ORBITER CARGO BAY THERMAL ENVIRONMENT DATA

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ORBITER CARGO BAY

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SEPTEMBER 1982

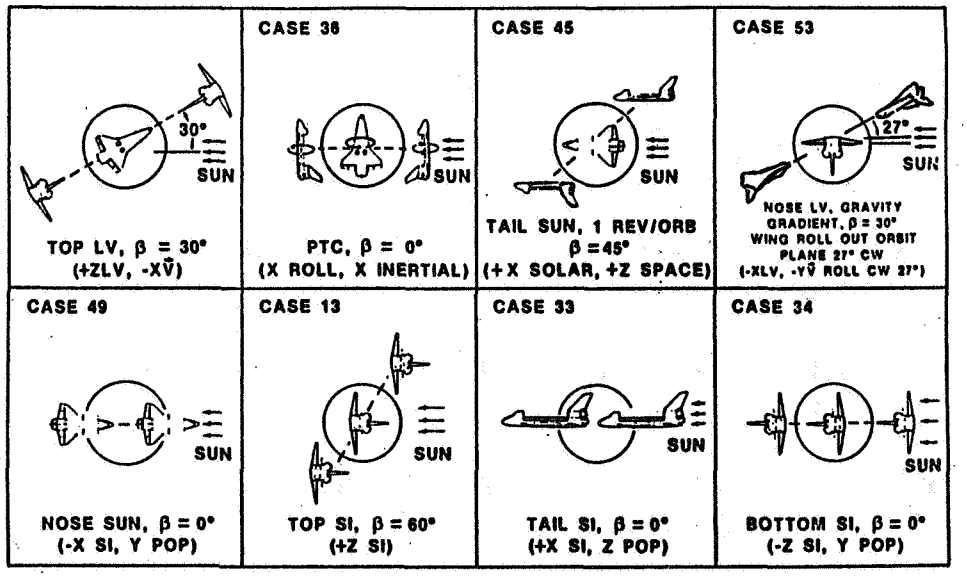
ORBITAL FLIGHT TEST THERMAL APPROACH

- CONSERVATIVE FLIGHT TEST TIMELINE
- FIRST FLIGHT THERMALLY BENIGN AS POSSIBLE
- EACH ADDITIONAL FLIGHT INCREASING IN THERMAL DIFFICULTY
- MEASUREMENT LOCATIONS DEFINED FOR ORBITER PERFORMANCE
- ORBITER MODEL PREDICTION COMPARISON FOR STS-1
- ORBITER MODEL CORRELATION BASED ON STS-2, STS-3 AND STS-4

ORBITAL FLIGHT TEST PROGRAM

	STS-1	STS-2	STS-3	STS-4
DATE	APRIL 12, 1981	NOVEMBER 12, 1981	MARCH 22, 1982	JUNE 27, 1982
BETA ANGLE	-26^{0} TO -19^{0}	-45^{0} TO -51^{0}	-23^{0} TO -36^{0}	-1 TO $+20^{0}$
MAJOR ATTITUDES FLOWN	SERIES OF SHORT HOLD ATTITUDES EXCEPT FOR TWO 9-9.5 HRS OF +ZLV	BASICALLY +ZLV	24 HRS TAIL SUN TOP TO SPACE ORB RATE 11 HRS PTC 80 HRS XSI (NOSE TO SUN 2 REV PER ORBIT ABOUT X-AXIS 27 HRS +ZSI (TOP 3-AXIS SI) 12 HRS PTC	10 HRS -ZSI (BOTTOM 3-AXIS SI) 7 HRS GRAVITY 12 HRS +ZLV (TOP 3-AXIS SI) 4½ HRS +ZSI 22 HRS -ZSI (BOTTOM 3-AXIS SI) 10 HRS PTC 61 HRS +XSI (TAIL 3-AXIS SI) 12 HRS PTC
END OF MISSION ATTITUDES	2 ORBITS TAIL TO SUN OPENED DOOR 2 ORBITS TOP TO SUN CLOSED DOOR	2 ORBITS TAIL TO SUN OPENED DOOR 2 ORBITS TOP TO SUN CLOSED DOOR	2 ORBITS TAIL TO SUN OPENED DOOR 2 ORBITS TOP TO SUN CLOSED DOOR	2 ORBITS TAIL TO SUN OPENED DOOR 2 ORBITS TOP TO SUN CLOSED DOOR

