File 8

(U) TEST REPORT

XB-70A

FLIGHT 1-1

(No. 1 Air Vehicle, No. 1 Flight)

21 September 1964

Classified by AFFTC
Subject to General Declassification
Schedule of Executive Order 11652
Automatically downgraded at two year intervals
Declassified on 31 December 1970

PREPARED BY

Joseph F. Cotton

Colonel Joseph F. Cotton
Test Director (Copilot)

Charles O. Johnson

Mr. Charles O. Johnson
Chief Project Engineer

XB-70 JOINT TEST FORCE (FTTB)
DEPUTY FOR SYSTEMS TEST
AIR FORCE FLIGHT TEST CENTER
EDWARDS AF BASE, CALIF.

cy 3 of 18 cys

TABLE OF CONTENTS

		Page No.
I.	TEST BRIEF	1
II.	TEST LOG	2
III.	INSTRUMENTATION	8
IV.	DATA	9
V.	ENGINEERING COMMENTS	10
	1. Propulsion	10
	2. Landing Gear	10
	3. Fuel System	12
	4. Airspeed Systems	12
VI.	OBSERVATIONS AND COMMENTS BY THE COPILOT	14
	1. Pre-Flight and Engine Start	14
	2. Pre-Taxi Checks	14
	3. Taxi	14
	4. Takeoff and Climb	15
	5. Level Off for Gear Retraction	16
	6. Descent and Landing	17
	7. Comments	18
	a. Fuel System	18
	b. Hydraulics	19
	c. Engine	20
	d. Flight Controls	20
	e. Cockpit Visibility	20
	f. Cockpit Feel	20
	g. Approach and Landing	21
	h. Landing Gear and Brakes	21
	8. Pilot Squawks	21
	9. Conclusions	22
VII.	RECOMMENDATIONS	24

I. TEST BRIEF:

1. The first flight of XB-70A 001 was conducted on 21 Sep 64. The airplane departed Palmdale at 0838 and arrived at Edwards AFB, California at 0945. (Flight Time - 1 Hr - 7 min). (U)

2. The test flight crew consisted of Mr. Al White, Chief Test Pilot, North American Aviation (NAA), Pilot and Colonel Joseph Cotton, XB-70A Joint Test Force Director, AFFTC, Copilot. (U)

3. Engine start began at 0657, but was interrupted when the No. 2 cooling loop pump failed to operate. The pump was rendered operative by cycling circuit breakers and engine start resumed at 0714. Taxi to the west end of the Palmdale Airport was initiated at 0813. Following gear, tire, brake, and wheel inspections, a maximum afterburner takeoff was made to the east. Rotation was accomplished at 170 KIAS and lift-off at 183 KIAS. (C)

4. Initial climb was made at approximately 220 knots with re-heat three (RH-3) power. Upon reaching Edwards AFB Rogers Dry Lake and following inspection by chase aircraft, an attempt to retract the landing gear proved unsuccessful. (Time - 0851) The main landing gear (MLG) doors opened and the bogies rotated, but did not fold. Consequently, the main gear did not retract. The gear was cycled down and a safe indication was received, but the MLG doors did not close. Nose gear cycle including door operation was completed in both directions. The flight was continued with all gear down, the nose gear door closed and the main gear doors open. (U)

5. Flaps were retracted at 0904. Stability data consisting of a longitudinal pulse, constant heading sideslip, release for dynamic lateral - directional stability, windup turn to 1.4g and a slow aileron roll were obtained at about 250 KIAS and 14,500 feet altitude. A speed-power point was then flown and the flaps were extended. (C)

6. Immediately after flap extension, the No. 3 engine was shut down because of an indicated overspeed. One low approach was conducted prior to the landing on Edwards AFB Runway 4. Touchdown was made at 180 KIAS. Immediately after touchdown, the rear tires on the left MLG bogie blew allowing the rear wheels and bogie to contact and drag on the runway surface. The drag chute was deployed and was jettisoned at 74 KIAS. The airplane came to a stop with approximately 1700 feet of runway remaining. The left MLG bogie assembly was extensively damaged and had to be replaced before the airplane could be towed from the runway. (C)

7. Chase for the flight consisted of four T-38's (used in relays) and TB-58 No. 662. A helicopter with the NAA rescue team followed the airplane during the takeoff and landing. (U)

II

21 SEP 64

TEST LOG
FLIGHT NO. 1

0610 PILOTS IN COCKPIT. RESERVICE HYD.

* 0617 TEMP ALOFT (°C)

5M	15.8	15M	0.7	25M	-21.7
10M	9.3	20M	-9.5	30M	-36.6
				35M	-49.6

0620 START CHECK LIST

* 0614 P_1 = 182% U_1 = 166%
P_2 = 183% U_2 = 168%

0616 P_1 = 186% U_1 = 187%
P_2 = 184% U_2 = 195%

0622 TIME HACK

0626½ INSTR MASTER ON

0635 STRONG SIGNAL UHF 1 WITH TM ON.

0645 NH_3 545 H_2O 4250

0650 FIRE DETECTOR - ALL CHECK OK

0652 CHECK LIST COMP.

0657½ START NO. 4 C/N 1836. LOW PEAK EGT. IDLE 58
NO. 2 COOL LOOP PUMP LITE ON. LITE WAS ALSO ON WITH GPU ON.
SELECT COOL LOOP PUMP 2 ON PANEL. NO PRESS IND.

0702½ SHUTDOWN NO 4. TROUBLE SHOOT COOL LOOP PUMP.

0712½ COOL LOOP PUMP OK NOW.

0714 C/N 2818. START NO. 4 520° PEAK - OK

0715½ START NO. 3 - NO IGNITION. CHECK & RESET C/B

0717½ START NO. 3 550° PEAK - OK

0719½ START NO. 1 470° PEAK - OK. SET NOZ & AIR DATA, STATIC & MASTER CAUTION COMING UP

0721 START NO. 2 490° PEAK - OK

0722½ START NO. 6 560° PEAK - OK

0723 START NO. 5 500° PEAK - OK
NO. 4 GEN ON

0724½ NO. 2 TANK - ON. NO. 3 = 26,700 & NO SUMP LOW IND.

