(Gp-4) TEST REPORT

XB-70A

FLIGHT 2-1

(No. 2 Air Vehicle, No. 1 Flight)

17 July 1965

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XB-70 JOINT TEST FORCE (FTTB)

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I. SUMMARY:

1. The first flight (Flight 2-1) of the second XB-70A, No. 62-207, completed all the test objectives. The flight was notable for its absence of in-flight squawks. This near perfect flight was marred only by a nose wheel steering hard-over which occurred while turning off the runway after the landing. The flight was completed 17 July 1965 by Mr. Al White, North American Aviation, Inc (NAA) Pilot, and Colonel Cotton, Air Force Flight Test Center (AFFTC), Copilot. The early morning takeoff was delayed because of electrical problems with the pitch trim system of the flight augmentation control system (FACS) and a heavy rain shower.

2. Takeoff was at 1302 from Palmdale Plant #42 runway 7 at a gross weight of 393,270 pounds. Total flight time was one hour and thirteen minutes of which twenty-one minutes was at supersonic speeds. Landing was at Edwards AFB.

3. Takeoff and climb to 35,000 feet was uneventful. After leveling at this altitude at .95 Mach stability maneuvers were performed, first with tips up then at the one-half position. The aircraft was then accelerated to 1.4 Mach at 40,000 feet. The windshield was raised and stability data were obtained with wing tips at the one-half and down positions. Stability maneuvers were performed to evaluate the effects of the wing dihedral.

4. The copilot flew the aircraft during part of the descent and made an ILS approach and a go-around. During the landing the drag chute failed to deploy. After stopping on the runway the aircraft was turned around and taxied back to the center taxiway because taxiway No. 1 at the end of the runway was blocked. In making the right turn onto the center taxiway the nose wheel steering went hard-over and did not disengage. Full brakes were applied and the aircraft stopped. The aircraft did not leave the taxiway. The engines were shut down and the aircraft towed in. Significant deficiencies in the aircraft at delivery are as shown in North American Report NA-62-904.

II. TEST LOG:

1100 Pilots in cockpit.

1141 Fuel tank readings (see fuel card).

1155 C/N 657 start engine No. 4; 16% reset; EGT - 570°C 1st peak; EDV - 35%; EGT 640°C 2nd peak; idle; all O.K.

1157 C/N 777 start engine No. 3; No. 1 cooling loop light is on; 15.5% reset; EGT - 610°C 1st peak; EDV - 35%; shutdown because the utility status light stayed yellow. No. 4 engine start put out the No. 1 cooling loop light. Advancing the throttle on engine No. 3 to idle causes the cooling loop light to go out.

1201 Start engine No. 3; 17% reset; tach hangs up; EGT - 590°C 1st peak; EDV - 35%; EGT - 610°C 2nd peak; idle; all O.K.

1202 Start engine No. 1; 16.5% reset; EGT - 540°C 1st peak; EDV - 34%; EGT 590°C 2nd peak; idle; all O.K.

1203 Start engine No. 2; 16% reset; EGT - 595°C 1st peak; EDV - 35%; EGT - 635°C 2nd peak; idle; all O.K.

1205 Start engine No. 6; 16% reset; EGT - 600°C 1st peak; EDV - 35%; EGT - 650°C 2nd peak; idle; all O.K.

1206 Start engine No. 5; EGT - 680°C 1st peak; EDV - 35%; EGT - 615°C 2nd peak; idle; all O.K.

1207 All engines started; start servicing hydraulics.

1217 Hydraulic servicing completed; flight control checks.

1222 Flaps down (14 seconds time required to lower the flaps). The red light in the gear handle flickered on once. There is a leak on the left hand brake cylinder.

1223 Fuel tank readings (see fuel card).

1224 Emergency generator checks.

1226

Engine No.	1	2	3	4	5	6
Rpm - %	61.2	61.1	61.4	61.2	61.2	61.0
EGT - °C	440	480	470	460	460	460
A_8 - %	70	74	65	67	72	70

1228 Alternate throttle checks. The extension plug for EE bay causes intercom noise.

1230 Close gear doors.

1231 Disconnect hydraulics; nose wheel steering check.

1233 U_1 head 200+; others in green; close cabin door. Drop U_1 to 190. U_1 keeps building up.

1234 Open cabin door; EE bay overheat light is on.

1237 Close cabin door; disconnect ground cooling.

1238 C/N 3240 data burst.

1239 Sump low level light - On; 21,100 lbs; fuel tank readings (see fuel card).

Test Log (Cont'd)

