UNCLASSIFIED

AD NUMBER
AD855043
LIMITATION CHANGES
TO: **Approved for public release; distribution is unlimited.**
FROM: **Distribution: Further dissemination only as directed by Army Materiel Command, Attn: AMCPM-LH, PO Box 209, St. Louis, MO 63166, APR 1969, or higher DoD authority.**
AUTHORITY
usaavscom ltr, 12 nov 73

THIS PAGE IS UNCLASSIFIED

AD
RDTE PROJECT NO.
USATECOM PROJECT NO. 4-6-0250-01
USAASTA PROJECT NO. 65-37

ENGINEERING FLIGHT TEST OF THE OH-6A HELICOPTER (CAYUSE)

PHASE D

FINAL REPORT

JOHN I. NAGATA
PROJECT ENGINEER

JOHN J. SHAPLEY, JR.
PROJECT PILOT

APRIL 1969

DISTRIBUTION

This document may be further distributed by any holder only with specific prior approval obtained through the Commanding General, Hq, USAMC, ATTN: AMCPM-LH, PO Box 209, St. Louis, Missouri 63166.

US ARMY AVIATION SYSTEMS TEST ACTIVITY
EDWARDS AIR FORCE BASE, CALIFORNIA 93523

DDC Availability Notice

~~US military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through the Commanding General, Hq, US Army Materiel Command (USAMC), ATTN: AMCPM-LH, PO Box 209, St. Louis, Missouri 63166.~~

Reproduction Limitations

Reproduction of this document in whole or in part is prohibited except with permission obtained through the Commanding General, Hq, USAMC, ATTN: AMCPM-LH, PO Box 209, St. Louis, Missouri 63166. DDC is authorized to reproduce the document for United States Government purposes.

Disposition Instructions

Destroy this report when it is no longer needed. Do not return it to the originator.

Trade Names

The use of trade names in this report does not constitute an official endorsement or approval of the use of the commercial hardware and software.

RDTE PROJECT NO. ____________
USATECOM PROJECT NO. 4-6-0250-01
USAASTA PROJECT NO. 65-37

ENGINEERING FLIGHT TEST OF THE OH-6A HELICOPTER (CAYUSE)

PHASE D

FINAL REPORT

JOHN I. NAGATA
PROJECT ENGINEER

JOHN J. SHAPLEY, JR.
PROJECT PILOT

APRIL 1969

DISTRIBUTION

This document may be further distributed by any holder only with specific prior approval obtained through the Commanding General, Hq, USAMC, ATTN: AMCPM-LH, PO Box 209, St. Louis, Missouri 63166.

US ARMY AVIATION SYSTEMS TEST ACTIVITY
EDWARDS AIR FORCE BASE, CALIFORNIA 93523

ABSTRACT

Performance and stability and control tests were conducted on the OH-6A helicopter to determine compliance with the detail specification HTC-AD 369-Y-8003 and to provide information for the operator's manual. Testing was performed by the US Army Aviation Systems Test Activity, Edwards Air Force Base, California. The testing consisted of 136 productive flight hours and was conducted from November 1966 to February 1968. The testing was conducted at Edwards Air Force Base, California and at auxiliary test sites at Bakersfield and Bishop, California. The OH-6A met all performance guarantees except for the OGE Standard Day, 2613 pound gross weight, sea level hover guarantee. For this condition the hover height was 15 feet. The overall stability and control characteristics were considered satisfactory and complied with the requirements of military specification 8501-A with the allowed deviations in the detail specification with the exception of the maximum roll rate allowed in paragraph 3.3.15, which was exceeded but was satisfactory. Three deficiencies, the emergency door release, the battery location and the absence of an electrical disconnect and the inability of balancing the tail rotor were found during the program. There were also seventeen shortcomings, which, if corrected, would improve the aircraft's operation and mission capabilities.

TABLE OF CONTENTS

table of contents-continued

INTRODUCTION

BACKGROUND

1. The production contract, awarded in May 1965, incorporated many changes to the prototype OH-6A helicopter. These changes are listed in the detail specification (ref 2, app II). The major changes included structural modifications to the airframe, an improved engine and a redesigned engine air inlet.

2. The US Army Aviation Systems Test Activity (USAASTA) was directed by the US Army Test and Evaluation Command (USATECOM) to conduct Product Improvement Tests (Phase D) on the OH-6A helicopter. The tests were divided into two major groups; Performance and Stability and Control.

TEST OBJECTIVES

3. The test objectives were to determine the performance and flight characteristics of the unarmed OH-6A helicopter, develop data for inclusion in the operator's manual (ref 3, app II), and to determine the effects of the modifications incorporated in the production vehicle.

DESCRIPTION

4. The OH-6A helicopter is an all metal, single-engine, rotary wing aircraft. The OH-6A design incorporates a single main lifting rotor and a tail rotor to provide antitorque and directional control. The main rotor is a four-bladed fully articulated system. The helicopter is powered by an Allison T63-A-5A engine derated to a five-minute takeoff power of 252.5 shaft horsepower (shp) at 100 percent (free turbine speed (N_2)). The cockpit configuration is two-place and has provisions for two passengers in the rear (cargo) area. The landing gear is of the skid-type with air-oil shock struts. Two fabric reinforced rubber bladder fuel cells are located under the flooring of the cargo compartment. The cells have a useable fuel capacity of 61.5 gallons. The dual, cockpit flight control system is conventional and unboosted. A detailed description of the OH-6A helicopter dimensions and systems is presented in appendix III.

SCOPE OF TESTS

5. The scope of the OH-6A Performance Engineering Flight Tests encompassed the airspeed envelope (range) at gross weights from

2000 to 2700 pounds, at altitudes from sea level to service ceiling for the maximum center of gravity (CG) range. Dynamic stability tests were not conducted at gross weights above 2400 pounds because of the limited envelope recommended by the contractor (ref 5, app II). The tests at gross weights above 2400 pounds were scheduled to be flown at the completion of the contractor's structural demonstration. The demonstration had not been accomplished prior to the completion of the USAASTA tests.

6. Testing was conducted at Edwards Air Force Base, Bakersfield and Bishop, California, from November 1966 to February 1968. The testing consisted of 136 productive flight hours.

7. A Pilot Rating Scale (PRS) was used to augment qualitative comments. This scale is illustrated in appendix V. The ratings may not necessarily reflect the pilot's opinions that would result from operation in a field environment. However, every effort was made to consider possible operational situations that might be encountered during mission accomplishment. In many cases, the conditions tested may be more severe than those which would exist in an operational environment. Use of this testing technique made it possible to discover and report potential discrepancies during the progress of the testing effort.

METHOD OF TESTS

8. Standard USAASTA test methods of data acquisition, reduction and analysis were employed to derive the conclusions and recommendations. The majority of the tests were conducted in nonturbulent atmospheric conditions so that the data would not be influenced by uncontrolled disturbances. A limited number of flights were accomplished during turbulent air conditions to evaluate stability and control under representative operating conditions.

9. An instrumented aircraft equipped with sensitive calibrated instruments was used to gather the data presented in this report. A detailed list and description of the test instrumentation is given in appendix IV. Qualitative pilot comments were used to aid the analysis of the data as well as to provide an overall assessment of the performance and flying qualities.

CHRONOLOGY

10. The chronology of the tests is as follows:

Test directive issued	7 July 1966
Test plan submitted	8 September 1966
Test plan approved	20 October 1966
Test aircraft delivered	16 September 1966
Tests started	8 November 1966
Tests completed	6 February 1968
Draft report submitted	29 February 1968

RESULTS & DISCUSSION

GENERAL

11. Performance tests were conducted on the OH-6A helicopter to determine compliance with the estimated and guaranteed performance outlined in the detail specification HTC-AD 369-Y-8003, revised 26 April 1965, and to provide information for inclusion in the operator's manual. These tests included hover, takeoff, level flight, climb, autorotation and autorotational landing performance. The OH-6A met all performance guarantees except the hover ceiling out of ground effect (OGE), standard day at alternate gross weight of 2613 pounds. Takeoff performance of the OH-6A helicopter was satisfactory under all gross weights and ambient conditions that allowed a minimum in ground effect (IGE) hover of four feet. Climb and autorotational descent performance was satisfactory. Maximum speed and range capabilities were very good. These results in conjunction with the low empty weight and consequent high payload yields a highly productive and economical helicopter. The autorotational landing performance ranged from very good at the design gross weight to unsatisfactory at the structural limit gross weight.

12. Flying qualities tests were conducted to determine the stability and control characteristics and to evaluate the envelope with respect to safety of flight. The data were used to evaluate compliance with the requirements of military specification MIL-H-8501A, (ref 6, app II), and the deviations allowed in the detail specification (ref 2, app II). Stability and control characteristics were satisfactory; requirements were met and no safety of flight conditions were encountered.

WEIGHT AND BALANCE

13. The test helicopter, serial number 65-12967, was weighed prior to starting the test program. The weighing was accomplished in a closed hangar with electrical load cells placed under the aircraft jack points. The basic weight (empty aircraft plus trapped fuel and oil) was 1144 pounds and the CG location was at station 105.76. This compares with the contractor weight and balance of the same aircraft which was 1143 pounds and the specification guarantee of 1163 pounds. The design gross weight of 2163 pounds was calculated in the following manner:

ITEM	WEIGHT/POUNDS
Basic Aircraft	1145.5
Pilot	200
Copilot	200
Fuel (useable)	398.5
Oil	6
Armor Protection and Mission Essential Equipment	213
Total Gross Weight	2163

After the instrumentation equipment was installed, the test aircraft weight was 1530 pounds and the CG location was 104.89.

14. As outlined in the detail specification (ref 2, app II), the following gross weights are defined:

Mission weight = 2163 pounds
Alternate 1A = 2400 pounds
Alternate 1B = 2613 pounds
Structural limit = 2700 pounds

AIRSPEED CALIBRATION

15. An airspeed calibration was performed on the boom and standard airspeed system. The test conditions and results are presented in figures 56 and 57, appendix I.

16. The position error on the standard system was a maximum of 6 knots at an indicated airspeed of 20 knots, decreasing to zero at all airspeeds above 85 KIAS. The airspeed system met the requirements of specification MIL-I-6115A at all airspeeds above 30 knots.

PERFORMANCE

Hover Performance

17. Hovering performance and flight characteristics were determined both IGE and OGE. The test results are presented in figures 1 through 15, appendix I. OGE and IGE hovering performance is summarized in figures 5 and 6. Performance guarantees (ref 2, app II) were met except for hover OGE standard day, 2613 pound guarantee at sea level. For this condition the hover height was 15 feet. This guarantee was missed by approximately 73 pounds or 3900 feet

as shown in figure 4. The ability of the helicopter to hover at a sea level standard day condition with a useful load to basic weight ratio of 1.22 is considered excellent.

Hover Flight Characteristics

18. The aircraft leaves the ground with the left side slightly low. The pilots had little trouble adapting to takeoff characteristics in calm air or into the relative wind. The cyclic forces can be trimmed to zero. The collective forces are not objectionable, although improvement is required to permit "hands off" flight. Approximately 15 pounds of left, rudder pressure is required which is not objectionable because of the location of the rudder pedals which allow them to serve as foot rests for the pilot. A directional, trim capability might be desirable for prolonged hover. Power management is excellent. Usually, one minor adjustment on the beep control is necessary from takeoff to hover. (Maximum droop noted was three rpm; less than one percent.) For most conditions the aircraft is not power limited and care must be exercised to prevent exceeding the transmission-torque and/or turbine outlet temperature (TOT) limitations, as in any derated system (PRS A-2, app V).

19. The OH-6A is very responsive in hover and is sensitive to wind velocity and direction. Under gusty air conditions, pilot workload increases significantly. Precision tasks are very difficult under certain conditions. Adequate control is available, providing the rigging is within the specified tolerances, but there is a tendency to over control because of high control sensitivity. The pilot's workload is minimized if the aircraft is kept within ±45 degrees of the wind line (PRS A-3).

Takeoff Performance

20. Takeoff tests were conducted to determine the performance of the OH-6A helicopter under conditions in which a vertical takeoff could not be made to clear a 50-foot obstacle. Under these conditions, a short acceleration close to the ground will enable the aircraft to operate out of short fields. Takeoff performance tests were conducted using a hover skid height of four feet with level acceleration to climb airspeed technique. Gross weight was varied to obtain a wide spread of the differential power coefficient (ΔCP = power coefficient available - power coefficient required) at test altitudes of 4000 feet and 9500 feet. For a ΔCP of zero (2-foot hover capability), on a sea level standard day and a gross weight of 2400 pounds, the best takeoff airspeed was 20 knots for a required distance of 130 feet. The airspeed and dis-

tance are misleading since the standard airspeed indicator is unuseable at low airspeeds. Consequently, an indicated airspeed of 30 knots should be used for a minimum airspeed to clear a 50-foot obstacle. This airspeed was a corresponding takeoff distance of 203 feet. At the high altitude conditions, there was a typical rapid deterioration in aircraft performance with an attendant decrease in takeoff performance. Similar characteristics were evident during the climb performance tests. Test results are presented in figures 19 through 22, and summarized in figures 16 through 18, appendix I.

Takeoff Flight Characteristics

21. During the transition and acceleration from hover to forward flight, longitudinal cyclic-collective pitch control coupling was encountered. As collective was increased, forward cyclic control was required. This coupling was not objectionable during takeoff but the pilot was not able to trim out the undesirable stick force for approximately 5 seconds because of the slow rate of the trim motor. Translational lift was characterized by a slight increase in vibration level and a tendency for the helicopter to pitch nose up. The vibration level was not excessive and the nose-up pitching tendency was easily controlled by use of forward cyclic control. A faster rate trim motor would be of assistance to trim out the undesirable stick force. This is not considered a mandatory correction since a pilot can adapt to these forces and "lead" the present trim motor to compensate for these forces. Rotation to the pitch attitude, corresponding to the desired climb out airspeed, was easily accomplished by the use of aft cyclic control. Rotation was initiated at an indicated airspeed of 3 to 5 knots less than the desired climb airspeed. A PRS of A-2 was assigned to the handling qualities during the takeoff portion of the performance test.

22. The takeoff tests were conducted using the boom airspeed system. The standard airspeed system was unreliable during takeoff tests because of large fluctuations at low speeds IGE. The standard airspeed system is so poor that the only method a pilot has to determine airspeed is by judging apparent ground speed and correcting for wind. This is not a desirable method when operating at high gross weight, high altitude and in confined area conditions. As an example of the poor indication, the boom airspeed system indicated 8 knots during a 4-foot level acceleration while the standard system indicated 20 to 25 knots. It is recommended that 30-knots, indicated standard airspeed (KIAS) be used as the minimum climb airspeed when maximum performance (shortest distance to clear a 50-foot obstacle) is required. Power management was excellent during the takeoff tests. The steady state droop was

less than one percent rotor rpm for all conditions tested. However, care must be exercised, by the pilot, to observe transmission-torque and TOT limitations during certain gross weight and temperature conditions. These characteristics require constant monitoring of the cockpit indicators, which might prove difficult under certain operating conditions. In general, derating, requiring attention and monitoring on the part of the pilot to avoid exceeding aircraft limitations, is undesirable.

