Phone 805 982-1658**

**Management POC**

**NFESC, Code 45**

**Phone 805 982-1674**

# Objective & Navy EQ Requirements



**Objective: Develop a framework to systematically identify and qualify compliant alternative cleaners for VOC and HAP containing solvents used in DoD maintenance operations.**

<b>Requirements</b>	<b>Priority</b>	<b>Requirement Title</b>
2.I.01.g	High	Control/Reduce emissions from Coating, Stripping, and Cleaning Operations
2.I.01.q	High	Control of VOC and HAP Emissions
3.II.03.a	High	Non-VOC/ODS Solvents and Cleaning Systems for Aircraft/Weapons and Shipboard/Shore Side Applications

# Problem Statement/Drivers-Regulatory



- **Many Petroleum-based Solvents/Cleaners are or contain:**
  - **Hazardous Air Pollutants (HAPs)**
  - **Photo Reactive Volatile Organic Compounds (VOCs)**
- **Clean Air Act**
  - **National Emissions Standards for Hazardous Air Pollutants (NESHAP)**
    - Requires tracking of 189 HAPs
  - **National Ambient Air Quality Standards (NAAQS) for ozone**
    - Air Quality Management Districts regulate VOCs
      - Require emission control equipment
      - Limit VOC content of solvents/cleaners
      - Process ban

# Approach



- **Develop a Framework to ensure Solvent Substitution**
  - **Joint Service Solvent Substitution Working Group**
    - Coordination
    - Collect/Disseminate information within DoD and NASA
    - Engage respective services and Joint Group for Pollution Prevention (JG-PP)
    - Manage and execute the overall process (Framework)
  - **Joint Service Solvent Substitution Methodology**
    - Road Map
    - Methodology to establish acceptance criteria to implementation
    - Gain Joint Service acceptance
  - **Joint Service Solvent Substitution Database**
    - Track Solvent Substitution efforts
    - Store historical information
    - Disseminate information
    - Industry access
- **Identify and prioritize maintenance operations requiring T&E**
- **Fund and execute solvent substitution efforts**

# Technology Description



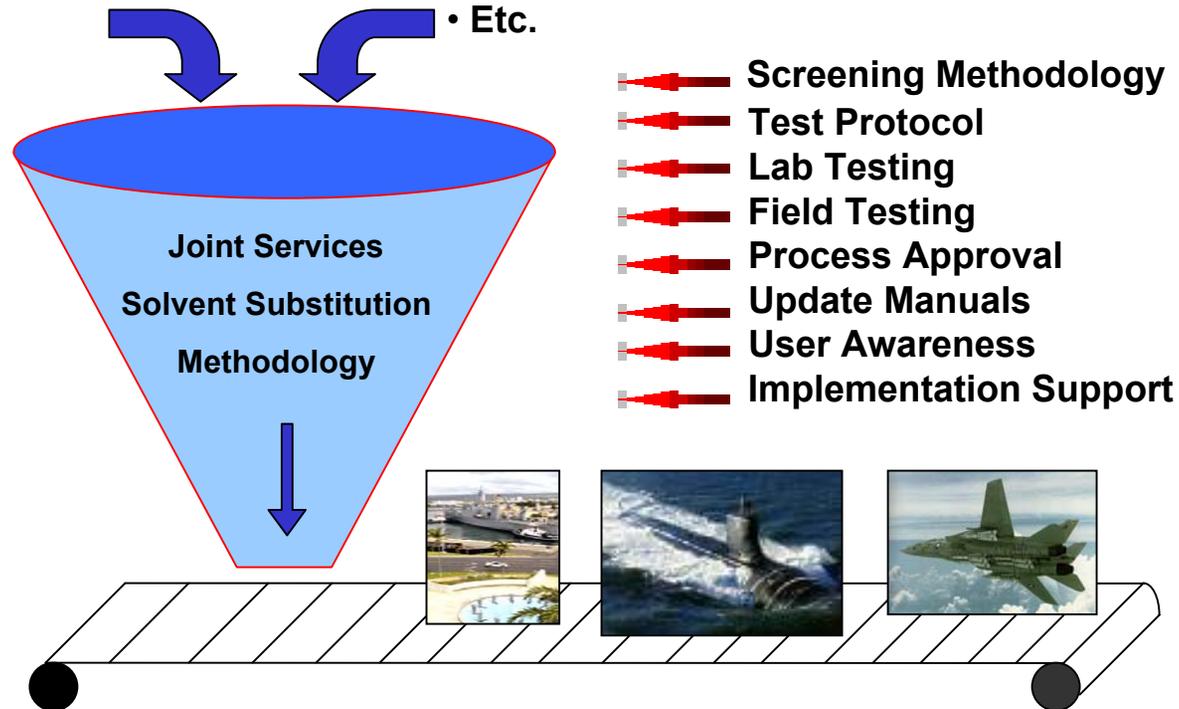
## Navy HAP/VOC Solvent Elimination Effort

### Targeted Processes

- Aircraft Maintenance
- Ship Maintenance
- Facility Maintenance
- Etc.

