NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
FLIGHT RESEARCH CENTER
Edwards, California

July 26, 1962

FLIGHT:	32 (No. 1 X-15)
PILOT:	Neil Armstrong, NASA
NASA 1:	Joseph Walker, NASA
B-52 PILOT:	Maj. Fitzhugh Fulton, USAF
LAUNCH PANEL:	Jack Russell, NASA
CHASE PILOTS:	T-38, Maj. Robert Rushworth, USAF
	F-104, Capt. Michael Collins, USAF
	F-104, Maj. Walter Daniel, USAF
	F-104, Maj. Robert White, USAF
LAUNCH AREA:	Mud Lake, Nevada
LAUNCH ALTITUDE:	45,000 feet
B-52 TAKE-OFF:	9:00 a.m., July 26, 1962
X-15 LAUNCH:	9:50 a.m., July 26, 1962

Today's X-15 flight will be piloted by Neil Armstrong of NASA. Through a series of pushover-pullup maneuvers, the pilot will evaluate the handling qualities of the aircraft simulating re-entry with yaw damper off and speed brakes extended.

Another of the purposes of today's flight will be further studies of aerodynamic stability and drag.

Rather than a straight climb, pilot Armstrong will pushover to "Zero G" at 60,000 feet and hold this until engine burnout, 83 seconds, at 100,000 feet. At burnout, he will adjust his attitude to "Four G's" and an angle of attack of 17 degrees, and continue his climb to a maximum altitude of 110,000 feet.

Launched from Mud Lake the 200 mile trip will take 11 minutes. Maximum speed is expected to be around 3750 m.p.h.

This will be Neil Armstrong's 7th flight in the X-15 and the 63rd X-15 flight. Armstrong last flew the X-15 on 20 April 1962.

White

31 total — 7 powered

22 Big engine — 11 powered

59 — 56 w/XLR-11 & 3 w/XLR-99

49 — w/XLR99

108 (Capture & Launch)

FLIGHT NO. : 1-32-53

PILOT: NEIL ARMSTRONG (7-3)

DATE : 7-26-62

FLIGHT TIME: :10:21.6

LAUNCH LAKE : MUD

LANDING LAKE: EDWARDS

LAUNCH TIME : 11:22:30.0

LANDING TIME: 11:32:51.6

ABORTS : NONE

CHASE : T-38 MAJ. RUSHWORTH

F-104 COLLINS

F-104 MAJ. DANIELS

F-104 MAJ. WHITE

B-52 : 003 MAJ. FULTON

MAJ. BEMENT

M_{max} : 5.74

V_{max} : 5851

H_{max} : 98.9K

$\bar{q}_{max}$: 841

ENGINE NO. : 106

BURN TIME : 82.8 SEC (B.O.)

THRUST-% : 100%

CONFIG. : VENT. ON, (SIDEARM WITH BEEP TRIM)

PURPOSE : AERO. STAB. AND DRAG, HANDLING QUAL. EVAL.

RESULTS : FULL BACK TRIM ONLY OBTAINED $\delta_h = -16°$, HYD. LEAK ALMOST DEPLETED #1 RESERVOIR

Plane:	X-15-1 #670	Date:	7/26/62
Flight:	1-32-53	TO:	1034
Pilot:	N. Armstrong	Launch:	1123
B-52:	#003	Land:	1133
		Total:	:10
		B-42 Land:	1157

12 minutes to launch

Neil:	#1 BCS on, cycle #2
	OK BCS off.
Russell:	Lube oil temp 117°
B-52	11 minutes.
Neil:	Precool is off.
	RAS auto is on.
NASA 1:	Fitz do you want (tape became unreadable) more from the time count?
B-52:	Roger we just passed 10 minutes, you say its 9 minutes 40 seconds from that time?
NASA 1:	Rog.
Neil:	APU cooling is normal.
	Blowers and BLN_2 and pressure cooling is on.
	Attitude looks good with heading 349 now.
	Still have a little bit of oscillation in inertial speed at about 900 fps and altitude of 45,000 feet.
	Cabin source is 3500 pounds.
B-52:	9 minutes.
Neil:	Helium shutoff valve is on.
	Hydraulic temps are -40 and -35.
	Data coming on.
	APU's, switch #2, #1.
Chase:	Looks good all the way.
Neil:	#1 hyd pressure dropped down to 2300 pounds.
B-52:	8 minutes.
	Both generators are reset.
NASA 1:	Want to confirm that hyd on the APU pressure?
Neil:	Coming up to 2500 now, #2 is 3400.
	Voltages are 200
	Mixing chambers are -35 and -40.
	Data going off.
	Flaps down now?
Chase:	Yes and up.
Neil:	Pitch, roll.
Chase:	Test out good.
NASA 1:	Engine reset?
Neil:	Engine reset Joe.
NASA 1:	Did you cutoff the B-52 LN_2 and power off Russell?
Russell:	Rog, off.
B-52:	7 minutes.
Neil:	Vibration recorders are on.
	#1 hydraulic pressure still 2300 pounds.
	Aux cabin pressure is on.
	Platform, I got 20,000 feet on the platform now and .....