Climb Performance

23. Continuous-climb performance tests were conducted from sea level to service ceiling at gross weights of 2160, 2400 and 2700 pounds. The airspeed for best rate of climb was determined from the level flight tests. Climb performance test results are presented in figures 23 through 26, appendix I. At a gross weight of 2160 pounds, the rate of climb at sea level was 1900 feet per minute (fpm). At 2700 pounds, the rate of climb at sea level was 1355 fpm. The sawtooth climb tests indicate that a variation of ±5 knots from the climb schedule will cause no significant decrease in rate of climb. The rotor speed-governing characteristics were such that the necessary collective changes did not vary rotor speed sufficiently to influence the climb performance.

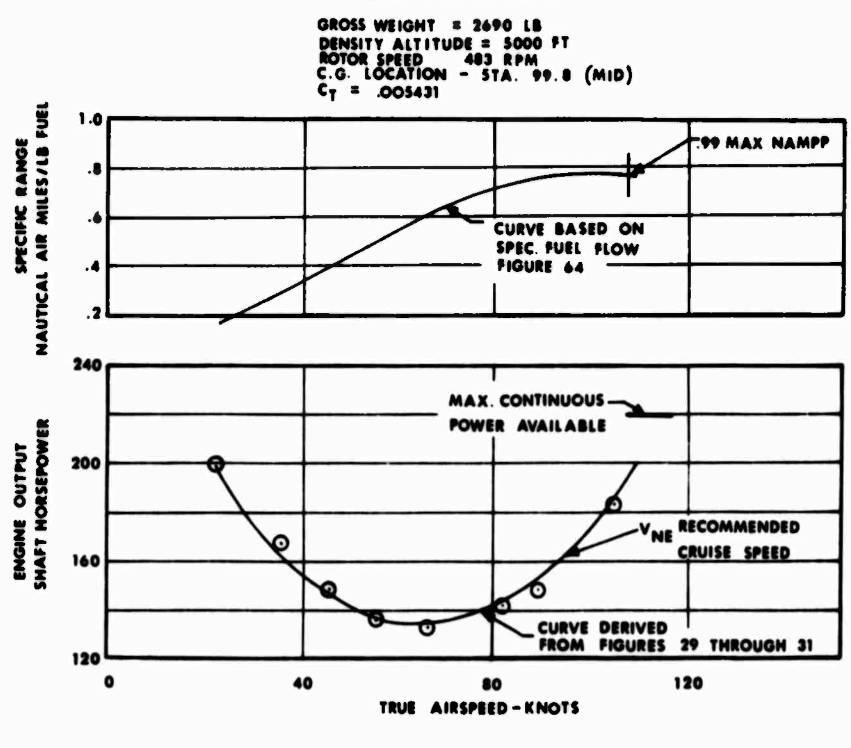
Climb Performance Flight Characteristics

24. The most significant flight characteristic noted during the climb tests was a random instability region which occurred at the best rate of climb speed. Random pitch and yaw oscillations occurred with controls fixed. These oscillations required a great deal of pilot attention to maintain the desired climb airspeeds. It is recommended that climbs be conducted at best rate of climb speed +10 knots which results in a decrease of approximately 50 fpm rate of climb speed, but improves stability characteristics. No significant power management problems were encountered during the climb tests. Under high gross weight conditions, it was desirable to use some lateral friction to eliminate aggravation to the pilot of a self-induced lateral oscillation. Caution must be exercised when entering a maximum power climb to observe the transmission-torque and engine TOT limits. A PRS of A-3 was assigned to the handling qualities observed, during the climb performance tests for an airspeed at best rate of climb +10 knots .

Level Flight Performance

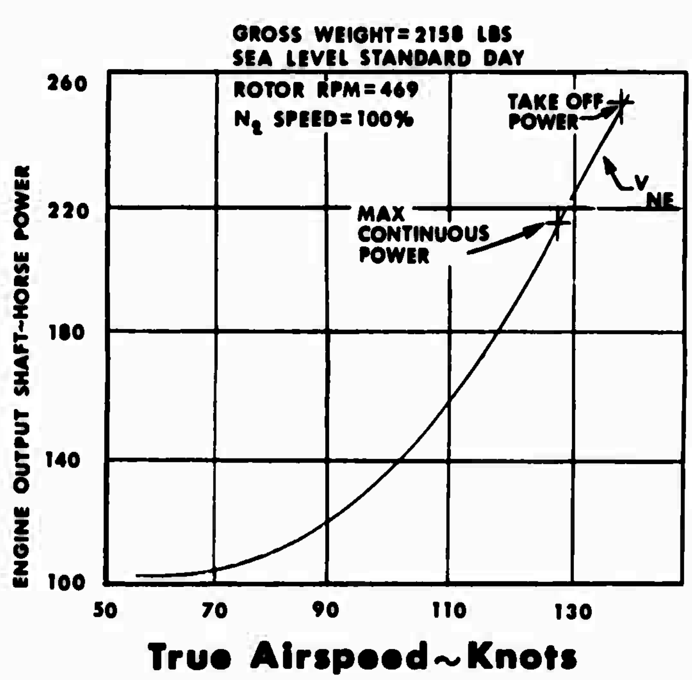
25. Level flight performance tests were conducted to determine power required as a function of airspeed. Tests were accomplished with doors ON and various combinations of doors ON and OFF configurations. Tests were conducted at takeoff gross weight from approximately 2000 to 2700 pounds and at density altitudes from sea level to 15,000 feet. The doors ON flights were ducted at a mid CG location while the doors OFF configuration flights were conducted at a forward CG. The results of the individual tests are presented in figures 32 through 46, appendix I. These data are also presented in nondimensional form in figures 29 through 31 and summarized in figures 27 and 28. An 8-percent increase in power is required at 100 knots true airspeed (KTAS) with the aft cargo doors removed. Removal of the front doors had no measurable effect on power required. Removal of all doors showed the same power increase as that for the aft doors removed (figs 47 through 49). Recommended cruise speed (the airspeed where 0.99 maximum, nautical air miles per pound of fuel (NAMPP) usage occurs) could not always be attained because of the flight envelope (V_{NE}) limitations. This characteristic is illustrated in figure A.

FIGURE A.
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION



26. Range and endurance were calculated for a mission gross weight of 2163 pounds, rotor speed of 469 rpm and at sea level standard day conditions. The fuel allowances were for a 2-minute warm-up and a 10-percent reserve at the completion of the range mission. The range was calculated to be 297 nautical miles (NM) at 119 KCAS, which exceeds the guarantee of 277 NM. Endurance was calculated to be 3.5 hours at a cruise speed of 62 knots. This exceeded the guarantee of 3.3 hours. The guarantee of 128 knots calibrated airspeed (KCAS) at the same conditions as above, for a V_{NE} limit airspeed, was met and the power required at 110 KCAS was 173 shp, as illustrated in figure B. This shp compares with the guaranteed value of not more than 179 shp.

Figure B.



Qualitative Level Flight Characteristics

27. Power management during level flight did not present any unusual problems. The droop compensation was satisfactory. When

stabilized airspeeds were selected at 469 or 483 rotor rpm from approximately 50 KIAS to V_{max}, a maximum variation of two to three rotor rpm (less than one percent) was encountered. It was difficult to stabilize for an extended period of time at airspeeds of 30 to 40 knots because of random disturbances which could be caused by rotor downwash on the 25-degree stabilizer. The minimum power-required curve is quite flat from 50 to 60 knots, and precise airspeeds were difficult to achieve with the power set. From 70 knots to V_{NE}, the level flight airspeeds were relatively easy to achieve. At 2600 pounds and 10,000 feet, it was difficult to maintain a precise airspeed with a constant power setting. A PRS of A-3 was assigned to the flight characteristics during the level flight portion of the performance tests.

Autorotational Descents

28. Tests were conducted to determine optimum rotor speeds and airspeeds for autorotational descents. In addition, data were obtained to allow determination of rates and angles of descent during autorotation. Autorotational-descent test results are presented graphically in figures 53 through 55, appendix I. The airspeed for minimum rate of descent (1380 fpm) was determined to be 60 KCAS at a rotor speed of 483 rpm. However, at a rotor speed of 400 rpm, the rate of descent decreases by approximately 200 fpm. The airspeed for minimum angle of descent was determined to be 82 KCAS at a density altitude of 5000 feet and rotor speed of 483 rpm. At this airspeed, approximately 0.91 nautical air miles could be traveled per 1000 feet of descent (PRS A-1). The rotor speed values for minimum rate of descent, as presented in figure 54, are suspect below 440 rpm. True autorotation, during which no power is delivered to the rotor, could not be achieved at rotor speeds of less than 440 rpm since this corresponded to the power turbine speed.

Autorotational Descent Flight Characteristics

29. At high gross weights full-down collective pitch will result in overspeeding the rotor; therefore, careful pilot attention is required especially during maneuvering flight. Constant attention to maintain stabilized conditions was required since small variations in airspeed resulted in relatively large variations in rotor speed. A PRS of A-2 was assigned for the autorotational descent during the performance phase of the test program at the mission gross weight of 2163 pounds. A PRS of A-3 was assigned for the alternate gross weight of 2400 pounds, and a PRS of A-4 was assigned for the structural limit gross weight of 2700 pounds.

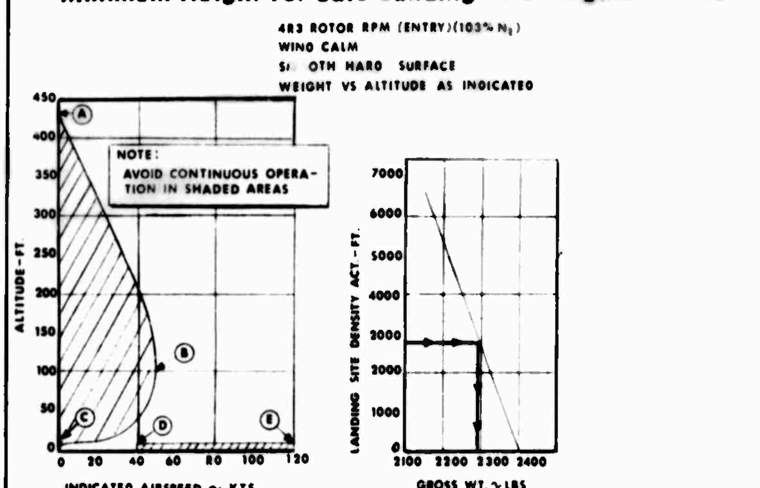
Power Recovery Characteristics

30. The power recovery characteristics of the OH-6A with the T63-A-5A engine were considered excellent. Recoveries from autorotation to takeoff power could be accomplished in approximately 1 second. This large, torque increase required the pilot to anticipate the directional control requirement to avoid excessive yaw oscillations. A PRS of A-1 was assigned to the power recovery characteristics.

Autorotational Landings

31. A limited amount of autorotational landing performance information was obtained before the testing was terminated, as a result of an accident which occurred during autorotational landing. The data for safe autorotational landings were obtained using a 2-second time delay on the cyclic and collective controls. The results of these tests are presented in figure C. Because of a significant difference between test results and contractor provided data, a change to the operator's manual (ref 3, app II) was recommended and incorporated. Autorotational landing performance was considered good at the design gross weight of 2163 pounds (PRS A-2). A limited qualitative investigation was conducted at various gross weights and altitude conditions. At the alternate 1A gross weight of 2400 pounds, there was less margin for error. A PRS of A-3 was assigned for the sea level condition. At 6000 feet density altitude, a PRS of A-5 was assigned. At the structural-limit, gross weight of 2700 pounds, a PRS of A-6 was assigned. As gross weights and/or altitude were increased, a less desirable PRS was assigned.

Figure C.
Minimum Height For Safe Landing After Engine Failure



STABILITY AND CONTROL

Static Trim Stability

32. Control position trim curves for the various altitudes, gross weight, rotor speeds and flight regimes are presented in figures 68 through 74, appendix I. The longitudinal control motion was positive (forward stick to increase airspeed) for all conditions tested. There were no objectionable discontinuities. The gradient was very shallow at speeds below 60 KCAS and then became increasingly positive with higher airspeeds. The lateral stick and pedal position moved right with increased airspeed to approximately 90 KCAS, above which there was a trend for a slight reversal. The longitudinal stick travel moved forward approximately one inch with a gross weight change of 300 pounds at a mid CG location (fig 69). The change in longitudinal stick position was a minimum of 0.3 inch at 30 KCAS to a maximum of 0.5 inch at 100 KCAS. The longitudinal control margin at maximum airspeed was 4.0 inches. The largest change in lateral stick and pedal position occurred at low speeds (30 KCAS). These values were 0.4 inch and 0.6 inch respectively. Above 60 KCAS there was essentially no effect from the increased gross weight and there were no changes in the characteristic shapes of the curves. At airspeeds below 60 KCAS, the longitudinal stick position was not sensitive to altitude changes below 10,000 feet (fig 68). As altitude was increased to 15,000 feet, the stick position moved forward approximately two inches at airspeeds below 60 KCAS. For airspeeds above 60 KCAS, the stick position moved forward with increasing altitude or airspeed. At maximum airspeed and 15,000 feet the longitudinal control margin was 4 inches. The lateral stick and pedal positions moved left approximately 1 inch and 1.5 inches respectively, with increased altitude.

33. The effect of decreasing rotor speed from 483 to 469 rpm, was to move the longitudinal stick position forward approximately 1 inch, leaving a control margin of 3.6 inches at the maximum airspeed. The lateral stick position was moved left 0.4 inch (fig 70). There was no airspeed influence apparent in the longitudinal and lateral stick changes. The pedal position moved left a minimum of 0.2 inch at 70 KCAS, with the change increasing to 1 inch at an airspeed of 20 KCAS.

34. The result of CG location changes from full forward to full aft are presented in figures 71 and 72. At sea level the longitudinal stick is moved approximately 1.5 inches farther forward as CG location is moved through the extreme position. The effect was minimized slightly with a 5000-foot altitude increase.

35. The longitudinal stick position is one inch more aft during autorotation than while in level flight at a comparable airspeed. This change is essentially constant for the airspeed range from 30 to 75 KCAS. For maximum power climb at 30 KCAS, the stick position is one inch more forward than during level flight. Between 40 and 50 KCAS there was a discontinuity and an apparent stability change. Airspeed was difficult to stabilize in this area and a trim condition was difficult to maintain (PRS A-4). Above 55 KCAS the stick position moved very little with increased airspeed. The previously discussed discontinuity was also present in the lateral and directional control positions.

36. The longitudinal stick position moved slightly aft for all rotor speeds during a full power climb at 47.5 KCAS. Collective position decreased with rotor speed while additional right lateral stick was required. The magnitude of these changes were small and not objectionable to the pilot. In autorotation, at an airspeed of 47.5 KCAS, the longitudinal stick position was moved one inch aft by a rotor speed change from 400 to 483 rpm. The lateral stick and pedal positions were moved slightly to the left during this rotor speed change.