1240	Tanks No. 6, 4 and 2 AUTO.
1241	Pull chocks.
1242	A.T.C. clears as filed; military power; engine Nos. 1 & 4 have 5° to 10°C higher EGT's than other engines. EGT engine No. 1 hunting $\pm$ 5°C.
1243	Idle; data off C/N 3526; start taxiing.
1244	Total fuel - 138,000 lbs; tank No. 3 - 31,700 lbs; turns are much easier to the left than before.
1248	EE bay temperature 65°F. Bring temperature selector to position No. 4; Tank No. 3 - 31,800 lbs; auto tanks No. 2, 4 & 6; going to tank No. 1. Tank No. 1 - 1,950 lbs.
1251	Tank No. 6 left - 19,000 lbs; 6 right - 14,900 lbs.
1252	VGH recorder - On; all white lights - On.
1254	About 3 cycles of chatter on left gear while slowing for a turn. Temperature selector position No. 3 - auto; EE bay temperature 67°F.
1255	Taxi into position and hold on runway 070. Heavy gear chatter on left, none on the right while stopping. LOX leaking. The TB-58 reports very light turbulence at 6,000 feet.
1258	Fuel tank readings (see fuel card) TACAN heading - good - 4° right.
1259	Reset counter.
1300	Ground crew reports everything O.K.
1301	Tank No. 1 - 2,800 lbs; P_1 has gone from 178 down to 160 at 1238 and to 145 at 1300. Data on C/N 147; advance power; light afterburner's on engines No. 3 & 4; 2 & 5; 1 & 6; coolant circulation - On.
1303	Brake release; full throttle; 100 KIAS; 135 KIAS going; copilot take throttles; airborne.
1304	Pull throttles to 70° angle; C/N 283; engines - good; hydraulics - solid; data off C/N 297.
1305	Come to 80° throttle angle C/N 308; U_1 - 200+; U_2 - 195; check odor in cockpit; climbing at 240 KIAS; 250 KIAS select gear up.
1306	Gear up in 23 seconds; C/N 407; select flaps up; light came on momentarily. Flaps up in 17 seconds; accelerating out.
1307	Total fuel 114,000 lbs; 11,000 feet; 310 KIAS; tank No. 6 right - 2,800 lbs; 6 left - 6,400 lbs; air vehicle has little different noise and feel; doesn't shake as much.
1308	.60 Mach; approaching 13,000 feet; cabin altitude 7,500 feet; AUX COOL - Off; LOX - 13 liters; airspeed tape 350 KIAS; pneumatic 348.5 KIAS.

Test Log (Cont'd)

1309	Engine cooling doors start to close; .75 Mach.
1310	.77 Mach; cooling doors all closed; advance power. Engines and hydraulics good.
1311	405 KIAS; maximum speed during the climb.
1312	TB-58 Mach .91; XB-70 Mach .95; tank No. 6 left 0. 6 right - 100; tank No. 6 - Off; reduce power; tank No. 4 - On; total fuel 100,500 lbs.
1313	Level at 35,000 feet; C/N 846; .95 Mach; 34,920 feet; engines No. 1 & 6 out of afterburner; total fuel 99,000 lbs.
1314	Engines No. 2 & 5 out of afterburner; data on C/N 887; controls free; FACS - Off; C/N 896, pull up and release; got 1.3 g's on pull up; C/N 919, marker; right sideslip and release; got 6° sideslip air vehicle seemed to hang up; C/N 980, marker; repeat sideslip maneuver; marker C/N 1,000; 5° is pilot's personal limit. Ailerons are a problem. Fuel tank readings (see fuel card).
1317	Data off C/N 1041; pilot gets 4° sideslip then has to put aileron in. Data on C/N 1060; 3° sideslip, release; maneuver damps out in 2 cycles; data off C/N 1099; trimmed out at 330 KIAS, .95 Mach, 35,000 feet.
1318	Throttle angle engines No. 3 & 4 - 72°; engines No. 1, 2, 5 & 6 at military power; 35,140 feet; 325 KIAS; total fuel 92,500 lbs; data on C/N 1140; wind up turn to the right.
1319	Get 1.4g's then back off - light airframe buffet.
1320	Wing tips down to 25°; add power for the turn; data off C/N 1228; total fuel 92,000 lbs; tank No. 4 - 21,100 lbs; tank No. 3 - 31,600 lbs.
1321	Controls free; trimmed at C/N 1327 - Data on; total fuel 90,500 lbs; tank No. 4 - 21,100 lbs; tank No. 3 - 29,700 lbs; tanks No. 2 & 4 - AUTO.
1322	Pull up and release - damp in 1 cycle C/N 1355, marker, sideslip.
1323	C/N 1426, marker, wind up turn to the left - 1.43 g's;EE bay temperature 47°F; AUTO No. 3 position; cockpit cool.
1324	Data off C/N 1462; light afterburner's engines Nos. 2 & 5; 1 & 6; start acceleration - maximum afterburner - supersonic - hydraulics - good.
1325	50 nautical miles south of Beatty.
1326	U_2 down to 147; it has been there quite awhile. Tank No. 2 - 19,800 lbs.

Test Log (Cont'd)