Neil:	Got internal power.
	Fire ext is auto.
	Alternate SAS Is armed.
	Hydraulic pressure on #1 coming up to 2800 pounds now.
NASA 1:	What kind of action do you get when you cycle?
Neil:	Both needles follow together, come back up together but #1 only comes to 2800 pounds now.
B-52:	5 minutes and 45 seconds.
NASA 1:	We've been indicating pressure down here all the time on that one.
Neil:	OK.
	Yar switch on, yar standby, SAS switch to monitor.
	Alt SAS lite is on.
B-52:	5 minutes.
Russell:	Going to have to hold a few seconds until this topoff is completed.
NASA 1:	Tighten the turn some Fitz.
B-52:	Roger tightening a little bit.
Neil:	..... channels work, alt SAS is OK.
Russell:	Unable to lock G pot at 2..... +5 now we can catch them.
Neil:	Flight gains 6-6-8.
	Horizontal stabilizer indicating zero in the cockpit.
Russell:	Through topoff Neil.
Neil:	OK.
	X-15 oxygen pressure 2700
	Going to X-15 oxygen.
	Cabin altitude indicates 35,500 and ventral is armed.
B-52:	4 minutes.
Neil:	#1 hydraulic now reads 2900 feet.
	Data on - calibrate.
NASA 1:	OK our folks say you can go ahead with the launch.
	What did you say about that platform altitude?
Neil:	Back down to 45 now and holding steady.
	Going to pressurize.
NASA 1:	You can leave the G pot unlocked clear up to launch Russell.
Neil:	Ammonia is 45, LOX is 48.
	Ammonia switches to jettison
	Going to jettison now.
Chase:	Looks good Neil.
B-52:	3 minutes.
Neil:	Back to pressurize.
	Data off.
	I'm on X-15 radio.
NASA 1:	5 x 5
Neil:	#1 hyd pressure reads 2950.
Russell:	Platform in specs.
NASA 1:	Mud Lake is now 8 knots from the southeast.
Neil:	8 knots from SE.
B-52:	Heading 177 Neil.
Neil:	I'm reading about 650 fps, 45,000 feet, attitudes look good, heading is 175.

B-52: 2 minutes.
Neil: APU bearing temps are +80 and +95
Data coming on
Ball nose.
OK α read about 1° and β is about 1/4° needle left.
Chase: Everything looks good out here.
Neil: Cine camera is pulse.
Head bumper is coming down.
B-52: 1 minute
Neil: Prime on.
Got an igniter ready lite.
Chase: Got 2 left showing
B-52: 40 seconds.
Neil: Precool on.
Igniter idle on.
LOX pump bearing is +20.
B-52: Tell me when you're ready?
Neil: OK 10 seconds.
B-52: Launch lite.
Neil: .... coming up on 350
Igniter idle,
Ready to launch, 3-2-1 Launch!

Chase: Looks real good Neil.
Neil: 430
Chamber pressure 580.
NASA 1: Altitude profile, 36, 37 seconds.
Neil: .....
NASA 1: Seem to be dropping just a little on the altitude profile and your course is taking you to the right.
Neil: OK.
10° and 2° angle of attack.
NASA 1: Coming through 90,000.
Neil: .....
.....
Going after .....
10° data on, pulse.
Speed brakes coming out.
NASA 1: We have you at 95,000.
And as you approach abeam of Race Track, you're about 5 miles right of course.
Neil: Pitch, trim, change ..... about 3° with brakes.
Little oscillation and smoke.
NASA 1: OK we're now at 100,000 and 5 miles right of course, 4400 fps.
Neil: Oscillation .....
Asmuch as 2 or 3°.
I think we have ..... back trim and about 9° which is a little left at this mach number.
NASA 1: You're coming right down the altitude profile as you approach Chine Lake, you're now 10 miles right of course.