ORBITER ATTITUDES



CARGO BAY MEASUREMENTS

14 CARGO BAY INSULATION SURFACE TEMPERATURES

2 WIRE TRAY SURFACE TEMPERATURES

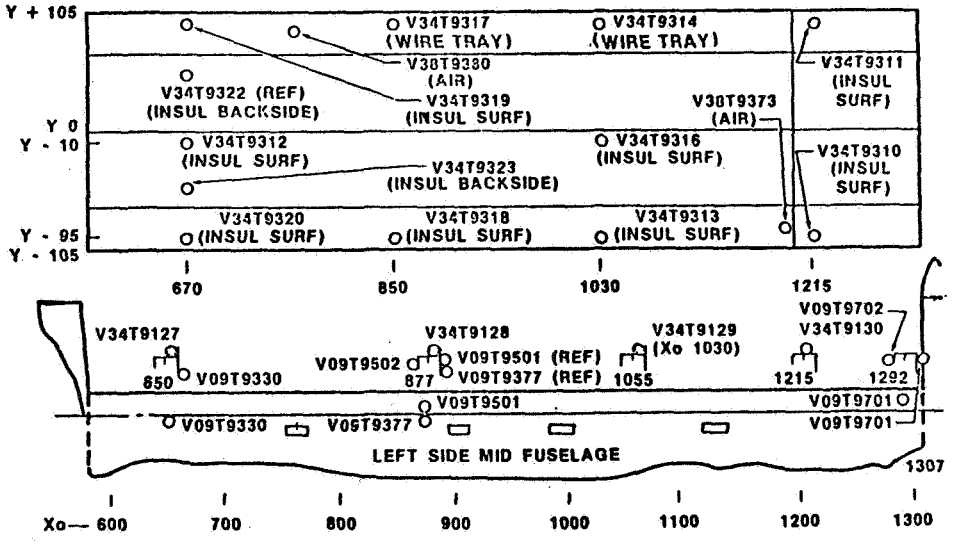
12 SILL LONGERON TEMPERATURES

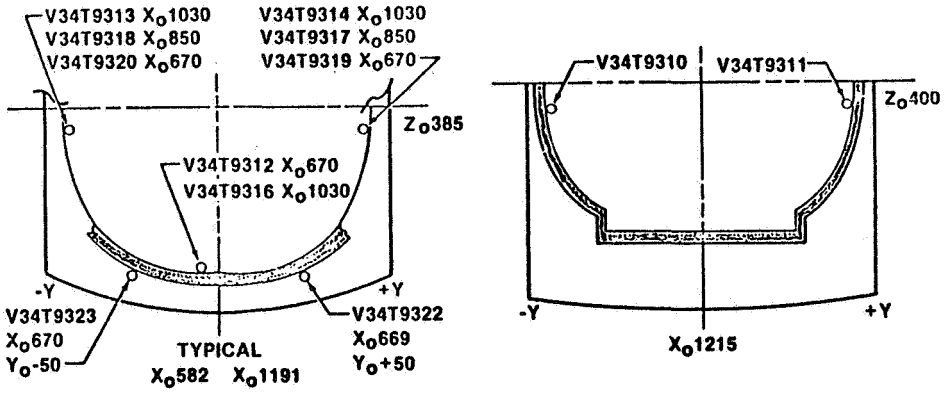
4 GAS TEMPERATURES

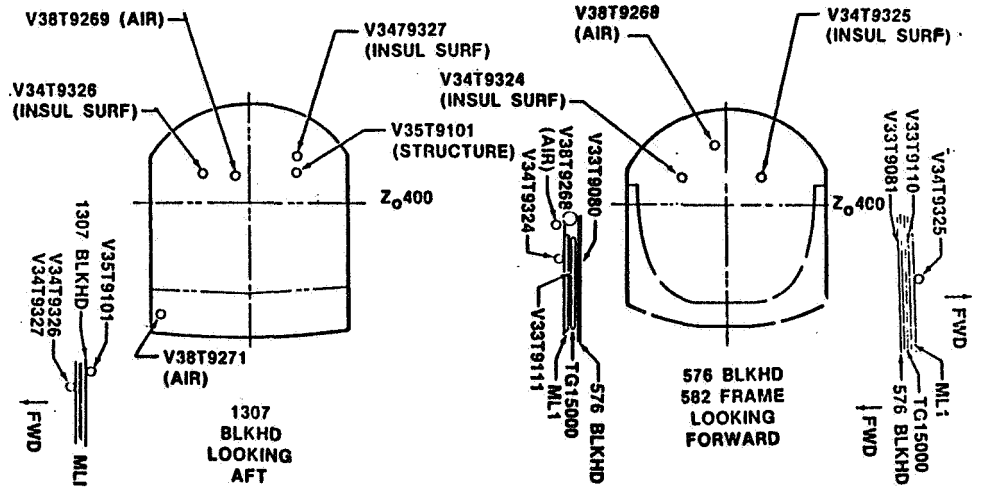
1 RADIATOR TEMPERATURE

1 GAS PRESSURE

CARGO BAY MEASUREMENT LOCATIONS







ORBITER PAYLOAD BAY

PRELAUNCH TEMPERATURES

	STS-1		STS-2		STS-3		STS-4	
	DATA °F	PREDICTION °F	DATA °F	PREDICTION °F	DATA °F	PREDICTION °F	DATA °F	PREDICTION °F
PURGE	80	80	70	70	70	70	70	70
AIR	80	80	70	70	70	70	70	70
LINER	80	80	70	70	70	70	70	70
LONGERON	75	70	70	70	70	70	70	70
FITTING	-	-	-	-	70	70	70	70
RADIATOR	75	75	70	70	70	70	70	70
BULKHEAD	80	80	70	70	70	70	70	70

ORBITER PAYLOAD BY

ASCENT TEMPERATURES

LIFTOFF/MIN/MAX

	STS-1		STS-2		STS-3		STS-4	
	DATA °F	PREDICTION °F	DATA °F	PREDICTION °F	DATA °F	PREDICTION °F	DATA °F	PREDICTION °F
LINER	80/62/84	80/36/97	70/50/65	70/24/80	70/50/65	70/24/80	70/50/65	70/24/80
LONGERON	75	70	70	70	70	70	70	70
FITTING	--	--	--	--	70	70	70	70
RADIATOR	75/65/70	75/65/75	70/57/60	70/60/70	70/57/60	70/60/70	70/57/60	70/60/70
BULKHEAD	80/50/70	80/30/80	70/50/70	70/30/80	70/50/70	70/30/80	70/50/70	70/30/80

ORBITER PAYLOAD BAY
ON-ORBIT TEMPERATURES
MIN/MAX

	STS-1 +ZLV $\beta \approx -30^{o}$		STS-2 +ZLV $\beta \approx -60^{o}$			
			PORT		STBD	
	DATA ^{o}F	PREDICTION ^{o}F	DATA ^{o}F	PREDICTION ^{o}F	DATA ^{o}F	PREDICTION ^{o}F
LINER	5/80	0/75	25/65	15/75	10/35	5/40
LONGERON	15/20	18/30	40/45	35/50	15/20	15/30
FITTING	-	-	-	-		
BULKHEAD	-10/+120	-25/+120	0/100	-10/115		

