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(NASA-CR-147639) RESULTS OF THE LOW SPEED AEROELASTIC BUFFET TEST WITH A 0.046-SCALE MODEL (747-AX1322-D-3/ORBITER 8-0) OF THE 747 CAM/ORBITER IN THE UNIVERSITY OF WASHINGTON WIND TUNNEL (CS 3) (Chrysler G3/16

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AEROTHERMODYNAMIC DATA REPORT

JOHNSON SPACE CENTER

HOUSTON, TEXAS

DATA MANagement services

SPACE DIVISION CHRYSLER CORPORATION

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RESULTS OF THE LOW SPEED AEROELASTIC BUFFET TEST WITH A 0.046-SCALE MODEL (747-AX1322D-3/ORBITER 8-0) OF THE 747 CAM/ORBITER IN THE UNIVERSITY OF WASHINGTON WIND TUNNEL (CS3)

by

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Prepared under NASA Contract Number NAS9-13247

by

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for

Engineering Analysis Division

Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number:	UWAL 1170
NASA Series Number:	CS3
Model Number:	747-AX1322D-3; Orbiter 8-0
Test Dates:	September 15 to 19, 1975
Occupancy Hours:	80

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WITH A 0.046-SCALE MODEL (747-AX1322D-3/ORBITER 8-0)

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ABSTRACT

Test CS3 (UWAL 1170) was part of a series of wind tunnel studies designed to assess the potential buffet problems resulting from orbiter wake characteristics with its tailcone removed, to provide design loads and acceleration environments, and to develop data on buffet sensitivity to various aerodynamic configurations and flight parameters. Data contained in this report, taken in large part from References 1, 4, and 6, are intended to support subsequent analyses of structural fatigue life, crew efficiency, and equipment vibrations.

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INTRODUCTION

To accomplish the objectives of this test, a 0.046 scale low speed aeroelastic buffet model (AX1322D-3) was tested on both rod and pylon mount systems in the University of Washington Wind Tunnel. Scope of the CS3 test was confined to ALT mission investigations to determine what attenuations relative to tailcone off buffet response levels could be achieved with several aerodynamic devices including full tailcone, partial tailcones, and air scoop flow deflectors. Orbiter body flap settings were varied in combination with these devices. In addition to these configurations, the test covered the ALT configuration with tailcone removed, the post-launch unmated Type 2 configuration and Type 1 clean airplane. Orbiter incidence was varied from 3° to 8° and flight conditions covered the ALT mission envelope. Attitude variations included angle of attack variations from -2° to $+6^{\circ}$ and sideslip variations from 0° to 5°.

The primary source of information for this report is Reference 6.

NOMENCLATURE

SYMBOL	DEFINITION
a	acceleration
A	accelerometer designation
ACCEL.	accelerometer (sensor)
AFUS	aft fuselage
ALT	approach and landing test orbiter
A/P	airplane
A_{sc}	area of scoop plate
B.F.	body flap (orbiter)
B.M.,BM	bending moment
B.S.	body station
CAM	carrier aircraft modification
CH.	channel (magnetic tape)
CPS	cycles per second
d	characteristic dimension for Strouhal number
DEG.	degrees
EA	elastic axis
EAS	equivalent airspeed
f	frequency
FFUS	forward fuselage
FREQ.	frequency
FT.	feet
FUS	fuselage

NOMENCLATURE (Continued)

SYMBOL	DEFINITION
g (or) G	gravity unit
h	altitude
HGT.	height (scoop)
HORIZ.	horizontal
HTAIL	horizontal tail
HZ	hertz
i_o	orbiter incidence angle
i_{sc}	scoop plate incidence angle
IM	inboard main wing fuel
inc	incompressible
IN-LB	inch-pound
IN-GMS	inch-grams
INAC	inboard nacelle
INBD.	inboard
KCAS	knots calibrated airspeed
KTAS	knots true airspeed
KEAS	knots equivalent airspeed
(L)	lateral axis
LAT.	lateral axis
LH	left hand
M	Mach number
MPH	miles per hour

NOMENCLATURE (Continued)

SYMBOL	DEFINITION
MTD.	mounted (as related to partial tailcone)
NOM.	nominal
mv	millivolts
OM	outboard main wing fuel
ONAC	outboard nacelle
ORB.	orbiter
OUTBD.	outboard
POS.	position
P.S.D./PSD	power spectral density
P.T.C.	partial tailcone
R	reserve wing fuel
REF	reference
R.H.	right hand
RI-SD	Rockwell International Space Division
R_{SC}	radial distance from nozzle reference to scoop edge, inches, full scale
RMS	root mean square
S	Strouhal number where $S = \frac{fd}{V}$
S.B.L./SBL	stabilizer butt line
SENS.	sensor
S.G.	strain gage

NOMENCLATURE (Continued)

SYMBOL	DEFINITION
STA	station
STAB	stabilizer
TAS	true airspeed
T.C.	tailcone fairing
UWAL	University of Washington Aeronautical Laboratory
V	airspeed
(V)	vertical axis
VTAIL	vertical tail
VERT	vertical axis
W.L.	waterline
X_O	orbiter body station
Z_O	orbiter waterline station
α	angle of attack
α_{FRL}	angle of attack relative to fuselage reference line
α_{WDP}	angle of attack relative to wing design plane
β	sideslip angle
δ_{BF}	orbiter body flap angle relative to orbiter fuselage reference line
ϕ_{sc}	scoop azimuth or toe-out angle
δ_{FRL}	stabilizer trim angle relative to fuselage reference line
σ	incremented response (Grms or BMrms)

NOMENCLATURE (Continued)

SYMBOL	DEFINITION
B.L./BL	BUTTOCK LINE
$\bar{c}$	mean aerodynamic chord
CL	centerline
FRL	fuselage reference line
IML	inner mold line
HL	hinge line
MPS	main propulsion system
MS	model station
OML	outer mold line
OMS	orbital maneuvering station
V_{CFB}	critical fin buffet velocity
V_D	design dive speed
WBL	water buttock line
X,Y,Z	lateral, spanwise, and vertical dimensions
Y_o	orbiter lateral distance from centerline
δ_{SC}	radial scoop measurement, inches
δ_{SP}	spoiler deflection angle
σ	used to denote incremental data (defined in text)

SUBSCRIPTS	DEFINITION
A	airplane scale
BF	body flap
e	equivalent (airspeed)
FRL	fuselage reference line
INC (or) inc	incompressible
M	model scale
O	orbiter
rms	root mean square value
sc	scoop
t	true (airspeed)
WDP	wing design plane

CONFIGURATIONS INVESTIGATED

The test article, a low speed, subsonic, dynamically-scaled aeroelastic model of the 747 CAM, used components of the existing TE1094 and TE995 commercial airplane 747 model, the required CAM unique components to simulate the carrier airplane, and a compatible 0.046 scale model of the orbiter payload furnished by Rockwell International Space Division. The composite model consisted of Boeing carrier airplane model AX1322D-3 and the RI-SD orbiter model 8-0. The airplane/orbiter interface was located at the rigid mounting pads provided in the orbiter model. The mated and unmated configurations were tested on a rod mount system in a clean gear-up configuration. No control surfaces were modeled. The airplane model featured flexible body, wing, nacelle struts, vertical tail, horizontal tail, orbiter support struts (including effect of local bulkhead flexibility), and tip fin attach braces. Rigid tip fin surfaces were used. The orbiter payload consisted of a rigid mass simulated model with a roll root spring flexure for the vertical tail that was "locked out" for complete rigid orbiter testing. A removable tailcone was provided simulating the RI-SD designated TC-4 or X3B shape. Provisions were made in the orbiter support system to vary orbiter incidence angle from 3 to 8 degrees up relative to fuselage reference line (FRL). Figure 2d shows a scaled schematic of the mated vehicle installation.

Initial testing was with the model mounted on a rod support to confirm the buffet levels measured in the CS1 test, Reference 2, and to establish a baseline buffet level for the Type I unmated configuration.

The remainder of the testing was conducted with the model mounted on a rigid pylon so that the angles of attack and yaw could be controlled. Provisions were made to simulate the rigid body motions of the horizontal tail, yaw and roll, due to attachment flexibilities.

The airplane model consisted of a conventional spar-section type of construction to obtain required component stiffness distributions. Single beam spars were used to represent the body, wing, vertical tail, and horizontal tail. Fairing sections were provided to obtain aerodynamic contours, and weights were added as required to simulate mass properties. Nacelles were elastically attached to the wing spar with vertical and side bending flexures. Orbiter supports were designed to simulate the stiffness coefficients of influence at the 3 orbiter attach points. The asymmetry and end conditions of the actual truss support system were modeled. A 2- strut brace system was used to simulate a 4- strut tip fin attach system. The .03 inch diameter wire braces were contained within non-load-carrying jackets which prevent buckling and provide aerodynamic shape. The rigid orbiter was designed around a 3.0 inch diameter tubular aluminum spar. Aerodynamic shape was provided by balsa frames, balsa stringers, and a urethane foam-fiberglass skin shell structure. The rigid tail was built around a single spar and featured a torsion flexure at the root attach. The orbiter was designed to be removable from the rod mount without rod disassembly.

CONFIGURATIONS INVESTIGATED (Continued)

The 747 CAM and orbiter model components were designated as follows:

747 CAM

A1	Aileron (inboard)
A2	Aileron (outboard)
$B_{27.8}$	Body
F_o	Flaps
$H_{15.1A}$	Horizontal tail
$H_{15.6A}$	Horizontal tail (with tip fins)
M_{25}	Inboard nacelle strut
$M_{26.8}$	Outboard nacelle strut
N_{57}	Inboard fan cowl
N_{58}	Outboard fan cowl
S_{1-12}	Spoiler/speed brakes
T_{19}	Flap track fairings
$V_{9.1}$	Vertical tail
$W_{44.1}$	Wing
$X_{18.4}$	Wing-body fairing

ORBITER

B_{26}	Body
C_9	Canopy
F_8	Body flap
M_{16}	OMS pod
N_{24}	MPS nozzles

CONFIGURATIONS INVESTIGATED (Concluded)

ORBITER - (Continued)

N_{28}	OMS nozzles
R_5	Rudder
$TC_{5.1}$	Tailcone
V_8	Vertical
W_{116}	Wing

Detailed Dimensional Data are presented in Table III.

INSTRUMENTATION

Instrumentation consisted of 11 accelerometers in the carrier airplane and 3 accelerometers in the orbiter. In addition to these, there were 3 bending strain gages in the spar root areas of the airplane empennage and 1 bending strain gage in the orbiter vertical tail spar root area. Further information on instrumentation can be found in References 1, 4, and 6.

TEST FACILITY DESCRIPTION

The UWAL tunnel is a closed circuit, double-return type with an 8 x 12 foot test section vented to the atmosphere. Two synchronized fans, one in each return duct, are electrically driven and can develop wind velocities up to 250 mph (dynamic pressures up to 160 psf) in the test section.

The balance system located directly below the test is capable of measuring six components simultaneously. The method of model mounting, along with the balance system, allows testing over a wide range of pitch and yaw angles with rapid positioning possible for any combination of angles. The balance is designed to measure all forces and moments with respect to the wind axis at the balance-moment center located on the tunnel axis. The forces and moments are then transmitted to an automatic read-out system where the data are simultaneously punched out on IBM cards, typed on a data sheet, and plotted on automatic plotters. If desired, the balance support strut and fairing can be removed from the test section so that the test section is free and clear of all obstructions.

The automatic read-out equipment is capable of recording 3 six-component data points per minute. The forces and moments are separated by the balance and transmitted to the automatic read-out system, then simultaneously punched out on IBM cards and typed out on a data-sheet. Any four of the six-components may be plotted on automatic plotters.

These data are then submitted to a CDC6400 computer, using a UWAL program designed to include all corrections which are to be made to the data. The output from the computer consists of another set of IBM cards on which the final, corrected coefficients are punched. These cards are then printed out using an IBM listing machine and can be used directly for data comparison or used for plotting purposes.

TEST PROCEDURE

For the rod mounted test condition, the model was trimmed with the horizontal tail. The model generally flies at about a 2° angle of attack relative to the fuselage reference line (FRL). For the pylon mounted test condition, the angles of attack and yaw were set prior to starting the tunnel. The tunnel speed was increased in increments from 40 mph to 110 mph. Speed was held constant at particular levels for sufficient time intervals to obtain constant speed response data for PSD (power spectral density) analysis.

DATA REDUCTION

Buffet response data were acquired through use of accelerometers and bending strain gages. The system utilized all sensors from the CS1 flutter/buffet test plus additional accelerometers in the horizontal stabilizer and tip fin area. Data reduction and documented results are limited to primary sensors. All data were recorded on magnetic tape using data samples ranging from 120 - 500 seconds for spectral analysis. On-line data were obtained using true RMS voltmeters. In general, these data show fair agreement with integrated power spectral density results. The Appendix of this report provides a complete tabulation of on-line results. High speed motion picture film also supplied visual records of response motions and tuft action from top, side and rear camera positions.

The effect of tunnel turbulence has been accounted for using an incremental approach similar to the technique described in Reference 5. The technique uses the square root of the difference of the squares to separate out those responses considered to be unrelated to the pure orbiter wake effect. The Type 1 clean airplane is used as the reference response level for 747 airplane responses, and the Type 2 mated ALT with full tailcone and faired body flap was used as the reference response level for orbiter responses. Throughout the report the symbol σ is used to denote incremented data where:

$$\sigma S_{rms} = \sqrt{(S_{rms})^2 - (S_{rms})^2_{REF}}$$

and S = Overall rms response level integrated from PSD plots or obtained from true rms meter readings for on-line data.

CONCLUDING REMARKS

The general results were consistent with the conclusions of CS1 buffet surveys (Reference 2) which indicated unacceptable buffet responses for tailcone off configurations with $\delta_{BF} = 0^\circ$ and acceptable response levels with the use of the full tailcone and faired body flap ($\delta_{BF} = -11.7^\circ$). The use of alternate aerodynamic devices yielded results reasonably consistent with the MA24 and CA16 investigations at Texas A&M (Reference 3). These approaches produced response levels lying between the tailcone on-off extremes.

The results indicate considerable configuration sensitivity for vertical fin buffet loads and less sensitivity for horizontal stabilizer buffet loads. Body flap setting was identified as a key parameter with the faired position generally resulting in lower loads over the average of all mission conditions when used without the scoops and partial tail-cones. The most favorable body flap position for scoops was $\delta_{BF} = 0^\circ$, and was generally most favorable in the range of $\delta_{BF} = 0^\circ$ to $+10^\circ$ for partial tailcones.