### Candidate Solutions

- Aqueous Solvents
- Biobased Solvents
- Ozone
- Etc.



*Being done  
in partnership  
with NAVSEA,  
NAVAIR, Army  
and Air Force*

**Processes not requiring extra record keeping & control measures**

# Before/After Comparison



<b>Before</b>	<b>After</b>
<b>VOC Emissions Control “End of the Stack” Approach</b>	<b>Eliminate Emissions Control Equipment Requirement</b>
<b>NESHAP Record Keeping Burden</b>	<b>Eliminate HAP Containing Solvents That Require Record Keeping</b>
<b>Toxic Release Inventory (TRI) Reportable Chemicals</b>	<b>Eliminate Chemicals That Are Reported Under TRI</b>

# Benefits: Before/After Comparison



	Cost (\$K/yr) P-D-680	Cost (\$K/yr) Biobased
Reporting	1251	646
Materials	83	414
Annual O&M	8000	2000
<b>Total Annual Costs</b>	<b>\$9,334</b>	<b>\$3,061</b>
<b>Annual Cost Savings</b>		<b>\$6,273</b>
<b>Capital Cost Avoidance</b>		<b>\$100,000</b>
<b>Total Savings (10yrs)</b>		<b>\$162,735</b>
<b>R&amp;D Investment (\$K)</b>		<b>\$850</b>
<b>ROI</b>		<b>191</b>

**Assumptions:** 276,000 lbs of solvents used by 11 activities  
 Reporting costs are \$4.53/lb for PD-680 and \$2.34 for bio-based  
 Material costs are \$0.30/lb PD-680 and \$1.50/lb Bio-based

# Milestones and Major Deliverables of Task



MILESTONE	FY02				FY03				FY04			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Survey New Solvents			■	■								
2. Collect Existing Solvent Substitution Data				■	■	■	■					
3. Identify Solvent Usage And Operations				■	■	■	■		■	■		
4. Conduct Solvent Elimination Workshop					■							
5. Develop Joint Service Solvent Sub. Meth.						■	■	■	■	■		
6. Develop Database and Populate						■	■	■	■	■	■	
7. Demonstrate Methodology									■	■	■	■
8. Revise Methodology												■
9. Implementation												■

# Technical Accomplishments to Date



## Task 1: Engage Industry

### – Manufacturing Week (CleanTech)

- Booth
- Generated new Solvent Manufacturers contacts
- Disseminated information on Current Effort

### – International Workshop on Alternatives to Toxic Materials in Industrial Processes

- Presentation on Effort
- Generated new Solvent Manufacturers contacts
- Disseminated information on Current Effort

