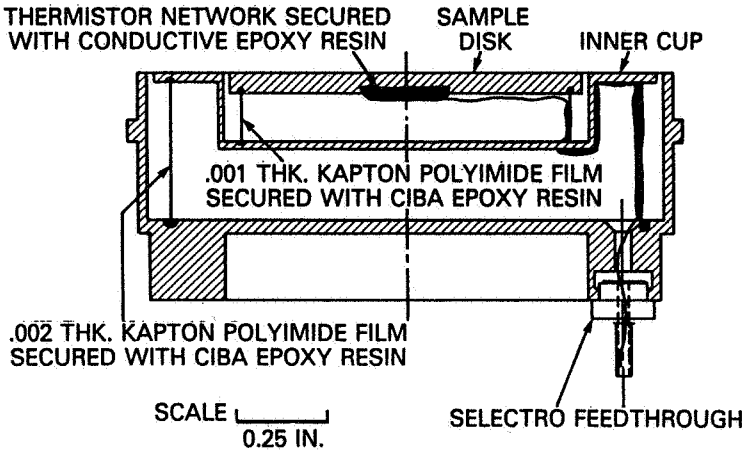
RESULTS OF THERMAL ENVIRONMENT MEASUREMENTS ON THE THERMAL CANNISTER EXPERIMENT AND GET AWAY SPECIAL ENCLOSURE

S. Ollendorf and D. Butler
Goddard Space Flight Center

INSTRUMENTATION

- FLUX SENSORS
  - CUPS CONTAINING THERMALLY ISOLATED SURFACES
  - PRT SENSORS WHICH MEASURED TEMPERATURE
  - SILVER TEFLON COATED (SAME AS CANISTER RADIATORS)
  - SIGNAL CONDITIONED THROUGH CANISTER ELECTRONICS
  - PREVIOUSLY FLOWN ON OSO, IMP AS COATING EXPERIMENT

SENSOR CUP DESIGN



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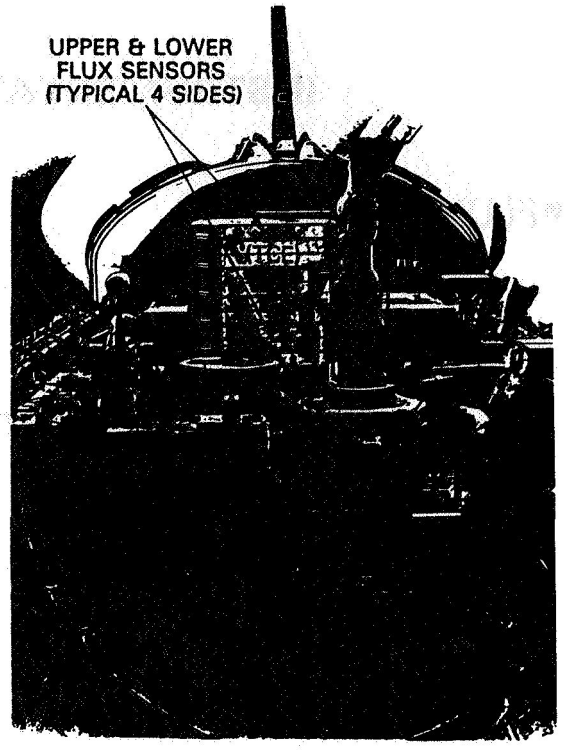
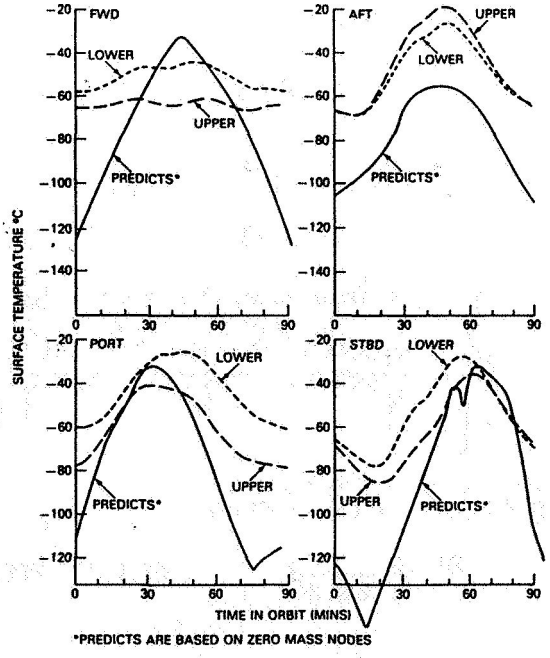
FLUX SENSOR LOCATIONS

