(Gp-4) TEST REPORT

XB-70A NO. 62-207

Flight 2-2, 10 Aug 65
Flight 2-3, 18 Aug 65
Flight 2-4, 20 Aug 65

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XB-70 JOINT TEST FORCE (FTTB)

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I. SUMMARIES:

1. Flights 2-2, 2-3 and 2-4 of the XB-70 No. 62-207 were checkout flights for the project pilots and were essentially the same profile consisting of a climb and acceleration to 1.4 Mach at about 40,000 feet altitude to demonstrate handling qualities at several points.

a. Flight 2-2 - 10 August 1965:

The crew was Colonel Joseph F. Cotton, Air Force Flight Test Center (AFFTC), Pilot, and Mr. Al White, North American Aviation, Inc (NAA), Copilot. Takeoff from Edwards AFB runway 04 occurred at 0717 PDT and landing on runway 04 was at 0844 PDT. The total flight time was one hour and twenty-seven minutes --- supersonic time was thirty-one minutes and time over Mach 1.4 was sixteen minutes. Maximum speed and altitude was 1.45 Mach and 41,000 feet. Takeoff weight was 490,000 pounds. During ram purge pressurization tests, with aircraft altitude at 35,000 feet and cabin altitude at 33,000 feet, Colonel Cotton exhibited hypoxic symptoms and control of the aircraft was assumed by Mr. White for the short period of time it took Colonel Cotton to recover. The ram air scoop retracted but the aircraft would not repressurize. The flight was terminated short of the planned two hours due to low fluid quantity indication in the Utility Number 2 (U_2) hydraulic system.

b. Flight 2-3 - 18 August 1965:

The crew was Mr. Van Shepard, NAA Pilot, and Mr. Al White, NAA Copilot. Takeoff from Edwards AFB runway 04 occurred at 1220 PDT and landing on runway 22 was at 1418 PDT. The total flight time was one hour and fifty-eight minutes --- supersonic time was forty-four minutes and time over Mach 1.4 was twenty-one minutes. Maximum speed and altitude was Mach 1.45 and 46,000 feet. Takeoff weight was 495,000 pounds. Stability and control maneuvers were accomplished at each of the scheduled configurations and conditions. Engine No. 1 was shut down as scheduled, and was relighted on the fourth attempt, while subsonic at 25,000 feet. No major in-flight discrepancies were reported. Only one of the two drag chutes developed fully on landing, and while taxiing in, No. 6 tire blew.

c. Flight 2-4 - 20 August 1965:

The crew was Lt Colonel Fitzhugh Fulton, AFFTC, Pilot, and Mr. Al White, NAA, Copilot. Takeoff from Edwards AFB runway 04 occurred at 1114 PDT and landing on runway 22 was at 1318 PDT. The total flight time

was two hours and four minutes --- supersonic time was forty-one minutes and time over Mach 1.4 was twenty-one minutes. This was the longest XB-70 flight to date. Maximum speed and altitude was Mach 1.44 at 42,000 feet. Takeoff weight was 495,000 pounds. Low speed handling, stability and control tests were completed. Per the test plan, Engine No. 1 was shut down and airstarted after several attempts. Sonic boom data were recorded at the Edwards National Aeronautics and Space administration (NASA) station.

II. CONFIGURATION CHANGES:

1. Flight 2-2:

   a. Alighting and Arresting Gear:

      (1) Drag Chute - Left hand drag chute deleted (2 chute configuration).

   b. Secondary Power:

      (1) Utility Hydraulic Distribution System - Emergency main landing gear sequence valve installed to reduce cross system leakage.

2. Flight 2-3:

   a. No Change.

3. Flight 2-4:

   a. No Change.

III. TEST LOGS:

1. Flight 2-2:

0554)	Start engines No. 4, 6, 5, 3, 1, 2;
0603)	(Cut No. 2 - No EDV).
0605	Restart No. 2- indicator orange then green; no EDV (Cut at 40%).
0612	Restart No. 2; 2 greens.
0615	Generators on - ground elect off; close gear doors and service hydraulics; P_1 - 165%; P_2 - 162%; U_1 - 170%; U_2 - 160%.
0620	Hydraulic carts disconnected and flight controls check.
0638	Ground cooling cart off (EE 71°).
0645	Brake release for taxi; (No chatter or strut walk).
0705	Final check (End of runway).
0709	All tanks AUTO.
0710	Reset counter.
0713	MIL power checks data on C/N 130; Tank No. 6 empty - off; data off C/N 170 all tanks on except 5 and 6.
0715	Fuel quantities:

1	30,850	6L	1,000	
2	28,500	6R	800	
3	32,400	7L	10,600	Total 201,000
4	35,800	7R	9,200	
5	26,700	8L	12,000	
		8R	10,900	

0716	Engine power up; light 3 & 4; 2 & 5 (Data on C/N 400).
0717	Brake release.
0719	Data off C/N 483.
0720	Gear selected up (Chase reported possible fluid leaking in gear) (Landing extend light intermittent triggering master caution).
0721	Tank No. 4 AUTO.
0723	Tanks No. 1, 2, 4, 7 and 8 AUTO Tank No. 4 on.
0724	18,400 feet - start right turn; 6L - 100 lbs - 6R - 1,400 lbs.
0725	Tank No. 6 off; tank No. 4 AUTO; tank No. 4 well below 21.
0727	.95 Mach (level off at 32,000 feet).
0729	MIN afterburner instability.

III. TEST LOGS CONT'D:

1. Flight 2-2 Cont'd:

0730	Speed check; 349 KIAS (Tape) 32,200 feet - XB-70 343.5 31,500 feet TB-58.
0733	Engine Nos. 1 and 6 out of afterburner (data C/N 1300); tank No. 4 still feeding.
0735	348.5 KIAS 32,500 feet - Mach .95 (XB-70); 342 31,720 feet (TB-58).
0736	Pull up and release - data off C/N 1540.
0737	700 pounds Tank No. 6 left.
0738	Data on C/N 1614 - sideslip - data off C/N 1655; data on C/N 1670 (351 KIAS - 32,300 feet) 1° left sideslip; (354 KIAS - 32,150) 2° sideslip - data off C/N 1727.
0739	Tank No. 5 - 19,300 feeding; data on C/N 1750, 3/4° left sideslip; 1.25g - shallow bank out.
0740	FACS off - left turn.
0742	Tips to one-half (32,000 feet) data C/N 1881.
0743	Data off C/N 1940 - total fuel 135,000.
0744	Cabin recorder on.
0745	Supersonic.
0747	Tank No. 4 - 50 pounds and off.
0749	34,000 feet - accelerate to 450 KIAS.
0750	U_1 - 200%; U_2 - 140% and drifting down; P_1 - 168%; P_2 - 190%; tank No. 2 to 100 pounds and off; 6 right 1,300 pounds.
0753	Climb through 36,000; 1.3 Mach; Tank No. 7 feed AUTO.
0754	1.35 Mach; 37,800 feet; data on C/N 2600; tips going down; data off 2654.
0755	Nose ramp up (Data on C/N 2702); (T/A about 8C) Mach 1.4.
0755:30	Tank 7R empty; 7L 53; Tank No. 7 off.
0758	Turn tank No. 1 on (does not feed automatically); data on C/N 2917; 452.5 KIAS 40,500 feet 1.397 Mach (XB-70); 456 40,550 feet 1.41 Mach (TB-58).
0800	Data off C/N 2997; 91,500 total fuel; tank No. 1 in manual. U_2 - 125% quantity. Data on C/N 3259; 1.38 Mach; sideslip and release; data off C/N 3313.
0806	Data on C/N 3353, sideslip, data off C/N 3540.
0810	Total fuel 71,000 pounds (using tank No. 8).

III. TEST LOGS CONT'D:

1. **Flight 2-2 Cont'd:**

0811	U_2	120% 165 psi head pressure	P_1	130% 205 psi head pressure
	P_2	170% 200 psi head pressure	U_1	pegged 200 psi head pressure

0812 MIN afterburner instability, No. 3 engine worst.

0813 Data on C/N 3770; 1.2 Mach;
U_2 down to 105; P_1 down to 120;
Tips to one-half, data off C/N 3803.

0814 Tank No. 8 - 3,100 pounds; light No. 2 and 5,
data C/N 3821; cabin altitude 8,000; EE - 41°;
Data C/N 3854 - through 37,000 feet.
Windshield down at Mach 1.1 - Data on C/N 3876;
40° T/A; U_2 - 100%, P_1 - 115%; EE 42°; NH_3 - 18.5;
H_2O - 4,150; cabin 8,000 feet; temperature 21°.

0817 Data on C/N 4017; .96 Mach, T/A 40°; purge now, scoop out O.K; cabin 30,000.

0818 Data C/N 4071, go to repressure, cabin altitude 34,000.

0819 Pilot has O_2 problem.

0820 Cabin 28,370; .93 Mach; 360 KIAS.

0821 Cabin at 24,000.

0822 U_2 - 80%; P_1 - 95%; data C/N 4256 tips up.

0823 H_2O and NH_3 O.K., elect O.K., H_2O 3900;
data C/N 4364 bleed air open.

0825 Total fuel 60,500 pounds.

0827 Tank No. 1 feeding.

0828 P_1 - 150%; U_1 - pegged; P_2 175%; U_2 95%.

0829 Cabin 10,000 C/N 4718.

0832 Gear down, flaps down and doors closed; 260 KIAS;
EE temperature 55°.
P_1 - 100%; U_1 - 190%; P_2 - 150%; U_2 - 110%;
Approach and go around.

0835 EE temperature 72°; data on C/N 5128.

0836 H_2O and NH_3 light on.

0838 Tank No. 1 - 3,000 pounds; U_2 - 140%; U_1 - pegged
P_1 - 160%.

0839 EE temperature 63° - relying on AUX COOL; have lost bleed air; refrigeration off.

0841 Data on C/N 5147; Tank No. 5 is on; Tank No. 1 is off.

0843 217 KIAS.

