NASA Acquisition Pollution Prevention Program Office
Kennedy Space Center, FL 32899

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Studies, Reports, and Recommendations in Support of the NASA Acquisition Pollution Prevention (AP2) Program at the John F. Kennedy Space Center (KSC), FL

Final Report
April 16, 2004

NASA Contract: NAS10-03029
Task Order No. 1

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Executive Summary

NASA Headquarters established the NASA Acquisition Pollution Prevention (AP2) Program Office in 1998 to help NASA Enterprises, Programs and Centers qualify and implement replacement materials or processes that reduce and eliminate the uses of hazardous materials. International Trade Bridge, Inc. (ITB), with corporate headquarters in Dayton, OH and a division office located in Merritt Island, FL, staff provides engineering, technical, and administrative program and project management support to the AP2 Program Manager. This report covers ITB's performance under Task Order No. 1 for the period April 17, 2003 to April 16, 2004.

The NASA AP2 Program operates in three distinct business entities:

- Agency
- U.S. Department of Defense (DoD)
- International

During this reporting period, ITB provided core program support across all three business entities. Core Support activities were largely comprised of program administration, regulatory support, information management, and marketing. These core activities provided the backbone to the other program and project support.

A major emphasis for ITB under Task Order #1 was the development and execution of pollution prevention projects. Specific project achievements included:

- Completed one NASA project and supported completion of two projects by the Joint Group on Pollution Prevention (JG-PP)
- Developed eight opportunities into active Agency and International projects
- Kicked off an additional three Agency projects (which were later discontinued)
- Managed or supported four active JG-PP projects
- Supported two new developing opportunities (by the Shuttle Environmental Assurance Initiative)
- Identified, further developed, or monitored at least ten pollution prevention (P2) opportunities/technologies for future project consideration
- Identified prospective opportunities with Air Force Space Command Pollution Prevention (AFSPC) Office and Naval Facilities Engineering Command (NAVFAC)

Finally, ITB provided tangible program-level support to the NASA AP2 Program Manager, the JG-PP Working Group, and the Portuguese Center for Pollution Prevention (C3P) Program.

Draft Final Report

AP2 Program Overview

As stated in a Memorandum of Agreement between NASA Headquarters and Kennedy Space Center (KSC), the NASA Acquisition Pollution Prevention (AP2) Program Office was established at KSC in 1998. The AP2 office resides within the Spaceport Engineering and Technology Directorate (YA), under the Office of the Associate Director for Spaceport Technology Project Management (YA-E), in the Operational Spaceport Project Office (YA-E2).

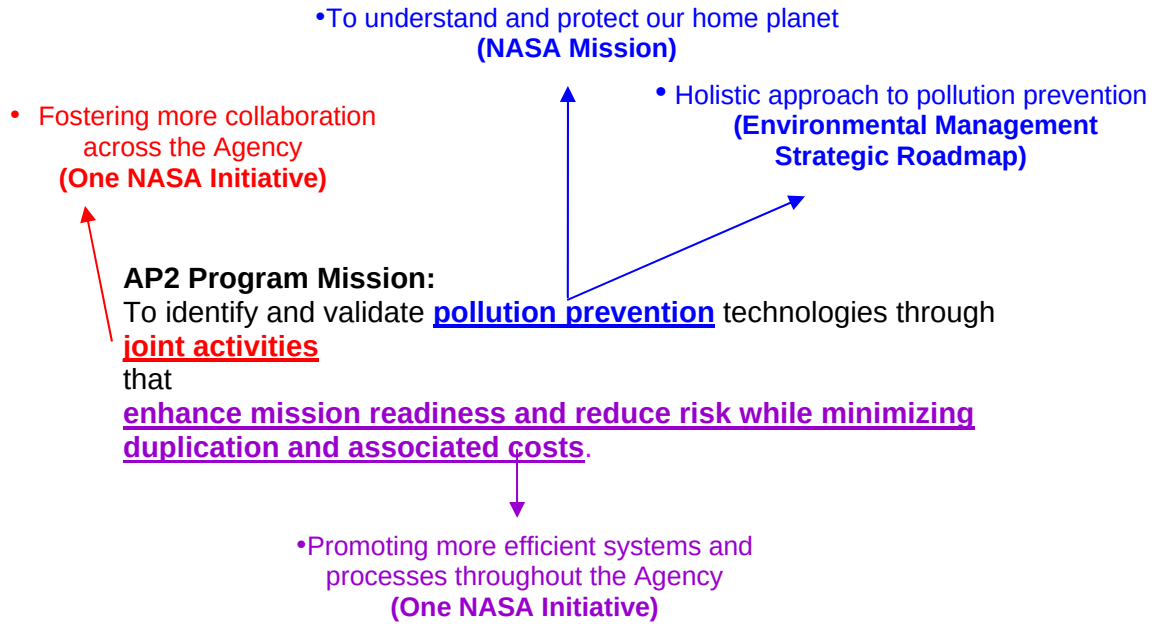
The AP2 Program Manager, Ms. Christina Brown, provides centralized Agency leadership for identifying, qualifying, and implementing common alternatives for reduction or replacement of hazardous materials used by NASA Enterprises

AP2 Program Mission

The work preformed under the Task Order #1 Statement of Work provides the NASA AP2 Program Office with reports and recommendations in support of the development, planning, and integration of Agency-wide joint service pollution prevention (P2) opportunity programs. The goal of the NASA AP2 Program Office is to reduce duplication among the Agency, services, and weapon systems, decrease the technical risk of alternative qualifications, and reduce the cost of material/process substitutions to the individual programs. Specifically, the NASA AP2 Program Office is tasked to integrate pollution prevention, systems health and safety risk assessments and environmental impact assessments into the entire life cycle of system programs from concept development to final disposal. This is accomplished by effectively implementing strategies to integrate environmental considerations into the NASA Centers, Enterprise Program Element and U.S. Department of Defense (DoD) weapon systems acquisition, operations and sustainment processes.

The AP2 Program mission directly relates to NASA's prime mission, the One NASA Initiative, and the Environmental Management Strategic Roadmap by focusing on collaboration between centers in identifying and testing more environmentally friendly technologies. Figure 1 depicts the various Agency mission relationships.

Figure 1 - NASA AP2 Program Mission



In enacting its mission, the NASA AP2 Program operates in three distinct business entities:

- Agency
- U.S. Department of Defense (DoD)
- International

International Trade Bridge, Inc. (ITB), with corporate headquarters in Dayton, OH, and a division office located in Merritt Island, FL, provides the engineering, technical, and administrative program and project management support to the NASA AP2 Program Manager. These activities may be exclusive to each business entity or shared by two or more in keeping with the Program's mission to identify common environmental issues and work collectively to find solutions that minimize effort, costs and technical risks.

This Draft Final Report for the NASA AP2 Program covers the period of April 17, 2003 through April 16, 2004. The report is divided into four major sections:

1. Core Program Support;
2. Agency Business Entity Support;
3. DoD Business Entity Support; and
4. International Business Entity Support.

A. Year In Review – Core Program Support

The objective of core program support is to establish and sustain a robust, core infrastructure that supports all necessary AP2 program and project functions. As such, core program support activities are shared across and benefit program business entities (NASA, DoD, and International).

The knowledge, skills, and abilities of the ITB contractors supporting the NASA AP2 Office allowed the Program to meet its mission of helping NASA Enterprises, Programs, and Centers qualify and implement less hazardous materials and/or processes. During this reporting period, the NASA AP2 Office was supported by the following personnel:

- ITB Program Manager: Mr. Brian Greene (Position held by Mr. Robert Hill prior to January 2004)
- Program Analyst: Ms. Katherine Torres, who joined the staff in January 2004 (Position held by Ms. Tess Hill prior to January 2004)
- Engineers:
    - Mr. Kevin Andrews
    - Mr. Kurt Kessel
    - Mr. Matt Rothgeb
    - Ms. Pattie Lewis, who joined the staff in July 2003
- Web/Database and Administrative Specialist: Ms. Cassandra Carroll.

Collectively, these personnel interfaced with senior NASA and DoD program and technical representatives, international executives, scientists, engineers, and numerous subject matter experts in the day-to-day development of program and project requirements and activities.

The core program support activities performed by the AP2 staff can be generally categorized as follows:

1. Program administration
2. Regulatory support
3. Information management
4. Marketing

Achievements and highlights under each of these four categories are discussed below.

1. <u>Program Administration</u>

Program administration is a primary function of the current Program Analyst, Ms. Torres, with additional support from Ms. Carroll. This function is critical to ensuring the effective and continuous direction and control of the AP2 Program. In this capacity, ITB planned and coordinated program scheduling, budgeting, and administrative tasks. Routine activities included:

- Maintenance of all necessary electronic tools and support material at Kennedy Space Center and the ITB Merritt Island office with no down time;
- Tracking travel and materials budgets for proper program supportability; and
- Facilitation of program logistics, such as meetings and conference calls, taking meeting minutes and action items during meetings and performing basic follow-up, and assisting in development of presentations.

Notable administrative achievements follow.

In March 2004, ITB worked with KSC ODIN to make the AP2 Calendar of Events electronically accessible to all AP2 personnel in Microsoft Outlook via KSC's server. The calendar lists program and project teleconferences, meetings and conferences for the NASA AP2 and Shuttle Environmental Assurance (SEA), Joint Group on Pollution Prevention (JG-PP), and the Portuguese Center for Pollution Prevention (C3P) Program. Previously, the calendar was updated at least monthly via e-mail requests to the NASA AP2 staff. Copies of the updated calendar were provided to the AP2 staff (and the AP2 Manager) in Microsoft

Excel. The benefits of now having one calendar electronically accessible via KSC's server include the following:

1. Allows any AP2 staff member to view and edit the calendar, including the AP2 Manager
2. Allows for more immediate, real-time updating of the calendar
3. Allows the calendar to be viewed via the internet from off-base, (i.e., through the KSC Webmail)
4. Includes most Microsoft Outlook calendar functions, such as options for inviting both required and optional attendees, ability to highlight events using different colors, etc.
5. Allows for agendas and other documents relative to an event to be attached to the calendar item, thus enhancing communication
6. When event involves travel, allows for notations to be made about how the traveler can be reached when on travel

During this reporting period, over 150 events were identified, scheduled, and attended by one or more ITB staff members and/or Ms. Brown (Table 1).

Table 1 - NASA AP2 Calendar of Events

Entity	Teleconferences	Meetings	Conferences/Workshops
NASA	47	28	10
JG-PP	57	13	7
C3P	2	8	1
Total	106	49	18

Program and project events from the AP2 calendar were also transcribed to the NASA AP2 web site, www.acqp2.nasa.gov. The latest AP2 calendar is attached for review. (See Appendix A)

ITB developed 10 PowerPoint presentations in support of Agency, DoD, and International program-level activities (presentations can be viewed upon request):

- "Lead-Free Solder and NASA," (NASA SEA Meeting, KSC, FL, May 2003)
- "NASA Environmental Manager's Panel Meeting," (Washington, D.C. June 2003)
- "Integrating Common Problems for Shared Solutions," (Air and Waste Conference and Exhibition, San Diego, CA, June 2003)
- "Earned Value Metrics," (JG-PP Principals' Meeting October 2003)
- "NASA KSC Environmental Council Meeting," (November 2003)
- "Reduction/Elimination of Emissions from Hexavalent Chrome (Cr6+) Plating Baths," (Integrating Common Problems for Shared Solutions for Technical Workshop in Lisbon, Portugal, September 2003)
- Panel on Specific Projects Aiming at Reduction of Volatile Organic Compounds in Industry," (Integrating Common Problems for Shared Solutions for Technical Workshop in Lisbon, Portugal, September 2003)
- "Project Area #5, Lead-Free Solder'" (C3P-NASA Technical Workshop in Lisbon, Portugal, September 2003)
- "NASA Acquisition Pollution Prevention Program Management Review," (Washington, D.C. February 2004)
- "Implementation of Earned Value Metrics," (JG-PP Working Group Meeting, Johnstown, PA, April 2004)

On occasion, ITB also prepared speaker notes and/or outlines for the AP2 Managers' use in delivering briefings.

ITB tracked all travel planned and made by staff. The following chart (Table 2) chronologically lists trips made during the reporting period under each of the business entities (See Appendix B for trip reports). The total number of person-trips was 47.