ORBITER PAYLOAD BAY
ON-ORBIT TEMPERATURES
MIN/MAX

	STS-3						STS-4		
	TAIL SUN ORB RATE		NOSE SUN 2 ORB RATE		TOP SUN		BOTTOM SUN	TAIL SUN	TOP SUN
	DATA ^{o}F	PRED ^{o}F	DATA ^{o}F	PRED ^{o}F	DATA ^{o}F	PRED ^{o}F	DATA ^{o}F	DATA ^{o}F	DATA ^{o}F
LINER	-153	-190	50/-100	50/-150	30/260*	0/200	30/-80	20/-100	210
LONGERON	-95/-50+	-90/-60	-40/-20+	-54/-30	100	115	-20	-40	-30
FITTING	-50	-60	-20	-35	125	140	-10	-35	110
BULKHEAD	-120	-55	20/-100	30/-130	0/100	-10/120	0/-80	30/-100	0/100

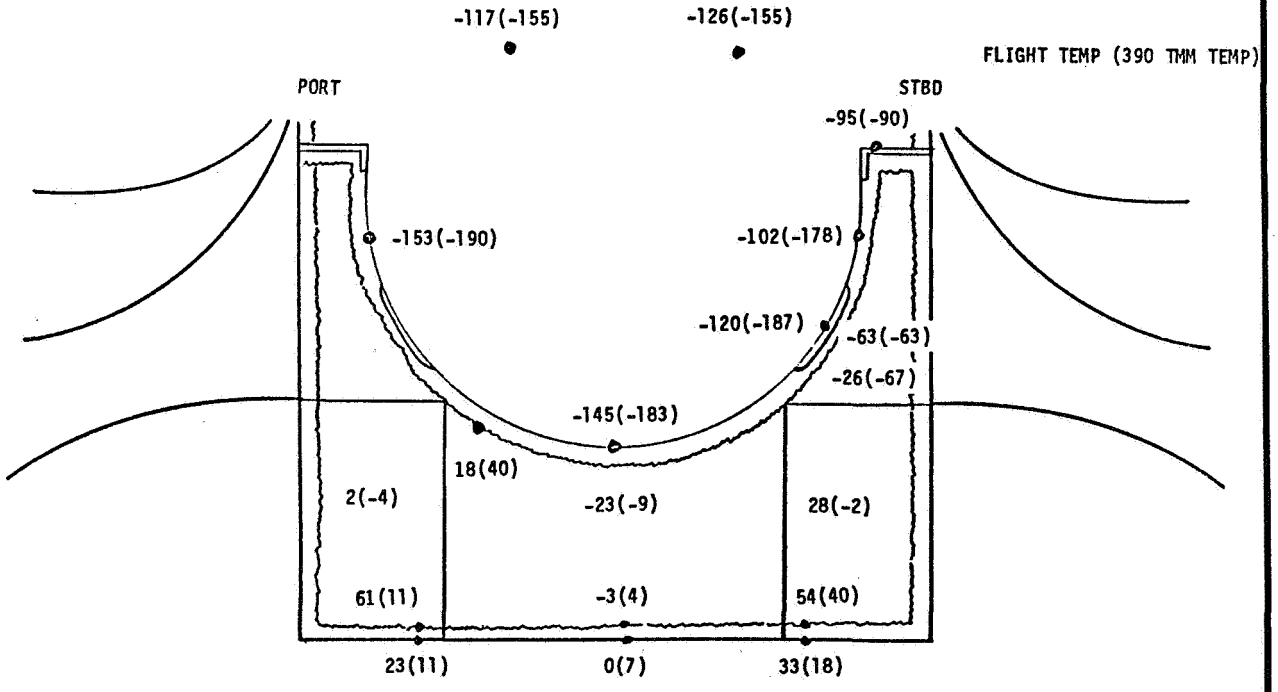
+ FWD/AFT LONGERON TEMPERATURE
* MEASUREMENT SUSPECT

ORBITER PAYLOAD BAY
ENTRY AND POSTLANDING TEMPERATURES
EI/TD/MAX*

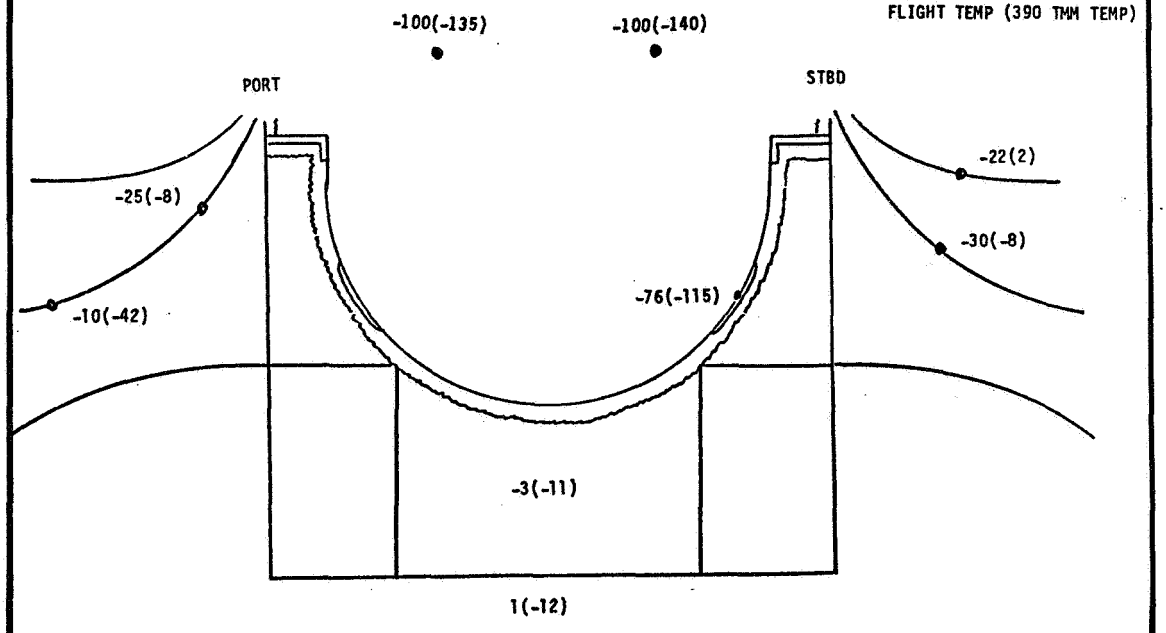
	STS-1		STS-2		STS-3		STS-4	
	DATA °F	PRED °F	DATA °F	PRED °F	DATA °F	PRED °F	DATA °F	PRED °F
PURGE**	55/65		55/65		55/65		55/65	
AIR[A]	- /45/80	- /50/80	- /70/80	- /105/105	- /60/85	-/105/105	- /70/80	
LINER	20/60/70	20/48/86	20/65/70	20/68/90	15/68/75	15/75/90	0/70/75	
LONGERON	3/30/75	3/25/70	10/40/70	10/30/60	5/60/70	5/45/65	0/50/75	
FITTING	-	-	-	-	15/65/70	-	10/60/75	
RADIATOR	10/32/80[B]	10/35/100	15/80/85[C]	15/85/95	20/80/85[C]	20/85/90	-5/75/80[C]	
BULKHEAD	20/50/65	20/42/87	20/60/65	20/42/87	15/60/70	15/65/80	0/65/75	