FLIGHT NO. 1

0725 NO. 3 GEN ON

0728 U_1 = 120 % P_1 = 205 %
U_2 = 150 P_2 = 170

0729 NO. 1 ENG → 100% TO CHECK HYD. CYCLE CONTROLS

0731 NO. 2 PRIM PUMP OSCIL 2800-4000. CONTROL CYCLES

0734 NO. 3 ENG RUN UP FOR HYD

0738 CHECKING PUMPS - ALL ENG. RECHECK NO. 2 PRIM. SLIGHT OSC.

0745 FLT CONTROL CHECK

0749 WIND ZERO

0750 FLT CONT CHECK COMP.
P_1 = 3750 PSI U_1 = 4100 P_1 = 205% U_1 = 115%
P_2 = 4150 PSI U_2 = 4100 P_2 = 185% U_2 = 168%

0753 SERVICE HYD.

0758 P_1 = 180% U_1 = 165%
P_2 = 176% U_2 = 168%

0800 FUEL READING

0801 FIRE DETECTOR - OK. NO. 4 TANK PUMP ON

0802 HYD DISCONNECTED - CLOSE DOOR NOW

0803 C/M 5756

0804 AUX COOL ON - FANS ON

0805 CONTROL PULSE FOR FLUTTER CHECK - 5100 LB

0807 NO. 4 TANK OFF 4500 LB TO LET SUMP DOWN & PULL OUT OF NO. 1

0808 EMER GEN ON. C/P ADI OSC & TILT. PILOT TO STDBY ADI & OSC 30° HDG

0811 CHASE 213. AIRBORNE P_1 = 188% U_1 = 190%
P_2 = 182% U_2 = 205%

ALL GSE DISC.

0812 TAXI CLEARANCE WIND 040° AT 8-10 KT

0813 TAXI 132,000 LB FUEL. LITTLE CHATTER IN LEFT TURN. (2)

0817 TURN RIGHT ON PARALLEL TAXIWAY (WEST). FUEL READING

0819 TB-5B ON EDW RUNWAY.

0821 CONTROL PULSE FOR FLUTTER

0823 TURN LEFT TO ENTER RUNWAY

0824 ON RUNWAY. NO. 6 TANK - AUTO. NO. 1 - OFF

0830 TIRE & GEAR CHECK. FLT CONTROL CHECK

0831 P_1 = 185% - 165%
P_2 180 U_1 200-205%

0832½ ANTI COLLISION LITES ON

0833½ FOUR MINUTE CHASE WARNING. CHECK LIST COMP.
"S" BAND BEACON - OK

0837½ C/N 7825 POWER TO MIL

0838¼ BRAKE RELEASE → MAX A/B

0839 ROTATE 170 KT, LIFT OFF 183. TIME 32 SEC. (2)

0839½ RH-3 220 KT. DATA OFF. CHASE SAYS - OK (2)
CLIMB 80° T/A. HOLD 222 → 226 KT

0841 6000 FT DATA ON 800/. OUT OF A/B TO MIL PWR (2)
109,000 LB FUEL

0841½ DATA OFF. HEAD TO LAKE

0842 TE-58 PASSING THRU BM. 221 KT. FLAP HANDLE DOWN, INDICATES BARBER POLE. CHASE SAYS OK. DRAINING FROM HOLE NO. 1. END FUS (OK H_2O BOILER).

0843½ SLIGHT RT THEN LEFT TURN

0844 9000 FT 106,500 LB. NO 1 ENG 50% (4)
NO. 2 ENG 50%
P_1 3400/205% U_1 4100/137%
P_2 4000/205% U_2 4000/205%

0845 CABIN = 7500 FT FL = 10,000 FT EAST LAKEBED

0848 MIL POWER 11,000 FT 217 KTS NORTH BASE (2)
101,000 LB FUEL. SLIGHT BUFFET CHASE REPORTS TIPS SHAKE.
P_1 = 3700/204% U_1 4000/156%
P_2 4000/205 U_2 4000/205
STATUS OK. DRAW OSC WHEN CYCLE CONTROLS

0849 NO. 3 TANK = 32,300

0850 EE = 42-44°F. AUX COOL OFF. ROLL OUT HDG 060°

0851 SOUTH BASE ~ 12,000 FT

0851½ C/N 8665 GEAR SELECTED UP. POINTED OUT DID NOT FOLD. NOSE COMPLETED CYCLE. GRN IND ON RH GEAR. LT & NOSE LITES OUT. RED LITE IN HANDLE.

0853½ GEAR HANDLE DOWN. RIGHT LITE OUT. DATA STILL ON. UTIL PRESS OK. GEAR DOWN OK. MAIN DOORS STILL OPEN. THREE GRN - NO RED.

0854 CHASE REPORTS DISCOLORATION FROM LEFT TRUNION DOOR. BLUE - COULD BE BLUE GREASE. CHASE 3 REPORTS NO. 3 NOZZLE WET - LIGHT SPRAY.

0855 A_8 = 38% RPM = 100%
12,500 FT 233 KIAS
EE = 49° LN2 = 34
90,000 LB FUEL 6L 16,500 6R 16,900 3 32,500 LB (C)

0856 P_1 = 205% U_1 205
P_2 = 205% U_2 205

0901 DECIDE FLY GEAR DOWN. ALT TEST CARD.
EE = 58° 1230 ON RHEOSTAT

0903 FUEL = 84000 LB (C)

0904 CIN 9417 DATA ON. FLARE UP. 14,700 FT.
11 SEC. HELD ALT OK END UP AT 15,300 FT. EXCELLENT
DATA OFF 9458.

0905 INTERVALOMETER TO 60 SEC. TURBULENT - LATERAL SHAKE AT 15,000, 255 KT LESS THAN MIL OVR

0907 AIS CHECK CHASE 242 KT 14,250 FT (2)
B-70 259 KT 14,530 FT

0908 P_1 205 U_1 160 - LOW DIAG
P_2 205 U_2 205

NO. 3 = 32,500 TOT = 77,000 LB (C)

0910 CIN 9800. DATA OFF 9944
TRIM SHOT
STATIC DIR → 3° β
EVENT 3 RELEASE FOR OVN LAT-DIR
EVENT - 1.3g TO LEFT 1.3g, BACK OFF TO 1g THEN TO 1.4g.
LEFT ROLL
CHASE 4 & 5 AIRBORNE

0913½ SET UP SPEED POWER POINT. DATA ON 15 SEC INT.

0915 254 KT 14850 FT T/A = 40° (C)

0918 TOT = 67,000 LB P_1 U_1 EE = 58°F
P_2 205 U_2 205 3500 FT (AGL)

GROUND COL DOORS - OPEN
~ 11 MIN LEFT TO 50,000 IN PATTERN
GROUND WIND 10 KT 020°

FLIGHT NO. 1

0920 16,800 FT 065 HDG 250 KIAS

0922 TANK 6 OFF

0923 DATA ON 10570. FLAPS DOWN. LOOK OK FROM CHASE. CHECK POLE. 23 SEC. NO LOSS ALT.

0923½ NO. 4 TANK AUTO

0924 SHUTDOWN NO. 3 - INDICATED 108% +. MAN THEN ACT THROTTLE DIDN'T PULL IT BACK. BACK TO MANUAL THEN SHUTDOWN. ENGR GEN - ON. DATA WAS ON.

