

QCX  
Airo  
CF105  
P-WT-137

Classification Authority Changed to ONL/AS  
C-105 P/wind Tunnel/137  
By authority of AVS  
PROGRAM OF SPARROW AND CANOPY TESTS  
Date 2-20-66  
Signature DBA  
AND SPARROW JETTISONING  
Rank / Appointment NAE Copy 4 AVSS

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A. V. ROE CANADA LIMITED  
MALTON - ONTARIO

ANALYZED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: CF-105

REPORT No: P/Wind Tunnel/137

FILE No:

No. OF SHEETS:

TITLE:

~~SECRET~~

Classification cancelled / Changed to UNCLASS  
By authority of AVES  
Date 27 Sept 96  
Signature [Signature]  
Unit / Rank / Appointment AVES

PROPOSED PROGRAM OF SPARROW AND CANOPY TESTS AT CORNELL

AND SPARROW JETTISONING IN OTTAWA.

PREPARED BY J. Clark DATE Feb. 1957  
G. Dimock

CHECKED BY DATE

SUPERVISED BY DATE

APPROVED BY **ORIGINAL SIGNED BY**  
**S. KWIATKOWSKI** DATE

ISSUE No.	REVISION No.	REVISED BY	APPROVED BY	DATE	REMARKS

SECRET

CF-105

SPARROW TRAJECTORY TESTS.

OBJECT

To Determine:

- (a) Missile characteristics at various trajectory positions along the fuselage
- (b) Errors due to manufacturing inaccuracies of missile models. (For example:  $1^\circ$  distortion of Sparrow tail-plane yields  $\Delta C_M = 0.21$   $\Delta C_N = 0.054$ )

In order to fulfill these conditions it is considered necessary to obtain 5 points in pitch and 5 in yaw. To eliminate inaccuracies at least 2 additional points will be needed at each trajectory position with the missile inverted.

METHOD

A proposed solution to the mechanical difficulties involved is to use a combination of rotatable eccentric sting and concentrically and eccentrically drilled missiles.

The following will be required for each missile at each trajectory station:

- (a) Sting that can be rotated and locked in four positions ( $\theta = 0, 90, 180, \text{ and } 270^\circ$ ) carrying a 4 component strain gauge on an eccentric spindle (giving  $\alpha = 1.0$ ,  $\beta = -1.0$ ,  $\gamma = -1.0$ ,  $\delta = +1.0$ ) in the 4 positions.
- (b) Missile model with a  $1.0^\circ$  eccentric mounting hole
- (c) Missile model with a concentric mounting hole. With these, the combinations in the following table can be achieved giving 5 points in pitch and 5 in yaw.

Possible errors can be eliminated by averaging runs 7 and 8 (for the concentric missile) and 5 and 6 (for the eccentric missile) and applying the corrections to all other runs.

# SECRET

## C.A.L. WIND TUNNEL PROGRAM

### 1. ARMAMENT

Instrumentation: 4 component missile balance  
2 component main balance

$\psi = 0$ ,  $\alpha$  range: -4, -2, 0, 2, 4, 6, 8, 10, 12

#### (a) High Trajectory - Missile No. 1

Mach No.: .95 and 1.20  
Stations: 1, 2, 3 and 4  
Angles:  $\alpha, \psi = 0, \pm 1, \pm 2$  (9) 80 runs  
(plus 8 check points)

#### (b) High Trajectory - Missile No. 2

As in 1(a) 80 runs.

#### (c) Low Trajectory - Missile No. 3

As in 1(a) 80 runs

#### (d) Low Trajectory - Missile No. 4

As in 1(a) 80 runs

#### (e) Missile No. 3 - Rolled 45°

Mach No.: .95 and 1.20  
Station: 3  
Angles:  $\alpha, \psi = 0, \pm \sqrt{2}$  (5) 10 runs

---

330 runs.