1327	1.10 Mach TB-58; 374 KIAS; data on C/N 1640, controls free, wind up turn to the right. Airspeed dropped to 1.08 Mach in the turn.
1328	TACAN checks Edwards - O.K.; Data off C/N 1747; total fuel 78,500 lbs; tank No. 2 stopped feeding at 19,500 lbs; tank No. 1 on - 3,550 lbs; tank No. 3 - 30,900 lbs.
1329	Data on C/N 1763; controls free; pull up and release; damp in 1 cycle; marker, full rudder - sideslip - to much aileron.
1330	34,240 feet; 392 KIAS; Mach 1.09; cabin altitude 8,000 to 8,500 feet; C/N 1814, marker, repeat sideslip maneuver, release, Data off C/N 1869; will not complete maneuver because too much aileron causes a yaw build up when air vehicle hits a little turbulence. Maximum afterburner at C/N 1890.
1331	Over Trona Pass.
1332	U_2 - 147 and holding; other hydraulics good at 200+.
1333	Rpm's 100% $\pm$ .2%; A8's and EGT's - O.K.; total fuel 69,000 lbs; tank No. 4 continuing to feed, now 3,800 lbs.
1334	40,000 feet; turning right.
1335	Data on C/N 2138, 1.22 Mach, wind up turn, data off C/N 2160.
1336	Total fuel 61,000 lbs; tank No. 4 - empty, off now; tank No. 1 - 4,000 lbs; tank No. 2 - 15,600 lbs; tank No. 3 - 28,700 lbs.
1338	Put windshield up; 1.41 Mach; 458 KIAS; 40,340 feet; total fuel 55,000 lbs.
1339	In turn; 1.41 Mach; 40,000 feet; data on C/N 2337; pull up and release - recovery - marker - C/N 2366 - sideslip, aileron difficult to fly.
1340	Got over 3° sideslip, marker C/N 2403 - release marker - new trim shot C/N 2468; right wind up turn.
1341	1.4g's - roll out; data off C/N 2505; 39,600 feet; 1.4 Mach; wing tips selected down to 65°.
1342	Data on C/N 2539; 2 barber poles; air vehicle wallowing a little; tips down in 34 seconds; right tip was down approximately 2 seconds before left tip.
1343	Right turn; select wing tips to 25°; both tips to 25° in 32 seconds.
1344	Total fuel 46,000 lbs; tank No. 2 - 4,700 lbs; tank No. 4 - 200 lbs; tank No. 3 - 28,800 lbs.

Test Log (Cont'd)

1345	1.25 Mach; fuel tank reading (see fuel card).
1346	Reduce power on engines No. 1 and 6; P_1 - 140; P_1 quantity starting to drop. C/N 2804, select wing tips to 0°; P_1 - 130; subsonic; put windshield down.
1347	300 KIAS; some airframe buffet; LN_2 7/8; Lateral trim change occurred with tip retraction; Data Off C/N 2870.
1348	P_1 - 130; U_2 - 125; tank No. 2 - 3,300 lbs; Off; Anti-collision light - On.
1349	Abeam Owens Lake; 30,000 feet; .8 Mach; 300 KIAS.
1350	Ground cooling doors engines No. 1, 2 & 3 - Open; Tank No. 3 - 23,700 lbs; Tank No. 5 - 2,500 lbs; Tank No. 5 - On; XB-70 - 25,000 feet; TB-58 - 25,000 feet; 25 miles north of China Lake.
1352	Tank No. 5 - 200 lbs; Off; 23,500 feet.
1353	Tank No. 6 - On; 6 left - 1,400 lbs; 6 right empty; sump is feeding; fluid levels - O.K.; P_1 - 170; U_2 - 130.
1354	Tank No. 6 left - 100 lbs; Off.
1355	Tank No. 2 3,500 lbs - On; 3 miles north of China Lake.
1356	Tank No. 2 - 2,800 lbs; total fuel 40,500 lbs; check Tank No. 3.
1357	Northwest of Randsburg.
1358	Descending through 16,000 feet.
1359	Tank No. 3 - 29,600 lbs; test empty, came back to 29,500 lbs; test full; tests O.K.
1400	Engines No. 1, 2, 5 and 6 to idle; engines No. 3 and 4 at 95% rpm; about 300 KIAS; five cooling doors - closed; all other cooling doors open.
1401	Tower reports winds at 7 knots at 170° to 210°; start ILS approach for low speed fly-by.
1403	U_2 - 120; U_1 - 200; 260 KIAS; gear down; gear looks O.K.; 3 green lights.
1406	TB-58 indicates 210 knots; XB-70 pilot indicates 205.5 knots; copilot 209 KIAS.
1408	Total fuel 36,000 lbs; tank No. 3 - 23,000 lbs; tank No. 2 - 100 lbs; Off.
1409	Tank No. 1 - 4,700 lbs; tank No. 3 - 21,200 lbs; sump low level light came on at 21,200 lbs.
1410	Cleared to land runway 040. Wind 220° at 4 kts.
1412	Airspeed XB-70 - 210 KIAS; TB-58 - 202 KIAS; wind calm; airspeed XB-70 - 207 KIAS; TB-58 - 208 KIAS.
1413	Touchdown; air vehicle bounced once; no drag chute deployment (pilot chute only).

Test Log (Cont'd)

1414	Nose wheel steering pushes air vehicle to right. Apply left rudder to counteract nose wheel steering problem.
1415	Make 180° turn at end of runway and return to center taxiway.
1419	Nose wheel steering disengaged while taxiing on runway. Air vehicle clear of runway. Steering did not come back to center when re-engaged.
	Brake chatter on left gear while trying to control air vehicle. Pilot got hard-over nose wheel steering signal. Nose wheel gear door came open. Nose wheel stopped about 3 feet from edge of concrete. Gear unsafe light is on. Air vehicle made skid marks while stopping, approximately 40 feet right, 80 feet left gear. Small fire in left forward brake - put powder on fire.
	Pilot hit throttles to below idle cutoff on Nos. 3 & 4 engines while attempting to disengage steering. No. 3 generator dropped off of the line. Caught No. 3 engine. No. 4 generator also dropped off the line and the No. 4 engine shutdown. Emergency generator on for a short time.
1425	Shut down engines No. 1 and 6.
1426	Shut down engine No. 2; telemetry off; emergency generator off; shut down engine No. 5; EE bay temperature 65°F; OAT 89°F; O_2 12 liters; H_2O 3,850 lbs; NH_3 145 lbs.
1428	Shut down engine No. 3.

