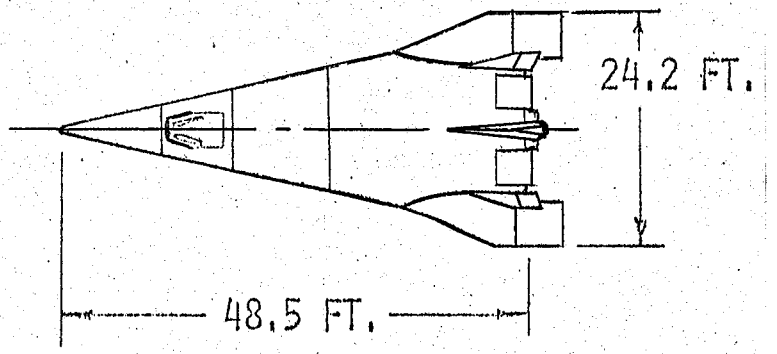
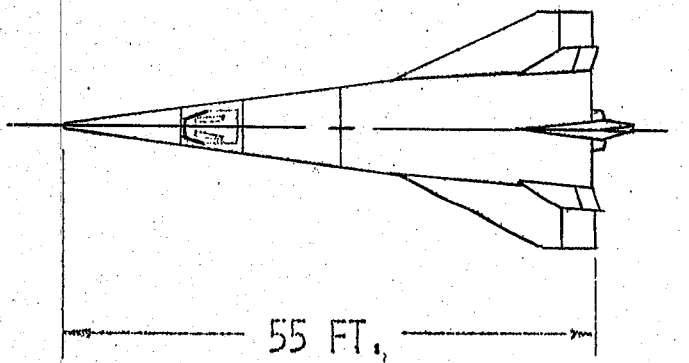
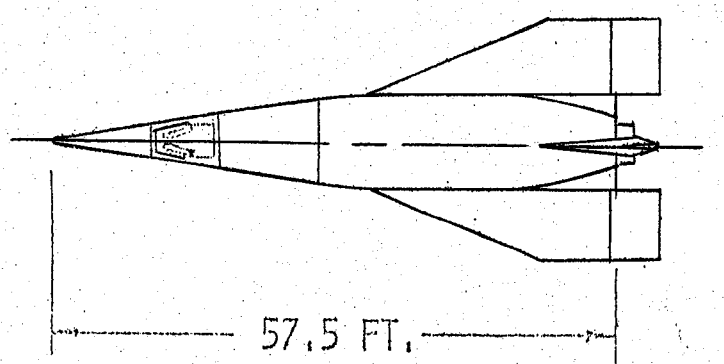
NHFRF STUDY CONFIGURATIONS



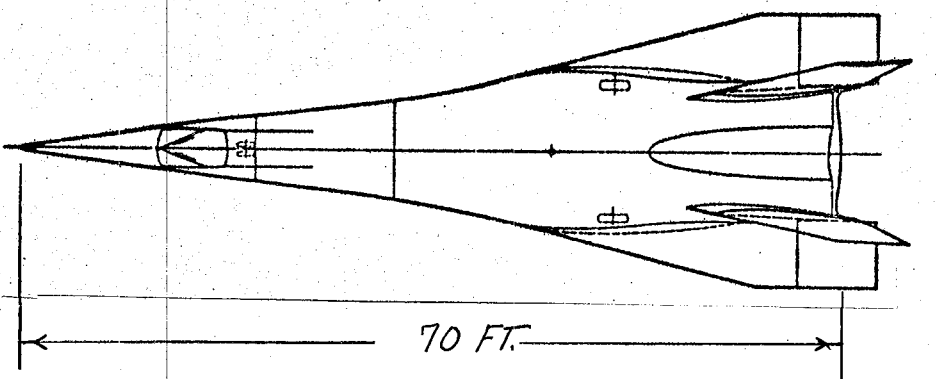
12-I Baseline



X-1



L-16



L-301

$L = 14.6"$

$Z_{cg} = .829"$

$X_{cg} = .62\,\ell$ $(9.052")$

Also See Mech. Design Mag. Jan. 4, 1968

M	R	L/D mzx
18.1	1.94	2.85
19.1	2.94	3.04
20.3	5.38	3.25

Self-trimming at $\simeq 9\text{-}10°\,\alpha$

$\frac{C_m}{C_N} = \frac{.0018}{.104}$ (cg at 61% C_T)

