

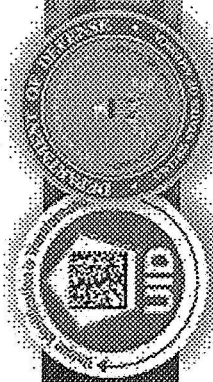
Abstract

UID...Now That's Gonna Leave A Mark

Since 1975 bar codes on products at the retail counter have been accepted as the standard for entering product identity for price determination. Since the beginning of the 21st century, the Data Matrix symbol has become accepted as the bar code format that is marked directly on a part, assembly or product that is durable enough to identify that item for its lifetime. NASA began the studies for direct part marking Data Matrix symbols on parts during the Return to Flight activities after the Challenger Accident. Over the 20 year period that has elapsed since Challenger, a mountain of studies, analyses and focused problem solutions developed by and for NASA have brought about world changing results. NASA Technical Standard 6002 and NASA Handbook 6003 for Direct Part Marking Data Matrix Symbols on Aerospace Parts have formed the basis for most other standards on part marking internationally. NASA and its commercial partners have developed numerous products and methods that addressed the difficulties of collecting part identification in aerospace operations. These products enabled the marking of Data Matrix symbols in virtually every situation and the reading of symbols at great distances, severe angles, under paint and in the dark without a light. Even unmarkable delicate parts now have a process to apply a chemical mixture, recently trademarked as Nanocodes, that can be converted to Data Matrix information through software. The accompanying intellectual property is protected by ten patents, several of which are licensed. Direct marking Data Matrix on NASA parts dramatically decreases data entry errors and the number of parts that go through their life cycle unmarked, two major threats to sound configuration management and flight safety. NASA is said to only have people and stuff with information connecting them. Data Matrix is one of the most significant improvements since Challenger to the safety and reliability of that connection.

UID Forum

Implementation Strategies for Programs and Suppliers



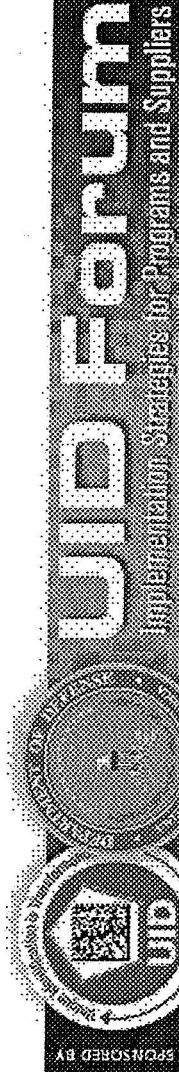
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UID... Now That's Gonna Leave A Mark

*UID Forum... Providence, RI
April 19-20, 2006*

**Fred Schramm
NASA Marshall Space Flight Center**

EXPLORE. DISCOVER. UNDERSTAND.

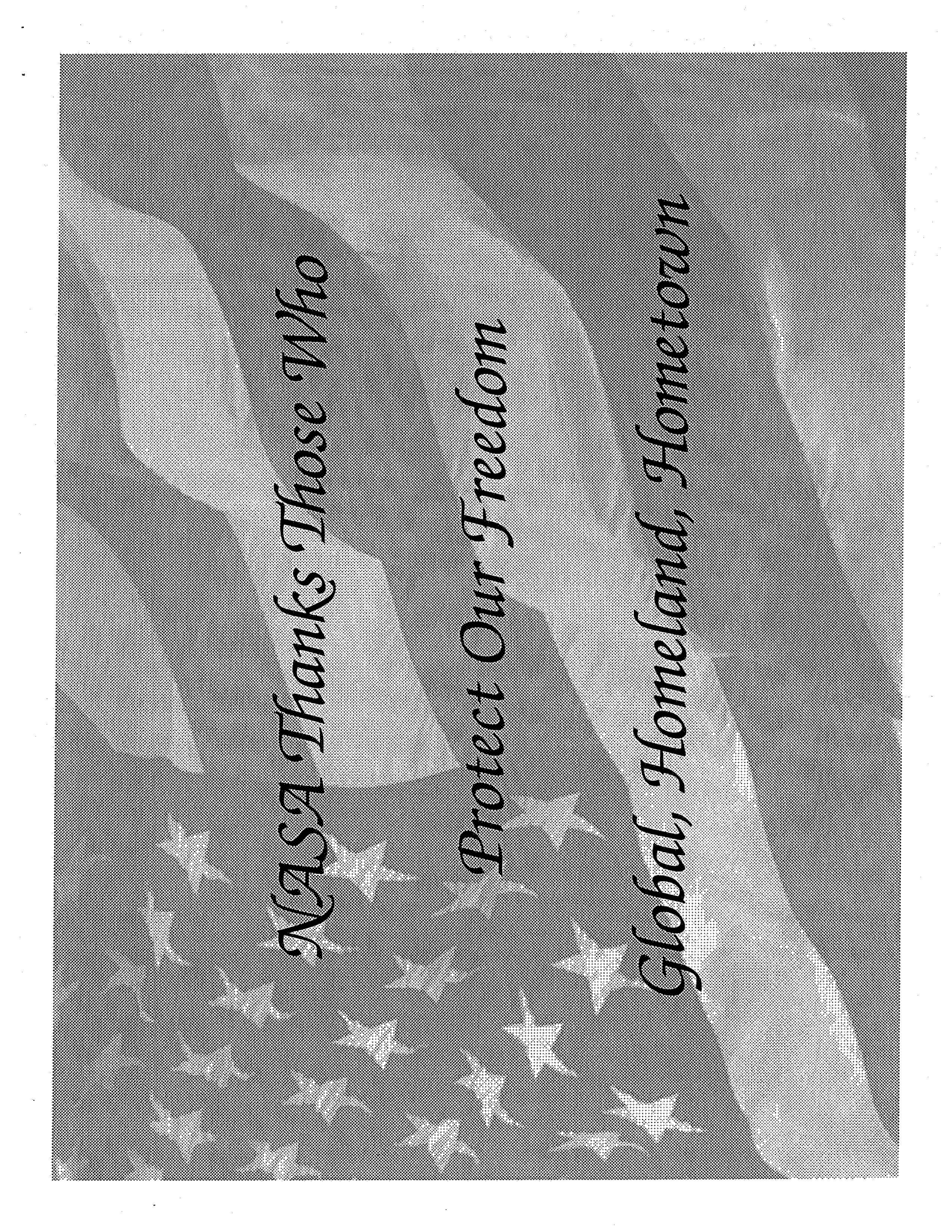


UID... Implementation Plan

Development

Based on the following areas:

- **ALS Integration**
- **Technical Documentation**
- **General Infrastructure Requirements**
- **Marking Requirements & Processes**
- **Costs**

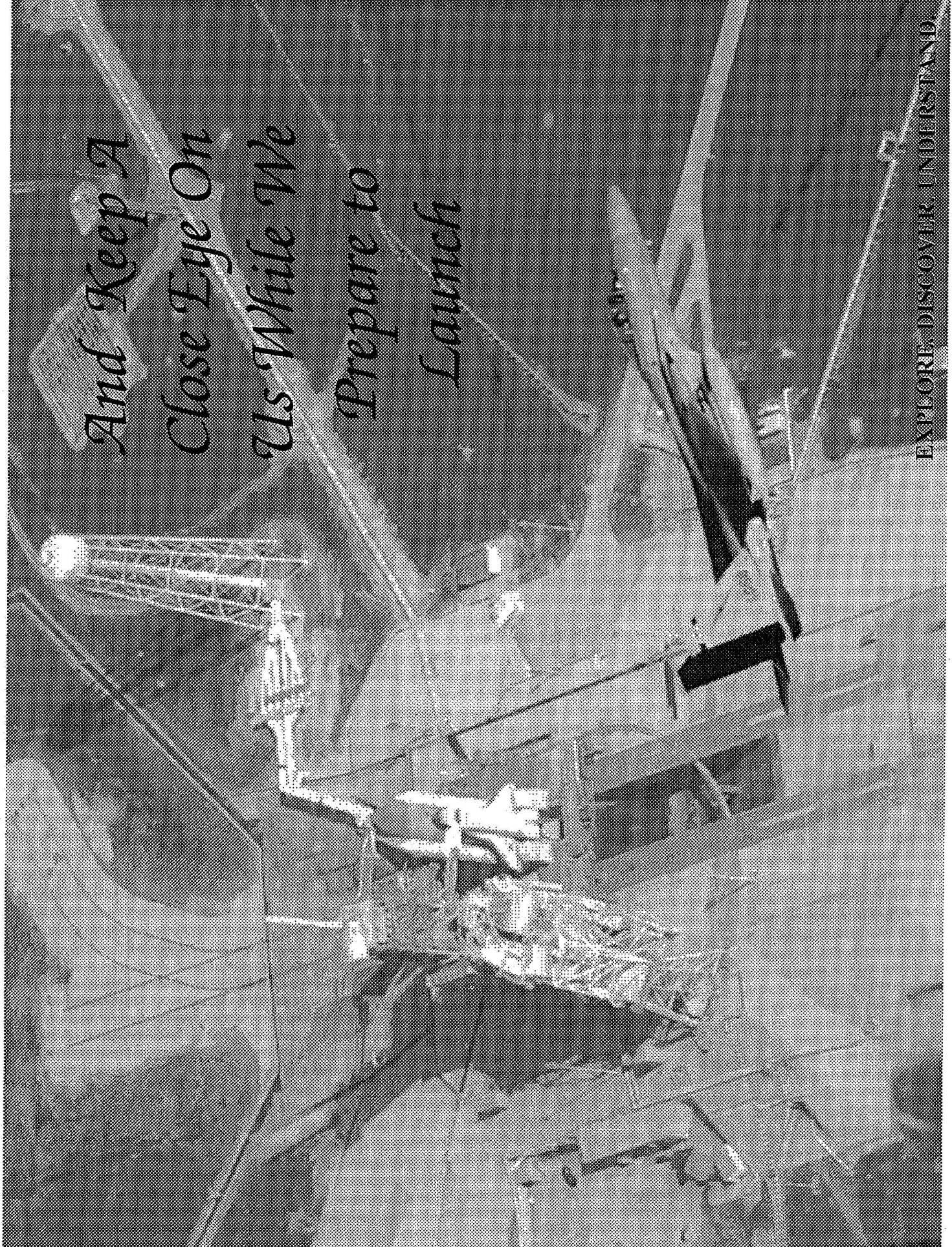


NASA Thanks Those Who

Protect Our Freedom

Global, Homeland, Hometown

*And Keep A
Close Eye On
Us While We
Prepare to
Launch*



EXPLORE, DISCOVER, UNDERSTAND.

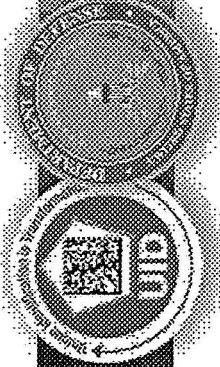
And See Us Home



EXPLORE. DISCOVER. UNDERSTAND.