III. DATA:

1. Fuel Data:

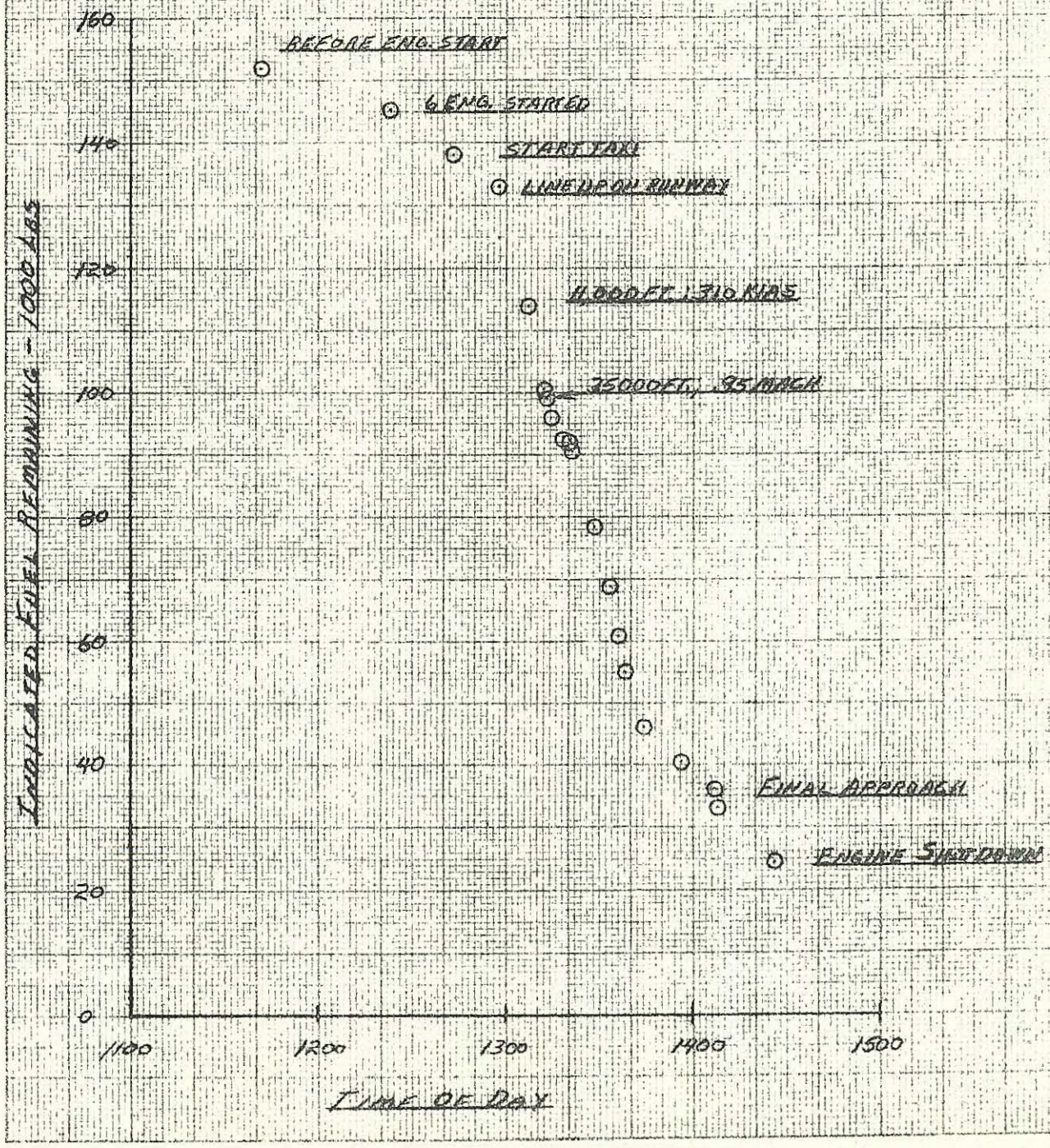
Time	0700	1141	1223	1258	1314	1345	1426	
Event	Just After Service	Pre-Engine Start	All Six Running	Lined Up	Level 35,000 ft	1.25 Mach	Engines Off	
Tank								
1	2,300	700	800	2,800	3,700	-	4,900	
2	29,850	27,650	27,650	25,400	25,150	-	100	
3	32,350	32,200	26,100	31,850	31,950	-	14,700	
4	36,400	35,400	35,300	35,550	2,800	50	050	
5	1,650	2,350	2,200	2,250	2,800	2,400	300	
6L	25,200	25,900	25,800	17,750	250	1,400	100	
6R	22,450	23,350	23,000	13,200	050	100	050	
7L	350	400	400	400	700	500	375	
7R	1,050	1,300	1,250	1,300	1,800	1,100	1,300	
8L	- 300	- 300	- 300	- 300	600	- 350	- 250	
8R	1,500	1,800	1,750	1,650	1,900	1,900	1,800	
Totals	154,250	152,000	145,250	133,000	96,000	-	24,500	