0927 177 KT. VS 170 KT CHASE. SLOWEST SPEED 175 KT (C)

0927½ LETDOWN TO PATTERN TOT FUEL = 56,000 LB (C)

0929½ 235 KT AT 9500 FT (C)
AL LEADS 6-8 KT HIGH
CHASE IN TO LOOK OVER GEAR. COCKPIT OK

0931 FULTON - SOMETHING SMALL OFF NG DOOR. INSTR WIRES LOOK LOOSE.

0932 227 KT WINDMILL RPM = 10% FLARE 194 (C)
MIN T.D. = 165

ON FINAL FOR LOW APPROACH.

0933½ AUX COOL ON - REFER OFF

0934 HOLDING 210 KT. NO. 3 = 2½% RPM STATUS YELLOW.

0935 ON RUNWAY. CHASE EST 50 ACT (OK) 200-205 KT (C)

0935½ LEFT TURN OUT. NO. 4 EMPTY

0939 DOWNWIND NORTH BASE 43,500 LB FUEL (C)

0940 BASE LEG ALT = 29.95 IN

0940½ TURN FINAL 2 MILES OUT 207 KT 42,000 LB (C)

0941½ DATA ON WIND 020° AT 12 KT

0943 TOUCHDOWN - LEFT GEAR FIRE (C)
2 CHUTES. 180 KT T.D.

0943½ JETTISON CHUTES 74 KT
AFT TIRES BLEW

0945 ON 11,000 DATA OFF. SHUTDOWN ON RWY 17 NEAR LAKE BED END.

P_1 205% U_1 115%
P_2 205 U_2 135

FUEL QUANTITY DATA
XB-70A 62-001

TEST FIRST FLIGHT DATE 21 SEPT 64

EST START

TIME		0630	0715	0730	0800	0815
C/N				3178		0478
Xfer		None	None	None	4 ON	OFF
Cond		Prep	4 started	All 6	All 6	TAXI
		to start		RUN	Finished	START
1	—	250		450	850	1500
2	20050	20375	20200	16300	16700	16300
3	32700	28750	28000	25300	33000	30400
4	20050	23500	23600	23650	5000	4600
6L	75200	38500	38500	38500	38550	38600
6R		37950	38000	37950	38000	37900
7L		400	500	550	550	500
7R		-400	-400	-400	-300	-200
8L		-100	+100	+200	350	500
8R		-100	000	000	100	100
Tot		150000	150000	147250	-	131500
LN_2		27/32	13/16	13/16		3/4+
OAT		39 1/2	49	50 1/2		54
NH_3		545	545	545		520
H_2O		4250	4250	4250		4250
LOX		17.8	—	17.5		
EE		50	48	50		
	6.5#/gal					
			0725	#2	#4	#1
			#2	OFF	ON	ON
			ON	0730	0740	0820
			SUMP		#4 OFF	
			26700		0807	

FUEL QUANTITY DATA
XB-70A 62-001

TEST FIRST FLT. DATE 21 SEPT 64

TIME	0525	0900	0915	0930	0941	0950
C/N	7078	9178	10078			—
Xfer	6 Auto	6 Auto	Auto			—
Cond	Lined	13750				
	up	ft.				
1	100 to 1000	500-1100	1000	1100		1150
2	16400	16300	16300	16600	3400	3450
3	32400	32500	32500	23500	29700	28350
4	4800	4600	4700	5200	100	-50
6L	37200	14700	5500	2400		2400
6R	38000	16000	9800	1400		1300
7L	650	700	700	600		800
7R	-250	-400	-350	000		0
8L	600	100	700	100		950
8R	300	400	100	300		200
Tot	130000	58000	19500	50000		40500
LN_2	3/4+	~~1/4~~	3/4-	5/8		1/2
OAT	55	~~52~~	52	56		66
NH_3	500					425
H_2O	4250			6 OFF		3750
LOX	17			APPX		16
EE	63			0923		65
	0824					
	#6			4 ON		
	auto			0936		

III. (U) INSTRUMENTATION:

1. AFFTC PCM Station:

As soon as the instrumentation data tapes were removed from the air vehicle, they were taken to Data Systems Division - Digital Processing Branch (DPB) to be reproduced (dubbed) and to make "Quick Look" Offner records of selected parameters. Data reproduced from the air vehicle tape was unacceptable as all traces were very erratic, the general appearance of which looked like the random presence of an unwanted 128 bit. In view of this, DPB requested from NAA a special test tape which contained time code words. Upon receipt of this tape, DPB evaluated their dubbing and "Quick Look" capability and generally concluded that they had problems. DPB is making every possible effort to determine the source of the problem and implement the necessary corrective action.

2. Airborne Data System:

a. On the surface, accurate time correlation appeared to be our biggest instrumentation problem. Because of an electrical power interruption during engine start and after the instrumentation was turned on, the data package time code generator reset; however, the cockpit counter was not correspondingly reset. By comparing parset time with telemetered ships data system time, both recorded on the same Offner recorder in the Flight Monitor Room, we found that the cockpit counter indication was 2430 seconds ahead of data system time. The possibility of this condition occurring again will be lessened on the next flight by having the pilots reset the system time and cockpit counter just prior to takeoff.

b. All on-board recorders functioned normally. Approximately 38 to 40 of the 48 minutes of available data time were used. Telemetry was satisfactory during the flight. In general, the complete data system functioned very well, and especially so for a system that has not been previously flown.

IV. DATA:

1. Landing:

Listed below is preliminary time event-distance data for the landing. The film is currently at the Pasadena Data Center for final data reduction.