### 2. CANOPY

#### (a) Hinge Moment in Yaw

Instrumentation: 4 hinge moment balances  
2 canopy static pressure taps  
(6 component main balance)

$\alpha = 2 \neq 10$ ,  $\psi$  range: -2, -1, 0, 1, 2, 4, 6

i. Forward closed, rear opening in stages

M = .80, .95, 1.00, 1.05, 1.10, 1.20  
Positions: 1/3 and 2/3 open 24 runs.

ii. Rear open, forward opening in stages

As in 2(a)i 24 runs

- iii. Rear closed, forward opening in stages  
 M = .80, .95, 1.05, 1.20  
 Positions: 1/3 and 2/3 Open 16 runs
- iv. Forward open, rear opening in stages  
 M = .95 and 1.20  
 Positions: 1/3 and 2/3 open 8 runs
- v. Both opening in stages  
 As in 2(a) iv. 8 runs

2. (b) Effect on Directional Stability

Instrumentation: 4 hinge moment balances  
2 canopy static pressure taps  
6 component main balance

$\alpha = 2 \notin 10$ ,  $\psi$  range: -4, -2, -1, 0, 1, 2, 4, 6, 8, 10, 12  
M = .80, .95, 1.00, 1.05, 1.10, 1.20

- i. Both closed 12 runs
- ii. Both open 12 runs
- iii. Front open, rear closed 12 runs
- iv. Rear open, front closed 12 runs

(c) Hinge Moment in Pitch

Instrumentation: 4 hinge moment balances  
2 canopy static pressure taps

$\alpha =$  -4, -2, 0, 2, 4, 6, 8, 10, 12  
M = .95 and 1.20  
 $\psi =$  0

With positions 1/3 and 2/3 Open

- i. Forward closed, rear opening in stages
- ii. Rear open, forward opening in stages
- iii. Rear closed, forward opening in stages
- iv. Forward open, rear opening in stages
- v. Both opening in stages.

2. (c) With no intermediate positions:

- vi. Both closed
- vii. Both open
- viii. Front open, rear closed
- ix. Rear open, front closed

All of section 2(c) to be run in conjunction with 1.

128 runs.

3. DIRECTIONAL STABILITY

Instrumentation: 6 component main balance

M = .80, .95, 1.00, 1.05, 1.10, 1.20  
 $\psi$  = -4, -2, -1, 0, 1, 2, 4, 6, 8, 10, 12.  
 $\alpha$  = 2 and 10

(a) Missiles in Stowed Position

12 runs

(b) Boundary Layer Bleed Exhausts Removed

12 runs

24 runs

4. AILERON EFFECTIVENESS

Instrumentation: 6 component main balance  
1 hinge moment balance

M = .95 and 1.20  
 $\alpha$  = -4, -2, 0, 2, 4, 6, 8, 10, 12  
 $\delta_A$  = -10, -5, 0, 5

To be run in conjunction with 1

0 runs.

5. RUDDER EFFECTIVENESS WITH CANOPY

Instrumentation: 3 component tail balance  
1 hinge moment balance

M = .95 and 1.20  
 $\alpha$  = -4, -2, 0, 2, 4, 6, 8, 10, 12  
 $\delta_r$  = 20, 10, 5, 0, -5

- (a) Both canopies closed
- (b) Both open
- (c) Front open, rear closed
- (d) Rear open, front closed.

To be included in 1.

0 runs.

SECRET

6. FIN PITOT-STATIC PRESSURES

Instrumentation: 2 pressure pick-ups

(a) In Yaw

M = .80, .95, 1.00, 1.05, 1.10, 1.20  
 α = 2 and 10  
 ψ = -4, -2, -1, 0, 1, 2, 4, 6, 8, 10, 12

- i. Upper combination only: short static and dynamic head
- ii. Upper and Lower combinations: short static and dynamic head

To be included in 3.