* MAXIMUM TEMPERATURES OCCUR AFTER TOUCHDOWN
** PURGE WAS 55°F INITIALLY, THEN INCREASED TO 65°F AFTER A FEW HOURS
A AIR MEASUREMENT APPEARS TO BE ENVIRONMENT TEMPERATURE
B RADIATOR FLOW FROM TD TO TD +15 MIN.
C RADIATOR FLOW FROM TD -6 MIN. TO TD +15 MIN.

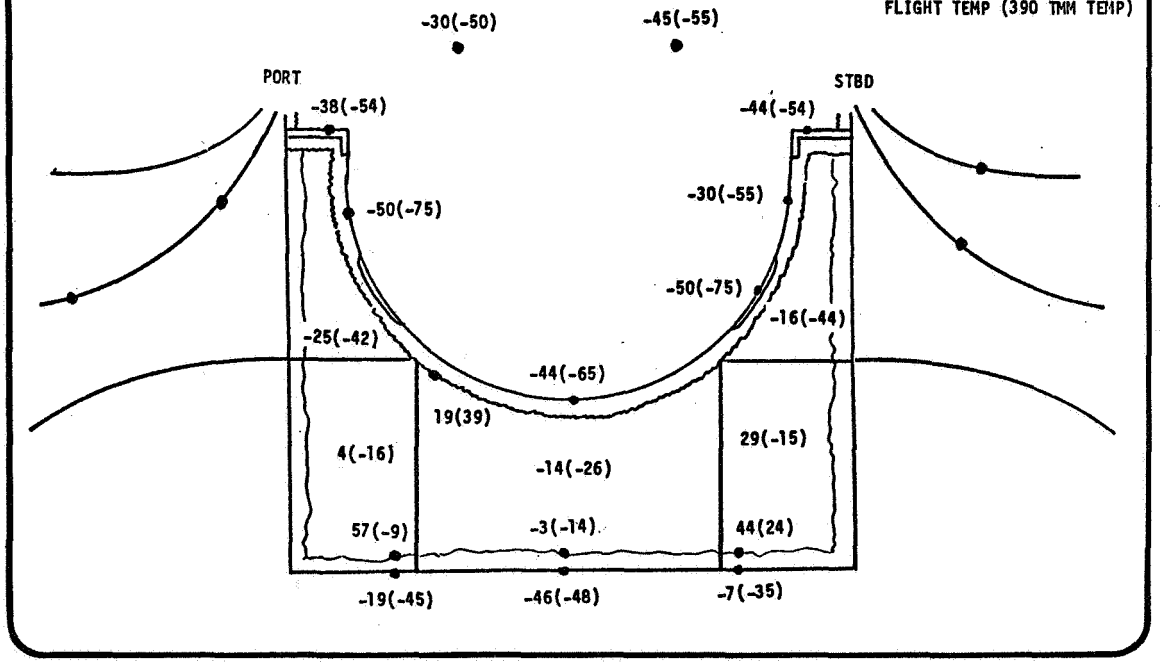
TMM/FLIGHT DATA COMPARISON
ORBIT AVERAGE TEMPERATURES
STS-3 TAIL SUN (22 HOURS)
FWD (X_0 = 584 - 919)