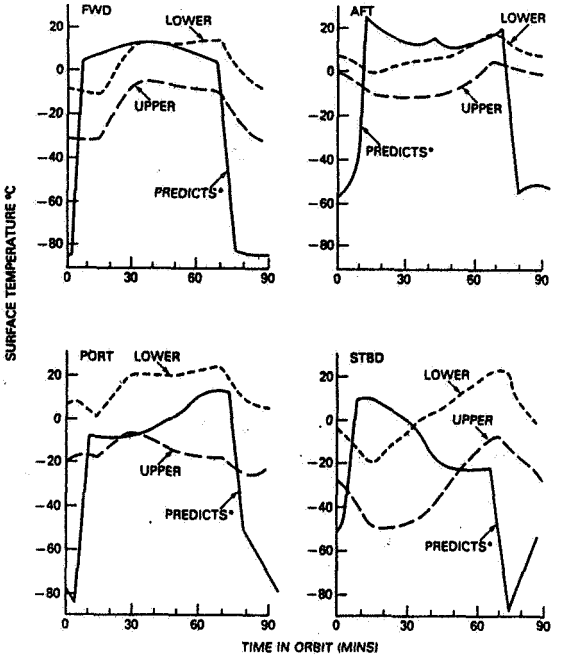
THERMAL CANISTER EXPERIMENT (TCE)



FLUX SENSOR TEMPERATURE HISTORY ($-X_{SI}$ MODE)

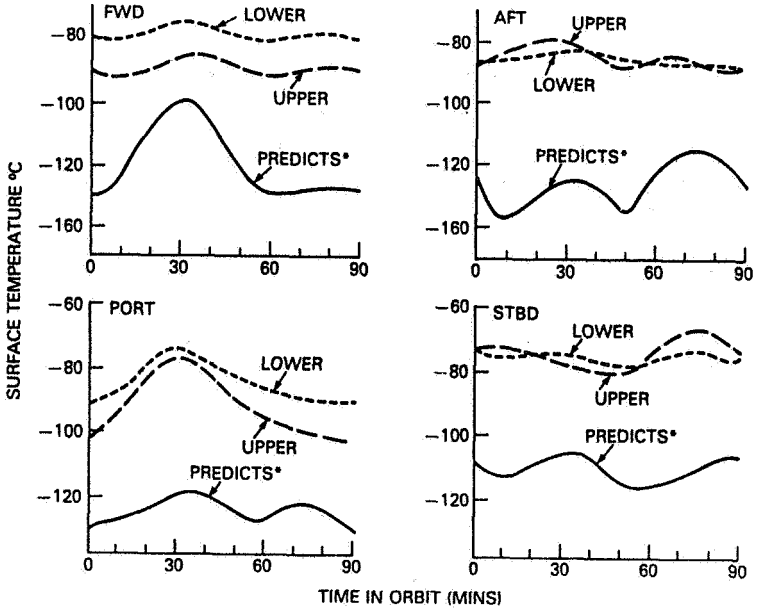


FLUX SENSOR TEMPERATURE HISTORY
(+ Z_{SI} MODE) HOT ORBIT



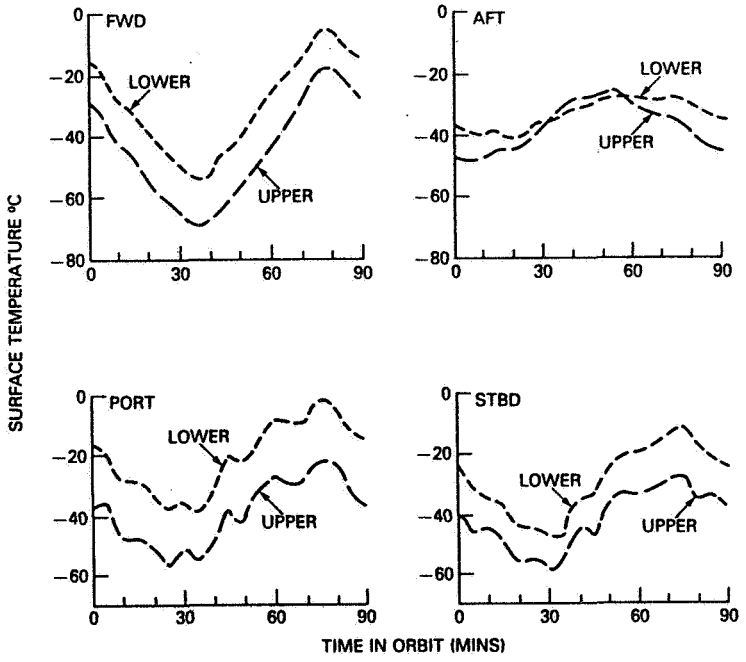
*PREDICTS ARE BASED ON ZERO MASS NODES

FLUX SENSOR HISTORY (–Z_{LV} MODE)
COLD ORBIT



*PREDICTS ARE BASED ON ZERO MASS NODES

FLUX SENSOR TEMPERATURE HISTORY (PTC MODE)



