

# PANEL ON SPECIFIC PROJECTS AIMING AT REDUCTION OF VOLATILE ORGANIC COMPOUNDS IN INDUSTRY

PRESENTERS:

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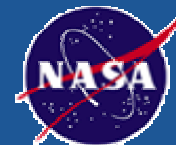
*Dr. Ing. Kevin S. Andrews*

*Ing. Matt Rothgeb*

**Lisbon, September, 19<sup>th</sup>, 2003**

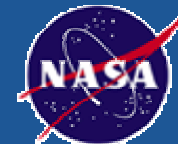


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# Project drivers

- Projects are typically born in response to an internal (process) or external driver
- The identification of C3P VOC emission reduction projects has its genesis in global environmental concern and national regulatory requirements



# Drivers for C3P VOC projects

- EU Regulations
- US Regulations
- Portuguese Regulations
- Occupational Health and Safety
- Environmental Protection
- Cost Savings

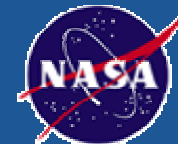


## Regulatory Drivers

EU Directive **1999/13/CE** with the objective to reduce both the direct and indirect effects of VOC emissions to human health in consequence of a series of procedures applicable to the industrial activities described in the Directive.

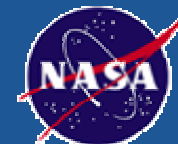
The Directive was adopted in Portugal by law **DL n° 242/2001**, which imposes:

- Elaboration of plans for solvent management concerning industrial sectors
- Elaboration of plans for solvent management
- Definition of emission limit values



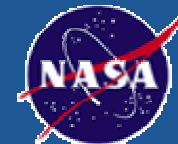
# These regulations aim to :

- Protect workers, thus providing safe conditions in terms of Occupational Health and Safety
- Contribute to environmental protection thus avoiding emissions of toxic substances to the atmosphere
- Provide cost savings obtained from both the recycling of solvents, prevention of losses, and use of cheaper solutions (in terms of recovery equipment and also by using non-organic based solvents)



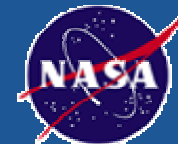
# *Industrial Sectors concerned for DL n<sup>o</sup> 242/2001:*

- Printing: off-set ; rotogravure \*; serigraphy, etc.
- Surface cleaning
- Painting and vehicle repair
- Coil coating \* and coating operations, including: metals, plastic, textiles, films and paper
- Coating of wood surfaces and wood impregnation\*
- Dry-cleaning\*
- Shoe making\* (\* regardless of prod. capacity)



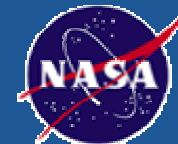
# *Industrial Sectors concerned for DL n° 242/2001:*

- Adhesive coatings
- Production of paints and inks
- Rubber processing\*
- Extraction of vegetable oils and fats\*
- Production of pharmaceuticals\*
- Production of laminated wood and plastics\*
- Production of iron for coils\* (\* regardless of prod. capacity)