Table 2 - NASA AP2 Task Order #1 ITB Staff Travel History

Location	Description	Date	Travelers		
			NASA	DoD	Int'l
			17 36%	20 43%	10 21%
Anaheim CA	Lead-Free Solder meeting & APEX Conference 2003	Mar-03		1	
Baltimore MD	NWTC - NASA Workmanship Technical Committee	Apr-03	1		
Colorado Springs CO	Aerospace Coatings Removal & Coatings Conference	May-03	1		
Dayton OH	JCAA/JG-PP Lead-Free Solder business meeting	May-03		2	
Lisbon PT	Portugal facility assessments #1	Jun-03			2
San Diego CA	Air & Waste Management Assoc. Conference	Jun-03	2		
Oklahoma City OK	Oxygen line cleaning mtg. @ Versar	Jun-03	1		
San Antonio TX	Hazardous Waste & Pollution Prevention Conference	Aug-03		2	
New Orleans LA	Joint Conference on Aging Aircraft (JCAA) Conference	Sep-03		2	
Lisbon PT	Center for Pollution Prevention Program (C3P) Workshop & Joint Oversight Group (JOG) meeting	Sep-03			4
Chicago IL	Surface Mount Technology Int'l Conference	Sep-03		1	
Arlington VA	JG-PP WG Face-to-Face	Sep-03		2	
Huntsville AL	Shuttle Environmental Assurance (SEA) meeting	Oct-03	2		
Philadelphia PA	Lead-Free Solder Workshop @ American Competitiveness Institute (ACI)	Nov-03	2		
Lisbon	Portugal facility assessments #2	Nov-03			3
Colorado Springs CO	Air Force Space Command/NASA AP2 meeting	Nov-03		1	
Robins GA	JG-PP Coatings for Support Equipment meeting	Nov-03		1	
Las Vegas NV	Tri-Service Corrosion Conference	Nov-03		1	
Stennis MS	Coating/ Depainting project meeting	Dec-03	2		
Las Vegas NV	DoD Laser Applications Information Exchange for Maintenance and Sustainment Solutions Forum	Dec-03		1	
Scottsdale AZ	Info Exchange for Alternatives to Toxic Materials	Dec-03	2		
Cocoa Beach, FL	Army Corrosion Conference	Feb-04	2		
Anaheim CA	APEX Conference 2004	Feb-04		1	
Vandenberg AFB, CA	Air Force Space Command/NASA AP2 meeting	Feb-04		1	
Chicago IL	CleanTech 2004 Conference	Feb-04	2		
Irving, TX	LFS testing kickoff meeting/LFS test board assembly	Mar-04		2	
Lisbon PT	C3P Volatile Organic (VOC) Compound project meeting #1	Mar-04			1
Johnstown, PA	JG-PP WG Face-to-Face	Apr-04		2	

47 total travelers

ITB regularly updated a Project Information Workbook, which includes the business entity project, date, status, and point of contact. In May 2003, ITB provided a copy of the Project Information Workbook for Mr. David Amidei, NASA Headquarters (HQ), Code JE.

ITB analyzed program and project Financial Profile Workbooks for the Joint Group on Pollution Prevention (JG-PP) to identify disparities between budget and requirements, and received and expensed funds. ITB documented these financial reports and coordinated

issues of concern with JG-PP and Project Integrators for resolution of respective worksheet disparities.

The ITB Program Analyst maintained virtually all Microsoft Outlook e-mail distribution lists with the exception of those distribution lists for Agency projects, which were maintained by ITB technical staff (Table 3). (Ms. Lewis maintained the distribution list for the two NASA AP2 Projects, Alternatives to Aliphatic Isocyanate Polyurethanes and Surface Prep/Depainting for Structural Steel, with input by Mr. Andrews). ITB also continued to update the project points of contact list for each NASA Center.

Table 3 – E-mail Distribution Lists

Distribution List	Number of Members
JG-PP Working Group and Assistants	38
JG-PP Execution Committee (Solvent Substitution)	23
JG-PP Project Selection Committee (Coatings)	25
JCAA/JG-PP Lead-Free Solder	190
Shuttle Environmental Assurance (SEA)	74

2. Regulatory Support

ITB provided regulatory support by reviewing applicable regulations, Executive Orders, NASA guides, handbooks, and international policies. Highlights follow.

ITB supported the NASA HQ Pollution Prevention NASA Policy Guidelines & HQ Sustainable Development Program Review. NASA AP2 participated in this bi-annual meeting at NASA HQ, discussing sustainability and how the AP2 Office may assist in attaining sustainability within NASA's industrial processes. At this review meeting, the current P2 progress of all NASA Centers was discussed in detail. Additionally, the P2 group as a whole will be looking toward sustainability as the goal for all processes, especially those processes using hazardous materials currently. The goal of sustainability is to ensure that regardless of regulatory changes and decreased availability of resources, NASA Centers and NASA as a whole will not only be able to sustain its current operations but also expand given increased market and regulatory pressure.

In identifying international pollution prevention needs, ITB reviewed applicable European and Portuguese regulations and standards (e.g., Directive 1999/13/CE, Regulation DL nº 242/2001, Decree Law (DL) 352/90, Regulating Ordinance nº 286/93).

In September 2003, ITB reviewed the Columbia Accident Investigation Board (CAIB) (See Attachment: Response to CAIB Report for CB 09.02.03) and made several recommendations which were ultimately provided to NASA HQ, including a recommendation to develop an AP2-led Agency project to identify and test materials and methods to improve the maintenance of launch pad structures to minimize the leaching of zinc primer onto Reinforced Carbon-Carbon components.

In December 2003, ITB reviewed NASA Standard 6002 "Applying Data Matrix Identification Symbols on Aerospace Parts" to determine the relation and applicability of it to the JG-PP Low/No VOC Identification Marking and Ink Stenciling projects. Mr. Rothgeb noticed the document when looking over standards currently used within NASA Centers. The goal of searching through current NASA standards was to identify any that could be directly related to past JG-PP Projects. NASA Standard 6002 can be directly correlated with the JG-PP Project #*J-95-OC-005* "Low-VOC Identification Marking". The various methods of low and no VOC ID marking are written into the standard for most operations involving ID marking. There is no evidence within the Standard 6002 that inhibits the use of any low-VOC marking

methods that were identified in the JG-PP project. It should now be determined if the JG-PP Projects results can be leveraged into a new project within NASA facilities.

In January 2004, ITB reviewed a NASA Advisory from Mr. Rich Wickman, NASA HQ. The NASA Advisory (NA-HQ-2004-01) was issued by Mr. Eric C. Raynor on January 5, 2003 regarding the potentially catastrophic failure of high strength steel components resulting from process exposure to aqueous cleaner solutions. Upon review, ITB determined that current NASA AP2 Projects will not be affected adversely by the NASA Advisory. Mr. Rothgeb also responded as such to a related inquiry from Dryden Flight Research Center (DFRC) involving parts washers.

In February 2004, Mr. Rothgeb was contacted by Mrs. Anne Meinhold (ITB) concerning the Clean Air Act Working Group (CAAWG) that exists within NASA. This group works toward addressing how NASA Centers are complying with air regulations. One topic of focus is the National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Defense Land Systems and Miscellaneous Equipment (DLSME). The NESHAP will affect NASA facilities, but the extent of this has yet to be determined. Mr. Rothgeb contacted Mrs. Sharon Scroggins at Marshall Space Flight Center (MSFC) to be included on the distribution list for this group. Mr. Rothgeb will be maintaining contact with the group in order to keep the AP2 Office notified of any regulatory changes that are of concern to NASA Centers.

3. Information Management

ITB developed, analyzed, and maintained various information management systems such as the AP2 Web Site, Center for Pollution Prevention (C3P) Web Site, the Pollution Prevention Integrated Technology Database (ITDb), Document Control System (DCS), and Kennedy Space Center Projects and Resources Online (KPRO). Following are specific achievements.

Web Sites

During this reporting period, ITB redesigned the AP2 and C3P web sites to be more effective information management systems that support Program visibility and enhance communications. Content and format changes to the AP2 Web site included: information regarding Agency, JG-PP and C3P activities; links to many valuable Pollution Prevention sources; and details of program and project calendar events. The Web site's final format and content were approved by Ms. Brown on May 30, 2003.

Visibility of the AP2 web site is limited because the site is kept behind the government-domain (.gov) firewall for security purposes. In September 2003, Ms. Carroll and Ms. Brown submitted documents to seek approval for public access of the AP2 web site. This request was approved; the web site was placed outside of the firewall on March 23, 2004 for public viewing. In April 2004, AP2 engineers began drafting revised pages for the AP2 Web site to better highlight AP2 projects; these will be completed and posted at the start of the next ITB-NASA task order.

During the beginning part of this reporting period, Ms. Carroll developed, maintained, and updated the C3P web site as needed. In early October 2003, Ms. Carroll published the briefings to the C3P web site from the 2003 C3P and NASA Technical Workshop, "Integrating Common Problems for Shared Solutions," held in September 2003 in Lisbon, Portugal. Maintenance responsibilities of the C3P web site were turned over to C3P on October 8, 2003.

Integrated Technology Database

In May 2003, ITB defined the following specifications for a Web-enabled database of P2 technologies and solutions for the possibility of storing the database on a server:

- Location of server: ITB Southern Regional Office, Merritt Island, Florida

- Server-side language: Cold Fusion MX

In a May 2003 meeting with the AP2 Program Manager, Ms. Brown provided direction that ITB should focus not only on web-enabling the current application but should also evolve the application into a more robust and usable tool that allows for real-time updating and multiple data-entry ports. The evolved tool should provide a mechanism for users (across multiple elements) to readily identify common needs and available solutions and thus facilitate dem/val of new technologies using joint partnerships in the domestic and international arena. Mrs. Brown stated that the ITDb must be able to match P2 needs to solutions and current projects/partners and thus provide a valuable tool to its users by saving time and money.

In a February 2004 meeting with the NASA AP2 Program Manager, Ms. Brown agreed with ITB's recommendation to have the ITDb reside on a third-party server. This option has the benefits of being the least expensive option while still providing acceptable functionality.

The next steps for ITB are to see to the third-party hosting, and begin updating the contents of the ITDb; thereby making it a tool that is relevant and useful to ITB engineers in project identification and development in support of the NASA AP2 Program and C3P.

Document Control System

ITB staffers developed and implemented a document control system (DCS) to ensure that all documents generated by the NASA AP2 program were stored in a central repository. The DCS provides a managed and efficient system to ensure that documents of contractual importance are accounted for and suitably archived. During this reporting period, ITB staff submitted 93 documents which have been assigned a tracking number and entered into the DCS by Ms. Carroll. A weekly back-up CD of the DCS is kept at the ITB South office.

Kennedy Space Center Projects and Resources Online (KPRO)

In February 2002, NASA KSC launched KPRO. KPRO is a centralized project management information system tailored to the unique project management practices of NASA and KSC using Microsoft Project. It is web enabled to allow real-time updating of project schedules, budget information, status reporting, and document sharing.

Ms. Carroll met with the AP2 Program Manager, Ms. Christina Brown, on November 7, 2003 and was tasked to explore and learn the KPRO system in preparation for full use beginning with the next Task Order in April 2004. NASA has authorized four (4) contractor seats to have the KPRO software installed; this action was completed on the following dates: Ms. Carroll on November 14, 2003 and Mr. Greene, Mr. Kessel and Mr. Andrews on November 26, 2003. Ms. Carroll loaded the initial AP2 Program schedule on November 14, 2003 with a subsequent meeting with Ms. Brown and additional program information loaded on December 1, 2003. Ms. Carroll and Ms. Brown will meet periodically in order to discuss the progress of this action.

4. Marketing

ITB developed and maintained professional networks with individuals across the Agency, the Department of Defense, and internationally in an effort to increase the visibility of the AP2 Program and ultimately to help identify potential joint projects and/or stakeholders. Such networking occurred through established relationships with NASA organizations, such as SEA; DoD organizations, such as JG-PP; and pubic and private organizations in Europe.

As one example of productive networking, in an April 2003 meeting with Mr. Paul Hayes, United Space Alliance, Materials & Processes (USA-M&P), ITB learned that USA was pursuing development of the following promising P2 technologies:

- Liquid Nitrogen Depainting
- Laser Shearography for TPS

- Non-Lead Dry Film Lubricant for High-Load Applications
- Cold Spray
- Organic Corrosion Inhibitor for Paints
- Convergent Spray Technology

Mr. Rothgeb, subsequently developed one of these technologies (Convergent Spray Technology) into an active NASA technology migration project. ITB engineers are considering future projects that may involve some of the other technologies and are monitoring USA's efforts accordingly. For example, ITB has since learned that the DoD and some companies have initiated testing of liquid nitrogen depainting.

To assist in keeping track of environmental personnel across NASA, ITB developed and electronically maintained pertinent contact information using Microsoft Outlook software. These contacts are routinely updated as new members join or information on existing members changes. Keeping updated points of contact allows the AP2 Office to minimize time searching for new or updated contacts as new projects develop.

Another important avenue for marketing continued to be attendance at technical conferences and workshops. ITB attended the following thirteen (13) technical conferences and workshops during this reporting period (Table 4):

Table 4 - NASA AP2 Attendance at Technical Conferences and Workshops

Event	Location	Date
NWTC - NASA Workmanship Technical Committee Workshop	Baltimore, MD	Apr-03
Aerospace Coatings Removal & Coatings Conference	Colorado Springs, CO	May-03
Air & Waste Management Association Conference	San Diego, CA	Jun-03
Surface Mount Technology Int'l Conference	Chicago, IL	Aug-03
Hazardous Waste & Pollution Prevention Conference	San Antonio, TX	Aug-03
Center for Pollution Prevention Program (C3P) Workshop & Joint Oversight Group (JOG) meeting	Portugal	Sep-03
Joint Conference on Aging Aircraft (JCAA) Conference	New Orleans, LA	Oct-03
Lead-Free Solder Workshop @ American Competitiveness Institute (ACI)	Philadelphia, PA	Nov-03
Tri-Service Corrosion Conference	Las Vegas, NV	Nov-03
DoD Laser Applications Information Exchange for Maintenance and Sustainment Solutions Forum	Las Vegas, NV	Dec-03
Alternatives to Toxic Materials Conference	Scottsdale, AZ	Dec-03
Army Corrosion Summit	Cocoa Beach, FL	Feb-04
Clean Tech Conference	Chicago, IL	Feb-04

ITB staff monitored pollution prevention needs and the state of possible solutions while attending the above technical conferences and workshops. Each event is fully detailed in a trip report (See Appendix B).

One result of the marketing conducted by ITB has been the building of new relationships around the world. Following are just a few of the more promising relationships recently developed:

- Air Force Space Command Pollution Prevention (AFSPC) Office
- Zinc Minimization Team (per Columbia Accident Investigation Board)
- Naval Facilities Engineering Command (NAVFAC)
- Air Force Corrosion Prevention Advisory Board (CPAB)

Establishing relationships with various government industry groups exposes the NASA AP2 program to additional resources to identify, develop, and execute projects; following are just a few examples:

1. Through a growing relationship with the AFSPC, ITB engineers are designing joint inter-agency projects that address the P2 needs of both NASA and AFSPC.

