

April 6, 1966

RESUME OF TWIN COMANCHE, PA-30, FLUTTER PROGRAM

A flutter program was conducted on the Twin Comanche, PA-30, at the end of the stability and control or handling qualities (quantitative and qualitative) program as a result of my flight comments on 3/10/66. This was the sixth flight on the aircraft and a qualitative pilot evaluation with primary emphasis on stall characteristics. A complete tabular listing (Attachment #1) of all flights on this aircraft is attached for reference. The pertinent remarks in the last paragraph of my pilot notes are presented word for word below --

"A dive was made to 205 knots IAS. On the pullout a high frequency chattering or vibration was noted in the longitudinal control system. This did not appear to carry over into aircraft response as I felt no acceleration effects."

Two more flights were made into the area for substantiation that possibly I had imagined something on the afore mentioned flight. The first was on 3/17/66 where the buzz was noted at 195 knots and was substantiated by Marvin R. Barber, project engineer. On flight #17 on 3/18/66, Lovic P. Thomas was taken up and verified control system buzz or vibration observed a small amplitude oscillation of the horizontal tail at 210 knots IAS.

At this point the aircraft was instrumented and four flutter flights subsequently performed. A resume of the flights in order follows:

Flight #1 - This flight was performed on 4/1/66 with myself alone as crew. It had been decided that the crew would be only the pilot for this flight series. The flight plan (see Attachment #2) was to make one dive out to 190 knots IAS at a  $\frac{dv}{dt}$  of approximately 2 knots/sec without any pilot pulse inputs. Subsequently the aircraft was stabilized at every five knot increment between 160 and 190 knots IAS and two sharp pitch pulses performed for data. Nothing unusual was noted in carrying out this flight plan.

Flight #2 - Due to an 80 cps undesirable propellar induced noise coming through on the accelerometer channels and too low a sensitivity on the strain gauge channel, changes were made in the instrumentation. This flight was made on 4/4/66 for one data point at 160 knots IAS stabilized to checkout the instrumentation.

Flight #3 - This flight on 4/4/66 was a repeat of flight #1 and again nothing unusual was noted out the end point at 190 knots IAS.

Flight #4 - This flight was made on 4/5/66 in accordance with attachment #3 with the exception of two deviations agreed on verbally by all concerned on the flight line. The first alteration was to go for one steady state point at 160 knots IAS to afford the photo chase aircraft an opportunity to work out his position, to feel out the relative acceleration capability of the two aircraft, and to correlate the airspeed indicator readings in each aircraft. The second alteration was to be a slow acceleration ( $dv/dt \approx 1$  knt/sec) to buffet onset not to exceed  $V_{ne}$ . Data and cameras were to be started passing through 180 knots and I was to stabilize at the velocity of onset.

After takeoff at 1250 we climbed to 10,500 feet to commence the first run. In diving to 160 it was ascertained that I would have to come back 2 inches on manifold pressure from full throttle so the chase aircraft could hold position and also that the Cessna 310 airspeed system was consistently reading 5-7 knots lower than mine. I made two sharp pitch pulses; nose down at 159.5 knots and nose up at 160.5 knots IAS.

Proceeded then to climb back up to 11,500 feet for the downhill acceleration to the vibration point. Started down with a power setting of 18 inches manifold pressure and 2400 RPM ending up at the terminal point at an attitude of approximately  $15^\circ$  nose down. The heading was southwest as per photographers preference for the best lighting. The data switch and cameras were turned on passing through 180 knots IAS as prearranged. I had my left hand on the control yoke after this point and my right hand on the throttles. I was using the electric trim all the way to keep the control forces essentially zero and ended up with a  $\delta_{tab}$  setting of 2.5 degrees nose down. I noted control column buffet at 208 knots IAS going through approximately 8000 feet altitude and overshot one knot to end up stabilized at 209 knots IAS. I nodded my head as prearranged to signal the chase aircraft pilot and cameramen to really work hard at holding position for pictures. I estimate after just a couple of seconds this light control system buzz took a drastic change in character. The aircraft just took off in a high frequency, I would estimate  $\pm 1$  g oscillation. My vision was blurred - I could not see the outside world or instrument panel. Within the confines of normal reaction time, I yanked the throttles both to idle and almost simultaneously started a pull up and slight right turn away from the chase aircraft. I would estimate the oscillation damped about the time the nose came through the horizon; at least that's when I got normal vision back again.

It was decided at this point to get the machine on the ground ASAP and inspect for damage. We proceeded from our location (7 miles west) for landing on the compass rose without exceeding the gear speed of 130 knots.

Comments of the chase pilot, John A. Manke, as well as the project engineer, Marvin R. Barber, who was a passenger in the Cessna 310 chase aircraft are included as Attachments 4 and 5, respectively.

