

Langley Research Center
Hampton, Virginia
23665

Reply to Attn of:

MEMORANDUM

TO: 359/Facility Safety Head, 8' Transonic Pressure Tunnel

FROM: 444/Head, Fracture Mechanics Engineering Section,
Mechanical Design Branch, Research Facilities Engineering
Division

SUBJECT: Results of Stress Coat Tests on the 8' TPT Blade Boxes

The subject tests were conducted to establish stress patterns within four of the blade boxes (Nos. 2, 16, 18 and 32). The highly stressed areas manifest by the patterns will be carefully monitored during future inspections of the boxes, and will probably be modified (to reduce the stresses) should new boxes be designed. The following sequence was followed in conducting the stress coat tests.

- (1) The four boxes were removed from the 8' TPT and ultrasonically cleaned. This removal occurred during the TPT's yearly maintenance shutdown.
- (2) All boxes and blades were reinstalled in the TPT and the tunnel run. This run (a) permitted debugging of all tunnel systems after the maintenance shutdown and (b) dried out the tunnel which was quite wet. Both (a) and (b) were necessary since stress coat must (a) be used within 48 hours of application (thus there was no time for extensive debugging) and (b) be used in a dry environment.
- (3) The four boxes were then removed from the tunnel, degreased, stress coated, and reinstalled in the tunnel. Approximately 18 hours lapsed between the application of the stress coat and the reinstallation of the boxes. Twelve of these hours were for curing the stress coat and four were for actual reinstallation.
- (4) The tunnel was started and accelerated to its maximum operating speed of 840 rpm. The tunnel was operated at this speed until the stagnation temperature reached

100°F. (The stress coat rapidly loses sensitivity at temperatures exceeding 100°F.) The boxes were then removed from the TPT and inspected.

5. Attachment 1 shows the areas where the stress coat cracked on the boxes. Three general areas cracked. A description of the cracked areas follows:
- (a) Boxes No. 2, 16, and 18 developed stress coat cracks near the outer edges of the side plates. No fatigue cracks have been found in these areas of the side plates.
 - (b) Boxes No. 16 and 18 developed stress coat cracks near the pin hole in the center plate. Numerous cracks have developed in these pin holes.
 - (c) Boxes No. 16 and 18 developed stress coat cracks in the transition radius on the center plate. No fatigue cracks have ever been found in this transition radius.
 - (d) Box No. 32 developed no stress coat cracks. Attachment 2 indicates this box has never developed fatigue cracks.

As a result of these tests, the highest stressed areas on the boxes were identified. These areas will be carefully monitored during future box inspections. Requirements for future inspections have been reviewed by Messrs. E.B. Geer, J.E. Knemeyer, F.E. Mershon, J.C. Miller and D.B. Wright, Jr., Drs. R.L. Goble and J.W. Ramsey, Jr., and the undersigned. Based on this review, the following inspection schedule was developed.

- (1) Each June, the side plates on all boxes shall be inspected using magnetic particle techniques. This inspection does not require removal of the boxes from the TPT.
- (2) Each November, all boxes shall be completely inspected using magnetic particle techniques. This inspection requires removal of the boxes from the TPT and shall be performed during the yearly maintenance shutdown.

All inspections shall be performed under the direction of the Materials Processing and Development Section, MTB, FD.