UID Forum

Implementation Strategies for Programs and Suppliers



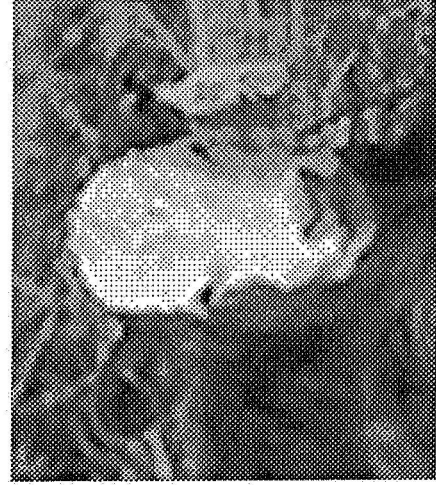
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Today's World...More Things Being Tracked... Even the Food Supply

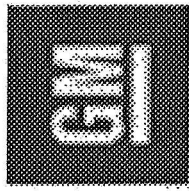
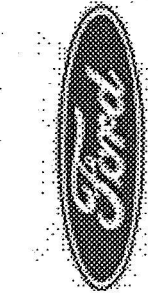


United States Department of Agriculture

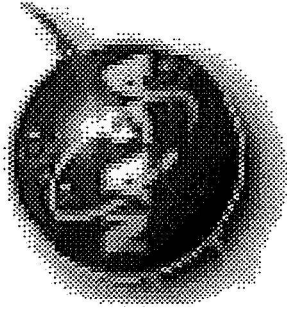
NEW NATIONAL ANIMAL ID SYSTEM WILL GUARD AGAINST MAD COW DISEASE AND ANIMAL HEALTH PROBLEMS



Different Organizations Track Products for Different Reasons



DAIMLERCHRYSLER

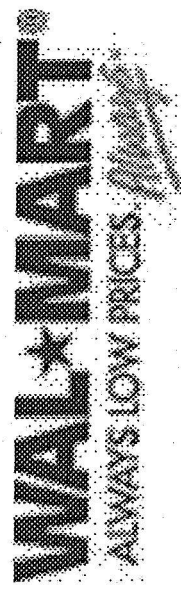
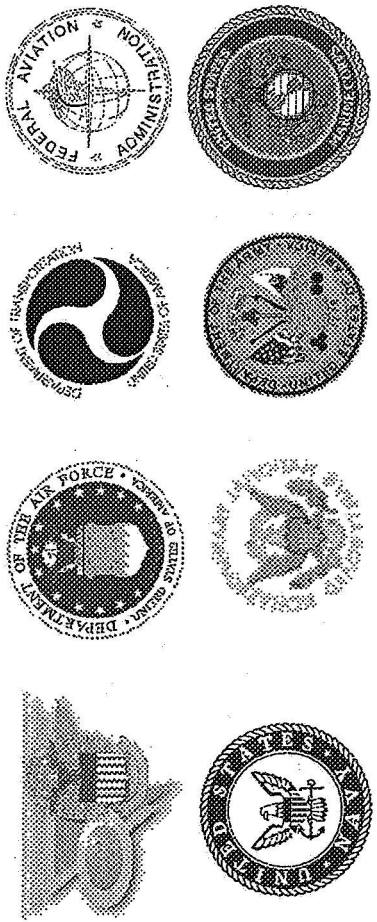


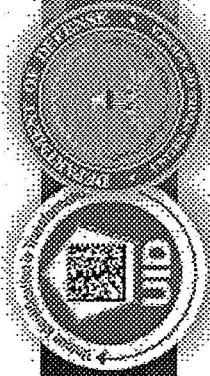
Configuration Management

TREAD ACI

Market

Competition



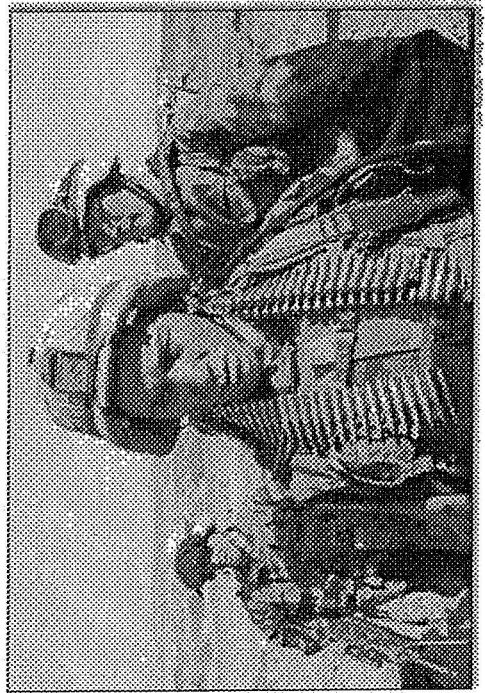
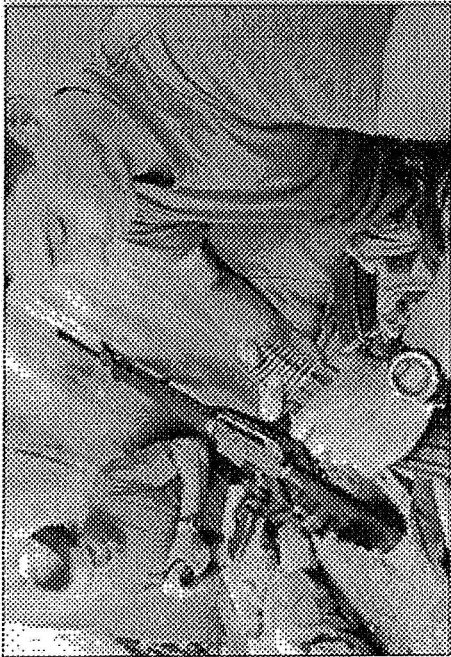
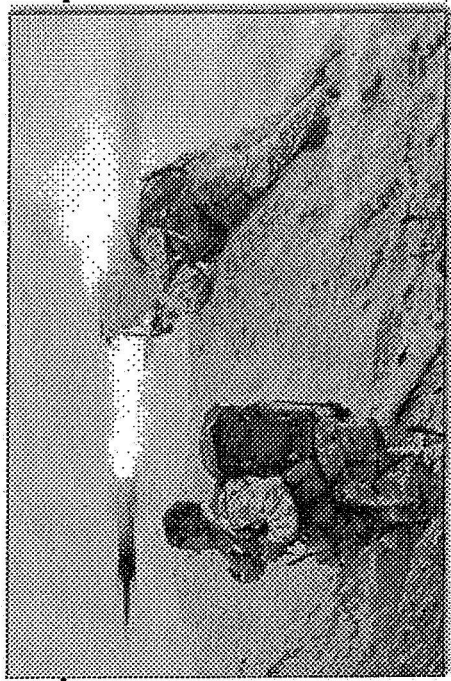


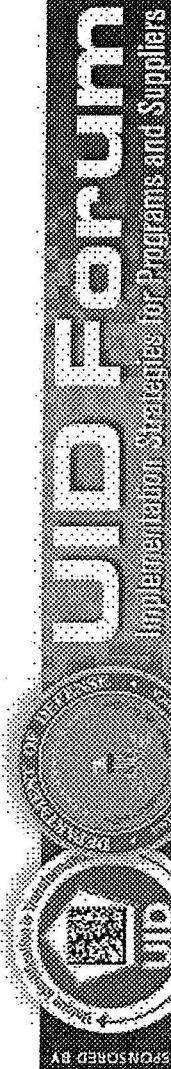
UIO Forum

Implementation Strategies for Programs and Suppliers

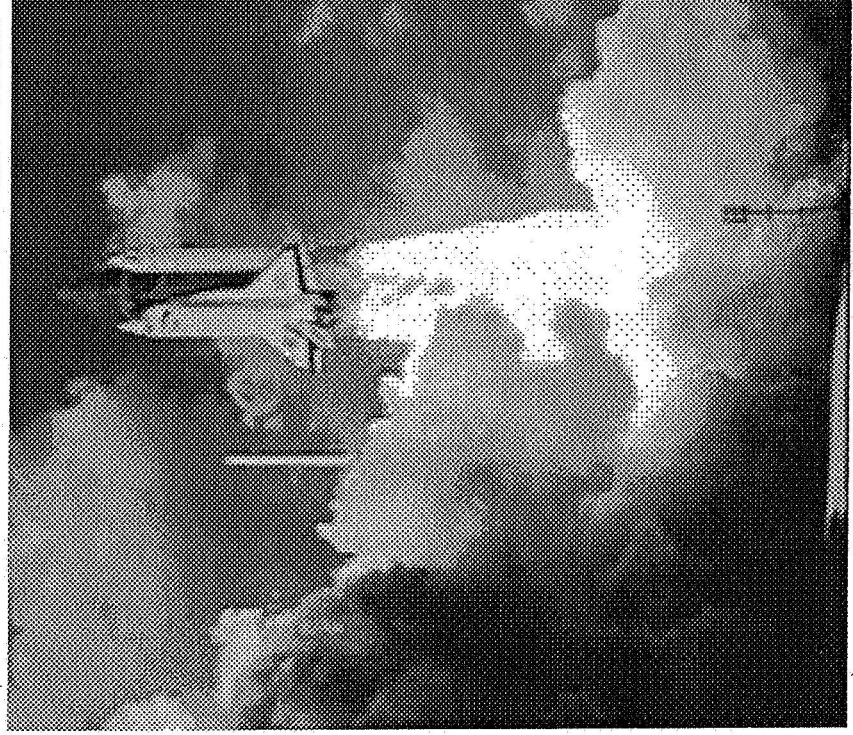
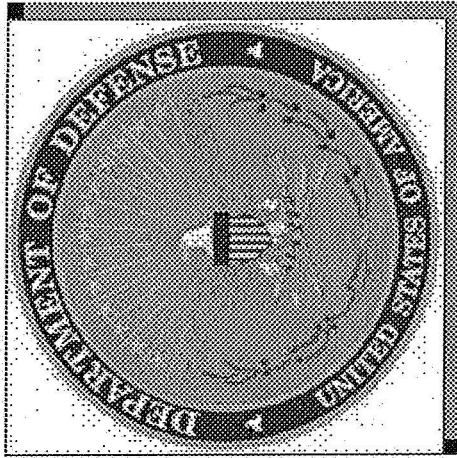
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UIO... Tracking for a Reason