37. The cyclic control forces could be trimmed to zero throughout the range of control travel encountered during level flight. At low airspeeds, the trim rate was too slow and it was necessary to hold excessive forces during speed and power changes (PRS A-4). Utilizing the maximum forward longitudinal continuous trim rate, the greatest untrimmed stick force was a push force of five pounds as the helicopter was accelerated from hover to 120 KCAS. After reaching this airspeed, it was necessary to hold the trim for six seconds before the forces were reduced to zero. From the hover condition with no longitudinal force trim applied, a similar acceleration produced a maximum longitudinal stick force of eight pounds. Trim forces resulting from flight regime changes are shown in table 1. A full-forward trim malfunction from a hover condition results in a longitudinal stick force of 21.5 pounds.

Table 1. Longitudinal Trim Forces.

Maneuver	Trim Force lb	Direction	Airspeed KIAS
Hover to climb	4	Fwd Long.	95
Hover to level flight (V_{NE})	8 5	Fwd Long. L Lat	0 to 120
Level flight (V_{NE}) to hover	8 5	Aft Long. R Lat	120 to 0

Fixed Collective Static Longitudinal Stability

38. The fixed collective static longitudinal stability was characteristically positive at airspeeds greater than 60 knots. The stability became slightly more positive as the trim condition approached the maximum airspeed. The maximum gradient recorded was 0.035 inch per knot, at a gross weight of 2100 pounds, a rotor speed of 483 rpm and a mid CG location. The increased gradient with airspeed was a desirable feature in that it tended to reduce the likelihood of inducing a pitch-up when making small airspeed changes while trimmed at a high speed. At trim airspeeds of 50 knots the stability gradient varied from slightly positive to neutral. This low stability area was near the airspeed for best climb performance. In all cases the stability was generally linear with no objectionable discontinuities (PRS A-3). For a given airspeed the stability was essentially the same for all gross weights and CG locations at altitudes below 10,000 feet (fig 75 through 87, app I). To the pilot, the apparent stability decreases with altitude primarily because the reduced airspeed envelope places the aircraft in a generally lower stability regime. At higher altitude (10,000 feet) there was a significant decrease in the stability level as the gross weight increased from 2100 to 2400 pounds. Further deterioration was present at a maximum gross weight of 2700 pounds. The stability characteristics were similar for rotor speeds of 483 and 469 rpm. The stability during climb was essentially the same as that during level flight (fig 83 and 84) at a similar airspeed. In autorotation the stability level was slightly lower, although still positive. There were no unusual or objectionable lateral stick motions associated with an

airspeed change from trim. As was noted during the trim curve analysis, the greatest lateral stick position change occurred at the low trim speeds and was approximately 1 inch right for a 30-knot airspeed change.

39. The control force stability was positive (push force required for a forward stick motion) for all conditions tested. The force stability characteristic, in addition to the control position stability features, contributes heavily to the overall static longitudinal stability in this flight regime. A stronger stability gradient would be desirable; however, an increased trimming capability would be necessary for the pilot to more easily relieve the higher stick forces. Lateral stick forces during airspeed changes from trim were not objectionable (PRS A-2).

Static Lateral-Directional Stability

Static Directional Stability:

40. The static directional stability was positive (left pedal for right sideslip) for all conditions tested. The stability was essentially linear and symmetrical for 15 degrees from zero. The test results are presented in figures 88 through 98, appendix I. There was a general increase in the stability level with higher airspeeds. Directional stability characteristics were very similar to those of the prototype helicopter. At the minimum-power-required speed there was a tendency for the stability to approach neutral at sideslip angles above 40 degrees. This change in stability, with airspeed, was compatible with the general sideslip requirements in the various flight regimes and was satisfactory (PRS A-3). Increasing the rotor speed from 469 to 483 rpm slightly reduced the pedal gradient with sideslip angle. The change was greater at higher airspeeds. Total directional control available was increased with the higher rotor speed. There was no qualitative change in the stability characteristics. At high sideslip angles, objectionable directional "kicks" were present. These "kicks" were possibly caused by disturbing the airflow through the tail rotor and stabilizers. At 50 knots, these were present above 20-degree left sideslips and 10-degree right sideslips, and at 100 knots, 15-degree left sideslips and 8-degree right sideslips. This condition should not cause any operational difficulties.

41. Higher gross weights and altitudes resulted in a slight deterioration of the static directional stability. The characteristics were similar in respect to airspeed and sideslip angle.

At 2100 pounds, the altitude effect was less noticeable than at 2400 pounds. Combinations of high gross weights and altitudes produced the least desirable flying qualities. These stability effects were more significant at low airspeeds. CG changes from forward to aft did not alter the stability characteristics, and the influence of the other variables were as previously discussed.

Effective Dihedral:

42. The effective dihedral was positive at all airspeeds as illustrated in figures 88 through 98, appendix I. This stability characteristic was found to be more positive than that shown by the prototype aircraft. At a low airspeed (53 KCAS) there was no change in the dihedral characteristics for rotor speed changes from 469 to 483 rpm, altitude variations from sea level to 5000 feet and gross weight changes from 2150 to 2400 pounds. For maximum airspeeds, the effective dihedral was decreased by higher altitudes, higher rotor speeds and higher gross weights. These changes were apparent to the pilot and were particularly noticeable when adverse combinations were existent, ie, high gross weight, high altitude and low rotor speeds.

Dynamic Stability

43. Dynamic stability tests were conducted at a rotor speed of 483 rpm, density altitude of 5000 feet, gross weight of 2100 pounds and at a mid CG location. Tests were conducted at 53 and 104 KCAS. Representative time histories are shown in figures 99 through 108. The level of stability was sufficiently high to provide a reasonable pilot workload without detracting from the controllability margins during maneuvering. During high-speed flight in gusty or turbulent air, there was on occasion, a slight pitch-up tendency which is aggravated by load factors or rapid control inputs.

44. The longitudinal dynamic stability was satisfactory at the test airspeeds. The pitch attitude and rate oscillations produced by a controlled, forward pulse input at low speeds were damped within 4 seconds and the maximum nose down attitude was 8 degrees (fig 96, app I). During an aft pulse input, the oscillations were damped out in approximately 6 seconds with a maximum nose up attitude of 10 degrees (fig 97) (PRS A-2). The pitch oscillation at the higher airspeeds took approximately 12 seconds to be damped out. forward or aft pulse input resulted in a

maximum nose up or nose down attitude of 11 and 15 degrees respectively. A pitch-roll couple occurred following a longitudinal input and the residual roll oscillation continued after the pitch oscillation had damped out; however, this was not disconcerting to the pilot (fig 101 and 102) (PRS A-3).

45. The lateral dynamic stability was satisfactory at all test airspeeds. The oscillations created by the lateral pulse input were well damped (PRS A-2). The roll rate increased as a function of increasing airspeed. However, the roll rate damped to 1/2 amplitude within 2 seconds (fig 105, app I) as required by MIL-H-8501A, paragraph 3.2.11.a.

46. The directional dynamic stability of the aircraft was satisfactory. The stability improved with increasing airspeed. A roll-yaw couple occurred following an input at all airspeeds with the roll oscillation increasing at the higher airspeeds. This roll oscillation continued for approximately 4 seconds after the yaw oscillation was damped out within 5 seconds (fig 106 and 107) (PRS A-3). This roll-yaw oscillation was irritating to the pilot during flights in turbulence (para 61).

Controllability

47. Controllability tests were conducted to determine the response rates and sensitivity accelerations resulting from various control inputs. Tests were conducted at a rotor speed of 483 rpm and gross weights of 2100 and 2400 pounds. The results are summarized in figures 109 through 112, appendix I. The helicopter motion was in the proper direction with no excessive time lag or hesitation following a control input. The time phasing of the rate and acceleration build-ups and the time to reach the maximum values were satisfactory. At high airspeed in turbulent air, there may be a tendency to over control which can introduce some blade stall indication and a slight pitching characteristic. The high controllability and rapid response contribute to the overall agility of the helicopter which is well suited for rapid maneuvering or nap-of-the-earth flying.

Longitudinal:

48. The longitudinal control response (maximum rate per inch of control displacement) was satisfactory and met the requirements of MIL-H-8501A, paragraph 3.2.11.1. In a hover, a maximum pitch rate of 23 degrees per second for a forward step and 20 degrees per second for an aft step was reached in an average time of 0.8 second (PRS A-2). During forward flight at an airspeed of 105

KCAS, a maximum pitch rate of 20 degrees per second was reached for a forward input and 13 degrees per second for an aft input. When altitude was increased to 10,000 feet, the maximum pitch rate was 14 degrees per second for a forward input and 11 degrees per second for an aft input (PRS A-2).

49. The longitudinal pitching acceleration characteristics were satisfactory. The angular acceleration was in the proper direction and occurred within 0.2 second after the control displacement. Following an aft longitudinal step displacement, the normal acceleration increased within 0.2 second and became concave downward within two seconds after the initial control movement (PRS A-2). These characteristics fulfill the requirements of MIL-H-8501A, paragraph 3.2.11.1. In a hover at light gross weights, the control sensivity was 21 degrees per second, per second, per inch ($deg/sec^2/in.$).

Lateral:

50. The lateral control response (maximum rate per inch of control displacement) was satisfactory but did not meet the requirements of paragraph 3.3.15 of MIL-H-8501A. In a hover, a maximum roll rate of 31 degrees per second per inch (deg/sec/in.) for a right step and 25 deg/sec/in. for a left step was reached in an average time of 0.6 second. During forward flight a maximum roll response of 21 deg/sec/in. was reached for a right input and 16.5 deg/sec/in. for a left input (PRS A-2).

51. The lateral rolling acceleration characteristics were satisfactory. The angular acceleration was in the proper direction and occurred within 0.2 second after the control displacement. Following a lateral step displacement the angular displacement at the end of 1/2 second was greater than 1.75 degrees (MIL-H-8501A, paragraph 3.3.18) (PRS A-2). In a hover at the light weight, the control sensitivity was 32 $deg/sec^2/in.$ of right displacement and 35 $deg/sec^2/in.$ of left displacement (PRS A-2). During forward flight at an aft CG the average control sensitivity was 57 $deg/sec^2/in.$ of right displacement and 50 $deg/sec^2/in.$ of left displacement (PRS A-2).

Directional:

52. The directional control response was satisfactory (PRS A-2) and met the requirements of MIL-H-8501A, paragraph 3.3.5. In a

hover a maximum yaw rate of 59 deg/sec/in. for a right step and 46 deg/sec/in. for a left step was reached in an average time of 0.8 seconds. During forward flight a maximum directional response of 24 deg/sec/in. was reached for a right pedal input and 21 deg/sec/in. for a left pedal input. As altitude was decreased, the maximum directional response was 20 deg/sec/in. for a right pedal input and 18 deg/sec/in. for a left pedal input.

53. The directional acceleration characteristics were satisfactory (PRS A-2). The angular acceleration was in the proper direction and occurred within 0.2 seconds after the control displacement. Following a rapid pedal displacement of approximately 1 inch, the yaw displacement was less than 50 degrees. This characteristic fulfills the requirement of MIL-H-8501A, paragraph 3.3.7. In a hover at light weight, the control sensitivity was 62 deg/sec^2/in. of right pedal displacement and 60 deg/sec^2/in. of left pedal displacement. During forward flight at an aft CG the average control sensitivity was 40 deg/sec^2/in. of right pedal displacement and 28 deg/sec^2/in. of left pedal displacement (PRS A-2).

Sideward and Rearward Flight

54. The sideward and rearward flight or hovering in wind capability was adequate for most conditions tested. Several restricting or compromising factors were encountered at various conditions and configurations. The test results are presented in figures 144 through 166, appendix I. The testing conducted during the early portion of the program showed that for some conditions during left sideward flight the aft cyclic longitudinal control remaining was less than 10 percent of the total control available. In addition, in the most unstable areas, the stick was intermittently contacting the longitudinal control stops. The test aircraft (S/N 65-12919) had been rigged by Hughes Tool Company (HTC) prior to delivery to USAASTA and had subsequently undergone numerous rigging checks by USAASTA personnel assisted by HTC representatives. The published rigging procedures were used during these checks. A thorough examination of the aircraft by HTC rigging personnel revealed that based on more precise and current procedures than those contained in the maintenance manual, the test aircraft was slightly out of rig. The recommended change by HTC was accomplished and the tests were repeated. With the modified

rigging, the average control position during flight allowed a 10-percent control margin for all conditions tested. The significant change that resulted from a small rigging change (1 degree of longitudinal cyclic pitch) would indicate that the aircraft is unduly sensitive to rigging procedures. The average control positions recorded and presented in the static test results were qualitatively considered to be indicative of, but not wholly conclusive with respect to, the stability and control characteristics in this flight regime. In an attempt to isolate these contributing factors, two additional test techniques were used. Dynamic upsets to the aircraft were simulated by pulse type control inputs about all axes. These were accomplished in calm air with the speed of translation being measured by a calibrated ground pace vehicle. At high and low a .speeds, the dynamic stability was positively dam 1. A disturbance resulted in a different attitude or heading. In the sideward flight regime between 8 and 16 knots, a directional disturbance caused undamped oscillations with the aircraft turning into the direction of translation (relative wind). The characteristic of the motion was such that once started it could not be precisely controlled by the pilot. During rearward flight, a forward pulse caused a rapid nose down pitching and loss of altitude (fig 64-A, app I). On several occasions, with the original rigging, full aft longitudinal control was required to recover from the maneuver. Use of collective control at this time to maintain height aggravates the pitching tendency and increases the longitudinal control equipment. The stability characteristic was independent of CG location; however, it is less critical at the aft CG loading. The control stops were not contacted with the modified rigging (PRS A-5).

55. Tests were also conducted to evaluate the effects of crosswinds and tailwinds on precision approaches. Using surface winds, approaches were made at 90-degree increments for various wind speeds. With wind speeds less than 10 knots, the aircraft was relatively stable and a precision landing could be accomplished. Flying qualities were least desirable and the corresponding pilot effort was highest during left crosswind and downwind approaches. Approaches during wind velocities of 16 knots are illustrated in figures 165 and 166, appendix I. Headwind and right crosswind approaches could be conducted without undue pilot effort. Left crosswind approaches introduced undesirable flight characteristics that were similar to those encountered at the same airspeed during the steady state tests, and extreme pilot effort with large, rapid, control inputs was required to accomplish the

approaches. Under these test conditions, a successful downwind approach was marginal. A disturbance which put the tail "out of wind" introduced a sudden requirement for corrective directional control. Any overcorrecting would then introduce an opposite pedal requirement of such magnitude and rapidity that the pilot could not prevent the helicopter from turning into the wind. The resulting turn was very rapid and a nosedown pitching motion was introduced. Increased collective application at this time contributed additional pitching moments. Depending upon the pitching rate, pilot reaction time and CG location, sufficient aft longitudinal control may not be available. The most important consideration during these types of maneuvers is the proper pilot reaction and the timing of the corrective input. When the pilot is familiar with the aircraft characteristics and is prepared to correct immediately, a downwind approach can be accomplished under the most extreme conditions within the flight envelope.