C. Michael Hudson
cc:

C. Michael Hudson
4544

112/E.B. Geer 397/T.P. Kelly

166A/JWDeLauder

166B/J.W. Huggett

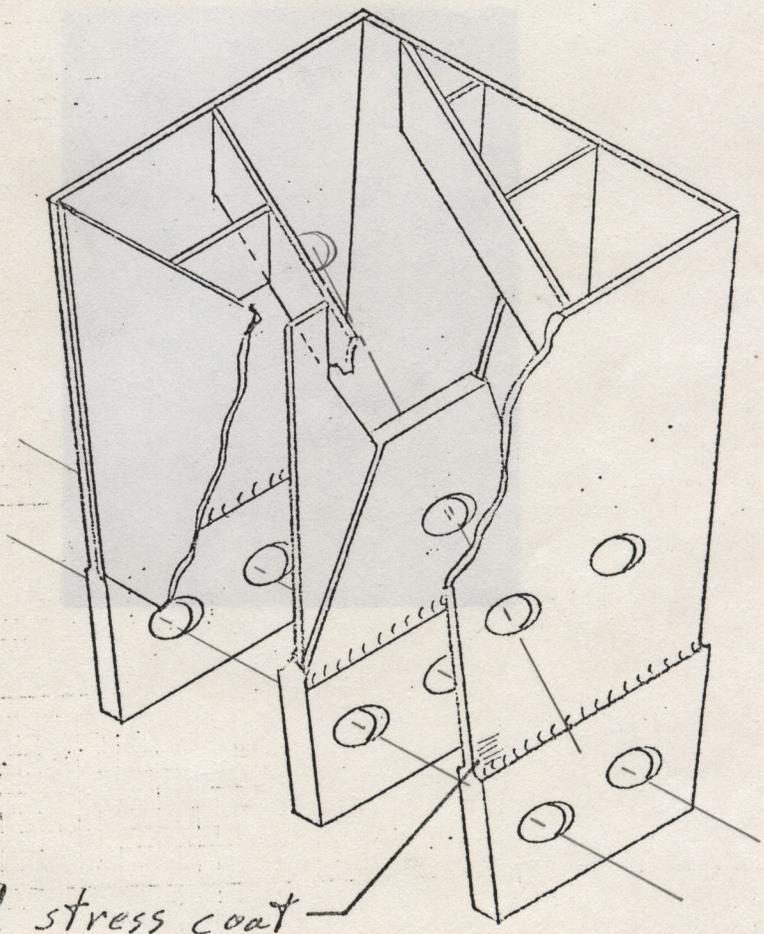
359/C.T. Schrum

438/FEM *zen*

436/JEK *Jek*

436/RLG *R*

Blade Box No. 2

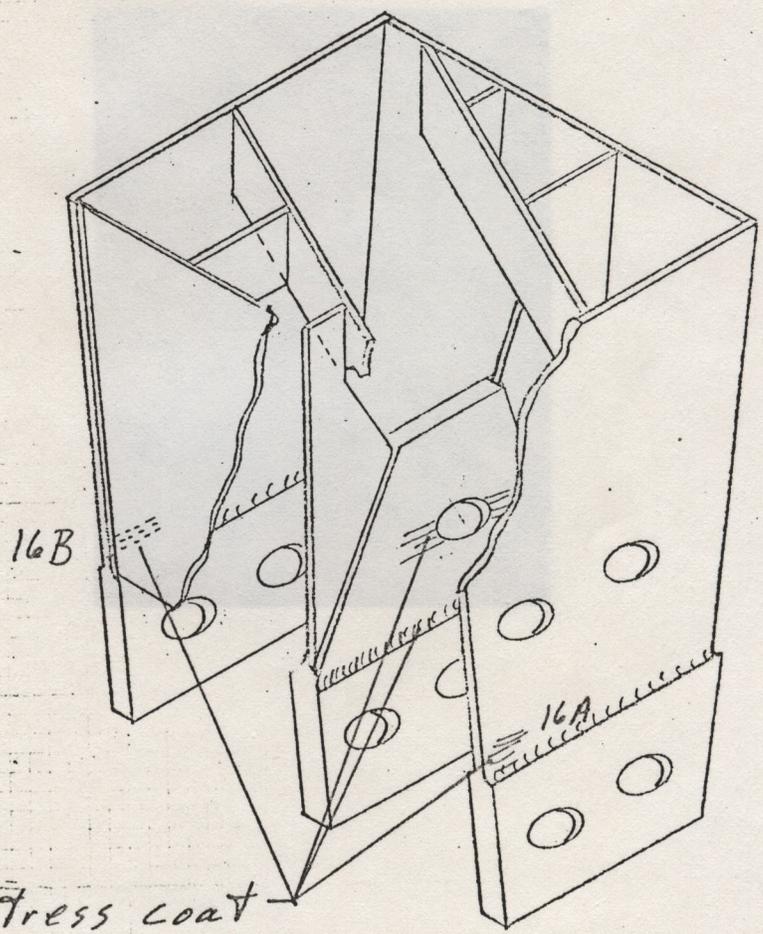


Area of fractured stress coat

strain required to fracture stress coat - ≈ 1000 $\mu\text{in./in.}$