2. Plot of Fuel Remaining:

FIG. 2-1

FUEL REMAINING VS TIME

XB-70A S/N 62-207



3. Hydraulic Use Log:

	P_1		P_2		U_1		U_2	
Time	F.L.	H.P.	F.L.	H.P.	F.L.	H.P.	F.L.	H.P.
1152	178	185	170	188	165	195	170	180
1218	178	188	181	190	172	195	181	185
1238	160	190	168	185	181	195	166	190
1300	145	190	160	185	165	195	155	190
1318	200	198	200	180	200	205	147	200
1345	100	-	-	-	-	-	-	-
1347	130	-	-	-	-	-	125	-
1400	-	-	-	-	200	-	120	-
1425	135	190	200	185	187	195	150	190
After Flight with System Unpressurized								
	40%	-	100%	-	80%	-	120%	

IV. ENGINEERING COMMENTS:

1. Nose Wheel Steering:

a. In the landing roll the pilot reported that nose wheel steering was "pushing" the aircraft to the right. Taxiway No. 1 was blocked requiring that a 180° turn be made on the end of the runway to return to the center taxiway. In taxiing back the pilot reported a disengagement of nose wheel steering. A right turn was made onto the center taxiway. The pilot was unable to return the nose wheel to neutral and the aircraft was braked to a stop before leaving the taxiway. During the stop the nose gear door came open, the gear safe light went out, and the red light in the handle came on.

b. In attempting to reach the steering control to disengage steering, the pilot knocked engines No. 3 and 4 throttles past the IDLE stop, both generators dropped off the line and the emergency generator came on. No. 4 engine shut down but he was able to catch No. 3 engine and brought it to IDLE and the generator came back on.

c. There was one instance of a hard-over signal in preflight which was investigated but could not be made to repeat. Also, in taxi tests the pilot reported an instance of no response to the left with full left rudder when the aircraft was going right.

d. Investigation after the flight revealed that the steering unit filter was coated with strips of plastic sheet. The steering actuator assembly was removed for further investigation. The condition was duplicated in bench test.

2. Nose Gear Drag Link Attachment Failure:

The structural attachment fitting at bulkhead station 1205 for the nose gear strut drag link was found cracked after the flight, and probably occurred at the time of the nose wheel steering hard-over. Laboratory examination of the material in the fitting indicated that it was defective. Samples of the aircraft No. 1 part and the replacement part were taken and it was determined that these were good parts.

3. Propulsion:

Engine performance was satisfactory during the flight. The engines were inspected for foreign object damage (FOD) following the flight. Very minor FOD was found on engines No. 1, 2, 3, 4 and 5. The inlet guide vanes were opened and the FOD benched out with the engines still installed in the air vehicle.

4. Drag Chute:

The three chute (Model Specification Configuration) drag chute configuration was installed for acceptance of this aircraft. The drag chute did not deploy because of fouling of the extraction chute lines. The pilot chute deployed which pulls the extraction chute bag but because of the extraction chute lines looping about the extraction chute bag, the extraction chutes were not pulled from the bag. The pull force of the small pilot chute was therefore transmitted directly to the extraction chute bridle and the main chute bags.

5. Brakes:

During taxi out for takeoff very little chatter was experienced in braking until stopping on the runway. At that time, very heavy chatter was experienced on the left gear which was reported by the pilot to be comparable to the worst ever experienced on aircraft No. 1. On landing, no chatter was experienced until the pilot applied brakes in the right hard-over nose wheel steering. Excessive left gear chatter occurred at that time. Tire skid marks were left for approximately 80 feet on the left and 40 feet on the right as a result of stopping the aircraft during the nose gear steering hard-over. The tires were not flat spotted indicating that the automatic brake system maintained excellent control during heavy braking to a full stop.

6. NASA Supersonic Transport Instrumentation:

a. Air vehicle No. 2 contains 460 instrumentation items installed specifically for research directed toward the national supersonic transport effort. The broad areas of coverage are skin friction, internal and external acoustics, thermal environment, base pressure, and gust loads.

b. No data were recorded during Flight 2-1 specifically in support of the NASA program. Much of the data, however, is being reviewed to ascertain the performance of the Instrumentation System. Incomplete instrumentation checkout, inoperable parameters, and in the case of surface static pressure orifices, inadequate

surface preparation resulted in a large number of erroneous parameters.

c. There was no attempt to measure sonic boom or runway noise for this flight.

V. OBSERVATIONS AND COMMENTS BY THE COPILOT:

1. Preflight, Engine Start and Taxi:

a. The scheduled early morning takeoff was initially delayed due to ARC-50 radio and primary pitch trim troubles and was additionally set back by rain showers.

b. The crew briefing and aircraft walk-around inspection were completed by time (T) 1045. The aircraft was in excellent condition. I wasted at least 10 minutes looking for fuel leaks. Reminiscing back to the early days of 001 I could only conclude, "What a difference a year makes."

c. Al and I were in the cockpit at T 1100. Probably due to the rain showers and high humidity, the outside surface of the inside right forward side window was more than half fogged over. By T 1200, the panel was completely clear and never fogged over again. I positioned the crew air shutoff "T" handle down about one-fourth of its total travel and left it there for the entire mission. It would assist in setting, reporting, and recording the position of this handle if it had markings on the shaft at each quarter position. I also noted the LN_2 gage was not marked in sixteenths as we have found so helpful on 001. I was unable to eliminate a constant clicking in the interphone which apparently was being generated by the correlation counter. As briefed, the copilot's attitude director indicator (ADI) had two red flags showing and was inoperative for the entire flight. The capsule thrust control test in the electronic equipment (EE) bay did not check out properly at first so to correct the condition, the descent control was removed from my left survival container.