Ride comfort and crew efficiency data were obtained from rod mount test results. The 747 cockpit accelerations are most sensitive to configuration changes with the lateral direction appearing more critical than the vertical direction. The orbiter cockpit accelerations are less severe and less sensitive to configuration effects. These rod mount studies were limited in scope, and data are not available for all of the scoop, tailcone, and body flap combinations.

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1. D180-18838-2, "Preliminary Summary Report for the CS-3 Aeroelastic Buffet Test of the 747 CAM/Orbiter in the University of Washington Wind Tunnel," October 1975.

2. D6-34100-1, "Final Report on the CS-1 Low Speed Flutter Model Test (UWAL 1160) of the 747 CAM with the Space Shuttle Orbiter, August 1975.

3. RI-SD Letter SAS/AERO/75-523, "Wake Survey Behind Orbiter in the Proximity of the 747 Vertical Stabilizer (Texas A&M Wind Tunnel) and 747 Vertical Root Bending Hinge Moments (MA24)," August 20, 1975.

4. D180-18838-1, "Pretest Information for the CS-3 Aeroelastic Buffet Test of the 747 CAM/Orbiter in the UWAL Wind Tunnel," August 1975.

5. NASA TND-7066, "Evaluation of an Aeroelastic Model Technique for Predicting Airplane Buffet Loads," Perry W. Hanson, Langley Research Center, February, 1973.

6. D180-18838-3, "Final Report on the CS-3 Aeroelastic Buffet Test of the 747 CAM/Orbiter in the University of Washington Wind Tunnel," November, 1975.

TABLE I. TEST CONDITIONS

TUNNEL SPEED (MPH TAS)	AIRCRAFT EQUIVALENT AIRSPEED SIMULATED (KNOTS)	ALTITUDE SIMULATED (FEET)
40	141	16,000
55	191	
70	244	
90	314	
100	348	

TABLE II. SUMMARY OF CONDITIONS TESTED

a. Rod Mounted Model

CONFIGURATION				TAIL CONE		BODY FLAP		MODEL SPEED MPH TAS: 55	70	90	100	110
CAM TYPE	MATED	UNMATED	i_o DEG	ON/OFF	VENTS	δ_{BF}	SCOOPS					
I		X	—	—	—	—	—		X	X	X	X
II		X	—	—	—	—	—		X	X	X	X
II	X		3	ON	NO	-11.7	—		X	X	X	X
II	X		6	ON	NO	-11.7	—		X	X	X	X
II	X		8	ON	NO	-11.7	—		X	X	X	X
II	X		3	ON	YES	-11.7	—		X	X	X	X
II	X		6	ON	YES	-11.7	—		X	X	X	X
II	X		8	ON	YES	-11.7	—		X	X	X	X
II	X		3	OFF	—	0	—	X	X	X	X	X
II	X		6	OFF	—	0	—	X	X	X	X	
II	X		8	OFF	—	0	—	X	X	X	X	
II	X		3	OFF	—	0	NOMINAL	X	X	X	X	
II	X		6	OFF	—	0	NOMINAL	X	X	X	X	
II	X		8	OFF	—	0	NOMINAL	X	X	X	X	

TABLE II. SUMMARY OF CONDITIONS TESTED

b. Pylon Mounted Model

* ALSO V = 40
** ALSO V = 55

ALT ORBITER

A_{sc} FT²	R_{sc} IN.	i_{sc} DEG.	ϕ_{sc} DEG.	CONFIGURATION	i_o	δ_{BF} \ V_M	β = 0°: 55	β = 0°: 70	β = 0°: 90	β = 0°: 100	β = 1°: 70	β = 1°: 90	β = 1°: 100	β = 2°: 70	β = 2°: 90	β = 2°: 100	β = 4°: 55	β = 4°: 70	β = 4°: 90	β = 4°: 100	β = 5°: 55	β = 5°: 70	β = 5°: 90	β = 5°: 100
				CLEAN 747	–	–	3 *	3	3	3							2 *	2	2	2				
				POST LAUNCH	–	–	4	4	4	4							1	1	1	1				
				FULL T.C. ○ VENTS ONLY ◇ WITH & WITHOUT VENTS	3°	-11.7°	1	1	1	1							1	1	1	1				
					6°	-11.7°	1	◇6	◇6	◇6							1	1	1	1				
					8°	-11.7°		◇6	◇6	◇6								9	9	9				
					3°	0°																		
					6° *	0°	1	◇5	◇5	◇5				1	1	1		1	1			1	1	1
					8°	0°		1	1	1								1	1	1				
				PARTIAL T.C. (STRAPS)	6° *	-11.7°	1	1	1	1							1	1	1	1				
						0°	1	1	1	1							1	1	1	1				
						+5°																		
						+10°	1	1	1	1														
				PARTIAL T.C. (POST)	6° *	-11.7°	1	1	1	1							1	1	1	1				
						0°	1	1	1	1							1	1	1	1				
						+5°																		
						+10°	1	1	1	1														
				TAIL CONE OFF ◇ i_o = 6 & 8°	6°	-11.7°	1	1	1	1							1	1	1	1				
						0°	1	◇7	◇7	◇7								4	4	4		4	4	4
						+5°	1	1	1	1														
						+10°	1	1	1	1							1	1	1	1				
				NOMINAL SCOOPS	6° *	-11.7°	1	1	1	1							1	1	1	1				
						0°	1	1	1	1								1	1	1				
						+5°	1	1	1	1							1	1	1	1				
6	34	29	10			+10°	1	1	1	1														
6	49	39	10	AIR SCOOP VARIATIONS	6°	0°	8	8	8	8	1 **	1	1	1 **	1	1	8	8	8	8	4	4	4	4
6	49	29	10				1	1	1	1							1	1	1	1				
12	34	29	10				1	1	1	1							1	1	1	1				
6	19	29	10				1	1	1	1							1	1	1	1				
6	34	0	10				1	1	1	1							1	1	1	1				
12	49	29	10				1	1	1	1														
6	49	19	10				1	1	1	1							1	1	1	1				
6	49	29	15				1	1	1	1							1	1	1	1				
6	49	29	5				1	1	1	1							1	1	1	1				

REF: KEY — α_{FRL}, DEG.; speeds in MPHTAS

KEY

1. 2
2. -2, 0, 2
3. -2, 0, 2, 6
4. -2, 2, 6
5. 2, 6 (VENTS), 6 (NO VENTS)
6. 2, 6 (VENTS), 2 (NO VENTS)
7. -2, 2, 6 (i_o=6), 2 (i_o=8)
8. -2, 0, 2, 4, 6
9. 2, 6

TABLE III. MODEL DIMENSIONAL DATA

a. Carrier Model (747 CAM)

MODEL COMPONENT: AILERON, A1

GENERAL DESCRIPTION: High speed (inboard aileron extending from WBL 13.35 to WBL 15.45 (model scale)

MODEL SCALE: .046

DRAWING NUMBER: 65-89585

DIMENSIONS:	FULL SCALE	MODEL SCALE
PER PANEL		
Area (aft of the HL), Ft^2	35.9	0.0835
Span (Theo), In.	69.92	2.10
Aspect Ratio	--	--
Rate of Taper	--	--
Taper Ratio	--	--
Sweep Back Angles, Degrees		
HL	0°	0°
Trailing Edge	17.76°	17.76°
Chords, Inches		
Root (Theo)	62.60	2.879
Tip (Theo)	99.77	4.588

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: AILERON, A2

GENERAL DESCRIPTION: Low speed (outboard) aileron extending from WBL 25.44 to 33.45 (model scale)

MODEL SCALE: 0.046

DRAWING NUMBER: 65-89585

DIMENSIONS:	FULL SCALE	MODEL SCALE
PER PANEL		
Area (aft of HL), Ft^2	76.70	0.1753
Planform	--	--
Span (Theo), In.	268.01	12.279
Aspect Ratio	--	--
Rate of Taper	--	--
Taper Ratio	--	--
Sweep Back Angles, Degrees		
HL	32.27	32.27
Trailing Edge	30.21	30.21
0.25 Element Line	--	--
Chords, Inches		
Root (Theo)	48.03	2.209
Tip (Theo)	34.90	1.605
MAC	--	--
Fus. Sta. of .25 MAC	--	--
W.L. of .25 MAC	--	--
B.L. of .25 MAC	--	--

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: BODY, $B_{27.8}$

GENERAL DESCRIPTION: 747-100 project body modified for pylon and rod mounting.

MODEL SCALE: 0.046

DRAWING NUMBER: 65C13695

DIMENSIONS:		FULL SCALE	MODEL SCALE
Frontal Area, ft^2		421	0.891
Projected Side Area, ft^2		4455	9.428
Wetted Area, ft^2		14093	29.881
Fineness Ratio		9.73	9.73
Overall Length, in.		2702	124.265
Maximum Width, in.		255.50	11.752
Location of:			
Wing 1/4 MAC ($W_{44.1}$)			
	MS, in.	1339.91	61.622
	WL, in.	190.75	8.773
Horizontal Stabilizer 1/4 MAC ($H_{15.1A}$) ▷1			
	MS, in.	2563.91	117.914
	WL, in.	311.47	14.324
Vertical Stabilizer 1/4 MAC ($V_{9.1}$)			
	MS, in.	2529.91	116.350
	WL, in.	528.00	24.286

▷1 Location given is for $\delta_{FRL} = 0°$

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TABLE IIIa. MODEL DIMENSIONAL DATA

MODEL COMPONENT: FLAPS UP, F_o

GENERAL DESCRIPTION: Clean wing (see $W_{44.1}$) flaps up

MODEL SCALE: 0.046

DRAWING NUMBER: 65-89585

DIMENSIONS: N.A.

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: HORIZONTAL TAIL, $H_{15.1A}$

GENERAL DESCRIPTION: Basic horizontal tail with elevator. The tail incidence is set by remote control. The incidence can be set manually and locked at selected angles.

MODEL SCALE: 0.046

DRAWING NUMBER: 65C13668, 65C15211, S01319-242, -252

DIMENSIONS:	FULL SCALE	MODEL SCALE
Area (planform), ft^2	1470	3.110
Span (Theo), In.	873	40.149
Aspect Ratio	3.6	3.6
Taper Ratio	0.25	0.25
Sweep-Back Angles, Degrees:		
Leading Edge	43.05	43.05
Trailing Edge	14.97	14.97
0.25 Chord Line	37.50	37.50
Chords, in.		
Root (Theo)	388	17.844
Tip (Theo)	97	4.461
MAC	271.6	12.491
MS of .25 MAC @ $\delta_{FRL} = 0^o$	2563.91	117.914
WL of .25 MAC	311.45	14.324
BL of .25 MAC	175.0	8.048
Wetted Area, ft^2	2417	3.334
Dihedral Angle, degrees	7.00	7.00
Incidence Angle, degrees	Vary	Vary
MS of Pivot	2594	119.298
WL of Pivot	292.5	13.455
Elevator (per panel):		
Root chord (Theo), in.	122.1	5.615
Tip chord (Theo), in.	27.67	1.272
Span (Theo), in.	371.03	17.064
Sweepback of HL degrees	27.49	27.49
Area aft of HL (Theo) ft^2	192.89	0.408

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: HORIZONTAL TAIL, $H_{15.6A}$

GENERAL DESCRIPTION: Horizontal tail, $H_{15.1A}$ with vertical fins on each tip at body BL 19.653

MODEL SCALE: 0.046

DRAWING NUMBER: 1319-55, -57, -60

DIMENSIONS: (TIP FIN)	FULL SCALE	MODEL SCALE
(See $H_{15.1A}$ for Horizontal Tail details)		
EXPOSED DATA (one side)		
Area, ft^2	200	0.423
Span, in.	251.44	11.563
Aspect Ratio	2.19	2.19
Taper Ratio	1.00	1.00
Dihedral Angle, degrees	--	--
Incidence Angle, degrees	--	--
Sweep Back Angle, degrees	0	0
Chord, in.	114.54	5.267

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: NACELLE STRUT, M_{25}

GENERAL DESCRIPTION: Inboard 747, JT9D nacelle strut

MODEL SCALE: 0.046

DRAWING NUMBER: 65-69716, S01007-587

DIMENSIONS:	FULL SCALE	MODEL SCALE
Wing BL of nacelle centerline, in.	470.0	21.615
Toe-in angle, degrees	2	2
Wetted Area ft^2 (each pylon)	181	0.383

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: NACELLE STRUT, $M_{26.8}$

GENERAL DESCRIPTION: Outboard 747, JT9D nacelle strut

MODEL SCALE: 0.046

DRAWING NUMBER: S01007-588

DIMENSIONS:	FULL SCALE	MODEL SCALE
Wing BL of nacelle centerline, in.	834.0	38.356
Toe-in angle, degrees	2	2
Wetted Area, ft^2 (each pylon)	181	0.383

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: NACELLE, N_{57}

GENERAL DESCRIPTION: Inboard fan cowl and primary 747 nacelle, flow through type - JT9D blow-in door inlet contours

MODEL SCALE: 0.046

DRAWING NUMBER: S01007-96, -97, -587, 65-89585

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length:		
Fan Cowl	104.0	4.783
Nacelle Assy.	219.17	10.079
Outside Diameter:		
Fan	101.67	4.676
Primary	68.67	3.158
Inside Diameter (TE)		
Fan	91.67	4.216
Primary	53.33	2.453
Wing BL of nacelle centerline, in.	470.0	21.615
Wetted Area, ft^2 (each assy.) (External surfaces only)	207.5	0.440

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: NACELLE, N_{58}

GENERAL DESCRIPTION: Outboard fan cowl and primary 747 nacelle, flow through type JT9D blow-in door inlet contours

MODEL SCALE: 0.046

DRAWING NUMBER: SO1007-96, -97, -588, 65-89585

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length:		
Fan Cowl	104.0	4.783
Nacelle Assy.	219.17	10.079
Outside Diameter:		
Fan	101.67	4.676
Primary	68.67	3.158
Inside Diameter (TE)		
Fan	91.67	4.216
Primary	53.33	2.453
Wing BL of nacelle centerline, in.	834.0	38.356
Wetted Area, ft^2 (each assy.) (External surfaces only)	207.5	0.440

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: SPOILERS, S_{1-12}

GENERAL DESCRIPTION: Spoilers S_{1-4} and S_{9-12} are outboard spoilers. Spoilers S_{5-8} are inboard spoilers. Adjacent spoilers S_{1-2}, S_{3-4}, etc. are made in one piece except for inboard spoilers S_{5-8} at $\delta_{SP} = 0^{\circ}$ and 20° which are made in individual panels.