ORBITAL AVERAGE FLUXES

	$\overline{-Z_{Lv}}$		$\overline{+X_{SI}}$		PTC		$+Z_{SI}$	
	MEASURED	PREDICT	MEASURED	PREDICT	MEASURED	PREDICT	MEASURED	PREDICT
	W/ft^2	W/ft^2	W/ft^2	W/ft^2	W/ft^2	W/ft^2	W/ft^2	W/ft^2
FWD_L	5.8	1.9	9.9	6.1	16.8	7.1	24.1	18.4
FWD_U	4.6		7.8		11.7		17.9	
$PORT_L$	5.4	1.9	11.9	4.3	17.3	8.8	27.7.	17.5
$PORT_U$	4.7		8.8		12.5		17.9	
AFT_L	4.8	1.7	10.7	6.6	13.4	6.6	25.1	22.3
AFT_U	4.9		11.3		12.5		21.4	
$STBD_L$	6.1	2.8	9.8	6.6	15.7	8.3	24.8	16.1
$STBD_U$	6.2		9.3		12.5		15.7	

APPROXIMATE MLI TEMPERATURES FOR THE FOLLOWING ORBITAL CASES:

ORBITER ATTITUDE	FLIGHT DATA	PREDICTIONS
• TAIL TO SUN		
PALLET	−80°C (MINIMUM)	−112
UPPER PLATFORM	−60°C (MINIMUM)	−118
LOWER PLATFORM	−48°C (MINIMUM)	−112
• NOSE TO SUN		
PALLET	−15/−48°C (MAX/MIN)	−53/−86
UPPER PLATFORM	−50/−60°C (MAX/MIN)	−57/−91
LOWER	−48°C (MINIMUM)	−85/−56
• BAY TO SUN		
PALLET	100°C/−10°C (MAX/MIN)	107/65
UPPER PLATFORM	+75/+10°C (MAX/MIN)	103/63
LOWER PLATFORM	+80/+30°C (MAX/MIN)	117/75

THERMAL ENVIRONMENT OSS-1 THERMAL CANISTER EXPERIMENT RESULTS

OBJECTIVE: TO MEASURE TOTAL ABSORBED FLUX ON THERMAL CANISTER RADIATORS IN ORDER TO DETERMINE HEAT REJECTION CAPABILITY

RATIONALE: OSS-1 PALLET CONTAINED A VARIETY OF INSTRUMENTS WITH IRREGULAR SURFACE GEOMETRY AND PROPERTIES WHICH LIMITED PREDICTABILITY

METHOD: MEASURE TEMPERATURE (T_S) OF ISOLATED SURFACES AND CALCULATE FLUX:

$$\frac{Q}{A} = \varepsilon \sigma T_S^4$$

WHERE:

Q/A = ABSORBED FLUX (W/FT^2)