d. Engine start sequence of Nos. 4, 3, 1, 2, 6 and 5 was initiated at T 1155, Counter Number (C/N) 657 and was completed in 12 minutes. No. 3 engine had to be shut down on the first start attempt because the utility status indicator remained yellow throughout the start. Without hydraulic pump telemetry, we could not take the chance on letting it run. When No. 4 engine was started, the No. 1 cooling loop pump caution light went out. This is not normal but we were assured that both pumps were operating satisfactorily. First peak exhaust gas temperatures (EGTs) ranged from 540°C on No. 1 to 680°C on No. 5. Second peaks of the EGT were 590°C to 650°C. All engine rpm indicators appeared to hang up and were sluggish in acceleration. The panel vibrators were operative but did not seem to be doing the job, so we supplemented them by rapping on the indicators.

e. Ten minutes after engine start the hydraulics were serviced and control cycles were completed. Flap extension time was 14 seconds. Idle power engine data at T 1226 were as follows:

Engine	1	2	3	4	5	6
% rpm	61.2	61.1	61.4	61.2	61.2	61.0
EGT	440	480	470	460	460	460
A_8	70	74	65	67	72	70

There was a very uncomfortable interphone noise generated when the ground crewman disconnected his headset in the EE bay. I could eliminate the noise by turning the ground interphone switch off, but rather than do that we had him unplug the extension cord. At T 1233, I turned AUX COOL on. The Utility No. 1 (U_1) head pressure continued to build up in spite of the bleed down efforts. We concluded the regulator was controlling a bit high. T 1239, the SUMP LOW caution light came on at 21,100 pounds and a minute later I turned tanks No. 2, 4 and 6 to AUTO (see fuel log sheet for further data). ATC cleared 207 as filed as A1 completed a six engine MIL power check at T 1242. At MIL, I noted engines No. 1 and 4 had that not too unusual 5°C EGT and one-half percent A_8 oscillation. A data cycle was taken during this engine run at C/N 3526.

f. T 1244, we started to taxi with the fuel totalizer at 138,000 pounds. A1 commented it was easier to turn left than we had found during the taxi tests. I had set the cabin temperature selector at the AUTO No. 4 position and it was getting a bit warm in the cockpit; the EE temperature was 65°F. Going west on the parallel taxiway the heading was 257°. T 1252, I turned the VGH recorder on and observed we had all the cockpit instrument and panel white lights up to full intensity. This flood of light overcomes the deep shadows and dark areas in the corners of the cockpit. T 1254, I selected AUTO position No. 3; the EE temperature was 67°F. T 1255, heavy brake chatter accompanied our stop on the takeoff runway. By this time we had used about one and one-half liters of oxygen and it appeared we might have a leak in the system. The ground crew reported all was well below, the counter was reset at T 1259 and chase was given the two minute warning to brake release at T 1300.

2. Takeoff and Climb:

a. T 1301, C/N147, data was turned on and all throttles were advanced to 85% rpm prior to going to MIN afterburner in the order of 3 and 4, 2 and 5, then 1 and 6. I turned on the REFER and COOLANT CIRC. Brakes were released at T 1302:25 and power checked O.K. at MAX afterburner. I timed the acceleration to 135 KIAS and it was two seconds greater than the handbook time.

Decision to go was made at 145 KIAS and I took the throttles as Al used both hands to initiate a slow rotation at 165 KIAS. Break ground and initial climb was much smoother than the first flight of 001. T 1303:30, at Al's request I reduced all throttles to 70° throttle angle (T/A) and data was turned off at C/N 297. I unfastened my oxygen mask to check the cockpit odor and detected a slight trace of smoke and that overheat smell commonly associated with new equipment. The odor had disappeared when I checked again about five minutes later. At C/N 308, I advanced power to 80° T/A as we continued the climb at 240 KIAS. T 1304:30, 250 KIAS, the gear retracted normally in 23:30 seconds. C/N 407, 260 KIAS, the flaps were retracted in 17 seconds. The flap pressure light came on only momentarily during the retraction.

b. Data Control called for us to check if the "S" band beacon in the EE bay was on as they had no plotter in Building 3940. The switch had been turned on during preflight, so we elected not to leave the seat. Al commented and I certainly agreed that the buffet and noise in the climb is less than that of 001. At .6 Mach, chase reported the engine cooling doors were still open. At 13,000 feet, the cabin altitude was 7,500 feet. Tape airspeed was 350 KIAS and pneumatic indicator was 348-1/2 KIAS. At .75 Mach, chase reported the cooling doors began to close and were all closed at .77 Mach. The highest indication on the vibe meter was 25% on No. 2 engine auxiliary drive subsystem (ADS). Maximum speed observed in the climb was 405 KIAS.

3. Level Off and Start of Tests:

a. T 1313, C/N 846, leveled 34,920 feet at .95 Mach. Engines No. 2 and 5 and later 1 and 6 were pulled out of afterburner. After a controls free trim shot, a pullup to 1.3g and release was completed. A FACS off sideslip to 6° brought a comment from Al that it seemed to want to hang out there --- he thought it could be he'd put in too much aileron. He limited the next sideslip to 5°, backed off to 3° and released and observed two cycles to damp directionally. At 35,000 feet, 330 KIAS, .95 Mach with 1, 2, 5 and 6 in MIL and 3 and 4 at 72° T/A, a windup turn to the right was completed to 1.4g. Light airframe buffet was felt --- fuel total was 94,000 pounds.

b. T 1319, the wing tips were positioned to half. A trim shot, pullup and release and sideslip maneuver were completed before the windup turn to 1.4g at 325 KIAS just north of Owens Lake. T 1323, all engines were advanced to MAX afterburner for the acceleration at 35,000 feet. The EE temperature was 47°F and the cockpit was a bit cool with the temperature selector in the AUTO No. 3 position.