2. Participation by Mr. Kevin Andrews as a technical support to the Zinc Minimization

Team demonstrated the ability of ITB engineers to support critical task teams at KSC.

3. ITB engineers have been invited to participate on the Air Force Corrosion Prevention Advisory Board. This panel meets annually to discuss strategies to address critical corrosion issues that affect the Air Forces ability to operate and maintain its' aircrafts and facilities.

B. Year In Review – Agency Business Entity

The objective of the Agency business entity is to encourage and lead joint P2 efforts to reduce hazardous materials across multiple NASA Centers and Programs. ITB's primary goal was to begin up to five (5) new Agency projects in 2003.

Prior to Task Order #1, ITB had identified dozens of ideas for potential P2 projects that might be common to two or more NASA stakeholders. These ideas were identified using both past Pollution Prevention Opportunity Needs Assessment (PPONA) findings and more recent surveys of NASA Centers and NASA groups, such as the Shuttle Environmental Assurance (SEA) Initiative. The next steps that ITB took under Task Order #1 were the following:

1. Identify candidate P2 projects – Gather data to allow project ideas to be developed.
2. Screen and propose candidate P2 projects – Propose the most promising joint projects to prospective stakeholders.
3. Commit stakeholders – Jointly determine the project's objective and scope, seek stakeholder buy-in, and identify tentative resource commitments
4. Execute P2 projects – Carry out the technical requirements of the project.

The following achievements occurred in each of the above four steps:

Identify Candidate P2 Projects

It quickly became apparent that the myriad of project ideas needed to be ranked using criteria that would highlight those ideas posing the most promise. Therefore, at the start of Task Order #1, ITB developed and applied ranking criteria to the potential project ideas. The result of this analysis was the following list of fifteen (15) candidate P2 opportunities to pursue, based largely on pervasiveness and potential chemical hazard:

1. Use of Convergent Spray Nozzle System to Apply Multi-Component Coating Materials
2. Replacing Current Parts Washers at NASA Centers with Bio-Parts Washers
3. Garnet Blast Cutting / Garnet Recycling (Technology Transfer)
4. VOC Emission Reduction
5. Aerosol Replacement
6. Oily Rage Recycling and Laundering at NASA Facilities
7. Metalworking Fluids Recycling (Technology Transfer)
8. Alternatives for Current Cleanliness Verification Fluids (Technology Transfer)
9. Alternatives for Chlorinated Solvents (Technology Transfer)
10. Alternative Low-Emission Depainting Technologies for Facility Applications
11. Non-Ozone Depleting Chemical (ODC) Line Cleaning System
12. Microwave Reactor Oxidizer Vapor Treatment System for Nitrogen Tetroxide
13. Non-Chromium Alkaline Cleaner for Aluminum
14. Emission Elimination Device (Chrome Bath)
15. Non-destructive Inspection (NDI) Processes

Screen and Propose Candidate P2 Projects

ITB next began to develop identified opportunities into actual projects. This effort required the identification and verification of specific processes and stakeholders to participate in the project. The following criteria were established as a guide to further screening projects:

- Number of stakeholders
- Magnitude of environmental impact
- Magnitude of cost savings
- Commercial availability of technology
- Technical maturity of alternatives
- Possibility of high project costs or difficulty obtaining funding
- Length of project schedule
- Importance to stakeholders

To promote a consistent framework for capturing and reporting responses to screening criteria, ITB developed a Project Summary Plan (PSP) for each candidate project. ITB used this PSP to delineate the types of information that needed to be collected for each candidate project. For those ideas that eventually become approved, full-fledged projects, the PSP will also serve as a basis for the Project Plan, which will simply go into more detail on the project requirements, scope, stakeholders, communication plan, deliverables, schedule, cost, and stakeholders as the project is executed.

ITB applied the above screening criteria, as documented in the PSPs, and by September 2003, had developed the following "short list" of most promising projects for which to present to prospective NASA stakeholders (Table 5):

Table 5- NASA AP2 Short List of Most Promising Projects

Project	Technical Thrust Area
1. Alternatives to Aliphatic Isocyanate Urethanes	Coating & Depainting
2. Low Emission Depainting on Steel	
3. Convergent Spray Technology Migration	
4. Parts Washer Alternatives	Cleaning
5. Validation of Non-ODC Cleaning System for T-38 Aircraft	
6. Replacements for CFC-113 in Precision Cleaning	
7. Identification of Alternatives to AK225	

Commit Stakeholders

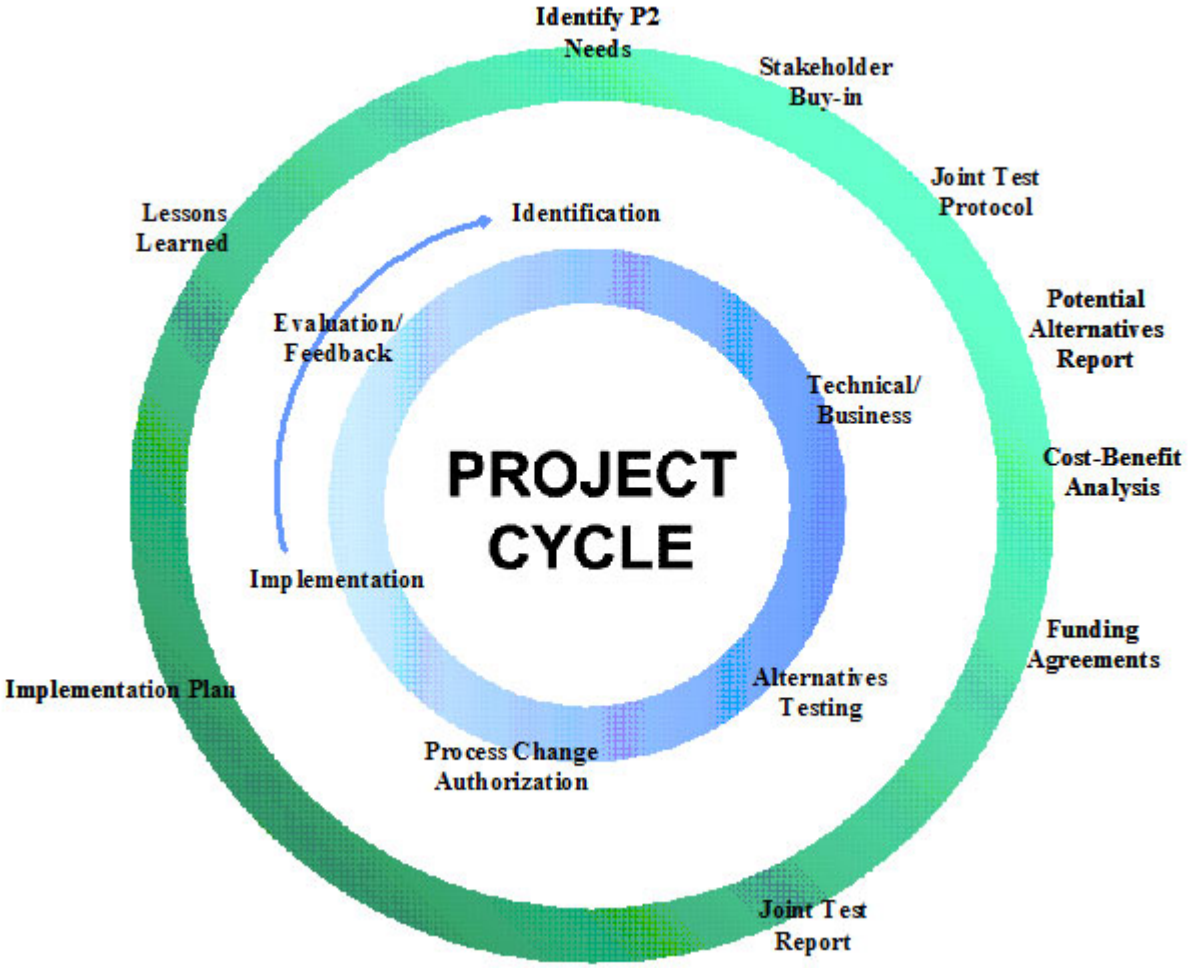
Beginning September 2003, ITB began holding teleconferences with technical representatives from numerous NASA centers and contractor sites for each of the seven projects. Details of the progress and achievements of each of these projects are discussed in more detail in the following sections. However, in summary it can be said that ITB was able to develop all seven projects into active projects, four of which are still active as of the date of this report. The last three projects in the list (#5 - #7) were discontinued mid-way through project development due to competing stakeholder priorities.

Execute P2 Projects

In general, P2 projects fall into one of two categories: managed P2 projects and supported P2 projects. Managed P2 projects are identified, developed, and executed by the AP2 Program office. Supported projects are ones where AP2 engineers lend their expertise, but do not manage the technical, cost, and schedule aspects of the project.

Regardless of managing one's own project or supporting another's project, AP2 engineers ensure that every project follows a standardized project cycle. The following figure (Figure 2) shows this project methodology used in project execution.

FIGURE 2 - Project Methodology

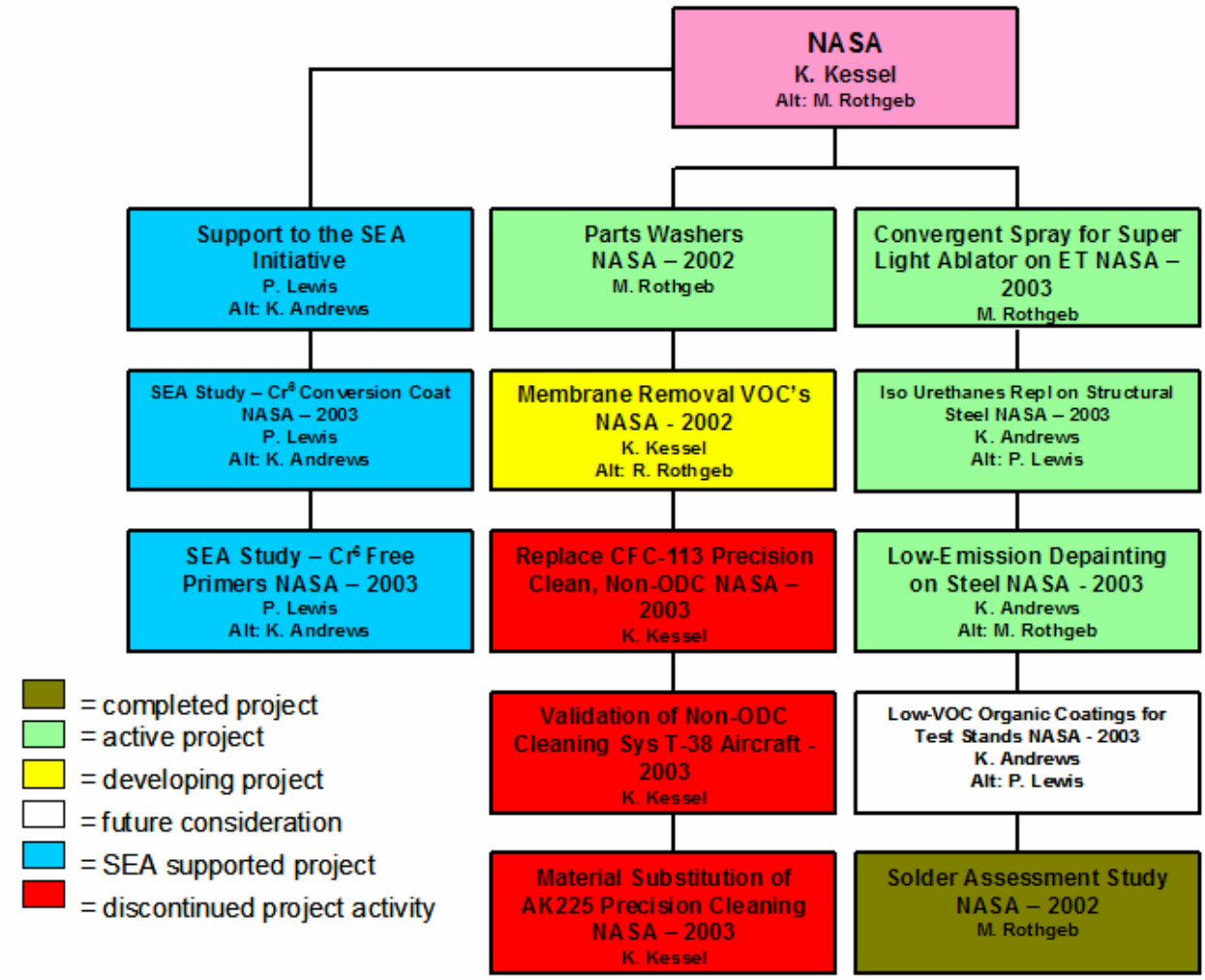


A key part of the project methodology is documentation of P2 needs, solutions, technical requirements, testing, results, and conclusions. Such documentation occurs from the very beginning to the end of any project, and helps ensure traceability of decisions, enhances technology migration, and reduces future duplication of effort. Following are four key technology documents:

1. *Joint Test Protocol (JTP)* - Documents the critical technical and performance requirements that an alternative material or process must meet to be considered acceptable.
2. *Potential Alternatives Report (PAR)* - Documents the viable alternatives, the down-selection process, and the alternatives ultimately recommended for testing/ implementation.
3. *Cost Benefit Analysis (CBA)* - Documents the analysis of economic feasibility of the potential alternatives as compared to the current (baseline) material/ process. In 2003, ITB analyzed various CBA methods and determined that the JG-PP CBA methodology (See Attached: CBA Methodology) was the best method for ITB to use on Agency AP2 projects. All new project CBAs will follow the JG-PP CBA Methodology. Ms. Lewis developed a guidance manual on how to conduct CBAs and specifically how to use the P2/Finance software. This manual will allow those employees new to CBAs to come up to speed quickly (See Attached: Overview P2FINANCE).
4. *Joint Test Report (JTR)* - Documents the testing and test results, and provides analysis and conclusions.