Qualitative Pilot Comments Regarding OH-6A Sideward and Rearward Flight

56. It is more difficult to stabilize in left sideward flight in the unstable area (8-20 knots). The aft longitudinal control margin was questionable at forward CG in left sideward flight under certain rigging conditions (para 54). Adequate directional control power is available to control aircraft heading relative to aircraft translation but because of high sensitivity it is easy to overcontrol. During right sideward flight, the transmission torque limits can be exceeded because of the left directional pedal requirements (the ease of exceeding the torque limits are a function of gross weight and speed). At 2700 pounds in right sideward flight at speeds above 20 knots, transient values to 100 psi were encountered. In addition to the directional control requirements, the uncomfortable stick position in the aft range increases pilot workload. The slow rate of the longitudinal trim device requires the pilot to tolerate high stick forces (16 to 18 pounds). The trim rate is so slow the pilot probably would not use it unless he had a requirement to operate in the regime for a prolonged period of time. The attention to torque limits at the increased gross weights will result in division of attention possibly resulting in ground contact (the workload appears to be somewhat less at high gross weights). The pilot proficiency required during these maneuvers is quite high. The surprise factor during operational use might be of significant importance. These characteristics are undesirable (PRS A-5).

AUTOROTATIONAL ENTRY

57. The simulated power failures were conducted to determine the maximum safe delay time prior to corrective action. The level flight entry tests were conducted as part of the preparation for the autorotational landing performance tests. The pilot and aircraft reaction to a sudden power loss was simulated by imposing delays on the various flight controls. Test results are presented in figures 167 through 172, appendix I. The tests were conducted at a gross weight of 2400 pounds, and entry rotor speed of 483 rpm, and at sea level altitude. The aircraft characteristics and control requirements were markedly different at airspeeds from hover to the maximum allowable. The best method was to attempt to hold all controls fixed for a specified time after the power reduction. The pilot option was to initiate corrective action when angular rate or attitude were considered excessive about any given axis. This pilot action would then indicate the critical parameter, a realistic time delay and the aircraft recovery conditions. A precise stick-fixed condition was difficult to maintain because of the pilot movements introduced by the aircraft motions, and the instinctive pilot reaction to these motions. As the time delay was increased and a critical parameter was approached, the pilot took corrective action. Based on this, the corresponding time delay should be the expected except for that of an incapacitated pilot.

58. A one-second delay at zero airspeed was not achieved for any controls other than the collective. The most critical control for this flight condition was the directional pedal. The maximum time delay that could be achieved was essentially pilot-reaction time. The corresponding left yaw attitude change was in excess of 60 degrees. Lateral control input closely followed the pedal input, while there was no immediate requirement for longitudinal control. The height change was not significant until the collective was lowered, after which the rate of descent increased rapidly. Minimum, transient rotor speed encountered was approximately 350 rpm (75 percent). Increasing the entry airspeed reduced the critical nature of all the control requirements. A two-second delay could be accomplished on all controls within the airspeed range from 40 to 80 KTAS (PRS A-1). There was no pilot apprehension during the entry. The aircraft's first reaction was to yaw, followed closely by roll, and then pitch. There was little or no altitude loss during the entry and the minimum transient rotor speed was 410 rpm (87 percent). At airspeeds from 80 KTAS to maximum, the yaw became less significant. The allowable delay in corrective lateral stick input

decreased with increasing airspeed and became pilot-reaction time at the maximum speed. Above airspeeds of 110 KTAS, the pitch and roll attitudes after a two-second delay were in excess of 20 and 40 degrees respectively, and resulted in excessive airspeed if not corrected immediately (PRS A-4). This trim change is permissable in accordance with Deviation No. 8 of the detail specification (ref 2, app II). The rotor speed decay rate also increased rapidly with increasing airspeed and was 50 rpm per second at 110 KTAS; however, the rotor rpm increases rapidly after the collective is lowered.

59. Analysis of the angular rate data indicates that the maximum rate occurred at various times after the power reduction, and was usually less than one second. As a result, data obtained at any stipulated time after the power reduction can be somewhat misleading. The maximum rate that occurred during the entry is a better indicator of the aircraft reaction and is perhaps a primary pilot reaction cue. In a similar manner, the maximum attitude change also occured at different times and in some cases was reached after the corrective action had been initiated. It is, however, indicative of what might be expected with an imposed delay or a pilot-reaction time based on a critical parameter.

BLADE STALL

60. A blade stall investigation was conducted and the results are presented in figures 50 and 51, appendix I. The recommended V_{NE} envelope is realistic for smooth air operation. Adequate blade stall warning is provided by a four per rev feedback through the cyclic during light blade stall, and collective feedback during heavy blade stall and an increase in four per rev sound level (PRS A-1).

FLYING QUALITIES IN TURBULENT AIR

61. The OH-6A flying qualities appear to deteriorate rapidly as a function of turbulence. During moderate-to-heavy turbulence under level flight conditions the directional heading changes are approximately ±5 degrees of desired heading at V_{NE} (as noted on the Radio Magnetic Indicator (RMI)). In turbulence, at airspeeds above 100 KIAS, more frequent control inputs are required to correct undesired aircraft motion, even though blade stall may not be encountered. (The recommended turbulence, penetration speed in the operator's manual is 80 knots.) A small amount of lateral cyclic friction is desired to damp out undesirable

lateral control feedback. During maneuvering flight in turbulence at airspeeds in excess of 100 knots, collective excursions and aircraft motion are disconcerting to the pilot, although adequate control is available (PRS A-3).

VIBRATION

62. Qualitatively, vibration characteristics within the recommended flight envelope are satisfactory (PRS A-1).

APPROACHES AND LANDINGS

63. Except for those conditions noted in paragraph 55, normal and precision approaches are very comfortable in the OH-6A helicopter (PRS A-1). Initially, there was a tendency to overshoot the landing area. Rotor rpm control is excellent. The skid landing gear is not adequate for continuous running landings on hard surfaces (see EIRU 72013). It is recommended that auxiliary skid shoes be incorporated to protect the skid tubes. Visibility during approaches is excellent. Touchdown attitude is slightly left-skid first. No ground resonance tendencies were noted during landing.

NOISE LEVEL AND VENTILATION

64. Noise level is satisfactory with a custom fitted helmet; however, a reduction in noise level is desirable. The noise level increased significantly with the doors removed. Ventilation is adequate in forward flight (PRS A-3).

GENERAL AIRCRAFT EVALUATION

Cockpit Evaluation

Entry and Exit:

65. Cockpit entry to the pilot's seat is accomplished using the handhold on the upper, forward position of the door frame and placing the right foot on the floor. The handhold location and design are satisfactory. The cyclic stick extends forward from underneath the seat and cannot be moved to a position that will permit ease of entry and seating. The pilot's leg must be raised over the cyclic stick. This could create difficulties to the unfamiliar pilot or an observer while the rotor is turning, and could be hazardous. In addition, the cyclic control is

exposed from the underside and loose equipment or an observer's foot can interfere with control motions. Door closing and latching is satisfactory; however, an improper door rigging will cause the latches to seat improperly against the strike plate. This may result in an inadvertent door opening during flight. Cockpit exit is accomplished in the reverse order of cockpit entry.

Emergency Exit:

66. Emergency door releases are provided for the jettison of the doors. The location of the release handle on the forward portion of the door frame is satisfactory. However, the handles are small and not adequately marked. The door jettison design is such that the actuation of the door jettison does not release the door latch. As a result, the door will not separate from the helicopter unless the door has been previously unlocked. This is inadequate and does not provide a true emergency exit capability.

Pilot's Seat Adjustment:

67. No seat adjustment is provided. The seat control geometry is satisfactory for all conditions other than the extremes. Full aft- and right-cyclic control requires a high degree of manual dexterity and is extremely uncomfortable. To achieve this control position, the pilot must hold the stick in an unusual manner which introduces a different control feel. Depending on the shoulder harness adjustment and pilot size, the stick may contact the right leg or stomach and the right elbow may contact the door handle. This is because of the bend in the cyclic stick and the neutral, longitudinal, cyclic-stick position (30 percent from full aft). A modified cyclic stick was evaluated on S/N 65-12927 and the problem was corrected. This modified, cyclic stick moved the stick grip approximately 1 1/2 inches forward of the previous position.

Cockpit Seating:

68. Headroom is adequate when seated and the seating comfort is very good when not wearing a parachute. If parachutes are required, the seat backs are removed to provide space. The seating comfort without parachutes is satisfactory for long periods of time (up to 3 hours).

Passenger Seating:

69. The passenger seats in the cargo compartment are not as comfortable as the cockpit seats but are adequate for the accomplishment of the intended mission.

Visibility on Ground:

70. Visibility on the ground is very good.

Pedal Adjustment:

71. Pedal adjustment is accomplished by removing the safety pin and placing the rudder pedal in one of the three positions available. The pedal adjustment is important since the seat is not adjustable. The adjustment is considered adequate for the mission of the helicopter.

Trim Device:

72. A cyclic trim control is located at the top of the cyclic grip. A pair of electrically operated actuators is used to vary the spring tension within the longitudinal and lateral trim units. The trim control is a 5-position switch. The positions are "off" in the center and momentary "forward," "aft," "left" and "right." It was determined that trim motor position could affect control-travel available and that trim motor position (neutral) was important during rigging operations. The longitudinal trim rate (approximately 3.3 seconds per inch of stick trim) was too slow to cope with moderately rapid, longitudinal-trim changes. The lateral trim rate was adequate for the lateral-trim changes necessary for normal flight. It was recommended (EIR 472010) that a trim motor with a faster rate be evaluated. This was accomplished on helicopter S/N 65-12927, and the increased trim rate was considered a significant improvement. Increasing the lateral trim rate produced no detrimental effects.

Heater Operation:

73. The heater operation and location of the control was considered adequate for the ambient conditions encountered. On helicopter S/N 65-12919, the heater control lever was damaged by normal use and should be improved.

Fuel System:

74. The fuel valve control, labeled "Pull to Close", is a push-pull knob, located on the electrical-control and circuit-breaker panel,

which mechanically actuates the fuel shutoff valve located on the fuel tank. The valve operation is such that it would be highly improbable to operate it inadvertently. The valve is difficult to operate under certain emergency conditions.

Flight Control System:

75. The description of the flight control system is contained in appendix III. Adequate, although slow, longitudinal and lateral trim devices are installed to compensate for control forces. The unboosted system enables the pilot to recognize the beginning of a blade stall, which is manifested by the feedback through the cyclic stick (approximately 4 per rev) during mild blade stall. During heavy blade stall, the feedback through the collective control provides the pilot with the warning that corrective action should be taken. This system is characterized by a lack of complexity, resulting in ease of maintenance, and is a desirable feature.

Radio and Navigation Equipment:

76. UHF communication is provided by an AN/ARC-51BX. The UHF installed on the test aircraft provided excellent communication. The FM communication and navigation equipment was removed to provide space for test instrumentation in the test aircraft.

Instrument Panel:

77. Flight instrument arrangement and location are adequate, but a vertical speed indicator would be a desirable addition. At low airspeeds, the production airspeed system fluctuates excessively and gives erroneous indications. Engine-instrument size, grouping and identification are good. The location of the rpm selector switch (beep control) is satisfactory.

Warning Lights:

78. The red warning lights are satisfactory as to size, location and function. It would be desirable to include a low rotor rpm indicator in addition to the "Engine Out" warning light. The "Engine Out" warning light and aural signal activate when engine N_1 speed drops below 55 percent N_1. This indication is good during partial-power and practice autorotation approaches. In other flight conditions, the pilot would use other cues such as control feedback and change in transmission noise level, to identify an engine failure. The yellow caution lights are difficult to see when the sunlight reflects on them.

Instrument Lighting:

79. The instrument lighting is satisfactory.

Fuel Quantity Instrument:

80. The fuel quantity indication is underdamped, causing large continuous fluctuations in flight. This is undesirable.

Twist Grip:

81. The throttle twist grip and friction adjustment are satisfactory.

Cyclic Friction:

82. Cyclic friction adjustment geometry and actuation are marginally acceptable, but improvement is desirable. The location of the cyclic friction makes it awkward to operate and the high gearing ratio requires an excessive number of turns to accomplish a change in setting. Full on to full off friction requires six turns for the lateral and seven turns for the longitudinal control. The knobs require three or four motions to achieve a full turn because of their size. This design appears to be a step backwards from existing designs.

Collective Friction:

83. The collective friction control is marginally acceptable. Depending on the aircraft rig and flight condition, the collective control may tend to creep upward or downward. A fine adjustment of added collective friction is necessary to correct this situation. However, it is difficult to add the right amount. A slight movement of the control may be too much collective friction and binding will occur.

Rotor Brake:

84. No rotor brake is provided. In high winds (25 knots) no problems were encountered during rotor engagement or shutdown.

Cargo Provisions:

85. Cargo provisions are adequate for the intended mission.

Engine Starting Procedure:

86. The most "comfortable" arrangement of depressing the starter button, until an N_1 ground idle speed is achieved, was by placing the right hand underneath the left leg. The left hand is used to operate the throttle and detent in the event of an aborted start. On the first engine installed the time required to accelerate to ground idle was up to 40 seconds which was considered unacceptable for field operation. Considerable liaison was affected with the engine manufacturer and the problems associated with the starting were corrected. Apparently the combinations of various tolerances in fuel control rigging were critical. The problems were apparently corrected since starts eventually were acheived in less than 20 seconds. Since it is required that the cyclic control be in neutral position during engine start, a simple means of identifying neutral, longitudinal and lateral cyclic stick position should be provided.

Control Response:

87. Control response can be observed during ground operation by moving the controls and observing the tip, path planes. No dead spots were noted.

Ventilation During Ground Operation:

88. No provision is made for ventilation on the ground except by removing the doors. Fumes were not noted during engine idle unless a downwind condition was encountered.

Noise During Ground Clearance:

89. Noise was not objectionable with custom fitted helmets.

Rotor Ground Clearance:

90. Ground crew must be aware of the tail rotor at all times and the main rotor on uneven terrain.

Ground Resonance Tendencies:

91. No ground resonance tendencies were encountered. The struts were serviced in accordance with the maintenance manual.

MAINTENANCE CHARACTERISTICS

Favorable Characteristics

92. The favorable characteristics are as follows:

a. The absence of a hydraulic system is a very desirable maintenance factor.

b. The light weight of the aircraft allows ease of ground handling.

