

# Item Unique Identification (IUID) Legacy Marking

IUID Center Representative  
NSWC Corona, IUID Center  
July 25, 2013

# Housekeeping

- Please mute your telephone (not on hold).
- Please use the chat box for questions which are critical to the understanding of the presentation
- Submit any question not requiring immediate attention to [CRNA-IUID\\_gateway@navy.mil](mailto:CRNA-IUID_gateway@navy.mil)
- Questions will be answered as time permits

# Overview

**Intro/Considerations**

**Policy Overview**

**Components of a Data Matrix**

**Additive/Intrusive Marks**

**Verification Overview**

**Application**

# The Very Basics



ECC200 Data Matrix Symbol

***The Department of Defense's (DoD) IUID requirements dictate an item's mark:***

1. Remains readable throughout the item's normal life cycle
2. Withstands all environmental conditions to which the item will be exposed under normal operating conditions
3. Provides no detrimental effects on the functional performance, reliability, or durability of the item

# Legacy Marking Considerations

Print



Verify



Scan



# Legacy Marking Considerations (Cont.)

Apply



Register



# Two Ways to Look at It

## IUID Legacy Marking

```
graph TD; A[IUID Legacy Marking] --- B[Policy]; A --- C[Technical];
```

### Policy

MIL-STD-130N w/ CH1

SECNAVINST 4440.34

### Technical

- Function
- Available marking area
- Material type
- Color
- Hardness
- Surface roughness/finish
- Surface thickness
- Operating environment

NOT MEASUREMENT  
SENSITIVE

MIL-STD-130N  
w/CHANGE 1  
16 November 2012

SUPERSEDING  
MIL-STD-130N  
17 December 2007

DEPARTMENT OF DEFENSE  
STANDARD PRACTICE  
IDENTIFICATION MARKING OF  
U.S. MILITARY PROPERTY



| AMSC 9251

AREA SESS

| DISTRIBUTION STATEMENT A. Approved for public release.

## 5. DETAILED REQUIREMENTS

### 5.1 General.

All requirements in Section 5 apply to the “item mark” as a single entity, which includes all data, HRI, and MRI related to a single PIN identity and configuration

### 5.2 Machine-readable information (MRI)

**marking.** MRI with HRI (translation or interpretation) shall be applied to items specifically designated for IUID by program managers or acquisition activities

#### 5.2.1.5 Assignment of IUID to legacy items.

...the Enterprise Identifier (EID) of the organization ensuring the uniqueness shall be the EID used to derive the UII versus any other EID represented in the prior marks.

**5.2.3.2 Two-dimensional Symbol.** The two-dimensional symbol shall be the Data Matrix ECC 200 in accordance with ISO/IEC 16022. Unless otherwise specified, the module size shall be no smaller than 0.0075 inch (0.19 mm) and no larger than 0.025 inch (0.635 mm). Square symbol sizes shall not exceed one inch (25.4 mm). The larger dimension of rectangular Data Matrix symbols, as permitted by ISO/IEC 16022, shall not exceed one inch.

#### 5.2.7.2. Data Matrix symbol quality.

The following acceptance criteria for all marking procedures can be used at the supplier’s choice:

- a. ISO/IEC 15415
- b. AIM DPM-1-2006 or ISO/IEC TR 29158
- c. SAE AS9132

When IUID is required.

16 November 2012

Do not use the MFR CAGE unless they are assigning the UII.

There are rules to follow about the size of the mark.

There are quality assurance requirements (verification).

When you have to do it.

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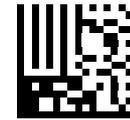
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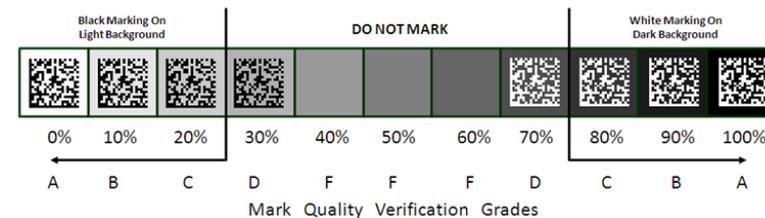
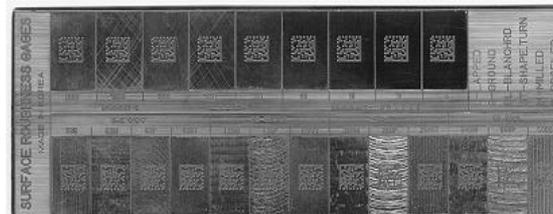
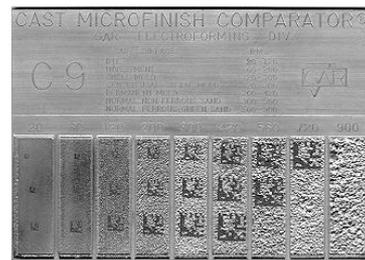
- a. ISO/IEC 15415
- b. AIM DPM-1-2006 or ISO/IEC TR 29158
- c. SAE AS9132