Figure 3 depicts the ITB engineering assignments to NASA projects that are active or under development, along with several other ideas for future project consideration.

FIGURE 3 - NASA Project Opportunities and ITB POCs



Because projects can begin and end at different schedules, ITB began categorizing every project using one of the following terms (and colored blocks in the project diagram):

1. *Completed projects* (**brown**) – Project cycle is completed through the evaluation/feedback step of the methodology
2. *Active projects* (**green**) – Projects beyond the stakeholder identification step, but the project is not completed
3. *Developing projects* (**yellow**) – Projects for which critical project-decision information is still being gathered (e.g., number and interest of the stakeholders, environmental impact, project cost and schedule, etc.)
4. *Discontinued projects* (**red**) – Projects initiated with the stakeholders, but which were later shelved
5. *Future projects* (white) – Ideas for future projects
6. *Supported projects* (selected colors other than those above) – Projects developed and/or being led by another entity besides AP2 (e.g., SEA).

The following table (Table 6) summarizes the status of project technology reports for the four active ("green") Agency projects.

Table 6 - NASA AP2 Project Report Summary

AP2 Project	JTP	PAR	CBA	JTR
Identification, testing and validation of alternatives to aliphatic isocyanate urethanes on carbon steel structural elements across NASA (Test Stands and Shuttle Support)	Second Drafts of JTP and Field Test Plan submitted to stakeholders	Second Draft was submitted to stakeholders	Collecting data to pen CBA	Testing not begun yet, awaiting project approval and resource commitment
Identification, testing and validation of low-emission surface preparation/ depainting technologies for carbon steel structural elements across NASA (Test Stands and Shuttle Support)	Second Drafts of JTP and Field Test Plan submitted to stakeholders	Second Draft was submitted to stakeholders	Collecting data to pen CBA	Testing not begun yet, awaiting project approval and resource commitment
Use of convergent spray technology to apply SuperLight Ablator to the External Tank at NASA MAF	Second Draft completed and distributed to stakeholders for review.	Technology Transfer Project - PAR not required.	Awaiting development of JTP before beginning CBA	Testing not begun yet
Identification and validation of alternative parts-washing technologies	JTP First Draft will be completed by April 2004 for stakeholders review.	Vendors have been contacted and all stakeholders have responded with their current parts washer inventories. PAR is being built currently.	Awaiting PAR before beginning CBA.	Testing not begun yet

In summary, with these projects, ITB staff is fostering cooperation between NASA Centers to reduce their hazardous material profiles, in the process epitomizing the “One NASA” objective.

The following sections provide more information on all the NASA projects, including Task Order #1 achievements and schedule.

1. Completed NASA Projects

NASA Solder Assessment Study 2002-2003

This short-term (5-month) solder study was actually performed and completed under a prior NASA-ITB contract, but its impact has continued under Task Order #1.

The objective of this study was to determine the potential risks to NASA should lead free solders accidentally be introduced to current processes and the risks if NASA does not work toward finding alternatives for future space transportation systems and support equipment. The approach involved performing site visits and interviews at NASA Kennedy Space Center (KSC), Marshall Space Flight Center (MSFS), Jet Propulsion Laboratory (JPL), Goddard Space Flight Center (GSFC), and Johnson Space Center (JSC) to collect pertinent solder usage data. This data collection was completed in December 2002.

Among the key findings and conclusions of the study were the following:

- In 2002, NASA performed between 8 and 12 million solder joints.
- Each joint can be considered a point of risk to electronics systems.
- Concerning the Shuttle program, Orbiter has nearly all components already procured, so risk is minimized.
- Risk is highest with areas of new construction (satellites, expendable vehicles).
- If lead-free solder is not considered now, any new space vehicles will be at increased risk.

ITB presented the results of this study at a meeting of NASA's Workmanship Technical Committee (NWTC) in April 2003, attended by experienced electronics engineers as well as Mr. Tom Whitmeyer, NASA HQ. One important result of this briefing was a heightened sense

of urgency among the NWTC participants concerning the need to develop a NASA-wide policy on lead-free solders (as well as tin whiskering). NASA Headquarters (Code Q) action was subsequently taken to address the knowledge data gaps that exist concerning lead-free solders. As a result, a FY2004 project has been proposed by NASA Marshall Space Flight Center titled "Lead-Free Solder Body of Knowledge", of which the purpose will be to perform a technology readiness overview of lead-free solder. The end product will be recommendations on what positions and measures that NASA should take with respect to the introduction of lead-free solders. NASA MSFC is proposing to use the NASA AP2 Program as the contract vehicle for this project and leverage off the AP2 Program Office's wide network of professional contacts in the U.S. and European electronics industry.

2. Active NASA Projects

Under Task Order #1, ITB kicked off seven Agency projects. Four of these projects developed into viable, active ("green") projects under Task Order #1:

1. Alternatives to Aliphatic Isocyanate Urethanes
2. Low Emission Depainting on Steel
3. Convergent Spray Technology Migration
4. Parts Washer Alternatives

Following is an overview of each project, along with achievements:

a. Alternatives to Aliphatic Isocyanate Urethanes

Background/ Need
NASA widely uses paints containing isocyanate urethanes on structural and non-structural elements in both shuttle and non-shuttle programs. Due to the toxicity of isocyanates, these paints are hazardous to workers and the painting operations are regulated under Occupational Safety and Health Administration (OSHA), National Institute for Occupation Safety and Health (NIOSH), and American Conference of Governmental Industrial Hygienists (ACGIH). An alternative paint that does not contain isocyanates but which performs acceptably is desired.

Objective
Validate alternatives to isocyanate urethane coatings.

Stakeholders
Kennedy Space Center, Stennis Space Center

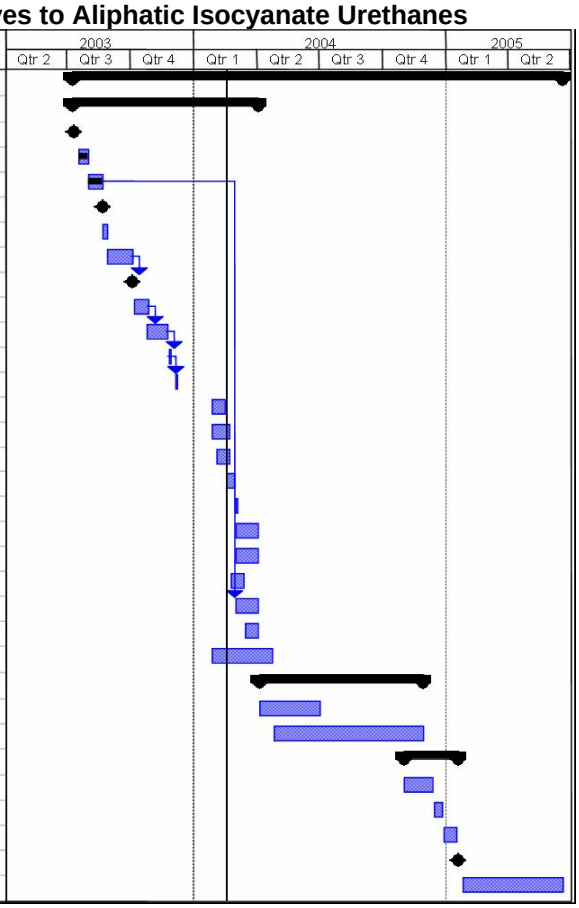
Benefits
- Eliminates environmental, safety, and health concerns with use of isocyanate urethanes.

Achievements
- Identified key stakeholders and benefits.
- Held multiple teleconferences and a face-to-face meeting at each participating center.
- Distributed second drafts of JTP and Field Test Plan.
- Distributed second draft of PAR.
- Began collecting data necessary to prepare CBA.

Schedule
ITB maintains the project's schedule in Microsoft Project (Figure 4).

Figure 4 - Schedule - Alternatives to Aliphatic Isocyanate Urethanes

ID	Task Name
1	**Aliphatic Isocyanate Urethanes**
2	**Technical**
3	Technical Telecon #1
4	Identify Technical Specifications
5	Draft Requirements Matrix/ Survey Form
6	Technical Telecon #2
7	Final Requirements Matrix/ Survey Form
8	1st Draft (Strawman) JTP
9	Technical Telecon #3
10	2nd Draft JTP
11	1st Draft PAR
12	KSC Face to Face
13	SSC Face to Face
14	1st Draft Field Test Plan
15	2nd Draft PAR
16	3rd Draft JTP
17	2nd Draft Field Test Plan
18	Technical Telecon #4
19	Final JTP
20	Final Field Test Plan
21	1st Draft CBA
22	Final PAR
23	Final CBA
24	**Business Plan**
25	**Alternative Dem/Val**
26	Testing Preparation
27	Testing
28	**Joint Test Report**
29	Write JTR
30	Review draft JTR
31	Incorporate stakeholder input
32	Submit Final JTR
33	**Implementation**



b. Low Emission Depainting on Steel

Background/ Need
NASA's current use of abrasive blasting for surface preparation/depainting of structural steel creates a fine, airborne dust. Such operations are regulated under OSHA, NIOSH, and ACGIH. An alternative technology that generates less dust is desired.

Objective
Validate a low-emission surface preparation/depainting technology for structural steel.

Stakeholders
Kennedy Space Center, Stennis Space Center

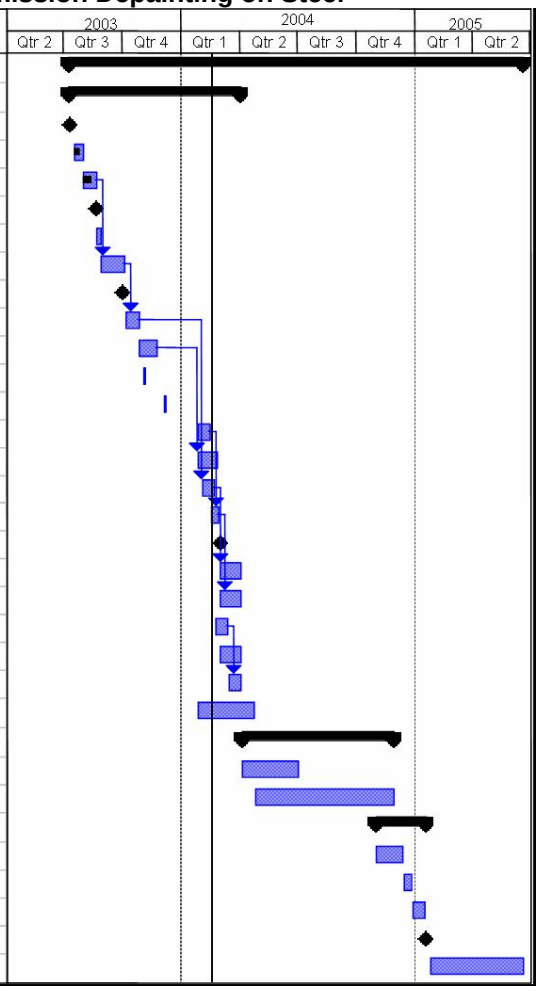
Benefits
- Improved corrosion protection of critical systems.
- Easier and less costly maintenance.
- Reduced flight hardware contamination.
- Reduced hazardous waste and worker exposure.

Achievements
- Identified key stakeholders and benefits.
- Distributed second drafts of JTP and Field Test Plan.
- Distributed second draft of PAR.
- Began collecting data necessary to prepare CBA.

Schedule
ITB maintains the project's schedule in Microsoft Project (Figure 5).

Figure 5 Schedule – Low Emission Depainting on Steel

ID	Task Name
1	**Surface preparation/depainting**
2	**Technical**
3	Technical Telecon #1
4	Identify Technical Specifications
5	Draft Requirements Matrix/ Survey Form
6	Technical Telecon #2
7	Final Requirements Matrix/ Survey Form
8	1st Draft (Strawman) JTP
9	Technical Telecon #3
10	2nd Draft JTP
11	1st Draft PAR
12	KSC Face to Face
13	SSC Face to Face
14	1st Draft Field Test Plan
15	2nd Draft PAR
16	3rd Draft JTP
17	2nd Draft Field Test Plan
18	Technical Telecon #4
19	Final JTP
20	Final Field Test Plan
21	1st Draft CBA
22	Final PAR
23	Final CBA
24	**Business Plan**
25	**Alternative Dem/Val**
26	Testing Preparation
27	Testing
28	**Joint Test Report**
29	Write JTR
30	Submit draft JTR for review
31	Incorporate stakeholder input
32	Submit Final copy of JTR
33	**Implementation**



c. Convergent Spray Technology

Background/ Need
The current process at Michoud Assembly Facility for applying ablative coating to the shuttle External Tank (ET) involves use of thousands of gallons of methyl ethyl ketone (MEK) and other solvents. However, United Space Alliance (USA) has proven a new technology--convergent spray technology (CST)—for applying a similar coating to the Solid Rocket Boosters (SRB). With some optimization, CST could replace the solvents used to apply ablative to ET.

Objective
To migrate CST technology to Michoud Assembly Facility ET ablator application operations

Stakeholders
Kennedy Space Center, Marshall Space Center, Michoud Assembly Facility, United Space Alliance, and Lockheed Martin

Benefits
- Eliminates thousands of gallons of MEK and other solvents for each External Tank processed.

- Decreases cost of operation; less procurement of hazardous materials.
- Reduces worker safety hazards.

