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...Now That’s Gonna Leave A Mark

UID Forum...Providence, RI
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Fred Schramm
NASA Marshall Space Flight Center

EXPLORE, DISCOVER, UNDERSTAND.
IUID... Implementation Plan Development

Based on the following areas:

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

NEW NATIONAL ANIMAL ID SYSTEM WILL GUARD AGAINST MAD COW DISEASE AND ANIMAL HEALTH PROBLEMS
Different Organizations Track Products for Different Reasons

Configuration Management

Market Readiness UID

TREAD ACT
UID... 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
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

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

A properly engineered and applied mark is a:

**FLAWLESS IMPERFECTION**

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

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

EXPLORE. DISCOVER. UNDERSTAND.
UID... Direct Part Marking and Reading

What to Expect
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

EXPLORE. DISCOVER. UNDERSTAND.
None of Them Are As Hard As Breaking the Sound Barrier

And You Do That Every Day
UID... There Will Be Easy Things to Mark and Read

EXPLORE. DISCOVER. UNDERSTAND.
UID... And Small Things to Mark and Read...and Stress Analyze
UID... There Will Be Hard Things to Mark and Read...and No Contrast After a While

Engine Block with Raised Data Cells

Engine Block with Dot Peen

Note: Both read at 27 inches with NASA scanner
UID...Time and Weather Can Also Affect the Read

Note: All read at 17 inches with NASA scanner
NASA Has Its Own Problems with

Exposure to the Elements

The Columbia Accident Extended The Exposure Period To 4 Years

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

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...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

How would you bar code softball core ???

And read it from the outside ???

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....
UID... Must Make All Identification Tools Work Together
Part ID... You’re Only Half Way Home
UID... Tracking Technologies Include Systems That Use Part Identification

Government and Industry Must Work Together on the Solution