- WEST TOWER CAMERA TO RUNWAY $\mathcal{C}_L$ = 5164.9 FT
- AIRPLANE LOCATION ON RUNWAY WITH RESPECT TO WEST TOWER CAMERA = 5164.9 × TAN(θ-180) FT

EVENT	FRAME	TIME~SEC	θ~DEG	TAN θ	DIST~FT
TOUCHDOWN	818	0	-3.64	-.06379	-330
LIFT-OFF	821	.75	-1.14	-.02007	-103
TOUCHDOWN	823	1.25	.5	.0[illegible]73	45
NOSE WHEEL ON	847	7.25	18.62	.33686	1,740
EXT. CHUTE DEPLOY	872	13.5	33.50	.65688	3,393
EXT. CHUTE BLSM.	882	16	37.91	.7785	4,020
MAIN CHUTE DEPLOY	885	16.75	39.15	.8132	4,200
MAIN CHUTES BLSM (2)	895.	19.25	43.06	.93415	4,820
ALL MAINS BLSM	938	30	53.44	1.349	6,970
JETTISON	1002	46	59.98	1.732	8,940
STOP	1140	80.5	63.69	1.988	10,254

- STOP POINT ON RUNWAY = 2807 + 10254 = 13 061 FT FROM WEST END.

NOTE: ABOVE DATA IS SINGLE STATION SOLUTION USING WEST TWR DATA
EAST TOWER DATA SHOWS AIRPLANE STOPPED AT

5165 TAN(180 - 161.38) + 2807 + 8692 =

1820 + 2807 + 8692 = 13,300 FT.

V. ENGINEERING COMMENTS:

1. Propulsion: (C)

a. The No. 3 engine was shut down in flight because of an indicated overspeed to 108%. Subsequent examination of the flight test data showed a fuel flow of 12,000 lb/hr and an rpm of 107%. The engine, S/N 170-562, has been removed from the aircraft and replaced with 572. The fuel control from 562 was sent to the Edwards AFB propulsion laboratory for X-ray, bench check, and partial teardown. The X-rays showed the fuel metering valve stuck in the 11,400 lb/hr fuel flow position. A partial teardown of the control revealed a ball bearing lodged between the metering valve rack and the gear case. Although no positive identification has been made, the bearing is similar to others used in the fuel control. The control has been shipped to the manufacturer (Woodward Governor Co., Rockford, Illinois) for further investigation. Although the engine windmilled freely in flight after shutdown, the engine could not be manually rotated during postflight inspection. The engine has been sent to the General Electric, Edwards AFB facility for partial teardown to determine the cause of seizure.

b. No. 2 engine (S/N 567) indicated 5.5 mils vibration just prior to landing. Investigation after engine shutdown revealed extensive FOD to the inlet guide vanes and the first stage of the compressor. The FOD was caused by an "Apex" screwdriver head which was found embedded in an inlet guide vane. The engine has been removed and replaced by No. 569. Engine No. 567 has been sent to General Electric, Edwards for partial teardown to determine the extent of the FOD downstream of the first stage.

c. The copilot reported nozzle instability of engine No. 4 just prior to shutdown. The nozzle instability has not been located on the data instrumentation tape. The nozzle will be tested for instability during engine runs prior to flight No. 2.

2. Landing Gear: (U)

a. Bogie Fold After Takeoff:

Photo coverage of the takeoff shows the bogie going to the folded position prior to assuming the 8° nose-up position normal for gear extended. Reason for this is unknown. This condition is undesirable because of possible touchdown right after lift-off which may result in touchdown with a folded or partially folded bogie.

b. Failure to Retract in Flight:

After the copilot raised the gear handle, the landing gear doors opened, both main landing gear (MLG) bogies rotated but did not fold, and the main gear did not retract. The nose gear retracted normally. The bogies remained in the rotated but unfolded condition until the gear handle was placed in the gear down position. The bogies then unrotated, locked in place and went to 8° nose-up. However, the main gear doors did not close. The nose gear locked down and the nose gear closed.

During Post Flight Inspection, an intermittent sequence switch was found on the RH bogie rotate down lock actuator. This switch apparently failed to actuate when the bogie rotation down lock actuator pin retracted. Therefore, the bogie shut off valve was not energized and utility system No. 1 pressure was not ported to the bogie fold actuators.

c. Erroneous Landing Gear Indications:

With the gear handle in the up position, the nose gear up and the main bogies rotated but not folded the following conditions existed in the landing gear position and warning lights.

(1) Left and nose gear indicator lights out

(2) Right gear green light "ON"

(3) Red light in handle "ON"

The nose gear light was out because the nose gear was up (normal condition). The left gear light was out because the gear had started to rotate (normal condition). The red light in the handle indicated an unsafe condition in the main landing gear because the gear did not retract (true condition). The right hand gear green light was an erroneous indication caused by the faulty bogie rotate and down lock switch. In addition to causing a false indication in the right gear position light, the switch caused the initial main bogie malfunction of not folding during the gear retraction sequence.

While descending through 8,000 feet, the copilot reported a gear warning horn, but that the red light in the gear handle was not on. The condition of a gear warning was expected since one (the RH outboard) rotate down lock switch was not actuated; however, the condition of a horn but no red light was abnormal. An intermittent malfunction was found in the gear handle and light assembly and the unit has been replaced.

d. LH Rear Brake Locked on Landing:

(1) The MLG left rear brake was apparently locked at the time of touchdown and the wheels did not appear to have rotated at any time during the touchdown or landing roll. As a consequence, the two LH rear tires blew approximately 1 second after touchdown. Reason for the locked brake has not been determined. The following are conditions which may have existed, but as yet have not been verified.

(a) During landing gear systems checkout and aircraft towing prior to first flight it was found that the brake actuators would not always stay in the retracted (OFF) position detents with the hydraulic system depressurized, but with head pressure on the reservoir. It is possible that this happened during the flight since utility No. 1 pressure is not ported to the brakes until after the gear is loaded and the ground safety switch actuated.

The head pressure may have been sufficient to hold the brakes locked, preventing wheel spin up and thus causing the tires to blow.

(b) It is also possible that hydraulic surge or high pressure in the return system resulted in braking loads which prevented wheel spin up.

(2) Changes are being made to the landing gear hydraulic and electrical systems to port utility system No. 1 pressure to the brakes (in addition to utility system No. 2 press) to power the brakes to the off position any time the struts are down and locked and brake not applied. This would protect against the brake actuators being out of detent, but not against surges in the return system.

e. Gear Doors Failed to Close:

After the gear was extended the main gear doors failed to close. It was found that the RH outboard bogie rotation down-lock actuator had failed to fully engage the down lock switch which sequences the doors to close. Similar problems were experienced during gear operations prior to first flight. To rectify this problem, the actuator orifice size is being increased from .073 to .090 inches.

3. Fuel System:

a. Boost Pump Failure:

The right lower (primary No. 2) fuel boost pump turbine rotor failed causing the rotor to seize. Failure was discovered during fuel pump checkout on 25 Sep 64. The pump was removed and investigation revealed one blade had failed causing the impeller to jam and the pump to seize. Cause of the failure is undetermined at this time. This pump was the heavy flange type with the new output line support and heavy clamp which were installed on 9 Sep 64. Since that time two taxi tests, one flight and two defuelings have taken place. No failure was indicated on this pump up to this time. This is the second pump to fail in this mode; the other being a previous failure on a cooling loop pump.