# The Department of the Navy IUID Marking Manual

- The DON Marking Guide has been revised (September 2011 Version 1.1)
- Brings together many established resources pertinent to marking IUID symbols on legacy items
  - Major Automatic Identification and Data Capture (AI/DC) manufacturers
  - Government and aerospace user groups under a collaborative agreement with National Aeronautics and Space Administration (NASA) and the United States Coast Guard (USCG)
  - DoD and DON Policies
  - ISO and MIL standards
- The body of the document is 7 pages long
- Its 17 appendices are 33 pages long

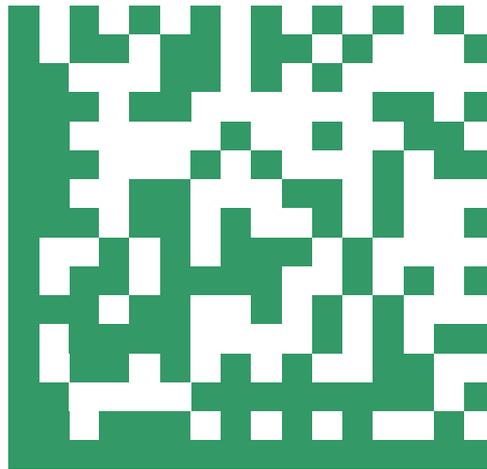


Average Roughness Level (millionths of an inch)	Minimum Cell Size (inches)
20 (0.000508 mm)	0.0075 (0.19 mm)*
60 (0.001524 mm)	0.0091 (0.23 mm)
120 (0.003048 mm)	0.0150 (0.38 mm)
200 (0.005080 mm)	0.0201 (0.51 mm)
300 (0.007620 mm)	0.0252 (0.64 mm)
420 (0.010668 mm)	0.0299 (0.76 mm)

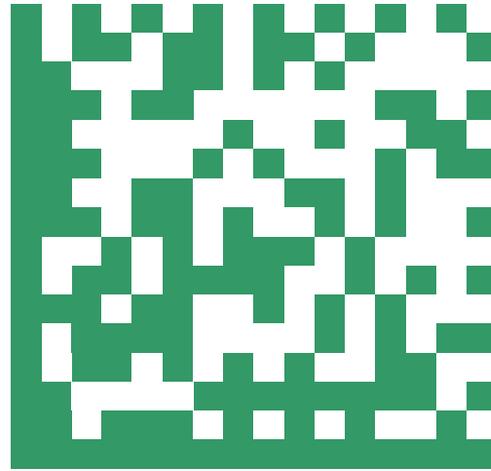


\* 0.0075 inches approaches the limits of many readers regardless of surface roughness.