Requirements to Track Products Start with Identification



*Part Numbers and Serial Numbers
Identify One Part From the Other*

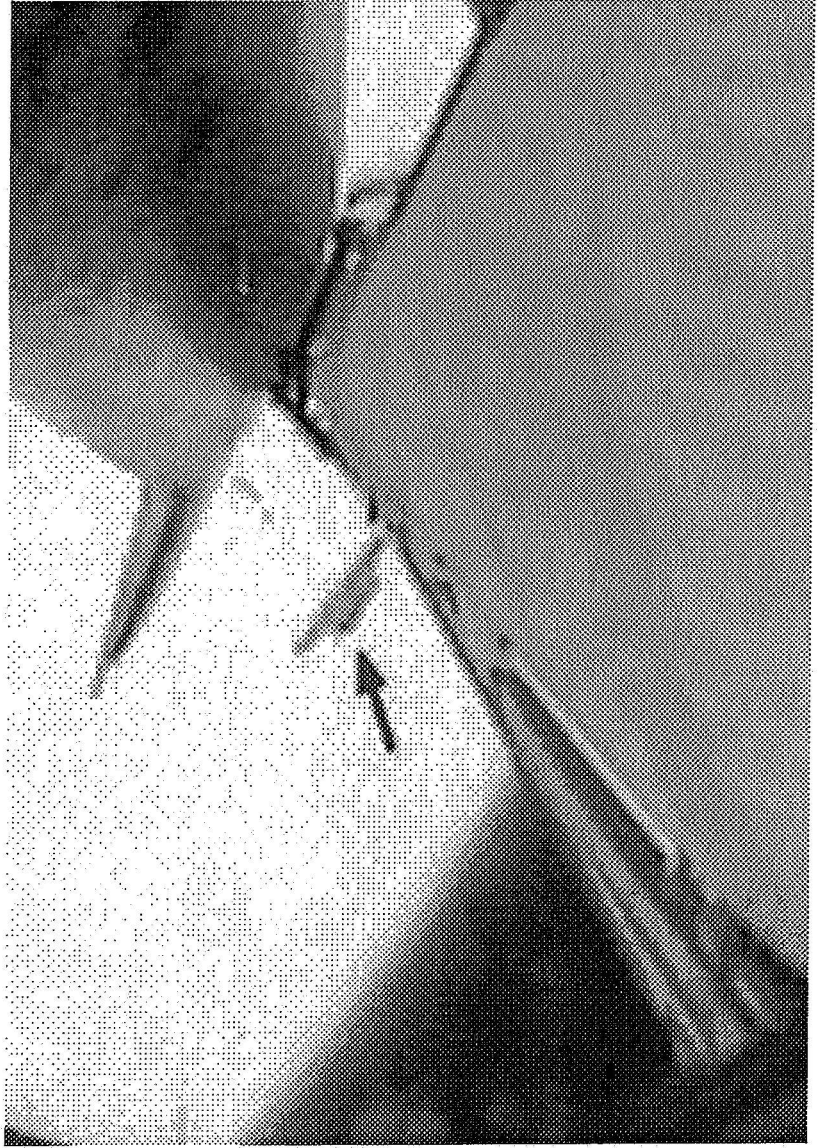
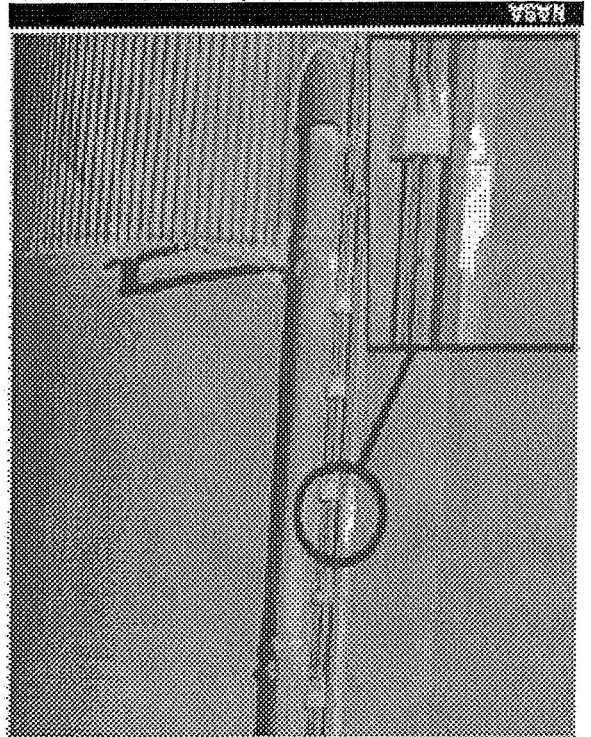
*CAGE Numbers Identify One
Supplier from the Other*

EXPLORE. DISCOVER. UNDERSTAND.

Not Everything Is a Part with a Number

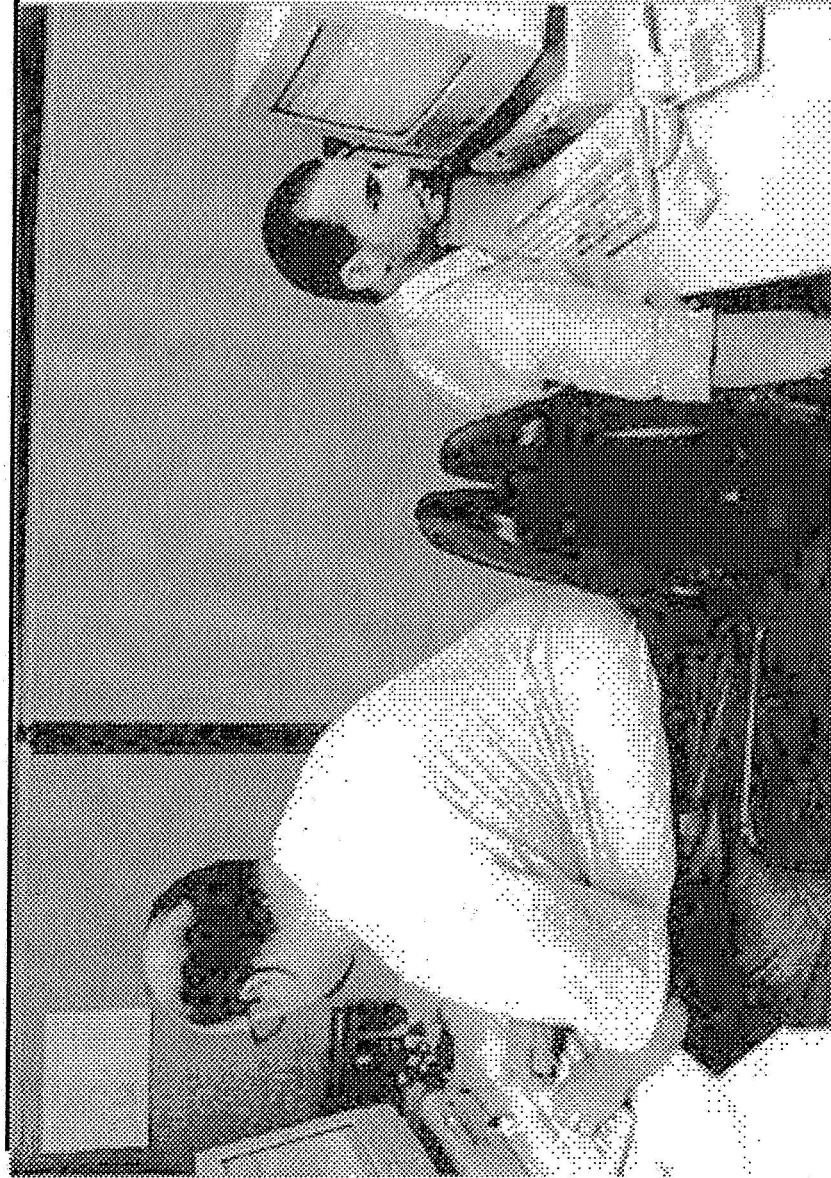
A Piece of External Tank Foam May Not Have A Part Number

But A Large Database Exists



EXPLORE. DISCOVER. UNDERSTAND.

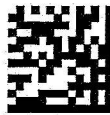
But For Parts with Part Numbers... Automatic Identification Choices



MIL STD 130... Certain Allowances for Parts That See the Easy Life

Bar Code Labels Are Cheap...and Work in Some Applications

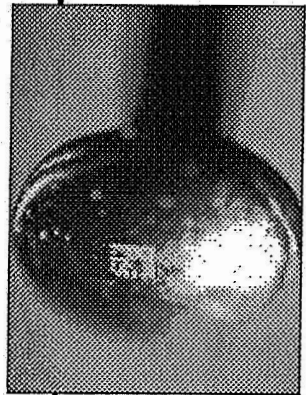
Tags and Nameplates Work in Some Applications



If space is limited or permanence required... Use 2D

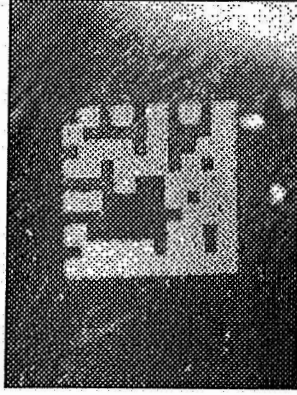
EXPLORE. DISCOVER. UNDERSTAND.

UID... Direct Part Marking



NASA's Primary Emphasis

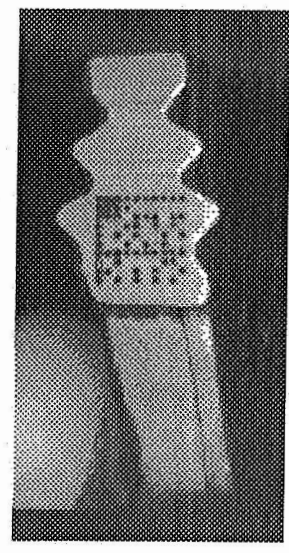
.....Item-Level Traceability
.....Track the Piece



Left: 10x10 matrix symbol
on the head of a straight pin

Know the Pedigree
.....Know who made it
.....Know who marked it
.....Know who stands behind it

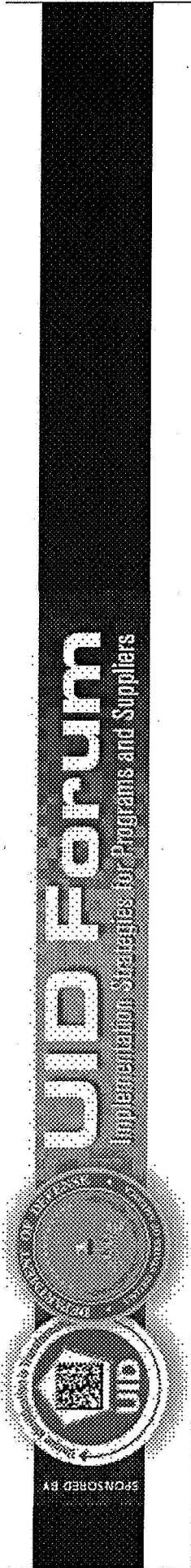
Below: 10x10 matrix symbol
on the side of a turbine blade



A properly engineered and applied mark is a:

FLAWLESS IMPERFECTION

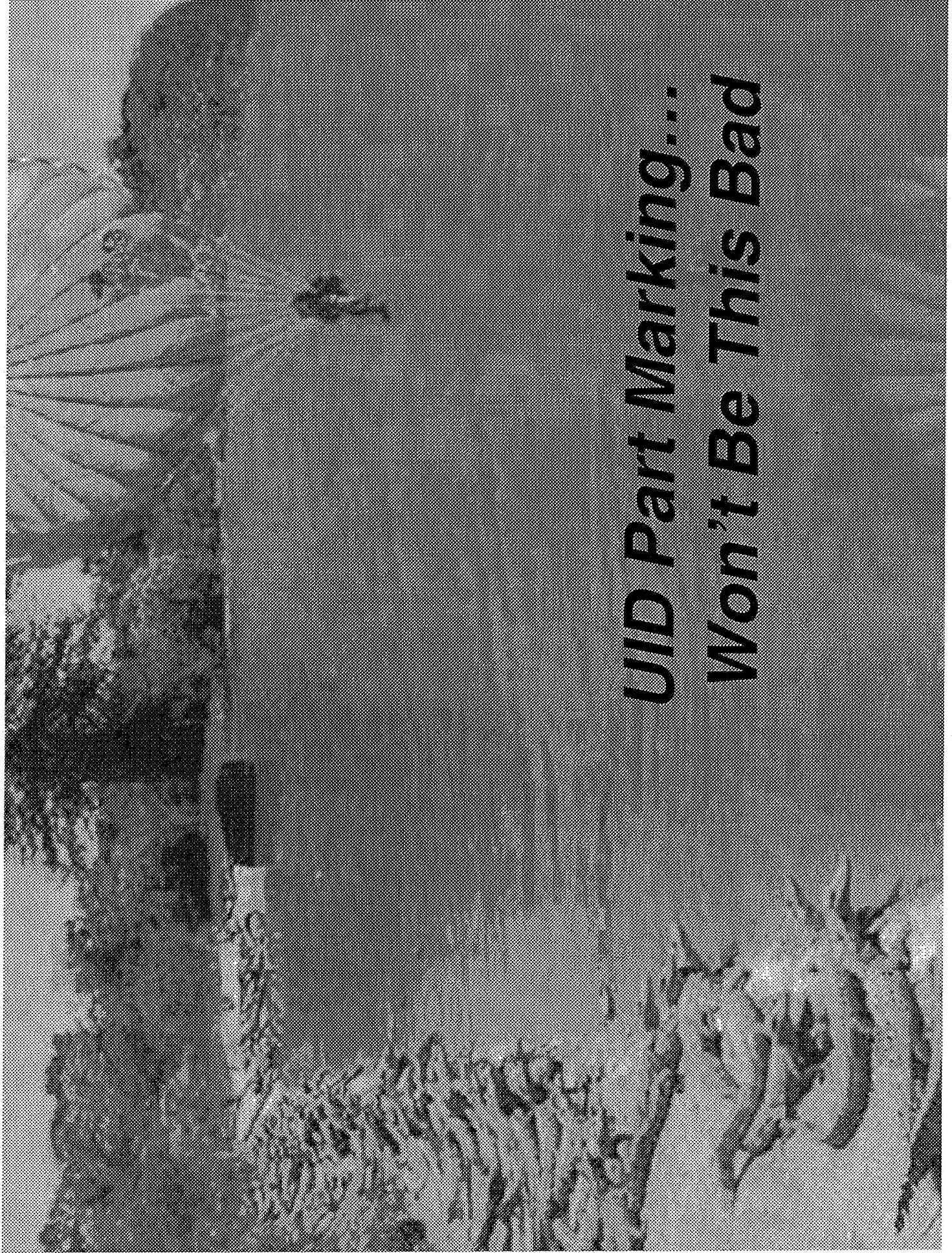
EXPLORE. DISCOVER. UNDERSTAND.

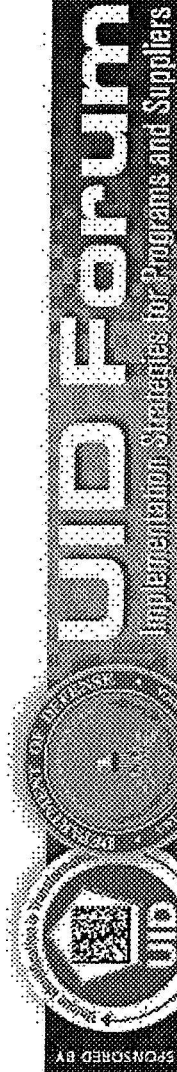


UID... Direct Part Marking and Reading

UID... EXPERT

***UID Part Marking...
Won't Be This Bad***





UID... There Are Some Direct Part Marking and Reading Problems

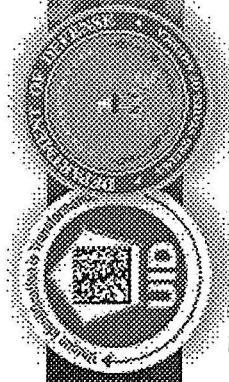
- **No Contrast Marks**
- **Curved, Shiny, Rough, Rusted Surfaces**
- **Parts Smaller Than the Mark**
- **Reads Needed at Distances**
- **Symbols Covered with Paint**
- **Items That Can Not Be Marked at All**

*None of Them Are As Hard As Breaking
the Sound Barrier*



*And You Do
That Every Day*

EXPLORE. DISCOVER. UNDERSTAND.



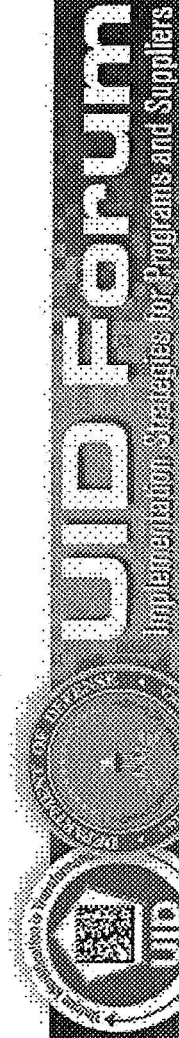
UID Forum

Implementation Strategies for Programs and Suppliers

UID... There Will Be Easy Things to Mark and Read



EXPLORE. DISCOVER. UNDERSTAND.

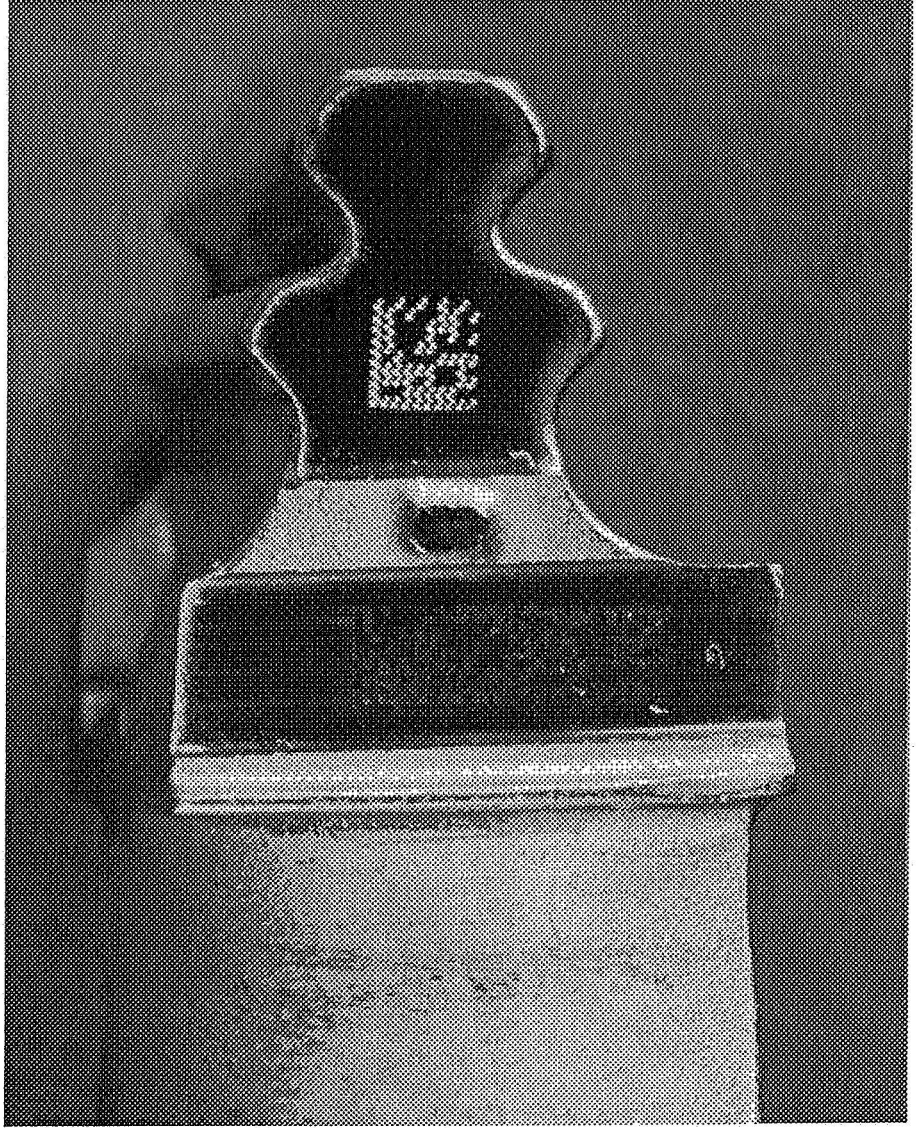


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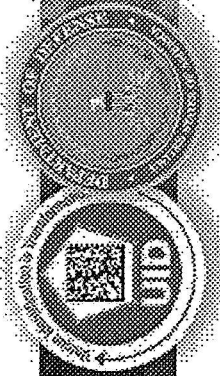
UID Forum

Implementation Strategies for Programs and Suppliers

UID... And Small Things to Mark and Read...and Stress Analyze



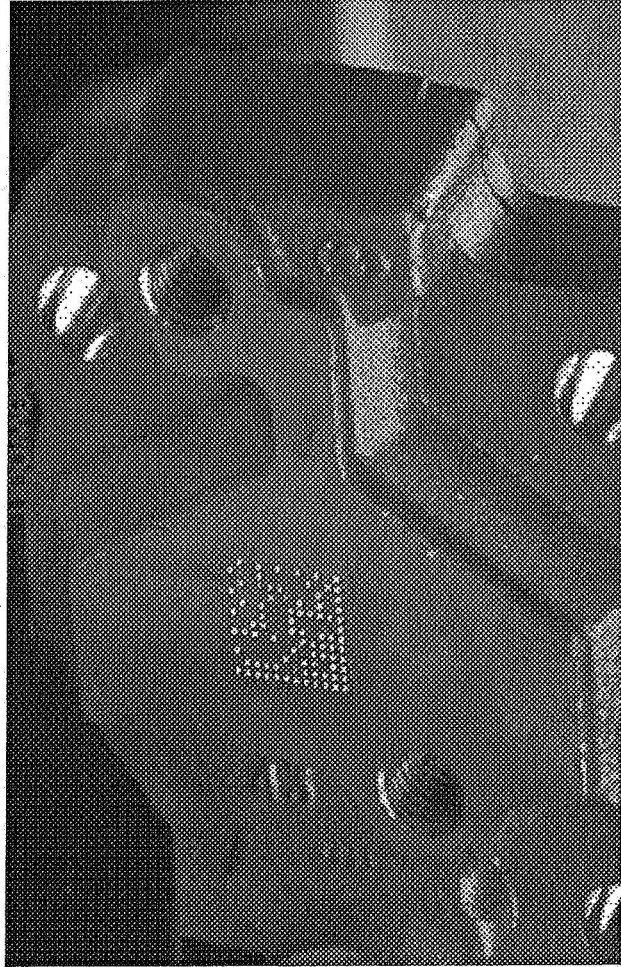
EXPLORE. DISCOVER. UNDERSTAND.