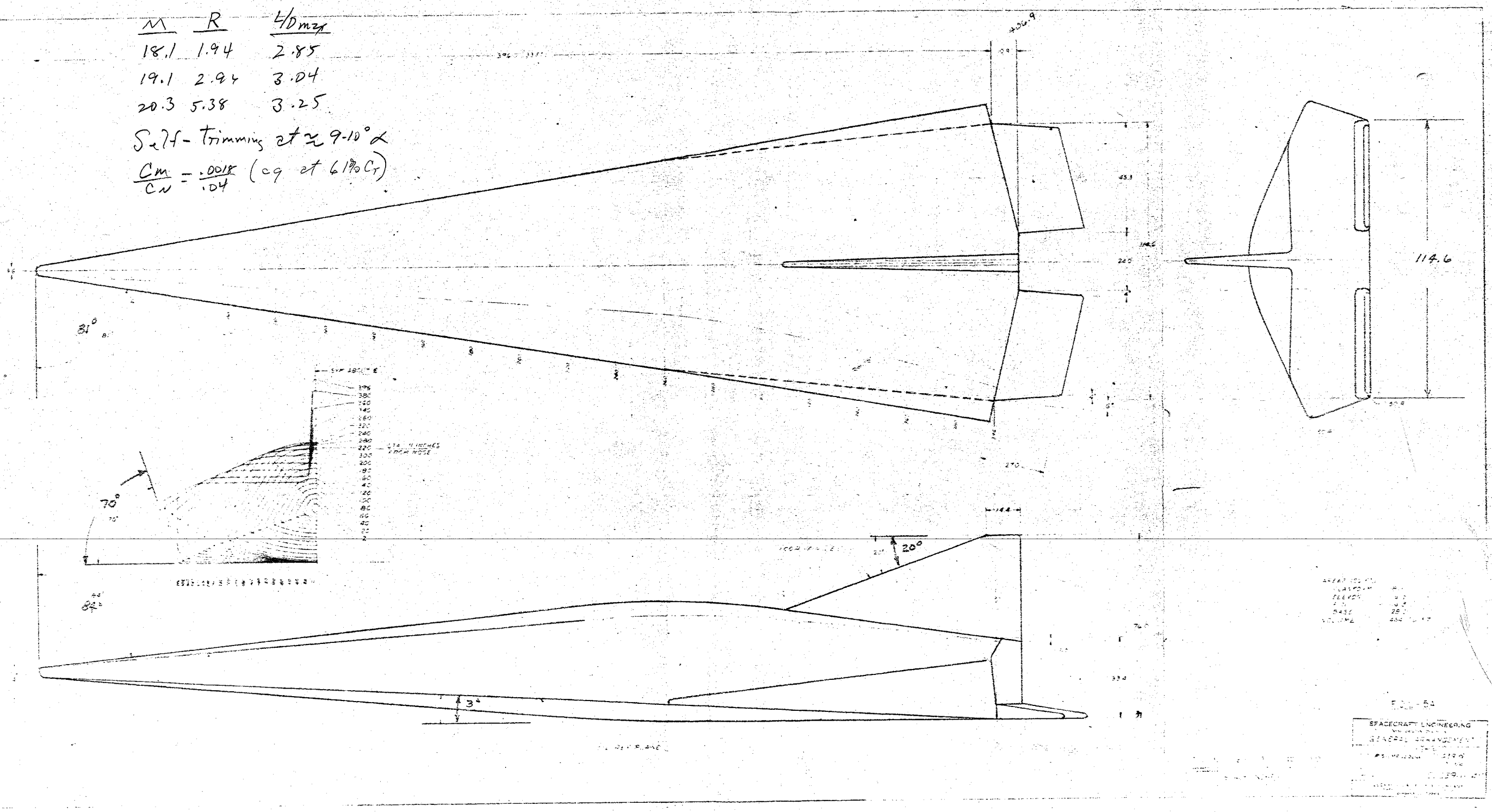