# *Application schedule for Regulation DL N° 241/2001:*

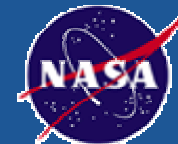
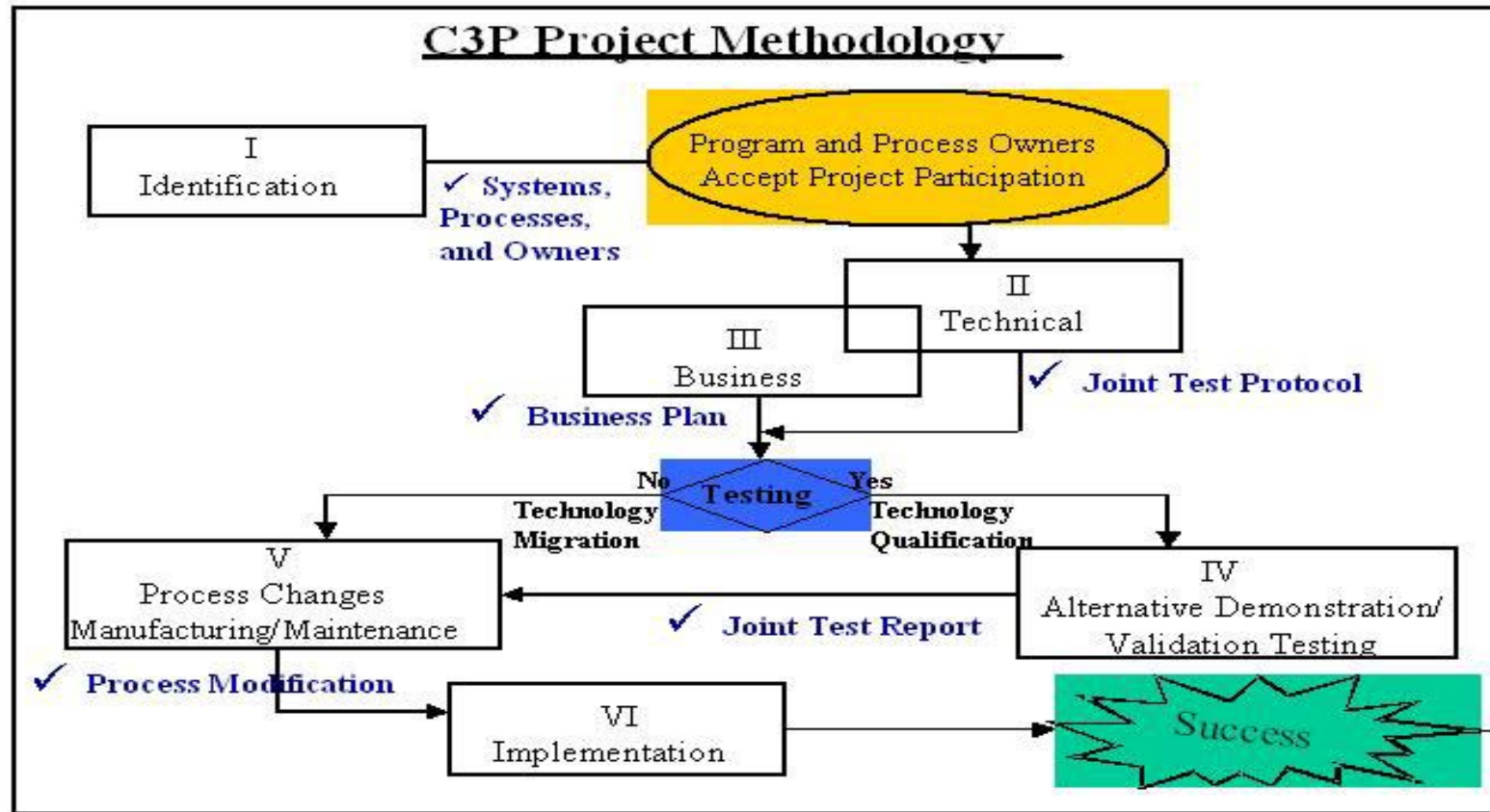
- **Must have an emission objective (broad):**
  - ✓ **new facilities: until 31/10/2001**
  - ✓ **existing facilities: until 31/10/2005**
- **Must have an emission objective (reduced):**
  - ✓ **new facilities: until 31/10/2004**
  - ✓ **existing facilities: until 31/10/2007**





# Integrating Common Needs for Shared Solutions Technical Workshop

## September 19, 2003, Lisbon, Portugal

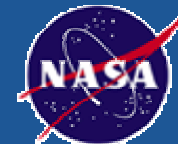


# Identification - Assessments

Centro Para Prevenção da Poluição-C3P and NASA formed an Assessment Team consisting of NASA Acquisitions Pollution Prevention Office (AP2), Instituto de Soldadura e Qualidade (ISQ) and Instituto de Engenharia Mecânica e Gestão Industrial (INEGI) engineers to accomplish an environmental technology need assessment



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# The Assessment Team

- P. Castelo Branco C3P
- Joaquim F. Silva Gomes INEGI
- Kevin Andrews NASA AP2
- Matthew Rothgeb NASA AP2
- Antonio Castro Vide INEGI
- Sonia Ferreira INEGI
- Rui Neto INEGI
- Isabel E. Mendes ISQ
- Ana Claudia Casinhas Coelho ISQ

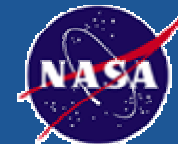


# Assessment Objectives

- To evaluate industrial processes that use or generate significant levels of VOCs
- To identify technologies or processes that could be used to meet European Union (EU) and Portuguese regulatory requirements
- To identify projects of benefit to both Portugal and NASA in reduction or elimination of VOCs