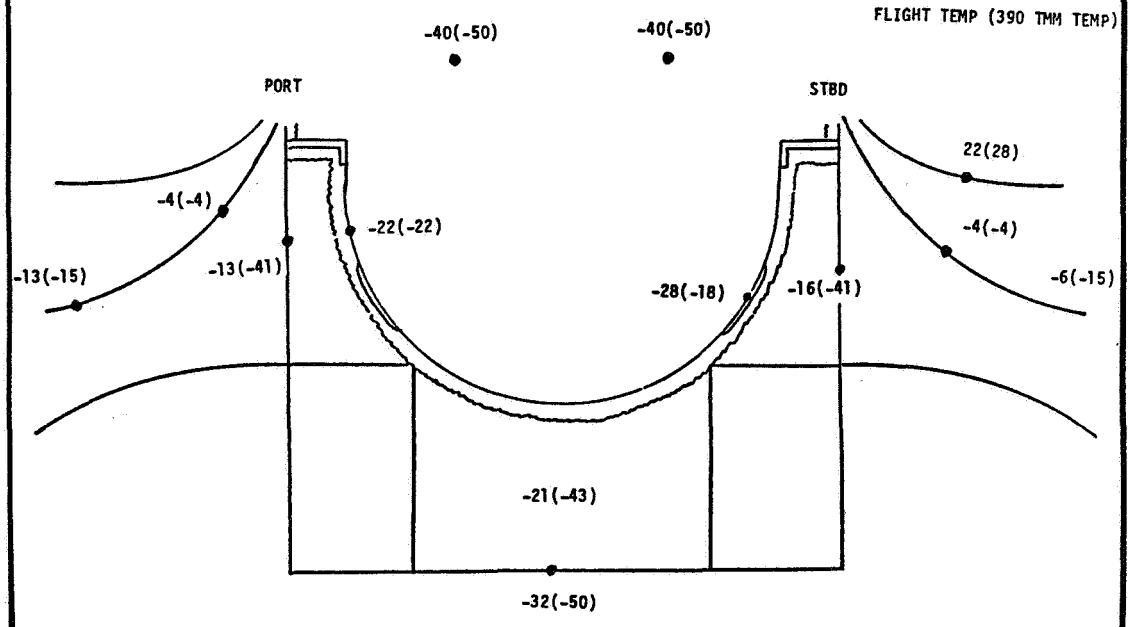
TMM/FLIGHT DATA COMPARISON
ORBIT AVERAGE TEMPERATURES
STS-3 TAIL SUN (22 HOURS)
AFT (X_0 = 919 - 1307)



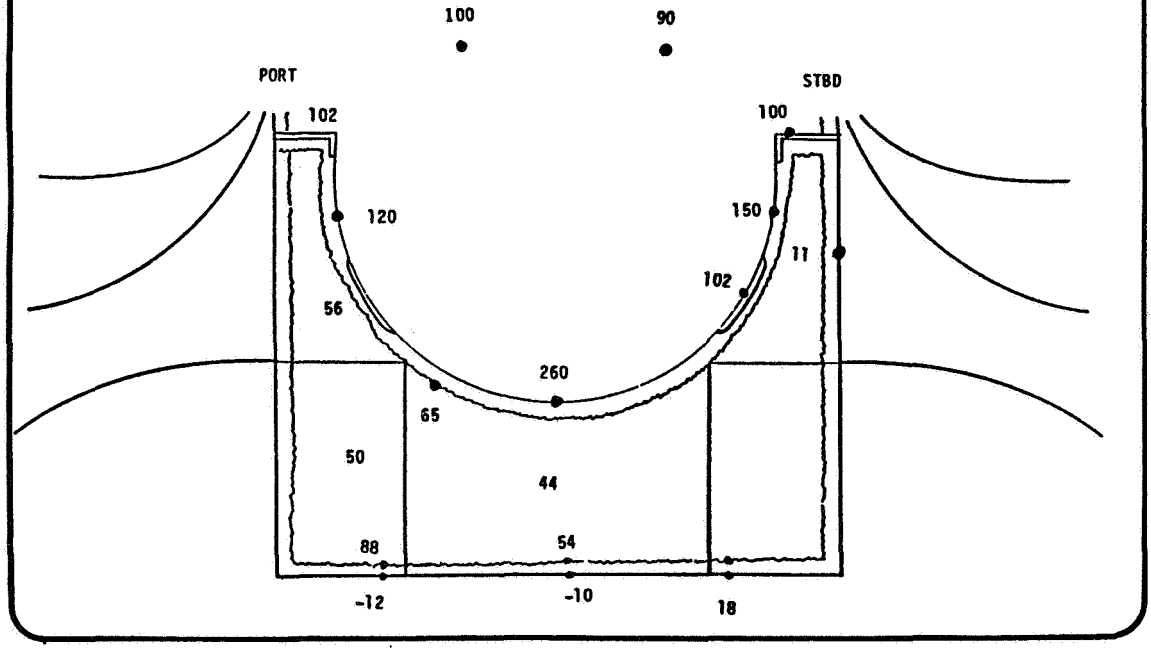
TMM/FLIGHT DATA COMPARISON
ORBIT AVERAGE TEMPERATURES
(STS-3 NOSE-SUN (78 HOURS)
FWD (X_0 = 584 - 919)



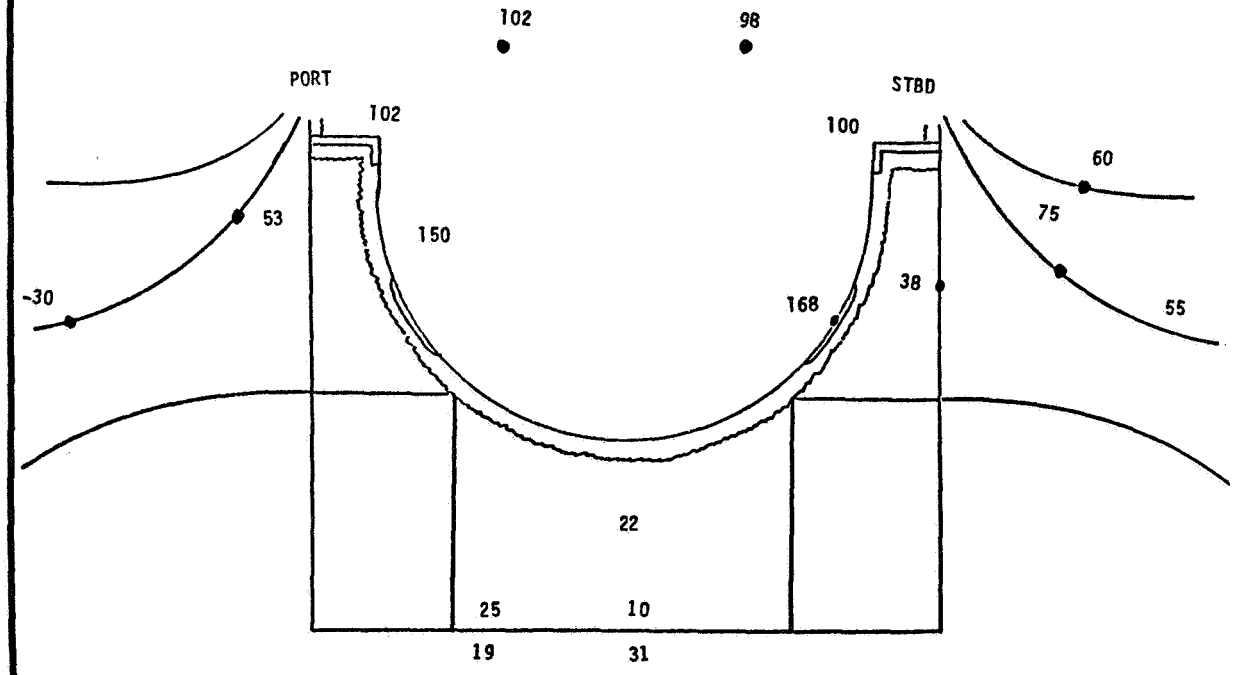
TMM/FLIGHT DATA COMPARISON
ORBIT AVERAGE TEMPERATURES
STS-3 NOSE-SUN (78 HOURS)
AFT (X_o = 919 - 1307)