Unfavorable Characteristics

93. The unfavorable characteristics are as follows:

a. No integral steps or work platforms are provided to allow maintenance personnel to inspect the main rotor head components.

b. The replacement of the windshields is difficult and time consuming.

c. The aircraft is sound structurally; however, as indicated by the EIR's submitted, the secondary structure materials appear to be of insufficient strength, which requires additional inspection and maintenance.

d. Jacking of the helicopter for purposes of weighing or maintenance of the landing gear is a very precarious operation because of the location of the jack points in relation to the landing gear. (The landing gear is too close to use tripod jacks and the skids move inward when weight is removed from the skids.) The jack points are so high that blocks have to be used under axle jacks.

e. Battery location and the absence of an electrical quick disconnect create a hazard in the event of an electrical fire or an overcharged battery.

f. Inability to balance the tail rotor assembly in the field creates the necessity for additional spares.

g. No handholds are provided for ground handling.

h. Excessive maintenance is required to replace the landing gear skid tubes. The skid tubes cannot be replaced without removal of the support struts. Special tools are required to attach the tube to the strut.

i. EIR's have been submitted for the following:

Nomenclature	Control No.
Actuator assembly, longitudinal cyclic trim	U72010
Battery, Ni-Cad	Z57691
Skid assembly, LC LH	U72013
Exhaust pipe	U72107
Exhaust tail pipe	U72120
Exhaust tail pipe	U72100
Exhaust tail pipe	U72093
Swash plate assembly	U72101
Swash plate assembly	U72111
Cyclic stick guard assembly	U72002
Landing gear skid	U72129
Connecting links	U72005
Longitudinal and lateral friction knob	U72011
Circuit breaker	U72015
Engine access door latch	U72244
Terminal board-TB2	U72240
Door assembly handle	U72241
Cargo latch cable assembly	U72123
Canopy and windows	U72246
Blade assembly, T RTR	Y72086
Pitot-static system	Z57690
Right pedal bracket assembly	U72103

CONCLUSIONS

GENERAL

94. The following conclusions were reached upon completion of the OH-6A Phase D tests:

a. The OH-6A met all performance guarantees except the hover ceiling OGE standard day at alternate gross weights (paras 11, 17, 25 and 26). The T-63 engine exceeded the fuel flow of the 580F engine model specification engine by 2 percent.

b. The OH-6A stability and control tests revealed no safety-of-flight considerations and handling qualities were considered very good (para 12 and 32 through 52).

c. The OH-6A met the detail specification weight requirements (paras 13 and 14).

d. The OH-6A hover performance is excellent for a helicopter of this size and weight class at the design gross weight (2163 pounds), and up to the alternate 1A gross weight (2400 pounds) (para 17).

e. Power management was excellent (paras 22, 27 and 30).

f. A region of random instability occured at the best rate-of-climb speed (para 24).

g. A degradation in level flight performance resulted from removal of the aft cargo doors (para 25).

h. A rotor overspeed condition can be encountered during autorotational descent at high gross weights (para 29).

i. During sideward and rearward flight, adequate control is available, but is is easy to over-control making precision tasks difficult (paras 54 and 56).

j. Adequate blade stall warning is provided by a four per rev feedback through the control system (paras 60 and 75).

k. Flying qualities deteriorate rapidly in turbulent air (para 61).

l. The high controllability and rapid response of the helicopter is well suited for rapid maneuvering and nap-of-the-earth flying (para 47).

m. The lateral control response did not meet the requirements of MIL-H-8501A, paragraph 3.3.15, but was satisfactory (para 50).

n. Vibration characteristics within the recommended flight envelope are satisfactory (para 62).

o. The seating comfort is satisfactory up to three hours (para 62).

p. The increased cyclic trim rate motor evaluated on the aircraft S/N 65-12927 was a significant improvement over the existing system (para 72).

q. The absence of a hydraulic or control boost system is desirable (paras 75 and 92a).

r. No vertical speed information is provided on the instrument panel (para 77).

s. The secondary structure appeared to be of insufficient strength which required additional inspections and maintenance (para 93c).

DEFICIENCIES AND SHORTCOMINGS AFFECTING MISSION ACCOMPLISHMENT

95. Correction of the following deficiencies is mandatory for acceptance of the aircraft.

a. The emergency door release does not provide true emergency exit capability (para 66).

b. Battery location and the absence of an electrical disconnect create a hazard in the event of an electrical fire or an overcharged battery (para 93c).

c. The inability to balance the tail rotor assembly in the field creates the necessity for additional spares (para 93f).

96. Correction of the following shortcomings is desirable for improved operation and mission capabilities.

a. At high gross weight and various altitude/temperature conditions care must be exercised to prevent exceeding the transmission torque and/or turbine outlet temperature limitations (paras 17, 22 and 56).

b. The rate of the production cyclic trim motor is too slow (paras 21, 56 and 72).

c. The standard airspeed system was unreliable during takeoff because of large fluctuations at low speeds IGE (para 22).

d. Autorotation landing performance varied from very good at the design gross weight of 2163 pounds, to poor at the structural limit gross weight of 2700 pounds (para 31).

e. Rigging procedures will effect the amount of control margin available in sideward and rearward flight (paras 54 through 56).

f. Stick positions in the aft range of stick travel increase pilot discomfort (paras 56, 65 and 67).

g. Autorotational entries with a 2-second delay, at airspeeds above 110 KTAS, resulted in pitch and roll attitudes in excess of 20 and 40 degrees respectively. This results in excessive increase in airspeed (para 58).

h. The landing gear does not have adequate wear resistance for continuous, running landings on hard surfaces (paras 63 and 93h).

i. The cyclic control is exposed from the underside, and loose equipment or an observer's foot can interfere with control motions (para 65).

j. The fuel quantity indicator needle is underdamped, causing large continuous fluctuations in flight (para 80).

k. The cyclic friction adjustment is marginally acceptable (para 82).

l. The collective friction control is marginally acceptable (para 83).

m. No integral steps or work platforms are provided (para 93a).

n. The replacement of the windshields is difficult and time consuming (para 93b).

o. No handholds are provided for ground handling (para 93g).

p. Excessive maintenance time is required to replace the landing gear skid tubes (para 93h).

RECOMMENDATIONS

97. Deficiencies of the OH-6A helicopter which should be corrected as soon as possible are as follows:

a. The emergency door releases should provide a true emergency capability (para 66).

b. A battery quick disconnect should be incorporated (para 93e).

c. Methods should be developed to permit tail rotor balancing in the field (para 93f).

98. The shortcomings which should be corrected on a high priority basis are as follows:

a. Consideration should be given to improving autorotational performance at the high gross weight and altitude/temperature conditions (para 31).

b. Operation of the OH-6A should be limited to the Alternate 1A gross weight except for emergency use (paras 17, 18, 22, 31 and 56).

c. A faster rate cyclic-control-trim motor should be incorporated (paras 31, 56 and 72).

d. The standard airspeed system should be improved for low speed (less than 30 KTS) IGE (para 22).

e. The flight manual should be revised to show an indicated climb airspeed at least 10 KIAS higher than best rate-of-climb airspeed for improved flying qualities (para 24).

f. Flying qualities should be improved in sideward and rearward flight (paras 54, 55 and 56).

g. The stick grip location should be moved approximately 1-1/2 inches forward of the present position (paras 56, 65 and 67).

h. Improvement of directional trim change characteristics is desirable for autorotational entries at high speed (para 58).

i. Minimum rotational airspeed, for maximum takeoff performance, should be 30 KIAS (paras 20 and 22).

j. Flying qualities in turbulent air should be improved (para 61).

k. The landing gear skid tubes should be redesigned to provide additional wear resistance (paras 63 and 93h).

l. The cyclic control should be protected from possible interference (para 65).

m. A fuel boost pump should be incorporated (para 74).

n. A vertical speed indicator should be added to the instrument panel (para 77).

o. Improve the cyclic friction control (para 82).

p. Improve the collective friction control (para 83).

q. Integral steps or work platforms should be provided (para 93a).

r. Windshield replacement capability should be improved (para 93b).

s. Secondary structure strength should be improved (para 93c).

t. Handholds should be provided for ground handling (para 93g).

APPENDIX I. TEST DATA

FIGURE NO. 1
SUMMARY HOVERING PERFORMANCE
OH-6A S/N 65-12[illegible]7
TAKEOFF POWER
ROTOR SPEED = 483 RPM
N_2 = 103%

NOTES:

1. SHP based on Engine Model Specification 580-F. (REF 9)
2. Below critical altitude SHP based on maximum allowable torque.
3. Above critical altitude SHP based on turbine outlet temperature limit.
4. Wind less than 2 knots.

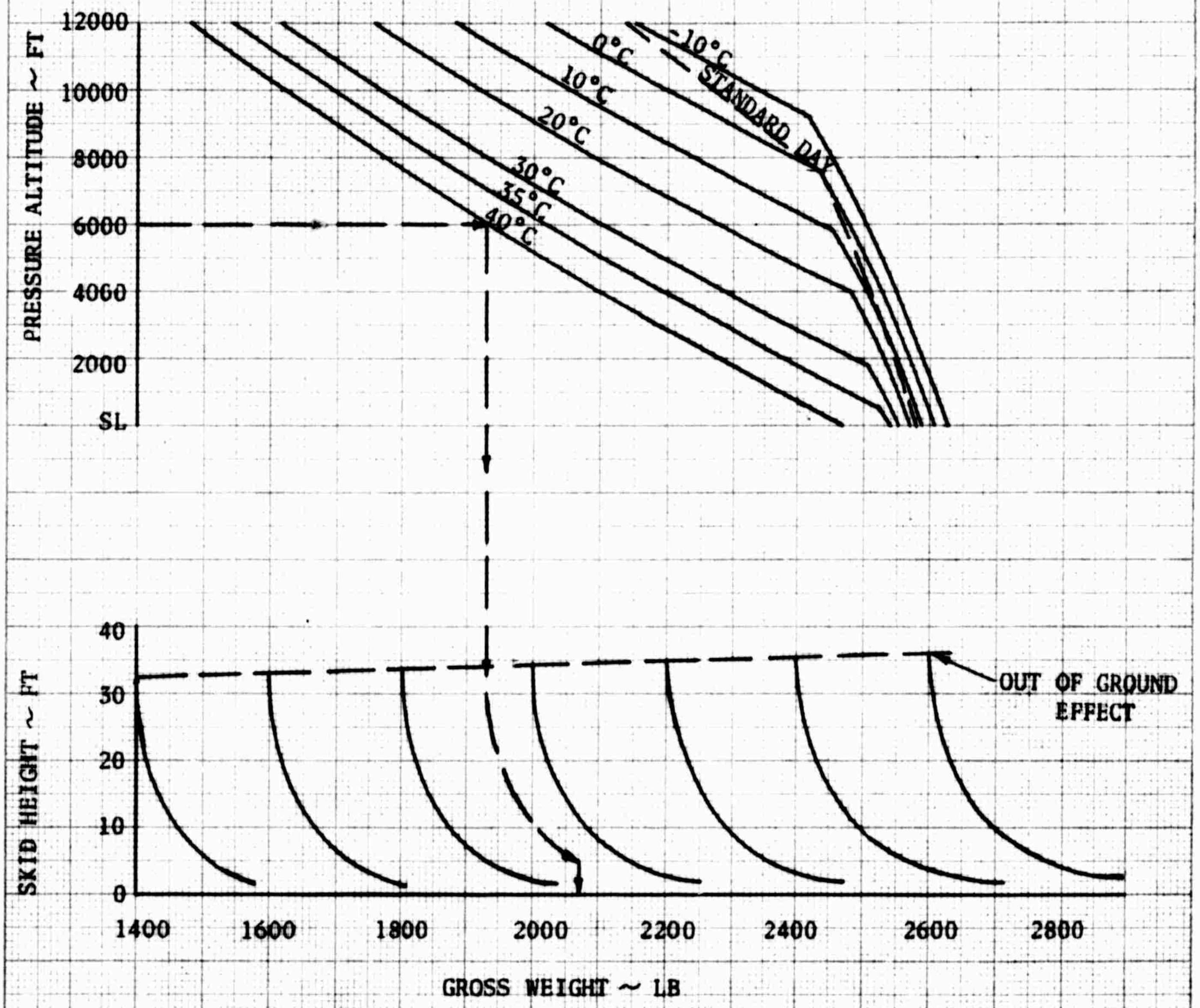


FIGURE NO. 2
SUMMARY HOVERING PERFORMANCE
OH-6A S/N 65-12967
MAXIMUM CONTINUOUS POWER
ROTOR SPEED = 483 RPM
N_2 = 103%

NOTES:
1. SHP based on Engine Model Specification 580-F. (REF 9)
2. Below critical altitude SHP based on maximum allowable torque.
3. Above critical altitude SHP based on turbine outlet temperature limit.
4. Wind less than 2 knc s.

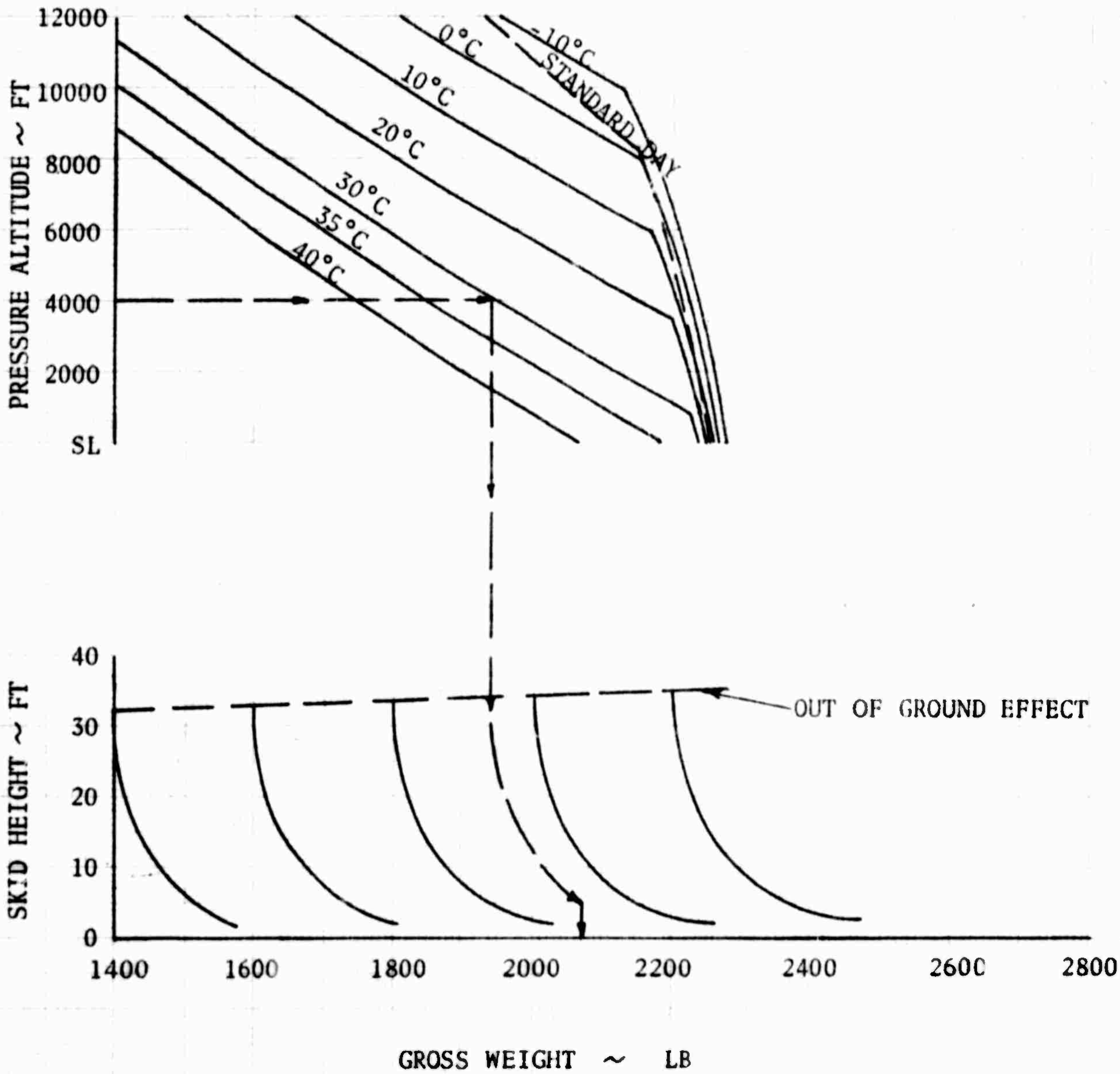


FIGURE NO. 3
SUMMARY HOVERING PERFORMANCE
OH-6A S/N 65-12967
TAKEOFF POWER
ROTOR SPEED = 469 RPM
IN GROUND EFFECT (4 FOOT SKID HEIGHT)
N_2 = 100%