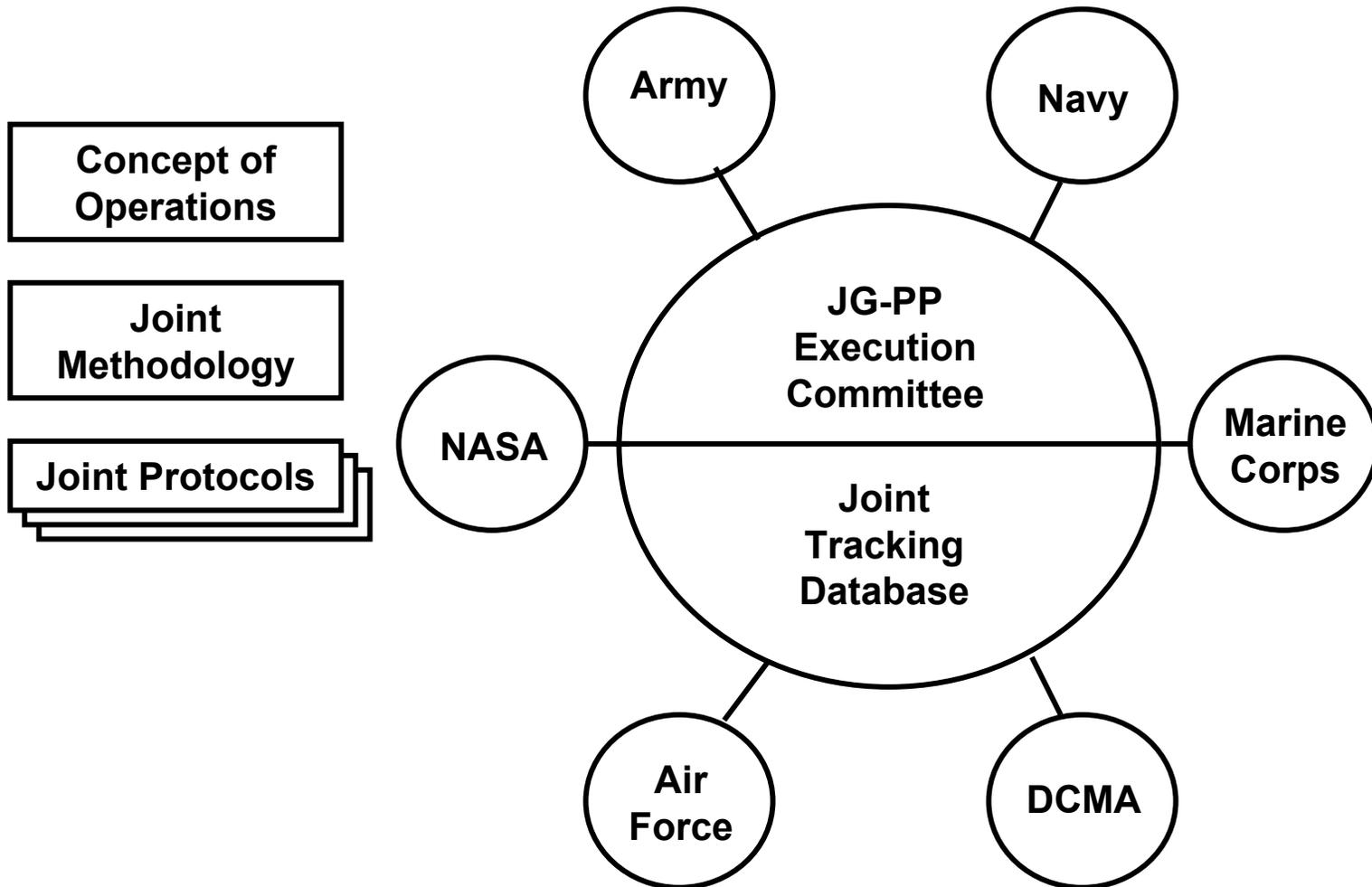
# Technical Accomplishments to Date



## Task 2: Coordination

- **Original Players (Joint Solvent Substitution Working Group)**
  - Navy (NAVFAC, NAVSEA, and NAVAIR)
  - Army (ARL, ATC, and AEC)
  - Air Force (AFMC)
- **Recently Added Players**
  - JG-PP (Joint Group on Pollution Prevention)
  - NASA (National Aeronautics and Space Administration)
  - Marine Corps
  - DLA (Defense Logistics Agency)
- **Future Players**
  - EPA (Environmental Protection Agency)
  - USDA (United States Department of Agriculture)
  - Industry

# Technical Accomplishments to Date



## Task 3: Identified Solvent Usage and Operations

- **Teamed with NAVSEA and NAVAIR**
  - Contracted with BAE Systems
  - Funded NAVAIR
  
- **Results**
  - Obtained Solvent Usage Data Within NAVSEA
  - Obtained Solvent Usage Data Within NAVAIR

# Technical Accomplishments to Date



## NAVSEA Chemical Usage

PRODUCT	NO. OF FACILITIES	HAPS (lbs)	VOCS (g/l)	NAVSEA TARGET CHEMICALS (lbs)	TOTAL POUNDS REPORTED
T-10 THINNER	4	19,750		41,489	56,330
SIGMA 90-30 THINNER	3	485		388	4,041
DOPE & LACQUER THINNER	4	564		815	2,508
ISOPROPYL ALCOHOL	3		790		17,421
N-BUTYL ALCOHOL	2		807	3,897	3,897
MINERAL SPIRITS	3		800		54,000