MODEL SCALE: 0.046

DRAWING NUMBER: SO1319-34, -144

DIMENSIONS:		FULL SCALE	MODEL SCALE
EXPOSED DATA (Per Panel)			
Area Ft^2	Inb'd	34.4	0.0729
	Outb'd	20.8	
Span (equivalent) in.	Inb'd		4.139
	Outb'd		6.899
Chords, inches			
Root	Inb'd		2.531
	Outb'd		1.840
Tip	Inb'd		2.531
	Outb'd		1.840

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: FLAP TRACK FAIRINGS, T_{19}

GENERAL DESCRIPTION: Flap track fairings, 4 on each side.

MODEL SCALE: 0.046

DRAWING NUMBER: S01007-403

DIMENSIONS:	FULL SCALE	MODEL SCALE
WBL of Track no. 1, in.	235.2	10.823
WBL of Track no. 2, in.	353.0	16.234
WBL of Track no. 3, in.	585.0	26.904
WBL of Track no. 4, in.	743.8	34.201
Distance from wing trailing edge to track trailing edge, in.	50	2.300
Length:		
Track no. 1	276.66	12.724
Track no. 2	255.0	11.727
Track no. 3	206.66	9.505
Track no. 4	193.33	8.891
Maximum Width:		
Track no. 1	30.0	1.380
Track no. 2	30.0	1.380
Track no. 3	28.33	1.303
Track no. 4	28.33	1.303
Depth Below Wing:		
Track no. 1	37.33	1.717
Track no. 2	36.66	1.686
Track no. 3	28.33	1.303
Track no. 4	28.33	1.303
Total Wetted Area, ft^2	932	1.972

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: VERTICAL TAIL, $V_{9.1}$

GENERAL DESCRIPTION: Vertical tail with a two section rudder. The rudder angle is set with fixed brackets.

MODEL SCALE: 0.046

DRAWING NUMBER: S01007-26 -27. -29, and 69-65919

DIMENSIONS:	FULL SCALE	MODEL SCALE
Area (Theo), ft^2	830	1.756
Span (Theo), in.	387	17.775
Aspect Ratio	1.25	1.25
Taper Ratio	0.340	0.340
Sweepback Angles, degrees		
Leading Edge	50.12	50.12
Trailing Edge	22.2	22.2
0.25 Chord line	45	45
Chords, in.		
Root (Theo)	461.67	21.232
Tip (Theo)	157.0	7.220
MAC	334.16	15.368
MS of 0.25 MAC, in.	2529.9	116.350
WL of 0.25 MAC, in.	528.0	24.286
Wetted area, ft^2	1701	3.599
Rudder Dimensions:		
Lower Section:		
Area aft of HL, ft^2	92.3	0.195
Span, in.	110.75	5.094
Upper Section:		
Area aft of HL, ft^2	137.6	0.291
Span, in.	234.75	10.795
Percent Chord of Rudder HL	70	70

TABLE IIIa. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: WING, $W_{44.1}$

GENERAL DESCRIPTION: 747-100 project wing twisted to simulate a 1g loading at a gross weight of 600,000 lbs. and a Mach number of 0.84 at 35,000 ft. altitude (V = 270 KEAS). The wing has cutouts for leading edge slots and flaps, trailing edge flaps, spoilers and/or speed brakes, wing mounted nacelles, wing mounted landing gear, and inboard and outboard ailerons.

MODEL SCALE: 0.046

DRAWING NUMBER: 65-89585

DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo) - ft^2	--	--
Planform	5500	11.637
Span (Theo) - in.	2348	107.986
Aspect Ratio	6.96	6.96
Rate of Taper	--	--
Taper Ratio	0.356	0.356
Sweep Back Angles, degrees		
Leading Edge, Inb'd/Outb'd	42.3/39.7	42.3/39.7
Trailing Edge, Inb'd/Outb'd	17.8/30.2	17.8/30.2
0.25 Element Line	--	--
Chords, in.		
Root (Theo)	652.0	29.987
Tip (Theo)	160.0	7.358
MAC	327.78	15.074
Fus. Sta. of .25 MAC	1339.90	61.622
WL of .25 MAC	190.77	8.773
BL of .25 MAC	494.03	22.721
Dihedral Angle, degrees	7.00	7.00
Incidence Angle, degrees	2.00	2.00
Wetted Area ft^2	9200	19.466

TABLE IIIa. MODEL DIMENSIONAL DAT (Concluded)

MODEL COMPONENT: WING-BODY FAIRING, $X_{18.4}$

GENERAL DESCRIPTION: Basic 747 wing-body fairing that includes the housing for the body landing gear. The fairing is an integral part of the body skins.

MODEL SCALE: 0.046

DRAWING NUMBER: 65C13695

DIMENSIONS: N.A.

TABLE III. MODEL DIMENSIONAL DATA

b. Orbiter

MODEL COMPONENT: BODY - B_{26}

GENERAL DESCRIPTION: Configuration 140A/B orbiter fuselage.

NOTE: B_{26} is identical to B_{24} except underside of fuselage has been refaired to accept W_{116}.

MODEL SCALE: 0.046

DRAWING NUMBER: VL70-000143B, -000200, -000205, -006089, -000145, VL70-000140A, -000140B

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length (OML: Fwd. Sta. X_o = 235), in.	1293.3	59.479
Length (IML: Fwd. Sta. X_o = 238), in.	1290.3	59.340
Max Width (At X_o = 1528.3), in.	264.0	12.141
Max Depth (At X_o = 1464), in.	250.0	11.498
Fineness Ratio	0.264	0.264
Area - Ft^2		
Max. Cross-Sectional	340.88	0.722

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: CANOPY - C_9

GENERAL DESCRIPTION: Configuration 3A. Canopy used with fuselage B_{26}.

MODEL SCALE: 0.046 MODEL DRAWING: SS-A00147, Release 12

DRAWING NUMBER: VL70-000143A

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length (X_o = 434.643 to 578), in.	143.357	6.593
Max Width (At X_o = 513.127), in.	152.412	7.009
Max Depth (At X_o = 485.0), in.	25.00	1.150

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: BODY FLAP - F_8

GENERAL DESCRIPTION: Configuration 140A/B orbiter body flap

NOTE: Hingeline located at X_o = 1528.3, Z_o = 284.3

MODEL SCALE: 0.046 MODEL DRAWING: SS-A00147, Release 12

DRAWING NUMBER: VL70-000140A, -000145

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length (X_o = 1520 - 1613), in.	93.00	4.277
Max Width, in.	262.00	12.049
Max Depth (X_o = 1520), in.	23.00	0.106
Fineness Ratio		
Area - Ft^2		
Max. Cross-Sectional		
Planform	150.525	0.319
Wetted		
Base	41.847	0.089

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: OMS POD - M_{16}

GENERAL DESCRIPTION: Configuration 140C

Orbiter OMS pod - Short pod

MODEL SCALE: 0.046

DRAWING NUMBER: VL70-008401, -008410

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length (OMS Fwd. Sta. X_o = 1310.5), in.	258.50	11.888
Max Width (At X_o = 1511), in.	136.8	6.291
Max Depth (At X_o = 1511), in.	74.70	3.435
Fineness Ratio	2.484	3.808
Area - Ft^2		
Max. Cross-Sectional	58.864	0.125

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: MPS NOZZLES - N_{24}

GENERAL DESCRIPTION: Configuration 140A/B orbiter MPS nozzles

MODEL SCALE: 0.046 MODEL DRAWING: SS-A00147, Release 12

DRAWING NUMBER: VL70-005030A, -00140A

DIMENSIONS:	FULL SCALE	MODEL SCALE
MACH NO.		
Length - In.		
Gimbal Point to Exit Plane	157.00	7.220
Throat to Exit Plane	99.2	4.562
Diameter - In.		
Exit	91.00	4.185
Throat		
Inlet		
Area - ft^2		
Exit	45.166	0.0957
Throat		
Gimbal Point (Station) - In.		
Upper Nozzle		
X	1445.00	66.456
Y	0.0	0.0
Z	443.00	20.374
Lower Nozzles		
X	1468.170	67.521
Y	±53.00	±2.437
Z	342.640	15.758
Null Position - Deg.		
Upper Nozzle		
Pitch	16	16
Yaw	0	0
Lower Nozzle		
Pitch	10	10
Yaw	3.5	3.5

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: OMS NOZZLES - N_{28}

GENERAL DESCRIPTION: Configuration 140A/B orbiter OMS Nozzles

MODEL SCALE: 0.046

DRAWING NUMBER: VL70-000140A (Location), SS-A00106, Release 5 (Contour)

DIMENSIONS:	FULL SCALE	MODEL SCALE
MACH NO.		
Length - In.		
Gimbal Point to Exit Plane		
Throat to Exit Plane		
Diameter - In.		
Exit		
Throat		
Inlet		
Area - Ft^2		
Exit		
Throat		
Gimbal Point (Station) - In.		
Left Nozzle		
X_o	1518.00	69.813
Y_o	- 88.0	- 4.647
Z_o	492.0	22.627
Right Nozzle		
X_o	1518.0	69.813
Y_o	88.0	4.047
Z_o	492.0	22.627
Null Position - Deg.		
Left Nozzle		
Pitch	±8	±8
Yaw	13°17'Outb'd,2°30' Inb'd	Same
Right Nozzle		
Pitch	±8	±8
Yaw	13°17' Outb'd, 2°17' Inb'd	

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: RUDDER - R_5

GENERAL DESCRIPTION: Configuration 140C orbiter rudder (identical to configuration 140A/B rudder)

MODEL SCALE: 0.046

DRAWING NUMBER: VL70-000146B, -000095

DIMENSIONS:	FULL SCALE	MODEL SCALE
Area - Ft^2	100.15	0.212
Span (equivalent), In.	201.00	9.244
Inb'd equivalent chord, In.	91.585	4.213
Outb'd equivalent chord, In.	50.833	2.338
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	0.400	.613
At Outb'd equiv. chord	0.400	.613
Sweep Back Angles, degrees		
Leading Edge		
Trailing Edge	26.25	26.25
Hingeline	34.83	25.599
Area Moment (Product of area and $\bar{c}$), Ft^3	610.92	.0595
Mean Aerodynamic Chord, In.	73.2	3.366

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: ORBITER TAILCONE - $TC_{5.1}$

GENERAL DESCRIPTION: Fairing mounted on orbiter fuselage base for ferry missions.

MODEL SCALE: 0.046

DRAWING NUMBER: Boeing Drawing Number: 1319-71

DIMENSIONS:	FULL SCALE	MODEL SCALE
Length	445.83	20.504
Max Width	303.33	13.950
Max Height	265.00	12.187
Fineness Ratio		
Area - Ft^2		
Projected frontal area	324.105	.686

TABLE IIIb. MODEL DIMENSIONAL DATA (Continued)

MODEL COMPONENT: VERTICAL - V_8

GENERAL DESCRIPTION: Configuration 140A/B orbiter vertical tail.

MODEL SCALE: 0.046 MODEL DRAWING: SS-A00148, Release 6

DRAWING NUMBER: VL70-000146A

DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo) - Ft^2		
Planform	413.253	.875
Span (Theo) - In.	315.720	14.520
Aspect Ratio	1.675	2.568
Rate of Taper	0.507	0.507
Taper Ratio	0.404	0.404
Sweep Back Angles, Degrees		
Leading Edge	45.000	45.000
Trailing Edge	26.25	26.25
0.25 Element Line	41.13	41.13
Chords:		
Root (Theo) WP	268.50	12.348
Tip (Theo) WP	108.47	4.988
MAC	199.81	9.189
Fus. Sta. of .25 MAC	1463.35	67.300
W.P. of .25 MAC	635.52	29.228
B.L. of .25 MAC	0.00	0.00
Airfoil Section		
Leading Wedge Angle - Deg.	10.00	10.00
Trailing Wedge Angle - Deg.	14.92	14.92
Leading Edge Radius	2.00	0.092
Void Area	13.17	.280
Blanketed Area	0.00	0.00

TABLE IIIb. MODEL DIMENSIONAL DATA (Concluded)

MODEL COMPONENT: WING - W_{116}

GENERAL DESCRIPTION: Configuration 4 NOTE: Identical to W_{114} except airfoil thickness. Dihedral angle is along trailing edge of wing.