Neil: OK ..... the hungry eye here?
What did you say I was in relation to China Lake?
NASA 1: You're just going by abeam of it.
Neil: That's about right then.
Yaw dampers reengaged, pushing it down to get a little more "q".
NASA 1: We have you a little high on velocity.
Neil: I'll leave the brakes out and I have the field in site.
NASA 1: Better sop-lock your heading.
Neil: Rog ..... couple degree oscillations in pitch from trim operations off this button.
OK here we're getting up some brake speed, brakes are hard to move.
Here comes the pushdown.
NASA 1: Have you passing 59,000 abeam of Saltdale.
Neil: Back off zero 'g'
Engine master is off.
Chase: What about position Sport?
Neil: I'm coming up NW of California City at 25,000.
I'm going to pullup for another subsonic pushover.
NASA 1: Is that your platform of pressure altitude you're reading.
Neil: Pressure altitude.
Got 50 on inertial.
Chase: Right:over the base.
Neil: OK I'm .9 now and a pushover.
NASA 1: Our radar altitude checking your platform altitude that time.
Neil: There's zero 'g' holding it.
OK not much on the data.
Brakes are in.
I have 280 knots, indicating about 4000 inertial.
NASA 1: We're reading 43 here.
Chase: What's your position Neil?
Neil: I'm about 5 miles north of the highway and about 2 miles west of the base.
NASA 1: You can get that "push to test" anytime.
Neil: Push to test now and off.
Chase: What's your altitude Neil?
Neil: I've got about 35 now.
NASA 1: Altimeter here at the base we don"t have.
Neil: I got it before I left.
Chase: What's your position again Neil?
Neil: I'm going to drift toward the center of north base heading 12 ..... and I'm a couple miles out.
Chase: Rog I should be real close to you somewhere here.
Neil: I can go to jettison now.
Chase: Go ahead.
Neil: That should be about all of it.
Chase: I'm on high key at 35,000.
Neil: I'm at high key at 26,000 now.
Chase: Good deal.
Neil: I'm headed about west now Bob.
Going thru 25.
This airplane could use a little trim.

NASA 1: I find it helps to wiggle the rudder around some.
Neil: I'll get through, just a little brakes here at 290 knots.
Brakes in and turning in Bob.
Chase: OK.
Neil: Ventral is checked armed, going to pressurize.
Lake in site.
Chase: Looks like the parachute, part of it is exposed.
Be interesting to see if it works this time.
Much loose stuff there in the lower ventral.
Neil: OK you call it.
Chase: OK, 3-2-1 pump.
Neil: Flaps.
Chase: Flaps are starting alright.
Three, I see skids, nose wheel, looks pretty good to me.
Good show!

Armstrong: Brakes coming out.
Flaps coming up
Cycle controls
Push to test ball nose
Data going off
Hydraulic pressures are 340 on #2 and #1 is now indicating 2000 pounds.
Temps are +65 and +70.
Tank pressures are 550 and 560
APU bearings are +100 on both sides.
There are no peroxide low lites.
Mixing chambers are -40 and -45
LOX source is flat, #1 and #2 are 1500
APU sources are 2400 on #1 and 2200 on #2.
Cabin source is 2300 pounds
3 axis ball reads 176
Inertial height reads -15,000 feet.
Inertial climb reads -100,000 fps.
X-15 oxygen reads 900 pounds

J MANICE

X-15 FLIGHT REQUEST

Flight No. 1-32-53 (Revised) Scheduled Date July 26, 1962

Pilot: Neil A. Armstrong

Purpose of Flight: Aerodynamic stability and drag; pilot evaluation of handling qualities

Launch: Mud Lake on magnetic heading 177°; SAS 6-6-8, ASAS "ARMED".