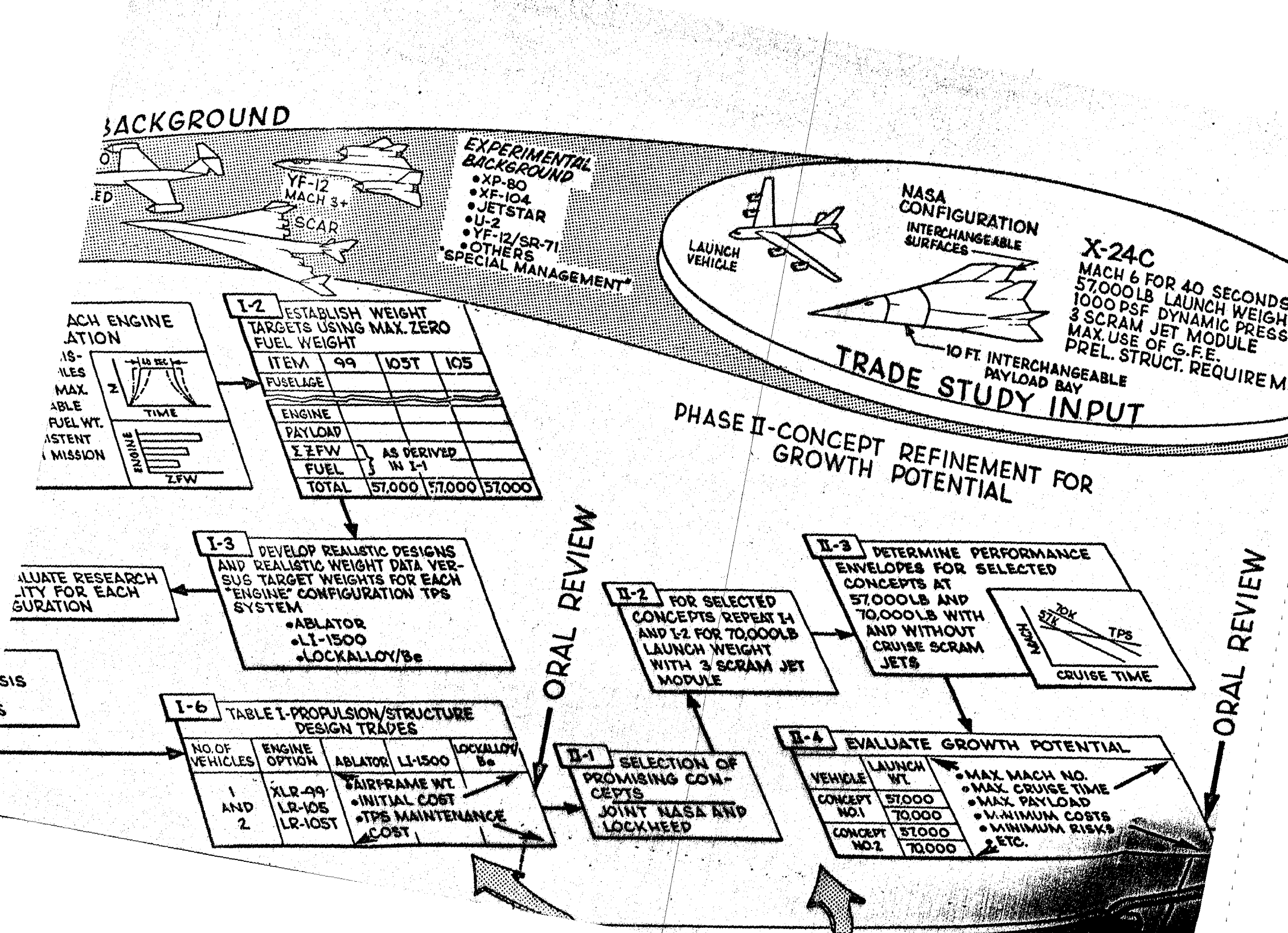