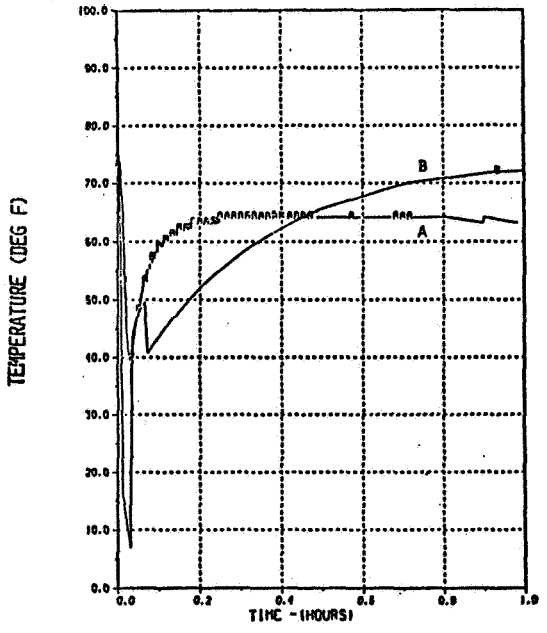
FLIGHT DATA
ORBIT MAXIMUM TEMPERATURES
STS-3 TOP SUN (24 HOURS)
FWD (X_o = 584 - 919)

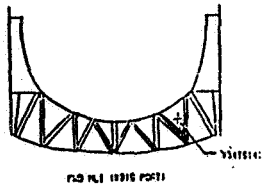


FLIGHT DATA
ORBIT MAXIMUM TEMPERATURES
STS-3 TOP SUN (24 HOURS)
AFT (X_0 = 919 - 1307)