*Fred W. Haise, Jr.*

Fred W. Haise, Jr.  
Aerospace Research Pilot

April 6, 1966

## TWIN COMANCHE (PA-30) PROGRAM

Flight #	Date	Time	Mission	Crew
1	3/8/66	:50	Checkout at Redding	Haise
2	3/8/66	2:45	Ferry Flight Redding to Edwards	Haise/Barber
3&4	3/9/66	:30	Fox & return for fuel	Haise/Manke
5	3/10/66	:50	Edwards to LAX	Haise
6	3/10/66	1:45	Qualitative	Haise/Tymczyszyn
7	3/10/66	:30	LAX to Fox	Haise
8	3/10/66	:15	Fox to Edwards	Haise
9	3/14/66	1:55	A/S Calib.	Haise/Manke
10	3/15/66	2:15	Stab. & Cont. Fwd. c.g.	Haise/Barber
11	3/15/66	2:05	" "	Haise/Barber
12	3/17/66	:35	Edwards to Van Nuys	Haise/Barber
13	3/17/66	1:55	Return to Edw Stalls - Mid c.g.	Haise/Barber
14	3/17/66	1:20	Stab. & Cont. Aft c.g.	Haise/Barber
15	3/17/66	:10	Fox to Edwards	Haise/Barber
16	3/18/66	1:10	Pilot Qual. Stalls & ILS	Haise/Dana
17	3/18/66	:25	Cont. Buzz Demo	Haise/Thomas
18	3/18/66	:55	Pilot Qual. Stalls & ILS	Haise/Mallick
19	3/21/66	:10	Edwards to Fox	Haise/Manke
20	3/21/66	:30	Edw to Norton AFB	Haise/Manke
21	3/21/66	2:25	ILS Data Series	Haise /Manke
22	3/21/66	:35	Norton to Edw	Haise/Manke
23	4/1/66	:55	Flutter Flt. #1	Haise
24	4/4/66	:20	Flutter Flt. #2	Haise
25	4/4/66	:35	Flutter Flt. #3	Haise
26	4/5/66	:30	Flutter Flt. #4	Haise

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
Flight Research Center

Flight Request

Flight No. Data Flt # 7

Date of Request 3/29/66

Date of Flight 4/1/66

Subject of test: High Speed Tail Vibration Test on the  
Piper Twin Comanche

Airplane Configuration: Cruise; Fwd cg; Instrumentation  
Film speed 2"/sec.

Engine identification \_\_\_\_\_

Instructions;

Don't burn fuel from the auxiliary tanks

I. Stick Free Elevator Pulses, two each at the following  $V_I$ :

- a. 160 Kts
- b. 165 Kts
- c. 170 Kts
- d. 175 Kts
- e. 180 Kts
- f. 185 Kts
- g. 190 Kts

The airplane will be in <sup>Zero</sup>Force Trim, with max power, and the rate of descent necessary to maintain the specified (throughout the Dive)

Data will be left on until the pilot has to recheck for all ...

T.o.wt., lbs. 190 T.O.c.g. Position % MAC 9.9 Flt. Range 7.3 to 9.8

Pilot D.H. Proj. Coord. 9000 Aprvd. Chief Res. Div. \_\_\_\_\_

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
Flight Research Center

## Flight Request

Flight No. DATA F11 #8Date of Request 3/20/44Date of Flight 3/4/44Subject of test: High Speed Tail Vibration Test (MT)Piper's Turboprop motor.Airplane Configuration: Cowling; Fuel C.G.; Turboprop motorMin. Speed 2"/sec; Camera Film Speed 49 Frames/Sec.

Engine identification \_\_\_\_\_

## Instructions:

Don't burn fuel from the auxiliary tanks

E. Stick Free Elevator Pulses; two each at the following V

a. 160 KTS

b. 170 KTS

c. 180 KTS

d. 190 KTS

e. 195 KTS

f. Increase speed by 5 knot increments until vibration occurs.

g. If vibration is absent - light pulse at 10 sec.

h. If vibration is absent - light pulse at 20 sec.

i. Increase speed slowly until vibration occurs.