Figure 1 FDL-5A Configuration


BACKGROUND
YF-12
MACH 3+
SCAR
EXPERIMENTAL BACKGROUND
•XP-80
•XF-104
•JETSTAR
•U-2
•YF-12/SR-71
•OTHERS
"SPECIAL MANAGEMENT"
LAUNCH VEHICLE
NASA CONFIGURATION
INTERCHANGEABLE SURFACES
10 FT. INTERCHANGEABLE PAYLOAD BAY
X-24C
MACH 6 FOR 40 SECONDS
57,000 LB LAUNCH WEIGH
1000 PSF DYNAMIC PRESS
3 SCRAM JET MODULE
MAX. USE OF G.F.E.
PREL. STRUCT. REQUIREM
TRADE STUDY INPUT
PHASE II-CONCEPT REFINEMENT FOR GROWTH POTENTIAL
ACH ENGINE
ATION
MAX.
ABLE
FUEL WT.
STENT
MISSION
TIME
ENGINE
ZFW
I-2 ESTABLISH WEIGHT TARGETS USING MAX. ZERO FUEL WEIGHT
ITEM | 99 | 105T | 105
FUSELAGE
ENGINE
PAYLOAD
ΣZFW
FUEL
AS DERIVED IN I-1
TOTAL | 57,000 | 57,000 | 57,000
I-3 DEVELOP REALISTIC DESIGNS AND REALISTIC WEIGHT DATA VERSUS TARGET WEIGHTS FOR EACH "ENGINE" CONFIGURATION TPS SYSTEM
•ABLATOR
•LI-1500
•LOCKALLOY/Be
ALUATE RESEARCH
ITY FOR EACH
GURATION
SIS
S
I-6 TABLE I-PROPULSION/STRUCTURE DESIGN TRADES
NO. OF VEHICLES | ENGINE OPTION | ABLATOR | LI-1500 | LOCKALLOY Be
1 AND 2 | XLR-99 LR-105 LR-105T | •AIRFRAME WT. •INITIAL COST •TPS MAINTENANCE COST
ORAL REVIEW
II-1 SELECTION OF PROMISING CONCEPTS JOINT NASA AND LOCKHEED
II-2 FOR SELECTED CONCEPTS REPEAT I-1 AND I-2 FOR 70,000LB LAUNCH WEIGHT WITH 3 SCRAM JET MODULE
II-3 DETERMINE PERFORMANCE ENVELOPES FOR SELECTED CONCEPTS AT 57,000LB AND 70,000LB WITH AND WITHOUT CRUISE SCRAM JETS
MACH
70K
57K
TPS
CRUISE TIME
ORAL REVIEW
II-4 EVALUATE GROWTH POTENTIAL
VEHICLE | LAUNCH WT.
CONCEPT NO.1 | 57,000
70,000
CONCEPT NO.2 | 57,000
70,000
•MAX. MACH NO.
•MAX. CRUISE TIME
•MAX. PAYLOAD
•MINIMUM COSTS
•MINIMUM RISKS
•ETC.

To Jim Penland

Here are two copies of the latest change on the scramjet model drawings.

Mell Cassidy

11-12-76

Joe

The model total price was $75,000.

The contract cost was approx $45,000.

Included in $75K is:

15,000 500 man-hours design & liaison

1,000 $1,000 raw materials

59,000 balance is fabrication - in-house and outside production.

As you are aware, the model is significantly more complex than we contemplated at the start of the program.