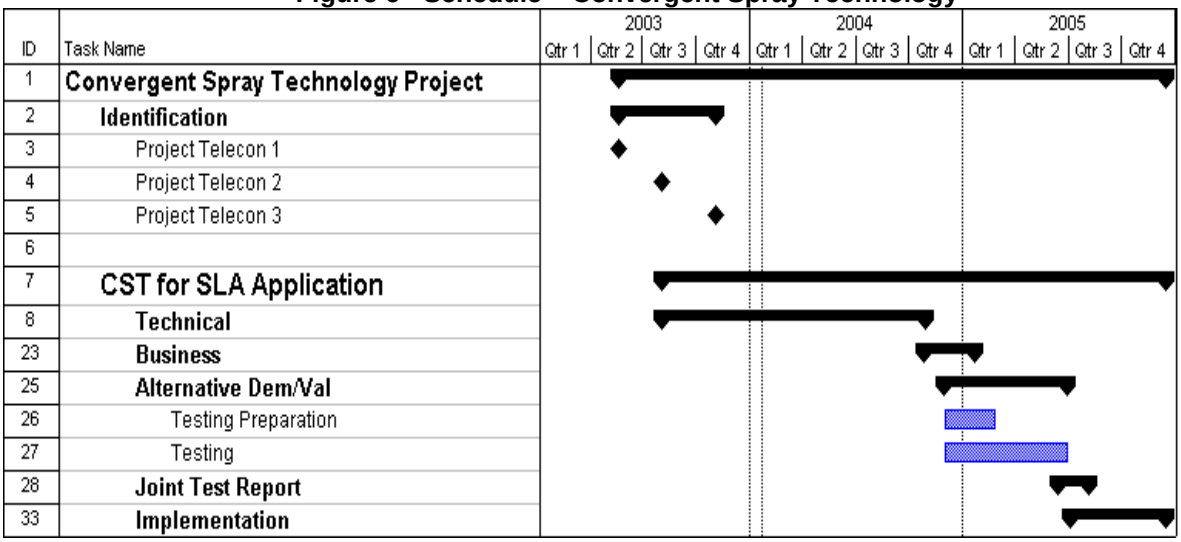
Achievements

- Held three quarterly teleconferences, identified key stakeholders and benefits.
- Began collecting data necessary to build JTP and test plans.
- Because of Return-to-Flight, the stakeholders asked that this project be kept on a slower track than normal, with only quarterly telecons.

Schedule

ITB maintains the project's schedule in Microsoft Project (Figure 6).

Figure 6 - Schedule – Convergent Spray Technology



d. Parts Washer Alternatives

Background/ Need

Parts washers currently used at some NASA Centers contain hazardous solvents and/or require the disposal of used cleaning fluids as hazardous waste. These solvent-based parts washers pose environmental, health and safety risks to NASA property and personnel.

Objective

Identify and test "green" parts washers that meet performance guidelines set by stakeholders. Perform a comparative analysis of current parts washers used at NASA facilities.

Stakeholders

Multiple NASA Centers – Kennedy Space Center, Marshall Space Center, Michoud Assembly Facility, Wallops Flight Facility, Glenn Research Center, Langley Research Center, Jet Propulsion Laboratory, Stennis Space Center, White Sands Test Facility, Goddard Space Flight Center and Ames Research Center.

Benefits

- Reduced costs associated with hazardous materials and hazardous waste handling.
- Eliminate or reduce the EHS footprint of this process throughout NASA Centers.

Achievements

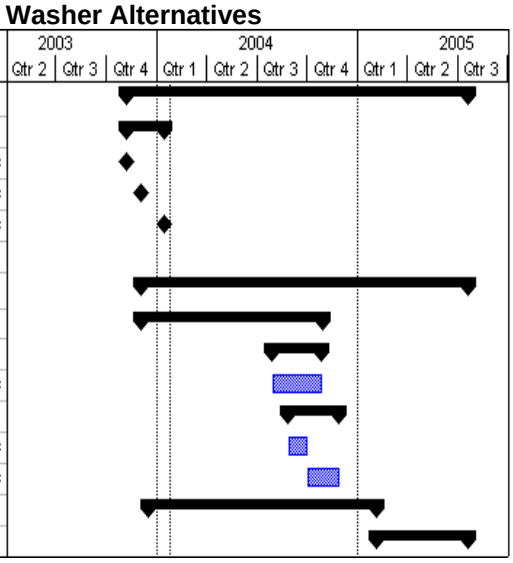
- Determined the deliverable most desired for stakeholders is a 'Consumer's Guide'.

- Surveyed Centers on current parts washers usage.
- Began development of performance guidelines and benchmarks that will be covered in the guide.

Schedule
ITB maintains the project's schedule in Microsoft Project (Figure 7).

Figure 7 - Schedule – Parts Washer Alternatives

ID	Task Name	Duration
1	**Parts Washer Alternatives Project**	**445 days**
2	**Identification**	**51 days**
3	Project Telecon 1	0 days
4	Project Telecon 2	0 days
5	Project Telecon 3	0 days
6		
7	**Parts Washer Consumer Guide**	**425 days**
8	**Technical**	**236 days**
26	**Business**	**63 days**
27	Business Plan	63 days
28	**Alternative Dem/Val**	**66 days**
29	Testing Preparation	26 days
30	Testing	41 days
31	**Hands on Testing of Washers**	**298 days**
36	**Implementation**	**120 days**



3. Developing NASA Projects

Membrane Removal of Volatile Organic Compounds (VOC)

Background/ Need
Throughout NASA locations, VOCs are generated during numerous manufacturing processes. These point source emissions are of great concern to some NASA Centers because of their location and ever increasing air emission regulations within such areas. Centers located in California are already very restricted in air emissions and other states are moving toward similar air regulations to reduce pollution within urban and suburban areas. Because of increased regulations, and the high cost that can be associated with process and/or materials change, there is an increased focus on developing technologies that can reduce VOCs without altering processes or materials within those processes. One of these technologies has been developed by the New Jersey Institute of Technology (NJIT) in coordination with Applied Membrane Technologies (AMT). The technology is a fiber membrane filter that is able to reduce the VOCs typically emitted in process lines by up to 98%.

NASA has worked with NJIT and AMT in the past, testing this technology at Kennedy Space Center. Tests results were very positive and the technology was able to eliminate over 97% of the VOCs from a paint booth emission stream and capture the solvents for re-use, recycling or disposal.

Objective
The objective of a future project with the NJIT/AMT Membrane technology is to further validate the technology within various environments where point source emissions of VOCs are encountered within NASA facilities. Such environments include paint booths, chemical laboratory hoods, chemical de-painting areas, solvent cleaning areas and pre-afterburner destruction of VOCs in order to reduce fuel costs. While membrane technology does not eliminate the use of high-VOC coatings, it can serve as an intermediate step toward the overall NASA goal of sustainability.

Potential Stakeholders
All NASA Centers

Potential Benefits
- Ease of compliance with VOC emission regulations (especially for those facilities in non-attainment areas).
- Capture and recover nearly all solvents that are regularly emitted to the atmosphere.
- Environmental footprint of operation is reduced.
- Cost effective when compared to environmental air emission credits and other VOC filtering or treatment technologies.

4. Discontinued NASA Projects

Of the seven NASA projects that ITB kicked off, three were discontinued mid-way through project development:

1. Alternative Non-ODC Precision Cleaning Solvents to Replace CFC-113
2. Alternative Non-ODC Precision Cleaning Solvents to Replace HCFC-225
3. Non-ODC Cleaning System for T-38 Aircraft

The first two projects above resulted from stakeholder feedback during and following an initial thrust area teleconference in April 2003.

A third project, Non-ODC Cleaning System for T-38 Aircraft, was pursued specifically with Johnson Space Center. ITB believed that the Oxygen Line Cleaning System developed by Versar Inc. and validated for use on DoD aircraft under the JG-PP project entitled "Non-ODC Oxygen Line Cleaning, Project Number: J-99-CL-015", would be an excellent technology transfer project. Further explanation of these projects, including reasons for discontinuance are provided below.

a. NASA Validation of Alternative Non-ODC Precision Cleaning Solvents to Replace CFC-113

Background/ Need
More than one NASA Center still uses chlorofluorocarbons (CFCs). Glenn Research Center uses CFC-113 in the calibration labs to clean equipment lines used in oxygen systems; these systems are comprised of lines of varying diameters. The precision cleaning process supports high volume, high pressure duct work for engine and combustion research. Lines range in size from 1/8 inch to 6 inches in diameter and from 6 inches to 96 inches in length.

Langley Research Center uses CFC-113 for cleaning and verification of cleanliness of LOX hardware. The 8 foot High Temperature Tunnel is used to simulate re-entry conditions and has an extensive pipe network to feed oxygen to the reaction. The current system is cleaned in place without dismantling and CFC-113 is flushed through the lines with ninety-eight percent re-capture efficiency.

Goddard Space Flight Center uses CFC-113 to rinse and flush disassembled space flight hardware. CFC-113 is also used for cleanliness verification procedures. At the start of the project, it was also believed (based on PPONA findings) that other Centers were still using CFCS.

Objective
Analyze non-ODC precision cleaning solvents and develop a validation test project for precision cleaning processes.

Achievements
- Conducted four project scoping teleconferences to identify NASA Center

needs and establish definitive pollution prevention projects.

- Developed a precision cleaning matrix that contains precision cleaning information pertaining to specifics such as process, pollution prevention needs and alternatives tested for nine NASA centers.
- Facilitated communication between NASA centers, including discussion on current pollution prevention activities and evaluation of common needs.
- Attained precision cleaning process information, including solvents used and work flow for all NASA centers conducting large scale precision cleaning activities.

Status - Discontinued

- During the scoping phase of the project, ITB determined that the majority of stakeholders have already addressed this issue.
- ITB was able to engage one Center that still uses CFC-113 to participate in a prospective project, thus eliminating the development of a joint project.
- The NASA AP2 Office is participating in JG-PP's efforts to identify a joint DoD-NASA cleaning project, possibly involving wipe solvents. This is an area of potential interest to NASA. As such, NASA needs will be included in any JG-PP cleaning project.

b. NASA Validation of Alternative Non-ODC Precision Cleaning Solvents to Replace HCFC-225

Background/ Need

More than one NASA Center uses hydrochlorofluorocarbons (HCFCs). HCFC-225, in particular, presents toxicity concerns. Michoud Assembly Facility uses large volumes of HCFC-225 for in-line flushing and some parts wiping for very large space flight hardware supporting External Tank.

Marshall Space Flight Center uses HCFC-225 for rinsing of parts, flushing of lines and the wiping of parts all used in support of flight and non-flight hardware. Part sizes vary greatly from small valve parts to large components pieces.

Stennis Space Center uses HCFC-225 to flush, wipe and rinse dissembled flight and non-flight space hardware components. Hardware size is very large and requires large solvent volumes.

United States Environmental Protection Agency (USEPA) has scheduled HCFC-225 for phase out by 2015.

Objective

Analyze non-ODC precision cleaning solvents and develop a validation test project for precision cleaning processes.

Achievements

- ITB conducted four scoping meetings (in concert with the CFC-113 Replacement project) in which initial project ideas were down selected to focused project thrust areas.
- Developed a precision cleaning matrix that contains precision cleaning information pertaining to specifics such as process, pollution prevention needs and alternatives tested for nine NASA centers.
- Facilitated communication between NASA centers, including discussion on current pollution prevention activities and evaluation of common needs.
- Attained precision cleaning process information, including solvents used and work flow for all NASA centers conducting large scale precision cleaning activities.

Status - Discontinued

- During the scoping phase of the project, ITB determined that the majority of stakeholders do not have the resources to address this issue at the current time.
- Michoud Assembly Facility, Marshall Space Flight Center and Stennis Space Center agreed that current solvent technologies would not allow for the replacement of HCFC-225.
- Michoud Assembly Facility, Marshall Space Flight Center and Stennis Space Center concluded that funding would not be made available to support this project since just recently the centers funded projects to replace CFC-113 with HCFC-225.
- Michoud Assembly Facility, Marshall Space Flight Center and Stennis Space Center agreed that since HCFC-225 is not scheduled for phase out until 2015 under current Clean Air Act regulations that this issue could be postponed until a later date.
- The NASA AP2 Office is participating in JG-PP's efforts to identify a joint DoD-NASA cleaning project, possibly involving wipe solvents. This is an area of potential interest to NASA. As such, NASA needs will be included in any JG-PP cleaning project.

c. NASA Validation of Non-ODC Cleaning System for T-38 Aircraft

Background/ Need

Johnson Space Center currently disassembles and removes oxygen lines from T-38 aircraft for cleaning. Initially, the precision cleaning of dissembled T-38 oxygen lines was performed using CFC-113. During the scoping phase of this project it was determined that Johnson Space Center was in the process of implementing a non-ODC two part cleaning process. The process being implemented was developed by White Sands Test Facility and includes the use of HFE-7100 and Vertrel MCA. HFE-7100 is used in the in-line oxygen line cleaning system, the alternative technology that ITB proposed for use on the T-38 aircraft. The in-line oxygen line cleaning system would greatly reduce the amount of time needed to clean the oxygen lines on the aircraft and reduce waste associated with the precision cleaning process.

The culmination of a four-year effort with the Air Force and Versar Inc. has resulted in the development of an environmentally friendly system capable of cleaning aircraft oxygen lines onboard the aircraft, thereby cleaning the entire plumbing system at once. The system is known as the Oxygen Line Cleaning System, or OLCS. Government representative observed, and approved the use of this equipment on the B-1B, F-15, F-16, and C-130 aircraft.

Objective

Analyze Air Force qualified in-line oxygen line cleaning system, and develop validation test project for use on NASA T-38 aircraft.