Geometric twist = 0. MODEL SCALE: 0.046

DRAWING NUMBER: VL70-000140A, -000200

DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo.) Ft^2		
Planform	2690.00	5.692
Span (Theo.) In.	936.68	43.077
Aspect Ratio	2.265	2.265
Rate of Taper	1.177	1.177
Taper Ratio	0.200	0.200
Dihedral Angle, degrees	3.500	3.500
Incidence Angle, degrees	0.500	0.500
Aerodynamic Twist, degrees		
Sweep Back Angles, degrees		
Leading Edge	45.00	45.00
Trailing Edge	- 10.056	- 10.056
0.25 Element Line	35.209	35.209
Chords: In.		
Root (Theo.) B.P.0.0.	689.24	31.698
Tip, (Theo.) B.P.	137.85	6.340
MAC	474.81	21.836
Fus. Sta. of .25 MAC	1136.83	52.283
W.P. of .25 MAC	290.58	13.363
B.L. of .25 MAC	182.13	8.376
EXPOSED DATA		
Area (Theo.) Ft^2	1751.50	3.705
Span, (Theo.) In. BP108	720.68	33.143
Aspect Ratio	2.059	2.059
Taper Ratio	0.245	0.245
Chords		
Root BP108	562.09	25.851
Tip 1.00 b/2	137.85	6.340
MAC	392.83	18.066
Fus. Sta. of .25 MAC	1185.98	54.543
W.P. of .25 MAC	294.30	13.535
B.L. of .25 MAC	251.77	11.579
Airfoil Section (Rockwell Mod NASA)XXXX-64		
Root b/2 =	0.113	.173
Tip b/2 =	0.120	.184
Data for (1) of (2) Sides		
Leading Edge Cuff		
Planform Area, Ft^2	113.18	.282
Leading Edge Intersects Fus M.L. @ Sta.	500.00	22.995
Leading Edge Intersects Wing @ Sta.	1024.00	47.094

TABLE IV. MODEL SCALE TO AIRPLANE SCALE CONVERSION FACTORS

	SCALING RATIO	MODEL SCALE FACTOR	FULL SCALE CONVERSION FACTOR
AIRSPEED	$\frac{V_M}{V_A}$	.1956	$V_A = 5.1125\ V_M$
FREQUENCY	$\frac{f_M}{f_A}$	4.252	$f_A = .23518\ f_M$
ACCELERA-TION	$\frac{a_M}{a_A}$	.832	$a_A = 1.20\ a_M$
BENDING MOMENT	$\frac{B.M._M}{B.M._A}$	$.6025 \times 10^{-5}$	$BM_A = 366\ BM_M$ (IN-LB) (IN-GMS)
ACCEL. P.S.D.	$\frac{(g^2/CPS)_M}{(g^2/CPS)_A}$	.1628	$(PSD)_A = 6.1425\ (PSD)_M$
B.M. P.S.D.	$\frac{(BM^2/CPS)_M}{(BM^2/CPS)_A}$	$.0854 \times 10^{-10}$	$(PSD)_A = .5695 \times 10^6\ (PSD)_M$ $(IN\text{-}LB)^2/CPS$ $(IN\text{-}GMS)^2/CPS$

REFERENCE DIMENSIONS (FS)

	ORBITER	747 CARRIER
WING AREA ~ Ft^2	2690	5500
MAC ($\bar{c}$) ~ INCHES	474.81	327.78
SPAN (b) ~ INCHES	936.68	2348.04

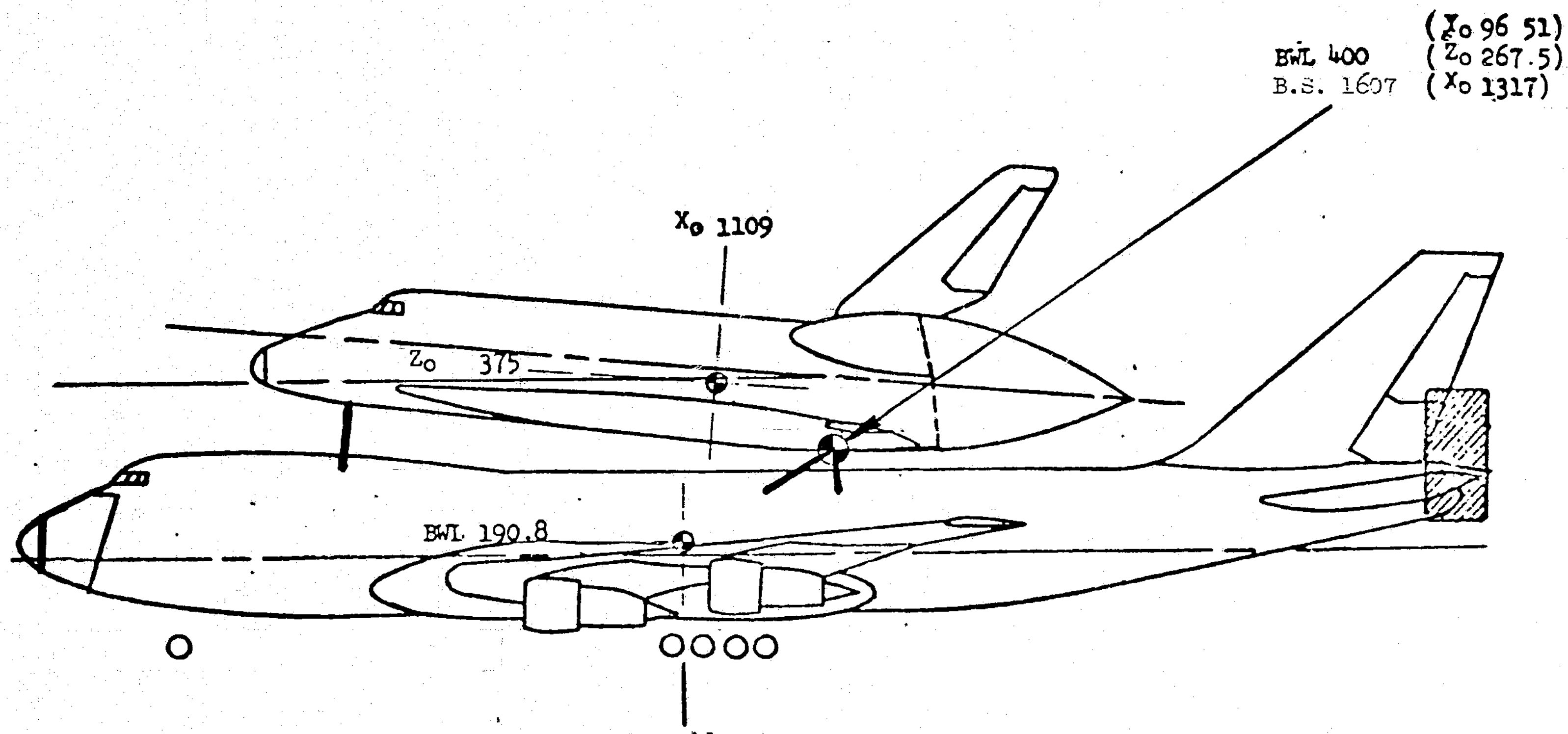
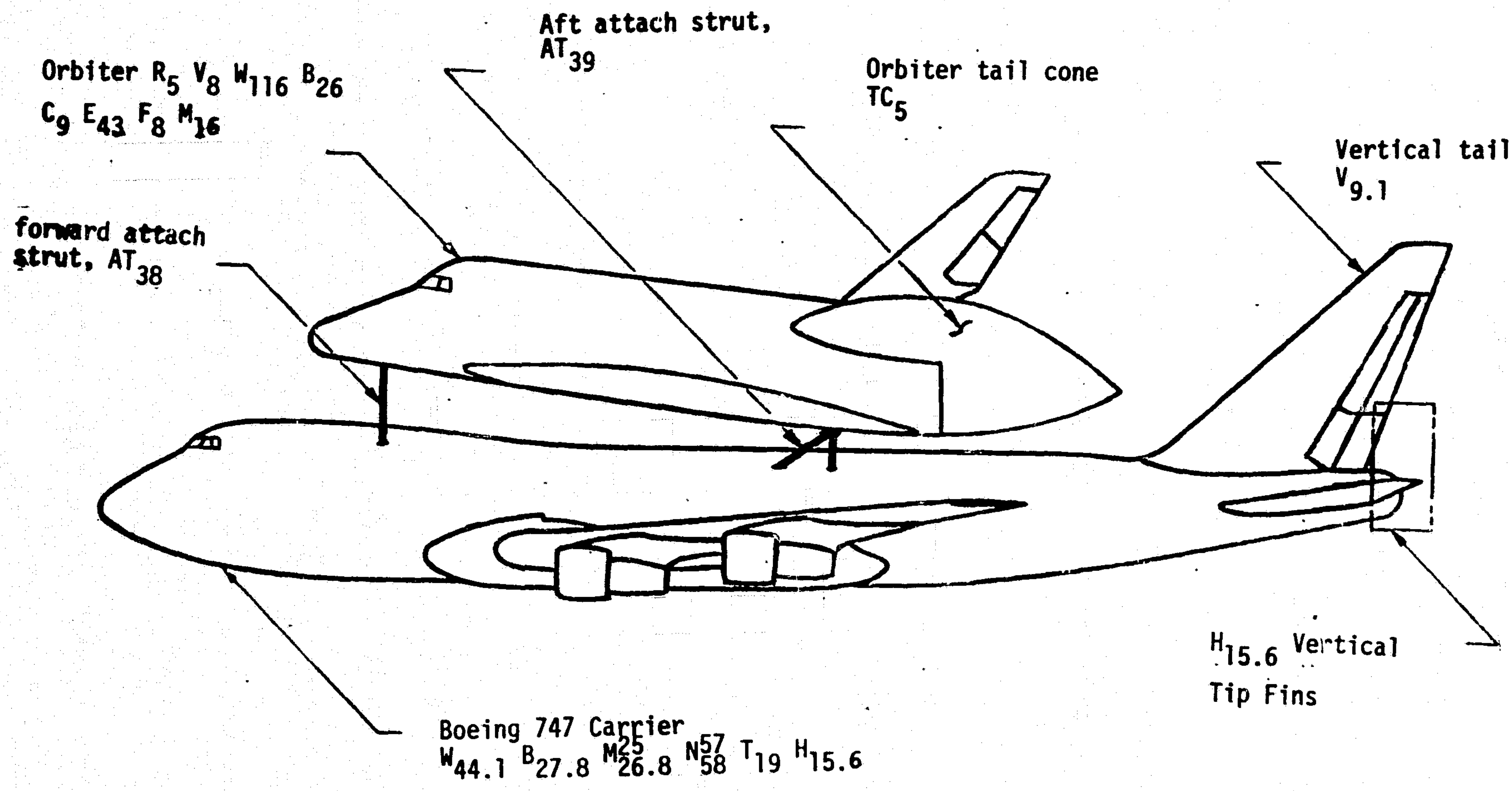
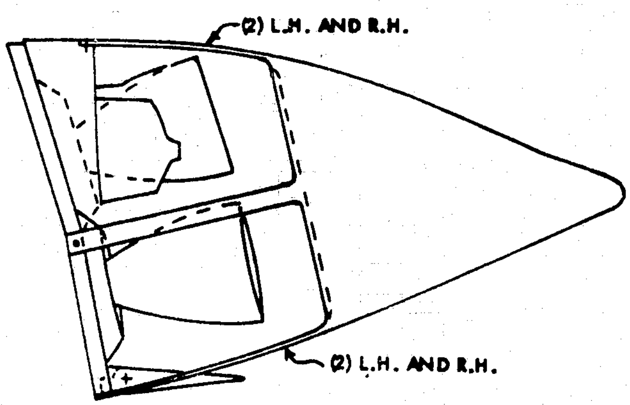


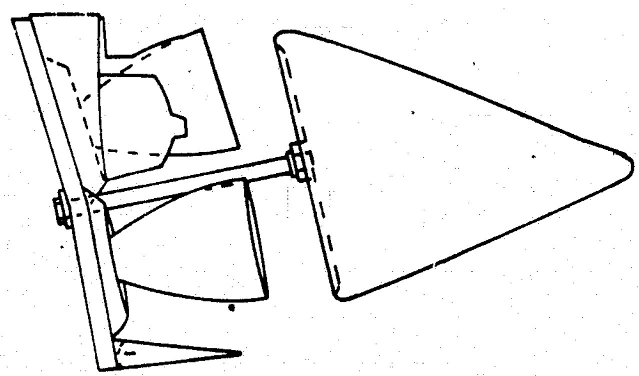
Figure 1. Orbiter/747 flight test configuration reference dimensions.



a. Orbiter/Carrier Model Nomenclature
Figure 2. Model sketches.

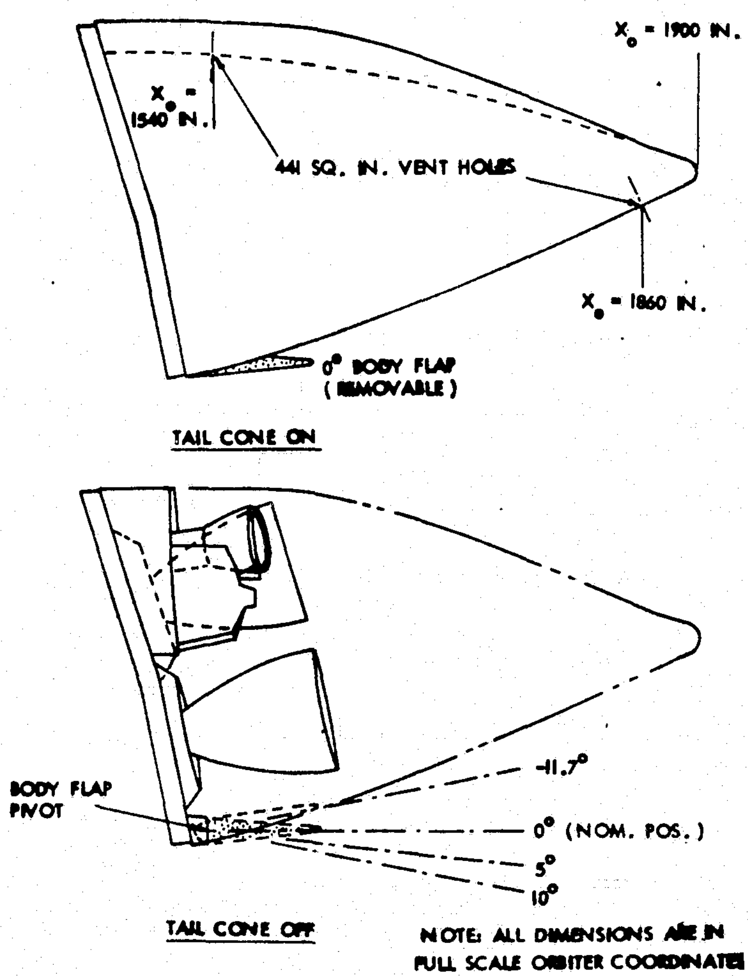


STRAP-MOUNTED (6 STRAPS)