Ray

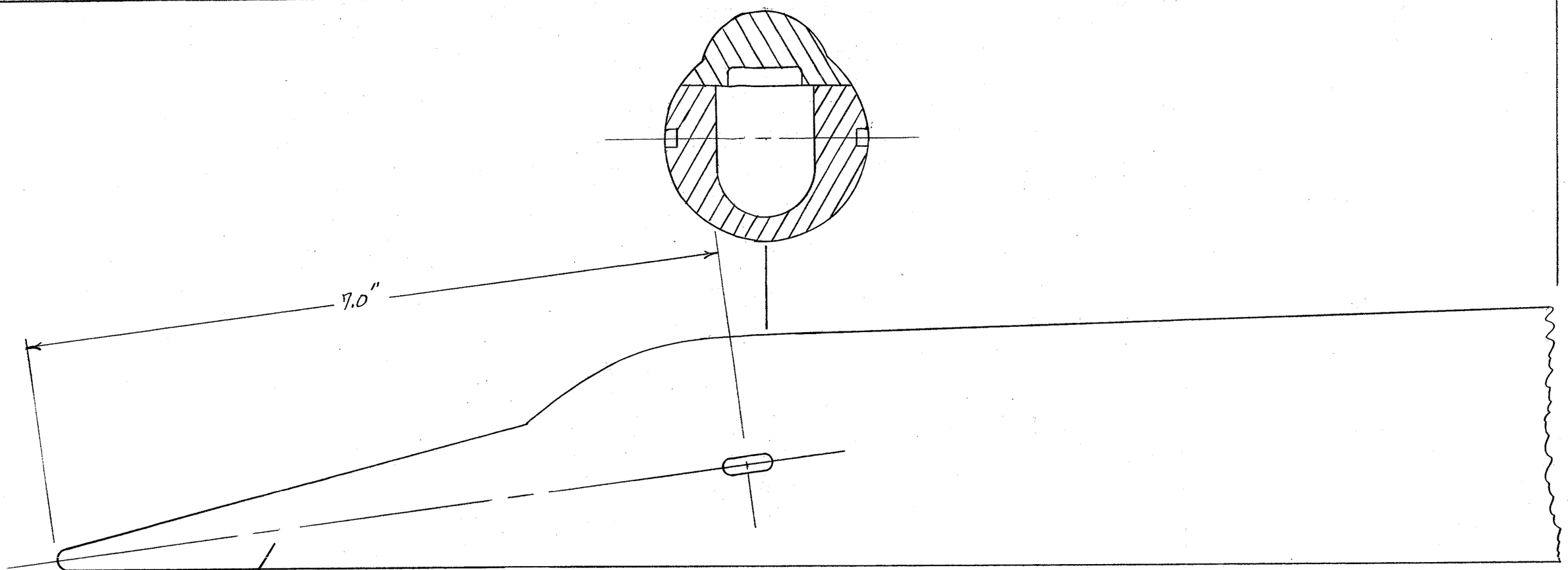
Overland SCHEDULE UPWT T.S. 1 12/1/76

DATE	PROJECT	SPONSOR	TASK	J.O.	ENGINEER	INSTRUMENTATION	REMARKS
11/29	LEAX B Struts	SAB	505-11-21-03	R5432	Monta	Force	
12/6	F-16 Fee Test	G.D.	505-11-41-16	R5813	Tresco		
12/13	Research Aircraft X-24C	HAB	505-11-31-02	R4322	Fournier/Rubbert	Force	Comp 12-23-76
12/29-1/2	Energy Conservation	LaRC					
1/3	Maintenance						
1/24	SCIF VI	SAB	505-11-21-03	R4483	Dollyhigh	Force	
1/31	Interagency Missile	I.A./SAB	505-11-22-01	R5289	Blair	Force	
2/14	OIS Scale Orbiter	SSD	506-26-30-01	R4389	Fournier/Spann	Force	
2/21	Store-Separation Tests	SAB	505-11-21-01	R5396	Stallings	Force	
2/28	MRAAM	NAVY			Hayes	Force & Pressure	
3/7	Skin Friction Measurements	SAB			Allen	Skin Friction Balance	
3/14	Eglin Missile	A.F./SAB			Graves	Force	
3/28	SHIPS III	SSD	506-26-30-01	R4387	Fournier/Spann	Force	

Call to Tunnels After LAC #3 Briefing

as of 9-2-76

- LTPT, Pierpont, 4517, Am on list for 1st week in Nov. 8th, for two weeks.
- 8' TPT, Kelly, 2631, Tu. shut down Nov. 15 - Dec 15 ∴ prob. after Jan 1st.
- UPWT, Corlett, 3181, Roger Feuriler, Char. Trescott. Don Wasson, Don Babbs. On list for Tentative date Nov. 15th
- M=6, 20" Tu., Cary, 3162, Shuttle sonic boom in Oct. & Cub's. Proj.