# Technical Accomplishments to Date



## NAVSEA Chemical Usage

PROCESSES (lbs)	ID-02-06	ID-05-00	ID-05-01	ID-05-02	ID-05-05	NL
T-10 THINNER	0	53,387	0	8,558	5,893	166
ISOPROPYL ALCOHOL	20,694	0	0	0	0	50
DOPE & LACQUER THINNER	1,209	1,311	14	21	1,757	0
N-BUTYL ALCOHOL	3,641	1,352	0	0	0	0
SIGMA 90-30 THINNER	0	0	0	260	2,894	177
MINERAL SPIRITS	0	0	0	0	0	4,165
<b>TOTAL PROCESS (IN POUNDS)</b>	<b>25,544</b>	<b>56,050</b>	<b>14</b>	<b>8,839</b>	<b>10,544</b>	<b>4,558</b>

ID-02-06 - Degreasing, wipe cleaning  
 ID-05-00 - Painting, multiple operations  
 ID-05-01 - Spray painting, compressed air  
 ID-05-02 - Spray painting, airless  
 ID-05-05 - Brush/roller painting  
 NL - Not Listed

# Technical Accomplishments to Date



## NAVSEA Chemical Usage

(lbs)	DOPE & LACQUER THINNER	SIGMA 90-30 THINNER	T-10 THINNER	ISOPROPYL ALCOHOL	MINERAL SPIRITS	N-BUTYL ALCOHOL
N-BUTYL ALCOHOL	614		27,028			4,985
XYLENE		395	26,233		42	
ISOPROPYL ALCOHOL				20,189		
MEK	1,084					
TOLUENE	776					

# Technical Accomplishments to Date



## **NAVAIR Usage Data:**

- Organizational
- Intermediate
- Depot

## **DLA Procurement Data:**

- Consistent with NAVSEA usage data

# Technical Accomplishments to Date



## Task 4: Conducted 2<sup>nd</sup> VOC/HAP Solvent Elimination Workshop

- **Workshop Attendees**
  - Joint Service Solvent Substitution Working Group
  - Key Contractors
  
- **Topics and Issues Discussed**
  - Methodology
  - Database
  - Engaging JG-PP
  - Strategy for engaging industry

# Technical Accomplishments to Date



## Task 5: Completed the Joint Service Solvent Substitution Methodology

### Information contained within Document:

- Description of Methodology
- Procedures to follow (Start to Finish)
- Flow Chart
- Environmental Parameters
- Health and Safety Parameters
- Solvent Characteristics
- Compatibility Tests and Methods
- Cleaning Efficiency Test Methods



### DRAFT JOINT SERVICES SOLVENT SUBSTITUTION METHODOLOGY

Prepared by  
Naval Facilities Engineering Service Center  
Pollution Prevention Technology Development Branch  
1100 23<sup>rd</sup> Avenue, Code 421  
Port Hueneme, CA 93043-4340

## Task 6: Develop Joint Service Solvent Substitution Tracking Database

- **Database Requirements**
  - ✓ Web Based
  - ✓ Tracks Project Status
  - ✓ Stores Project Information
  - ✓ Stores Developed Acceptance Criteria
  - ✓ Stores Historical Information
  - ✓ Industry Access (Populate and Retrieve)
  
- **Results**
  - Database Developed
  - NFESC Web Site
  - Ready for Beta Test

# Technical Accomplishments to Date



## DoD/Vendor On-Line Interface to Match Process Acceptance Criteria With Commercially Available and Validated Alternative Cleaners

The screenshot shows a web browser window displaying the homepage of the DoD Solvent Substitution Tracking Database. The page has a blue header with the DoD seal on both sides and the title "DoD Solvent Substitution Tracking Database" in the center. Below the header, there is a red heading "Welcome to the DoD Solvent Substitution Tracking Web Site." followed by a paragraph of introductory text. The text explains the site's purpose and provides links for users to enter the site or apply for registration. At the bottom, it states the site is hosted by the Naval Facilities Engineering Service Center and includes links for a warning statement, privacy notice, and disclaimer.

**Welcome to the DoD Solvent Substitution Tracking Web Site.**

The Department of Defense (DoD) Solvent Substitution Tracking Web Site is a comprehensive site designed to provide information on completed, ongoing, and proposed solvent substitution efforts throughout the DoD.

The intent of the web site is to provide solvent substitution information on DoD processes and solvents so data can be leveraged and prevent the duplication of efforts.