Attachment 1

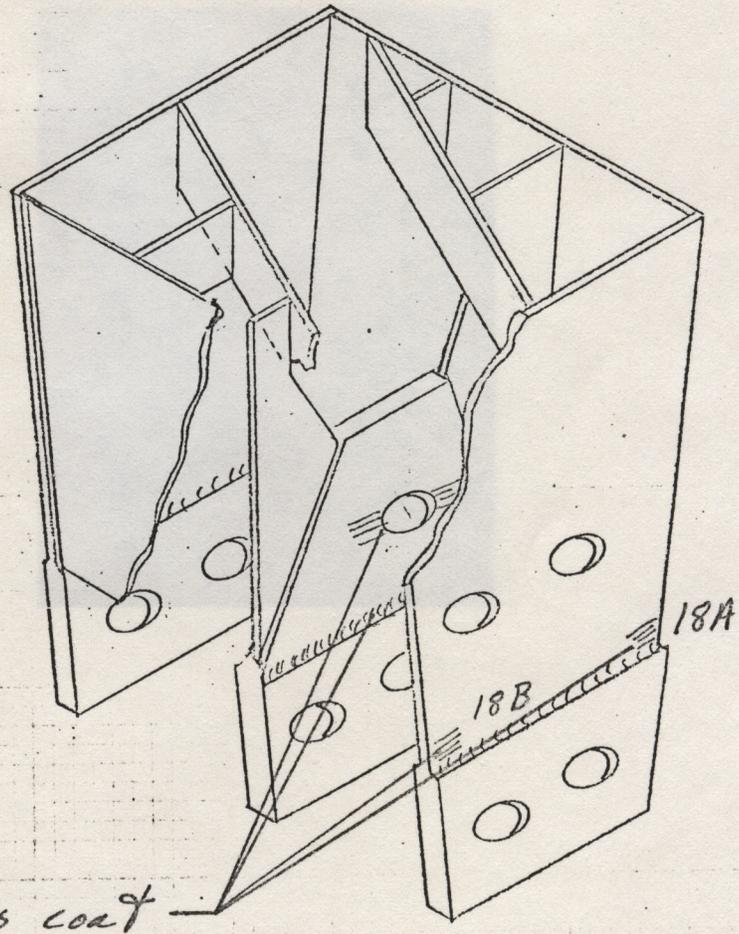
Blade Box No. 16



Areas of fractured stress coat

Strain required to fracture stress coat - $\approx 1000 \mu\text{in/in}$.

Blade Box No. 18.



Areas of fractured stress coat

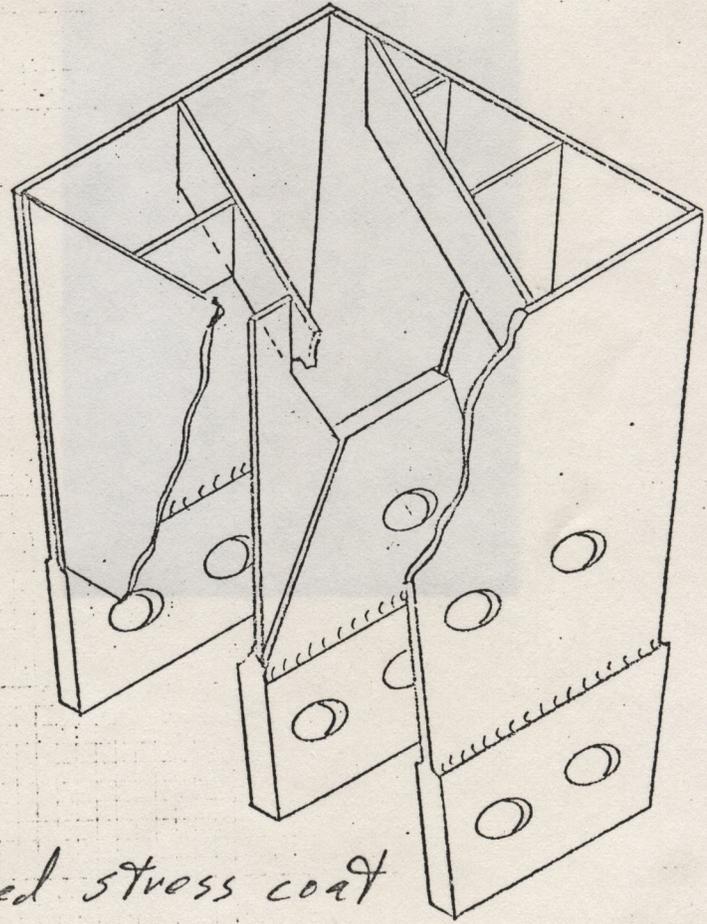
strain required to fracture stress coat - ≈ 1000 $\mu\text{in/in}$.