Item	Time	Alt.	Vel.	α	q	Event
1	0	45	790	2	145	Launch, light engine, increase to 100%T. Rotate until 2g is attained.
2	31	52	2000	9	675	Maintain 2g until $\theta = 30°$ - maintain $\theta = 30°$.
3	37	60	2200	5	675	Pushover to 0 "g".
4	83	100	5700	0	675	Burnout - Set SAS 6-6-0 - pullup to $\alpha \approx 10°$ Perform δ_a pulse.
5	109	106	5300	10	300	Extend speed brakes. Perform δ_a pulse.
6	130	111	5000	10	250	(Peak Alt.) Pullup to $\alpha \approx 15°$. Perform δ_a pulse at pilot's discretion. Trim to $\delta_H = -25°$.
7	247	87	2500	13	200	Pushover to $\alpha \approx 5°$. Reset SAS 6-6-8.
8	319	60	1600	5	350	Retract speed brakes - perform pushover-pullup maneuver ($\alpha \approx 5, 0, 10$)
9						Vector to high key for landing, start jettison (H_2O_2 "OFF").
10						High key, check ventral armed, pressurize tanks, perform push-over-pullup maneuver ($\alpha \approx 10, 0, 10$) when at $M \approx 0.8$, push-to-test ball nose.
11						Before APU shutdown, cycle controls, retract flaps, set stabilizer trim to zero, data "OFF".

MANKE, T. A.

X-15 FLIGHT REQUEST

Flight No. 1-32-53 Scheduled Date July 26, 1962

Pilot: Neil A. Armstrong

Purpose of Flight: Aerodynamic stability and drag; pilot evaluation of handling qualities

Launch: Mud Lake on magnetic heading 177°; SAS 8-6-8, ASAS "ARMED".

Item	Time	Alt.	Vel.	α	q	Event
1	0	45	790	2	145	Launch, light engine, increase to 100%T. Rotate until 2g is attained.
2	31	52	2000	9	675	Maintain 2g until $\theta = 30°$ - maintain $\theta = 30°$.
3	37	60	2200	5	675	Pushover to 0 "g".
4	83	100	5700	0	675	Burnout - Set SAS 8-6-0 - pullup to $\alpha \approx 15°$ ($\alpha_{max} = 17°$, $g_{max} = 4$). Set $\delta_H = -25°$. Perform δ_a pulses at pilot's discretion.
5	180	140	3800	12	50	Max altitude - extend speed brakes. Perform δ_a pulses at pilot's discretion during entry.
6	355	60	1600	10	400	Retract speed brakes - perform pushover-pullup maneuver (α = 10, 0, 10).
7						Vector to high key for landing, start jettison (H_2O_2 "OFF".)
8						High key, check control armed, pressurize tanks, perform pushover-pullup maneuver ($\alpha \approx$ 10, 0, 10) when at $M \approx 0.8$, push-to-test ball nose.
9						Before APU shutdown, cycle controls, retract flaps, set stabilizer trim to zero data "OFF".

Notes:

1. Duration of flight approximately 11 minutes.
2. Emergency lakes - Grapevine and Cuddeback.
3. θ vernier will be set at 30°, α null will be set at 15.

Ground Rules For No Launch:

1. Malfunction of any SAS channel.
2. Malfunction of inertial platform altitudes.
3. Malfunction of hot nose.
4. Malfunction of microwave.

Alternate Situation After Launch:

1. If engine light cannot be affected within 30 seconds, jettison propellants and land at Mud Lake.
2. For delayed engine light add 5 seconds to pushover time.
3. If radar or radio fail proceed as planned.
4. For inadvertent engine shutdown prior to 35 sec, return to Mud Lake, 35-60 sec. proceed to Grapevine, 60-65 sec proceed to Cuddeback, 65 seconds or more proceed to Rogers. Two engine starts may be attempted at any time.
5. For total pitch or roll damper failure proceed to Rogers. Do not increase α above 12°.
6. For ball nose failure maintain 2g until θ = 30°, pushover at 35 seconds proceed to Rogers. Make ASAS checks during deceleration.
7. For attitude failure, maintain 1.5g until 40 seconds, pushover to 0 g proceed to Rogers, make ASAS checks during acceleration.

38°N
37°N
36°N
119°W
118°W
117°W
116°W
MUD 5000
BRATTY RADAR
GRAPEVINE 4000
RACETRACK 3700
Owens Lake
PANAMINT 1650
BALLARAT 1050
Searles Lake
SILVER 1000
BICYCLE 2300
3 SISTERS 3000
Hopper Lake
EDW
DAG
HEC
R-4806
R-2524
R-2502
R-2506