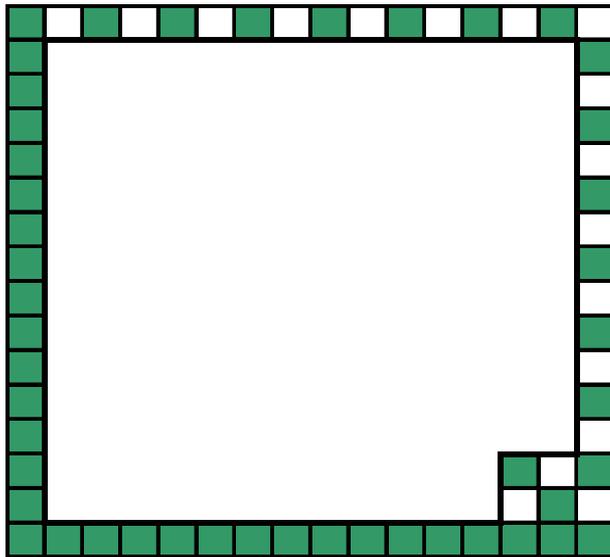
# 2D Data Matrix Barcodes



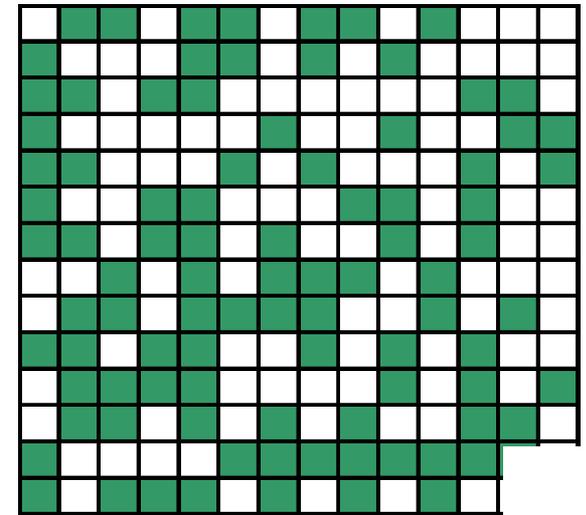
# 2D Data Matrix Barcodes



Fixed pattern



Data



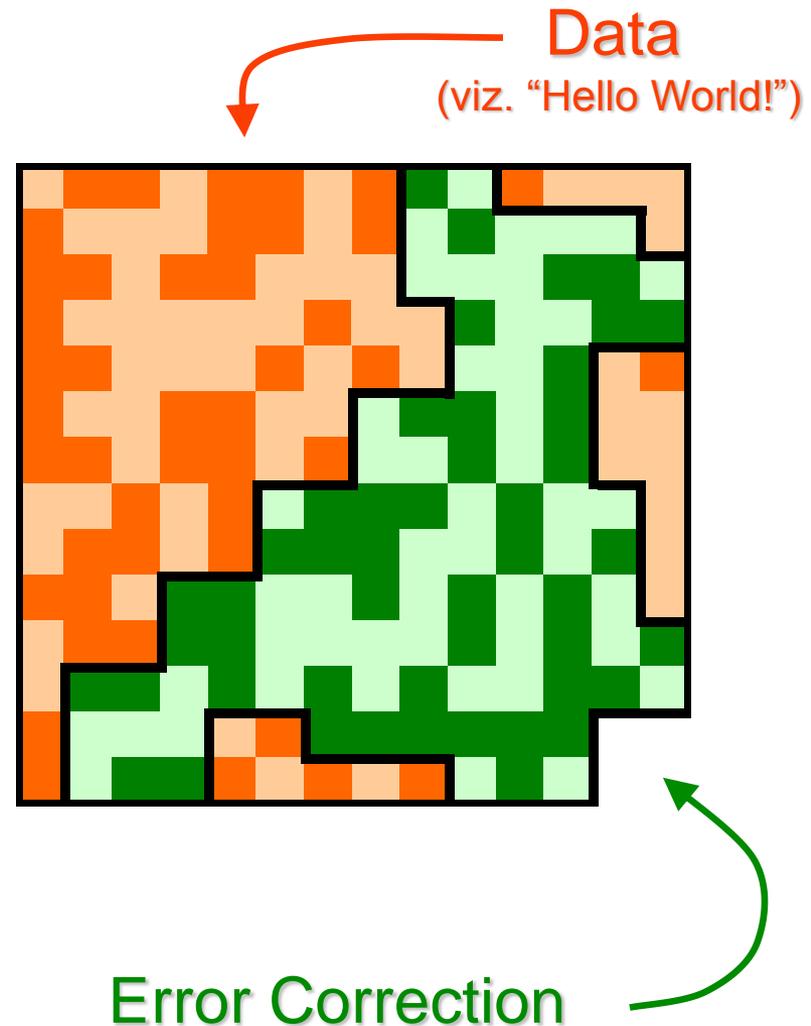
To read the barcode a scanner will overlay a grid on the image of the symbol and extract the fixed pattern and then the data.

# 2D Data Matrix Barcodes

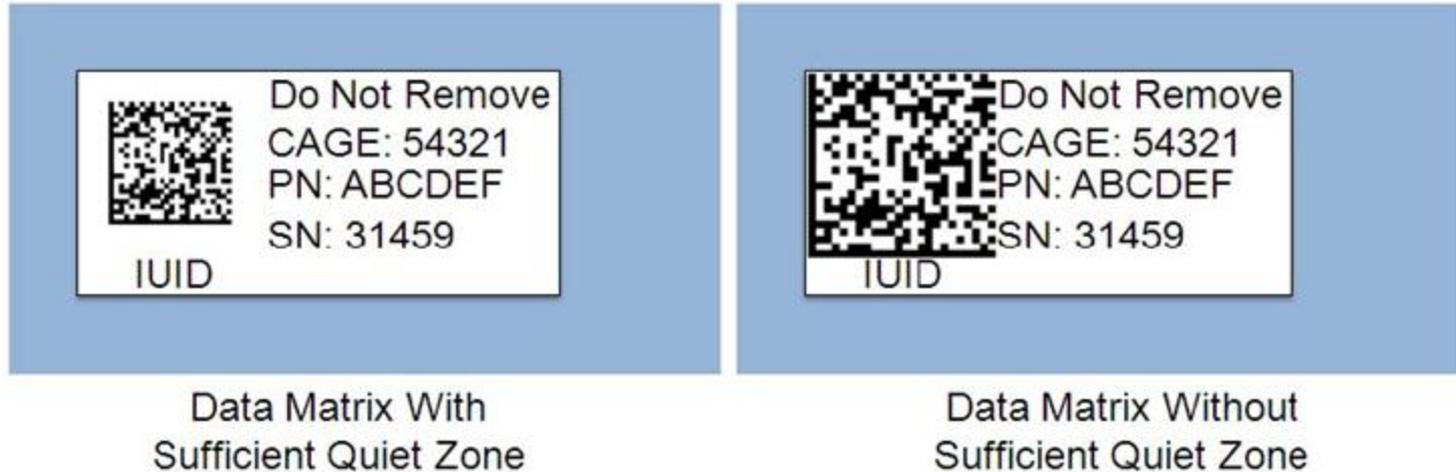
The upper-left-hand corner actually contains most of the data. The lower-right-hand corner carries error correction.

The error correction allows damaged marks to be read and for all of the encoded data to be recovered.

In theory, about 50% of the mark can be damaged. In practice, about 30% of the mark can be damaged.

