



PROJECT: Shuttle Sched. B		<b>TEST REQUEST</b>				TR NUMBER S139089	CHG. New
TITLE OF TEST Testing of Vericode Marked Materials					CERTIFICATION YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		
					TYPE OF TEST Evaluation		
ENGINEERING ORIGINATOR L. Burgess	ENGINEERING COORDINATOR L. Burgess	PHONE x3006	LEDGER 30808	G.O. 49930	SUBACT 10552		
TEST AGENCY M&P Engineering Lab	TEST COORDINATOR M. Leifeste, D. Sueme	PHONE x4673	SWA	IDWA	RPA		
PROJECT CONSTRAINT None	HARDWARE EFFECTIVITY	TYPE OF REPORT LTR					
INSPECTION REQUIRED? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> SD <input type="checkbox"/> CUST <input type="checkbox"/>	TEST REPORT DISTRIBUTION L. Burgess, R. Haas, D. Roxby, D. Wang J. Litwinski, M. Fowler (JSC) T. Bejarano, M&P Mgt.	SCHEDULE TSD: 4/18/94 TCD: 9/30/94					
TEST SPECIMEN Various, as described in test plan	REFERENCES Schedule B "Skills Retention"						
ACCURACY REQUIREMENTS N/A							
TEST OBJECTIVE AND BRIEF DESCRIPTION OF EFFORT							
<p><b>Objective:</b> To evaluate the effect of Vericode marking on several selected materials.</p> <p>During the first phase of this effort (Ref. LR 6158), over 20 metallic and nonmetallic materials were marked using a Nd:YAG laser and examined metallographically. Results are reported in Report No. LTR 6158-2470. From these results, the need for further testing was identified. This test plan addresses some of the metallurgical evaluations, fatigue testing and environmental testing that are required.</p>							
APPROVAL SIGNATURES							
TEST REQUESTER <i>L. Burgess</i>	4/13/94	OTHER <i>R.Q. Haas</i>	4/14/94				
REQUESTING MANAGER <i>C. Silverman</i>	4/14/94	OTHER					
REQUESTING DIRECTOR		PROJECT ENGINEER					
RELIABILITY/SAFETY		CHIEF ENGINEER					
PRODUCT ASSURANCE		TEST AGENCY					
M&P ENGINEERING		PROJECT ENGINEERING RELEASE <i>[Signature]</i>	4/14/94				

**TESTING OF VERICODE MARKED MATERIALS**

TR No. S139089

**Materials**

Tests will be performed on the following 1/8" thick sheet materials.

Material Cost: \$4200

7075 aluminum	A286 CRES
2195 aluminum-lithium (Weldalite)	Inconel 718
Ti-6Al-4V	

**Task 1****Optimization of Laser Marking Parameters**

Specimen configuration: 1" x 6" x thickness for all test materials. Two specimens each are required for each test material.

Materials to be tested: 7075 aluminum, 2195 aluminum-lithium, Ti-6Al-4V, Inconel 718, A286

1. Identify 6 to 9 different laser combinations (amps, frequency and speed) capable of producing machine readable matrix symbols on each selected material. The first setting selected will be the one that produces the lightest, shallowest marking which can be consistently decoded. Subsequent settings will be adjusted upward (least harsh to most harsh), in even increments, until the deepest marking is produced. (SSD-Huntsville)
2. Perform metallographic and SEM analysis on the Vericode marked coupons. The purpose of this testing is to evaluate and establish suitable final parameters for laser marking. (SSD-Downey)

**Task 2****Fatigue Testing**

Specimen configuration: Procure twenty-four (24) material coupons for each selected material and machine fatigue test specimens per L&T STD-0030. (SSD-Downey)

Materials to be tested: 2195 aluminum-lithium, Ti-6Al-4V

1. Laser mark twenty (20) of the specimens in the minimum radius area using optimized parameters developed in Task 1. Do not mark the remaining four (4) specimens. These will be used as control specimens.
2. For each material, fatigue test all twenty four (24) specimens (R = -1.0) at room temperature with loads applied at a rate of 30 Hz. Compare data and identify those materials that can be safely marked with no greater than 15% drop in fatigue life
3. Perform SEM/metallographic evaluations as required to verify quality of the specimens and nature of the failures.

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**Task 3**  
**Environmental Testing**TR No. S139089

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Specimen configuration: 1" x 2" x thickness specimens of each material will be used.

For each material identified for either thermal cycling or salt spray testing, Vericode mark one set of coupons using five different marking methods (dot peening, micro-abrasive blasting, machine engraving, laser etching and electro-chemical etching). (SSD-Huntsville)

**1. Thermal Cycling**

Materials to be tested: Ti-6Al-4V, Inconel 718, A286

Perform high temperature cycling tests to simulate temperatures seen during launch and landing. Tests will be conducted at 1425F for 520 seconds. (SSD-Downey) Following exposure, the specimens will be evaluated for machine readability of the Vericode markings. (SSD-Huntsville)

**2. Salt Spray Testing**

Materials to be tested: Super Korupon painted 7075 aluminum, 2195 aluminum-lithium, A286, Ti-6Al-4V

Perform salt spray testing for 96 hours per MIL-STD-1312, Method 1 to simulate launch site and SRB recovery environments. (SSD-Downey) Following exposure, the specimens will be evaluated for machine readability of the Vericode markings. (SSD-Huntsville)

**Task 4**  
**Report Preparation**

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A final report (LIR) is to be prepared documenting all test procedures and results.

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