To enter this web site, please have your login name/password ready and click here: [Enter DoD Solvent Substitution Tracking Web Site](#)

If you do not have a login name/password, you can apply for one here: [Apply for NETS Registration](#)

---

This is an official U.S. Navy web site and is hosted by:

*Naval Facilities Engineering Service Center*

---

[DoD Warning Statement](#)   [Privacy and Security Notice](#)   [General Disclaimer](#)

# Technical Accomplishments to Date



## April 2004 – BETA Test

**DoD Solvent Substitution Tracking Database**

[HOME] [LINKS] [FORUMS] [CALENDAR] [HELP] [LOGOUT]

Logged in as: Bugs Buzny

### Adding a Solvent Document

Document Title:

Document Summary:

Input Process:

If your desired Process is not on the list, then you may add a Process to this list by clicking [here](#). This will open up a new window with information on the Process you wish to add. When done, close the Solvent window and return to this screen. Refresh the screen. Cnt-R, and the Solvent you added will now appear on the Process menu list.

Upload Document Report (Word, PDF, or text files ONLY):

[\[Back to Home Page\]](#)

### Adding Test Data for a Solvent

Before filling out the test data, make sure that all the laboratories that you plan on using are listed on the laboratory menu. If your desired laboratory is not on the menu, then click [here](#) to add it to the menu. This will open a new window; when you are finished adding a laboratory, then close the window and return to this page. Refresh the page, and you will see the laboratory added to the laboratory menu. When all your desired laboratories are on the menu, then proceed with the filling out of the test data form.

Also, if you do not find the ASTM Test # on the list below, you can add it in by clicking [here](#).

TEST #	TEST TITLE	RESULT	Units	Lab-atory
<input type="checkbox"/> 40 CFR 796.3100 or 796.3240	Biodegradability	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding Lab Name"/>
<input type="checkbox"/> ADS-61 Draft/MIL-PRF-87937C	Cold Stability/Low Temperature Stability	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding Lab Name"/>
<input type="checkbox"/> ADS-61 Draft/MIL-PRF-87937C	Heat Stability/Accelerated Storage Stability	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding Lab Name"/>
<input type="checkbox"/> ADS-61-PRF	Fluorescent Penetration Inspection	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding Lab Name"/>
<input type="checkbox"/> AR 40-5	Toxicity	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding Lab Name"/>
<input type="checkbox"/> ASTM D-1133	Kaon-butanol value	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-1296	Odor	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-1298	Apparent specific gravity	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-130-94	Steel Corrosion	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-130-94	Copper Corrosion	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-1353	Non-Volatile Residues	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-156	Color	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-2240-95	Rubber Compatibility - Compression Set	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-2240-95	Rubber Compatibility - Durometer Hardness	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-235	Detector test	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D256	Effects on PCITFE, Impact Strength	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-2834	Non-Volatile Content	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-2879	Vapor pressure	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>
<input type="checkbox"/> ASTM D-3167-93, ASTM D3933-	Viscosity	<input type="text"/>	<input type="text" value="cubic meter"/>	<input type="text" value="Adding"/>

### Materials Compatibility Criteria

Test # and Title	Requirement	Reference
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>

### Cleaning Efficiency Criteria

Test # and Title	Requirement	Reference
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>
40 CFR 796.3100 or 796.3240   Biodegradability	<input type="text"/>	<input type="text"/>

# Implementation Accomplishments and Plan



- 1. Coordinated with NAVSEA, NAVAIR, ARMY, Air Force, DLA, GSA, and JG-PP (Joint Service Solvent Substitution Working Group)**
- 2. Distribution List for Methodology Review Includes NAVAIR (Dayle Dierks, David Brock), NAVSEA (Deborah Verderame, Keit Ung), Army (Wayne Ziegler, Patrick Donahue), and Air Force (Debora Meredith)**
- 3. Distribution List Expand to Include Personnel From Depots**
- 4. Contacted >150 DoD and Non DoD Personnel**
- 5. Next Step to Ensure Full Endorsement of Methodology**

# Logic Model for Cleaning Solvents for the 21<sup>st</sup> Century



<b>Navy Benefits</b>	<b>Navy will have a process to systematically and efficiently replace solvents/cleaner with environmentally compliant alternative cleaners</b>
<b>Customer Capability</b>	<b>Minimize costs associated with cleaning operations by reducing environmental compliance costs</b>
<b>Products</b>	<b>Environmentally friendly cleaners</b>
<b>Project Milestones</b>	<b>MS 5 (Q2,FY04) – Methodology Development and MS 6 (Q3,FY04) – Database Development</b>

# Summary



- **Formed Strong Partnerships with NAVAIR, NAVSEA, Air Force, Army, NASA, and JG-PP**
- **Developed Joint Solvent Substitution Methodology**
- **Developed Solvent Elimination Database**
- **Solvent Elimination Offers Great Potential for Cost Savings; ROI 191**