0844 Touchdown - 2 chute - 1 stream;
Chute jettison O.K.

III. TEST LOGS CONT'D:

1. **Flight 2-2 Cont'd:**

0845 Brakes smoking a little;
U_1 - 180%; P_1 - 110%; U_2 - 105%; P_2 - 162%.
EE temperature 67°.
Fuel inerting light on; military power runs 3 and 4,
Data on C/N 5987 - off C/N 5995;
Runs 2 and 5 (Data on C/N 6020 - off C/N 6026);
Runs 1 and 6 (Data on C/N 6050 - off C/N 6135).

0852 Data on C/N 6080 - full throws of flight controls - data off C/N 6135.

0853 Bleed air checks.

0857 P_1 - 100%; 185 psi head pressure: U_2 - 115%; 175 psi head pressure;
U_1 185%; 195 psi head pressure; P_2 - 155%; 190 psi head pressure.

0858 Engine No. 1 shut down; No. 2 off.

0859 Right brake still smoking.

0900 Tank No. 3 - 28,000 pounds; tank No. 5 - 5,900 pounds;
Tank No. 1 250 pounds.

III. TEST LOGS CONT'D:

Flight 2-3:

Start Engine No. 5; rpm 16.5%, reset; light off; EGT - 570°C, 1st peak; EDV; EGT - 600°C, 2nd peak; idle; O.K.

Start Engine No. 6; rpm 17.0%, reset; light off; EGT - 560°C, 1st peak; EDV; EGT 650°C, 2nd peak; idle; O.K.

1115 Start Engine No. 4; rpm 17.0%, reset; light off; EGT - 580°C, 1st peak; EDV; EGT 630°C, 2nd peak; idle; O.K.

1117 Start Engine No. 3; rpm 16.0%; reset; no light off in 20 seconds.

1119 Check circuit breakers; recycle circuit breakers.

1120 Start Engine No. 3; rpm 16.0%, reset; light off; EGT 610°C, 1st peak; EDV; EGT 610°C, 2nd peak; idle; O.K.

1121 Start Engine No. 1; rpm 17.0%, reset; light off; EGT 550°C, 1st peak; EDV; EGT 585°C, 2nd peak; idle; O.K.

1123 Manual start Engine No. 2; primary hydraulic removed; 15.0%; light off; EGT 650°C, 1st peak; EDV; hydraulic status lights green at 45% rpm.

1127 Generator checks - O.K.
both cooling loop pumps out.

1128 Hydraulic reading (See page 13 b(1))

1133 Emergency generator check - O.K.

1137 Flight controls check;
ADS - N_2; #1 - 41%; #2 - 41%; #3 41%.

1140 Nose wheel steering engaged.

1141 Trim for takeoff.

1142 Disconnect ground cooling carts.

1147

Engine No.	1	2	3	4	5	6
A_8 - %	70	74	65	67	72	62

1148 Military power runs; vibes on Engine No. 6 50% at 85% rpm and 40% at Military power; stabilize for 30 seconds - O.K.

1151 Pull chocks.

1152 Start taxi; cleared for runway 04; wind 180° at 6 knots.

1202 Hydraulic readings (See page 13 b(1)).

1205 Cleared as filed.

III. TEST LOGS CONT'D:

2. a. Flight 2-3 Cont'd:

1208	Taxi into position and hold runway 040.
1214	Fuel tank readings (See page 13 b(2)). Some type of liquid seems to be dripping or running on the fuselage about one foot from the insignia, top of the star, on the left side of the air vehicle. The liquid appears to be dark in color. The right side of the air vehicle appears to be clean.
1218	C/N 150 data on.
1219	Light afterburner engine nos. 3 and 4; 2 and 5; 1 and 6.
1220	Brake release.
1222	Landing gear up; gear doors are closed. Holding 20 lbs force; 265 KIAS; C/N 411; flaps up; tank 6 off, tank 6R 1,200 lbs. Cooling doors are closing. Tank 4 stopped at 21,100 lbs; tank 2 is feeding. Light afterburners. Data on C/N 830.
1232	Mach 0.85; hum in floor boards; reduce power.
1234	25,000 feet - Owens Lake approximately 3 miles ahead.
1235	Climbing through 28,200 feet.
1236	Air vehicle wallowing. Augmentation is on. Tips are down. Augmentation is causing buzz in rudder pedals. TB-58 is on 192° radial of Tonopah. Turn right to 12° heading. Tank 2 stopped feeding at 18,500 lbs. Tank 4 is feeding now. FACS off - rudder buzz went away. Very light airframe buffet. TB-58 crew reports there are no visual indications of rudder movement.
1238	Data on C/N 1280; slow input right rudder to 3°.
1239	C/N 1344 - right rudder Tank 4 stopped feeding. Mud Lake 12 miles ahead. Total fuel 155,000 lbs. Tank 6 down; tank 4 feeding; light afterburners on engines 1 and 6. Vapor coming out of engine no. 4 periodically. Engines look good; U_2 - 165%.
1247	Supersonic; tank 4 off; tank 5 on; total fuel 146,000 lbs; C/N 1851 data off.

III. TEST LOGS CONT'D:

2. a. Flight 2-3 Cont'd:

1248	U_2 - 150%.
1249	Chase pilot thought he saw fluid coming out of engine no. 4; tank 5 off at 13,000 lbs; total fuel 133,500 lbs.
1251	Mach 1.2; south of Owens Lake.
1253	U_2 - 150%; cabin recorder on C/N 2178.
1255	XB-70 458.5 KIAS; 37,280 feet; 1.32 Mach; TB-58 463.5 KIAS; 37,100 feet; 1.31 Mach.
1256	Mach 1.4.
1258	Rogers Dry Lake in sight. Light to moderate turbulence reported by the XB-70. TB-58 has a trace of turbulence. 42,400 feet. XB-70 and TB-58 getting light to moderate turbulence.
1300	Total fuel 112,500 lbs; TB-58 dropped back for sonic boom test. Engine No. 3 EGT went to 1000°C when afterburner was selected. Engine No. 3 to idle. Engine No. 3 - Military power Mach 1.37; start turn to north. Mach 1.415; moderate turbulence in turn. Tank No. 7 off; total fuel 103,000 lbs. 7L - 900 lbs; set up for pitch pulse; pitch augmentation off; C/N 2990. Sideslip; light turbulence at 2.5°; C/N 3180; 3° right rudder.
1310	Tank No. 1 - 27,600 lbs; FACS off.
1311	Total fuel 90,000 lbs. C/N 3334 data on.
1313	Tips selected full down; tips caused a slight pitch up; U_2 - 130%. C/N 3360; apply more power. Start turn; Mach 1.36; pitch augmentation off; 1.25g's on pitch up; FACS off; turbulence, cannot get air vehicle trimmed. Start left turn; start deceleration.
1319	U_2 - 128%.
1320	Tips selected up to one-half position. Data off C/N 3958.
1322	Total fuel - 72,500 lbs.
1324	Total fuel 68,500 lbs; tank 8L - 300 lbs; data on C/N 4080; pull up; pitch augmentation off; data off.
1326	FACS off; sideslip C/N 4185; continuous data.

1328	Start deceleration from 1.2 Mach to .95 Mach.
1330	Going subsonic.
1331	Total fuel 61,000 lbs.
1332	U_2 - 110%; leave nose ramp down; U_2 - 90%; engine power and attitude seem to affect U_2 readings.
1333	Wing tips up.
1335	Shut down engine No. 1 for airstart tests; data on C/N 4760; idle; rpm 65%; throttle off; windmill rpm - 33%; EGT low peg at less than 100°C; Mach .80; 24,700 feet. No start.
1337	Mach .815; data on C/N 4870; C/N 4882 throttle on; rpm 32%; data off C/N 4918; engine did not start.
1339	Increase airspeed to Mach .90 and try to airstart again.
	Turn pitch augmentation on - got oscillation
	Turn data on to record oscillation.
	Turn pitch augmentation off - oscillation ceased.
	Data off C/N 5036.
	Rpm 38%; throttle on; 23,600 feet; throttle off, no start; tried again in 30 seconds - no start.
	Tank No. 1 1,600 lbs and feeding; total fuel 53,000 lbs.
	Try to airstart again at Mach .90; cycle throttle.
	U_2 - 115%; data on C/N 5491; throttle on; rpm 36.5%; 26,400 feet; Mach .90.
	Idle 65% rpm; EGT - low;
	Data off C/N 5555.
1349	Total fuel 48,500 lbs.
1351	U_2 down to 80% during descent.
1352	U_1 pegged; P_2 150%; P_1 145%; U_2 80%;
	Data on interval short.
1356	Total fuel 45,500 lbs; sump tank 32,200 lbs; tank 5 - 5,600 lbs.
1357	U_2 back up to 90%; turbulence.
1358	LN_2 - 55%; tank No. 1 - 200 lbs; tank No. 6L - 2,700 lbs; tank No. 6R - 400 lbs.
	Problem with pitch trim.
	Primary pitch trim will not work.
	Holding about 20 lbs of forward force.
	Landing gear selected down; gear slow in coming out.
	Gear down. Flaps selected down.
	U_2 - 120%; P_1 - 180%; flaps down.

III. TEST LOGS CONT'D:

2. a. Flight 2-3 Cont'd:

1404 Still having a problem in trying to get the primary pitch trim to work.
Tower reports winds 8 knots at 220°.
Make low pass on runway 220.
Total fuel 35,500 lbs. Sump fuel 27,500 lbs.
Land; runway 220
Wind 180° at 4 knots
Drag chutes deploy
Jettison drag chutes
Sump fuel 22,000 lbs.
Full throws
Data on 7767
Data off 7812
Military power engine runs:

Engine No.	1	2	3
Rpm - %	100.0	100.0	100.0
EGT - °C	895	875	880
A8 - %	38	42	40

Data on C/N 7896 stabilized.