4. Airspeed Systems:

a. Position Error:

From several airspeed cross checks with chase aircraft it appeared that the XB-70 pilot's indicated airspeed was 5 to 8 knots higher than chase IAS. These conditions are tabulated on the following page:

a. Position Error (Cont'd)

Time	IAS		ALT	
	XB-70	T-38	XB-70	T-38
0909	250	242	14550	14250
0912	255	250		
0927	177	170		

The T-38 position correction at 240 - 250 knots is approximately plus 1 knot; at 170 knots IAS it is approximately plus 2 knots. Applying these corrections reduces the apparent XB-70 position error to plus 4 to 7 knots at 240 - 250 knots and to plus 5 knots at 170. Neither the T-38 or the XB-70 is corrected for instrument error. Phototheodolite data for the low approach is being analyzed to determine the magnitude of position error during that phase of the flight.

VI. OBSERVATIONS AND COMMENTS BY THE COPILOT:

1. Preflight and Engine Start:

After completion of the external walk-around inspection, Al White and I entered the cockpit at 0610 and started the internal checklist at 0620. During preflight, a strong signal was heard through the UHF No. 1 receiver when the telemetering switch was placed to the ON position. No. 2 UHF was used for the flight. The checklist was completed at 0652. No. 4 engine was started at 0658 and at idle the No. 2 cooling fuel pump caution light was on. Because of this, No. 4 throttle was closed at 0703 and a ten minute delay resulted to troubleshoot and correct the cooling fuel pump condition. No. 4 engine was started satisfactorily with a start temperature of 520° at 0714. No. 3 engine start was aborted because of no ignition and then was started satisfactorily with an EGT of 550° at 0717. As No. 1 engine was started at 0720, the set nozzle and air data caution lights flickered faintly and static could be heard in the intercom as the engine came up to idle speed. No. 2 engine was successfully started at 0721 with an EGT of 490°. At 0723 No. 6 was started with an EGT of 560° and with the start of No. 5 at 500° all six engines were running at 0724. (U)

2. Pre-Taxi Checks:

Starting at 0729 ten minutes were required to check hydraulic pump stability through telemetry while engine speeds were varied from idle to 100% rpm. At 0745 flight control system checks were initiated and required five minutes for completion. At 0758 hydraulic reservoir servicing was completed and fluid levels were recorded which are included in the hydraulics portion of this report. At 0801 fire detection system checks were completed and at 0803 the counter number (C/N) was recorded as 5758. AUX cooling and fans were turned on at 0804. When the emergency generator was turned on at 0808, the copilot's attitude indicator tilted approximately 90° and oscillated violently. To eliminate this Al selected standby attitude directional indicator (ADI) on the flight display control panel. This brought the attitude indicator upright but the heading continued to oscillate approximately 30°. I put tape over the indicator for the duration of the flight. (U)

3. Taxi: (C)

At 0813 we started to taxi with a fuel totalizer of 132,000 lbs. In the left turn from the run pad very little chatter was experienced even though Al did not apply brakes. At 0817 a right turn from a heading of south was made on to the parallel taxiway and again some brake chatter was felt in the airplane even though the pedals were not depressed. The wind was reported at 030° at 6 knots variable to 090° at 8 knots with a maximum velocity of 10 knots during the morning. I heard a wind report to photogrid, after takeoff, of 4 knots from the northeast. Al commented that there was a little fog to the east and I noted it was a bit hazy in all quadrants. As we proceeded west to the end of runway 07 the chase pilots checked in with control. Chase No. 1 was a TB 58 #662 piloted by

Lt Colonel Fulton and Mr. Van Shepard. Chase No. 2, a T-38, was piloted by Major Don Sorlie and Chase No. 3, another T-38, was piloted by Major Bob Smith. Chase No. 4, a T-38, was piloted by Lt Colonel Jake Knight and Chase No. 5, a T-38 piloted by Major Russ Rogers, joined the flight later. While taxiing I noted the side-by-side cockpit movement and on the west end of the taxiway we seemed to get in frequency with the high and low points of the concrete which excited and maintained a moderate yet definite amount of vertical cockpit movement. The cockpit outside air temperature indicator was 54° F, the ammonia level was 520 lbs., and the fuel totalizer was 130,500. At 0824 we were aligned with the takeoff runway, No. 6 fuel tank switch was positioned to AUTO, tires and flight control checks and checklist were complete at 0834 when a four minute warning was given to the chase aircraft. The wind sock was limp indicating little or no wind. The haze and morning sun reduced the visibility of a clear desert sky. The cockpit outside air temperature was 55°, Al's heading 70°, ammonia quantity 500 lbs., water 4250 lbs., and 17 liters of oxygen. The EE temperature was 65° and my altimeter reading was 2545 with a setting of 2992. Liquid nitrogen level was just over 3/4 and the identification friend or foe (IFF) was set to mode 3, code 05. (C)

4. Takeoff and Climb: (C)

At 0837½ C/N 7825, data was turned on. Al advanced to Mil power and at 81% rpm I turned the REFER on. Al released brakes at 0838¼ and after five to ten seconds we began to roll advanced power to max afterburner (A/B). Speed check was made at 100 KIAS (18 seconds) and a decision to go was made at 140 KIAS (24 seconds). All systems looked normal and the ride was comfortable throughout the takeoff roll. Rotation was initiated at 170 KIAS and I estimated we were in the air at 183 KIAS after my stop watch time of 32 seconds. When becoming airborne it was quite evident that I could not see anything but sky over the nose. A sharp edge, short period directional oscillation was felt in the cockpit as we climbed and turned left toward the dry lakebed. Data was turned off after being airborne about 30 seconds. One minute after airborne, and at Al's request, I set a throttle angle of 80° on all engines. His speed control was excellent as I indicated from 222 to 226 KIAS. I noticed that even the marker beacon light worked as we passed the outer marker on climb-out. At 0841, C/N 8007, 220 KIAS and about 6,000 feet, data was turned on and we came out of A/B to mil power with a fuel totalizer reading of 109,000 lbs. During the climb we were indicating 222 KIAS and the chase reported 215 KIAS. I observed 1/2° right sideslip on Al's indicator. Our rate of climb was 800 feet per minute with a throttle angle (T/A) of 50°. Time check, using the voice tape, shows we were at 8,000 feet, four minutes and ten seconds after brake release, C/N 8130, fuel totalizer 108,000 lbs., with the sump tank holding 32,000 lbs. The chase was indicating 215 and we were indicating 221 KIAS on the tape and 224 on the standby airspeed. At 0844 we were at 9,000 feet, 106,500 lbs., when I first noticed that although the flap lever was still down the flap indicator showed intermediate. Both the chase and B-70 pilots observed that the flaps were still down. No. 4 accessory drive