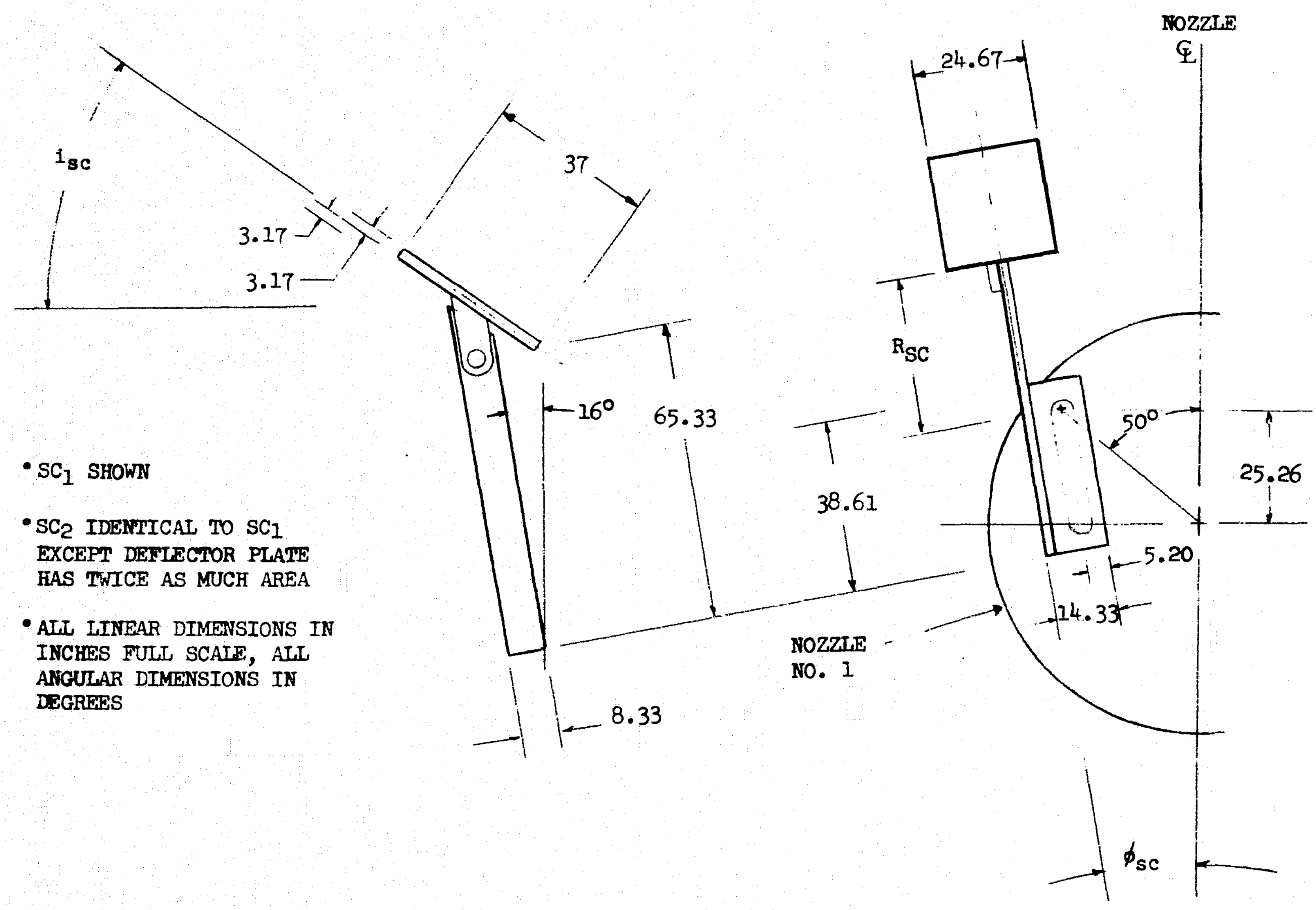


POST-MOUNTED

b. Attachment Schemes for the Partial Tailcone
Figure 2. Continued.

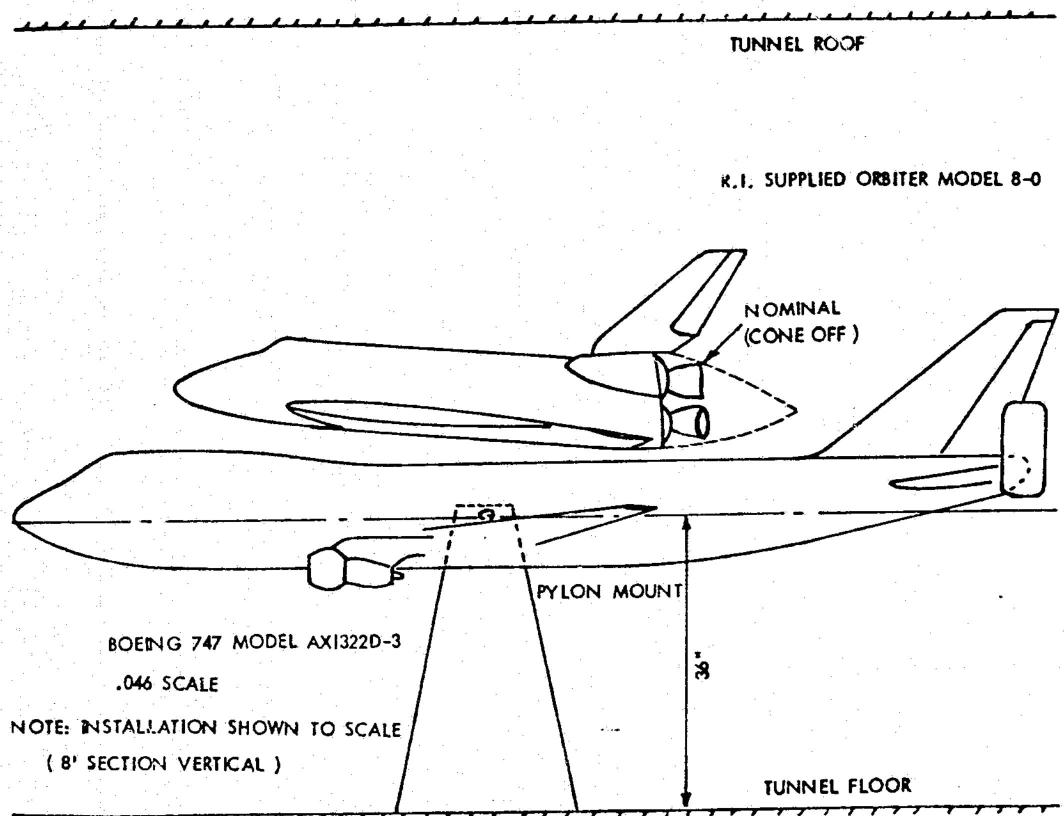


c. Body Flap Positions for Tailcone On and Tailcone Off
Figure 2. Continued.

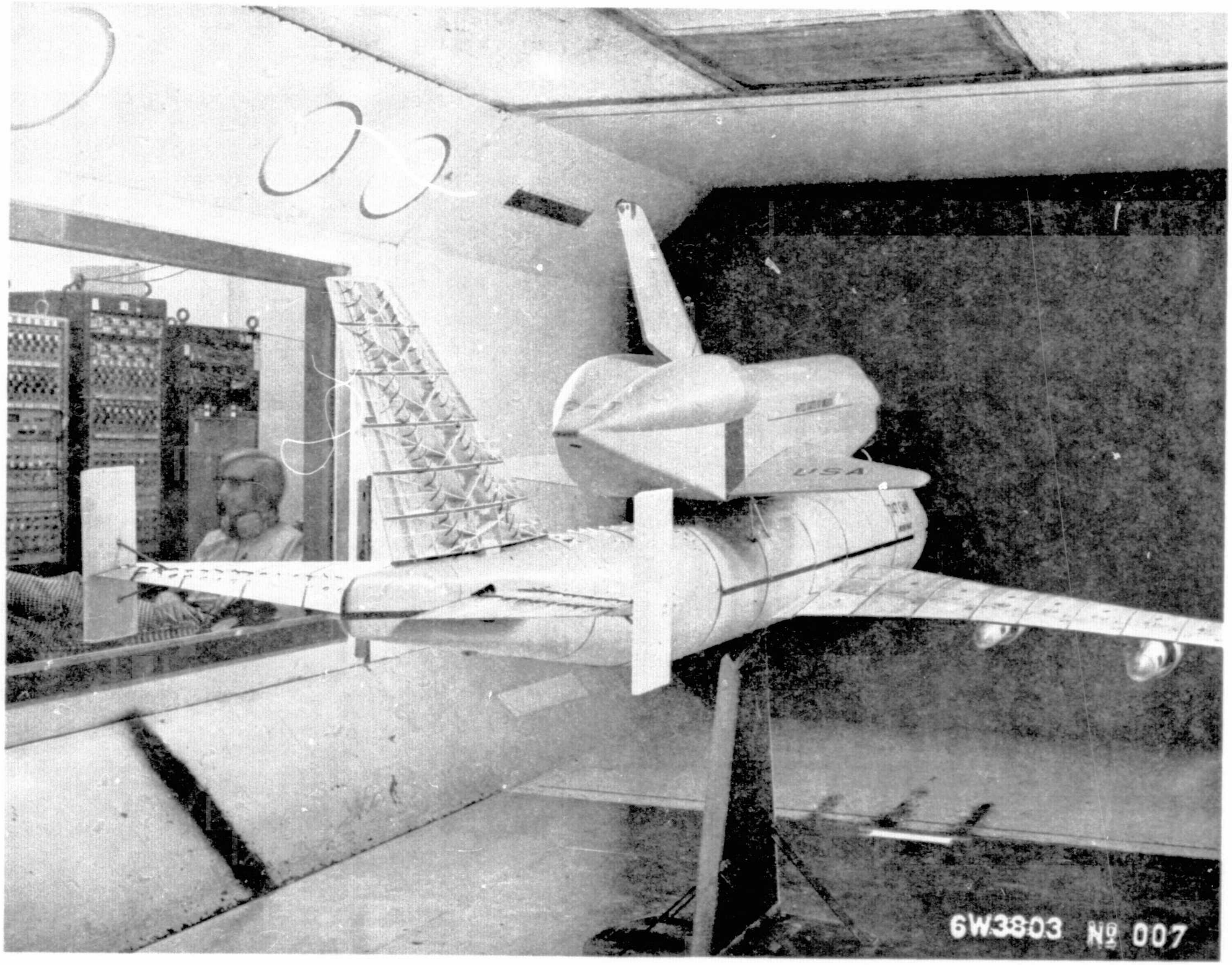


- SC_1 SHOWN
- SC_2 IDENTICAL TO SC_1 EXCEPT DEFLECTOR PLATE HAS TWICE AS MUCH AREA
- ALL LINEAR DIMENSIONS IN INCHES FULL SCALE, ALL ANGULAR DIMENSIONS IN DEGREES

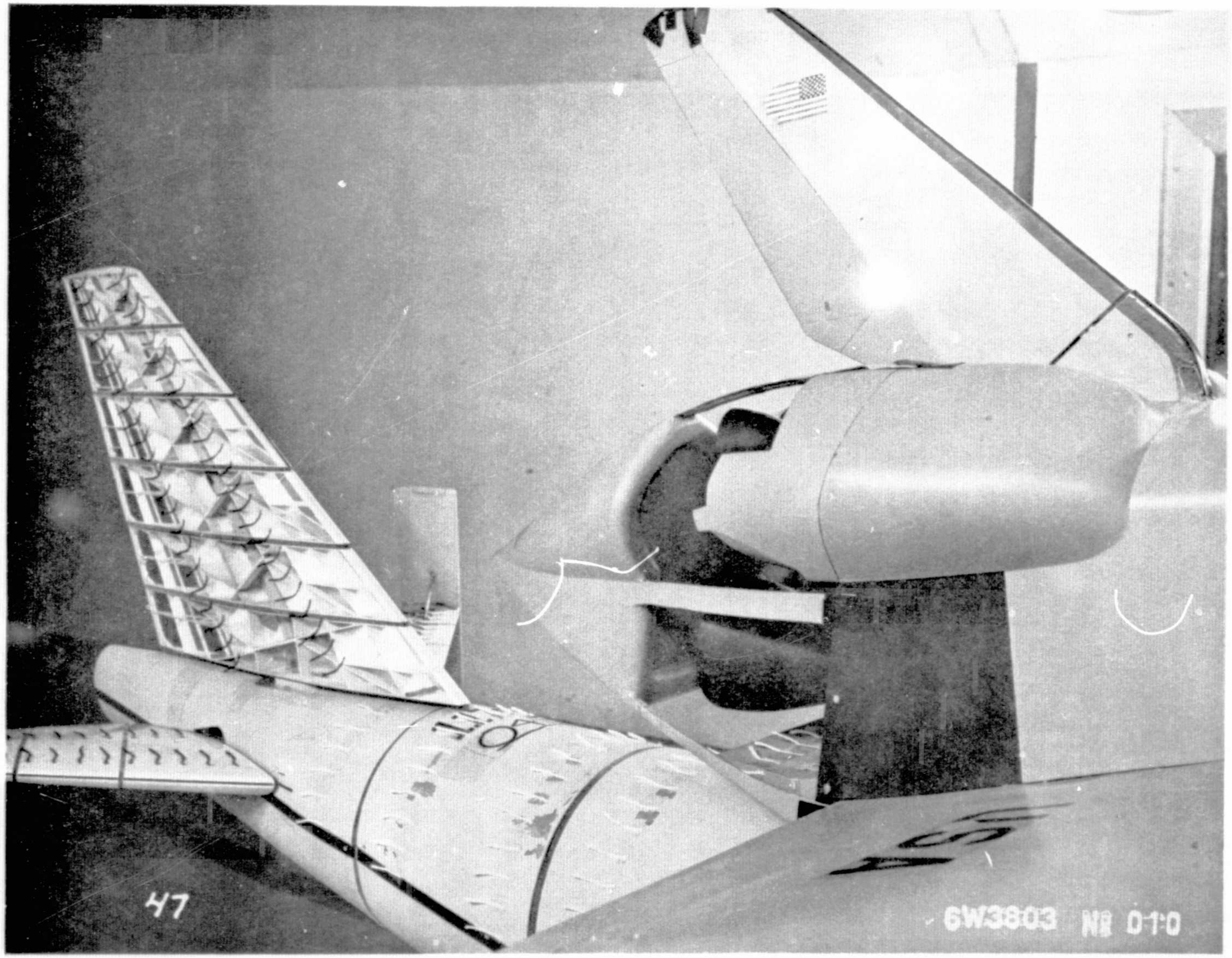
d. Air Scoop Geometry
Figure 2. Continued.



e. Model Installation Schematic
Figure 2. Concluded.