Engine No.	4	5	6
Rpm - %	100.2	100.3	100.5
EGT - °C	875	880	870
A8 - %	39	41	42
Vibes Eng - %	22	20	40
Vibes ADS - %	11	8	9

Data on C/N 7970 stabilized.
Hydraulic readings (See page 13 b(1)); shut down engines 1 and 6; data on C/N 8000, select afterburner Engine No. 3.

III. TEST LOGS CONT'D:

2. Flight 2-3 Cont'd:

b. Hydraulic and Fuel Charts:

(1) Hydraulic Charts:

Time	Hydraulic	Quantity %	Head Pressure - psi
1128	U_1	170	207
	U_2	160	188
	P_1	168	195
	P_2	190	192
1202	P_1	160	200
	P_2	158	200
	U_1	160	208
	U_2	165	190
1430	P_1	158	
	P_2	160	
	U	195	
	U_2	109	

(2) Fuel Chart:

Time	Tank	Quantity - Lbs	Tank	Quantity - Lbs
1214	1	29,800	6R	9,000
	2	27,200	7L	10,250
	3	32,350	7R	10,600
	4	35,000	8L	12,100
		25,500	8R	12,400
	6L	5,500	Total	210,000

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III. TEST LOGS CONT'D:

3. Flight 2-4:

1003	Start Engine No. 5 - 15%, reset, 600° 1st peak, EDV 35%, 590° 2nd peak, 2 green.
1005	Start Engine No. 6 - 16%, reset, 540° 1st peak, (went back to pumping mode) green then orange then green.
1007	Start Engine No. 4 - no rotation; try again no rotation.
1008	Start Engine No. 4 - rotation, 16%, reset, shutdown, no ignition.
1010	Try Engine No. 4 again - rotation, 16%, reset, 560° 1st peak, EDV 34% (No. 2 fuel cooling pump light on).
1013	Start Engine No. 3 - rotation, 16%, reset, 615° 1st peak, EDV 35%.
1015	Start Engine No. 1 - 16%, reset, 565° 1st peak, EDV.
1017	Soft start Engine No. 2 - 15%, reset, 640°, EDV.
1018	Engine No. 4 generator on, voltages normal.
1019	Engine No. 3 generator on, Engine No. 4 generator off, voltages a little higher.
1019:30	Engine No. 4 generator back on, disconnect ground electrics, bleed air check O.K.
1021	Service hydraulics: P_1 - 160% - 200 lbs U_1 - 158% - 201 lbs P_2 - 162% - 185 lbs U_2 - 186% - 207 lbs
1027	Tank No. 6 in AUTO.
1031	Flight control checks.
1039	Altitude throttle check.
1041	Door closed - both fans on.
1043	P_1 - 160% - 208 lbs U_1 - 157% - 202 lbs P_2 - 165% - 190 lbs U_2 - 190% - 205 lbs
1043	Disconnect ground cooling.
1046	MIL power checks; data on C/N 190, off C/N 200.
1048	Taxiing.
1103	Flaps down, wind 210° at 5 knots.
1104	Fuel reading: 1 - 30,700 lbs 6R - 8,300 lbs 2 - 29,150 lbs 7L - 10,400 lbs 3 - 32,500 lbs 7R - 10,000 lbs 4 - 36,250 lbs 8L - 12,500 lbs 5 - 25,900 lbs 8R - 12,700 lbs 6L - 12,700 lbs Total - 222,000 lbs (All tanks switched to AUTO except T_5).
1105	P_1 - 138%, P_2 - 160%, U_1 - 145%, U_2 - 180%.

III. TEST LOGS CONT'D:

3. Flight 2-4 Cont'd:

1106	Left lower anti-collision light did not come on.
1110	Reset counter.
1113	Data on C/N 213.
1114	Afterburner light 1 & 6, 2 & 5, 3 & 4, brake release.
1115	Takeoff - 200 KIAS.
1116	Gear up.
1117	Flaps up.
1118	All fluid levels pegged.
1118:30	Buzzing vibration in air vehicle at 300 knots Cabin altitude - 8,000 feet, air vehicle altitude 11,000 feet.
1119	Data C/N 608 - reduce power to Military T-6 empty, 6L - 100, 6R - 0, Tank No. 6 off Data off - 635.
1121	Climbing at 355 KIAS.
1122	Data on C/N 787 light afterburner 1 & 6.
1123	Data off C/N 825.
1124	Tank No. 4 turned off on schedule - Tank No. 2 feeding Total fuel - 174,000 lbs, cabin altitude 8,000+, all hydraulics pegged except U_2 - 192%, climbing through 26,000 feet, low pitched hum in air vehicle again.
1127	Leveling at 32,000 feet.
1128	Tank No. 2 - 19,300 lbs; tank No. 4 feeding again U_2 - 180%, P_1 - 190%, P_2 & U_1 pegged out.
1130	Data on C/N 1255 for pitch pulse.
1131	Lost something --- may have been antenna (later determined to be a NASA instrumentation rake on top of right wing).
1135	Data on C/N 1585 --- sideslip maneuver.
1137	Windup turn. FACS on - jitter in rudder pedals --- yaw 2 seemed to take it out.
1138	Data off C/N 1763, tank No. 4 empty, tank No. 5 on.
1139	Data C/N 1821 - sideslip - FACS on.
1140	Total fuel 151,500 lbs; data off C/N 884.
1141	Tips to one-half.
1142	Data on C/N 1965.
1143	FACS on, sideslip.
1144	Data off C/N 2119.
1145	Start acceleration.

III. TEST LOGS CONT'D:

3. Flight 2-4 Cont'd:

1146	Data on C/N 2213 - afterburner on - supersonic.
1147	Tank No. 5 - 13,400, Data off C/N 2279, hum
1148	in air vehicle since .9 Mach.
	Mach 1.1, U_1 - peg, U_2 - 170%, P_1 - 194%, P_2 - 198%.
1149	Mach 1.16 - a little turbulence.
1150	Total fuel 131,500 lbs. 1.2 Mach at 32,000 feet (start
1154	gradual climb).
	Tank No. 2 empty.
1155	1.4 Mach - leveling at 41,000 feet.
1157	Total fuel 113,000 lbs - cabin altitude holding.
1158	Data on C/N 2930 - pitch pulse, pitch damper off
	pitch pulse, data C/N 2960 - sideslip, data off
	C/N 3,000.
1159	Data on C/N 3030 - windup turns - Data off C/N 3061.
1200	7R - 900 lbs, 7L 2,200 lbs, total fuel 107,500.
1201	FACS off.
1202	Data on C/N 3175, sideslip, tank No. 7 off.
1203	Data off C/N 3225, tips down - FACS on.
1206	Data on C/N 3400, pitch pulse, pitch damper off,
	FACS on - sideslip.
1207	Data off C/N 3495.
1208	Data on C/N 3520 - windup turn to the left data
	off C/N 3540.
1210	B-58 - 1.39 Mach, XB-70 - 1.40 Mach.
1212	Total fuel 85,500 lbs.
	P_1 - 180%, P_2 - 190%, U_1 - pegged, U_2 - 150%.
1213	Tank No. 1 does not feed in AUTO,
	data on C/N 3864 - sideslip.
1214	Release - data C/N 3912.
1215	Nose ramp up (reduces noise).
1216	Pull up, start left turn and decel.
1217	Tank No. 1 stopped feeding at 13.600 lbs.
1220	Data on C/N 4243, pitch pulse 1.2 Mach.
1222	Sideslip; total fuel 67,500 lbs.
1223	Start decel to .95 Mach, data off C/N 4480.
1224	MIL power and descending.
1225	1.15 Mach (China Lake IR in position).
1226	Tank No. 1 will not feed in AUTO, 1.1 Mach, 45%
	data remaining, buzzing at 1.05 Mach and 33,000 ft.
1227	32,500 feet and subsonic.
1228	T_1 to AUTO, T_2 down.
1229	Reduce power on 4 engines, cabin altitude has not
	changed.

III. TEST LOGS CONT'D:

3. Flight 2-4 Cont'd:

1230	Left turn - noise returned at .9 Mach.
1231	Nose ramp down.
1232	Set up for engine shutdown and start, 88% rpm, EGT 400° to 450°. (Try airstart No. 1) Data on C/N 5090, No. 1 engine at idle, EGT 160°, rpm 62%, data C/N 5140 at shutdown.
1235	(Try airstart) Data C/N 5190, rpm 32%, EGT less than 100°; nozzle position 70%, .8 Mach.
1235:30	Throttle on, off, on, off, on.
1237	Throttle off, no light, next try at higher Mach number (.9) data off C/N 5297. U_1 - pegged, U_2 - 145%, P_1 172%, P_2 - 185%.
1238	Total fuel 54,000 lbs.
1241	(Try airstart) Data on C/N 5490, 37.3% rpm, EGT 100°.
1242	Throttle on - Data C/N 5610 (rpm holding) - Throttle off - Data C/N 5642 - No start.
1244	Decrease altitude 5,000 feet to 20,000 feet and .9 Mach.
1246	Tank No. 1 - 500 lbs - total fuel 47,500 lbs.
1247	(Try airstart) Data on C/N 5881, 38.8% rpm - power on Data C/N 5889, throttle off C/N 5924, on C/N 5928, off C/N 5956, on C/N 5960, off C/N 5993, data off C/N 5995 - no start. Try airstart again (.9 Mach - 20,000 feet) 38.8 rpm, gradual throttle power on.
1253	Advance throttle gradually.
1258	Try airstart again - 400 KIAS and 15,000 feet, rpm 33.6%, throttle on - ignition on (lit at about 10° above idle in 2 or 3 seconds - data C/N 6115).
1300	6L - 4,700 lbs - 6R - 600 lbs - tips coming up at 14,000 feet.
1302	U_1 - pegged, U_2 - 100%, P_1 - 120%, P_2 - 155%.
1304	All cool doors open except aft engine No. 5 door, 10,000 feet and 260 knots, light to moderate turbulence at 10,000 feet (B-58 very light turbulence).
1305	Total fuel 32,500 lbs.
1306	Gear down, flaps down.
1310	U_1 - pegged, U_2 - 165%, P_1 - pegged, P_2 - pegged. Total fuel 29,000 lbs.
1316	Touchdown.
1318	Two drag chutes good.