system's (ADS's) vibration was 40 to 50% and No. 2 engine vibration was 50 to 55% at mil power setting. I still couldn't see much, if any, of the ground over the nose. We still had a light and sometimes moderate side-to-side shaking in the cockpit. Al's comment was: "its kind of a rattler isn't it?" At 0845, we passed through 10,000 feet on the east side of the lakebed with the cabin holding 7500. The hydraulic system pressures were: P_1 3600 to 3700, P_2 4000, U_1 4050 to 4100, U_2 4000. At 0847, the airplane was still shaking around a bit and both Al and I agreed that it was somewhat of a different feeling than we had expected. We were both anxious to get the gear up and see what it would feel like clean. Chase reported no turbulence and commented that our wing tips did shake a bit. 0848 still holding mil power, we passed through 11,000 feet north of the base with 217 KIAS. Fuel totalizer was 101,000, sump 32,300 and tank No. 6 feeding properly. Cabin held 8,000 feet, EE temperature was 44° and AUX COOL was turned off. (C)

5. Level Off for Gear Retraction: (C)

At 0851 we were south of the base at 12,000 feet. Data was turned on, C/N 8665, and I placed the landing gear handle up at 0851½. The chase reported gear doors coming down, the main gears rotating and the nose gear retracting. In 30 seconds the chase reported that both main gears had rotated but had not folded and the nose gear appeared up and locked. In the cockpit we had a red light in the handle, a green light on the right gear and the green lights were out on the left and nose gears. At 0853½, landing gear handle was placed down, the right gear light went out and came back on, the left green came on and the nose gear green light came on. In 25 seconds the nose gear was down but all doors stayed open. The red light in the handle was out. The chase reported discoloration around the left trunion door which was blue in color. The control room reported they suspected this to be grease which had been applied to the door rollers. Chase also reported a fluid leak and a light misty spray emitting from a wet area around No. 3 engine nozzle. No. 3 engine instruments appeared normal at mil power 100% rpm, 900° EGT and 38% nozzle. Other nozzles were at or near 40%. 0855, we were at 12,500 feet, 233 KIAS with an EE temperature of 49°, LN_2 3/4, fuel totalizer 90,000 lbs., and the sump tank 32,500 lbs. Tank No. 6 left was 15,600 and No. 6 right 16,900. At 0901, we made a decision to go to the alternate test card which included performance and stability with the gear down. Al reported the tape counters were at 75 and 95%. I had placed the cockpit temperature selector rheostat at 1230 position, EE temperature was 50°, cabin pressure 8,500 ft., "T" handle approximately 3/4 of an inch down and the cockpit was very comfortable. Time 0904, C/N 9417, the flap retraction was initiated at 14,700 feet. In 17 seconds they were up and the indicated altitude was 15,000 feet. Al controlled the trim change in an excellent manner and the data was turned off at C/N 9458. At 0905, data was set at 60 second interval, the chase reported light turbulence and we were experiencing the directional shake in the cockpit. No. 2 engine vib meter was 55%, Al had some difficulty getting trimmed up as the turbulence continued and the aircraft was shaking, B-70 altitude was 15,900 feet

and 252 KIAS while the chase reported 14,700 feet and 245 KIAS. A few minutes later the B-70 reported 14,550 feet KIAS of 250 while the chase reported 14,250 feet and 242 KIAS. At 0910½, C/N 9800, a trim shot was made at 250 KIAS, event marker and pull up to 1.2g and release, event marker and sideslip to indicated 3°, and event marker for a windup turn to the left to 1.4g at 255 KIAS, when chase recorded 250 KIAS. Then an event marker and a roll left followed by data OFF at C/N 9944. At this time Chase Nos. 4 and 5 reported in airborne. 0920 we started to set up for speed power point at 16,800 feet, 65° heading, 250 KIAS and data on 15 second interval, cabin temperature was still very comfortable. At C/N 10070, 254 KIAS, 14850 feet T/A 40°, 100% rpm all engines speed power was initiated. B-70 253 KIAS and Chase No. 2 reported 245 KIAS, B-70 altitude 15,250 feet, B-58 altitude 15,400 feet. Our fuel totalizer was 67,000 lbs. At 16,000 feet the cabin altitude was 8,500, EE temperature 50° and the cockpit was very comfortable. At this point I took control of the airplane at 260 KIAS. I found it very easy to control and trim in pitch, highly responsive in roll with light aileron forces. Chase reported No. 3 engine venting fluid continuously now. Tank No. 6 was turned off when No. 6 left digital was oscillating 2800 to 2900 and 6 right was 1700. No. 4 tank boost pump was placed in automatic. Edwards wind was reported 020° at 10 knots. C/N 10570, time 0923½, altitude 15,200 feet, flap retraction was initiated. In 23 seconds the chase called flaps were down and I observed practically no loss or gain in altitude. The flap indicator had been showing up when the flaps were up. At 0924½ Al shut down No. 3 engine when he saw it overspeeding to 108%. I turned data on continuously during the shutdown. No. 3 generator switch was turned off, No. 3 generator out caution light came on, the emergency generator came on and its caution light came on. At 0927, data was turned on for a time history and the airplane was slowed to a minimum speed of 175 KIAS. Minimum speed reported by the chase was 170 KIAS. Again I noticed the reflection of the ground beneath us on the inner side of the outer forward windshield on Al's side of the cockpit. (C)