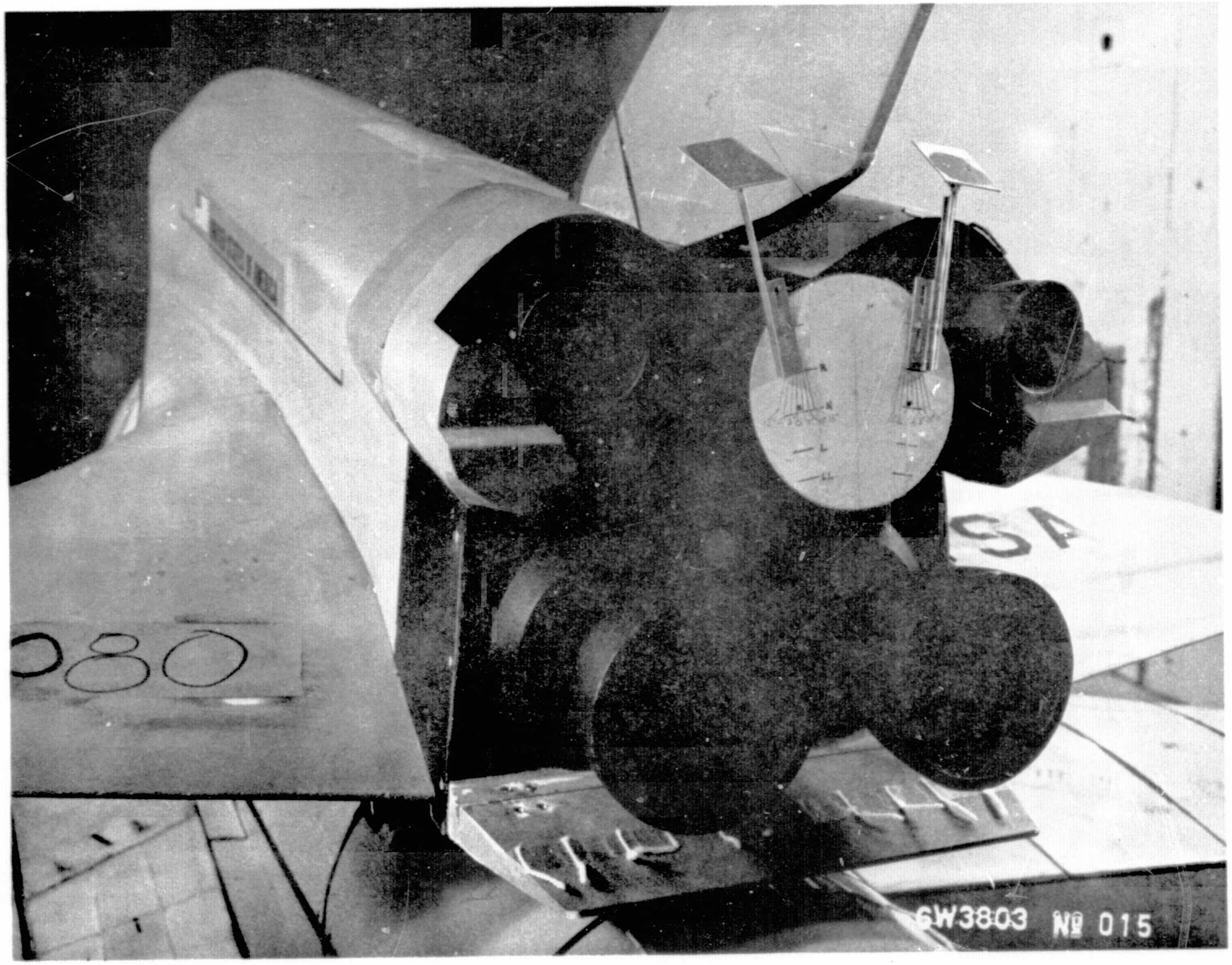


a. 747 CAM/Ferry Orbiter, Pylon Mounted
Figure 3. Model photographs.



b. Partial Tailcone, Strap Mounted
Figure 3. Continued.

c. Partial Tailcone, Post Mounted
Figure 3. Continued.



d. Detail of Scoop Attachment and Adjustment
Figure 3. Concluded.

DATA FIGURES

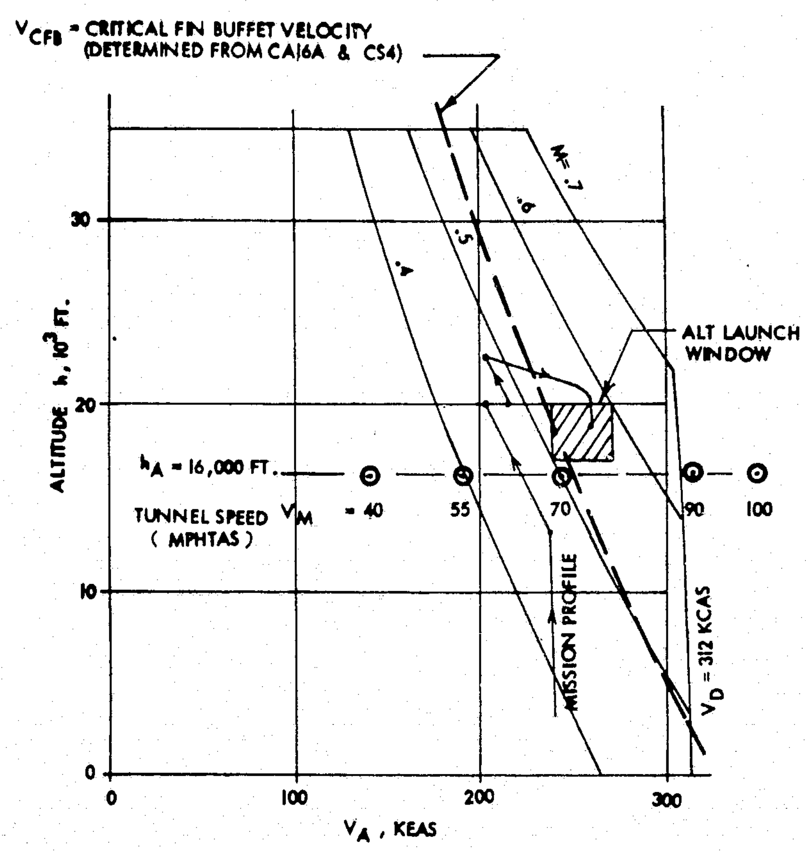


Figure 4. Flight conditions vs. test points, CS3 aeroelastic buffet test.

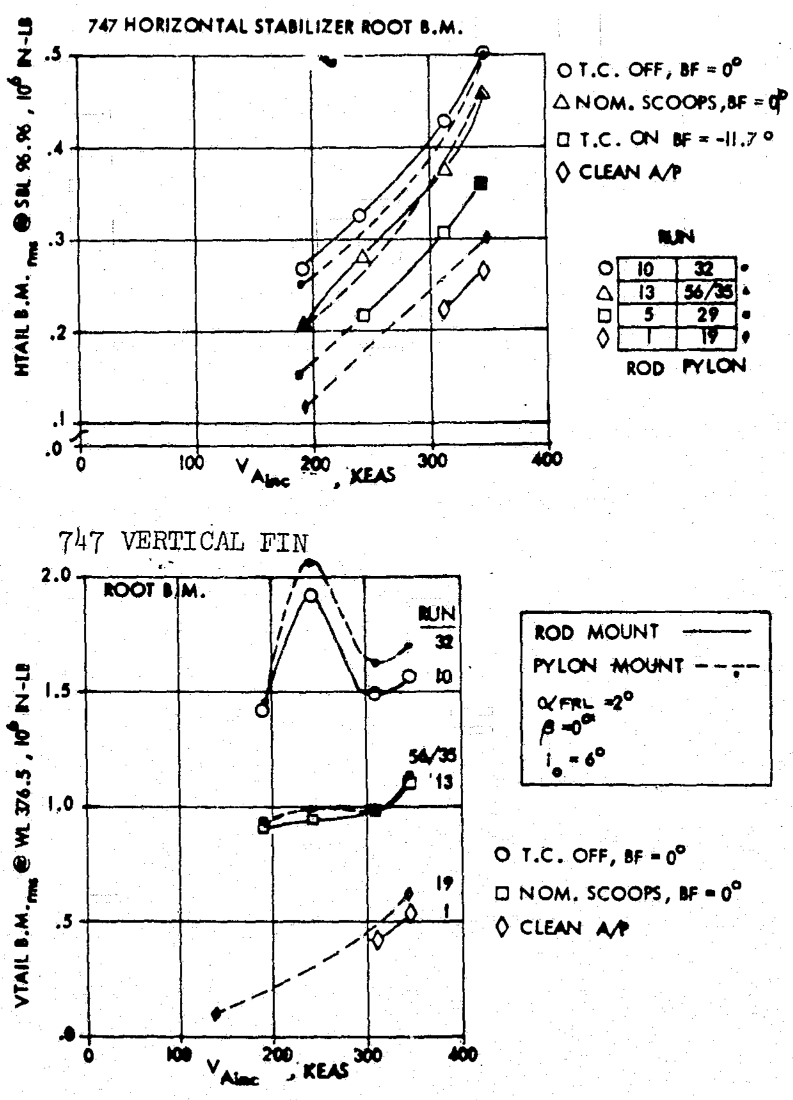


Figure 5. Rod mount vs. pylon mount buffet loads comparisons.

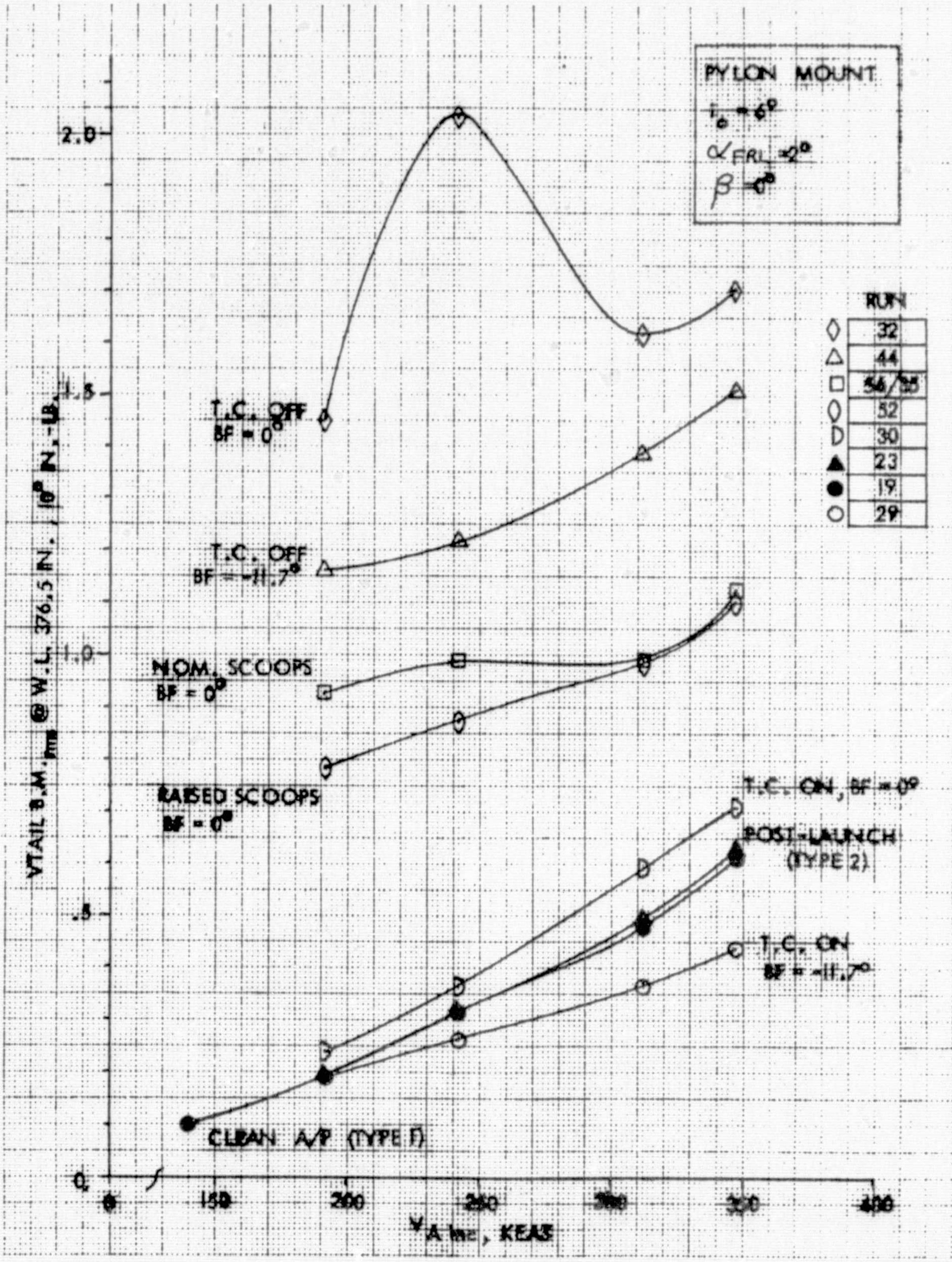


Figure 6. 747 vertical tail buffet loads.