4. Supersonic Data:

a. T 1324, with all engines at MAX afterburner, we accelerated at 35,000 feet and were supersonic at 1324:30. We passed east of China Lake and were forced to turn right to south because of a thunder storm in the southeast corner of SOA Alpha. A1 completed a windup turn to the right at Mach 1.1 and data was turned off at C/N 1747. At C/N 1763 a trim shot was taken followed by a pullup and release and a sideslip. Again A1 commented that he had used too much aileron as he released and turned data off at C/N 1869. T 1330, altitude 34,240 feet, 392 KIAS, Mach 1.09 the cabin altitude was between 8,000 and 8,500 feet. We were over Trona Pass and hydraulics looked good with the lowest U_2 holding at 147%. Engines were 100% $\pm$ .2, nozzles and EGTs were checked and were O.K.

b. T 1334, we levelled at 40,000 feet and with C/N 2138, Mach 1.22, a windup turn was completed and data off C/N 2160. The windshield was raised at T 1338, 458 KIAS and 40,340 feet. At Mach 1.41 A1 was in trim and completed a pullup and release and sideslip. He commented that it was difficult to prevent the yaw from increasing by use of ailerons --- after reaching 3° it seemed to want to increase in yaw on its own. He released controls from a 2° sideslip, obtained a new trim shot, and completed a 1.4g windup turn to the right and turned data off C/N 2505.

c. T 1340, 396 KIAS, 1.4 Mach wing tips were put down to full. The right tip showed down and locked about two seconds before the left. Total travel time was 34 seconds. A1 commented that the airplane wallowed a bit about the time the tips had reached their full down travel. Because of the fuel state we raised the tips to half at T 1342; this required 32 seconds. T 1345 the tips were raised to full up, P_1 was 100%, and it appeared the fluid level was dropping.

5. Deceleration and Descent:

T 1346, we were subsonic. LN_2 was 7/8 and we placed the windshield down. At 300 knots we felt some airframe buffet and A1 commented there was a light lateral trim change as the tips were retracted. T 1347, we were southbound abeam Owens Lake headed to the right of Searles, 20 miles north of Ballarat Lake at .87 Mach when the noise in the cockpit started to build up. At 30,000 feet, .8 Mach, 300 knots indicated, chase reported engine cooling doors were starting to open. The sump level was 27,700 pounds, all pump switches were off and I attempted to get some of the fuel out of tank 5. Tank 1 level was 2,500 pounds but Data Control advised not to attempt to transfer this fuel because the pumps in this tank were inoperative. Tank 6L contained 1,400 pounds of fuel so I

attempted to get that out and was successful in reducing it to 600 pounds. T 1357, we both commented the cockpit was a little cool so I increased the selector to position 4. The total fuel was 40,500 lbs and the sump was 29,600 lbs.

6. ILS, Low Approach and Landing:

a. We were northwest of Randsburg at 16,600 feet when Al invited me to take control and continue the letdown. We placed throttles 1, 2, 5 and 6 in idle; 3 and 4 at 95% and I continued the descent at 300 knots. Tower reported winds from 170° to 210° at 7 knots and just north of Boron I made a left turn to the northeast followed by a right turn on to the ILS. Data Control gave us a C.G. of 21% and at T 1402 we extended the gear at 260 KIAS; extension time was approximately 26 seconds. At T 1404, we were on the ILS localizer for a low approach on runway 22; the tower reported wind of 160° at 2 knots.

b. On final the B-58 called out "210 KIAS" and I observed 209-1/2 on my airspeed tape. A little later he called "210" and I observed 205. I continued the approach to approximately 10 feet above the runway and a minimum of 198 KIAS speed before power was applied for the go-around. Speed and pitch control were very comfortable but the lateral response and the light aileron forces were, as always, surprising to me and required a few minutes to adjust to.

c. T 1408, Al took control of the airplane and turned around for a landing on runway 04. Fuel totalizer was 33,000 lbs when the sump low light came on at 21,200 pounds. T 1410, with a totalizer of 30,000 lbs, Al came down final at an average speed of 210 KIAS. During the final approach, chase called out "208 KIAS" and we read 207 KIAS. Looks to me like this airplane compares a bit closer to the other chase airplanes' airspeed than does 001. At T 1412, about 2 miles out, 201 KIAS, I noticed a lateral oscillation, apparently a gusty condition, which caused a wing drop just prior to touchdown at 162 KIAS. The flare speed was 187 KIAS. Chute deployment speed was 152. Drag chute doors opened and the pilot's chute came out but the deceleration chutes failed to develop. The landing time was 1415.

d. It was quite apparent from the directional behavior of the airplane, after the nose came down, that the nose wheel steering did not engage smoothly. As we proceeded to roll out and taxi back to the center taxiway the airplane wanted to pull right and required approximately 2 to 3 inches of left rudder pedal to keep it going straight. As we turned off the center taxiway at a slow speed and Al proceeded to straighten the nose wheel a hard-over steering malfunction occurred. I thought for a minute we were going to roll

off the taxiway and hit the Mobilcom bus. Al applied brakes, pulled all throttles to idle and we came to a stop. In pulling the throttles back rapidly he went aft of the idle detent which shut off fuel to engines No. 3 and 4. The generators went off the line and the emergency generator took over. He was able to catch No. 3 before it died and brought it up to idle but No. 4 engine died. We had a red light in the gear handle and the nose gear green light had gone out. Mobilcom reported the nose gear door had come open. Al put No. 3 generator back on the line and for the first time, other than for test, we had the opportunity to use the manual bus tie switch. It worked exactly as designed. I selected generator 3, the bus tie OPEN and right hand primary DC caution lights went out. Because of the nose gear condition we shut engines down on the taxiway and the airplane was towed to the run pad.