Note: Sample Prism Furnished

X-24C-L-301 Force Model
Prism Installation
Eng: Jim A. Penland 11-18-76 Appli. Section HSAD Dr. No. 24-C-302

Engineer – Jim A. Penland

PP 1

TEST LOG

20" M=6 HYPERSONIC TUNNEL

TEST NUMBER 6503

DATE Jan. 11, '77 →

Free Transition

MODEL NHFRF L-301

MOMENT REFERENCE 65% ℓ

REYNOLDS NUMBER 6.8×10^6/ft²

	MODEL CONFIGURATION	SURFACE DEFLECTION δ_{e_L}	δ_{e_R}	$\delta_{V_{UL}}$	$\delta_{V_{UR}}$	RUN NUMBERS $\alpha = +4°$ to $+20°$ $\beta = 0°$	$\beta = -4°$
	B (Basic body)	—	—	—	—	142	143
	Bc (Body & canopy)	—	—	—	—	139	140
	BcW	0	0	—	—	78	83
	BcWVL	0	0	—	—	85	86
	BcWVU	0	0	0	0	74	75
	BcWVLVU (Trim)	+10	+10	0	0	95	—
✱	↓ ↓	0	0	0	0	71	72
		-10	-10	0	0	89	—
		-20	-20	0	0	99	—
	BcWVLVUE (Trim)	+10	+10	0	0	93	—
✱	↓ ↓	0	0	0	0	67	68
		-10	-10	0	0	91	—
		-20	-20	0	0	101	—
	Roll Control	+10	-10	0	0	92	—
	Yaw Control	0	0	+5	+5	103	—

22 runs

Engineer: Jim A. Penland

pp 2

TEST LOG

20" M=6 HYPERSONIC TUNNEL

TEST NUMBER 6503

DATE Jan. 11, '77 →

Free Transition

MODEL NHFRF L-301

MOMENT REFERENCE 65% ℓ

REYNOLDS NUMBER 6.8×10^6/ft

MODEL CONFIGURATION	SURFACE DEFLECTION				RUN NUMBERS	
					α = +4 to +20	
	δ_{e_L}	δ_{e_R}	$\delta_{V_{UL}}$	$\delta_{V_{UR}}$	$\beta = 0°$	$\beta = -2°, -4°$
$B_C W V_L E$	0	0	—	—	124	125
$B_C W V_U E$	0	0	0	0	127	130
$B_C W V_L V_U E$ ($5°$ Drag B_r) (Trim)	+10	+10	+5	−5	110	—
↓	0	0	+5	−5	104	105
↓	−10	−10	+5	−5	115	—
$B_C W V_L V_U$ ($5°$ Dr. Br.)	+10	+10	+5	−5	112	—
↓	0	0	+5	−5	119	120
↓	−10	−10	+5	−5	113	—
$B_C W V_L V_U E$ ($5°$ Drag Br.) Roll Control	+10	−10	+5	−5	116	—
" Yaw "	0	0	+10	0	122	—
10° Drag Br.	0	0	+10	−10	106	109
20° " "	0	0	+20	−20	135	136
$B_{cs} W V_{Ls} V_U$ (Lockheed Clean)	0	0	0	0	132	133
B_S (Lockheed Body)	—	—	—	—	145	146

Sent to Bob Hath 7-15-77

Jim A Pen.
pp 1064

Plotting Schedule for Test 6503, 20" M=6 Tu.