6. Descent and Landing: (C)

Let-down to the pattern was initiated was 56,000 lbs., of fuel and the chase reported 230 KIAS. Al commented that we had been running 6 to 8 knots above the speed reported by the chase. At 8,200 feet, with three green gear lights and no red light in the handle, the landing gear audio signal came on. This was correct because the doors were open -- the handle light had malfunctioned. Chase No. 1 reported he observed some small item fly off the nose wheel door. At 227 KIAS, approximately 6,000 feet, No. 3 engine windmilled at 10% and both hydraulic status indicators stayed green. Edwards wind was reported at 020°, 10 KIAS. Approach speed 194, flare 184 and minimum touchdown 168. At 0934, we turned in toward the field for a low approach on runway 04; I turned AUX COOL on and the REFER off. At 210 KIAS No. 3 engine windmilled at 2½%, utility status remained green but primary status indicator was yellow. There was a light turbulence and the side-by-side movement in the cockpit existed. As we passed over the runway at 50 feet, data was on at C/N 1297 and airspeed 205, chase airspeed 205, our total fuel was 49,000 lbs. After the low pass a left turn was initiated and we passed over north base. Looking out the left Al could see our shadow on the ground and Fitz was quick to point out

that the big long one was us. No. 4 tank was empty and No. 2 was turned to AUTO on 0936½. At 0940, the checklist was completed on the downwind leg in a left hand pattern north of the base, EE temperature was 70°, fuel totalizer 43,500 lbs., recommended final approach 192, best flare 182, and minimum touchdown 166. At 0942½, we were on the final approach with a fuel totalizer of 42,000 lbs., wind reported 040°, at 12 knots and altimeter setting 29.95. Between two and three miles out I started calling airspeed which varied from 202 KIAS to 207 KIAS as we approached the threshold. There was some turbulence on final in to the one mile point which caused a directional disturbance of the airplane very similar to that experienced after takeoff. I recorded the touchdown speed at 180 KIAS. It was a very good landing, but chase was soon to call that the left gear was on fire. Al let the nose gear down and I deployed the chute. Very little braking was used and there was no difficulty at all in maintaining a straight path down the runway. The chute was jettisoned at 74 KIAS and the release could very definitely be felt. At 0945, C/N 11900, data was turned off. Utility No. 1 fluid level had dropped to 115 and Utility No. 2 to 185 indicating the fluid leak at the left gear. I observed No. 4 engine nozzle indicator oscillating and recorded data from C/N 12246 to 12255. Before engine shutdown I checked the ADS and engine fire detector light circuits and they were satisfactory. At 0954, the last engine (No. 4) was cut. (C)

7. Comments:

a. Fuel System: (C)

Engine start was made with all pump switches off and the refueling switches in automatic. After engine start, No. 3 tank was used until the level was 26,700 lbs., time 0725, when No. 2 tank was turned on. 4,000 lbs., were taken out of No. 2 tank and at 0730 its level was 16,300. At 0740, No. 4 tank pump switch was turned on and remained on until 0807 when its level was 4,500 lbs. Tank No. 1 quantity had increased from 250 to 1,500 lbs., so during taxi No. 1 tank pump switch was turned on to reduce the level as low as possible. After turning the No. 1 tank pump switch off, while taxiing and after stopping, I observed No. 1 tank quantity fluctuating from 100 to 1,000 lbs., indicating fuel sloshing. At 0824, aligned with the runway for takeoff, No. 6 pump switch was placed in AUTO and two minutes later I verified and showed Al that No. 6 tank was feeding fuel from both left and right and the sump was maintained at 32,850 lbs. In the climb, at 8,000 feet, the sump level was 32,000 lbs. Time 0848, 11,000 feet, the sump level was 32,300 lbs., and No. 6 was feeding satisfactorily. At 0855, 12,500 feet the sump level was 32,500 lbs., totalizer 90,000 lbs., 6L 15,600 lbs., and 6R 16,900 lbs. At C/N 10070 the totalizer was 67,000 lbs. Time 0923, tank No. 6 was turned off when 6L was 2,800 to 2,900 lbs., and 6R was 1,700. At this time, tank No. 4 switch was placed in AUTO. At 0935, the total was 49,000 lbs. Time 0936½, No. 4 was empty and turned off and No. 2 turned to AUTO. Fuel on downwind was 43,500 lbs., and on final it was 42,000 lbs. Totalizer

reading at shutdown was 40,500 lbs., and the sump level was 28,300 lbs. The liquid nitrogen level went from 3/4 full to 1/2 during flight. (C)

The fuel system procedure, indicators, controls, and actual supply were all satisfactory. (C)

b. Hydraulics:

Cockpit fluid level readings were as follows:

Time	0728	0758	0811	0831	0844	0846
U_1	120	165	190	165	190	187
P_1	205	180	188	185	205	205
U_2	150	168	205	200	---	205
P_2	170	176	182	180	---	205
Condition	Carts Connected	Service Complete	Prior to taxi	Just before takeoff	9,000 ft in climb	10,000 ft in climb

Time	0855	0904	0908	0918		0945
U_1	175	165	160	160		115
P_1	205	205	205	205		205
U_2	200	205	205	205		185
P_2	---	205	205	205		205
Condition	After gear failure	Flap operation	15,000 ft	16,000 ft		Stopped on runway

This indicates to me that with fluid temperature increase and expansion, all but Utility No. 1 increased to full and the primary levels remained at maximum. The fluid loss at the left gear on landing can be seen in a drop of Utility 1 and 2 fluid levels at time 0945.

During letdown for landing, 225 to 230 KIAS, No. 3 engine windmilled at 10 to 12% and both the utility and primary status indicators stayed green. It was not until we were on final 210 KIAS, with No. 3 windmilling at 2½% rpm, that the primary status went yellow. The utility status indicator stayed green. (U)

c. Engine:

No. 3 engine failed to ignite on the first start attempt. Chase reported fluid leaking from No. 3 in flight and it was later shut down due to an overspeed indication. No. 2 engine displayed its usual 50 to 55% vibration at mil power. The loss of No. 3 engine had little or no effect on control or performance during the low approach and landing. Although postflight inspection revealed No. 2 had foreign object damage (FOD) I could see no indications or effects of it in the cockpit. After landing, I noted No. 4 nozzle indicator oscillating approximately 5%. This could be a normal condition but as a precaution continuous data was taken prior to shutdown. (U)

d. Flight Controls:

I controlled the airplane for a few minutes and gained the impression that it responded and felt much like the simulator. It was easy to control and trim in pitch, very responsive in roll and the aileron forces were lighter than I prefer. I have concluded that accurate elevon position is difficult to determine by a ground observer and still am of the opinion that an elevon position indicator is needed in the cockpit. (U)

e. Cockpit Visibility:

After rotation for takeoff and during the slow speed climbout, I soon realized there was little use of my looking outside and ahead since all I could see was the top of the black nose and the blue sky. In level slow speed flight there was some improvement but I could only conclude that the forward visibility in both the climbout and slow cruise was poor. In left turns I could see ground reflections on the inner side of the outer left forward windshield panel. They were not really distracting during daylight but I would expect them to be very undesirable while flying at night. I was pleasantly surprised when on the low approach and landing I observed a much improved forward and side visibility. For a comparison, I consider the approach and landing visibility as good as that of the B-58. (U)

f. Cockpit Feel: (C)

A few seconds after we broke ground it became quite apparent that I was feeling a motion I hadn't expected. The airplane was very active directionally, a magnification of the waddle I had felt and reported on the taxi tests. This was a short period, sharp edge, side-to-side jostling. To me it was practically all directional and very little of the motion was in pitch or roll. The ride was roughest just after takeoff and on final prior to landing which led me to believe there was a wind shear and associated turbulence from near the surface to about 2,000 feet. I observed airframe buffet in the XB-70A at times when the chase reported they felt no turbulence. I couldn't really recall any time when we weren't getting jostled around in our seats some -- it definitely increased when turbulence was reported by the chase pilots.