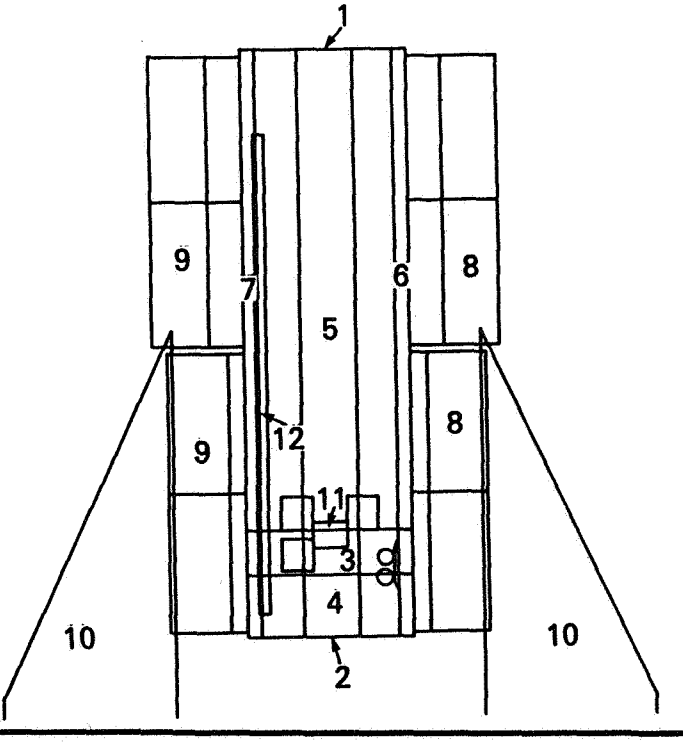
ε = EMMITTANCE

σ = STEPHEN-BOLTZMANN CONSTANT

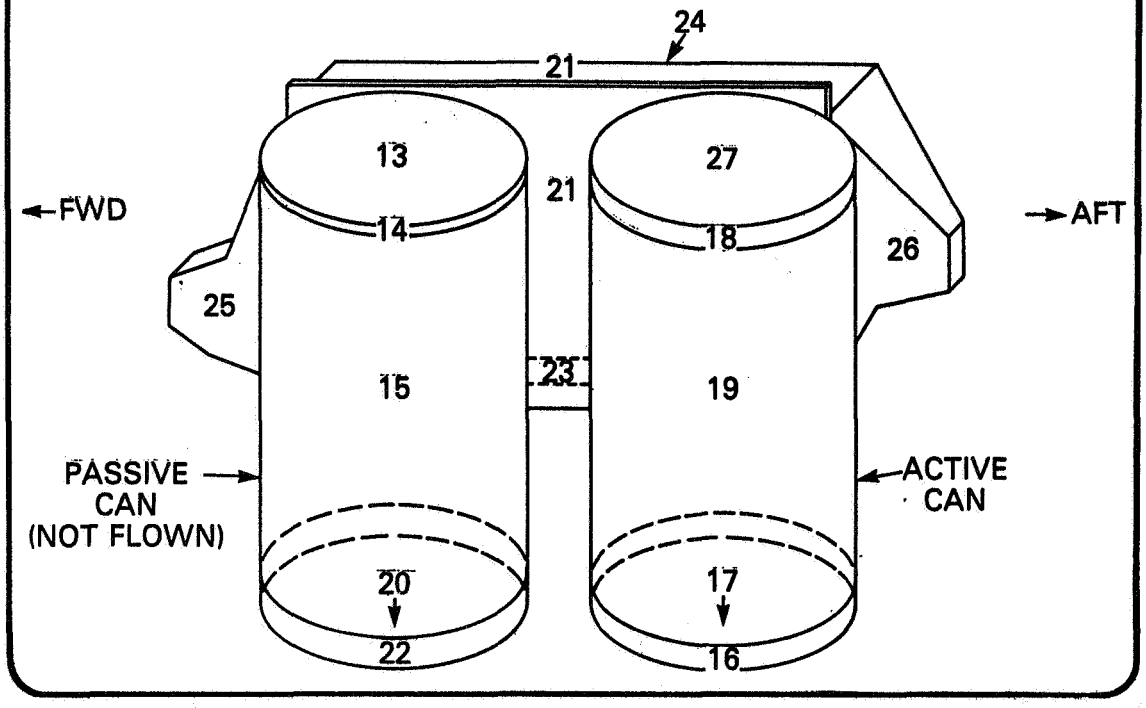
KAPTON EROSION

- KAPTON ON EXTERNAL SURFACES SUFFERED CONSIDERABLE EROSION DURING FLIGHT IN RAM DIRECTION
- SAMPLES REMOVED FROM THE TCE WERE MEASURED FOR WEIGHT LOSS, SOLAR ABSORBTANCE, IR EMITTANCE, TENSILE STRENGTH AND PERCENT ELONGATION
- SURFACE TEMPERATURE WAS APPROXIMATELY
- RESULTS SHOWED BETWEEN 16-35% WEIGHT LOSS, A CHANGE IN $\bar{a}/\bar{\varepsilon}$ FROM .62 TO .83, A CHANGE IN TENSILE STRENGTH FROM 22 TO 18K PSI AND PERCENT ELONGATION FROM 38 TO 10%
- CAUSE THOUGHT TO BE FROM INTERACTION OF ATOMIC OXYGEN/UV AND TEMPERATURE
- COVERING KAPTON WITH BETA CLOTH OR COATINGS WILL PROBABLY OFFER ENOUGH PROTECTION FOR FUTURE APPLICATIONS