(b) In Pitch

M = .95 and 1.20  
 ψ = 0  
 α = -4, -2, 0, 2, 4, 6, 8, 10, 12

- i. Upper combination only:  
 Short and long static heads  
 short and long dynamic heads
- ii. Upper and lower combinations:  
 short and long static heads  
 short and long dynamic heads

To be included in 1.

0 runs.

7. TUFTS

Instrumentation: Camera

M = .80, .95, 1.00, 1.05, 1.10, 1.20  
 ψ = -4, -2, -1, 0, 1, 2, 4, 6, 8, 10, 12  
 α = 2 and 10

To be included in 2.





RUN	BALANCE			MISSILE TYPE.	MIS. ATTITUDE			TOTAL ATTITUDE		
	$\alpha$		Sym.		$\alpha$		Sym.	$\alpha$		Symbol
1	1.0	0	B <sub>u</sub>	Eccentric	1.0	0	S <sub>BU</sub>	2.0	0	B <sub>U</sub> S <sub>BU</sub>
2	0	1.0	B <sub>R</sub>	Eccentric	0	1.0	S <sub>BR</sub>	0	2.0	B <sub>R</sub> S <sub>BR</sub>
3	-1.0	0	B <sub>D</sub>	Eccentric	-1.0	0	S <sub>BD</sub>	-2.0	0	B <sub>D</sub> S <sub>BD</sub>
4	0	-1.0	B <sub>L</sub>	Eccentric	0	-1.0	S <sub>BL</sub>	0	-2.0	B <sub>L</sub> S <sub>BL</sub>
5	1.0	0	B <sub>U</sub>	Eccentric	1.0	0	S <sub>BD</sub>	0	0	B <sub>U</sub> S <sub>BD</sub>
6	-1.0	0	B <sub>D</sub>	Eccentric	1.0	0	S <sub>BU</sub>	0	0	B <sub>D</sub> S <sub>BU</sub>
7	1.0	0	B <sub>U</sub>	Concentric	0	0	S <sub>WD</sub>	1.0	0	B <sub>U</sub> S <sub>WD</sub>
8	1.0	0	B <sub>U</sub>	Concentric	0	0	S <sub>WU</sub>	1.0	0	B <sub>U</sub> S <sub>WU</sub>
9	0	1.0	B <sub>R</sub>	Concentric	0	0	S <sub>WR</sub>	0	1.0	B <sub>R</sub> S <sub>WR</sub>
10	-1.0	0	B <sub>D</sub>	Concentric	0	0	S <sub>WU</sub>	-1.0	0	B <sub>D</sub> S <sub>WU</sub>
11	0	-1.0	B <sub>L</sub>	Concentric	0	0	S <sub>WL</sub>	0	-1.0	B <sub>L</sub> S <sub>WL</sub>