This feeling is not completely new to me as I experienced similar fuselage and cockpit behaviour in the B-36 and C-97. I did not feel that this cockpit motion had any effect on my ability to perform the required crew duties. I am not concerned about this condition as a result of this flight since it was all flown at low speed, gear down and augmentation off. (C)

g. Approach and Landing: (C)

Between two and three miles on final the apparent turbulence and resultant airframe and cockpit disturbance was very noticeable. At Al's request I called out his airspeed down final which was 202 to 207 KIAS and as we approached the threshold the cockpit motions subsided. I observed a touchdown speed of 180 KIAS between the 2,000 and 3,000 foot markers. The touchdown was a very good one and certainly gave no cause for blown tires or locked brakes. Very soon after touchdown chase called fire, Al let the nose down and I deployed the drag chute. The chute was very slow deploying, one canopy was late developing and I did not feel the same definite tug we experienced on the taxi test. Nose wheel steering was smooth and effective, some brake was used and the chute was jettisoned at 74 KIAS. As the chute released I felt a very positive lurch forward. We came to a slow and comfortable stop and awaited gear inspection and instructions. (C)

h. Landing Gear and Brakes:

I concluded that these systems were our two black eyes for the day and that we would have looked much better without either. I fully agreed with the decision to not attempt a second gear retraction. The brake lock and blown tires were certainly a surprise finale since the brakes had performed so well at high speed on the taxi tests at Palmdale. (U)

8. Pilot Squawks: (U)

a. No. 2 cooling fuel pump light was on after start of No. 4 engine.

b. No. 3 engine did not ignite on first start attempt.

c. Main landing gear rotated but did not fold on attempt to raise gear.

d. No. 3 engine indicated 108% rpm and engine was shut down.

e. Left rear main wheels locked on landing, tires blew out and wheels were destroyed.

f. Flap indicator showed barberpole with flaps down.

g. Gear horn blew below 8,000 feet with three green lights and no red in the handle. (U)

9. Conclusions:

a. I logged a total flight time of one hour and seven minutes. Brakes were released at 0838:15 and we stopped on the runway after landing at 0944:50. (U)

b. The highest speed I observed was 264 KIAS and the maximum altitude was 16,800 feet. The lowest speed I observed in flight was 175 KIAS, near 15,000 feet, during slow speed handling. (C)

c. Yaw augmentation was checked out and available but was never engaged in flight. (U)

d. Scheduling and control of, conversation by, and support received from the chase crews was outstanding. (U)

e. In spite of malfunctions and damage the engines provided all the thrust we needed to comfortably complete the gear down flight. (U)

f. Nose wheel steering system performed satisfactorily. (U)

g. Engine and ADS fire detector system gave me no false warnings and checked out satisfactorily from pre-flight to shutdown. (U)

h. ILS and TACAN were not evaluated. (U)

i. IFF was reported as satisfactory. (U)

j. Fuel system operation was satisfactory. No management, indicator or control problems were experienced. (U)

k. Electrical system was satisfactory. (U)

l. Flap control system was satisfactory. Flap indicator went intermediate in flight when the flaps were down. (U)

m. Throttle control system was satisfactory. (U)

n. Cockpit instrumentation indicators, controls, and counters were satisfactory. The voice tape recorder worked well until the final approach for landing, when for some reason it stopped and started again a few minutes after the landing. The analog and digital green "ON" lights are hidden behind the control wheel thus fail to attract my attention when data is on. (U)

o. Drag chute development was much slower than we experienced on the 122 KIAS taxi test. I did not observe the deployment speed --- jettisoned it at 74 KIAS. The jettison was quick and clean. (U)

p. Unsatisfactory is all that need be said about the main gear and left aft brake. (U)

q. Capsule seat and equipment was comfortable. Helmet, mask and oxygen system worked satisfactorily. Arm rests caused annoying elbow interference and were folded down.

r. Hydraulic system performance was satisfactory. The pumps were stable, pressure remained within limits and the fluid levels stayed up until the gear damage and fluid leakage occurred on landing. The late addition of the cockpit hydraulic quantity gages were paid for by the confidence they gave the crew prior to and during flight.

s. Communications were satisfactory. We could always talk to Mobilcom, Data Control, the Tower, Chase, the Ground Crew and on intercom as required. A telemetering signal fed into No. 1 UHF, on guard frequency, but it did not interfere with the mission conversations.

t. Environmental system performed satisfactorily. I was never uncomfortable from excessive noise or extreme temperatures. The cabin pressure and temperature and EE bay temperature were easily maintained at proper levels. No ammonia fumes detected in the cockpit.

u. Copilot's attitude and heading indicators were intentionally rendered inoperative. Airspeed, altitude and rate of climb tapes appeared satisfactory. Angle of attack and acceleration tapes were not evaluated.

v. I congratulate Al White on his flying, the engineers for sufficient system solidarity to support a safe first flight, the maintenance team for their calmness in face of delay and trouble, the controllers for their excellent help and all the troops for getting us off on the day we were scheduled.

w. I was disappointed that the gear did not retract, the engine had to be shutdown and the bogie was damaged but I'm glad we have a flyer and that the flight test program is finally underway. (U)

Joseph F. Cotton
Col. USAF.

VII. RECOMMENDATIONS:

1. Relocate the instrumentation record indicating lights so that they are more conspicuous than in the present location which is hidden by the control wheels. A flashing indicator is suggested rather than the present steady light. (U)

2. Install an instrument on the pilot's instrument panel to indicate elevon position in pitch. This instrument will eliminate the condition of the pilot being uncertain of trim elevon position, especially prior to and after takeoff. (U)

3. Install skids on forward end of main gear bogies. Skids have been installed on aft end to protect the rear of the bogie beam and possibly wheels in the event of blown rear tires. There is no protection for the front of the bogie or the forward wheels. (U)