UID Forum

Implementation Strategies for Programs and Suppliers

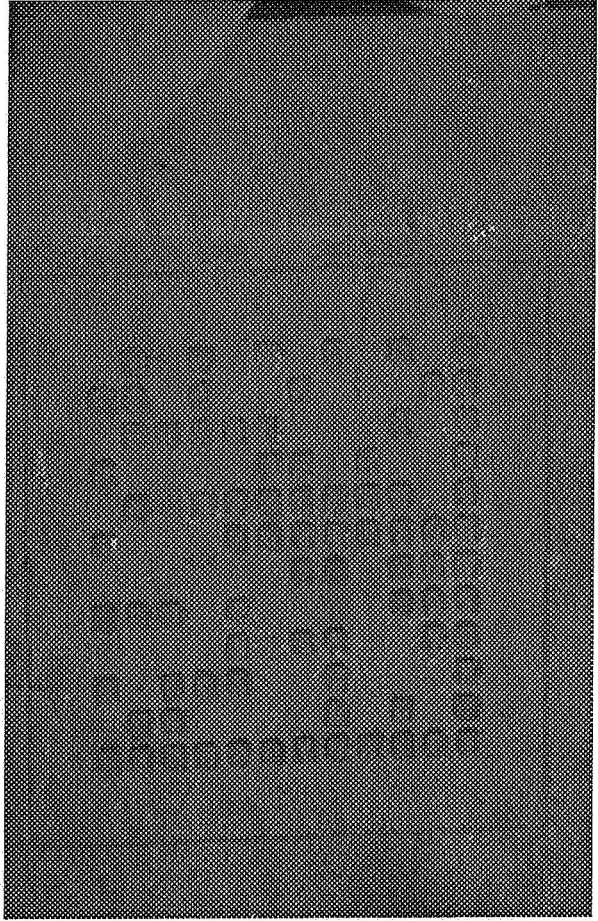
UID... There Will Be Hard Things to Mark and Read...and No Contrast After a While



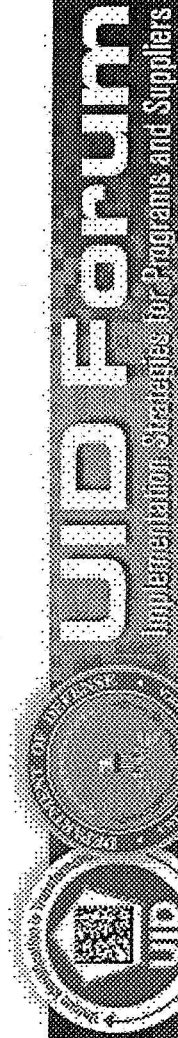
Engine Block with Dot Peen

Note: Both read at 27 inches with
NASA scanner

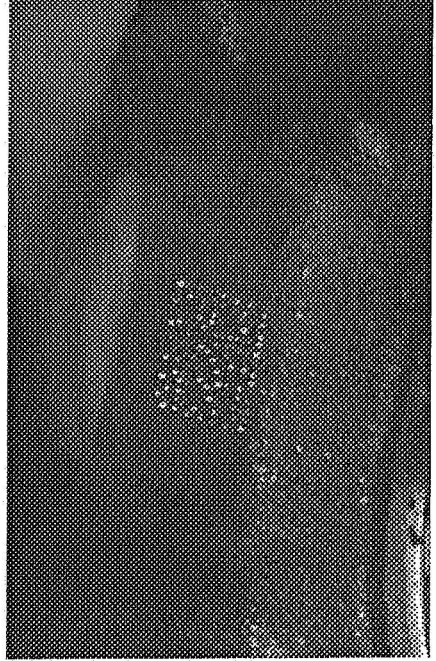
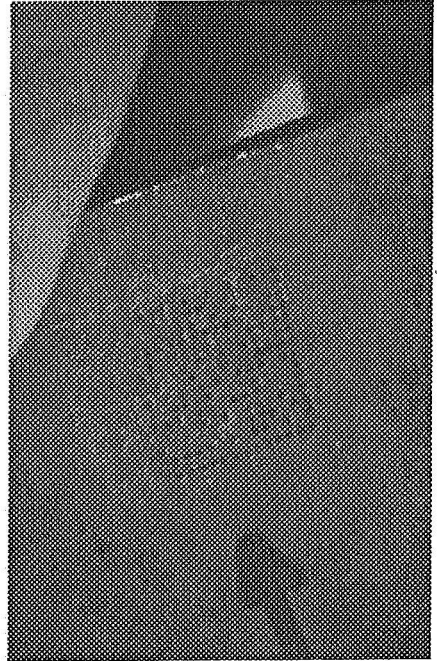
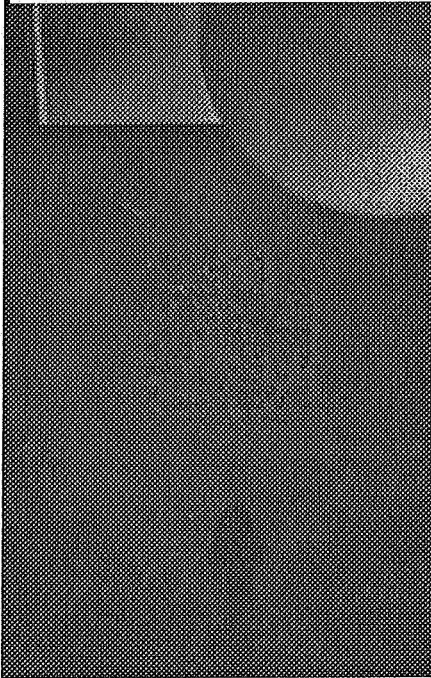
Engine Block with Raised Data Cells



EXPLORE. DISCOVER. UNDERSTAND.

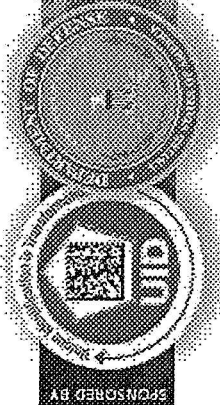


UID... Time and Weather Can Also Affect the Read



Note: All read at 17 inches with NASA scanner

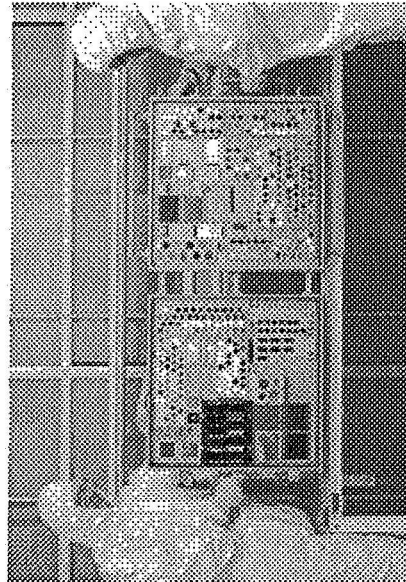
EXPLORE. DISCOVER. UNDERSTAND.



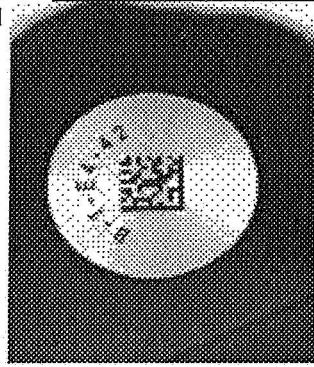
UIID Forum

Implementation Strategies for Programs and Suppliers

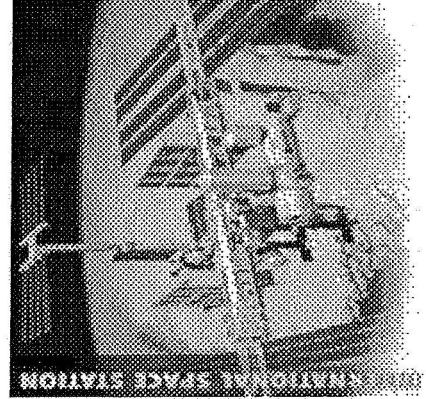
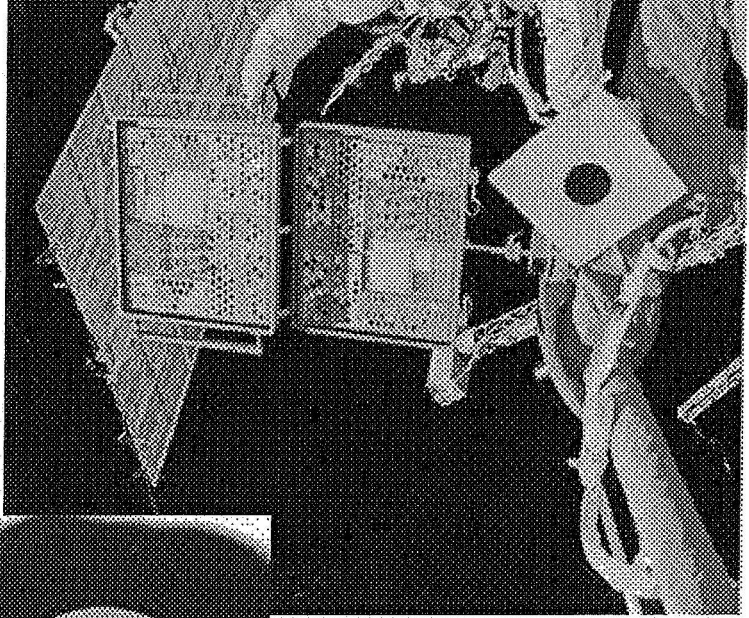
NASA Has Its Own Problems with Exposure to the Elements



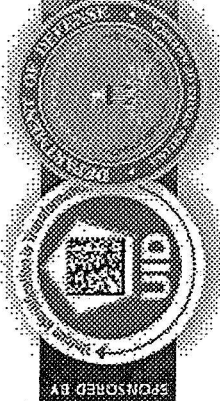
The Plan Was To Expose The Samples to Space For A Year...But



The Columbia Accident Extended The Exposure Period To 4 Years



EXPLORE. DISCOVER. UNDERSTAND.



WTD Forum

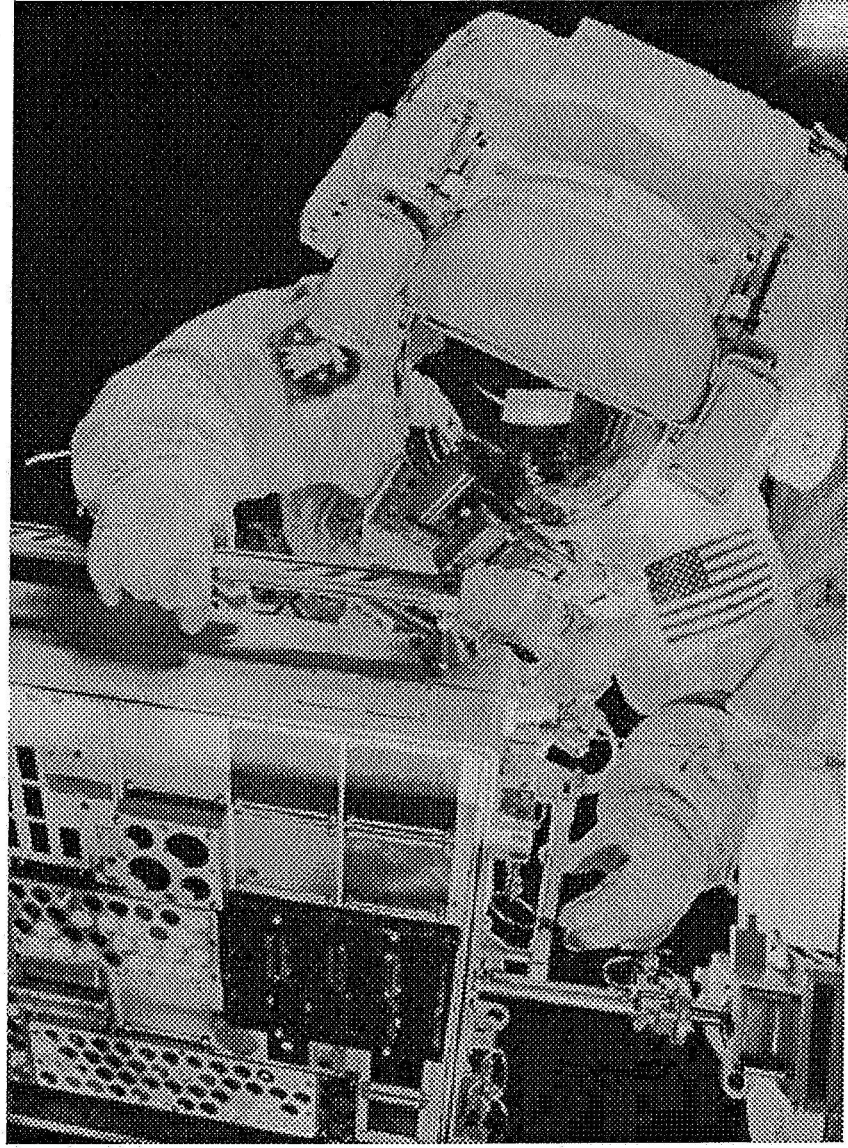
Implementation Strategies for Programs and Suppliers

NASA Has Its Own Problems with Exposure to the Elements

The Astronaut Was In The Vicinity and Retrieved The Experiment on First Flight.