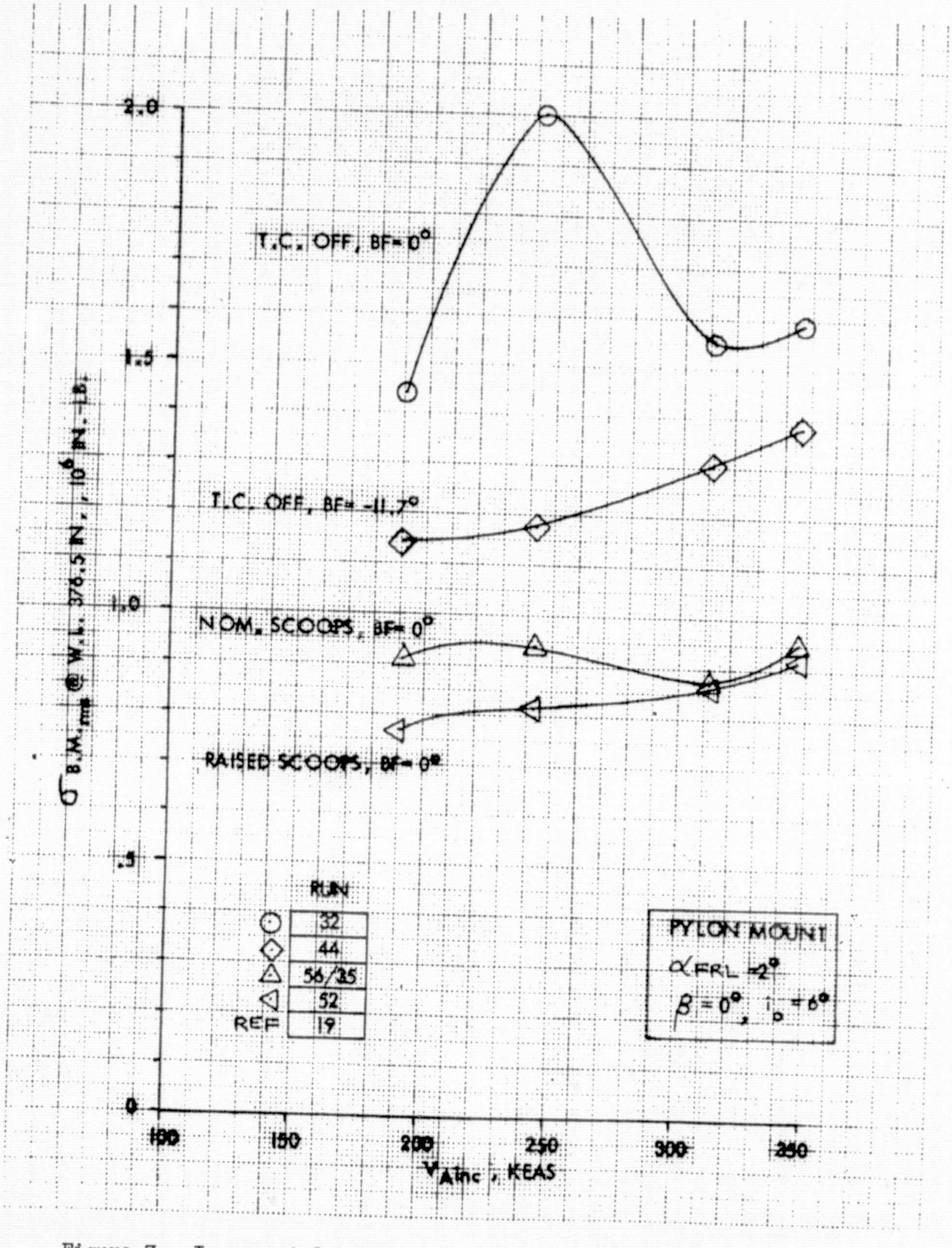


Figure 7. Incremental buffet loads for the 747 vertical tail.

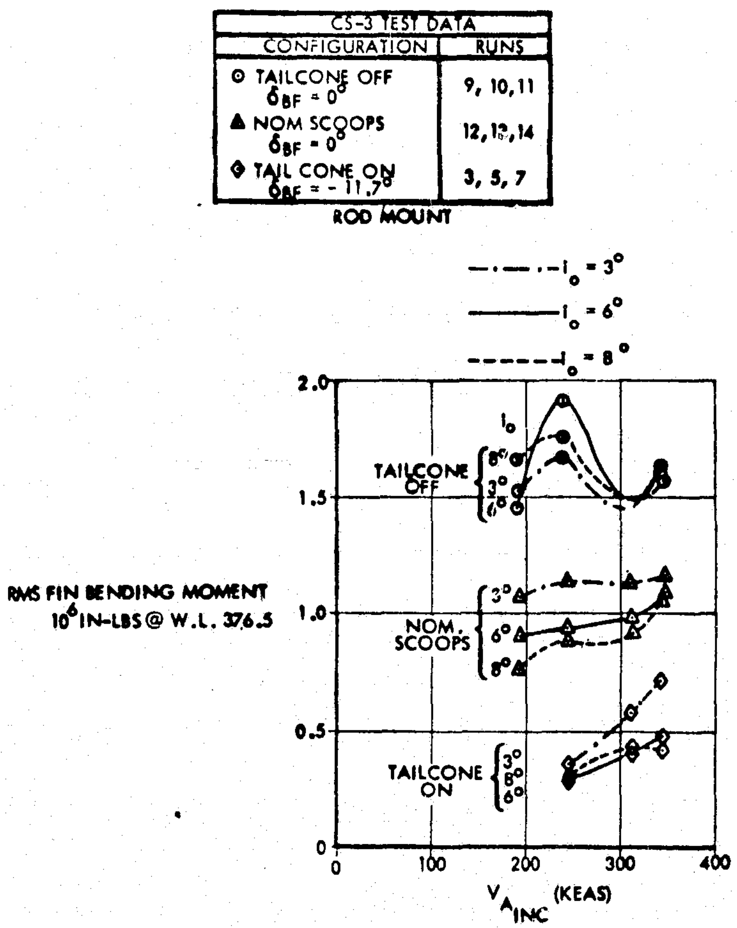


Figure 8. Orbiter incidence effect on 747 vertical fin buffet loads - rod mount.

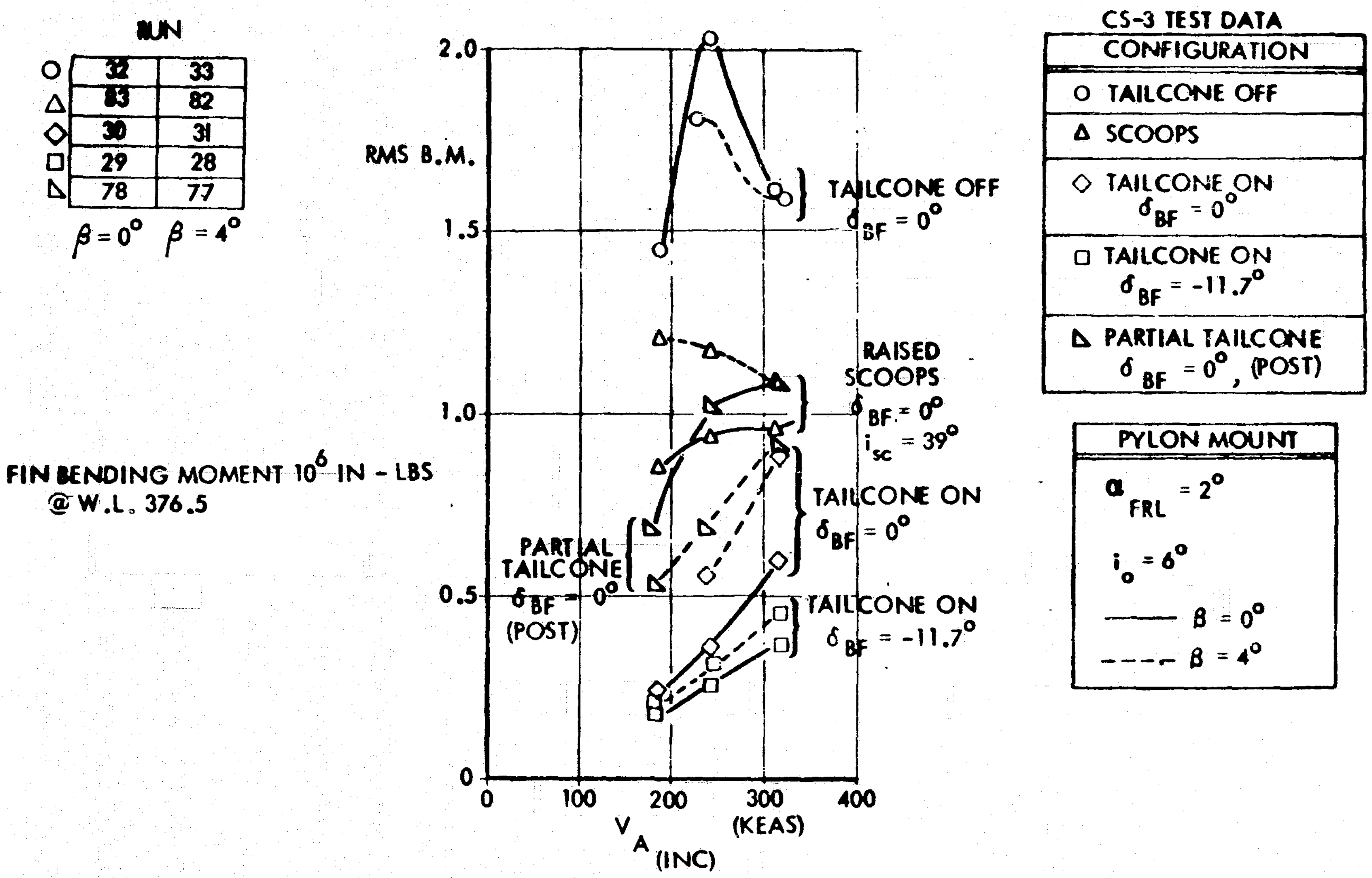


Figure 9. Sideslip effect on 747 vertical fin buffet loads - pylon mount.

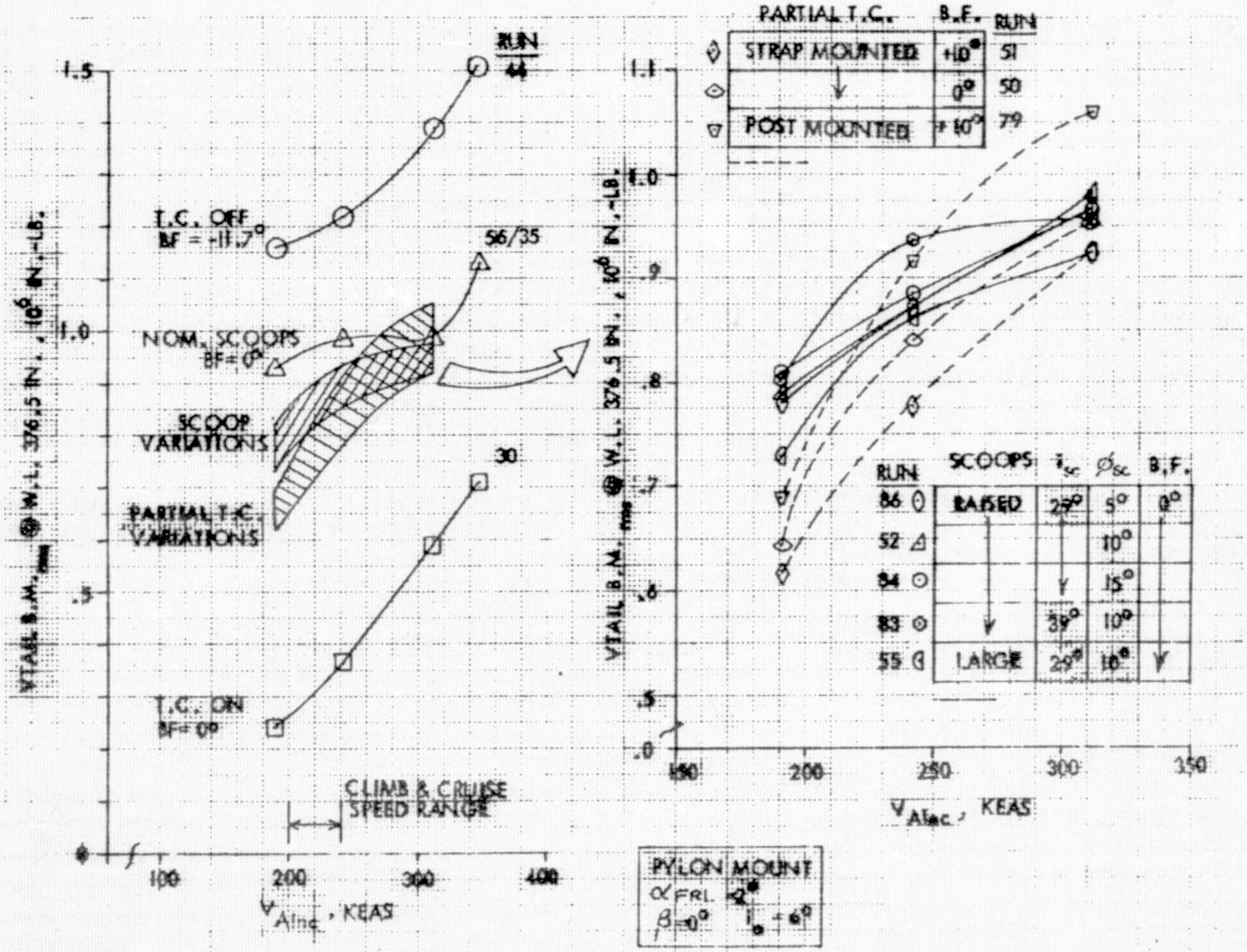


Figure 10. 747 vertical tail buffet loads for selected scoop and partial tailcone variations.

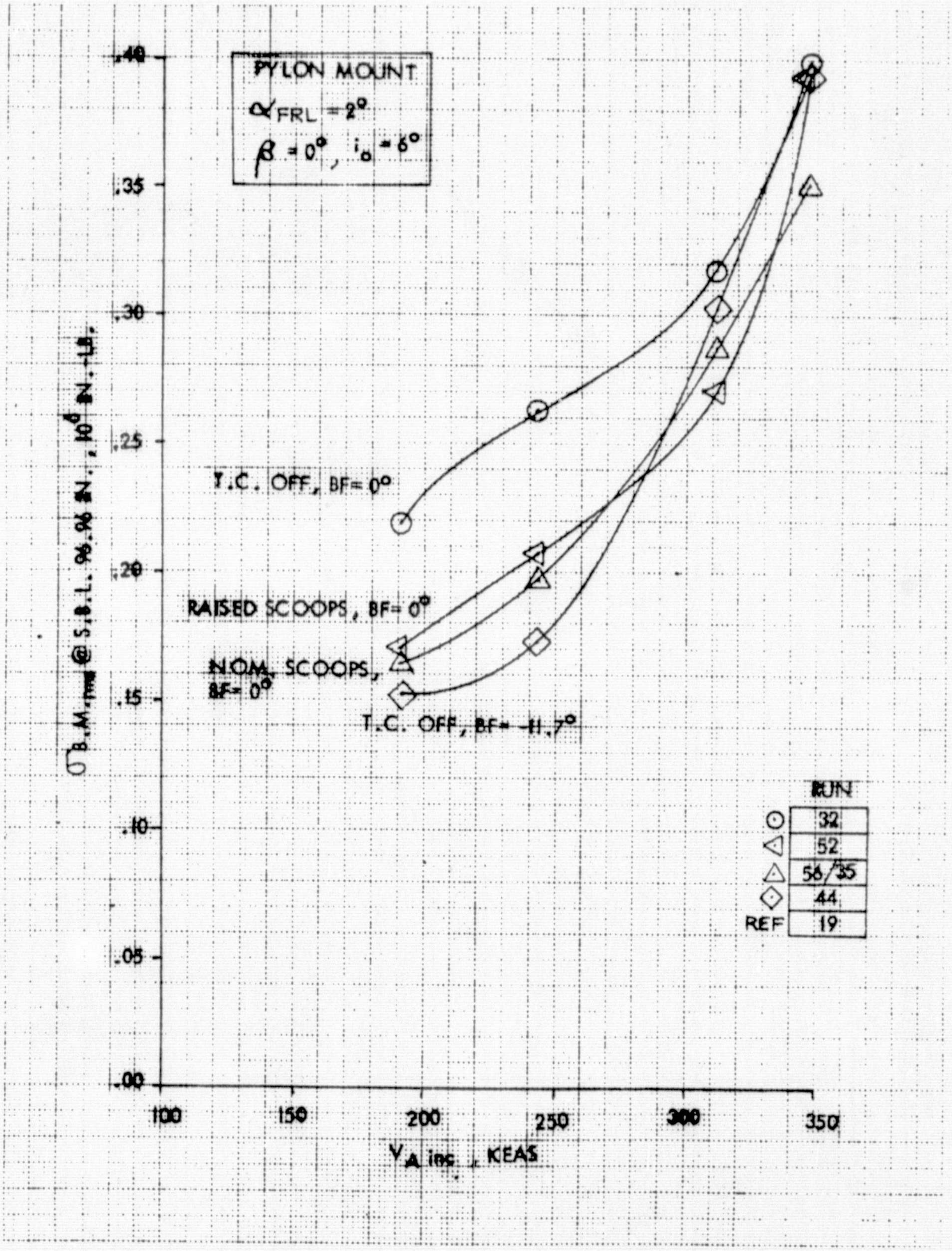


Figure 11. Incremental buffet loads for the 747 horizontal tail.