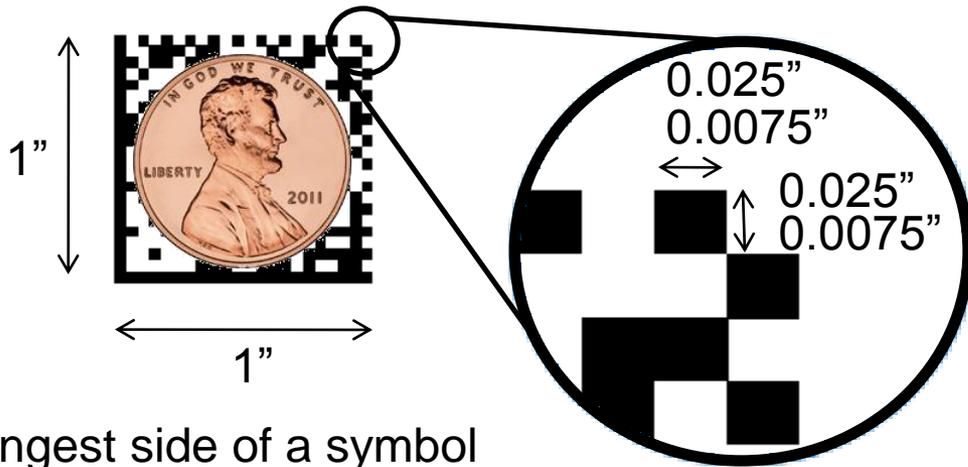


# Quiet Zones are Important to Barcodes



- A clear space (quiet zone) must be left around the outside of the symbol in order for the scanner to successfully decode the data matrix.
- A minimum of one cell width of quiet zone must be left around the symbol.
- However, due to variations in surface finish, it is helpful to extend this area. If possible, allow an additional 10% of the longest symbol side.

# What's a Module? & How small are we talking?



The longest side of a symbol shall not exceed one inch.

The module size shall be no larger than 0.025 inch.

The module size shall be no smaller than 0.0075 inch.

Per MIL-STD-130N/Ch1



Smallest IUID compliant data matrix possible would be 0.011 in<sup>2</sup> (0.105" per side)

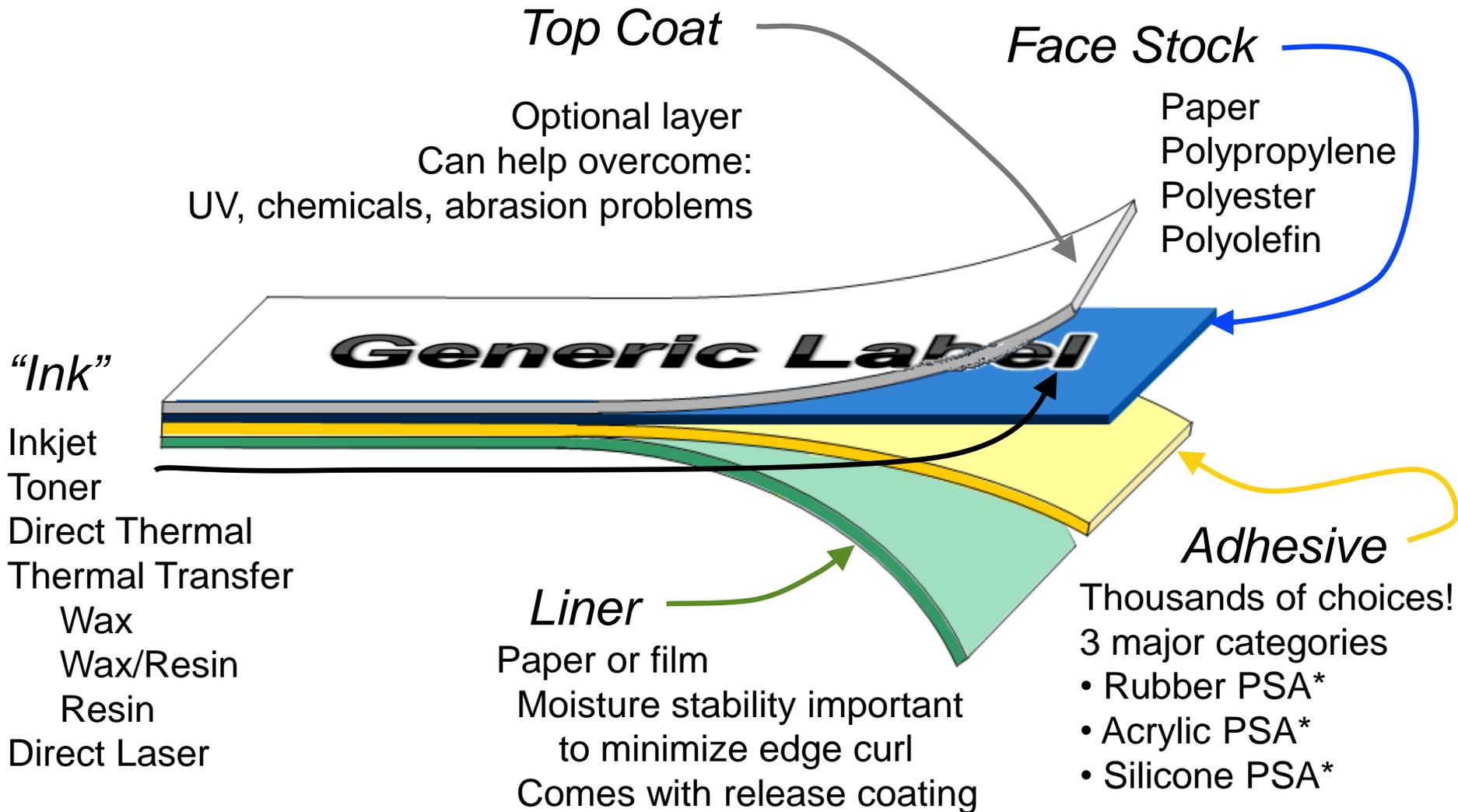
*40 x 40 data matrix using 0.025" modules → 1" matrix with a 170 character limit*