NOTES:
1. SHP based on Engine Model Specification 580-F. (REF 9)
2. $T_{T_2} - T_a = 0°$
3. $P_{T_2}/P_a = 0.998$
4. Generator load (HP_{ext}) = 1.2 HP
5. SHP based on exhaust extension losses as defined in Figure 63
6. ▫ Hover guarantee

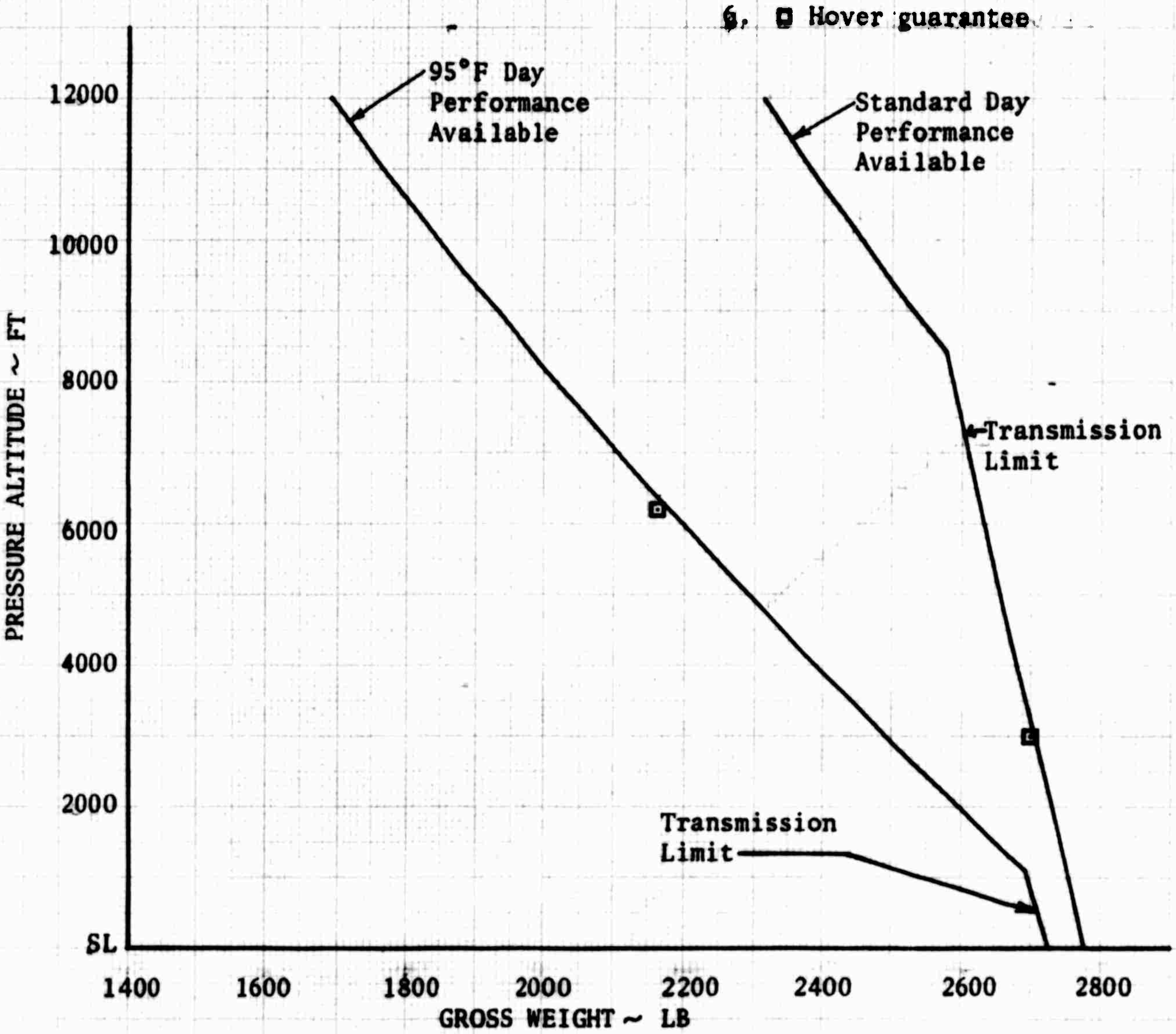


FIGURE NO. 4

SUMMARY HOVERING PERFORMANCE

OH-6A USA S/N 65-12967

TAKEOFF POWER

ROTOR SPEED = 469 RPM

OUT OF GROUND EFFECT

N_2 = 100%

NOTES:

1. SHP based on Engine Model Specification 580-F. (REF 9)
2. $T_{T_2} - T_a = 0°$
3. $P_{T_2} / P_a = 0.998$
4. Generator load (HP_{ext}) = 1.2HP
5. SHP based on exhaust extension losses as defined in Figure 63
6. ◘ Hover guarantee

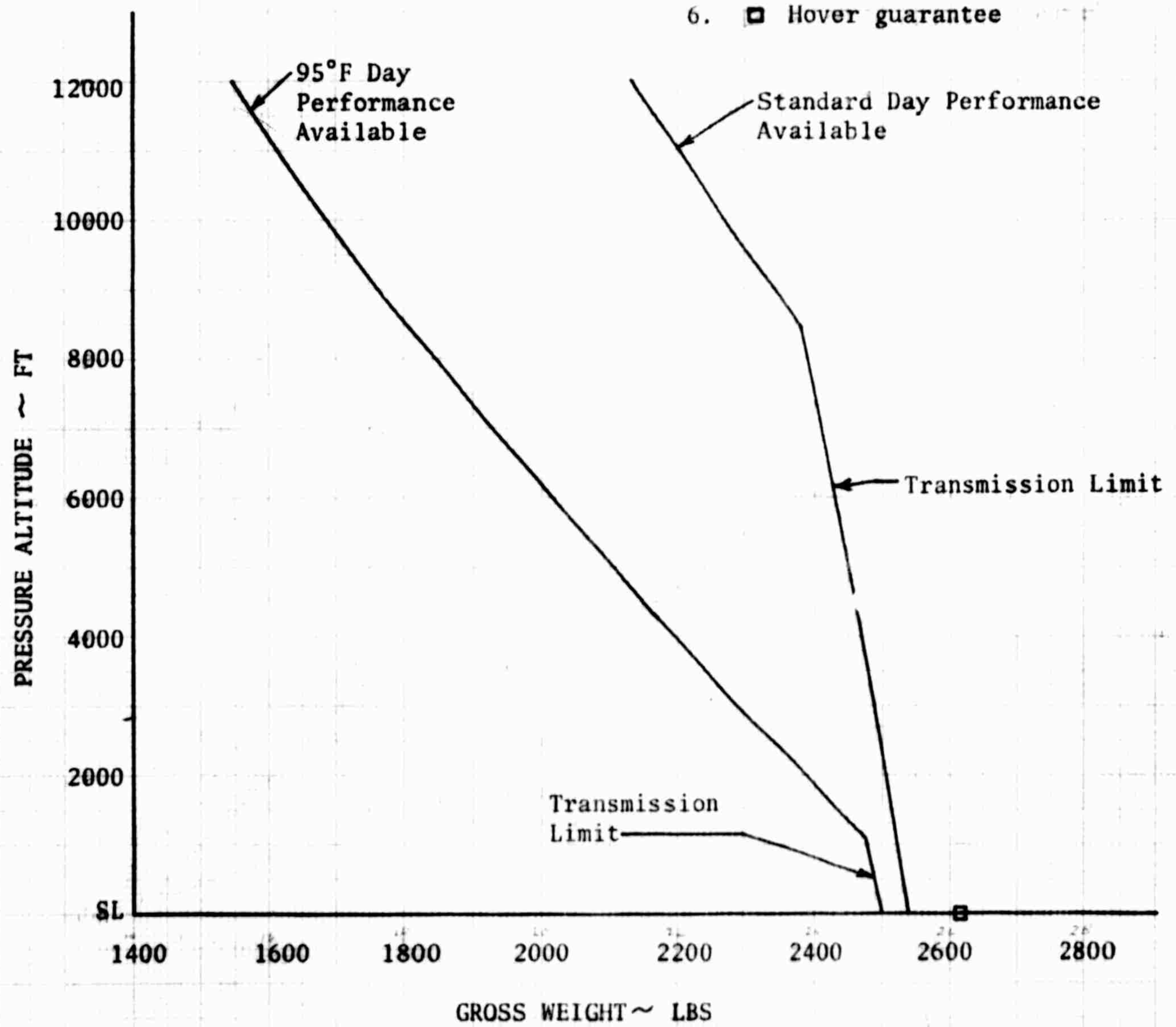


FIGURE NO. 5
SUMMARY HOVERING PERFORMANCE
OH-6A S/N 65-12967
TAKEOFF POWER
ROTOR SPEED = 483 RPM
IN GROUND EFFECT (4 FOOT SKID HEIGHT)
N_2 = 103%

NOTES:
1. SHP based on Engine Model Specification 580-F. (REF 9)
2. $T_{T_2} - T_a = 0°$
3. $P_{T_2}/P_a = 0.998$
4. Generator load (HP_{ext}) = 1.2 HP
5. SHP based on exhaust extension losses as defined in Figure 63

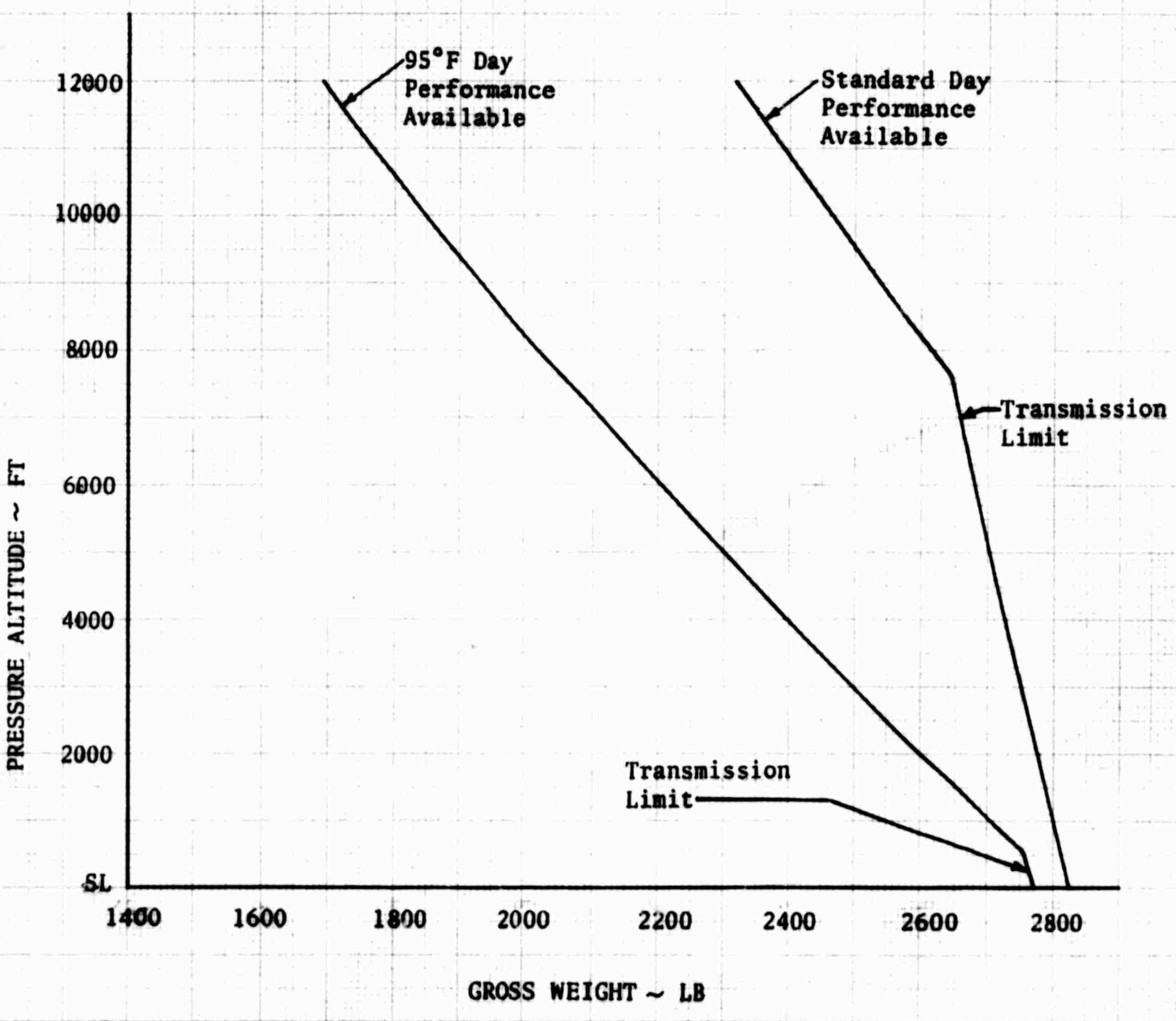


FIGURE NO. 6
SUMMARY HOVERING PERFORMANCE
OH-6A USA S/N 65-12967
TAKEOFF POWER
ROTOR SPEED = 483 RPM
OUT OF GROUND EFFECT
N_2 = 103%

NOTES:
1. SHP based on Engine Model Specification 580-F. (REF 9)
2. $T_{T_2} - T_a = 0°$
3. $P_{T_2}/P_a = 0.998$
4. Generator load (HP_{ext}) = 1.2 HP
5. SHP based on exhaust extension losses as defined in Figure 63