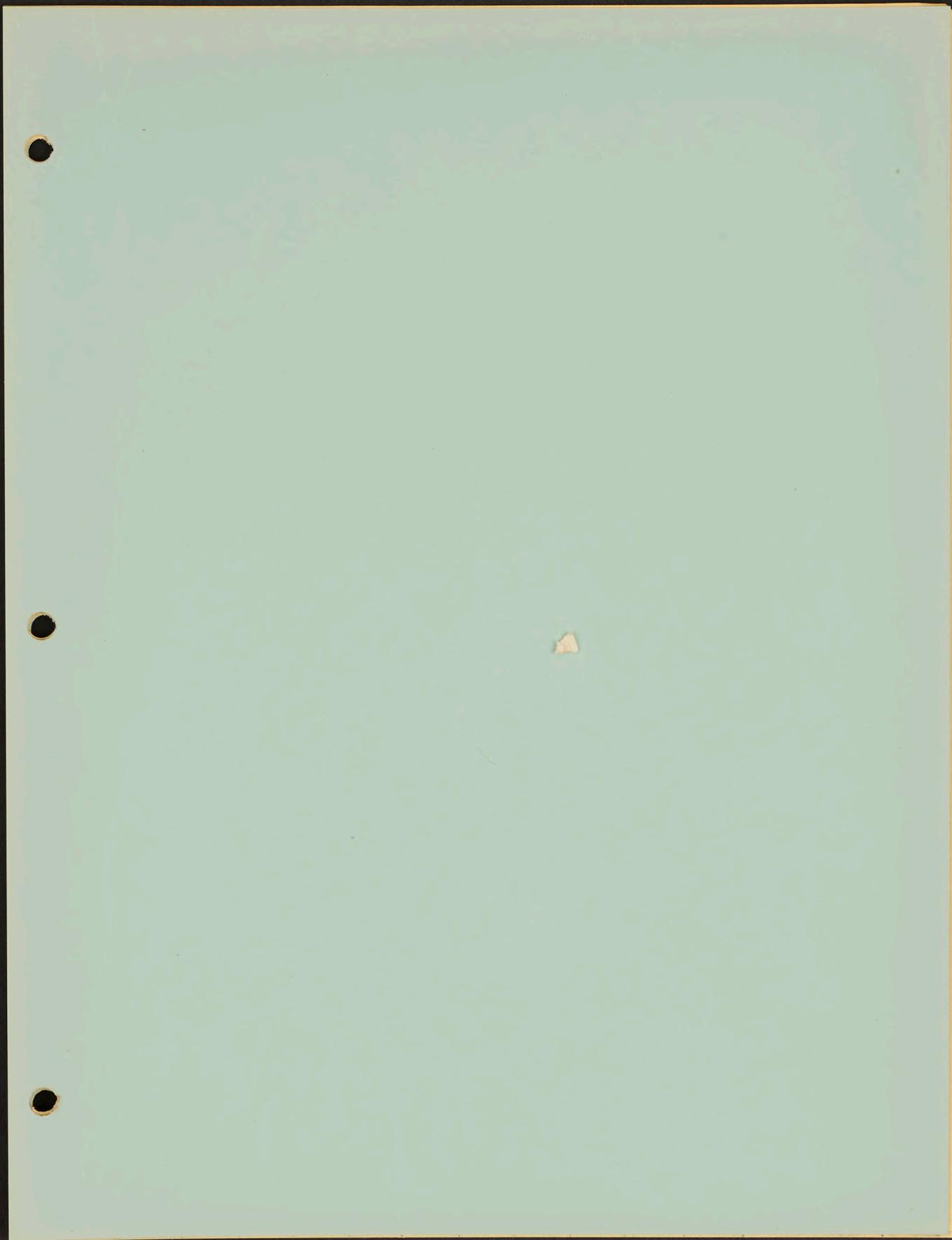
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4 X 11 X 5 X 6 X 9 X 2

10 X

3 X



# SECRET

CF-105

## SPARROW JETTISONING TESTS.

February 1957

### FACILITY

N.A.F. Low Speed Tunnel - Ottawa

### PURPOSE

To evaluate jettisoning of Sparrow Missiles from C-105 aircraft under different flight conditions.

To establish sequence of jettisoning such that no interference is present (missile to airframe or missile to missile).

To prove release mechanism.

### MODEL

.07 Scale C-105 Model

+ 100 Models of Sparrow missiles

32 weighing .148 lb.

32 weighing .278 lb.

36 weighing .606 lb.

### INSTRUMENTATION

Angle of attack and yaw indicator. Recording photographic cameras.