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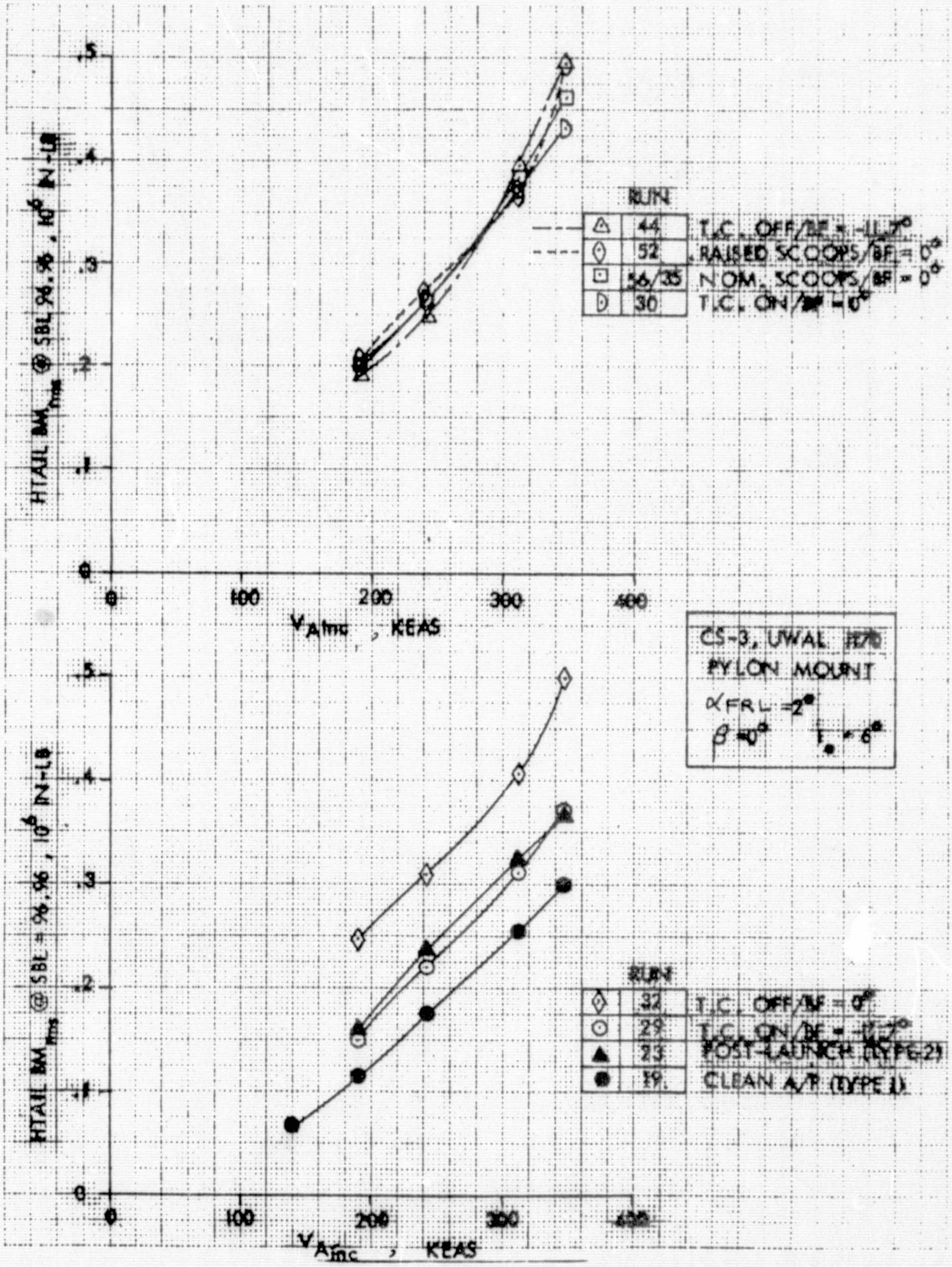


Figure 12. 747 horizontal stabilizer buffet loads.

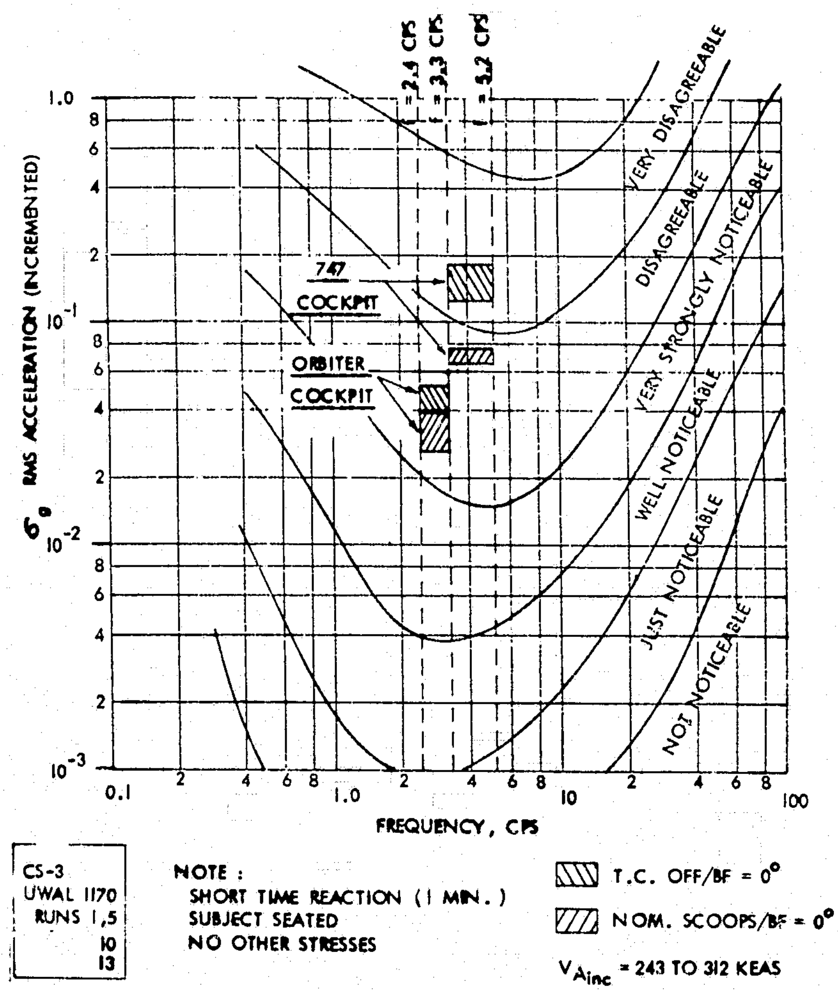


Figure 13. Ride comfort effects due to lateral response from tailcone off buffet (incremented).

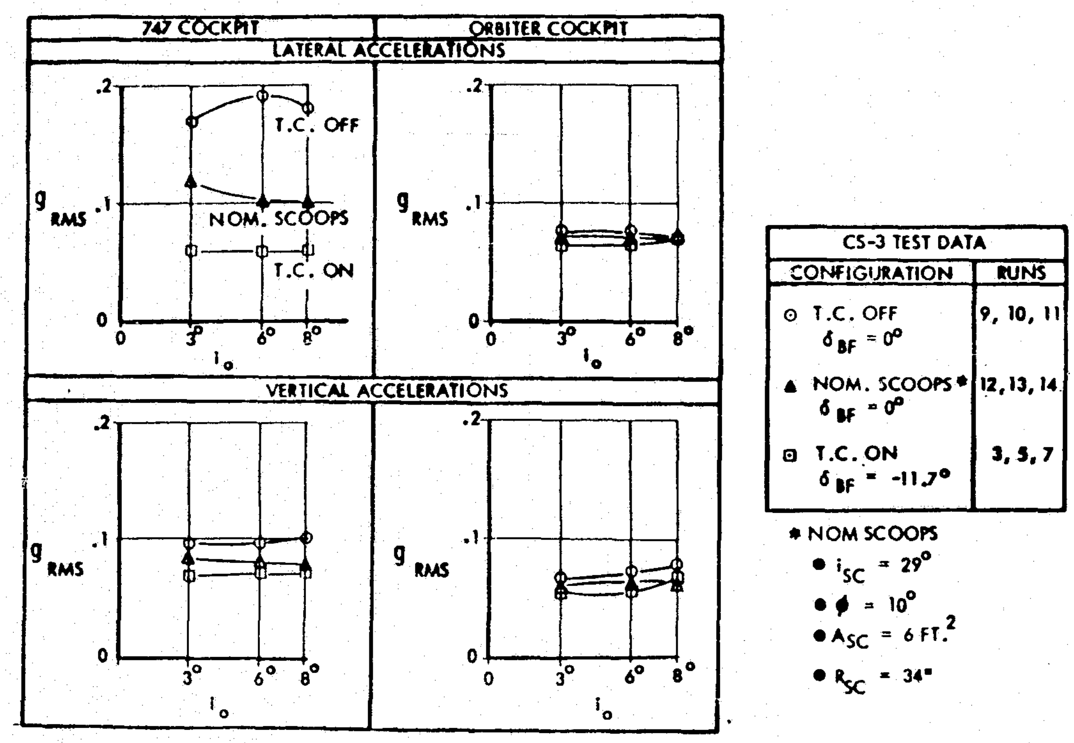
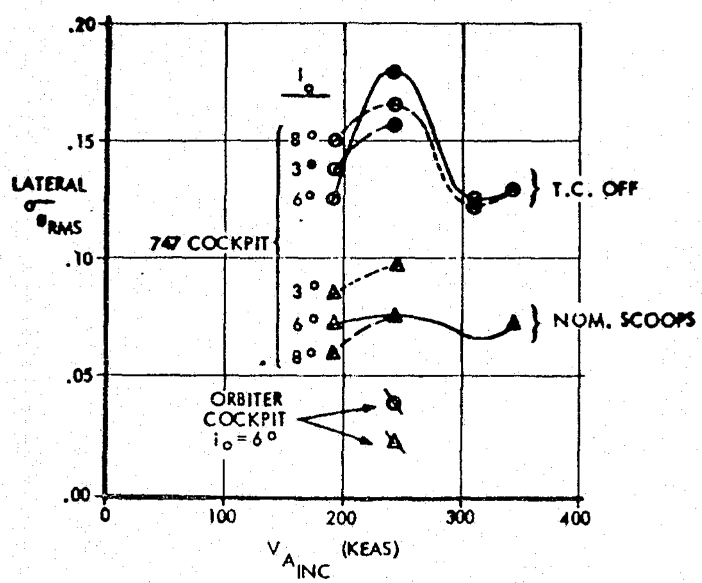


Figure 14. Orbiter incidence effect on cockpit accelerations for V_{INC} = 243 KEAS.



CS-3 TEST DATA

CONFIGURATION	RUNS
● TAILCONE OFF $\delta_{BF} = 0°$	9, 10, 11
▲ NOM. SCOOPS $\delta_{BF} = 0°$	12, 13, 14

SPECTRUM PEAK FREQ. BAND

● ▲ ~ 747: 3.3 TO 5.4 cps

~ ORBITER: 2.4 TO 3.5 cps

NOTE: INCREMENTED ACCELERATION BASED ON:

$$\sigma_{g_{RMS}} = \sqrt{(g_{RMS})^2 - (g_{RMS})^2_{REF}}$$

- FOR 747 COCKPIT: $(g_{RMS})_{REF}$ = CLEAN 747, TYPE 1 (RUN 1)
- FOR ORBITER COCKPIT: $(g_{RMS})_{REF}$ = TAILCONE ON, $\delta_{BF} = -11.7°$ (RUN 5)

Figure 15. Incremented lateral accelerations at crew cockpits.

CS-3 TEST DATA

CONFIGURATION	RUN
⊙ TAILCONE OFF $\delta_{BF} = 0°$	10
▲ NOM. SCOOPS $\delta_{BF} = 0°$	13
⊡ TAILCONE ON $\delta_{BF} = -11.7°$	5
✦ CLEAN 747	1

ROD MOUNT

$i_o = 6°$

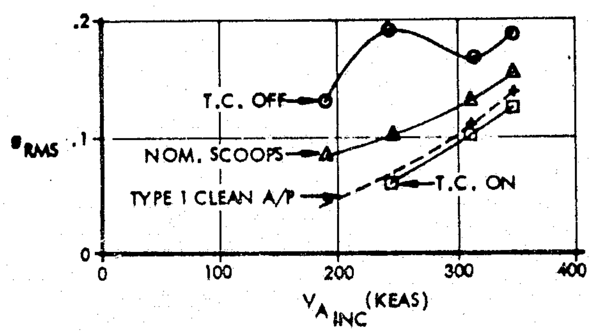


Figure 16. 747 cockpit lateral response accelerations for various flight configurations.