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RECOMMENDED ENVIRONMENTAL TEST
LEVELS FOR THE GAM 87A APPLICATION
OF THE XW-59-X1 (SRD)

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
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RECOMMENDED ENVIRONMENTAL
TEST LEVELS (U)

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Walter H. Suiter, 7185-3

ABSTRACT

This study selects a minimum number of standard tests from SC-4451(M), or suggests modifications of standard tests, which may be considered by the project division responsible for the GAM 87A application. The environmental conditions listed are those which are presented in the GAM 87A stockpile-to-target sequence. The suggested tests are based upon confirmation of, or extensions to, the STS environment by cross-checking with 7185-3 "data bank" environmental information.

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RB Craner

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INTRODUCTION

This study was undertaken to assist the Project Division in formulating a detailed test plan for the GAM 87A application of the XW-59-X1 warhead. The environmental data presented were taken directly from the Stockpile-to-Target Sequence for GAM 87A, RS 3466/38562, dated June 1961, and compared to "Data Bank" environmental information. In cases where the "Data Bank" environment is considered to be significantly less severe than that presented in the STS, appropriate notes are made.

The status of the XW-59/MINUTEMAN environmental test program should be reviewed in an effort to eliminate some of the following tests if the environmental conditions are similar, or if the XW-59-X1/GAM 87A warhead design is not significantly changed.

PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Temperature			
High +160°F	WH in AEC shipping container	A1	160°F for 12 hrs.
Low -65°F	"	A3	-65°F for 4 hrs.
-40°F stabilized		Accomplished in A3	after stabilization
Shock -65 to +125°F, 20 min.	"	A5	+160°F for 4 hrs.,
-40 to -65°F, 20 min.	"	A5	5 min. change to -65°F
-40 to +80°F, less than 1 min.*	"	A5 modified to	-65 for 4 hrs., 5 min.
+80 to -40, less than 1 min.*	"	obtain limits of +80 and -40°F with maximum possible rate of change.	change to +160°F 3 complete cycles.
Fluctuation			
High 90°F to 160°F	"	A2	90°F for 10 hrs., 4 hr. linear change to +160°F, 160°F for 4 hrs., linear change to 90°F, 30 consecutive cycles. Constant RH 15%.
Low - Not presented in STS	"	A4	Stabilize at -65°F. Ave. chamber rate of change to -80°F. Hold at -80°F for 24 hrs. Return to -65°F and hold for 4 hrs. or stabilization.

* Less than one minute is unrealistic from a facilities standpoint, transition time not to exceed 2½ minutes.

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PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Temperature			
Shock -40°F to +80°F (less than +160 to 80°F 1 min.)*	WH removal from AEC shipping container and RV (bare warhead)	No test recommended, adequately accomplished in A5.	
High 160°F 10 sec., 165°F (Ballistic flight)	WH in re-entry vehicle	A1 No test recommended	160°F for 12 hours.
Low -65°F 32 hrs. -40°F Stabilized -75°F occasionally	"	A4 Modified to limit duration of -80°F to 8 hrs.	Stabilize at -65°F Ave. chamber rate of change to -80°F for 8 hrs.
Shock +80 to -40°F less than 1 min.* -40 to +80°F less than 1 min.* +160 to 80°F less than 1 min.*	" " "	A5 modified to obtain limits of +80 and -40°F with maximum possible rate of change	3 complete cycles.
Fluctuation High +90 to +160°F	"	A2	90°F for 10 hrs., 4 hr. linear change to +160°F, 160°F for 4 hrs., linear change to 90°F, 30 consecutive cycles. Constant RH 15%.
Low - Not presented in STS	"	A4	Stabilize at -65°F Ave. chamber rate of change to -80°F, hold at -80°F for 4 hrs., return to -65°F and hold for 4 hrs. or stabilization.

* Less than one minute is unrealistic from a facilities standpoint, transition time not to exceed 2½ minutes.

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PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Humidity			
High 93 to 97% RH at 80 to 85°F for 20 hrs., changing to 100% RH w/condensation at 75 to 80°F for 4 hrs.	WH in AEC shipping container and re-entry vehicle	B1	Constant 93% RH, 86°F to 149°F to 86°F to 68°F. 10 consecutive 48 hr. cycles.
Low 15% RH at 90°F for 10 hrs. Linear change in 5 hrs. to 2% RH at 160°F, 2% RH at 160°F, for 4 hrs. Linear change in 5 hrs. to 15% RH at 90°F.	"	No test recommended, adequately accomplished in A2	
Winter Freezing Cycle Not presented in STS	"	H	60% RH at 64°F linear, 2 hr. change to 0°F. RH uncontrolled, 2 hr. change to 64°F, 30 consecutive cycles.
Pressure			
High, 15.4 psi	"	C1	Subject WH to 70 in hg. absolute
Low 0 psi	"	G	-65°F and 2.12" hg.