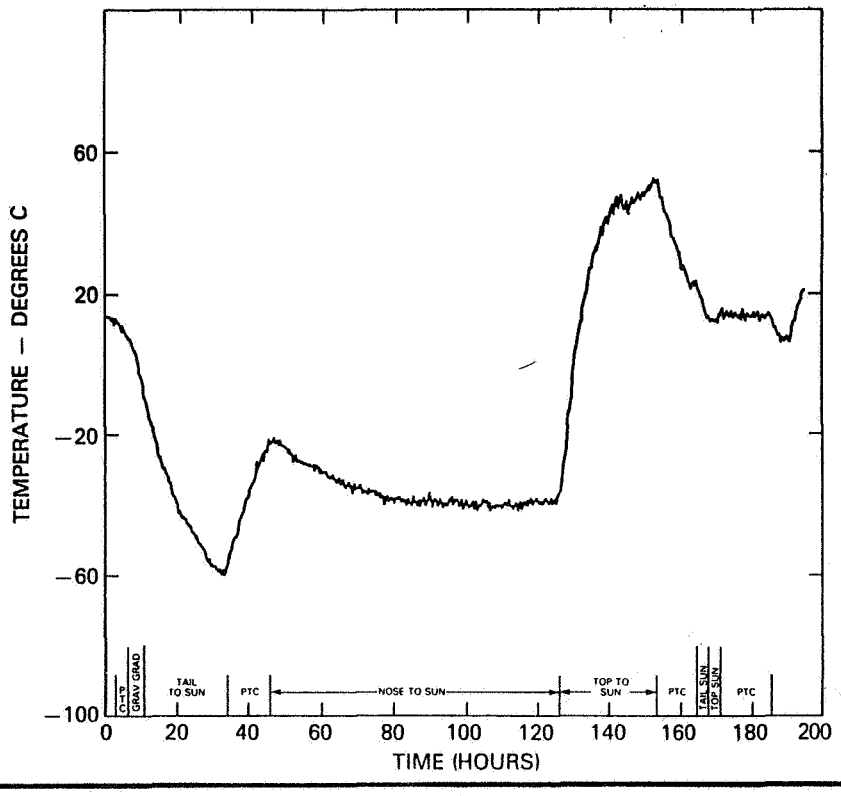
GAS – STS-3

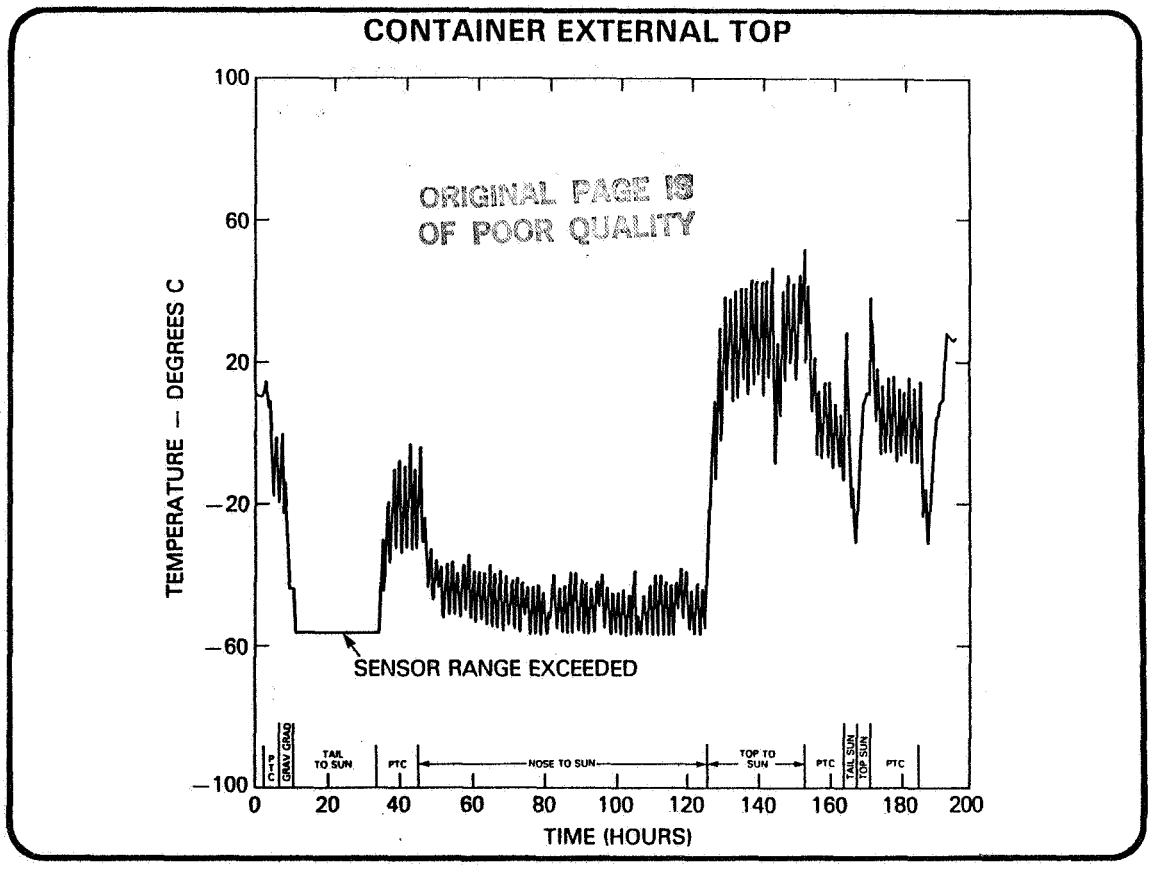


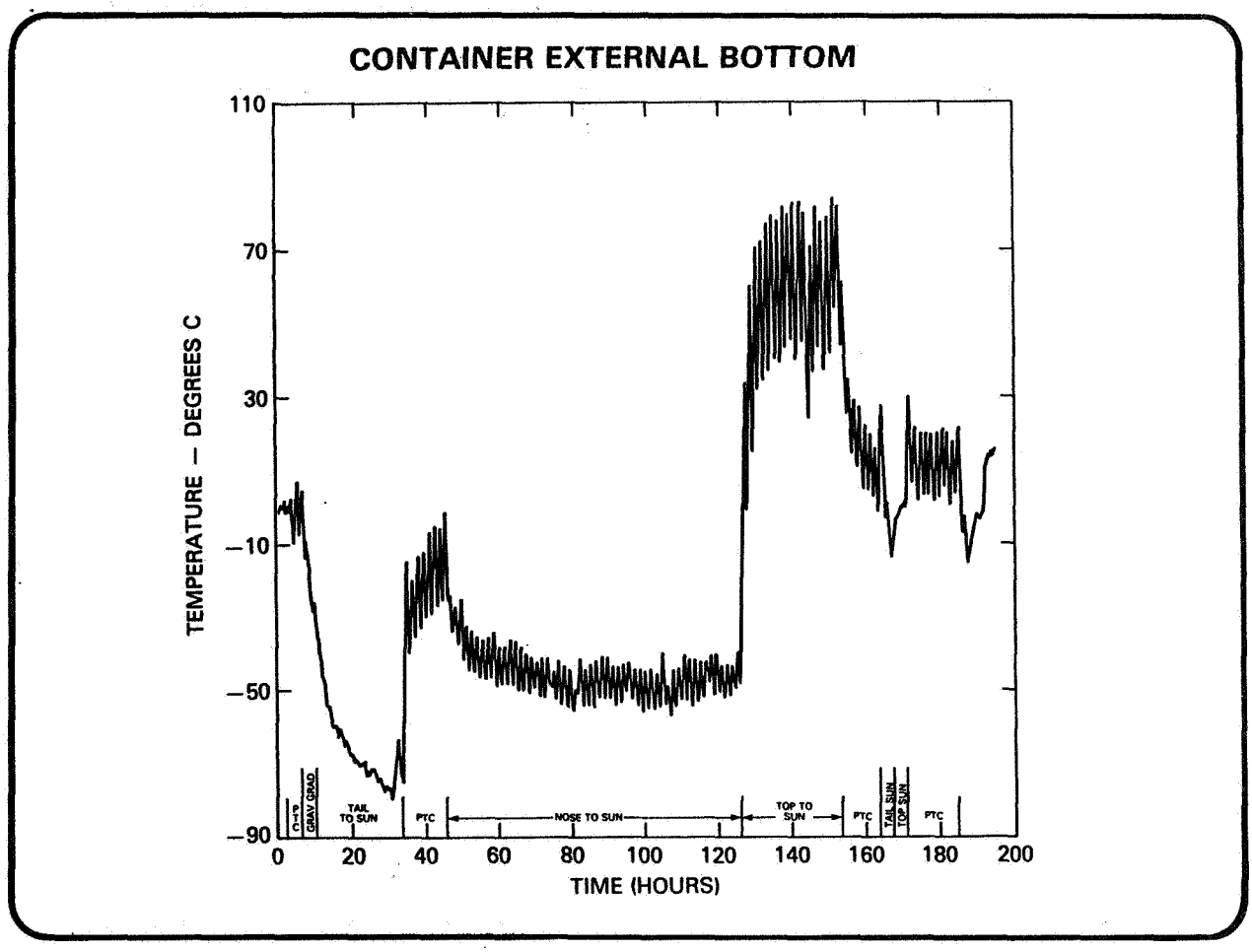
GSFC GAS CANS & ADAPTER BEAM EXTERNAL NODAL BREAKDOWS STS-3



ADAPTER BEAM FACE



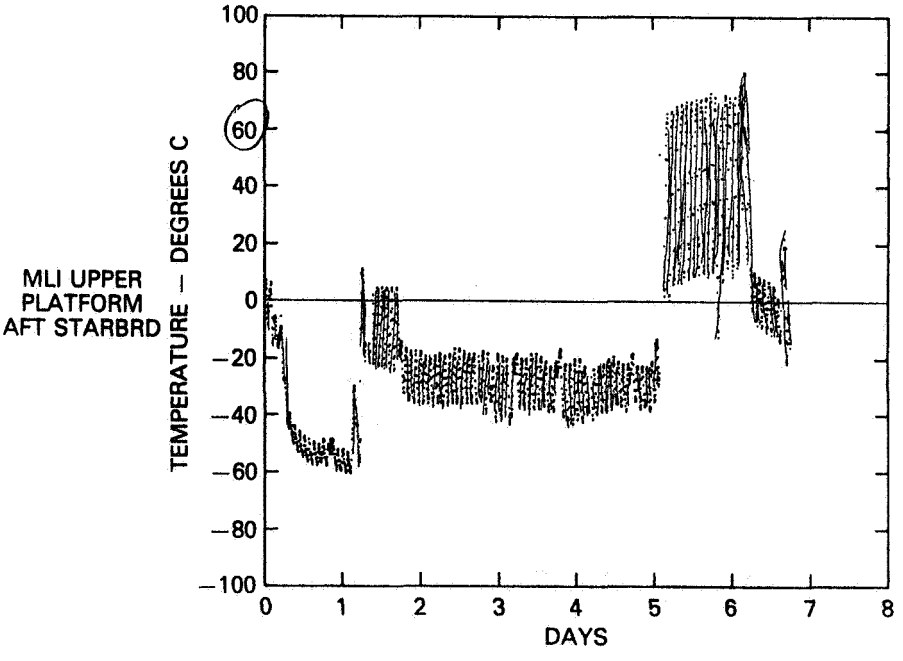

CONTAINER EXTERNAL TOP
ORIGINAL PAGE IS
OF POOR QUALITY
TEMPERATURE – DEGREES C
100
60
20
−20
−60
−100