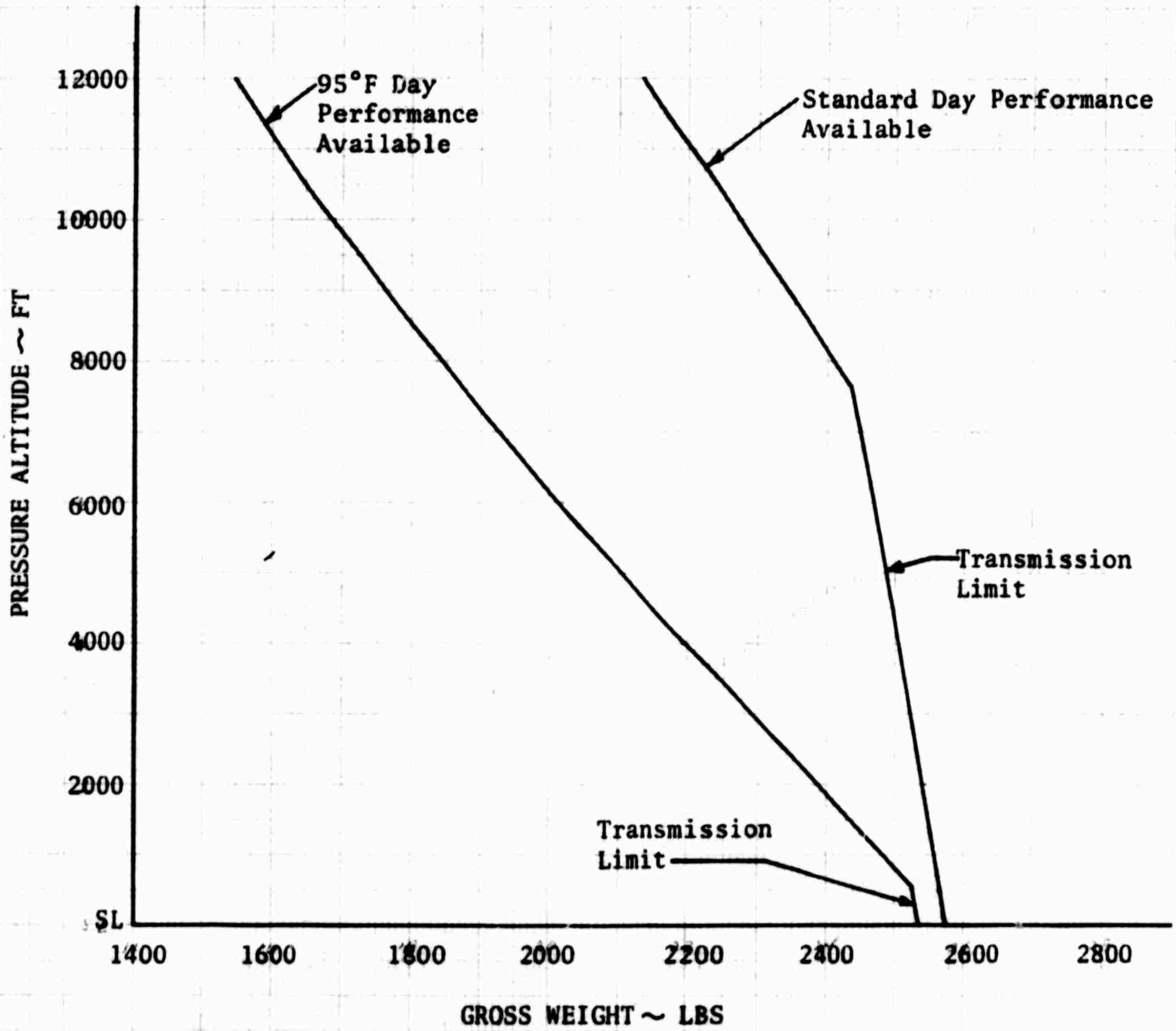


FIGURE NO. 17
HOVERING PERFORMANCE
OH-6A USA S/N 65-12967
FREE FLIGHT METHOD
WINDS LESS THAN 2 KNOTS

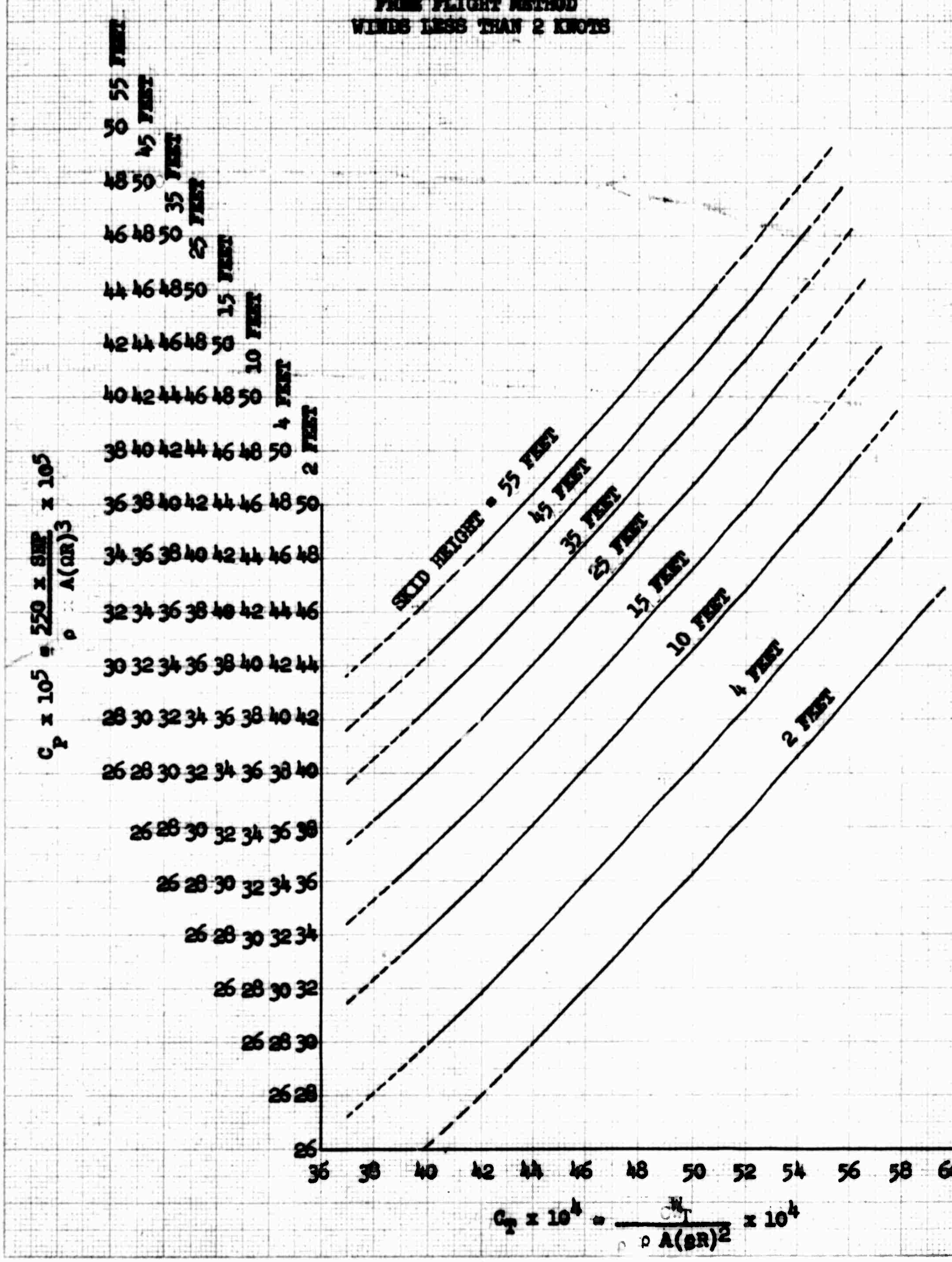


FIGURE NO. 8
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 2 FT.
FREE FLIGHT METHOD
WINDS LESS THAN 2 KNOTS

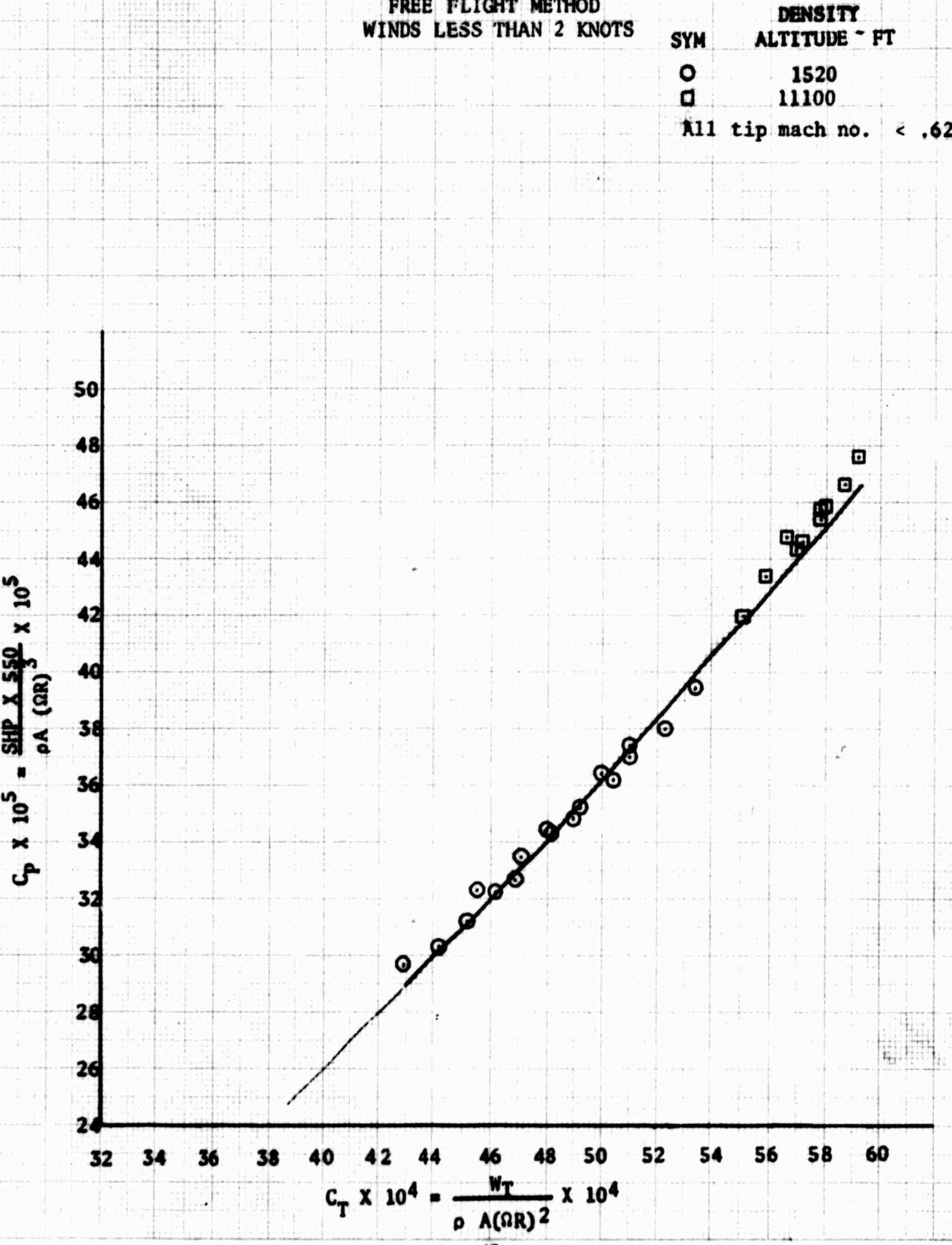


FIGURE NO. 9
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 4 FT.

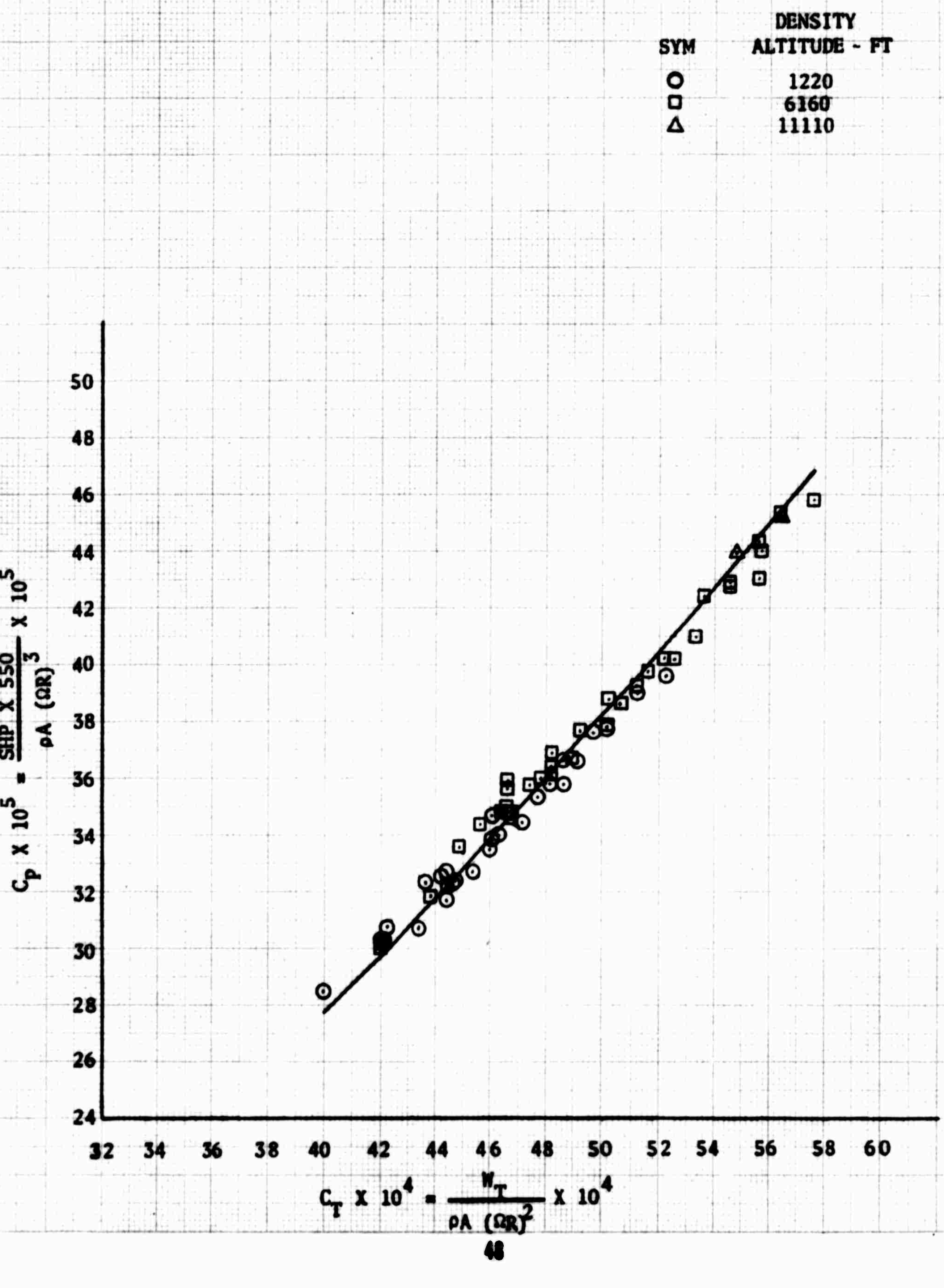


FIGURE NO. 10

NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 10 FT.