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PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Precipitation			
Rain 12"/11 hr. 55 min. 2"/5 min. 11"/11 hrs. 7"/1 hr.	WH in AEC shipping container and re-entry vehicle	M	4 ± 1"/hr. for 2 hrs.
Snow 40#/ft^2	"	No test recommended.	
Hail ½" diameter at 4"/hr., wind 50 mph	"	No test recommended.	
Sand, Dust, Salt Spray, Fungus			
Sand and Dust as encountered along ocean beaches and arid or desert areas	"	N	Dust concentration 0.5 to 0.25 gm/ft^3. Temp. 80 ± 5°F, humidity not to exceed 30% air velocity 1300 ± 100 ft/min.
Salt Spray or Fog as encountered along and in the vicinity of salt water beaches	Material Tests	L1	20% water solution of sodium chloride for 50 hrs.
Fungus	Material Tests	L2	86°F, 95% RH for 28 days.
Beetles, bugs, mites, etc.		No test available.	

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PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Static Acceleration*			
To failure, which must be at least 53 G equivalent static acceleration	WH in re-entry vehicle		53 G applied at 45° from nose on horizontal centerline.
Acceleration			
2.0 G fwd or aft 6.1 G up or down 2.0 G lateral	WH in re-entry vehicle oriented on centrifuge arm to receive applied load at 45° from the nose on the horizontal centerline.	F1 modified to obtain 40 G.	40 G centrifuge.
33.0 G fwd 0 G lateral 0 Rad/Sec^2 pitch			
5.48 G fwd 11.10 G lateral 43.3 Rad/Sec^2 pitch			
2.8 G aft 5.85 G lateral 0.5 Rad/Sec^2 pitch			

* To qualify RV/WH combination for centrifuge test.

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PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

SPS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Vibration			
Transport* 0.4" DA 5 - 73 cps; 8 G, 73-200 cps; 4½ G, 200-2000 cps	WH in AEC shipping container and re-entry vehicle in RV shipping container	E1b modified to limit maximum acceleration to 3 G	3 G - 10-2000 cps
B-52 Carry 0.1 2 DA 5 - 20 cps; 0.06" DA 20 - 73 cps; 7 G 73 - 800 cps; 9 G 800 - 1200 cps; 5.5 G 1200 - 2000 cps	WH in re-entry vehicle simulating pylon mounting	E1b modified to limit G level to 1.5 G	1.5 G ** 10-2000 cps
Powered flight and re-entry 0.4" DA 5 - 12 cps; 3 G 12 - 2000 cps	WH in re-entry vehicle 3 G applied at WH, RV interface	E1b modified to limit G level to 3 G	3 G *** 10-2000 cps

* Magnitude of 8 G during transport not borne out by data bank information.

** Magnitude of 1.5 G considered adequate as an input to the aircraft-missile interface.

*** Suggest that the XW-59-X1 be categorized as Class B equipment.

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PROPOSED ENVIRONMENTAL TEST PROGRAM, CAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Shock			
Air Transport* Fwd 8.0 G Aft 8.0 G Up or +5.0 G Down -2.0 G Lateral 1.5 G	WH in AEC shipping container	D2 Modified to obtain maximum acceleration of 5 G	½ sine, 5 G pulse duration which produces maximum response
Truck Transport Fwd 5.0 G Aft 5.0 G Up or +5.0 G Down -2.0 G	"	Accomplished in D2 above	
Rail Transport 30 G longitudinal 1 G lateral 2 G up or down	"	Sa modified for increments of velocity	11 mph maximum velocity ramp test
Mating ½" drop on mating cradle or on shipping container	Unpackaged WH	½" drop as described in STS environmental conditions. Conduct drop in lateral and vertical direction.	
Handling 12" drop on any face onto concrete surface	WH in AEC shipping container	12" drop as described in STS environmental conditions. Conduct drop at -40°F.	

* Loads indicated for air transport are not borne out by data bank information.

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PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SL-4451 Test	Abbreviated Test Description
Shock			
Transport 20 G, 11 ± 1 ms	WH in RV	Recommendation for tests withheld pending clarification of shock conditions	
RV Mating to Missile 5 G 11 ± 1 ms	WH in RV		
Aircraft Carry 6.0 G down, 4.0 G up 0.15 to 0.5 ms 2.5 G lateral, fore and aft	WH in RV		
Missile Re-entry and Flight			
20 G fwd, 3.0 - 6.5 ms 15 G any axis 11 ± 1 ms	WH in RV		

PROPOSED ENVIRONMENTAL TEST PROGRAM, GAM 87A/XW-59-X1

STS Environmental Conditions	Configuration	SC-4451 Test	Abbreviated Test Description
Acoustic Noise	WH in RV	E3a	160 db, 75-9600 cps
151 db 56 to 7200 cps	SPL applied external to RV		
142 db			
155 db 56 to 7200 cps			
169 db 56 to 7200 cps			