SENSOR RANGE EXCEEDED
CHIP
GRAV GRAD
TAIL TO SUN
PTC
NOSE TO SUN
TOP TO SUN
PTC
TAIL SUN
TOP SUN
PTC
0
20
40
60
80
100
120
140
160
180
200
TIME (HOURS)


CONTAINER EXTERNAL BOTTOM
TEMPERATURE – DEGREES C
110
70
30
−10
−50
−90
CHIP
GRAV GRAD
TAIL TO SUN
PTC
NOSE TO SUN
TOP TO SUN
PTC
TAIL SUN
TOP SUN
PTC
0
20
40
60
80
100
120
140
160
180
200
TIME (HOURS)

GAS THERMAL RESULTS

	PREDICTIONS	FLIGHT
ADAPTER BEAM (HOT-BAY TO SUN)	$\pm$ 37°C $\pm$ 46°C (α = .32) (α = .36)	+ 45 TO + 50°C
ADAPTER BEAM (COLD-NOSE TO SUN)	−78°C	−40°C
BOTTOM COVER (HOT-BAY TO SUN)	+ 63°C	+ 60 TO + 65°C
BOTTOM COVER (COLD-NOSE TO SUN)	−76°C	−45 TO −50°C
TOP COVER (HOT-BAY TO SUN) (BRACKET)	+ 31°C	+ 25 TO + 35°C
TOP COVER (COLD-NOSE TO SUN) (BRACKET)	−73°C	−47 TO −51°C