Achievements

- Established lines of communication between the NASA AP2 Office and Johnson Space Center which could be used for future project development.
- Developed working relationship with the appropriate Johnson Space Center and Air Force points of contact.
- Attained all required engineering schematics and associated specification documents.

Status - Discontinued

- Johnson Space Center reviewed the project and felt that there was no value added in changing the current process. NASA still requires that OLCS be demonstrated and validated on T-38 aircraft before considering implementation. NASA was not interested in providing a T-38 aircraft for demonstration and validation testing.

- Currently the Joint Council on Aging Aircraft is working to establish demonstration and validation efforts on T-38 aircraft. The NASA AP2 Office has provided support to this effort by obtaining T-38 schematics and NASA specifications relating to precision cleaning and T-38 aircraft.

5. Future NASA Projects

Low-VOC Organic Coatings for NASA Test Stands

Background/ Need
This effort is currently under development and is envisaged as a joint project. The Air Force has recently undertaken a project to evaluate the use of low-VOC coatings in select performance environments (support equipment). ITB engineers under the NASA AP2 program will support this project by providing substrates at NASA as test environments. The results obtained from this exercise will be migrated to larger NASA structures. This methodology allows NASA to lower the financial burden typically associated with such projects.

Status
- The state of the technology has been established, as well as vendor contact. The goal is to quickly engage this candidate project when the circumstances support.
- ITB will continue to monitor low-VOC organic coatings through professional connections and attendance at technical conferences.

6. Supported NASA Projects (SEA)

ITB participated in teleconferences and face-to-face meetings of the Shuttle Environmental Assurance (SEA) initiative. ITB's support involved:
- Responding to SEA action items and other specific requests for information.
- Offering technical knowledge relevant to SEA activities and studies for P2 project development in technical areas such as:
  - Alternatives to chromate conversion coatings.
  - Alternatives to chromate primers.
  - NASA usage and alternatives to tin-lead solders for electronics.
  - Regulations surrounding brominated flame retardants.

As just one example of ITB's proactive support to SEA in 2003: as a follow-on to discussions between Mr. Andrews and the Air Force concerning nonchromate conversion coatings, ITB provided SEA members with an Air Force report addressing the test results of a non-chromate pre-treatment vs. non-chromate primers. This report provided critical and timely information to the SEA in support of SEA's collaborative studies on alternatives to chrome conversion coatings and chrome primers (See Attached: SEA CrC studies 10.20.03).

ITB offered to facilitate the collection of technical and testing requirements and information on potential alternatives for the collaborative studies. ITB’s support was instrumental in accelerating the SEA process of initiating project efforts in 2003 by several months. Unfortunately, the SEA members were slow to provide ITB their technical requirements and potential alternatives. Nonetheless, ITB stands ready to support SEA on the two P2 problems identified to date: replacements for hexavalent chromium conversion coatings and replacements for hexavalent chromium primers (See Attached: SEA CrP studies 01.29.04).

a. Replacements for Hexavalent Chromium Conversion Coatings

Specific ITB achievements for this SEA collaborative study included:
- Co-founded the SEA Chrome Conversion Coatings Sub-committee and was instrumental in the start of this effort beginning months earlier than originally planned.
- Developed a Requirements Survey for distribution to the Sub-committee to

identify Shuttle applications and requirements.
    - Consolidated the Survey results and presented them to the SEA group at the October 2003 Face-to-Face Meeting.
- Based on this information, the Sub-committee proposed a test plan and potential alternatives to be considered.

b. Replacements for Hexavalent Chromium Primers

Specific ITB achievements for this SEA collaborative study included:

- Developed a Requirements Survey for distribution to the Sub-committee to identify Shuttle applications, requirements, and potential impacts.
    - Consolidated the Survey results and helped in developing a test plan and identifying potential alternatives.
- Determined common requirements with other Agencies to reduce duplication of effort.

ITB is continuing support of these SEA collaborative efforts through assigned action items. The AP2 Office plans to lead the migration of any approved coatings to other NASA programs.

C. Year In Review – DOD Business Entity Support

ITB's objective for the Department of Defense (DoD) business entity is to leverage resources with the DoD, primarily the Joint Group on Pollution Prevention (JG-PP), to maintain environmental technology cooperation and qualify shared alternative material and process solutions that are less or non-hazardous to the environment.

DoD support activities can be categorized as follows:

1. JG-PP Working Group (WG)/program support
2. Identify P2 needs and develop DoD projects
3. Manage, support and monitor active JG-PP projects

Achievements and highlights under each of the three categories are discussed below.

1. JG-PP Working Group (WG) / Program Support

ITB regularly supported the JG-PP WG through participation in teleconferences, business, and technical meetings: JG-PP Principals' Meetings; and Joint Logistics Commanders (JLC) Meetings. ITB personnel have a wealth of experience and knowledge of JG-PP operations. This support contributed to JG-PP's continued success and drive for continuous improvement.

In terms of program support, two achievements of note occurred under Task Order #1:

1. The implementation of performance metrics; and
2. An update to the JG-PP Concept of Operations (CONOP), both discussed below.

To address technology implementation concerns raised by the JG-PP Principals, the JG-PP WG and their contractors took action to develop a plan for implementing performance metrics for JG-PP projects and the JG-PP program as a whole. ITB took the lead in developing a framework for these metrics, suggesting specific metrics, tools, and a plan for implementing them. The WG largely accepted ITB's recommendations on the metrics. These included a recommendation to measure performance in categories such as cost, schedule, environment, and implementation for all new JG-PP projects. One key performance tool proposed by ITB and accepted by the WG was the use of earned value management (EVM) to keep projects on track and promote efficient use of resources. ITB is implementing the same earned value concepts into the new NASA AP2 projects. The WG agreed with the recommendations to use the testing phase of NASA AP2-led Lead-Free Solder project as a pilot project for implementing the metrics. ITB prepared PowerPoint slides describing the proposed EVM approach for briefing the JG-PP Principals.

Of additional note, Ms. Tess Hill, Program Analyst, coordinated a major update to the JG-PP Concept of Operations (CONOP) in 2003. Among the important revisions was an emphasis on the JG-PP project selection process.

2. Identify P2 Needs and Develop DoD Projects

ITB provided significant support to JG-PP's FY2004 project selection process. ITB collected, sorted, matched, and ranked priority P2 needs that each of the Services and NASA provided, with emphasis on problems common to the greatest number of Services. Because of the detailed and technical nature of the project ideas, the JG-PP WG created a project selection sub-committee of government representatives and support contractors to recommend one or more specific projects to the WG. ITB participated in the sub-committee teleconferences and supported data calls. The result of this process was the recommendation and subsequent JG-PP WG approval to pursue development of two new ideas for JG-PP projects: Wipe Solvent Cleaning; and Coatings.

In parallel support of JG-PP's own project selection process, ITB made concerted efforts to establish working relationships with other DoD entities, namely the Air Force Space Command, Colorado, and the Naval Facilities Engineering Service Center (NFESC), Port Hueneme, California. ITB established contacts with pollution prevention personnel in these organizations, and information was shared related to possible common P2 needs. The AP2 Office plans to continue to foster these relationships in 2004.

3. Manage, Support and Monitor Active DoD Projects

As with Agency P2 projects, DoD projects may be categorized as either managed or supported projects. With the exception of the JCAA/JG-PP Lead-Free Solder project (which was managed by the AP2 Office), all other JG-PP projects were supported projects from NASA's perspective. Of these, the JG-PP supported projects of most interest in the past year were:

1. Low-VOC Coatings for Support Equipment
2. Portable Laser Coating Removal System

On these projects, ITB acted as the liaison to assure that NASA requirements were being incorporated and/or to facilitate technology migration.

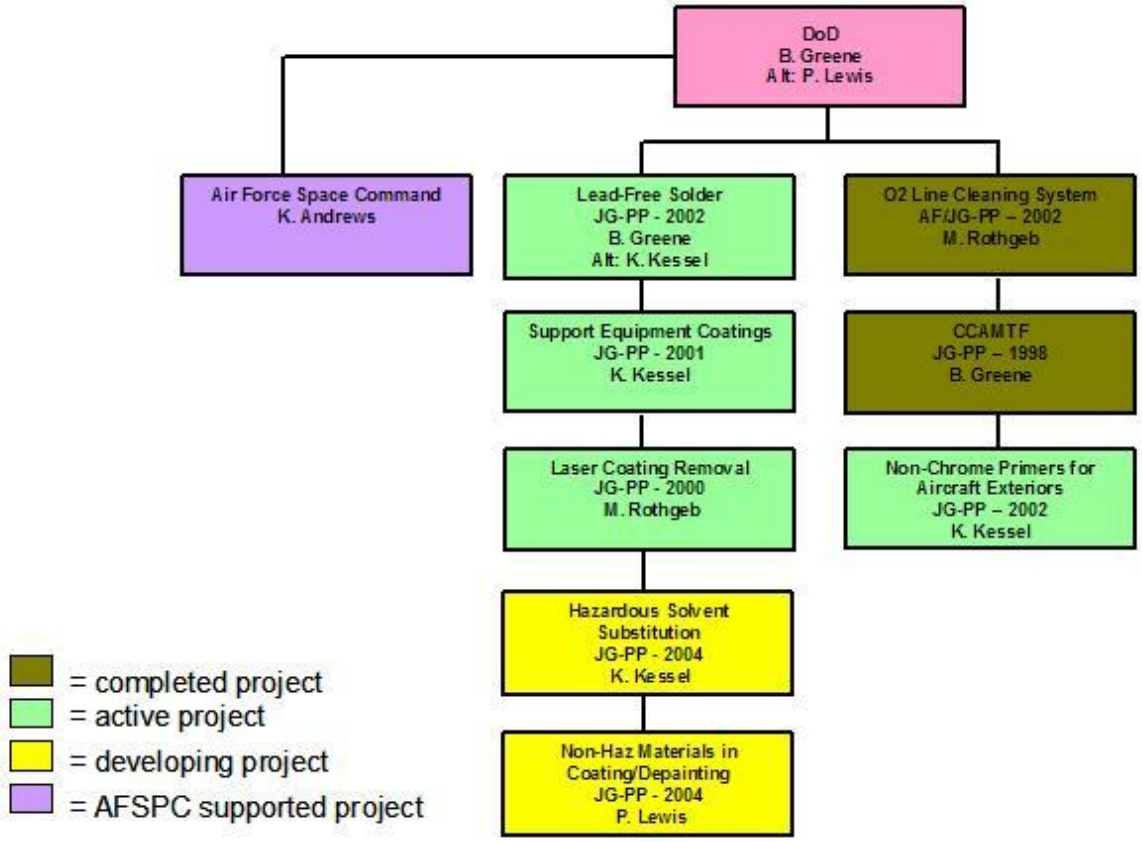
ITB also monitored the following active JG-PP projects for applicability to NASA:

1. Nonchromate Primers for Aircraft Exteriors (Lead: Air Force)
2. Chromium Electroplating Alternatives for Actuators, Helicopter Dynamic Components, Propeller Hubs, and Landing Gear (Lead: Navy/ Hard Chrome Alternatives Team [HCAT])
3. Low-VOC Identification Marking (Lead: JG-PP/ CTC)
4. Joint Cadmium Alternative Team (Lead: Naval Air Systems Command [NAVAIR])
5. Lead-Free Dry Film Lubricants (Lead: Propulsion Environmental Working Group [PEWG])
6. Nonchromate Aluminum Pretreatments (Lead: NAVAIR)

Finally, ITB continued to identify and monitor efforts in the DoD research & development community to address P2 problems in areas such as cleaning, depainting, coating, metal finishing, and “green” electronics. One identified effort still being monitored is an Air Force Nitrogen Tetroxide project that plans to build and test a full-scale microwave reactor. This technology may hold future promise for destroying NASA fuel and oxidizer vapors. A second R&D project of interest was an Army Hydrazine Replacement project, although the catalysts underlying this technology will require significant development before becoming viable.

Figure 8 depicts the ITB engineering assignments to those DOD projects that are completed, active or under development.

FIGURE 8 - DoD Business Entity Project Opportunities and ITB POCs



The following sections provide an overview of ITB's activities for those DoD projects of most significance.

Completed DoD-NASA Projects

a. Non-ODC Oxygen Line Cleaning System

Objective
Provide NASA technical support and requirements definition for the validation of non-ODC cleaning system to clean oxygen lines on DoD and NASA aerospace vehicles

Stakeholders
Consortium of NASA, Air Force, Army, Navy, and industry

Findings and Conclusions
- Government representative observed, and approved the use of in-line oxygen line cleaning equipment for the B-1B, F-15, F-16, and C-130 aircraft.
- Systems/solvents tested can potentially be utilized to clean almost any type line (hydraulic, fuel, coolant, environmental, etc.) on several different applications, such as tanks, machinery, and hospital oxygen lines.

Project Evaluation/ Feedback
JTP acceptance criteria were met, indicating that the solvents and selected cleaning methods were sufficient for cleaning the oxygen lines.

Achievements
- Military services have changed their Technical Orders to allow use of technology
- Services have prepared Program Objective Memorandums (POMs) for

equipment

b. JG-PP Circuit Card Assembly and Materials Task Force (CCAMTF) Project

Objective
Validate using simulated test board the electrical reliability of selected low-VOC conformal coatings and lead-free board finishes on various electronic circuits.

Stakeholders
Consortium of Air Force, Army, Navy, and industry

Findings and Conclusions
No drop-in replacements for current lead board finishes and high-VOC conformal coatings. However, for certain applications (circuits), certain lead-free finishes, and low-VOC conformal coatings perform satisfactorily.

Project Evaluation/ Feedback
Because of the huge scope of this project and piece-meal funding, testing took very long (4 years). This resulted in the loss of some stakeholders' interest and one stakeholder implementing material on their own.