Turn Cowling off, note altitude & rate of descent - Hold vertical for 5 seconds. DO NOT EXCEED  $V_{max}$  or  $V_{no}$  WHICHEVER COMES FIRST. Leave data on and recover from vibration by applying slight bank.T.o.wt. <sup>(X)</sup> lbs. 3,190 T.O.c.g. Position % MAC 9.8 Flt. Range 9.9 to 9.8Pilot \_\_\_\_\_ Proj. Coord. 7 Aprvd. Chief Res. Div. \_\_\_\_\_

April 6, 1966

## CHASE PILOT REPORT OF FLUTTER FLIGHT NO. 4

Date : 4/5/66  
Aircraft: Cessna 310 N6940T  
Mission : Photo chase for Twin Comanche N7845Y Flutter Test  
Crew : Pilot, J. Manke  
Proj. Eng, M. Barber  
Cameraman, R. Rhine  
Cameraman, E. Childress

Takeoff was at 1240. During the climb the formation position for optimum camera coverage was determined. At 10,500 feet, a practice run to 160 KIAS was initiated. During this run it was determined that the indicated airspeed in the Cessna 310 was 5 to 8 knots lower than in the Twin Comanche. At the termination of the practice run, the aircraft were climbed to 11,500 feet and the data run was commenced. The chase aircraft was on the left side of the test aircraft. At 180 KIAS, the camera men began taking pictures. At approximately 200 KIAS (chase aircraft), the test aircraft pilot nodded his head signaling that he could feel vibration. I looked at the horizontal tail of the test aircraft and could see an up and down motion at the tip of about  $\pm 1/2$  inch. Shortly thereafter (about 3 seconds) the test aircraft chopped his throttles and started a rolling pullout to the right (away from the chase aircraft). At this time I got a good plan view of the bottom of test aircraft. The entire aircraft appeared to be shaking violently at high frequency. It appeared as if the entire bottom skin of the aircraft was rippled. I estimate I was able to observe the plan view for about 2 seconds before it passed beyond my field of view.

The mission was terminated at this point, we were about 5 miles northwest of the compass rose. At this point, I picked up landing interval on the test aircraft and landed shortly behind him on the lakebed. Flight duration was 45 minutes.



John A. Manke  
Aerospace Engineer & Research  
Pilot

April 5, 1966

## POST FLIGHT NOTES FOR DATA FLIGHT 10 ON THE (PA-30) N7845Y

This was the fourth flight the aircraft had made since it had been instrumented. The calculated gross weight was 3,044 lbs. at T.O. and 2,971 lbs. at T.D. The calculated CG position was 85.6 in.  $\approx$  11.0% M.A.C. at T.O. and 85.5 in.  $\approx$  10.9% M.A.C. at T.D.

The stabilator was mass-balanced 59 in-lb trailing edge heavy. This was the mass-balance of the stabilator when we obtained the aircraft from the distributor, and it should be noted this is 10 in-lbs heavier than the design specification calls for.

The airplane was instrumented as follows:

- A. Three Statham accelerometers were placed in the fairing cavity of the stabilator. Two were placed on the right side of the stabilator as far forward and aft as possible. The other was placed on the line of rotation of the left side of the stabilizer.
- B. A four acting-arm strain-gauge was positioned on the trim-tab connecting rod.
- C. A motion picture camera was mounted in the cabin area such that it could photograph the left side of the stabilator through the rear side window. The film speed was 48 frames per second.

A Cessna 310 aircraft, carrying two hand-held cameras, was utilized as the photo-chase airplane. The frame rates for these cameras were 24 and 200 frames per second.

Attachment 5 (cont)

The scheduled flight plan was as follows:

Run No.	A/S Kts		Data	Cameras
1	160	Two $\delta e$ (stick free) pulses	ON	OFF
2	150 $\rightarrow$ vib speed	Accelerate at 2 kts/sec to vibration speed & hold for five seconds	ON	ON at 180 kts
3	165	Two $\delta e$ (stick free) pulses	ON	OFF
4	170	" " "	"	"
5	175	" " "	"	"
6	180	" " "	"	"
7	185	" " "	"	"
8	190	" " "	"	"
9	195	" " "	"	"

NOTE: Continue runs in approximately 5 knot increments to 5 knots below vibration onset speed (vibration onset speed to be determined in Run 2).


The aircraft took off from Edwards at 12:40. After climbing to an altitude of 10,000 feet, a shallow dive to 160 knots IAS was made. This dive was to serve two purposes; (1) a practice run for the photographers, and (2) a comparison of the two airplanes airspeed systems. The chase-plane airspeed system read 5 kts lower than the PA-30 airspeed system.

After reascending to altitude, the second dive was initiated. The airspeed systems were compared again at 180 kts and the chase plane reading of 5 knots low was verified. The cameras and data were turned on when the chase plane was indicating 180 kts.

As the flight test engineer riding in the chase aircraft, I observed the following occurrences:

At 200 kts (chase plane) I noticed three short duration, low amplitude oscillations (estimated  $\pm 1/4$  inches displacement at the tips of the stabilator). With no appreciable change in airspeed, the oscillation then became incessant and much higher in amplitude with an estimated displacement of  $\pm 2$  inches at the tips. The airplane instantly gained altitude and disappeared from my sight. The time of day was 13:10.

The remainder of the scheduled flight was cancelled. The airplane landed at Edwards at 13:25.

  
Marvin R. Barber  
Aerospace Research Engineer