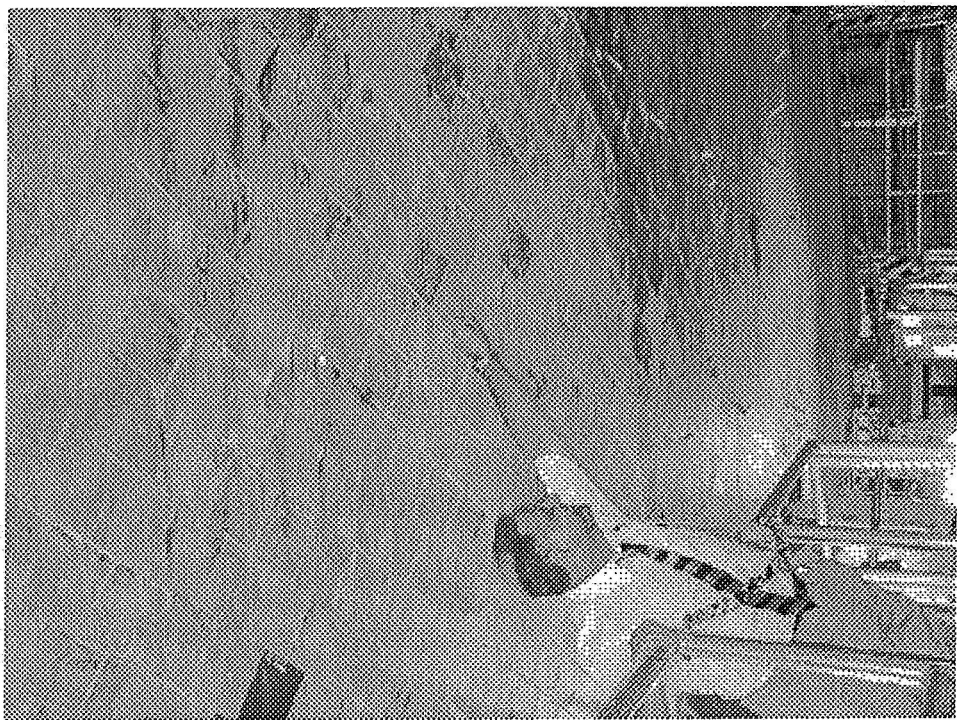
All Samples Looked Good As New Except Copper Coating Turned Green.

Micro Meteoroid Impacts Noted on One Sample



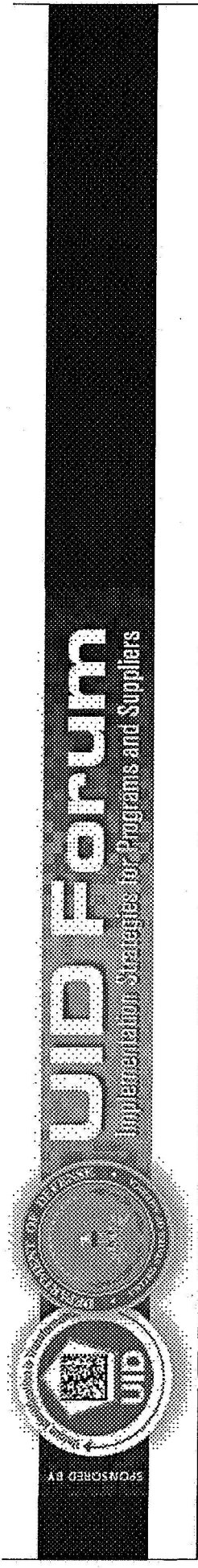
EXPLORE. DISCOVER. UNDERSTAND.

NASA Has Its Own Problems with Exposure to the Elements



**Thermal Protection System Tile
16 Times in Space on OV-103 (Discovery)....
Looked Good and Readable**

EXPLORE. DISCOVER. UNDERSTAND.

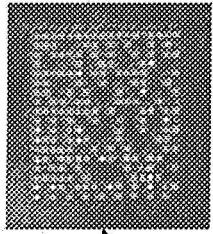
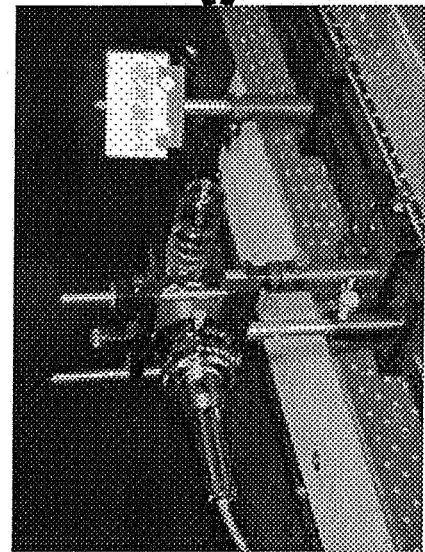


UID... There Are Some Direct Part Marking and Reading Problems

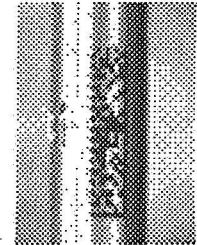
SOME CRAZY SOLUTIONS

One Reading Remedy... *New Pair of Glasses from Space Station*

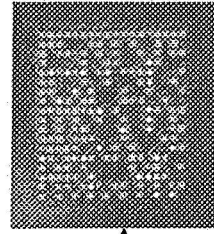
NASA Optical Scanner For Visible Marks



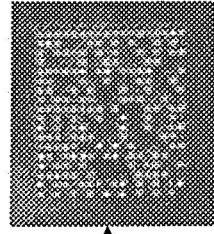
No contrast mark
 on smooth aluminum
 at 30 degree angle



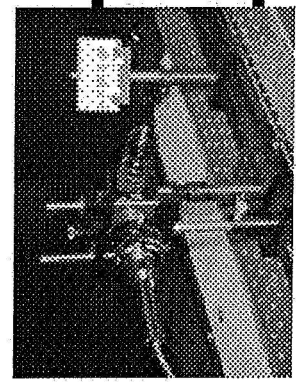
Shiny screwdriver



60'



20'



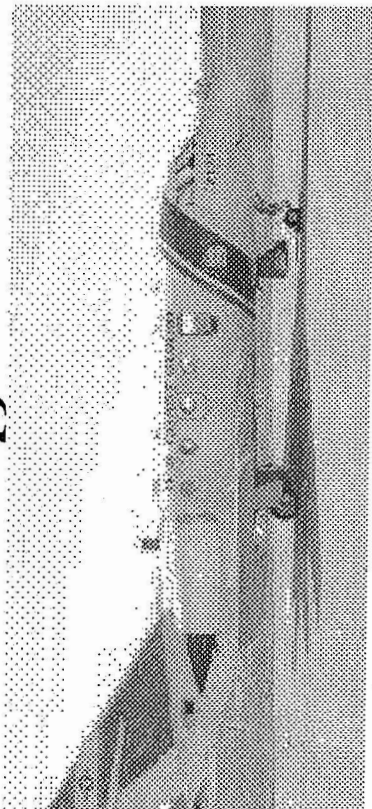
New Distance Capability Being Developed

EXPLORE. DISCOVER. UNDERSTAND.

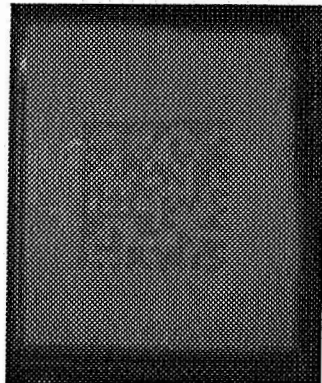
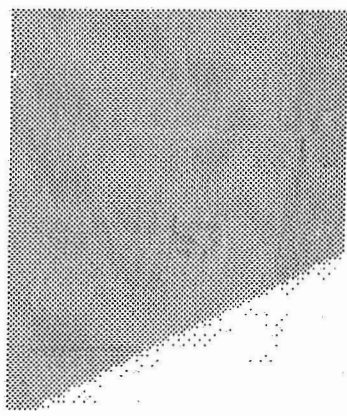
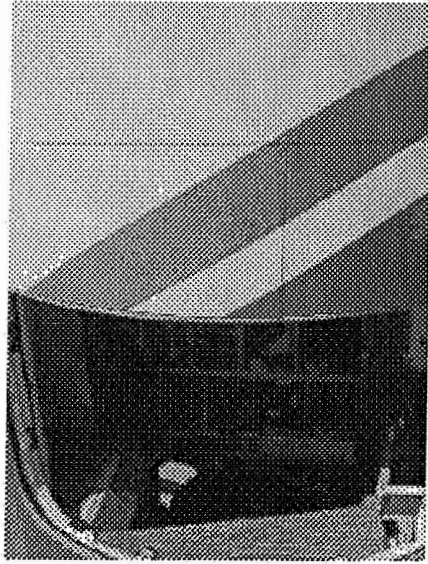
UID...Encounters the Painted Part

Magnetic

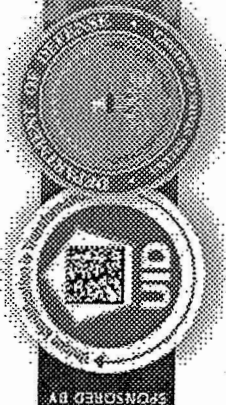
Mark Survived
8 Months of
Coast Guard Duty



Mark Decoded



EXPLORE. DISCOVER. UNDERSTAND.