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. **SECRET**

SHEET NO. 1

AIRCRAFT C-105  
SPARROW  
JETTISONING TESTS

N.A.E. LOW  
SPEED WIND TUNNEL

PREPARED BY

DATE

CLARK

JUN 56

CHECKED BY

DATE

RUN	X	B	g dial	V KTS	MISSILES		EQUIVALENT			ACTUAL P.DIAL	REMARKS
					HIGH	LOW	M	KTAS	ALT		
<u>MINIMUM PROGRAM</u>											
1	12.8	0	4.4	590	2		.20	132	S.L.		
2	2.3		27.6	147.5			.50	330			
3	1.3		54.4	207.0			.70	463			
4	.9		80.0	251.0			.85	562			
5	12.8		4.4	590	2		.20	132			
6	2.3		27.6	147.5			.50	330			
7	1.3		54.4	207.0			.70	463			
8	.9		80.0	251.0			.85	562			
9	5.4		23.9	137.2	2		.50	307	20000		
10	2.6		46.8	192.0			.70	429			
11	1.8		68.9	233.0			.85	521			
12	5.4		23.9	137.2	2		.50	307			
13	2.6		46.8	192.0			.70	429			
14	1.8		68.9	233.0			.85	521			
15	13.7		21.0	128.6	2		.50	287	40000		
16	6.7		41.1	180.0			.70	403			
17	4.4		60.4	218.0			.85	489			
18	13.7		21.0	128.6	2		.50	287			
19	6.7		41.1	180.0			.70	403			
20	4.4		60.4	218.0			.85	489			
21	2.3	+5	27.6	147.5	2		.50	330	S.L.		
22	.9		80.0	251.0			.85	562			
23	5.4		23.9	137.2			.50	307	20000		
24	1.8		68.9	233.0			.85	521			
25	13.7		21.0	128.6			.50	287	40000		
26	4.4		60.4	218.0			.85	489			
27	2.3	-5	27.6	147.5			.50	330	S.L.		
28	.9		80.0	251.0			.85	562			
29	5.4		23.9	137.2			.50	307	20000		
30	1.8		68.9	233.0			.85	521			
31	13.7		21.0	128.6			.50	287	40000		
32	4.4		60.4	218.0			.85	489			

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MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