III. TEST LOGS CONT'D:

3. Flight 2-4 Cont'd:

Chute jettison normal.

1319 Total fuel 21,000 lbs, sump 19,400 lbs.

1320 Military power

	1	2	3	
Rpm - %	100.3	100.2	100.4	(Data C/N 7880)
EGT - °C	900	875	885	
A_8 - %	39	43	37	
ADS Vib - %	10		18	
Eng Vib - %	20	18	20	

1322 Military power

	4	5	6	
Rpm	100.2	100.6	100.5	
EGT - °C	870	880	875	
A_8 - %	40	42	41	
ADS Vib - %	10	4	12	
Eng Vib - %	25	22	32	(Data off C/N 8015)

Shutdown engines No. 1, 2 and 6

P_1 - 152%, 200 lbs U_1 - 189%, 195 lbs

P_2 - 170%, 195 lbs U_2 - 132%, 190 lbs

LN_2 - 47% NH_3 - 370 H_2O - 3,150

O_2 - 16.5 EE Bay Temperature 65°F.

IV. ENGINEERING COMMENTS:1.

Propulsion:

a. Flight 2-2:

No major in-flight problems were encountered; however, post-flight inspections showed minor foreign object damage (FOD) on engines No. 2, 4 and 6. The FOD on the engines in positions No. 2 and 4 can be benched out with the engines installed in the air vehicle. Engine No. 6 has two nicks in the first stage of the compressor rotor which are above Technical Order (T.O.) limits. Engine No. 170-554 (Position 6) will be replaced with Engine No. 170-555. A partial teardown on Engine No. 170-554 by General Electric (G.E.) Edwards, showed that the majority of the FOD was to the 7th and 8th stages of the compressor. The engine will have twenty rotor blades, mostly 7th stage, five stator blades, two 1st stage and two 2nd stage turbine blades replaced.

b. Flight 2-3:

(1) Exhaust Gas Temperature (EGT) and Nozzle (A_8) Oscillation:

On 17 August 1965, Flight 2-3 was aborted during the take-off roll because of a drop in EGT on Engine No. 170-555 (position 6). Engine runs, after the flight was aborted, showed an EGT/A_8 oscillation. Changing the temperature amplifier did not solve the problem; therefore, the engine was removed and sent to G.E. Edwards in order to check the main fuel and nozzle area controls. Engine No. 170-555 (position 6) was replaced with Engine No. 170-560.

(2) Exhaust Gas Temperature - Overlimits:

The EGT on Engine No. 170-578 (position 3) went above limits when afterburner power was selected at approximately 1.4 Mach and 41,000 feet. The pilot noticed the EGT was above 1020°C for more than three seconds. The engine seemed to operate normally during the rest of the flight at or below military power. Engine S/N 170-578 will be removed and Engine S/N 170-564 will be installed. Engine S/N 170-564 is not an instrumented engine; therefore, it will be installed for only one flight. A postflight examination of the data revealed that the nozzle went closed prior to the exhaust gas overtemperature problem. Contamination of the hydraulic filters in the nozzle area control is the suspected cause of the nozzle malfunction.

(3) Engine Airstarts:

Engine airstart tests were conducted using Engine No. 1. The engine was shut down at Mach .8 and 25,000 feet. Two unsuccessful attempts to restart the engine at .8 Mach and 25,000 feet, were made prior to accelerating to .9 Mach. The engine restarted on the third attempt at .9 Mach. The airstart system checked O.K. during postflight tests.

c. Flight 2-4:

(1) No major problems were encountered in flight: however, during engine airstart tests Engine No. 1 did not airstart as predicted. Three attempts at Mach .8 and 25,000 feet, six attempts at Mach .9 and 25,000 feet, three attempts at Mach .9 and 20,000 feet, two attempts at Mach .79 and 15,000 feet, were made before the engine was airstarted at Mach .79 and 15,000 feet. After the flight the igniter box and ignition leads were removed from the engine by NAA and sent to G.E. Edwards for tests. Test conditions were simulated for the above mentioned altitudes and Mach numbers. All tests were successful.

(2) Engine airstarts are scheduled for Flight 2-5. Engines No. 5 and 6 will be used for the airstarts to see if the problem is peculiar to all engines or only to Engine No. 1.

2. Tire Failure:

a. During taxi in from Flight 2-3, and just prior to turning into the runup pad, No. 6 tire blew. Excessive wear had been reported by the ground crew prior to taxi in. The tire wear pattern had the appearance of under-inflated operation in that wear was through 7 to 8 plies on either side of center and the center showed little wear. No skid spots were found on the remains of the blown tire; however, a section of tread in the blown area was not found. This tire had been installed new prior to Flight 2-3 abort on 16 August 1965, which occurred at a speed of about 80 knots during the takeoff roll. Little braking was used and there was no evidence of wear following taxi in.

b. A mismatch in tire diameters existed between co-rotating wheels 5 and 6 beyond established limits. This mismatch was being monitored to determine if mismatch limits could be increased. Mismatch was 7/8 inch in diameter prior to Flight 2-3 with No. 6 being the smaller tire. The No. 5 tire indicated no unusual wear and was not replaced after this flight.

b. Flights 2-3 and 2-4:

(1) Unusually low U_2 quantities were reported during both of these flights. Minimum quantity readings were 80% and 100% respectively. No leaks were identified which could have explained the indicated drop in quantity.

(2) Cross system leakage was suspected and tests were made to determine this. No cross system leakage was found.

(3) Error in the indicating system temperature compensator was suspected and limited checks were made. No error was found.

(4) Since the U_2 system had been opened up prior to both flights, it is possible that air trapped in the system worked out or caused foaming in the reservoir causing a false quantity indication in the system during preflight operations which eventually resulted in a drop in the indicated quantity during flight.

5. Landing Light Extend Indicator:

During the period when the landing gear was retracting on Flight 2-2, the landing light extend indicator flashed intermittently. Prior to the flight, the extend light and actuator was removed, but the associated electrical components such as relays were not removed. Relay chatter from vibration probably caused the intermittent indication. Subsequent to Flight 2-3, the associated relays for landing light extend indications were removed, and no similar erroneous indications occurred during Flights 2-3 and 2-4.

6. Ram Air Operation:

During Flight 2-2 air PURGE was selected to open the ram air scoop at 35,000 feet and .95 Mach. The cabin pressure altitude depressurized from 8,500 to about 30,000 feet where it stabilized until REPRESSURE was selected. Repressurization of the cabin was unsuccessful as the cabin pressure altitude depressurized further to 35,000 feet. During the ram air scoop opening the Engine Environmental Air Distribution System (EEADS) differential pressure switch was triggered. This switch is installed in the environmental bay to detect leaks in the EEADS. The EEADS switch, in turn, shut off the main bleed air valve causing the repressurization to be unsuccessful. PURGE was again selected and, as the air vehicle was descending the cabin altitude stabilized near 25,000 feet. Next the bleed air switch was placed in the OPEN position, REPRESSURE was selected, and then

the cabin repressurized successfully. Later in the flight (below 10,000 feet) the bleed air switch was positioned to AUTO so that the cabin pressure altitude would approach the air vehicle altitude. Instrumented data shows that the repressurization difficulty was caused by the tripping of the differential pressure EEADS switch from a negative pressure reference.

V. OBSERVATIONS AND COMMENTS BY THE PILOT:

1. Flight 2-2: (Colonel Joseph F. Cotton)

a. Preflight, Engine Start and Taxi:

(1) I had looked forward to this, my first left seat flight, for many months and it turned out every bit as educational and enjoyable as I had anticipated. The fuel loading at time (T) 0400 was:

1	31,100	5	26,400	7R	9,650
2	28,900	6L	11,600	8L	11,900
3	32,550	6R	14,500	8R	10,750
4	36,300	7L	10,550	Totalizer	225,500

(2) The external and internal inspections were completed by T 0400. A fuel leak in the right wheel well was the only discrepancy which caused concern and discussion. The leak was accepted since it was believed to be coming from tank 6 right which would be used down prior to brake release and would be empty soon after takeoff. Establishing fuel leakage limits in confined areas such as wheel wells is a great need as acceptance criteria by both ground and flight crews.

(3) With the crew briefing on weather and aircraft status completed, Al and I entered the cockpit at T 0500. Tower temp-erature was 69°F; the wind was 230° at 2 knots; Mobilcom temperature was 69°F; aircraft total temperature indicator was 70-1/2°F. The auxiliary gyro platform system (AGPS) light went out in 178 seconds. At T 0540, headings were:

Great Circle 214-1/2°,
True 215-1/2°, and
Mag 215°.

(4) Engine start was initiated at T 0553. Order of start and first and second exhaust gas temperature (EGT) peaks were as follows:

Time	Eng. No.	1st Peak	2nd Peak	Comments
0553	4	590	630	
0555	6	600	645	
0557	5	600	590	
0600	3	595	590	
0601	1	565		
0602	2	600		Slow acceleration and no primary hydraulic EDV by 45% so start was aborted.
0605	2	625		No EDV by 40%. Start aborted.
0612	2	625	645	

(5) This delay in starting and concern about pump overspeeding at idle could be relieved, if not eliminated, by monitoring the pumps during start with ground instrumentation similar to that used on 001. After engine start, a data burst was completed between counter numbers (C/Ns) 2080 and 2085. Flight control full throws were completed at C/N 2608.