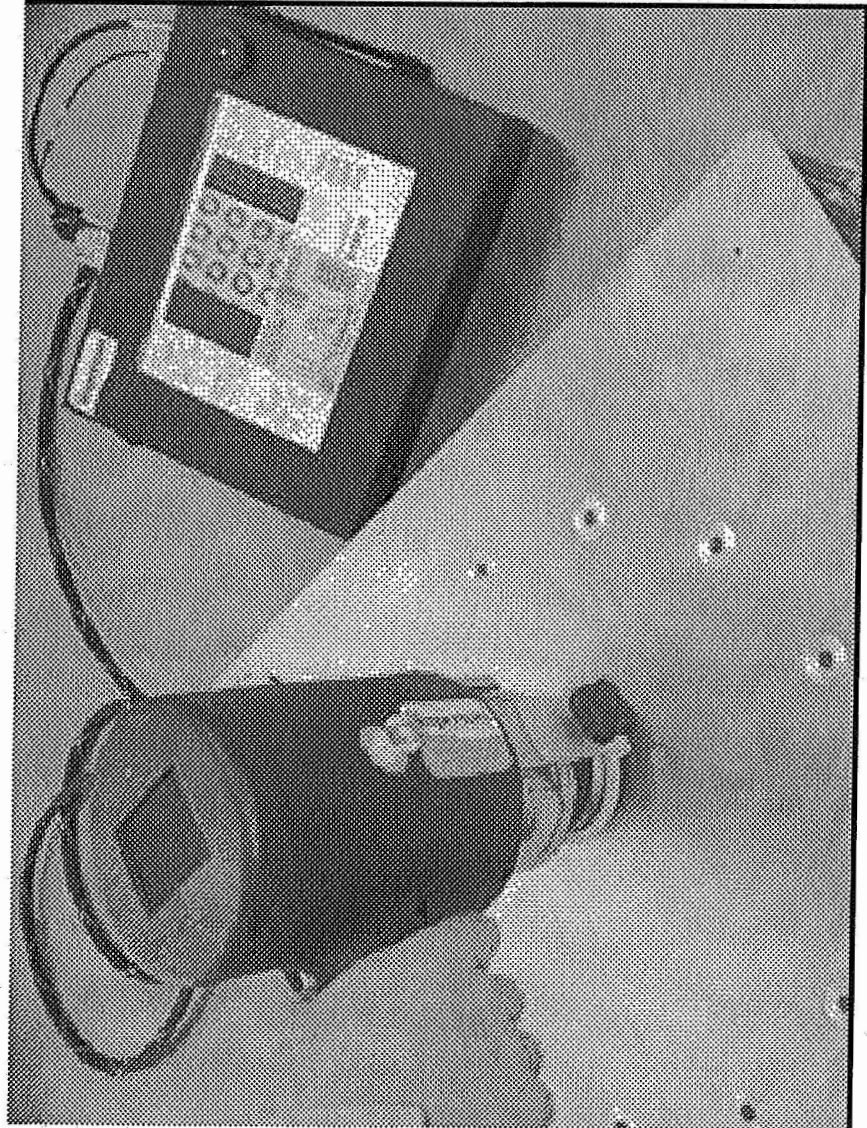


UID Forum

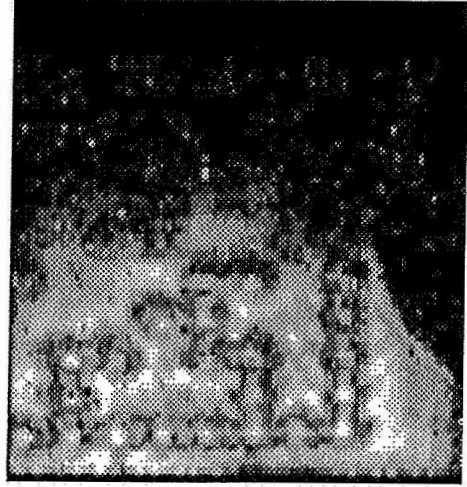
Implementation Strategies for Programs and Suppliers

UID...Encounters the Painted Part

Ultrasonic

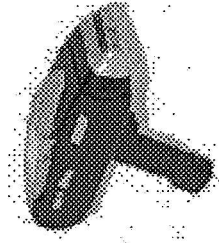
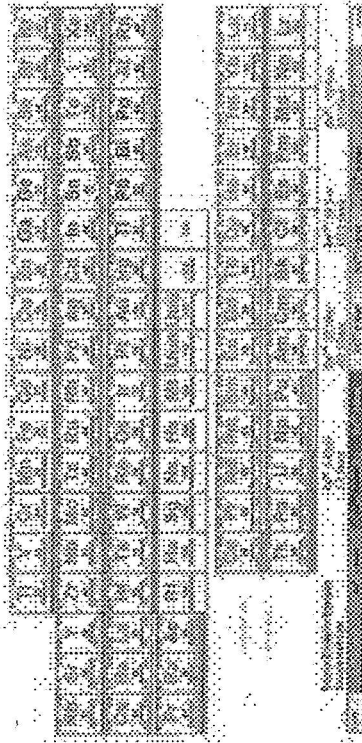


**Reads Through 6 Layers
of coatings
Detects density and
surface height changes**



EXPLORE. DISCOVER. UNDERSTAND.

UID...Encounters the Unmarkable Part Nanocodes



Conversion

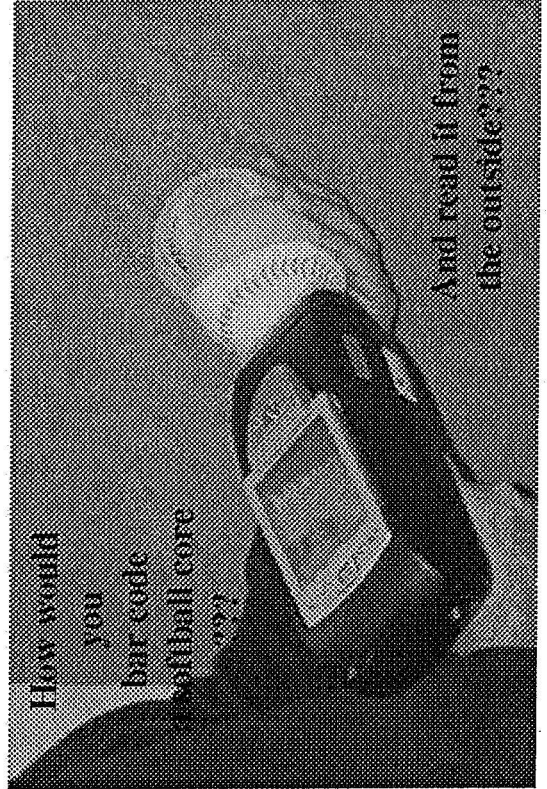
⇐

⇒

X-ray fluorescent
“chemical
bar code”

**Matches to the
Supplier Code**

Software converts
to ASCII
and symbol of choice



EXPLORE. DISCOVER. UNDERSTAND.

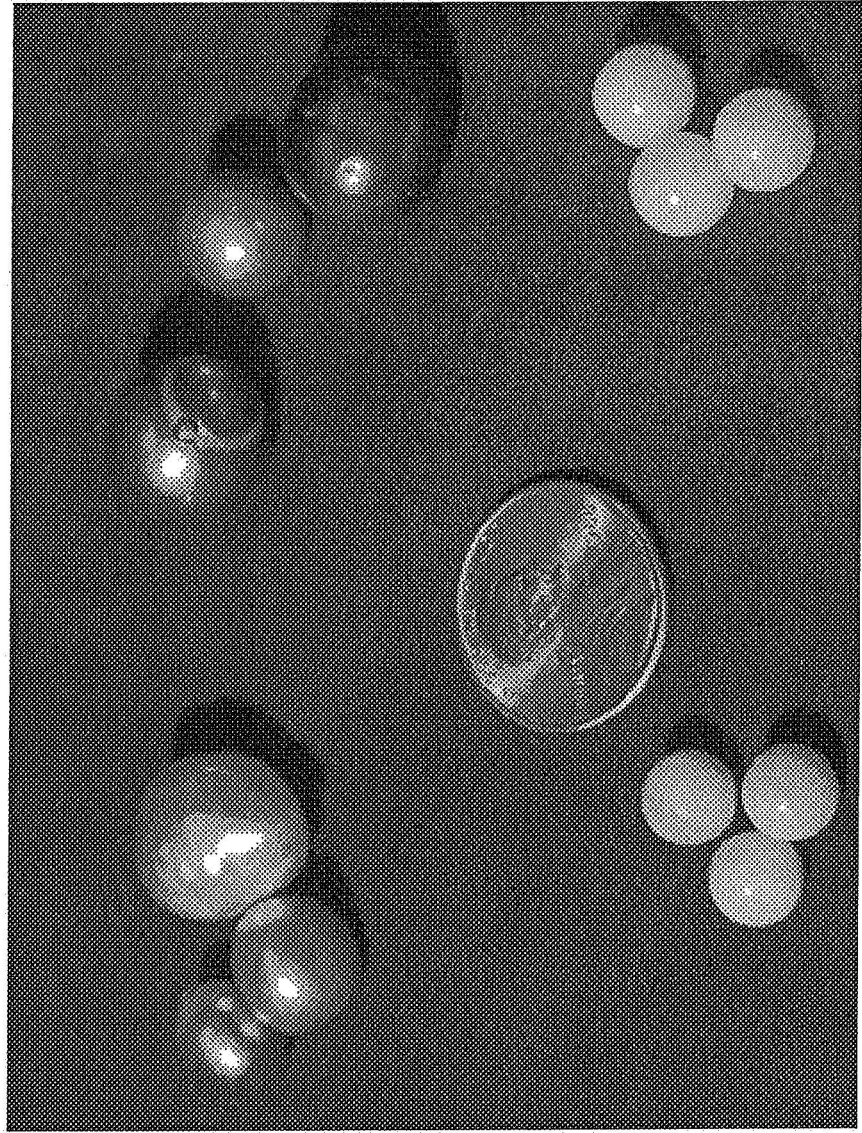
UID...Encounters the Unmarkable Part Nanocodes

*How would you
do it ???*

Bar code a cultured pearl...
on the seed...
without a surface change...
plant it in an oyster