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The need assessments were completed at 24 government and commercial manufacturing and maintenance facilities in Portugal

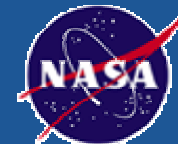


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<b>ALTO</b>	<b>CIN</b>	<b>RMC</b>
<b>AMCOR Flexibles</b>	<b>CODISA</b>	<b>Salvador Caetano</b>
<b>Autoeuropa</b>	<b>Hempel Paints</b>	<b>SILAMPOS</b>
<b>CaetanoBus</b>	<b>Leica</b>	<b>Têxtil Manuel Gonçalves, S.A</b>
<b>Cifial Ferragens</b>	<b>Lisgráfica</b>	<b>Tintas Barbot</b>
<b>Cifial Fundação</b>	<b>Monteiro Ribas</b>	<b>Tintas Sinclav</b>
<b>Cifial Torneiras</b>	<b>Phillips</b>	<b>VALSAN</b>
<b>Tap Air Portugal</b>	<b>MAPREL</b>	<b>Oficinas Gerais deMaterial Aeronautico</b>



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## VOC Project Ranking rationale

- Pending regulatory requirement
- Preferred P2 method is identification environmentally preferable alternatives rather than treatment at the end of the pipe

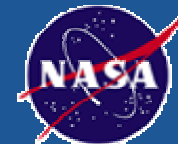
### **But -**

For some applications there is insufficient time to demonstrate and validate product replacements that will meet the VOC Emissions regulations



## Assessment Findings

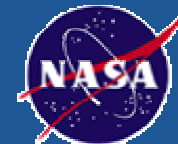
The Assessment Team determined that to meet the challenges of EU and Portuguese reductions in VOC emissions would require an integrated technology effort in best management practices, control technologies, and the identification and validation of alternative materials.



## C3P Assessment recommendations:

C3P continue joint project identification & development efforts in the following areas:

- 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





# **Project Area 1**

## VOC Emission Control



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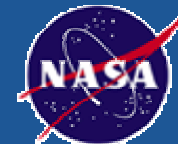
- Determine the performance environment present for each stakeholder and group accordingly
- Identify all potential emissions treatment technologies and group according to which stakeholders they best suit
- Work with Stakeholders to build Potential Alternatives Report as well as develop Joint Test Protocol
- Conduct cost benefit analysis

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Some stakeholders may have already looked into technologies or may be using technologies but could benefit from further testing and could contribute with CBA and emissions reduction information



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# VOC Emission Control

- Potential Alternatives Report identifies Commercial Off the Shelf Technologies that will be considered to treat VOC emissions
- COTS Technologies will likely include:
  - Biological Treatments
  - Absorption / Neutralization / Precipitation
  - Filtration (Wet Scrubbing, Membrane Technology)
  - Oxidation (Chemical, Thermal, Catalytic)
  - Cold Plasma
  - Others?

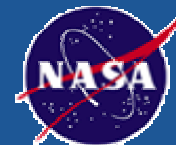


# **Project Area 2**

## **Reduction/Elimination of VOCs In cleaning operations**

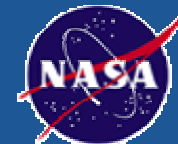


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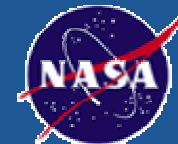
# Reduction of VOCs in Cleaning Applications

- Solvents used in critical and non-critical cleaning applications are high-VOC solvents
- Replacing these solvents with low / no VOC cleaning alternatives will reduce regulatory burden on industries
- Substrates used, cleanliness standard to be met and contaminants to be cleaned will determine the best likely alternative



## VOCs in Cleaning Applications

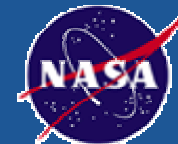
- Determine the working environments present for each stakeholder and group accordingly
- Identify suitable alternative cleaning technologies and classify by stakeholder
- Work with stakeholders to build Potential Alternatives Report and develop Joint Test Protocol
- Conduct cost benefit analysis



## **Project Area 3**

### Identification of Low / No VOC Coatings, Inks and Adhesives

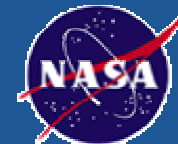
High VOC solvents have traditionally been used in Coatings, Inks and Adhesives due to their high volatility - this facilitates that rapid curing



# Challenges to identification of alternatives

## Material Performance requirements

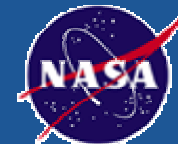
- Gloss retention
- Corrosion protection
- Adhesion
- Flow characteristics
- Chemical resistance
- Weatherability etc.