(6) Discrepancies noted prior to taxi were:

(a) Sky Genie transparent plastic case should include a decal showing "4-1/2 turns."

(b) Emergency generator switch does not have an AUTO position decal visible to the pilot.

(c) When the TACAN was turned on a whine was generated in the intercom background.

(d) Fire warning light remained on when the No. 5 auxiliary drive subsystem (ADS) fire detector test switch was held forward.

(e) Left forward flood light for pilot's instrument panel was out.

(f) No. 2 engine primary hydraulic pump went from motoring to pumping phase during start.

(g) Static received in pilot's headset when transmissions are made on UHF No. 1.

(h) Takeoff trim light would not come on with elevons trimmed in proper takeoff position.

(7) We started to taxi at T 06+5: temperature 72°; wind calm and altimeter setting 29.92. Nose wheel steering and brakes were smooth and comfortable as we rolled along at 10 to 15 mph under idle to 65% rpm power. At 5 to 10 mph the cockpit was smooth and steady, absent of pitching motions. Over 10 mph, gentle up and down cockpit oscillations occurred about once every second. Near 15 mph they were much more noticeable, approaching annoying, at 1-1/2 to 2 cps. The brake pedal forward tilt and amount of travel required to get braking action were greater than I have become accustomed to and was somewhat surprising. I will need more experience before I arrive at a firm opinion, but my initial impression of the pedal position and travel is not too favorable. There was no annoying brake chatter experienced while taxiing out.

(8) The lineup and stop on runway 04 at T 0705 was completed with only light brake chatter by rolling and turning very slowly and using a very easy and delicate braking technique. The data counter was reset to zero at T 0710.

(9) After realigning Great Circle for over 30 seconds both the magnetic and Great Circle headings were 042 . T 0713, data was taken at MIL power. Engine instruments were as follows:

	1	2	3	4	5	6
Rpm - %	100	100	100	100	100	100
EGT °C	900	875	875	880	880	880
A8 - %	37	43	40	40	41	42

Tank No. 6 was empty and turned off at T 0714 with a totalizer of 201,000 pounds. The brakes were checked by the ground crew while I alternately held and released the brake pedals. Ammonia level was 465 pounds and water 4,350 pounds.

b. (Takeoff and Climb:

(1) From 85% rpm, T 0716, the order of afterburner light off was 3 and 4, 2 and 5, then 1 and 6. T 0717, the brakes were released. The initial takeoff roll was very rough. I kept expecting the nose wheel steering to disengage due to the roughness and directional distrubances felt in the cockpit. After about 3,500 feet initial roll, the roughness subsided and the decision to go was made at 150 KIAS. This was the roughest takeoff ride I've felt in the XB-70. I suspect it was caused by the rough runway surface.

(2) Al took the throttles and I initiated a slow rotation, using both hands, at 185 KIAS. Attitude judgment and control movements were easy and resulted in a very comfortable feeling during rotation and initial climb. Takeoff speed was very near 210 KIAS. Data was turned off at C/N 483. Initial climb tape angle of attack was 10° at 230 KIAS. Hydraulic levels, pressures, and the external visual inspection by chase were O.K. so the gear handle was placed up at 232 KIAS. Fitz (chase) reported the right gear was a bit slower than the left but they both went up and the doors locked satisfactorily.

(3) Near 6,000 feet at 20° left bank was initiated to a northwest heading. At 7,000 feet and 255 KIAS the flaps were retracted. Five partial rolls, nose up, on the pitch trim knob comfortably controlled the nose down trim change resulting from the flap retraction. Airspeed

when flaps indicated up, was 264 KIAS. The landing light extend caution light blinked on and off intermittently.

(4) I was slow getting on the desired climb speed of 400 KIAS and as a result crossed California City northwest bound near 13,000 feet at 370 KIAS. I attempted to trim out the persistent 3/4° right sideslip. I was on 400 KIAS about 15,000 feet. I checked that my seat was as high as I could get it without bumping my helmet on the cockpit overhead sill. That big black nose insisted on denying me the forward visibility I have so long been accustomed to in other aircraft.

(5) The cockpit noise and light vibrations, common to both XB-70s, started to smooth out at .88 Mach, 395 KIAS, and 25,000 feet. At .92 Mach there appeared an audible buzz. I'm not sure when or if it disappeared. There was no apparent control or airframe vibration associated with this noise. The cabin recorder was turned off at C/N 955.

c. Data at 32,000 Feet, .95 Mach, Tips Up, FACS Off:

(1) Initial level off was at 32,500 feet and .95 Mach. Overshooting both speed and altitude to 32,800 feet and .98 Mach I reduced power and experienced MIN afterburner instability in engines No. 3 and 6 which was easily corrected by a slight increase in throttle angle. There was some lateral-directional wallowing observed at this time. The tape angle of attack was 5°.

(2) T 0730, we were very near Owens Lake and recorded an airspeed point with TB-58 No. 662.

XB-70		TB-58	
Tape KIAS	349	KIAS	343-1/2
Pneumatic KIAS	350	Altimeter	31,500
Altimeter	32,200		

(3) T 0732, C/N 1300, MIN afterburner instability persisted so I reduced 1 and 6 to MIL as we held a north heading for Tonopah. With flight augmentation control systems (FACS) off and wing tips still up, the ball was centered but the sideslip needle was one-half degree right. A touch of aileron and rudder trim zeroed the needle. Another airspeed point was recorded as follows:

XB-70		TB-58	
Tape KIAS	348-1/2	KIAS	342
Altimeter	32,500	Altimeter	31,720
Mach	.95		

It was noticeably pleasant and easy to control and stabilize both speed and altitude.

(4) Between C/Ns 1498 and 1540, a pullup and release was completed to 1.42 indicated G. The pull force was applied and held to 1.2G and released with the resultant slight overshoot. At 50 nautical miles south of Tonopah, 500 feet above aim altitude and with the sideslip needle near zero, I set up for a left sideslip out to 2°.

(5) Between C/Ns 1617 and 1655, I applied right rudder and fed in left hand down wheel as required to hold the heading. I soon saw I had done something wrong as the 2° sideslip soon became 3 and was fast on its way to 4 or more. With Al's advice to get off the ailerons I tried to neutralize the wheel and ruddered the sideslip needle back to or near zero. I was by no means positive of the precise correct actions required to get back to a zero sideslip condition. I was aware of its tendency to yaw out but had no idea it was this sensitive to control. It was obvious to me I had fed in both rudder and aileron too fast so set up again to repeat this point.

(6) Between C/Ns 1670 and 1727, 351 KIAS, 32,300 feet I applied right rudder very slowly and, to the expense of letting the heading change, was even slower and easier on the ailerons. At 354 KIAS, 32,150 feet I got out to 2° left sideslip, returned the wheel to neutral and left ruddered the sideslip needle to zero. I guess this is the way I should have performed the maneuver the first time but I'm glad I didn't for I learned far more the other way. If a velvet touch isn't used on the controls either the tips should be at half or the FACS should be on. The positive dihedral effect and strong yaw generating ailerons with FACS off and wing tips up create the only control problem I have seen to date in the XB-70. Light aileron forces and the use of a sideslip instead of yaw indicator distract from my ability to control this condition.

d. Turn, Tips Half, FACS On, Supersonic:

(1) T 0740, we were 25 nautical miles south of Tonopah and started a left bank. C/N 1750, I initiated a windup turn to 1.25G. I had to apply left rudder to correct for a 3/4° left sideslip which accompanied the turn.

(2) When the FACS was turned on the augmentation lights went out and Al reported he felt rudder buzz. I couldn't feel the buzz but did observe a lateral directional oscillation of low magnitude. At 356 KIAS, 31,600 feet, .95 Mach, an event was marked at C/N 1881 and the tips were lowered to HALF while in a 20° left bank. I did not observe the expected lateral trim change with the tip lowering. Tips showed HALF at 32,000 feet. Data was turned off at C/N 1940 and 1 and 6 engines were advanced into afterburner. Fuel totalizer was 135,000 pounds.

(3) T 0744, data on at C/N 2018, over Coaldale to record us going supersonic. We were in a 30° left bank at 32,400 feet when we got the jump and I rolled out on the 180° heading. The control and aircraft response at the jump were smooth and completely uneventful.

(4) Control and response in the acceleration was excellent. However, I did not trim nose down adequately and a slight climb resulted. We were at 460 KIAS, 34,400 feet, C/N 2484, T 0751:30 and started to climb. Utility No. 2 (U_2) fluid level was down to 140%. Both attitude indicator balls were centered yet the sideslip needle was not zero. The Mach was 1.3 at 36,000 feet.

e. Mach 1.4, 41,000 Feet, Tips Full, Nose Ramp Up, Sonic Boom:

(1) Photo chase joined on our right wing and between C/Ns 2600 and 2654, while climbing through 37,800 feet at Mach 1.35, the tips were lowered to FULL. I didn't experience any noticeable lateral wallowing or trim change during the wing fold.

(2) With Palmdale 80 nautical miles ahead, throttle angle (T/A) 80°, Mach 1.41 the nose ramp was raised at C/N 2702. I certainly miss seeing the horizon and had it been possible I would have stopped the windshield at an intermediate position to afford me that highly desirable condition. An airspeed comparison was recorded as follows:

XB-70		TB-58	
KIAS	452-1/2	KIAS	456
Altimeter	40,500 feet	Altimeter	40,550 feet
Mach	1.397	Mach	1.41

(3) With the intention of turning PITCH AUG off I selected the wrong switch and turned YAW AUG 1 off instead. The location of the PITCH AUG power switch is very poor - relocation should be given strong consideration. With YAW AUG 1 off, instead of PITCH AUG off, a pullup and release was completed to 1.2G.