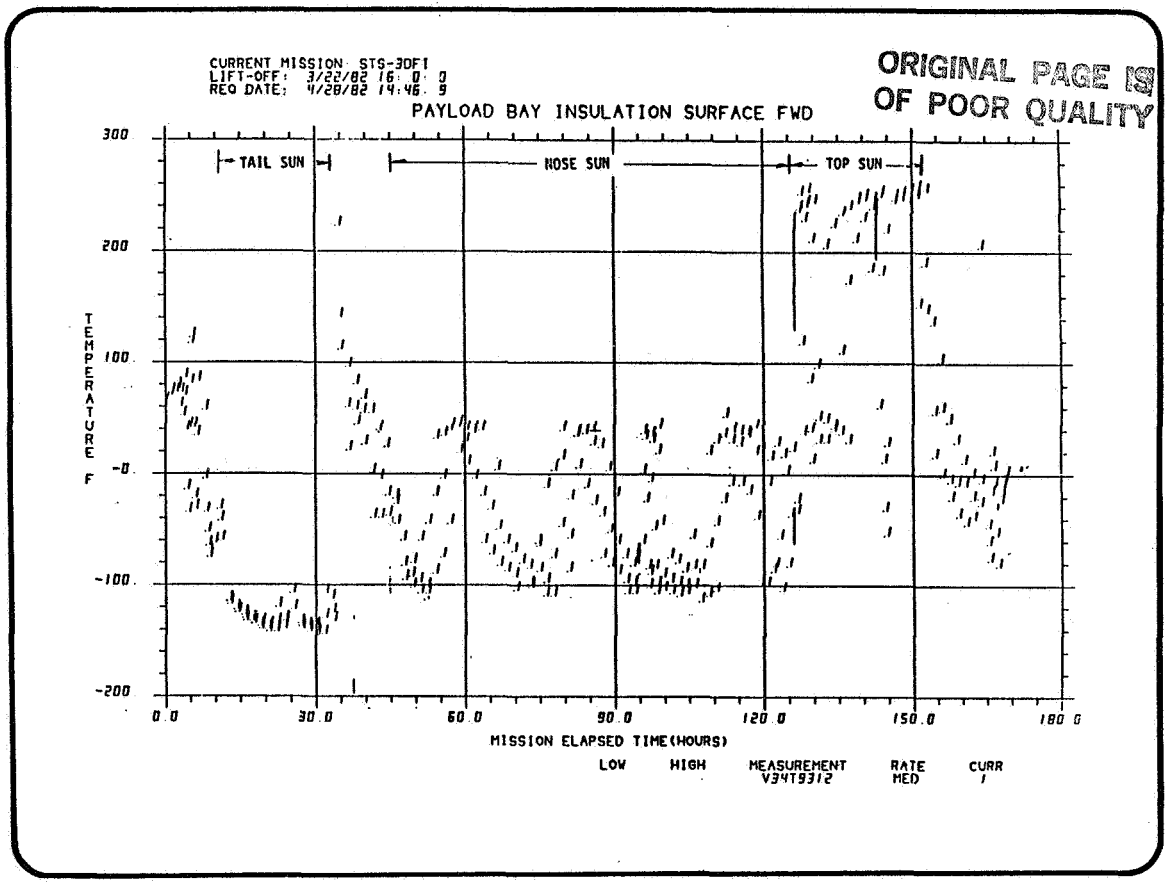
TMM/FLIGHT DATA COMPARISON
STS-2 ASCENT

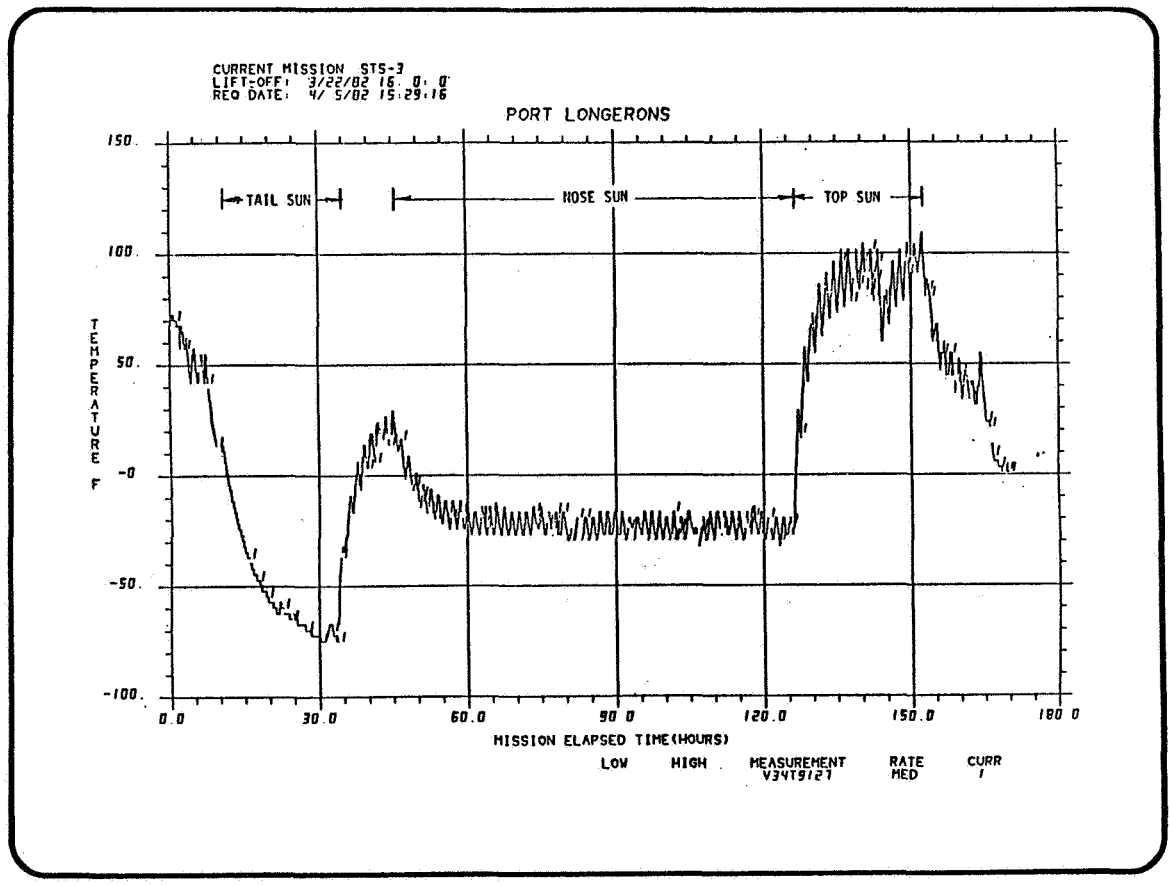




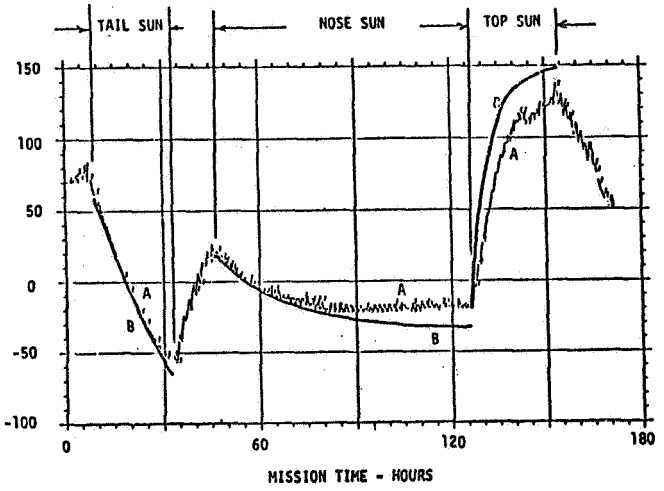
A - STS-2 FLIGHT DATA (V34T914
B - NODE 1268 PREDICTIONS

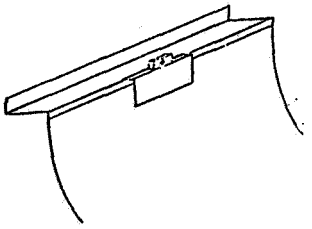
X_0 919 MLI CLOSEOUT (FWD)





