SMA Memo 120
P/N 41700490000

Simpson Gumpertz & Heger Inc.
Consulting Engineers

Arlington, MA / San Francisco, CA

T R A N S M I T T A L

Date: 17 March 1998 **Comm.** **96755**

To: Smithsonian Astrophysical Observatory
60 Garden Street
Cambridge, Massachusetts 02138

Attention: Mr. George Nystrom

Client: Smithsonian Astrophysical Observatory

Subject: CFRP Type -5 for SMA Antenna

Enclosed are the following:

2 copies of binders containing the following:

- Table of results of testing of type -5 tubes with comments.
- 5 photographs showing the failed specimens - tube end and corresponding insert.
- 14 photographs showing close up of inserts.
- 20 photographs through a microscope of surfaces of inserts

Note: All of the above, except for the microscope photographs, were previously forwarded to you.

____ **Per your request**	_____ **Approved**	____ **For correction**
_X_ For your information/records	**Approved as noted**	____ **Not approved**
____ **For your approval/comments**	_____ **Revise and resubmit**	**Resubmit for record copy**
____ **For your review/comments**	**Returning to you**	____ **Please return**

By: Joseph Antebi

JA01-98.amg

Comm 96755 CFRP - Testing of bonded joints for SMA Antenna												
JJW												
6/18/97				Do=	26.8							
				Di=	23.3							
				l=	25.4							
				Total Wetted Area		1997	sq mm					
						3.095	sq in.					
	Axial Tests											
	Load kN	lbs	psi									
Specimen				Adhesive in Shear			Adhesive in Tension					
05-02	22.71	5105	1649	Partially Cohesive (25%)			Partially Cohesive (20%)					
				Circular ring in glue								
05-03	9.80	2203	712	Slightly Cohesive (15%)			Cohesive (60%)					
05-04	19.02	42761	1381	Cohesive (35%)			Slightly Cohesive (15%)					
05-05	20.60	4631	1496	Partially Cohesive (25%)			Slightly Cohesive (10%)					
				Vertical pink tint line								
05-07	22.40	5036	1627	Mostly Cohesive (50%)			Cohesive (30%)					
05-09	21.64	4865	1572	Cohesive (40%)			Less than 5% Cohesion					
				Pinkish tint in ring direction								
05-13	16.78	3772	1219	Partially Cohesive (20%)			Less than 5% Cohesion					
				Thickness of black fibers layers increases toward bottom of shear interface								
05-14	24.91	5600	1809	Mostly Cohesive (50%)			Partially Cohesive (25%)					
				30% Pinkish lint beneath glue layer								
05-15	19.57	4399	1421	Slightly Cohesive (10%)			Slightly Cohesive (10%)					
				30% Pinkish tint beath glue layer								
05-16	15.22	3421	1105	Extremely Cohesive (60%)			Partially Cohesive (20%)					
				25% Pinkish tint beneath glue layer								
05-18	27.26	6128	1980	Cohesive (30%)			Slightly Cohesive (15%)					
				15% Pinkish tint beneath glue layer								
05-20	13.98	3143	1015	Cohesive (45%)			Slightly Cohesive (15%)					
				65% Pinkish tint beneath glue layer								
05-22	20.66	4644	1500	Cohesive (45%)			0% Cohesive					
				35% Pinkish tint beneath glue layer								
05-23	20.72	4658	1505	Partially Cohesive (25%)			Less than 5% Cohesion					
				30% Pinkish tint beneath glue layer								
Mean	19.66	4420	1420									
Min	9.80	2203	712	All specimens had fine longitudinal crack upon failure								
Max	27.26	6128	1980	*All sections had many circular rings encompassing the exterior of the insert and interior of tube								
	14	14										
Std Dev.	4.53	1019	329									
	* Specimen NO-07-05-13 was loaded to approx. 9.5 kN at a crosshead rate of 100 mm/min.											
	Test manually stopped. No apparent signs of distress											
	Specimen was reset and tested to failure at crosshead speed of 1.5 mm/min											

Comm 96755 CFRP - Testing of bonded joints for SMA Antenna			
JJW			
6/18/97			
	Interior of Pipe		
Specimen	**circular rings interrupted by:**	HOLIDAYS	More Comments
05-02	longitudinal fibers 25% of total area		
		Large Holiday (10%)	
05-03	Holiday		
		Holiday (5%)	
05-04	longitudinal fibers 33% of total area		Pinkish tint on interior diameter and tip of exterior diameter on end of insert
		Holiday (5%)	
05-05	Not interrupted		
	Pinkish tint on pipe tension surface	No Holiday	
05-07	longitudinal fibers - 50% of total area		
		Holiday (20%)	Glue on end of insert adhered to interior of pipe
05-09	longitudinal fibers 40% of total area		Pinkish tint at boundary of glue and end of insert.
		Small Holiday (Less than 5%)	Glue on end of insert adhered to interior of pipe
05-13	longitudinal fibers 20% of total area		Delamination at interface of glue to steel insert (5%)
		No Holiday	
05-14	longitudinal fibers 50% of total area		Pink blotch beneath upper section of insert
		Holiday (5%)	Glue on end of insert adhered to interior of pipe
05-15	faintly by longitud		Glue on end of insert adhered to interior of pipe and pinkish tint at glue interior pipe interface
	Finger-like Holiday (	2 0 %)	
05-16	Circular rings not distinct, nor crisp:		
		Small Holiday (Less than 5%)	
05-18	large section of longitudinal fibers		Glue on end of insert adhered to interior of pipe and pinkish tint at glue interior pipe interface
		Small Holiday (Less than 5%)	
05-20	longitudinal fibers 40% of total area		Pinkish tint around interior diameter of insert end
		No Holiday	Pinkish stripe from inner diameter to outer diameter of insert end.
05-22	longitudinal fibers 45% of total area		Pinkish tint at insert end
			Glue on end of insert adhered to interior of pipe and pinkish tint at glue interior pipe interface
05-23	longitudinal fibers 25% of total area		
		Small Holiday (Less than 5%)	