Achievements
- Applied lessons learned from the CCAMTF project to other JG-PP projects.
  - Example: ITB developed an implementation survey form for the most-recent meeting of the JG-PP Coatings for Support Equipment project.

Active DoD-NASA Projects

a. JCAA/JG-PP Lead-Free Solder Project

Background/ Need
Consumer electronics are driving the commercial market to be "green", i.e. use lead-free alternatives. However, lead-free reliability in Class 3 (high performance) environments is unknown.

Objective
A joint DoD-NASA-OEM project was formulated to provide baseline data to allow eventual qualification and validation of lead-free solder alloys for use in manufacture and repair of electronic equipment.

Stakeholders
- NASA KSC, JPL, MSFC, JSC, GSFC, Ames Research Center (ARC), United Space Alliance – Solid Rocket Booster (USA-SRB), Boeing-Orbiter
- Air Force, Army, Navy, Marines, Dept. of Energy
- More than 25 manufactures and vendors
- Day-to-day management of project is executed by ITB

Benefits
- Estimated 3.5-to-1 return on NASA's financial investment (NASA gets >$1.2M in testing for $350K)
- NASA AP2 becoming focal point for new Agency, DoD, and International lead-free solder initiatives
- JTP meets NASA core testing needs (JTP concurrence from NASA MSFC, Boeing/Orbiter, JPL)

Achievements
- JG-PP WG successfully turned management of project over to JCAA
- Received numerous (> 30) JTP endorsements

- Completed design of test board
- Solidified funding and in-kind contributions
    - NASA pays for testing materials and one test (Mechanical Shock)
    - Air Force pays for other tests not offered as in-kind
    - Received offers by Sandia Laboratory, Boeing-Anaheim, and Florida CirTech (a solder supplier) to donate time and/or materials to the project as their in-kind contribution. To date, over $350K in in-kind offers have been received from OEMs and other team members, assumed to be among the highest donations of any JG-PP project past or present.
- Rockwell-Collins purchased components and boards and provided them to assembly house (Boeing-Irving, Texas)

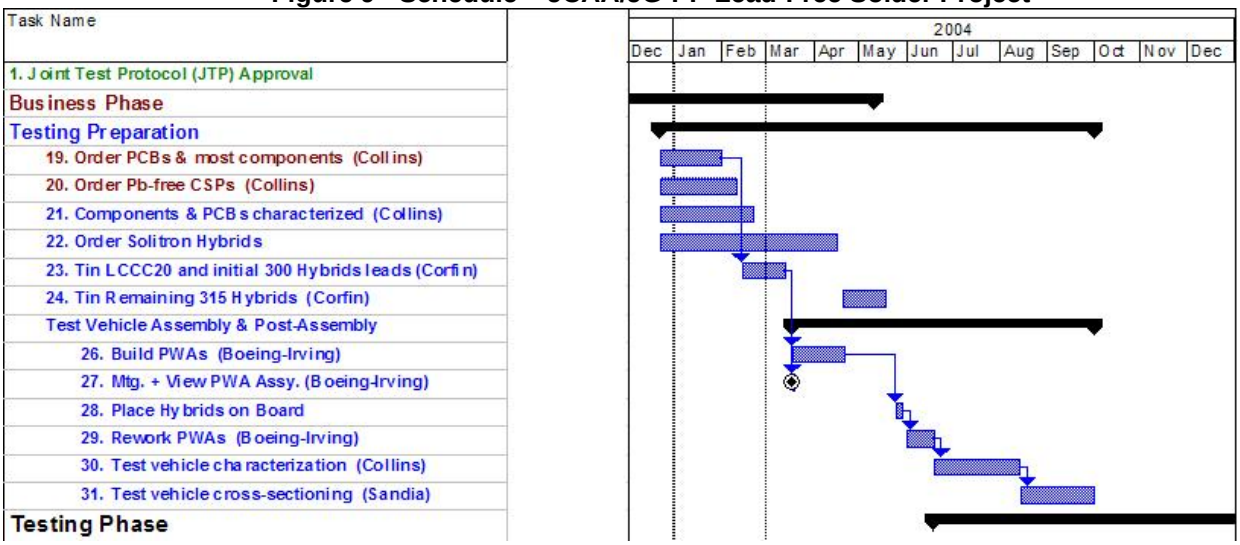
Next Steps

- See that requisite testing subcontracts are established
- Assemble test boards.
- Begin testing

Schedule

ITB maintains the project's schedule in Microsoft Project (Figure 9).

Figure 9 - Schedule – JCAA/JG-PP Lead-Free Solder Project



Task Order #3

Because of some inherent overlap of discussion topics between ITB task orders, ITB is hereby reporting significant Task Order #3 activities under this Task Order #1 Draft Final Report. Task Order #3 relates to the procurement and selected testing and evaluation of lead-free solders. In short, all testing materials needed for the Lead-Free Solder project are being purchased under Task Order #3, as well as the services to conduct mechanical shock testing and lead-free residue analysis.

Following are some key milestones related to Task Order #3.

September 30, 2003 – ITB subcontractor (Rockwell Collins) on contract to purchase testing materials.

December 16, 2003 – Stakeholders agreed upon the exact number and types of electronic components to use.

December 17, 2003 – Rockwell Collins began ordering parts.

January 1, 2004 – ITB subcontractor (ACI) on contract for mechanical shock testing and lead residue testing.

Upon receipt, components and bare boards are being checked to make sure they are of the right number, dimensions, and other specifications. To date, no anomalies have been found.

Parts are then being shipped to Boeing-Irving, Texas, where Boeing will assemble them into the completed test boards. This effort should be completed in April 2004.

b. JG-PP Low-No-VOC and Nonchromate Coatings for Support Equipment Project

Objective
Demonstrate that alternative coating technologies meet the performance standards required by the DoD and NASA for their support equipment and implemented as a coating system.

Achievements
- For NASA – The following JG-PP-tested coatings were qualified for use under NASA-STD-5008:
    - Bare (no topcoat) zinc primer Ameron D-9HS and Devoe 304H
    - Top-coated zinc primer coating system Ameron D-9HS and PSX 700
- For DoD – Coatings that met the required performance standards are still under review for implementation

Next Steps
- ITB continues to work with MSFC on the National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Defense Land Systems and Miscellaneous Equipment (DLSME) data collection effort to further identify opportunities for implementation of the newly approved support equipment coatings.
- Continue efforts to get JG-PP approval for an Implementation Survey.
    - DoD implementation of new technologies, including the modification of specification documents, is an extremely lengthy process with-in the DoD.

c. JG-PP Portable Laser Coating Removal Systems (PLCRS) Project

Objective
Develop and test portable laser systems as an alternative to chemical and/or physical hand-stripping of small parts.

Achievements
- Three laser systems are being tested. Finished first of three strip cycles on most substrates.
- Of the three laser systems, two systems may be of future interest to NASA:
    - "Clean-laser“ (ND-YAG) – for paint removal from composite and aluminum surfaces between space flights
    - Quantel (ND-YAG) laser – replacement for glove-box paint removal from complex geometries.

Next Steps
- Gain support from NASA contractors who may consider demonstrating and possibly implementing PLCRS.
- Coordinate NASA’s involvement in demonstration of PLCRS for NASA and Navy, 2nd Qtr 2004, Jacksonville, FL. Testing of PLCRS systems will be completed in a few months from start.

d. JG-PP Nonchromate Primers for Aircraft Exteriors Project

Objective
Conduct laboratory and field testing to allow for qualification and implementation of nonchromate primers for aircraft exteriors.

Achievements
- Using the JG-PP data, Boeing approved the JG-PP-qualified non-chrome primer for limited applications on the Orbiter.
- Boeing/Orbiter had applied and been evaluating the performance of the JG-PP-qualified nonchromate primer on flipper doors of Orbiter Columbia.
- Preliminary results of nonchromate primer were encouraging. Unfortunately, no useful data was obtainable from aftermath of STS-107.

Next Steps
- ITB will continue to monitor Air Force development and testing of nonchromate coating systems and share the findings with Boeing/Orbiter.

Monitored DoD Projects/Technologies

a. Air Force Microwave Reactor Fuel/Oxidizer Vapor Treatment System

The Air Force and NASA currently use nitrogen tetroxide as an oxidizer combined with hydrazine as a fuel for various space launch vehicles. Fueling and deservicing spacecraft constitute the bulk of operations in which environmental emissions of nitrogen oxides (NOX) occur. The Air Force has conducted laboratory bench testing and small-scale field testing of a microwave reactor system that decomposes fuel and oxidizer vapors into harmless by-products with great success. Based on these tests, the Air Force is currently in the design phase to test a full-scale unit at Vandenberg Air Force Base.

The AP2 Office has polled various center contacts regarding possible NASA interest in this technology. Based on those responses, it was determined that the technology is impractical at this time for existing large scale applications. The AP2 Office is currently examining the possibility, however, that the technology may have uses in payload processing or other facilities that have much lower flow rates as well as possibly being used in conjunction with existing scrubbers to reduce the amount of scrubber liquor disposed of as hazardous waste.

b. Army Hydrazine Replacement Technologies

NASA and DoD currently use hydrazine as a fuel combined with nitrogen tetroxide as an oxidizer for various space launch vehicles. NASA also uses hydrazine in Auxiliary Power Units (APUs) on the Orbiter. Hydrazine, however, is a highly toxic, corrosive, and ignitable chemical that requires elaborate procedures to minimize environmental and worker safety and health risks.

The Army is looking at two hydrazine replacement technologies that are of possible interest to NASA:
1. Demonstration/Validation of a non-hydrazine gas generator and
2. Replacements for monomethyl hydrazine fuel.

In response to AP2 Office inquiries, technical stakeholders determined that the technologies are still too much in the developmental stages and recommended that NASA should wait until the technologies become more developed and show actual results before becoming actively involved in the projects.

D. Year In Review – International Business Entity Support

ITB's overall objective for the international business entity is to support the Portuguese Institute of Environment and Centro Para Prevenção da Poluição – C3P (English translation: Center for Pollution Prevention) under the NASA/Portugal Joint Statement (JS) and the Terms of Reference (TOR). C3P is the AP2 counterpart organization in Portugal.

The international support activities in the past year can be generally categorized as follows:

1. C3P program development
2. Stakeholder identification and commitment
3. Needs identification
4. Project development

Achievements and highlights under each of the four categories are discussed below.

1. Program Development

ITB staffers provided mentorship and administrative support to C3P in the following activities:

- Training of C3P assigned engineers in P2 assessment and environmental management practices. ITB engineers also provided mentorship to C3P engineers on technical report writing and presentations.
- Technical and administrative support for the C3P Workshop in September 2003 – (The Workshop was attended by over 100 participants from 6 countries).
- Administrative support to the Joint Oversight Group (JOG) meeting in Lisbon, in September, in accordance with the requirements of the JS/TOR.
- Provided support for C3P at the Paris Air Show "Le Bourget", in June 2003.
- Supported attendance at the Foundation for Luso-American Development (FLAD) Workshop.

2. Stakeholder Identification and Commitment

ITB provided technical and administrative support to C3P in identifying stakeholders and fostering commitment. This included attending technical and programmatic meetings to identify and engage key stakeholders.

ITB provided technical support to the C3P Executive Director in his activities to establish relationships with:

- EMBRAER , Brazil
- European Association of Aerospace Manufacturers
- European Defense Industries Group (EDIG)
- NATO Industrial Advisory Group (NIAG)
- Oficinas Gerais de Material Aeronáutico (OGMA), Portugal
- TAP Air Portugal
- ANIMEE – Portuguese Association of Manufacturers and Electrical and Electronic Equipment

3. Identify International Needs

ITB engineers identified and evaluated P2 needs relative to current NASA concerns. Utilizing the NASA AP2 methodology, ITB engineers conducted over 36 individual Pollution Prevention Opportunity Needs Assessment exercises in Portugal and identified the following 15 distinct P2 needs for C3P to consider:

1. Dem/Val of suitable alternatives to hexavalent chrome (Cr^{+6}) in metal surface finishing conversion coatings and primer coatings
2. Dem/Val of non-chrome sealants for the fuselage and other metal to metal panel joints

3. Identification, demonstration and validation (Dem/Val) of low/no-VOC paints and coatings
4. TCE replacement in dip tank cleaning and degreasing operations
5. Dem/Val of alternatives heavy metal plating (chrome and cadmium) for aerospace components
6. Lead-free solder reliability testing
7. Reduction/elimination of VOCs and HazMats in cleaning applications
8. Reduction/elimination of emissions from hexavalent chrome (Cr^{+6}) plating baths
9. VOC emission control
10. Dem/Val of PD680 replacement
11. Identification of non-hazardous paint stripping for aircraft aluminum shells
12. Dem/Val of lead-free dry film lubricants
13. Turco 4215 replacement
14. Non-trichloroethylene (TCE) oxygen line cleaning systems
15. VOC solvent and HazMat free technologies for depainting on aluminum and composite substrates

4. Project Development

Working with OGMA and TAP, ITB took the previous list of 15 P2 needs and identified six (6) candidate EU/Portuguese P2 projects (Table 7), of these; ITB engineers recommended four projects for kickoff by C3P in 2004, and two in 2005. Projects identified were selected based on their importance to the stakeholders and the relative maturity of the alternative technologies or materials. Due to resource requirements, projects will be staggered through 2004 and 2005.