DFI LONGERON RETENTION FITTING
- LATCH TEMPERATURE -



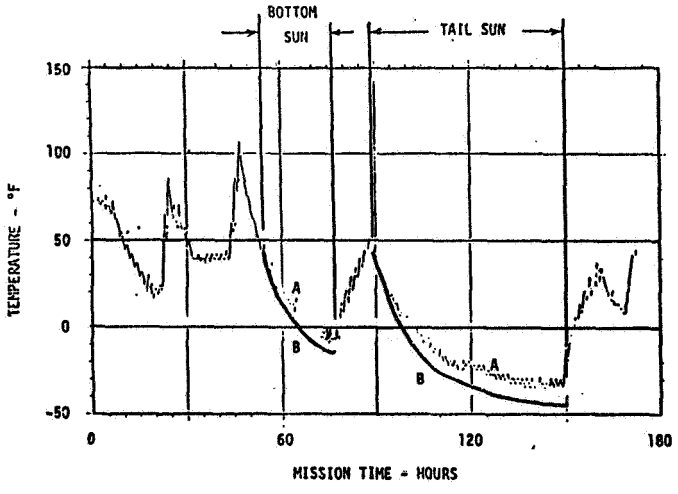


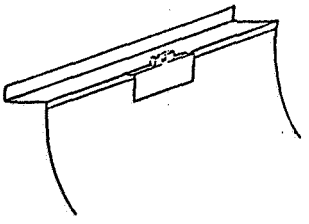
A - STS-3 FLIGHT DATA

B - SIMPLE RETENTION FITTING TMM

TMM/FLIGHT DATA COMPARISON

DFI LONGERON RETENTION FITTING
- LATCH TEMPERATURE -





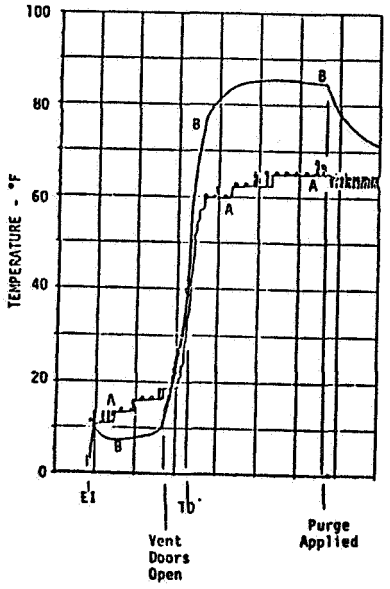
A - STS-4 FLIGHT DATA

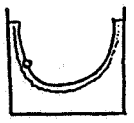
B - SIMPLE RETENTION FITTING TMM

TMM/FLIGHT DATA COMPARISON

STS-3 ENTRY

FWD LINER (X_o=670)

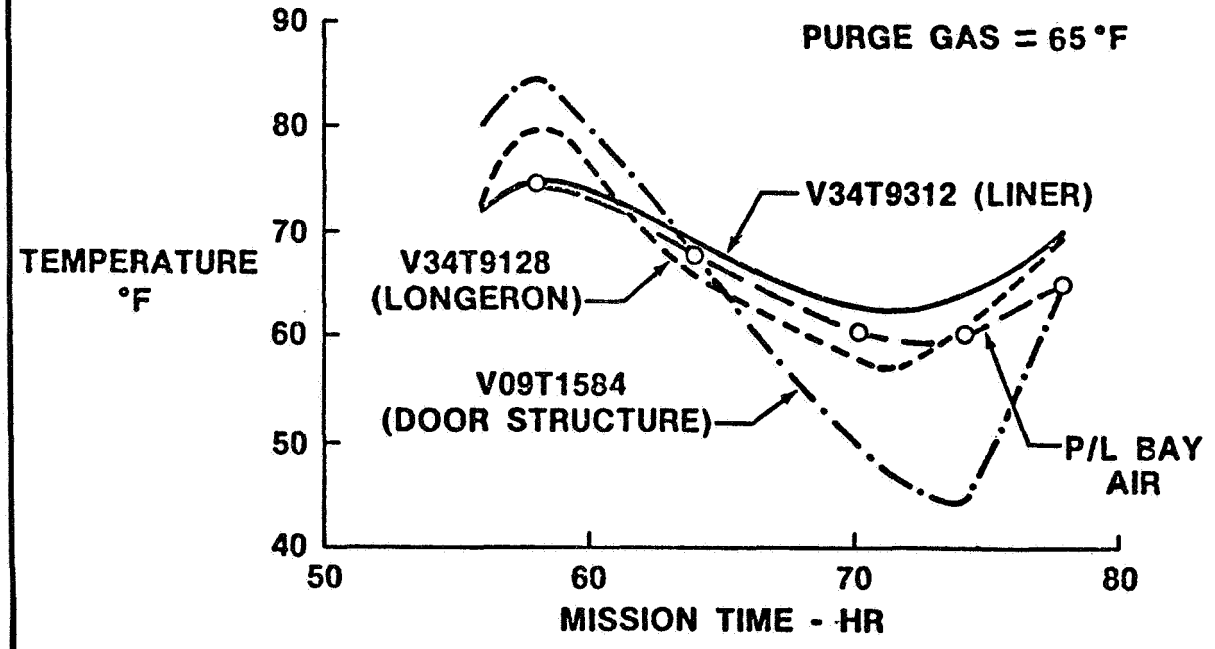




A - STS-3 FLIGHT DATA

B - 390 TMM

STS-1 POSTLANDING TEMPERATURES



CONCLUSION

- IN GENERAL THE FLIGHT THERMAL ENVIRONMENT IS LESS SEVERE THAN PREDICTIONS EXCEPT FOR POSSIBLY TOP SUN.

- NO ADVERSE THERMAL EFFECT ON THE ORBITER OR PAYLOAD AS A RESULT OF INTERACTION FOR PAYLOADS FLOWN ON THE FIRST FOUR FLIGHTS.