(4) The chase fell back at 41,000 feet as we started a 30° left bank to boom Edwards. The fuel totalizer was 91,500 pounds and the Mach was near 1.42 as we passed nearly over the field at T 0800. The U_2 fluid level continued to decrease and was now 125%. I rolled out on 345° for Tonopah and turned PITCH AUG off. At C/Ns 3259 - 3313, completed a release from one-half rudder sideslip at 1.38 Mach.

(5) T 0806, C/N 3353, turned all FACS off and checked that the four caution lights were on. A continual lateral directional small magnitude wallowing was experienced. I thought my control inputs were exciting and aggravating the motion so I was as careful as possible with the ailerons. I was unable to comfortably stop the sideslip needle or the associated aircraft movements with any individual or combined movement of aileron or rudder. The sideslip balls were both centered, yet the sideslip needle was off, I therefore, concluded the needle indicates erroneously during supersonic flight. At C/N 3510, Mach 1.42, 41,000 feet, a FACS off sideslip was initiated out to 2°. I expected the aircraft to behave much better than this with the tips full down and FACS off. I was certainly not impressed with the lateral directional stability and my ability to comfortably control these motions. FACS on or tips HALF should be used at this flight condition. The fuel total was 71,000 pounds and U_2 fluid level was 120% so we turned left and started deceleration with engines No. 2, 3, 4 and 5 out of afterburner.

f. Deceleration, Tips Raised, Subsonic, Descending:

(1) While accomplishing the check list I noted that the SSN knob is too far aft to comfortably see or reach. Some rearrangement on this left switch panel console is highly desirable.

(2) T 0813, C/Ns 3770 - 3803, Mach 1.2, the tips were raised to HALF and U_2 continued to drop to 105%. P_1 fluid level was 120%. Due to hydraulic fluid levels and fuel state the deceleration was continued and at C/N 3876, Mach 1.1 the windshield was lowered.

(3) T 0815:30, C/N 3928, we went subsonic with U_2 at 100% and P_1 at 115%. Throttle angles were 40 .

g. Ram Purge:

(1) (U) In descent, approaching .95 Mach and 35,000 feet, the following environmental control system (ECS) data were recorded:

Ammonia	440 pounds	EE Temperature	42°F
Water	- 4,150 pounds	Oxygen	- 18.5 liters
Cabin Altitude	8,000 feet	Total Temperature	21°F

(2) At C/N 4017, .96 Mach, 34,600 feet, with T/A 40° I selected the cabin air switch to PURGE. The cabin altitude stabilized at 30,000 feet for a few seconds and chase reported the scoop was out. At C/N 4071, I selected the cabin air switch to REPRESSURE and the cabin altitude increased to 34,000 feet. I continued to hold the switch down as is required before releasing it at a cabin altitude of 26,500 feet, but the cabin did not repressurize. While holding the switch down I suffered from an apparent lack of oxygen. I held the mike button and the cabin air switch down. My vision was blurred, I breathed heavily in an attempt to get oxygen and my normal senses were only 10% to 20% efficient. I never lost consciousness, could hear Al and Fitz talking to me but could only think of maintaining wings level in descent and respond to the need to hold the cabin air switch to REPRESSURE until the cabin reached 26,500 feet.

(3) Al pushed me back in the seat and repositioned the cabin air switch to PURGE. He declared an emergency condition and took control of the aircraft for a short period. Returning to near normal I checked the oxygen toggle and connections and they were all properly positioned. I tightened the oxygen mask to my face by inserting the sabres into the retainer latch one more notch. I called out .93 Mach, 28,000 feet, and 370 KIAS. At 356 KIAS the tips were raised at C/N 4256. U_2 was 80% and P_1 95%. We went to REPRESSURE and the scoop went in. The bleed air switch was placed open at C/N 4364 and the cabin held below 20,000 feet, with an aircraft altitude of 20,500 feet. At 16,000 feet the cabin was 9,000 feet and the electronic equipment (EE) temperature held below 50°. It appeared that the bleed air had been shut off when the scoop came in as experienced on a ram purge test on Flight No. 1-4.

h. Letdown, Low Approach and Landing:

(1) Tank No. 1 was at 15,000 pounds and not feeding properly for Al but U_2 had increased to 95%. With a fuel total of 60,500 pounds, tank No. 1 started feeding and P_1 fluid level was up to 150%. At 9,000 feet we went to AUTO on the bleed air switch. FACS off at C/N 4999. A definite right wing down roll transient was experienced when FACS was disengaged. It was trimmed out easily.

(2) I slowed to 250 KIAS and maneuvered the aircraft some before extending the gear. U_1 was 200% plus and U_2 still 95%. P_1 was 150%. C/N 4718, cabin altitude 10,000 feet and with EE temperature 78°F we went to OPEN with the bleed air switch and at 9,000 feet returned the switch to AUTO. The EE temperature held 55°F.

(3) The gear and flaps were extended near 260 KIAS. Fluid levels were: P_1 - 100%, P_2 - 150%, U_2 - 110%, and U_1 - 190%. Fuel totalizer 56,500 pounds so flare speed was 195 KIAS. On final, the WATER-AMMONIA caution light was on. Fitz called 215 KIAS in the TB-58 when I read 212 KIAS.

(4) A low approach was completed to about seven feet at 210 KIAS. The bleed air switch was placed to OPEN as we remained in a left hand closed pattern. U_1 fluid level was pegged and U_2 held 140%. On downwind, tank No. 1 was 2,900 pounds, EE 63°, bleed air open, AUX-COOL - ON and REFER - OFF.

(5) The wind was calm so the landing was on runway 04. There was light turbulence about 2 miles from touchdown but it was smooth for the flare and landing. The average speed on final was 215 KIAS, bleeding off to 205 KIAS as we approached the threshold. I did not observe the touchdown speed but estimate the touchdown point 3,000 feet down from the end. Only one of the two chutes deployed. Al suggested and assisted in increasing the amount of brakes used in stopping.

(6) I came off the brakes and let it roll out into the overrun before doing a 180° back to the turnoff. The fuel inerting caution light came on with a 35% quantity. MIL power runs were made in this order: 3 and 4, 2 and 5, then 1 and 6. Flight control full throws were recorded. Hydraulic fluid levels just prior to shutdown were:

P_1 - 100%, P_2 - 155%, U_1 - 185% and U_2 - 115%.

i. <u>Flight Squawks:</u>

(1) No. 2 engine primary hydraulic pump went from motoring phase to pressurized pumping mode on engine start.

(2) Left hand instrument flood light out.

(3) Cabin air would not repressurize after selecting PURGE.

(4) Fuel inerting light was on during taxi in (Quantity 35%).

(5) Landing light extend light on intermittently during flight.

(6) Tank No. 1 would not feed in AUTO.

(7) Only one drag chute deployed.

(8) Copilot's mike switch intermittent.

(9) U_2 level decreased to 85% during flight.

(10) Pilot's oxygen system malfunctioned.

(11) Sideslip needle off one-half degree to the right.

(12) Tank No. 7 left had 3,100 pounds remaining when 7 right was 0. When No. 5 auxiliary drive subsystem fire detector switch was held forward the fire warning light stayed on.

j. Pilot's Summary:

(1) The required visual check for wide open inlets, during the pilot's exterior inspection cannot be made due to the absence of reference marks on the roof of the inlet.

(2) A wheel well fuel leak again existed. Acceptance was based on the assumption it would stop with the use of fuel from tank No. 6. Acceptance of these enclosed area fuel leaks should be based on "go - no go" limits established formally by inspection.

(3) The proper number of turns of rope on the "Sky Genie" shaft (4-1/2) is easily forgotten, and is not indicated on or near the equipment. A stencil providing this information on the transparent plastic cylinder is highly desirable.

(4) The AUTO position for the emergency generator switch is not visible to the pilot when the switch is in its center position.

(5) The brake pdeal forward tilt and travel, required to obtain braking action, were much greater than expected.

(6) Brake chatter was heavy and caused very uncomfortable airframe vibrations while taxiing at light gross weight. Only by use of a very delicate braking technique and extremely slow taxiing could the chatter be kept light at heavy weight.

(7) The flight control trim for takeoff (TTO) light would not come on with the controls at or near the required trim position. The system and light should be operational.

(8) The forward visibility in climb and cruise with the windshield ramp down is poor. The nose of the airplane obstructs much of the center viewing area. The obstruction from view of the natural horizon when the windshield ramp is up is a distinct disadvantage. A variable position ramp would enable the pilot to adjust the windshield to partially reduce drag and noise, yet provide some forward visibility and view of the horizon.

(9) The TACAN and heading systems gave excellent performance.

(10) Pitch attitude and speed stability characteristics are excellent. Control of these are both easy and comfortable.

(11) There were no noticeable lateral trim or attitude changes during wing tip fold operations.

(12) Engine power instability in MIN afterburner was an annoying distraction. Elimination of this characteristic would be highly desirable.

(13) The existence of an inboard leak around the nose area of the oxygen mask and the absence of positive pressure in the mask caused a lack of oxygen and resulted in the pilot experiencing hypoxia.

(14) The lateral directional stability and control characteristics with FACS off and the wing tips up under yawed conditions are marginal. Sideslip maneuvers in the FACS off and wing tips up configuration must be performed with caution. Increasing the aileron control forces would improve harmony with the elevator forces and the handling qualities of the aircraft. Replacement of the sideslip indicator with a yaw indicator would assist in the performance of and recovery from stability maneuvers. At 1.4 Mach the aircraft handled and behaved better with the wing tips at half than at the full down position. It appears that half tips should be used earlier in the climb.