OSS-1 THERMISTOR TEMPERATURES



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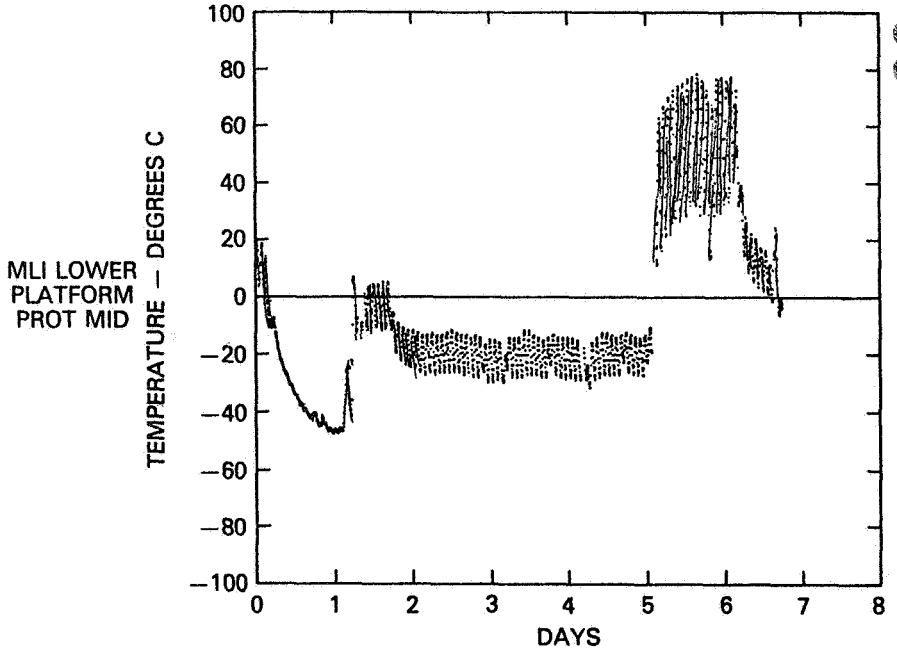
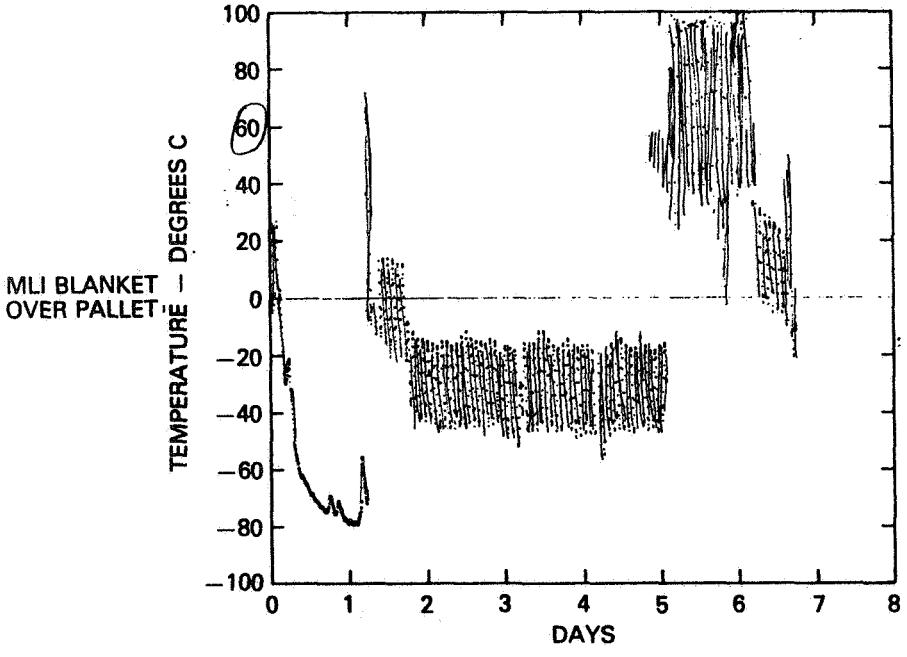


OSS-1 THERMISTOR TEMPERATURES



SUMMARY

- FLUX LEVELS MEASURED IN ALL STS ATTITUDES ARE HIGHER THAN PREDICTIONS
- IN COLD ($-Z_{LV}$) AND MODERATE ($\mp XS_I$) ATTITUDES FLIGHT RESULTS ARE A FACTOR OF 2 TO 3 HIGHER THAN PREDICTS
- IN HOT ATTITUDE MUCH BETTER AGREEMENT OCCURRED

CONCLUSIONS

- IN COLD OR MODERATE ATTITUDES OTHER SOURCES MAY BE CONTRIBUTING TO ADDED INPUTS I.E. ALBEDO, EARTH SHINE, SHUTTLE BACKGROUND, ETC.
- IN HOT ATTITUDE SMALLER DIFFERENCES COULD BE ATTRIBUTED TO COATINGS ASSUMPTIONS OR CALCULATION UNCERTAINTY

THERMAL CANISTER EXPERIMENT (TCE) RE-ENTRY DATA