Original Data Reduction by Paul Quirk

Parameter	Scale	Limits
α	5°/in	−5° to +20° ✓
C_N	0.04/in	−0.12 to +0.28 ✓
C_L	0.04/in	−0.12 to +0.24 ✓
C_A	0.02/in	0 to +0.06 ✓
C_D	0.02/in	0 to +0.12 ✓
L/D	1.0/in	−4.0 to +4.0 ✓
C_m	0.004/in	−0.012 to +0.016 ✓
$(C_L)^2$	0.01/in	0 to +0.06
C_{Y_β}	0.02/in	−.02 to +.02 ✓
C_{n_β}	0.004/in	−.004 to +.008 ✓
C_{l_β}	0.004/in	−.004 to +.004 ✓

13 & 2
12 + pp
+12 150 pages.

Plotting Schedule (Continued) Test 6503, 20" M=6 Tu.

Pairing of Runs., C_N, C_A, C_L, C_D, L/D, C_m, C_L^2

Plot #	Runs	Configurations	M	Purpose
1	142, 139, 78, 85, 74, 71	C_{AB} B, B_c, B_cW, B_cWV_L B_cWV_U, $B_cWV_LV_U$	6.	Build-up
2	85, 124, 74, 127, 67	B_cWV_L, B_cWV_LE, B_cWV_U B_cWV_UE, $B_cWV_LV_UE$	"	Engine Build-up
3	142, 139, 145	B, B_c, B_S,	"	Lockheed Body
4	71, 119, 67, 104	$B_cWV_LV_U$, $B_cWV_LV_UD_b$ $B_cWV_LV_UE$, $B_cWV_LV_UED_b$		5° drag brake
5	67, 92, 103	$B_cWV_LV_UE$ $\delta_e = \pm 10°$ $\delta_L = +5°$		Roll & Yaw Cont.
6	104, 116, 122	$B_cWV_LV_UED_b$ $\delta_e = \pm 10°$ $\delta_r = +5°$		Roll & Yaw Cont.
7	67, 104, 106, 135	$B_cWV_LV_UED_b$ $\delta_{D_b} = 0, 5, 10, 20°$		Drag Brakes
8	74, 71, 132	B_cWV_U, $B_cWV_LV_U$, $B_{cs}WV_{Ls}V_U$		Lockheed, Clean
9	$^{+10}95$, 71, $^{-10}89$, $^{-20}99$	$B_cWV_LV_U$, $\delta_e = +10, 0, -10°, -20°$		Trim
10	93, 67, 91, 101	$B_cWV_LV_UE$, $\delta_e = +10, 0, -10, -20$		Trim
11	110, 104, 115	$B_cWV_LV_UED_b$, $\delta_e = +10, 0, -10$		Trim, $\delta_{D_b} = 5°$
12	112, 119, 113	$B_cWV_LV_UD_b$, $\delta_e = +10, 0, -10$		Trim, $\delta_{D_b} = 5°$

Jim A. Penland

Plotting Schedule (Continued) Test 6503, 20" M=6 Tu

Pairing of Runs, C_{Y_β}, C_{n_β}, C_{l_β}

Plot #	Runs	Configuration	M	Purpose
1	142/143, 139/140, 78/83, 85/86, 74/75, 71/72	B, Bc, BcW, BcWVL BcWVu, BcWVLVu		Build-Up
2	85/86, 124/125, 74/75, 127/130, 71/72, 67/68	BcWVL, BcWVLE, BcWVu BcWVuE, BcWVLVu, BcWVLVuE		Effect of Engine
3	67/68, 104/105, 106/109, 135/136	$BcWV_LV_uED_b$, $\delta D_b = 0, 5, 10, 20°$		Drag Brakes
4	71/72, 119/120, 67/68, 104/105	$BcWV_LV_uD_b$, $BcWV_LV_uED_b$, $5°$		Drag Brakes
5	142/143, 139/140, 145/146	B, Bc, B_s		Lockheed Body
6	74/75, 71/72, 132/133	BcWVu, BcWVLVu, $B_{cs}WV_{Ls}V_u$		Lockheed Clean