*132 x 132 data matrix using 0.0075" modules → 0.99" matrix with a 1,954 character limit*

# Environmental Conditions

Mild Environments	Moderate Environments	Harsh Environments
<p>General office conditions where there are moderate temperatures and minor exposure to non-abrasive cleaning chemicals. Examples include office furniture, calculators, computers, reproduction machines, and so forth.</p>	<p>Indoor or general outdoor use. Parts are exposed to some chemicals and abrasives, moderate cleaning and exposure to outdoor environments in temperate regions. Examples are in-plant fixed assets, embedded parts, internal air, sea or ground vehicle components (less engines), and so forth.</p>	<p>Harsh indoor/outdoor conditions; long-term exposure to salt air, caustics; extreme temperature variations; exposure to chemicals, including petroleum products; frequent cleaning and exposure to autoclaves, chemicals, or abrasives. Examples are external aircraft components, engine parts other than internal combustion engine components, refinery equipment, work-in-process manufacturing, and tools</p>
<p>Minimum suggested cell size 0.008-inch required for successful reading.</p>	<p>Minimum suggested cell size 0.010 inch (0.254 mm).</p>	<p>Minimum suggested cell size 0.020 inch (0.508 mm) or larger.</p>
<p>Minor damage can render a mark unreadable.</p>	<p>Error correction can reconstruct symbol.</p>	<p>Less error correction needed.</p>
		

# The World of Labels



\* PSA is short for Pressure Sensitive Adhesive

# Label Strengths & Weaknesses

## Labels...

- + Are the cheapest option
- + Work for a majority of situations
- + Produce high contrast marks
- + Have low impact when “goofed up”
- + Can show quick progress toward compliance
- + Are printed apart from hardware
- Are destroyed by temperature extremes
- Can fall off/be removed
- Can be soft (durability problems)
- Are additive (mass, volume, out-gasses)
- Can be vulnerable to certain chemicals & UV light

# Adhesives

## **Rubber Adhesives**

Adhesives made from natural or synthetic rubbers which are made tacky by mixing them with various compounds.

- High Initial Strength (**Good Thumb Appeal**)

- Economical

### **Performance Characteristics Include:**

- Adequate for short term, non-critical applications
- Limited chemical, temperature and Ultra Violet light resistance

## **Acrylic Adhesives**

A combination of acrylic monomers and other compounds.

- Permanent bonding applications
- Have a high initial bond and adhere well to most surfaces
- Lower initial adhesion than their rubber counterparts

### **Performance Characteristics Include:**

- Excellent aging characteristics
- Outstanding chemical and ultra violet light resistance
- Higher temperature stability than rubber adhesives
- Good for long term, durable applications!

## **Silicone Adhesives**

Polymers with an inorganic backbone and organic side groups

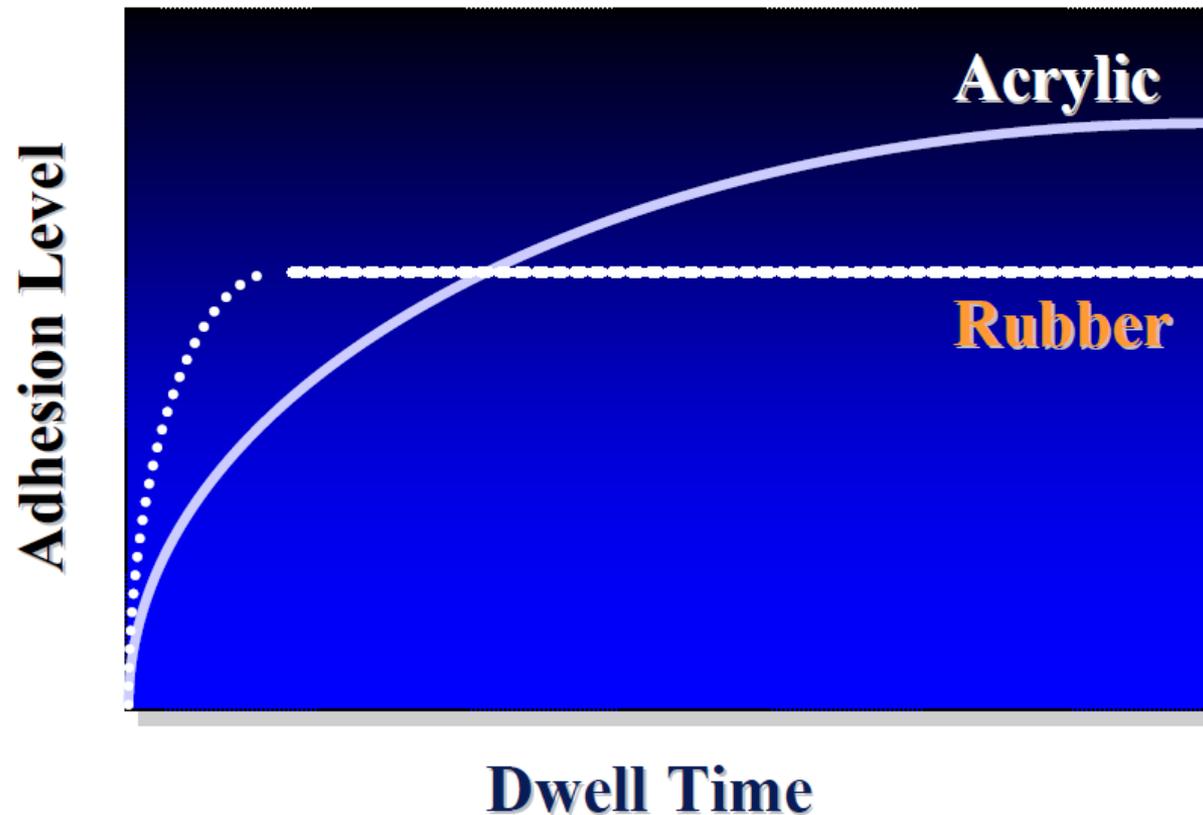
- Bond to silicone-coated and other LSE surfaces
- Widest temperature range
- High cost