## Low / No VOC Coatings, Inks and Adhesives

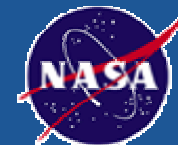
- Determine the working environments present for each stakeholder and group accordingly
- Identify suitable alternative cleaning technologies and classify by stakeholder performance and testing requirements
- Work with stakeholders to build Potential Alternatives Report and develop Joint Test Protocol
- Conduct cost benefit analysis



# Where do we go from here?

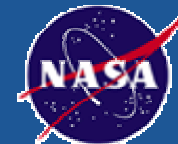
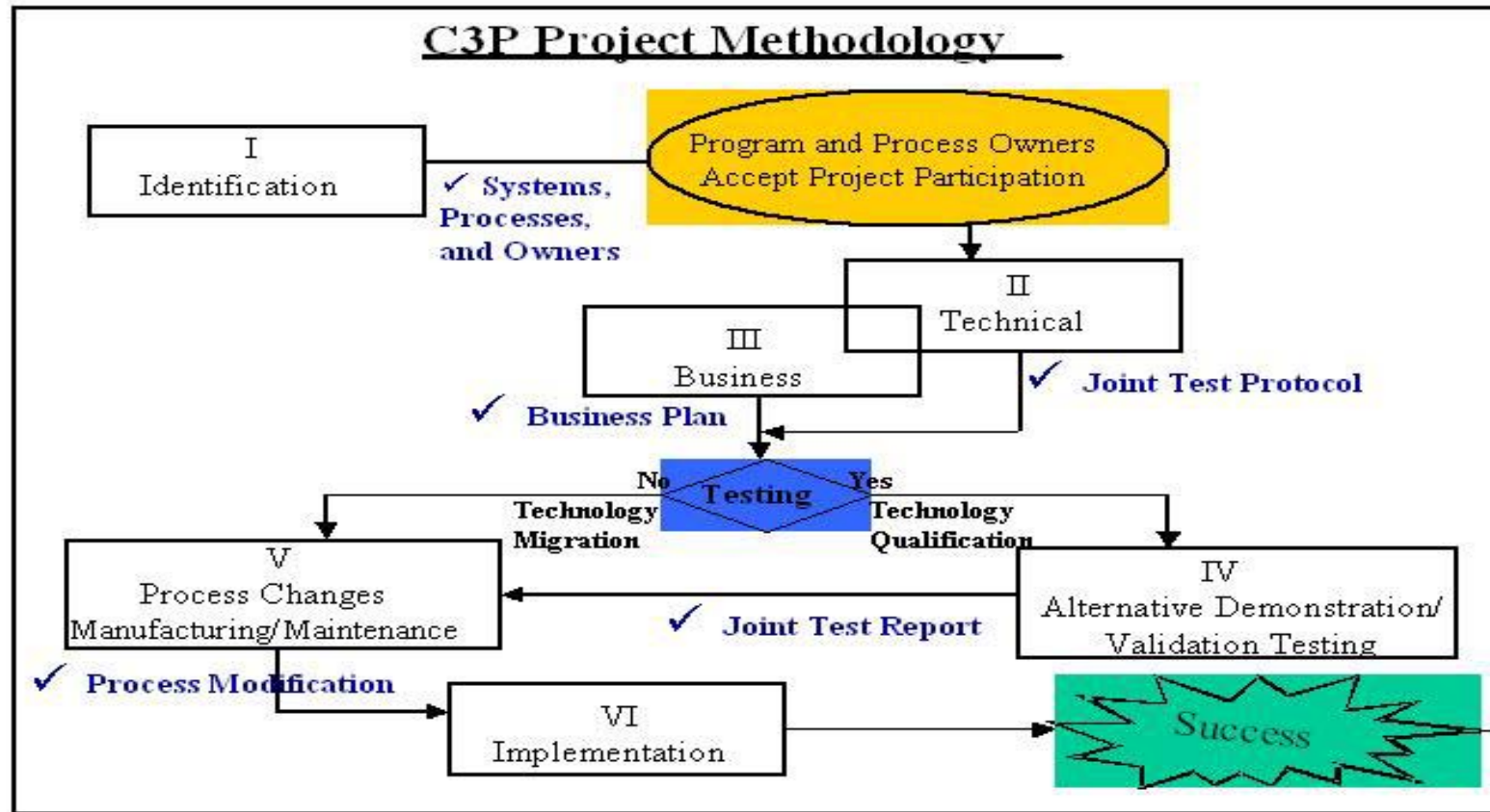