7. Airconditioning (ECS):

The crew air shutoff "T" handle was placed in the one-fourth down position at engine start where it remained throughout the flight. The cockpit was a bit warm during taxi in AUTO 4 so I backed off the temp selector to position 3. An over-temperature smell (light burning odor) was present in the initial climb out but it soon disappeared. At 35,000 feet, in subsonic cruise, the AUTO 3 position produced a cool cockpit but the selector was not increased to position 4 until we were in the descent. The cabin altitude remained between 7,500 and 8,500 feet throughout the flight. The EE temperature was never observed out of or even near the limits. This system performed very well.

8. Fuel:

Engine start and pre-taxi runs were made on No. 3 tank. The SUMP LOW light came on at 21,100 lbs and at that time tanks 2, 4 and 6 pump switches were placed in AUTO. Fuel totalizer at taxi and takeoff were 138,000 lbs and 133,000 lbs respectively. Tank 6 switch was turned off with a totalizer of 100,500 lbs; tank 6L indicated empty and 6R 100 lbs. Tank 4 stopped feeding initially at 21,100; tank 2 stopped at 19,500 lbs. They both later fed out on schedule to 50 and 100 lbs respectively. The totalizer was 33,000 in the landing pattern and at shutdown was 24,500 lbs. While making a letdown and ILS approach I left No. 2 tank pump's switch on with the tank at or near empty for 10 to 12 minutes. This system performed as planned.

9. Maintenance Discrepancies:

a. Nose gear steering pulls right. Disengaged once while taxiing, and went hard-over without disengaging. Green light on nose gear went out, door came open and red light came on in handle.

b. Drag chute failed to deploy.

c. Correlation counter clicks in copilot's headset.

d. RPM indicators are sticky during engine start.

e. "S" band beacon inoperative.

f. Liquid oxygen leaking.

g. Cooling loop fuel pumps do not operate according to specifications.

h. Utility No. 1 head pressure high.

10. Copilot's Summary:

a. The timely success of the flight was marred only by the nose wheel steering malfunction experienced taxiing in after landing.

b. No. 62-207 appears to be smoother and quieter in flight than her predecessor No. 62-001.

c. Speed and longitudinal control were maintained easily and comfortably during the letdown and ILS. High roll response and light aileron forces will take a bit of getting accustomed to.

d. Unlike 001, some lateral wallowing and light lateral trim changes were noted when the wing tips were folded to full down and full up. The right tip indicator showed full down two seconds before the left.

e. Indicated airspeeds of 62-207 in the landing pattern were closer to those of the chase aircraft than 001 have been.

f. The LN_2 level readings and recordings would be more meaningful if the gage was marked in 10% increments.

g. The aircrew shutoff handle shaft should be marked (with paint) to permit easy and accurate settings at the one-fourth, one-half and three-fourths positions.

h. Tank No. 2 fuel pumps were inadvertently left on 10 to 12 minutes after the tank was at or near empty.

i. The inadvertent shutdown of engines No. 3 and 4 during the rapid throttle retardation is a condition which should be carefully examined and, if possible, eliminated.

j. The "S" band beacon, voice tape recorder, and drag chutes were inoperative.

VI. CONCLUSIONS:

1. The in-flight systems malfunctional deficiencies were most notable by their absence during this first flight of a modern highly complex aircraft.

2. The nose wheel steering "hard-over" malfunction resulted from foreign material (plastic bag) entering the hydraulic servo valve.

3. Systems which gave overall satisfactory performance were:

Engines	Flaps
Fuel	Instrumentation
Landing Gear	Communications
Brakes	Fire Detector (ADS & Engine)
ECS	IFF
Hydraulics	Radios
Flight Controls	Oxygen
TACAN	Wing Fold
Nose Ramp	

4. The pilot inadvertently knocked engines No. 3 and 4 throttles into cutoff when attempting to disengage the nose wheel steering.

5. The drag chute failure to deploy was most likely a result of improper packing.

6. The nose gear drag link attachment fitting failure was the result of a material deficiency.

7. Tank No. 2 fuel pumps were inadvertently left on 10 to 12 minutes after the tank was empty.

8. The LN_2 quantity indicator is primarily qualitative in degree of exactness.

VII. RECOMMENDATIONS:

1. Consideration be given to deleting the hydraulic filter bypass in the nose wheel steering system.

2. Change the throttle rigging to actuate the fuel off-on switch when the throttle is closer to the off position.

3. Provide fuel tank empty caution lights to reduce the copilot workload and protect fuel pumps from prolonged dry tank operations.

4. The LN_2 quantity indicator should be marked in percent (every 10%) by use of a peripheral overlay.

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