### **Performance Characteristics Include:**

- Suitable for long term, critical applications
- Higher temperature resistance, service range 30°F to 500°F
- Resistance to chemicals, moisture and UV
- Clean removability to some substrates
- Out-gassing can obscure electro-optics

# The Tortoise & the Hare

The bond strength of Acrylic adhesives builds over time...



# Direct Part Marking

## ***Typical intrusive marking methods include:***

Abrasive blast

Direct laser marking using short wavelength lasers

Dot peening (stamp impression)

Electrochemical etching (electrolytic surface coloring or metal removal processes)

Engraving

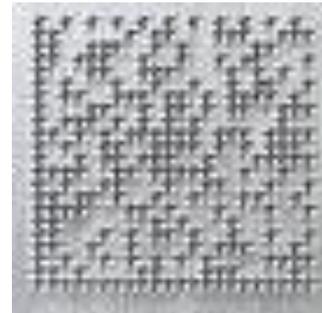
Fabric embroidery

Laser shot peening

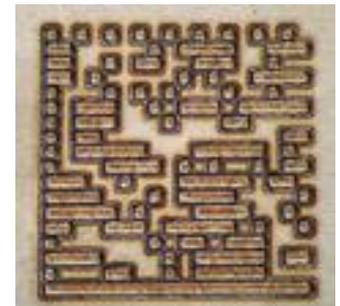
Milling



***Cast***



***Dot Peen***



***Laser Etch***

# Intrusive Marks Require Engineering Analysis



Source: NAVAIR Material Engineering Report 460664MER1 of Oct 2010

# Non-Recurring Engineering

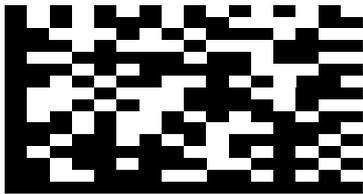
## **SECNAVINST 4440.34 of 22 December 2009 Section 5f:**

Engineering change requests and drawing revisions shall not be required when affixing labels with IUID markings to legacy equipment if it does not impact form, fit or function and if the following conditions are met:

- (1) The existing label is completely removed.
  - (a) The new label with IUID compliant data matrix is placed in the same location as the replaced label.
  - (b) The new label with IUID compliant data matrix has the same dimensions as the replaced label.
  - (c) The new label material and method of marking is the same as the replaced label or an improved and qualified media replacement. The IUID compliant data matrix must be permanent, per MIL-STD-130N with Ch 1 of 16 Nov 2012.
  - (d) The new label is affixed on the item in the same manner as the replaced label.
  - (e) The information on the replacement label may be resized or repositioned anywhere on the label to accommodate [the] IUID compliant data matrix.
- (2) A replacement label is not required if sufficient space exists to place the IUID compliant data matrix or label to the right, left, up or down with respect to the existing label.
- (3) A replacement label is not required if room exists on the current label to add an IUID compliant data matrix.
- (4) When otherwise determined by the appropriate Technical Authority (TA) of the respective organization.