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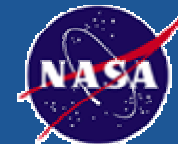
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# Stakeholder Buy - In

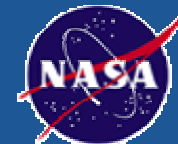
Stakeholder role:

- Define need
- Identify performance and testing requirements
- Maintains project momentum
- Resource contribution
- Implements approved technologies



# Technical Phase (Scoping the project)

The Technical Phase is defined by the identification of testing / performance requirements (JTP) and potential alternative materials or processes (PAR).



# Joint Test Protocol

The JTP describes the technology and performance requirements.

The testing identified in the JTP is multi-phased.

- Screening
- Common
- Extended



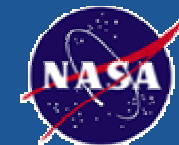
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# Screening Tests

Test Category	JTP Section	Test Name	Acceptance Criteria	Reference(s)
<b>SCREENING</b>	3.1	These are preliminary tests performed on a number of candidate portable laser coating removal systems. Systems that meet the requirements of the screening tests will be subjected to additional tests listed in this JTP.		
	3.1.1	Coating Strip Rate	Acceptance criteria based on requirement analysis or survey results and/or 0.06 ft <sup>2</sup> per minute at 6 mils nominal thickness	Air Force Engineering Qualification Plan (AF EQP)
	3.1.2a	Warping/Denting	No warping/denting observable at 10X magnification	
	3.1.2b	Metal/Composite Erosion	No metal/composite erosion observable at 10X magnification	
	3.1.2c	Hardness	No significant change in hardness	ASTM E18
	3.1.2d	Tensile Testing	No statistically significant degradation between baseline and test articles	ASTM E8
	3.1.3a(1)	Confirmation of Cladding Penetration	A black indication means "fail." No black indication means "pass"	
	3.1.3a(2)	Determination of Cladding Loss	No more than 20 percent cladding removed after four de-paint cycles	
	3.1.3b	Surface Profile/Roughness	2024-T3 (Alclad): Not to exceed 125 micro inches 2024-T3 (Bare): Not to exceed 125 micro inches	SAE MA4872
	3.1.3c	Determination of Substrate Temperatures During Coating Removal Process	7075-T6 (Alclad): 300°F maximum spike condition Graphite Epoxy Laminate: 200°F maximum spike condition	



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# Common Tests

Test Category	JTP Section	Test Name	Acceptance Criteria	Reference(s)
	3.1.4	Four-Point Flexure	No statistically significant degradation between baseline and test articles	ASTM D6273
	3.1.5	Rotary Wing Metallic Substrate Assessment		Air Force EQP ASTM E466, ASTM E647
<b>COMMON</b>	3.2	These tests are the requirements agreed upon by the participant DoD services, NASA, and the aerospace industry for portable laser coating removal systems that pass the screening tests.		
	3.2.1	Coating Strip Rate	Acceptance criteria based on requirements analysis or survey results and/or 0.25ft <sup>2</sup> per minute at 3 mils nominal thickness	AF EQP
	3.2.2a	Warping/Denting	See JTP Section 3.1.2a	
	3.2.2b	Metal/Composite Erosion	See JTP Section 3.1.2b	
	3.2.2c	Hardness	See JTP Section 3.1.2c	
	3.2.2d	Tensile Testing	See JTP Section 3.1.2d	
	3.2.3a	Wet Tape Adhesion Test Procedure	Adhesion performance greater than or equal to 4a as specified in ASTM D3359	ASTM D3359



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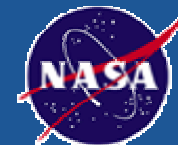
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# Extended & Field Evaluation Testing