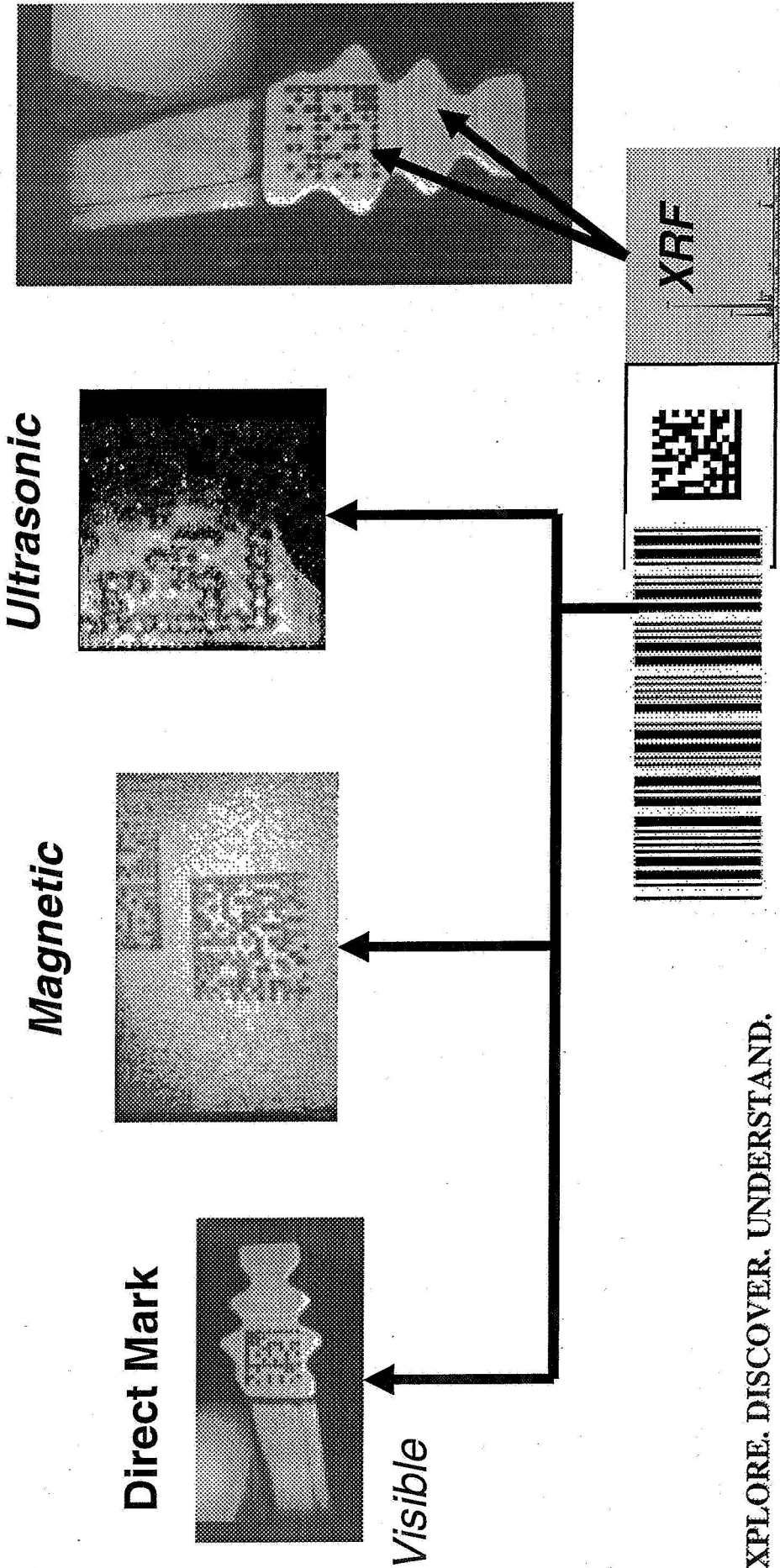
Then read the bar code
two years later when
the pearl is formed....

Conversion => 



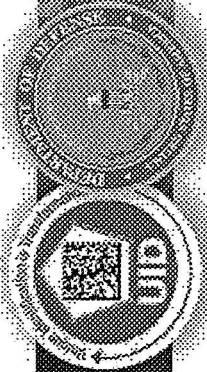
EXPLORE. DISCOVER. UNDERSTAND.

UID... Must Make All Identification Tools Work Together



EXPLORE. DISCOVER. UNDERSTAND.

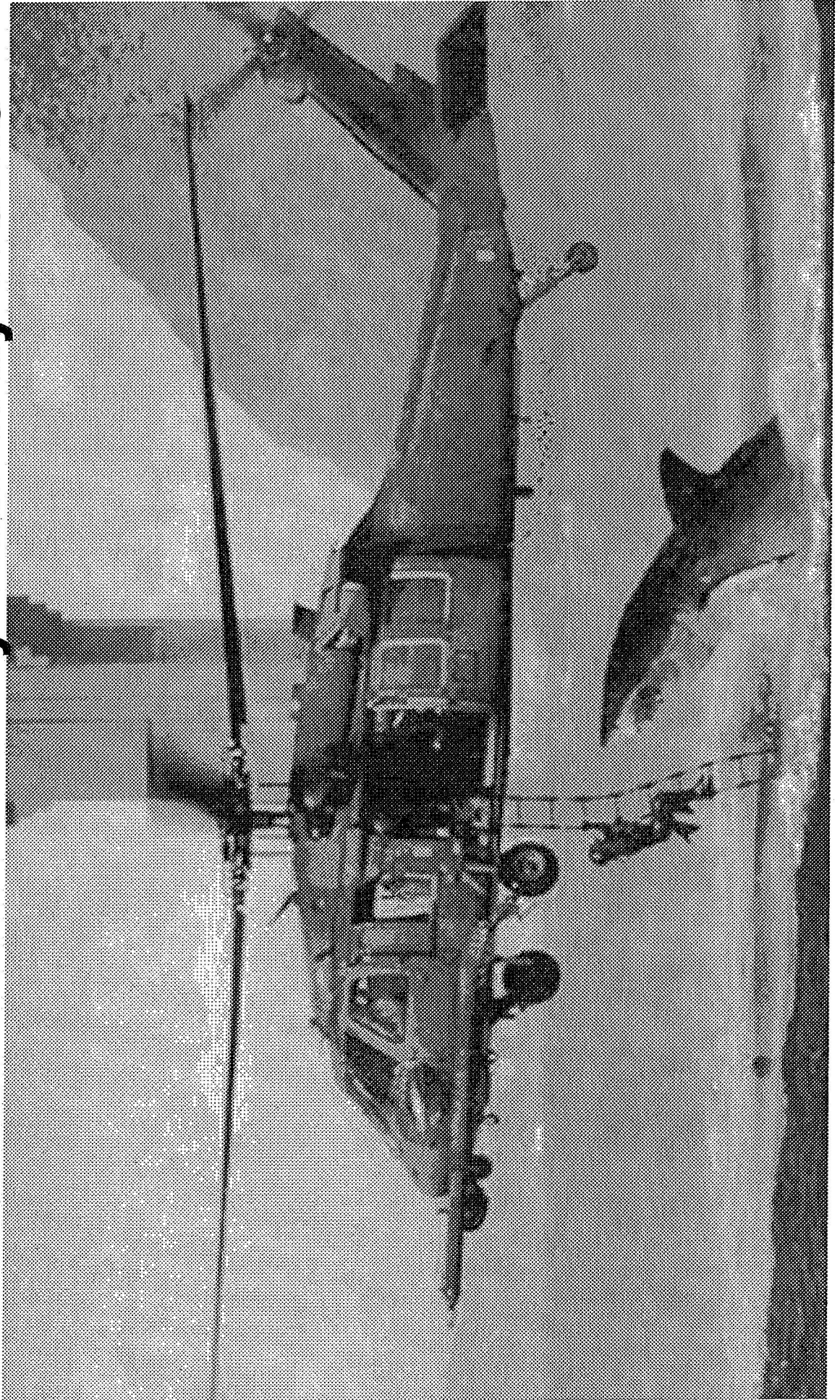
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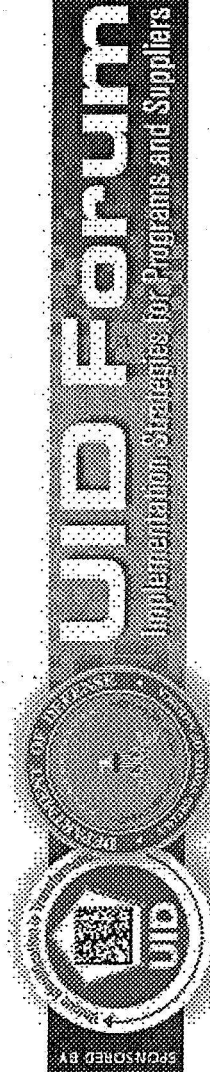


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Implementation Strategies for Programs and Suppliers

Part I D... You're Only Half Way Home



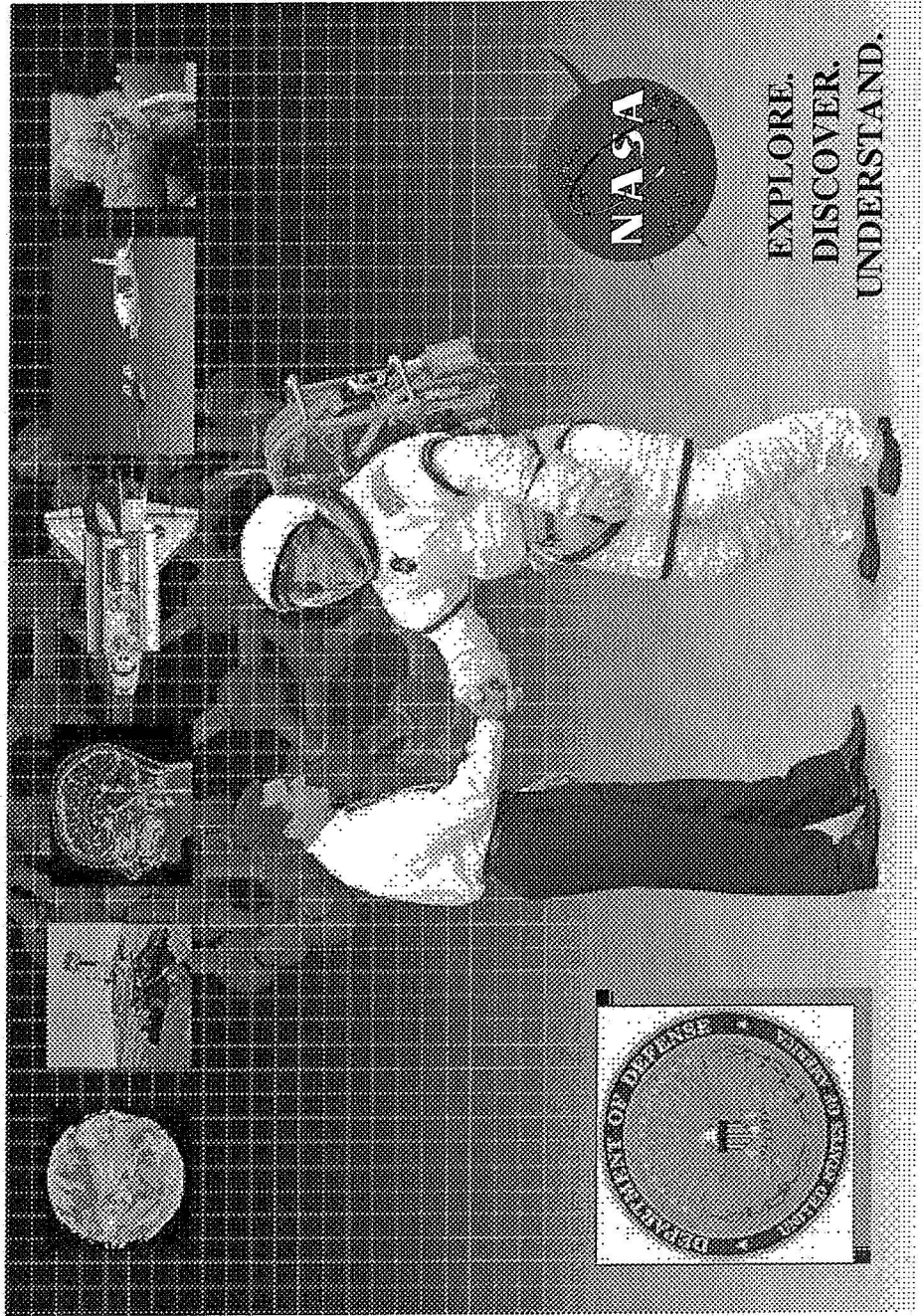


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UID Forum

Implementation Strategies for Programs and Suppliers

UID... Tracking Technologies Include Systems That Use Part Identification



*Government
and
Industry
Must
Work
Together
on the
Solution*