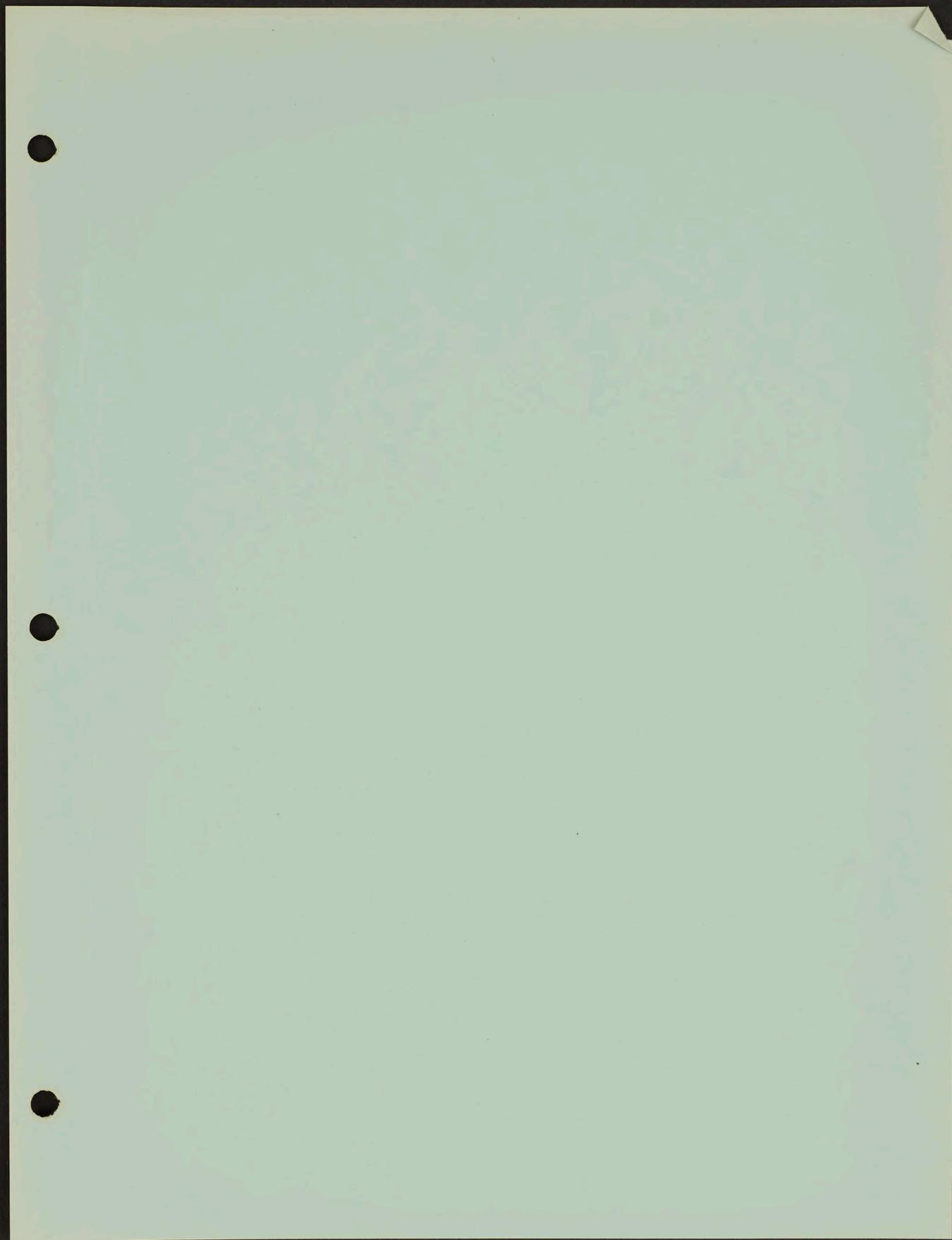
REPORT NO. \_\_\_\_\_  
SHEET NO. 11

AIRCRAFT C105  
SPARROW  
JETTISONING TESTS

N.A.E. LOW  
SPEED WIND TUNNEL

PREPARED BY \_\_\_\_\_ DATE \_\_\_\_\_  
CLARK DEC 56  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

RUN	X	B	P dial	V FPS	MISSILES		EQUIVALENT			ACTUAL Point	REMARKS
					HIGH	LOW	M	KTS	ALT		
33	2.3	±5	276	1475		2	.50	330	5.1		
34	.9		80.0	2510			.85	562	↓		
35	5.4		23.9	1372			.50	307	20000		
36	1.8		68.9	233.0			.85	521	↓		
37	13.7		21.0	1286			.50	287	40000		
38	4.4	↓	60.4	218.0			.85	489	↓		
39	2.3	0	276	1475	2	2	.50	330	5.1		
40	.9		80.0	2510			.85	562	↓		
41	5.4		23.9	1372			.50	307	20000		
42	1.8		68.9	233.0			.85	521	↓		
43	13.7		21.0	1286			.50	287	40000		
44	4.4	↓	60.4	218.0	↓	↓	.85	489	↓		
<u>ADDITIONAL RUNS WITH RECOVERED MISSILES (IF ANY)</u>											
45	2.3	±5	276	1475		2	.50	330	5.1		
46	.9		80.0	2510			.85	562	↓		
47	5.4		23.9	1372			.50	307	20000		
48	1.8		68.9	233.0			.85	521	↓		
49	13.7		21.0	1286			.50	287	40000		
50	4.4	↓	60.4	218.0			.85	489	↓		
51	2.3	±5	276	1475	2	2	.50	330	5.1		
52	.9		80.0	2510			.85	562	↓		
53	5.4		23.9	1372			.50	307	20000		
54	1.8		68.9	233.0			.85	521	↓		
55	13.7		21.0	1286			.50	287	40000		
56	4.4	↓	60.4	218.0	↓	↓	.85	489	↓		



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