# Verification

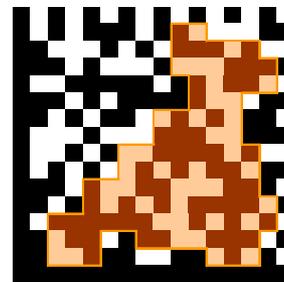
Verification grades (“A”–“F”) eight characteristics of the mark  
Grades of “B” or higher are required to pass the mark



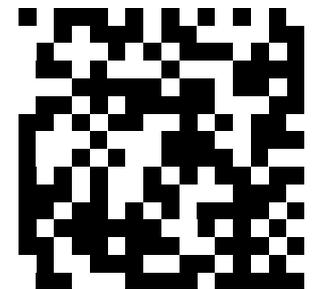
Axial  
Non-uniformity



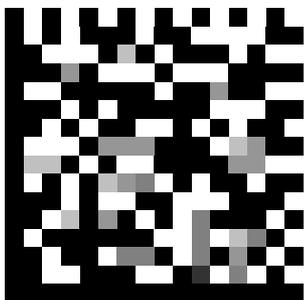
Grid  
Non-uniformity



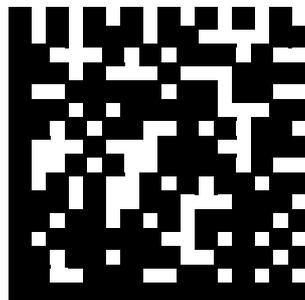
Unused  
Error Correction



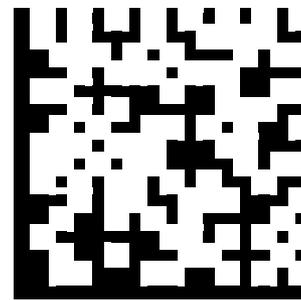
Fixed Pattern  
Damage



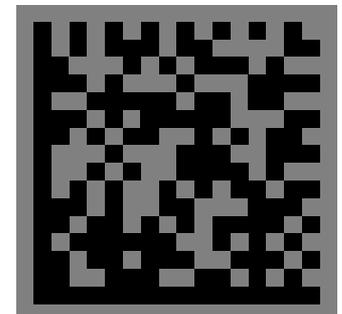
Modulation



Over-print



Under-print



Contrast

# A Readable, Failing Mark



UNDER PRINT

OVER PRINT

FIXED PATTERN  
DAMAGE

FIXED PATTERN  
DAMAGE

# A Verification Sampling Plan

<b>Lot Size</b>	<b>Sample Size to Test</b>	<b>Max. Defects to Accept Lot</b>
1-25	21	1
26-50	41	3
51-100	54	4
101-150	75	6
151-200	78	6
201-300	89	7
301-500	101	8
501-600	112	9
601-800	113	9
801-1000	114	9
1000-5000	125	10

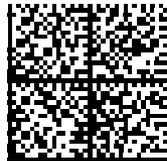
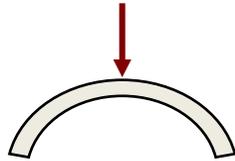
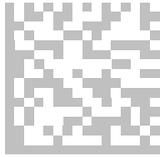
## For example

If 100 labels were printed, 54 of them would be randomly verified. If more than 4 barcodes failed verification, the quality of the lot would be rejected and all 100 barcodes would be verified, discarding those that failed verification.

# Readability of the Mark

Expensive Readers

Hard to Read



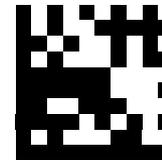
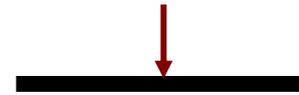
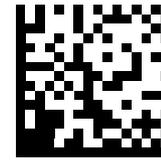
Contrast

Shape

Cell Size

Reflectance

Easy to Read



Cheap Readers

# Application Is Critical



- **Time**

- Allow at least 72 hours before testing the ultimate adhesion strength. This gives the adhesive time to *flow*, effectively covering your substrates.



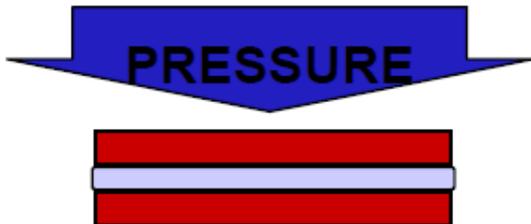
- **Temperature**

- Applying your adhesive at room temperature is always best. Slightly higher temperatures can actually improve adhesive flow, speeding up the the bonding process. At cold temperatures, select an adhesive made for application in cold temps.



- **Pressure**

- Applying adequate pressure will accelerate the adhesive flow and eliminate trapped air. This will ensure higher adhesive coverage of the substrate.