(15) The FACS power switches are located too far forward and the SSN control knob is located too far aft on the pilot's left console panel. A rearrangement of this panel is considered important. It is desirable to eliminate the need for the pilot to reset the SSN knob during flight.

(16) During flight, the Utility 2 and Primary 1 hydraulic fluid level indicators decreased to a low of 80% and 95% respectively.

(17) Only one of the two drag chutes developed on landing.

(18) The cabin would not repressurize following the ram purge tests at 35,000 feet.

2. Flight 2-3: (Mr. Van Shepard)

Mr. Van Shepard, North American Aviation, Inc., was the first pilot on this flight. No Air Force pilot report will be written.

3. Flight 2-4: (Lt Col Fulton)

a. Introduction:

(1) The flight was scheduled for 1100 hours takeoff. The purposes of the flight were left seat pilot experience for Lt Colonel Fulton, handling characteristics and stability data up to 1.4 Mach, and engine restarts at subsonic speeds.

(2) The flight went as planned and all tests were completed except for a restart of the No. 5 engine, which was eliminated after considerable difficulty was experienced in restarting the No. 1 engine.

b. Preflight and Flight Preparation:

I arrived at the airplane at 0740 and began a around inspection. walk The airplane appeared in excellent condition except for several fuel leaks which I discussed with Air Force and North American Aviation, Inc (NAA) inspectors. The only leaks of consequence appeared to be coming from tank No. 6 and were leaking in the area of the right landing gear. The inspectors and I agreed that the airplane could be flown with the leaks since tank No. 6 would be emptied within a short time after takeoff. After reviewing the flight plan, Mr. White and I entered the cockpit at 0920 and by 0945 were ready to start engines.

c. (In the Cockpit Prior to Taxi:

The starting gross weight was approximately 518,000 pounds which included an indicated 239,500 pounds of fuel. Engine starts were begun at 1002 and completed at 1015 hours. The maximum exhaust gas temperature (EGT) encountered during first peak was 640° on the No. 2 engine. The No. 4 engine did not rotate on the first two attempts and then failed to light off on the third attempt after the "Shepard soft start" method was used to get rotation. The soft start method was again used on the fourth attempt and a normal start occurred. The No. 6 engine went to electrical depressurizing valve (EDV) at 34%, as scheduled, but then went immediately to the pumping mode at 35%. All hydraulic systems were serviced to around 160% except U_2 which was over serviced to 180% to compensate for a small leak in the No. 2 auxiliary drive system (ADS) bay. Fuel was transferred from the No. 6 tank to minimize the fuel leak problem. After a military power engine run, the airplane was ready for taxi out.

d. Taxi:

The taxi out was started at 1047 hours with approximately 24,000 pounds remaining in tank No. 6. The airplane taxied well in the "taxi" mode and felt very comfortable at around 20-25 knots ground speed. The steering was responsive in both directions and no problems were encountered in judging when to begin turns. The wide taxiways were very beneficial. Again, there was a moderate frequency oscillation during taxi out when the airplane seemed to get in frequency with the spacing of the concrete blocks on the taxiway. Only mild brake chatter occurred at slow speed. The brakes were very powerful, but an excessive amount of pedal travel was necessary to obtain the desired response and the pedal force was too high. The airplane was stopped in the runup area and the ground crew made a visual inspection.

e. Takeoff and Initial Climb:

The indicated fuel quantity ten minutes prior to brake release was 222,000 pounds. The No. 5 fuel tank switch was left off and all others set to automatic. The engines were advanced two at a time into minimum afterburner Counter Number (C/N) 213. Brake release was at 1114 and seemed fairly smooth. All engines were set at maximum afterburner and the airplane accelerated rapidly. A rough area of the runway was encountered near 100 knots speed. Rotation was started at 180 knots and lift-off came at 200 knots as planned. The after takeoff acceleration appeared slow but after gaining approximately 20 knots the acceleration rate picked up considerably. A slight tendency for lateral overcontrolling was overcome within a few seconds. The gear locked up in 25 seconds and the flaps were retracted immediately afterward.

f. Climb:

Two minutes after lift-off, the 400 knot climb speed had been reached. A strong airframe buzz began at 390 knots IAS, therefore, after a few seconds the airplane was slowed to 355 KIAS and the climb continued at that speed. The buzz could not be identified but it could be heard and felt in the floor of the airplane. Tank No. 6 was emptied around 12,000 feet. The climb continued in maximum afterburner except for about three minutes between 12,000 and 15,000 feet where military power was selected. An airframe buzz or noise of less magnitude than noted at 390 knots was encountered between .85 and .87 Mach. This same buzz was detected later in the flight each time the airplane was flown between .85 and .87 Mach. Shortly after passing 26,000 feet with the indicated speed at .97 Mach, a feeling of left wing heaviness was noted. Instinctively, right aileron was applied to bring the wing up. A quick check of the sideslip

indicator showed approximately 3° right sideslip and that the aileron application was causing the sideslip to increase. The ailerons were released and rudder used to level the wings. On several subsequent checks of this latent sideslip tendency, it was found that very careful control manipulations were necessary to prevent excessive buildups of sideslip with the wing tips up at high subsonic speeds. Use of the rudders to aid in correcting small wing down conditions prevented inadvertent sideslips from developing. The airplane was leveled at 32,000 feet and .95 Mach with two engines at military power and the others set in afterburner at approximately 70° throttle angle.

g. Handling Qualities and Stability at .95 Mach and 32,000 Feet:

(1) The airplane was trimmed with the flight augmentation control system (FACS) off. Very little effort was required to maintain the desired speed and altitude. A positive longitudinal pitch pulse (C/N 1255) of approximately 1.4G was applied. The response was essentially deadbeat but the chase airplane reported something fell off the XB-70. After several minutes, it was concluded that the object was probably a National Aeronautics and Space Administration (NASA) pressure rake that had been attached to the upper surface of the wing. The flight plan was continued with a left sideslip (C/N 1585) followed by a release. The tendency to build up sideslip was again noted but as long as the angle wasn't allowed to go over 2-1/2 to 3° it was easily controlled. The release damped to approximately one-half amplitude in one cycle. The period of the directional oscillation seemed fairly long. A right sideslip to 2° and a release showed the same characteristics. A windup turn to the left at 1.4G required elevator forces higher than desirable and F_s/G was estimated to be around 55-60 pounds.

(2) FACS was turned on and a buzz in the rudder pedals was traced to the yaw 2 system. With the FACS on, the sideslip (C/N 1821) was increased to 2° without any tendency to buildup. The release was deadbeat. During the windup turn, there was no apparent difference in F_s/G; however, the FACS didn't take out a 1° sideslip.

(3) With 151,500 pounds of fuel remaining, the wing tips were lowered to 25°. FACS was still on. A longitudinal pulse (C/N 1965) was deadbeat although it was followed by a few short cycles of fuselage oscillation. Full rudder produced 4° of sideslip with a slight tendency to increase which was easily controlled. The directional oscillation was deadbeat when released.

(4) FACS was turned off with the wing tips still at 25°. The sideslip characteristics were similar to the FACS on condition just checked and the release damped to one-half amplitude in approximately one cycle. Data was off at C/N 2119.

h. Acceleration to 1.4 Mach:

With the tips at 25°, all FACS were turned off and maximum afterburner was set on the engines to accelerate. The airplane went supersonic (C/N 2213) without any noticeable trim change; however, the altimeter jump did not occur until the indicated Mach was 1.02. The airplane felt very solid during the acceleration. At 1.16 Mach, light turbulence was encountered but the B-58 chase alongside classified it only as a trace of turbulence. Again, the stick forces were noted as being too high and the longitudinal trim button was used frequently for pitch control. After accelerating to 1.20 Mach at 32,000 feet, a constant IAS climb was established to reach 1.4 Mach at 41,000 feet.

i. Handling Qualities and Stability at 1.4 Mach and 41,000 Feet:

(1) With 113,000 pounds of fuel remaining, tips at 25°, and all FACS on except pitch augmentation, the airplane was stabilized for a stability set. Two pitch pulses (C/N 2930) were accomplished. The first wasn't large enough so it was repeated. The characteristics were excellent with near deadbeat damping. It was very easy to get one to two degrees of sideslip during normal lateral control movements. The sideslip (C/N 2960) was gradually established at approximately 4° and it appeared that the slope of the curve becomes very shallow near that sideslip angle since the airplane seemed to be "happy" at a little more or a little less sideslip even though very little control movement occurred. When released from a 2° sideslip, the airplane showed excellent damping. A windup turn (C/N 3030) exhibite the same high longitudinal forces.

(2) FACS was turned off and another sideslip (C/N 3175) performed. It was very easy to put in too much aileron and exceed the intended sideslip angle. A release from slightly over 1° damped out very good.

(3) FACS was turned on again and the wing tips set at 65°. Handling qualities were the best seen in any configuration so far. A pitch pulse (C/N 3400) was deadbeat although a few small rapid oscillations from fuselage flexing followed the basic airplane deadbeat damping. With full rudder, only 1-1/2° of sideslip could be generated

and there was no tendency to get more sideslip than desired. A release from 1° damped out rapidly. A windup turn (C/N 3540) was similar to previous longitudinal accelerated maneuvers.