BY D. WHITE DATE 12/21/77
CHKD. BY _____ DATE _____

SUBJECT 8' TPT BLADE
SOCKET

SHEET NO. 4 OF _____
JOB NO. _____

Blade Box No. 32



No areas of fractured stress coat

Strain required to fracture stress coat. - $\sim 1000 \mu\text{in./in.}$

BY *CWAT* DATE *1-3-78*

SUBJECT *Photo of Fractured
Stress Cont. Blade Box
No. 16*

SHEET NO. *5* OF _____
JOB NO. _____



NASA
L-77-8745

BY *CMH* DATE *1-3-78*

SUBJECT *Photo of Fractured
Stress Coat. Blade Box
No. 18*

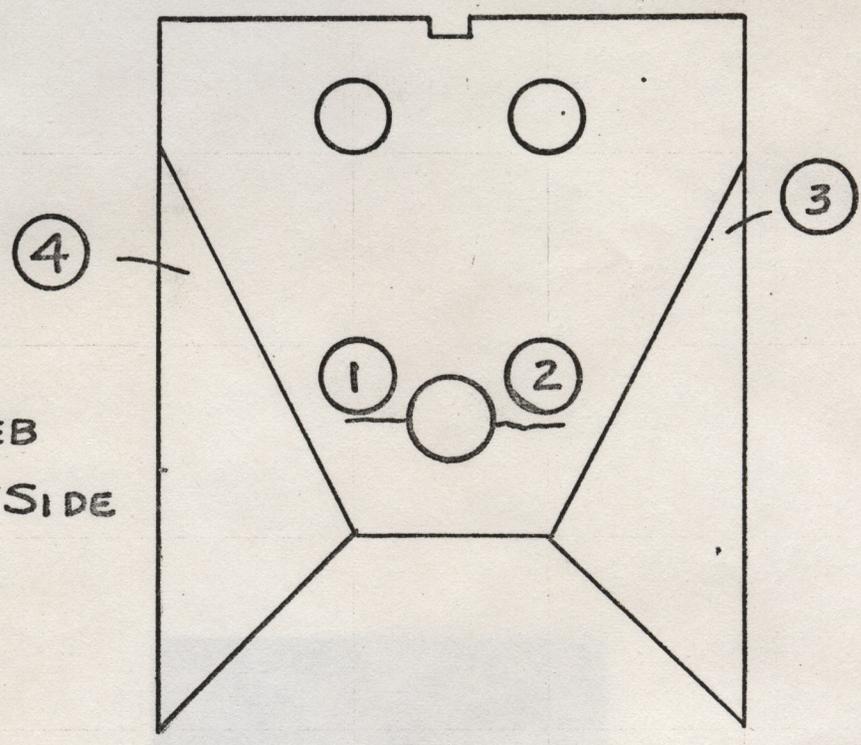
SHEET NO. *6* OF _____
JOB NO. _____



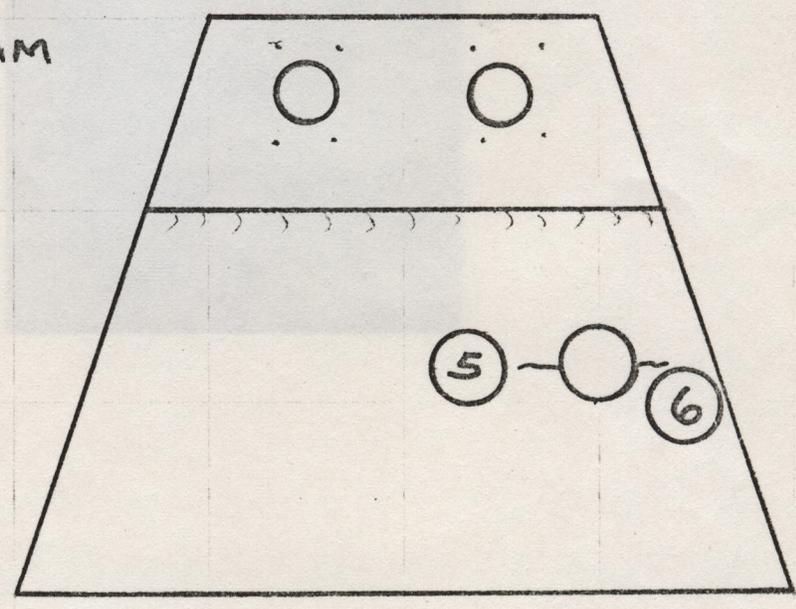
NASA
1-77-8744

#5
R/B 85-95

CENTER WEB
UPSTREAM SIDE



DOWNSTREAM
SIDE



SEE SHEET 2 FOR CRACK LOCATION ON
EACH BLADE BOX

Attachment 2

BY Wright DATE 9/4/75

SUBJECT 8' TPT
Blade Socket Repairs
CRACK LOCATION

SHEET NO. 2 OF
JOB NO.

BLADE BOX	1	2	3	4	5	6
1	✓	✓				
2		✓				
3	✓	✓	✓	✓		
4			✓	✓		
5	✓	✓	✓	✓		
6	✓	✓	✓	✓		
7	✓	✓	✓		✓	
8						
9			✓	✓		
10						
11	✓	✓	✓			
12	✓	✓	✓	✓		
13				✓		
14		✓	✓			
15	✓	✓		✓		
16						
17						
18	✓			✓		
19			✓	✓		
20	✓			✓		
21		✓	✓	✓		
22		✓				
23	✓		✓	✓		
24	✓	✓	✓			
25	✓		✓			
26						
27			✓	✓		
28		✓				
29	✓	✓	✓	✓		
30		✓	✓			
31						
32(4A)						