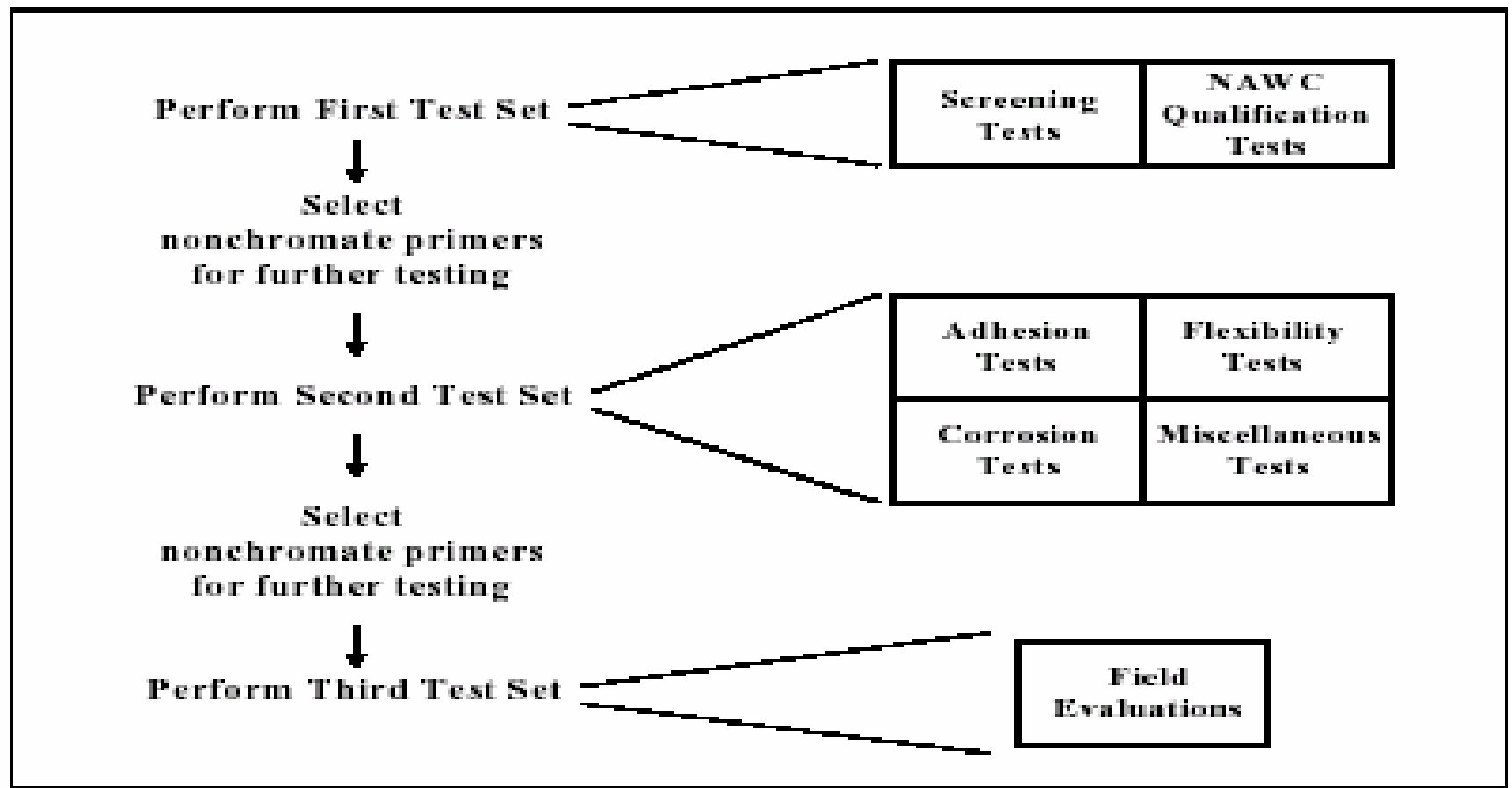
<b>EXTENDED</b>	3.3	These tests are unique to a particular service or agency mission profile rather than the entire DoD, NASA, and aerospace industry.		
	3.3.1a	Tension Testing	Testing detail and results shall be documented for review and determination of pass/fail values	ASTM D638
	3.3.1b	Compression Testing	Testing detail and results shall be documented for review and determination of pass/fail values	ASTM D695
	3.3.1c	Open Hole Fatigue	Testing detail and results shall be documented for review and determination of pass/fail values	ASTM E647
	3.3.2	Conductivity	No significant change in electrical conductivity	Eddy-Current Method
	3.3.3	Fixed Wing Metallic Substrates – Fatigue Crack Growth Rate	This test will only be conducted if the Rotary Wing Testing in JTP Section 3.1.5 fails	
<b>FIELD EVALUATION</b>	3.4	These tests are intended to test performance requirements of candidate portable laser coating removal systems and compare the alternatives in an operational environment.		
	3.4.1	Ease of Handling	The system can remove coatings with manning of two. System can be moved and manipulated around equipment by two persons. Portable Laser Gun Head weighs less than 5 pounds	
	3.4.2	Full Unit Operational Testing	The system performs at the depot/field location as it did in previous screening and common tests.	