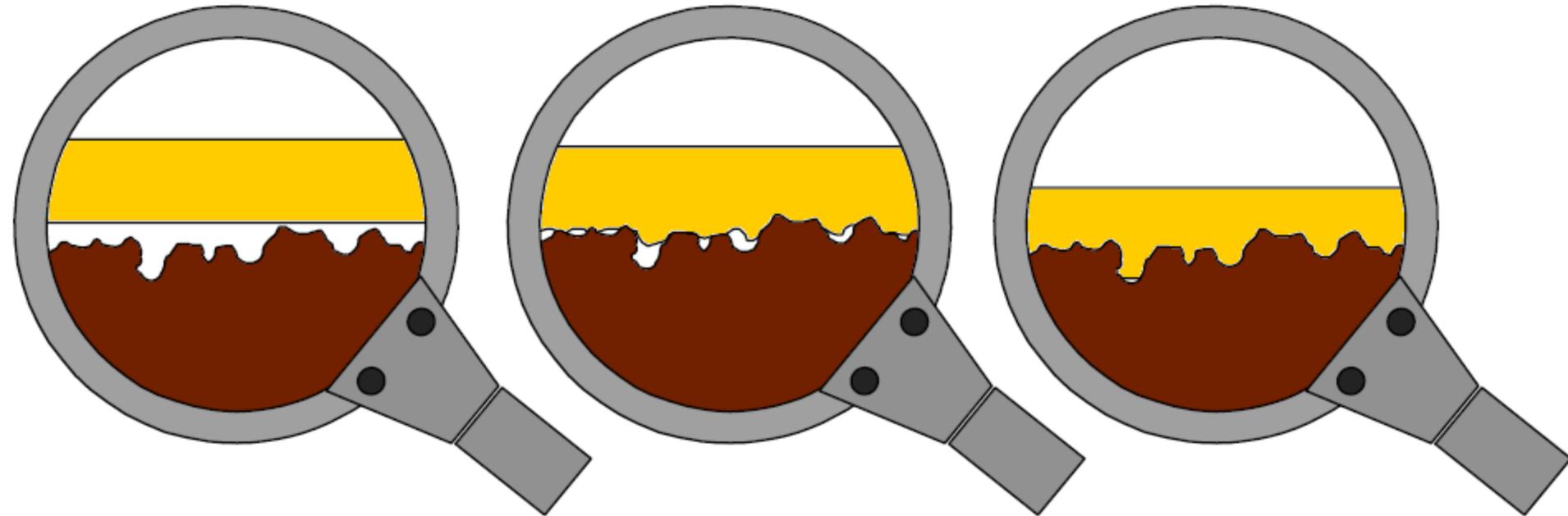
# Common PSA Terminology

- **Adhesion** – Ability to stick or bond to a substrate.
- **Cohesion** – Internal strength of an adhesive to itself.
- **Substrate** – The surface or material to which you want your PSA to stick.
- **Surface Energy**
  - A measure of the molecular attraction of the facial contact of a material.
  - Property that will effect the ability the PSA to stick.
- **Wet out** – The ability of an adhesive to flow and/or reflow over a surface to maximize bond strength based on higher contact area.



# Wet Out & Ultimate Strength

*Dwell Time allows adhesive to “flow” into the Peaks & Valleys of the Substrate*

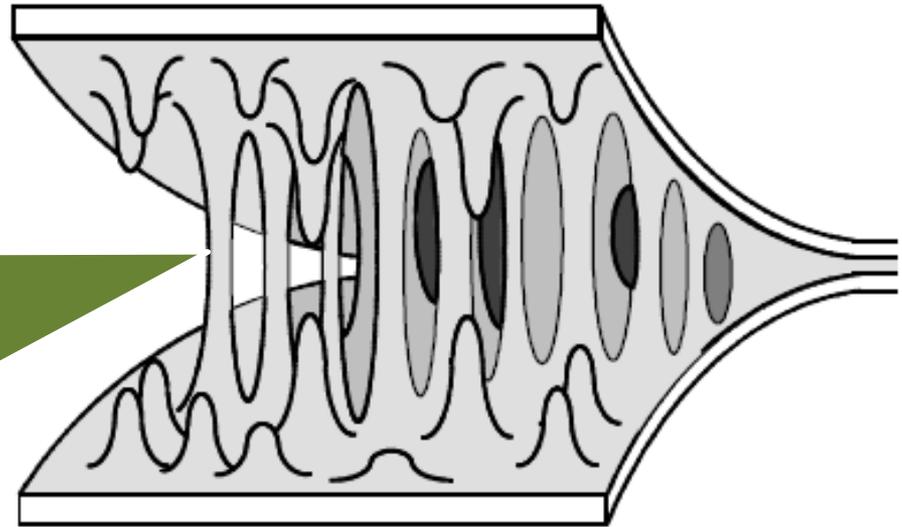


**Initial Adhesion  
No Dwell Time**

**Ultimate Adhesion  
72 hrs @ 25 °C**

# Adhesion/Cohesion & Failure

Adhesives that flow easily reach their ultimate strength fast but can be torn apart. This is called Cohesive Failure.



If the adhesive pulls away from the substrate it is called Adhesive Failure (Not Shown Here)

# Functional Placement Of The IUID Mark

Protected



In-Service Convenient

In-Storage Convenient



# IUID Resources

OSD UID Policy Office Website [www.uniqueid.org](http://www.uniqueid.org)

Trusted site for policy, updates, FAQs, and IUID newsletter

DoN IUID Website

[https://acquisition.navy.mil/rda/home/acquisition\\_one\\_source/item\\_unique\\_identification\\_iuid](https://acquisition.navy.mil/rda/home/acquisition_one_source/item_unique_identification_iuid)

MIL-STD 130 (current version is N, Change 1 as of Nov 2012)

Marking standards and requirements

DoD Guide to Uniquely Identifying Items (currently v2.5 as of Sep 2012)

Business rules, additional guidance for legacy items

Defense Acquisition University (DAU) [www.dau.mil](http://www.dau.mil)

Continuous Learning Courses (CLM200, CLE 040) to increase IUID knowledge

IUID Helpdesk [iuid.helpdesk@dla.mil](mailto:iuid.helpdesk@dla.mil)



**QUESTIONS  
&  
ANSWERS**