Table 7 – 2004 Candidate EU/Portuguese P2 Projects

No.	Project ID	Description
1	C3P.Proj.CCC.Port.001	Identification of suitable alternatives to hexavalent chrome (Cr+6) in conversion coating Alodine 1200 on AL 2024, 7075, and 6061.
2	C3P.Proj.NCS.Port.001	Dem/Val of Non-Chrome sealants for the fuselage and other metal to metal panel joints
3	C3P.Proj.VOC.Port.001	Replacement of high VOC coatings for aircraft painting and in general painting scheme.
4	C3P.Proj.TCE.Port.001	Trichloroethylene (TCE) replacement in dip tank cleaning and degreasing operations. It is regulatory requirement that TCE use cease in 2007.
5	C3P.Proj.CPC.Port.001	Dem/Val of suitable alternatives to hexavalent chrome (Cr+6) in primer coatings (AL 2024, 7075, 6061).
6	C3P.Proj.CEC.Port.001	Dem/Val of alternatives to Chrome and Cadmium plating on fasteners and engine components; landing gear, turbine fans, etc.

During the project identification and selection phase the following considerations were taken into account;

- Importance to the Portuguese stakeholders
- The maturity of the alternative technologies
- Level of reciprocating benefit to NASA

Schedule

ITB maintains each project's schedule in Microsoft Project (Figure 10).

Figure 10 - Schedule – 2004 Candidate EU/Portuguese P2 Projects

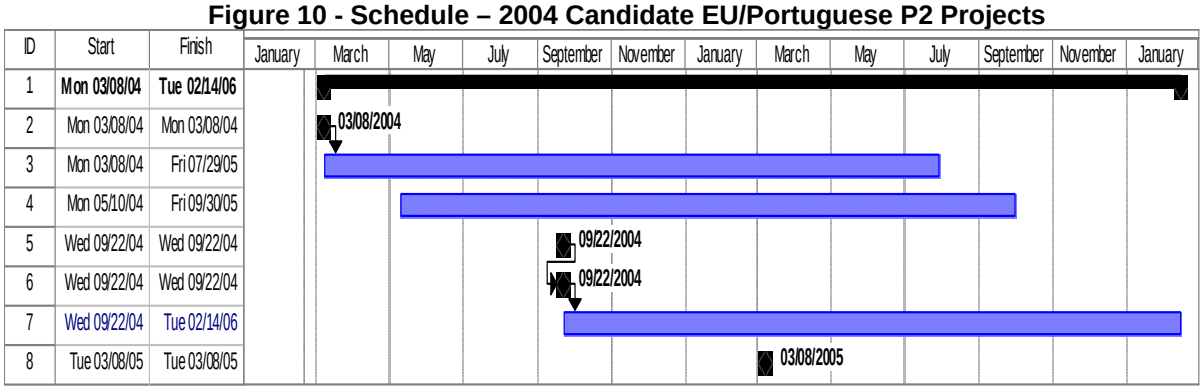
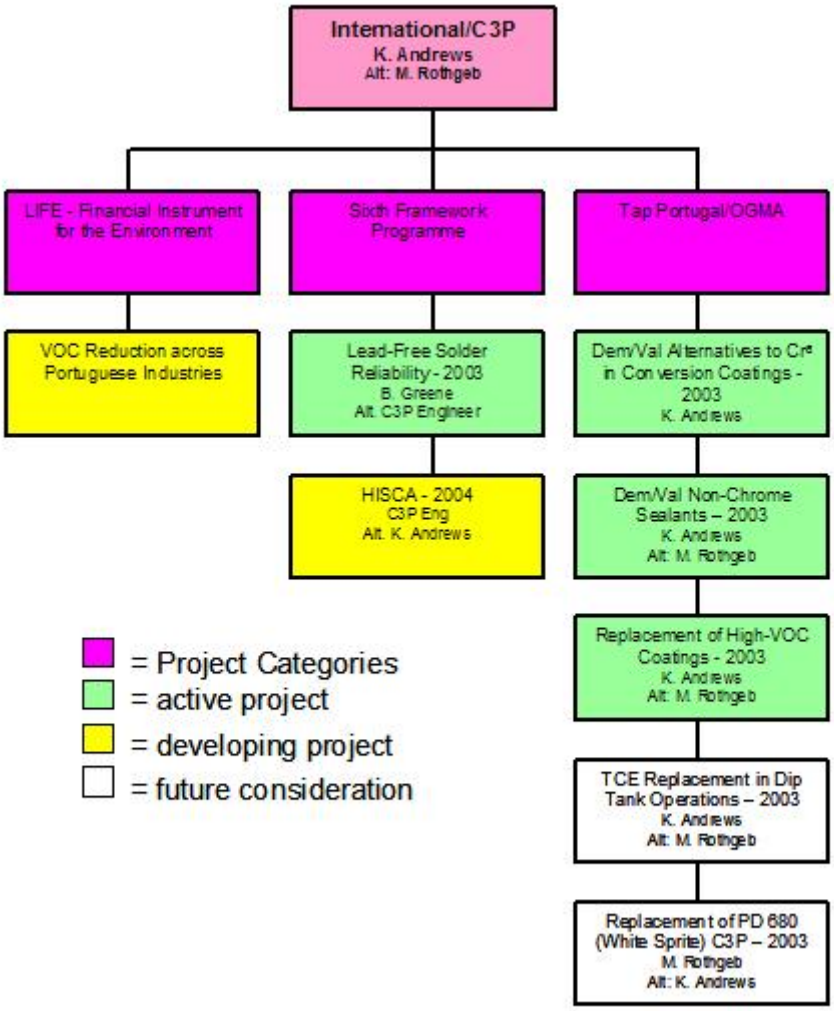


Figure 11 depicts the ITB engineering assignments to those international projects that are active or under development, along with other ideas for future project consideration.

FIGURE 11- International Business Entity Project Opportunities and POCs



The following sections provide further discussion on ITB's activities in international project development.

a. Tap-OGMA Projects

1. Dem/Val Alternatives to Cr6 in Conversion Coatings – 2003

Objective
Test and implement alternatives to conversion coating Alodine 1200 in aircraft processing operations in Portugal.

Achievements
- P2 needs assessments conducted at OGMA and TAP resulted in the identification FY04 C3P projects
- Follow-on technical meetings at OGMA / TAP helped solidify commitment and define project parameters
- C3P OGMA and TAP have agreed to move forward with this project.
- Defined project teams and conducted a formal project kick-off meeting in March 2004

Next Steps
- Prepare the following draft documents - JTP, PAR, CBA and Field Tests demonstration / validation studies.
- Begin laboratory and field testing.

2. Demonstration and Validation of Non-Chrome Sealants – 2003

Objective
Test and implement alternatives to hexavalent chrome containing sealants used in aerospace industry to seal critical metal to metal joints and impart corrosion inhibiting properties. Hexavalent chrome containing sealants are used in the aerospace industry to seal critical metal-to-metal joints.

Achievements
- Conducted technical meetings at OGMA / TAP to establish project parameters and define commitment
- OGMA and TAP have agreed to move forward with this project.
- Defined project teams and conducted a formal project kick-off meeting in March 2004

Next Steps
- Prepare the following draft documents - JTP, PAR, CBA and Field Test demonstration / validation studies.
- Begin laboratory and field testing.

3. Replacement of High-VOC Coatings – 2003

Objective
Test and implement alternatives to currently used high VOC coatings by the Portuguese industry. This project has reciprocal benefit to NASA because we are currently working with the Joint Services to reduce VOC emission levels in domestic operations.

Achievements
- Conducted technical meetings at OGMA / TAP to establish project parameters and define commitment
- OGMA and TAP have agreed to move forward with this project.
- Defined project teams and conducted a formal project kick-off meeting in March 2004

Next Steps

- Prepare the following draft documents - JTP, PAR, CBA and any Field Test demonstration / validation studies.
- Begin laboratory and field testing.

b. Financial Instrument for the Environment (LIFE) Projects

1. Portuguese National VOC Reduction Project

Objective

Identify, test, and validate low-VOC materials for commercial and industrial process in Portugal. This project is in support of EU Directive 1999/13/CE - to reduce both the direct and indirect effects of VOC emissions to human health. The Directive was adopted in Portugal by law DL nº 242/2001 which imposes;

a) Elaboration of plans for solvent management concerning involved industrial sectors
b) Elaboration of plans for solvent management for each industrial unit
c) Observation of compliance to emission limit values

Achievements

- ITB engineers performed VOC P2 site assessments at 30+ facilities in Portugal. ITB engineers identified the following pollution prevention opportunities for a national VOC programme:
  - VOC emission control – control release until low VOC materials/processes are qualified
  - Reduction/elimination of VOCs and hazardous materials in cleaning applications
  - Identification, demonstration and validation of low/no-VOC paints, coatings, inks and adhesives
  - Reduction/elimination of VOCs from ink/paint stenciling and marking

- C3P submitted VOC reduction proposal to European programme LIFE 2003/2004.

Next Steps

- C3P/NASA will continue to build stakeholder base as project is developing.
- Upon receipt of LIFE authorization C3P shall define and scope national VOC projects.
- Initiate LIFE VOC Project.

c. Sixth Framework (Fr6) Programme Projects

1. Lead-Free Solder Reliability Project

Objective

Design “green electronics” testing program that will complement JG-PP and other European lead-free testing programs. This project will address the impact of the following parameters on reliability:

- Solder alloy
- Board finish
- Components
- Tests and testing conditions

Achievements

- ITB performed solder site assessments at 12+ facilities in Portugal revealed interest and need for reliability data on new lead-free solders.

- C3P submitted project scope and funding requirements (proposal) to the Fr6 Committee.

Next Steps

- C3P/NASA will continue to build stakeholder base as project is developing.
- Upon receipt of Fr6 authorization C3P shall define and scope project
- Initiate lead-free solder project

2. HISCA Project

Objective

Submit project proposal - Heavy Ions Substitution for SME Supply Chain in Aeronautics, "HISCA" to Fr6. This project address a reduction in the use of heavy ions in European aerospace processing.

Achievements

C3P submitted the proposal as a joint effort by:

- AIRBUS
- The European Association of Aerospace Industries (AECMA)
- The German Aerospace Industries Association (BDLI)
- C3P
- The French Aerospace Industries Association (GIFAS)
- Hellenic Aerospace Industry (HAI)
- ROLLS ROYCE
- The Society of British Aerospace Companies (SBAC).

Next Steps

- C3P will continue to build stakeholder base as project is developing.
- Upon receipt of Fr6 authorization C3P shall define and scope project
- Initiate HISCA project

Summary

ITB's staff of eight personnel provided critical engineering, technical, and administrative program and project management support to the AP2 Program Manager under Task Order #1. ITB's Program Analyst and Web Database Specialist continued to provide the core, robust infrastructure that supported program and project activities in every business entity. For the engineering staff, the development and execution of projects was a major emphasis under Task Order #1. Over the course of the past year, ITB achieved the following on *28* Agency, DoD, and International projects:

- Completed three (3) projects:
    - NASA Solder Assessment
    - JG-PP Oxygen Line Cleaning
    - JG-PP CCAMTF
- Developed eight (8) opportunities into active Agency and International projects:
    - Convergent Spray Technology
    - Parts Washer Alternatives
    - Alternatives to Isocyanate Urethane
    - Low-Emission Depainting
    - C3P Lead-Free Solder
    - C3P Chrome Conversion Coating
    - C3P Alternative Sealants
    - C3P Low-VOC Coatings
- Kicked off an additional three (3) Agency projects which were ultimately discontinued:
    - Alternatives to CFC-113 Precision Cleaning
    - Line Cleaning for T-38 Aircraft
    - Alternatives to HCFC-225 Precision Cleaning
- Continued to manage and support four (4) active JG-PP projects:
    - Lead-Free Solder
    - Coatings for Support Equipment
    - Nonchromate Primer for Aircraft Exteriors
    - Portable Laser Coating Removal System
- Supported two (2) new developing opportunities (by SEA):
    - Non-chrome Conversion Coatings
    - Non-chrome Primers
- Further developed five (5) P2 opportunities for future project consideration:
    - Membranes for VOC Removal
    - JG-PP Wipe Solvents
    - JG-PP Coatings
    - C3P VOC Reduction
    - C3P Heavy Ion Removal (HISCA)
- Identified three (3) new P2 opportunities:
    - Coatings for NASA Test Stands
    - C3P TCE
    - C3P PD680
- Monitored two (2) DoD projects/technologies of possible future interest:
    - Air Force Microwave Reactor Fuel/Oxidizer Vapor Treatment System
    - Army Hydrazine Replacement Technologies
- Identified prospective opportunities with Air Force Space Command and NAVFAC.

Finally, ITB performed the following key program-level accomplishments under Task Order #1.

- Supported the JG-PP Working Group's efforts to continually improve its internal procedural documents (e.g. Concept of Operations, Methodology diagram, approach to project selection) and address the desires of the JG-PP Principal Members (e.g. performance metrics).
- Supported C3P's efforts to identify P2 needs and resources (including funding) and develop a business framework that will soon allow C3P to become a viable, self-sufficient organization.

Next year (FY2004), ITB hopes to build upon these above accomplishments.

Concerning project plans for FY2004, current schedules call for ITB to:

- Complete one or more Agency and DoD projects
- Kick off at least one new Agency project
- Continue to manage or support up to 10 active Agency, DoD, and international projects in FY2004

In addition, as the need arises and with direction from the AP2 Program Manager, ITB plans to:

- Develop new supported projects with AF Space Command and/or NAVFAC
- Continue identification and further development of opportunities within the Agency (e.g., NASA MSFC Lead-Free Solder Body of Knowledge), JG-PP, and internationally (e.g., Embraer)

Conclusion

The NASA AP2 Program remains a very viable and active Agency program. All ITB resources are fully employed in providing support to develop and maintain the current level of programmatic and project efforts across the three business entities. The ultimate success of each project remains subordinated to the level of strategic direction provided by NASA, the individual performance of the project integrator, and from the responsiveness of those identified as project stakeholders. The ITB project integrators will continue to identify the challenges and risks for maintaining the level of program and project activity being conducted to the NASA AP2 Program Manager for direction.