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# Non-chromate Primer Test Flow



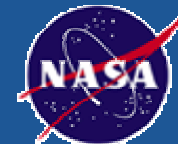
# Project Business Elements

- Cost Benefit Analysis
- Resource contribution; in-kind or other
- External Funding; EU, LIFE etc.



# Project Schedules

- Need/Purpose of Schedule
- Generic Project Schedule



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ID	Task Name	Duration	2003				2004				2005			
			Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1	<b>Identification</b>	<b>65 days</b>	[Black bar]											
3	<b>Technical</b>	<b>150 days</b>	[Black bar]											
4	<b>Joint Test Protocol</b>	<b>150 days</b>	[Black bar]											
5	Technical Telecon #1	0 days												
6	Identify Technical Specifications	10 days												
7	Draft Requirements Matrix/ Survey Form	10 days												
8	Technical Telecon #2	0 days												
9	Final Requirements Matrix/ Survey Form	15 days												
10	1st Draft (Strawman) JTP	35 days												
11	Technical Telecon #3	0 days												
12	2nd Draft JTP	30 days												
13	Technical Telecon #4	0 days												
14	Technical Telecon #5	0 days												
15	Various Draft JTPs & Telecons	45 days												
16	Final JTP	15 days												
17	Potential Alternatives Report	150 days	[Blue bar]											
18	Cost Benefit Analysis A	75 days	[Blue bar]											
19	<b>Business</b>	<b>63 days</b>					[Black bar]							
20	Business Plan	63 days					[Blue bar]							
21	<b>Alternative Dem/Val</b>	<b>242 days</b>					[Black bar]							
22	Testing Preparation	63 days					[Blue bar]							
23	<b>Testing</b>	152 days					[Blue bar]							
24	Joint Test Report	23 days									[Blue bar]			
25	<b>Implementation</b>	<b>106 days</b>									[Black bar]			



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# LIFE Programme

A proposal is currently being elaborated regarding submission to European Programme LIFE 2003/2004.

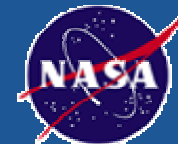
**LIFE PROGRAMME:** European Programme funded by the EU aimed to support demonstration actions regarding environmental protection.

Proposals are to be received by the Portuguese Secretariat until October 2003, reviewed and send with a recommendation to the competent EU Life Office in Brussels who will decide on projects to be funded in 2004, based on a positive evaluation given by the Member States recommendation, evaluation by a selection committee and the available budget.



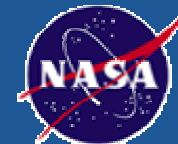
## *Phase 1 – Industrial sectors characterisation*

- 1.1 – Detailed inventory of involved companies and its characterisation in terms of industrial processes, technologies, emissions (both stationary and diffuse sources).
- 1.2 – Report on industrial sectors characterisation, as a basis for elaborating VOC emissions reduction plans.



***Phase 2 – Development of general VOC emissions reduction plans and tools for supporting industries to adapt to the Regulation:***

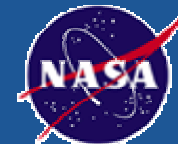
- 2.1 – Analysis of Best Available Technologies concerning VOC emissions reduction and prevention applicable to the industrial sectors
- 2.2 – Development of general VOC emissions reduction plans
- 2.3 – Development of specific tools to support industrial companies to comply with the VOC emissions reduction plans as well as specific emission levels





## *Phase 3 – Follow-up of VOC emissions reduction plans*

- 3.1 – Dissemination of the general VOC emissions reduction plans and awareness of industrial operators
- 3.2 – Follow-up of specific VOC emissions reduction plans for each industrial unit, concerning technical support, monitorisation actions and evaluation of periodic progress reports
- 3.3 – Preparation of a final global report on Project results



# PROJECT VOC:

**SUGGESTIONS AND PARTNERS ARE  
WARMLY WELCOME !**

**THANKS**



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