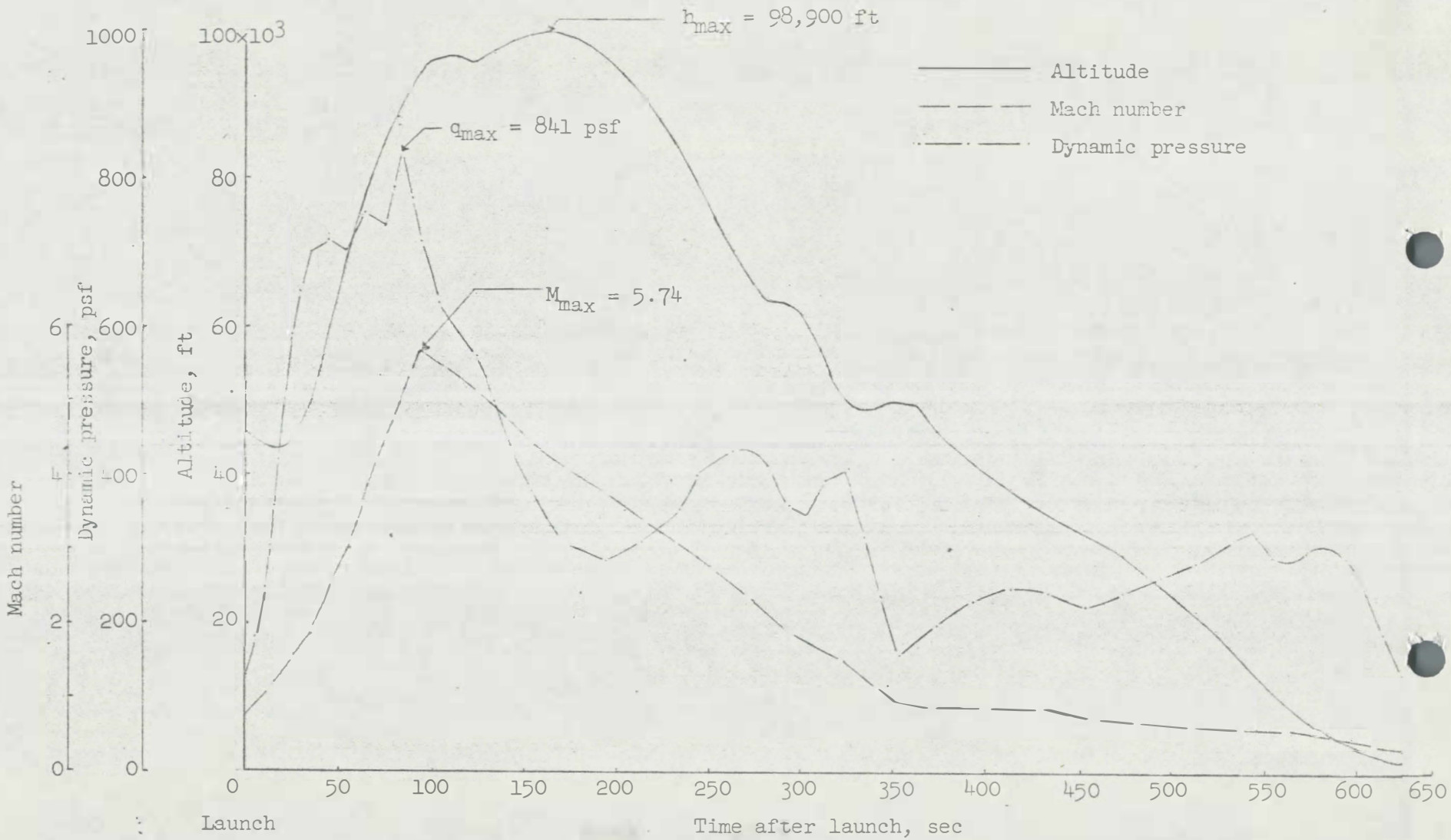

Figure 1.- Time history of Mach number, altitude, and dynamic pressure based on radar data for flight 1-32-53.

X-15 OPERATIONS FLIGHT REPORT

FLIGHT NO: 1-32-53 DATE OF REPORT: 8/3/62

PILOT: N. A. Armstrong DATE OF FLIGHT: 7/26/62

CARRIER AIRCRAFT: B-52 #003 LAUNCH LAKE: Mud Lake

PURPOSE: (1) Aerodynamic Stability and Drag
(2) Pilot Evaluation of Handling Qualities

I. Discussion of Activities Prior to Flight

A. Annulus chill leakage was reduced during preflight service by lowering service pressure from 30 psi to 20 psi. An aluminum foil/glass wool blanket was installed on the LOX tank forward end to confine leakage. ASAS gyro temperatures remained low at -70°F, rising to -55°F when chill was terminated. APU starts were normal during flight with no evidence of hydraulic system freezing.