(4) With FACS off and the wing tips still at 65°, the flying qualities were not as good as those previously seen with FACS off and tips at 25°. The sideslip became more "skittish" and it was easy to inadvertently get in phase with the yaw during aileron movements. When sideslipping the airplane (C/N 3864), it was noted that rudder application was not very effective but only a small aileron movement caused the sideslip to immediately begin to build up. When released from the sideslip, the damping characteristics were still good.

j. Deceleration From 1.4 Mach to 1.2 Mach:

Prior to the deceleration, the airplane was stabilized at 1.4 Mach and the nose ramp raised. There was no detectable change in power required when the ramp went up. There was, however, a decrease in noise level and a marked decrease in visibility. The power was reduced and as the airplane slowed, the wing tips were reset to 25°. A mild nose down trim change occurred as the wing tips went from 65° to 25°.

k. Handling Qualities and Stability at 1.2 Mach and 41,000 Feet:

With all FACS on except pitch augmentation and wing tips at 25°, a stability set (C/N 4243) was accomplished. This was followed by a sideslip and release with the FACS off. All handling characteristics were similar to those exhibited with the same airplane configuration at 1.4 Mach.

l. Deceleration From 1.2 Mach to Subsonic Speed:

FACS was reset to on and the nose ramp lowered again. With 67,500 pounds of fuel remaining, the throttles were retarded to military power for the deceleration. The China Lake F-4B took infra red (IR) measurements with military power set as the airplane decelerated from approximately 1.15 Mach to .95 Mach. No trim change was noted in the transonic region: however, a slight airframe buzz or noise began at 1.05 Mach and persisted until approximately .90 Mach. Another noise began at .87 Mach and the windshield ramp was raised for a few seconds to determine if the noise would be eliminated. It was reduced but not eliminated and the windshield ramp was lowered again.

m. Subsonic Engine Starts:

With the FACS on and the wing tips at 25°, the airplane was stabilized at 25,000 feet with a speed of .80 Mach. The No. 1 throttle was retarded to idle. The EGT was 160° and the rpm was 62%. The throttle was cut (C/N 5140). With the 32% rpm, 100° EGT and 70% A_8 the restarts were attempted. The throttle was on 30 seconds, off 5 seconds, on 30 seconds, off 5 seconds, and on 30 seconds without a successful light off. While still holding 25,000 feet, the speed was increased to .90 Mach. The windmill rpm advanced to 37.3%. Again, a series of three airstarts (C/N 5490) were attempted without a successful light off. After descending to 20,000 feet, the airplane was again stabilized at .90 Mach. With a windmill rpm of 38.8%, another series of three airstarts (C/N 5889) were unsuccessfully tried. All of the previous attempts had been done with a normal throttle advance to idle; however, General Electric (G.E.) suggested trying a slow advance from shutoff to idle. Therefore, with 38.8% rpm at .90 Mach, another series of three airstarts (C/N 6218) were initiated. The engine did not light off, therefore, the airplane was descended to 15,000 feet and 400 knots IAS established. A series of restarts were begun (C/N 6518) with a windmill rpm of 33.6%. The throttle was advanced slowly from cutoff to idle and on to approximately 10° above idle without a light off. The throttle was cut for 5 seconds and advanced in the same manner without success. Again the throttle was cut for 5 seconds and then slowly advanced. As the throttle reached the position approximately 10° above idle, the engine restarted (C/N 6615) and accelerated normally to idle speed. Fourteen unsuccessful airstarts and one successful airstart were accomplished. Because of the difficulty in restarting No. 1 engine and because of the fuel used during that time, it was decided to eliminate the planned restart of the No. 5 engine.

n. Descent and Pattern Entry:

The throttles were retarded to descend and at 14,000 feet, 400 KIAS, the wing tips were retracted to up. The airplane was slowed to less than 300 KIAS and the FACS turned off. A high downwind leg for runway 22 was established. The wind was reported as 230° at 14-20 knots. Total fuel indication was 32,500 pounds with 31,200 pounds in tank No. 3 and the flare speed was computed as 188 knots IAS. The airplane was slowed to 260 knots and the landing gear extended during the turn to base leg. As the flaps were lowered, the elevator trim button was rolled forward 2 or 3 turns. As a result, the flap trim change was very mild.

o. Low Approach and Landing:

The airplane was established at 210 knots for the final approach and low altitude fly-by. There was considerable turbulence and the aileron manipulations used to keep the wings level resulted in undesirable sideslips of one to two degrees. Even with the turbulence, speed control was excellent and the desired speed could easily be kept within two knots of aim. The airplane was flown down to approximately 15 feet above the runway and held at that elevation while continuing down the runway. Military power was applied for go around and the airplane was pulled up and turned on a wide downwind leg. When on the base leg near the Rocket Test Site, a moderate turbulence was encountered that shook the XB-70 quite a bit. The B-58 pilots reported only light turbulence at the same time. The final approach was again flown at 210 knots IAS with the same turbulence that occurred during the low approach. A slight lateral overcontrolling tendency existed during the early part of the final approach but was overcome as the approach was continued. Speed was decreased gradually in the flare and the touchdown was smooth at approximately 180 knots IAS. The airplane was very responsive in the flare and landing. The nose was lowered immediately to the runway and the drag chute deployed at 155-160 knots. Both chutes inflated normally and light to moderate braking was used to stop. The drag chute was jettisoned around 50 knots.

p. After Landing:

Military power engine runs were completed in the runup area near the westend of the runway. After taxiing to the run station, the engines were shut down with approximately 18,000 pounds of fuel remaining.

q. Systems:

(1) Engines:

Engine operation was generally excellent. Afterburner instability occurred several times during partial afterburner operation, but could be stopped by advancing or retarding the throttle slightly. The No. 1 engine was very difficult to restart following an intentional shutdown.

(2) Environmental:

The system worked well and only two or three minor temperature adjustments were needed to refine the desired cockpit temperature. The cabin altitude was constant the entire flight at approximately 8,200 feet.

(3) Flight Control:

The flight control system functioned excellently except for the yaw 2 system which caused small rudder oscillations to be fed through the rudder pedals.

(4) Fuel:

Almost all of the fuel in each tank was useable. The final fuel reading obtained had an indication of 18,000 pounds total fuel and 16,550 pounds of fuel remaining in tank No. 3. This was the smallest quantity of unuseable fuel on any XB-70 flight.

(5) Hydraulics:

There were no in-flight indications of hydraulic leaks except for the U_2 quantity which decreased slightly. The decrease was very small and caused no concern.

(6) All other systems operated satisfactorily.

VI. CONCLUSIONS:

1. Left seat checkout was successfully accomplished for pilots Fulton, Shepard and Cotton.

2. Systems which gave overall satisfactory performance were:

a. Flight 2-2:

Engines	IFF
Fuel	Flight Instruments
Landing Gear	Flight Controls
Nose Wheel Steering	Wing Fold
Flaps	TACAN
Instrumentation	Nose Ramp
Electrical	AICS (Not Used)
Communications	

b. Flight 2-3:

Fuel	IFF
Landing Gear	Environmental Control System
Nose Wheel Steering	Flight Instruments
Flaps	Oxygen
Instrumentation	Flight Controls
Electrical	Wing Fold
Communications	TACAN
Fire Detector	Nose Ramp
	AICS (Not Used)

c. Flight 2-4:

Fuel	Environmental Control System
Landing Gear	Flight Instruments
Nose Wheel Steering	Oxygen
Flaps	Flight Controls
Instrumentation	Wing Fold
Electrical	TACAN
Communications	Drag Chute
Fire Detector	Nose Ramp
IFF	AICS (Not Used)

3. The air vehicle's tendency to develop large sideslip angles due to aileron is very undesirable. Restoring moment in yaw with FACS off and wing tips up is inadequate.

4. The slow speed (above 300 KIAS) handling characteristics of the air vehicle are better with the wing tips at the one-half position than with the tips up.

5. The Air Force pilots prefer a yaw indicator in lieu of the present sideslip indicator.

6. Numerous subsonic engine airstarts were attempted before a successful start was obtained.

7. Minimum afterburner instability continues to be an annoyance.

8. Undesirable airframe noises and vibrations occur in several speed ranges.

9. Forward visibility is less than desirable.

10. The required visual check for wide open inlets cannot be made during the pilot's exterior inspection due to the absence of reference marks on the roofs of the inlets.

11. A fuel leak existed again in the wheel well.

12. Trapped fuel (fuel that cannot be transferred to the sump tank) in air vehicle No. 2 is 1,500 to 2,000 pounds contrasted to the 9,000 to 10,000 pounds trapped in air vehicle No. 1.

13. The trim for takeoff system readiness light is not reliable.

14. The repressurization difficulty during Flight 2-2 was caused by the tripping of the differential pressure engine environmental air distribution system (EEADS) switch during a negative pressure reference that occurs in the .95 Mach region.

15. The combination of an inboard leak around the nose area of the oxygen mask and the absence of positive pressure in the mask caused a lack of oxygen that resulted in the pilot experiencing hypoxia during the depressurization phase of Flight 2-2.

16. The AUTO position for the emergency generator switch is not visible to the pilot when the switch is in the center position.

17. The FACS power switches are located too far forward for adequate pilot accessibility.

18. Brake chatter continues to be heavy below 10 knots while taxiing at light gross weights.

19. Utility No. 2 hydraulic system fluid quantity indication tends to drop significantly during flight.

20. The drag chutes are unreliable.

VII. RECOMMENDATIONS:

1. Investigate means of correcting the large sideslip angles generated by small lateral control movements.

2. Increase the aileron control force.

3. Schedule the wing tips to the one-half position soon after the air vehicle attains 300 knots in climb.

4. Continue investigation of the subsonic engine restart envelope.

5. Identify sources of noise and vibration that occur in the airframe.

6. Mark external reference lines on the inlets to facilitate the pilot's exterior check for wide open inlets.

7. Establish "go - no go" fuel leak criteria.

8. Relocate the FACS power switches further aft on the present panel.

9. Continue to investigate the cause of brake chatter and correct this deficiency.

10. Correct discrepancies in the trim for takeoff system and make system operational.

11. Identify and correct the cause of Utility No. 2 hydraulic system quantity change.

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