B. Reduction of the length of the canopy forward locating pin by 1/8 inch eliminated the post landing canopy opening problem.

C. The lower ventral was recovered, however, the chute door was prematurely deployed prior to ventral jettison. The case pilot reported the chute was partially exposed but remained in place until ventral jettison. Prior to flight the door latch was modified and rigged to provide maximum engagement, and the ventral-off torque box cover was installed to maximize the ventral actuation pin compression (minimizes the effect of ventral shimming).

D. The RH windshield was inspected with a portable polarized light source; indication of aft edge area annealing was not noted. The glass was replaced with a new glass from stock because of a chip in the rear edge where a TC separated (Sauricin cement had been used to attach the TC). Further inspection of the glass in Los Angeles by NAA with a one-quarter wave polarized light source revealed extensive annealing.

E. A cockpit pressure loss occurred during the engine shutdown deceleration. The loss was not detected by the pilot.

F. The automatic LOX topoff system was inoperative due to a defective X-15 probe; no parts are available.

G. The flight was accomplished with 81.5 cfm cockpit leakage.

II. Aircraft Configuration Changes

A. Engine S/N 107 was replaced due to sticky H_2O_2 metering valve operation. Disassembly of the valve revealed extensive scoring of body and piston surfaces. Engine S/N 106 was installed.

B. The modified side arm stick with the beep trim was installed again and incorporated an improved switch action. A more positive switch "feel" and reduced travel were obtained.

C. Ball nose S/N 005 was replaced with S/N 004. The sensor cooling malfunction of the previous flight was traced to the temperature sensing switch.

III. Instrumentation Configuration Changes

During the RH windshield replacement, the glass TC installation was deleted, and one of the TC junctions was placed on the retainer rear inner surface approximately centered and 1/4 inch aft of the forward edge.

IV. Preflight Discussion

A. A thorough check of the LN_2 bay hydraulic system heaters eliminated a heater failure as a contribution to the frozen hydraulic systems of the previous flight.

B. The preflight ground run of engine S/N 106 was satisfactory. Post operation inspection revealed partial deterioration of the steam seal; a "foamy" leak was obtained with 30 psi helium. The leak was accepted for one-flight only. A check of the physical condition following flight indicated no change.

C. The LOX safety valve leaked following propellant service sufficiently to effect precool of the engine lines and pump. The engine was placed in reset to operate the lube oil pump and prevent over-cooling of the pump bearings.

D. A 1.5 hour delay was declared following pilot entry because of C-130 range support. No problems were encountered during the hold; annulus chill was maintained.

V. Flight Events

A. Leakage from the LOX scupper drain port was noted during taxi. LOX leakage has occurred prior to pressurization during several ground operations. No detectable leakage occurred following pressurization during the flight.

B. The pilot reported low and erratic hydraulic pressure on the No. 1 APU during start and subsequent operation. The T/M monitor pressure was normal, and the launch was accomplished on the assumption of a faulty cockpit transmitter. Following landing, a serious hydraulic leak was noted and traced to a pin hole leak in the cockpit source transmitter line. Very little oil remained in the No. 1 reservoir at APU shutdown.

C. The platform was operated from taxi until landing in the inertial mode due to an inadvertent switch position error at the launch panel. System performance was expected to have been degraded.

D. The pilot selected full nose up trim during the flight and obtained a maximum of 15° stabilizer angle (25° is normal). Angle of attack correlated with the T/M indication for stabilizer position. Post flight checks produced full throw operation. The control system will be checked for binding and tension regulator action.

E. Cockpit smoke was reported by the pilot.

F. The X-15 breathing oxygen supply was reduced from 2700 to 900 psi during flight.

G. Post flight check loads were accomplished.

VI. Future Aircraft Activities

The A/C was delivered to NAA, Los Angeles on August 3, 1962 for ECP-15-155 Compliance by NAA. Major A/C system components and all instrumentation items were removed prior to delivery. The initial work phases are expected to be completed by October 12, 1962, and the A/C will be returned to FRC for the remaining work. Additional EO Compliance and maintenance will be accomplished by NASA during the period between redelivery and ECP-15-155 completion on November 23, 1962.

Approved By: Perry V. Row
Perry V. Row
X-15 Senior Project Engineer

Prepared By: R. S. Waite
Ronald S. Waite
X-15 Project Engineer

RSW:bjc