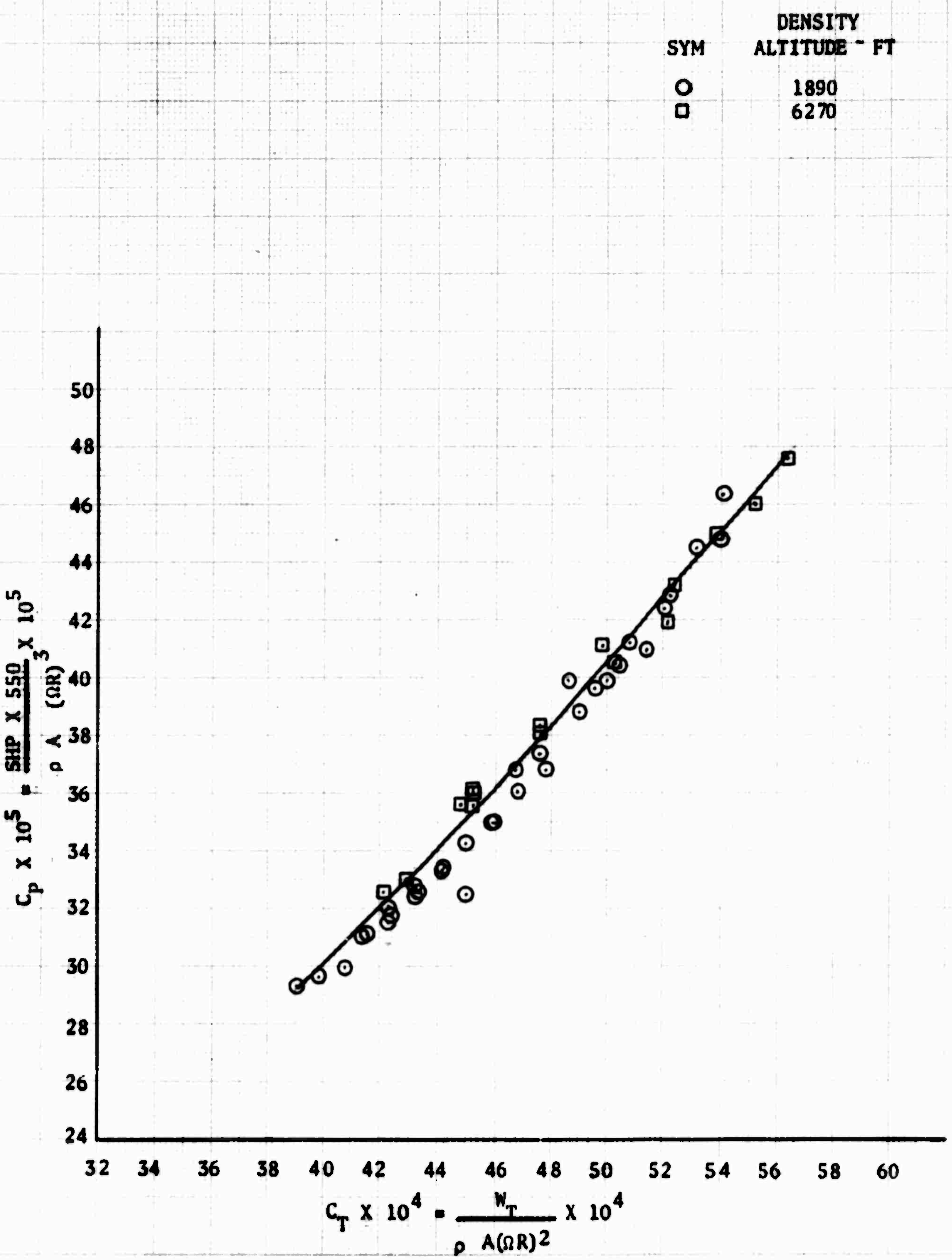


FIGURE NO. 11
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 15 FT.

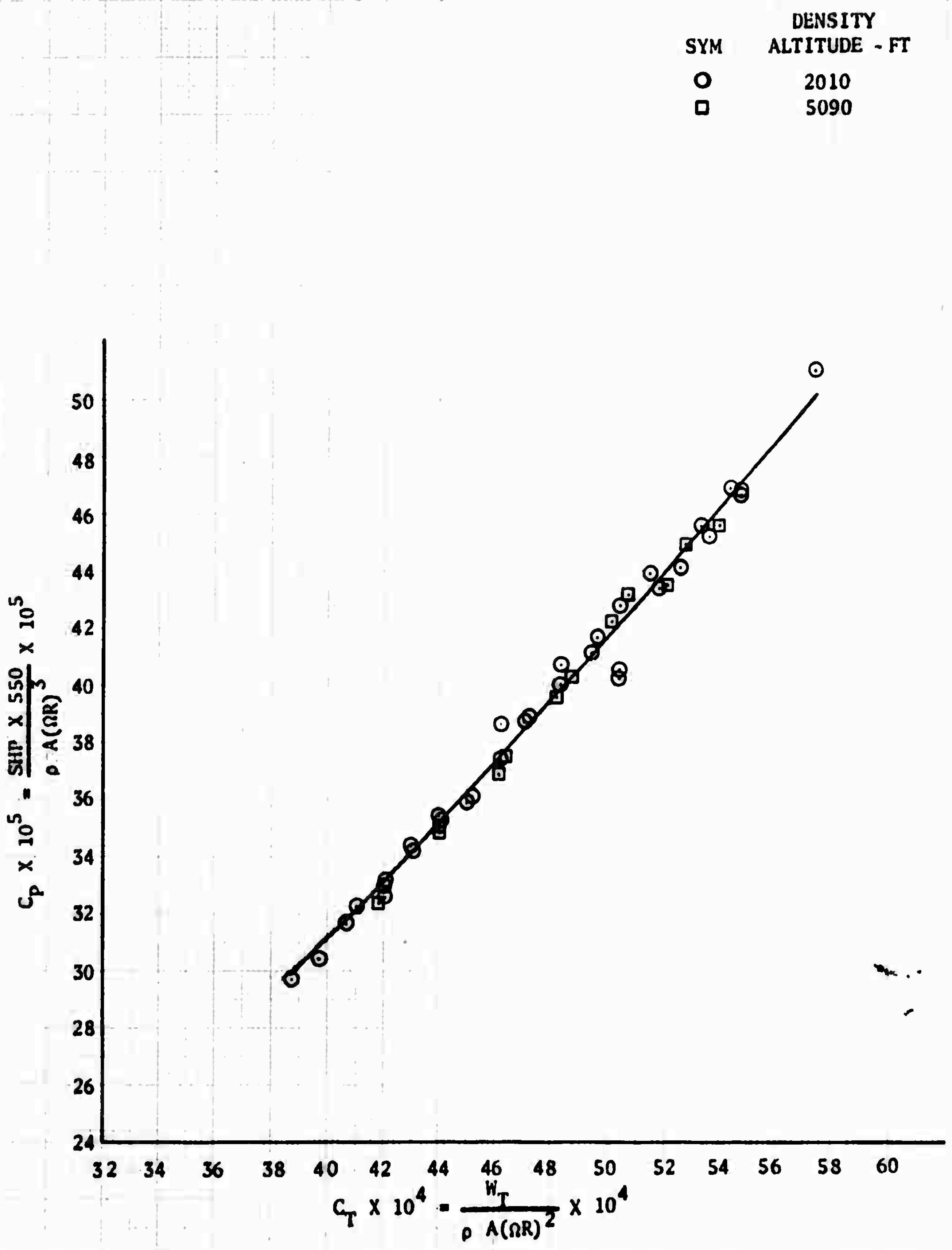


FIGURE NO. 12
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 25 FT.

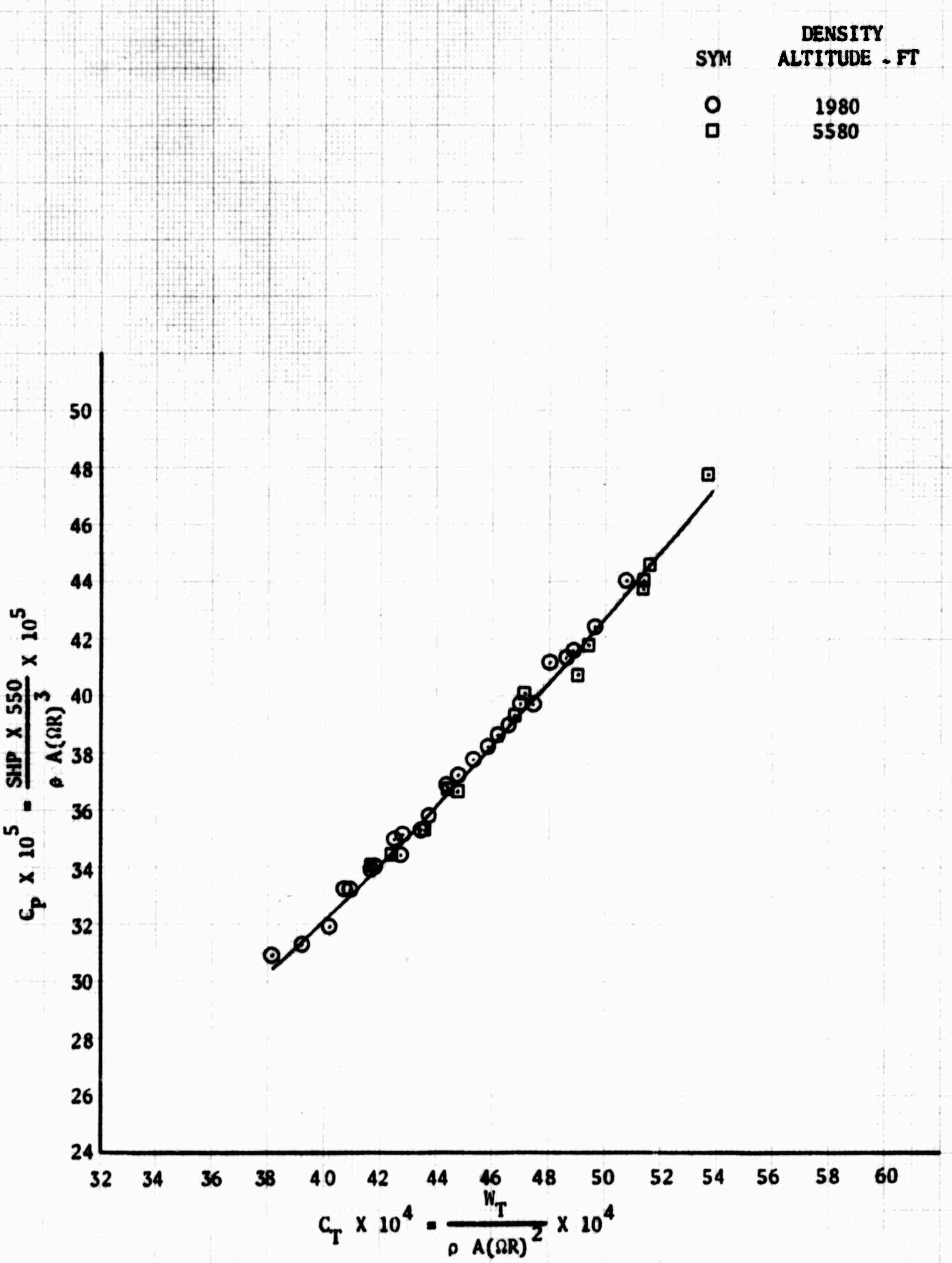


FIGURE NO. 13
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 35 FT.

SYM	DENSITY ALTITUDE - FT
○	1690
□	5650

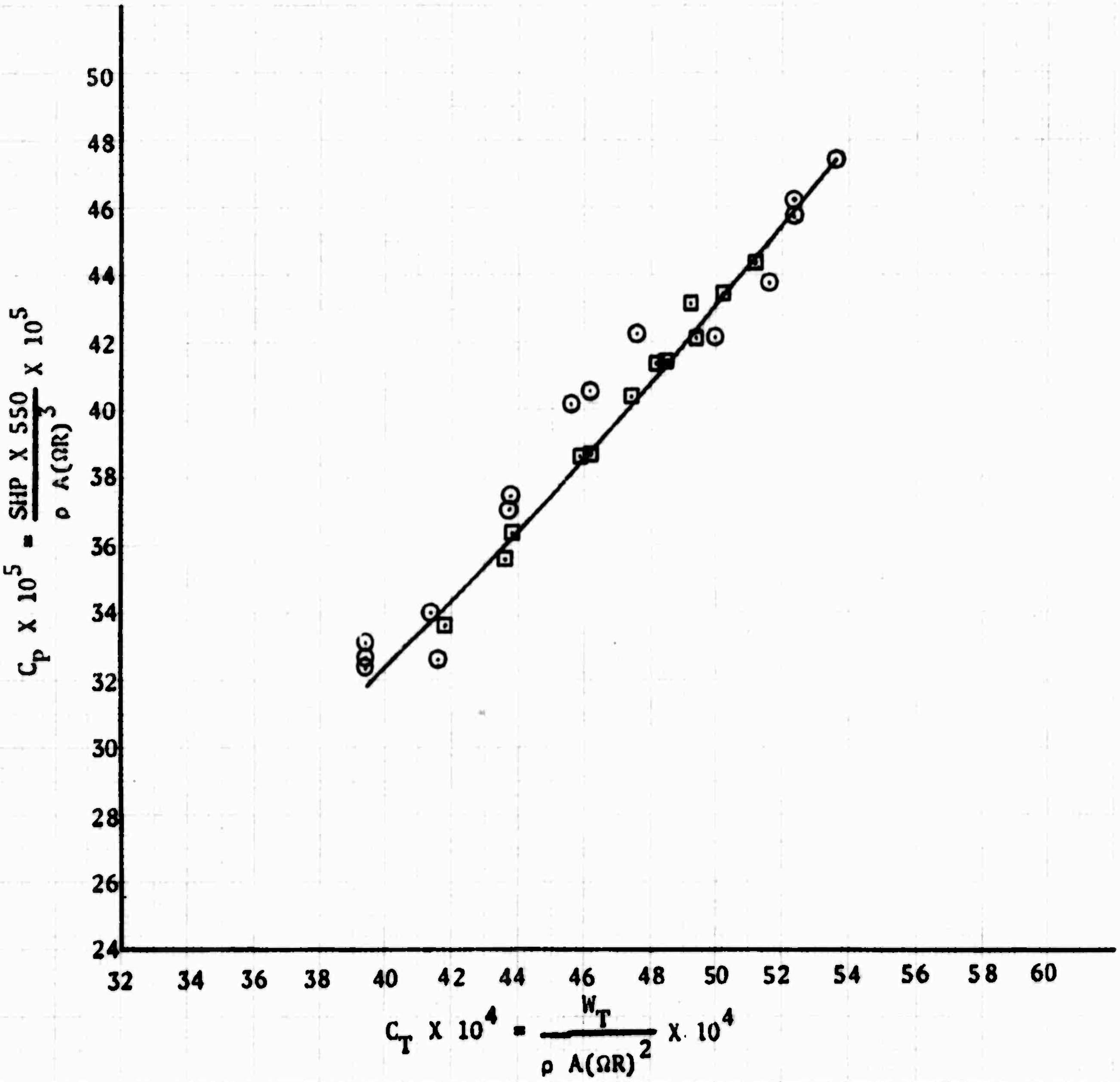


FIGURE NO. 14
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 45 FT.

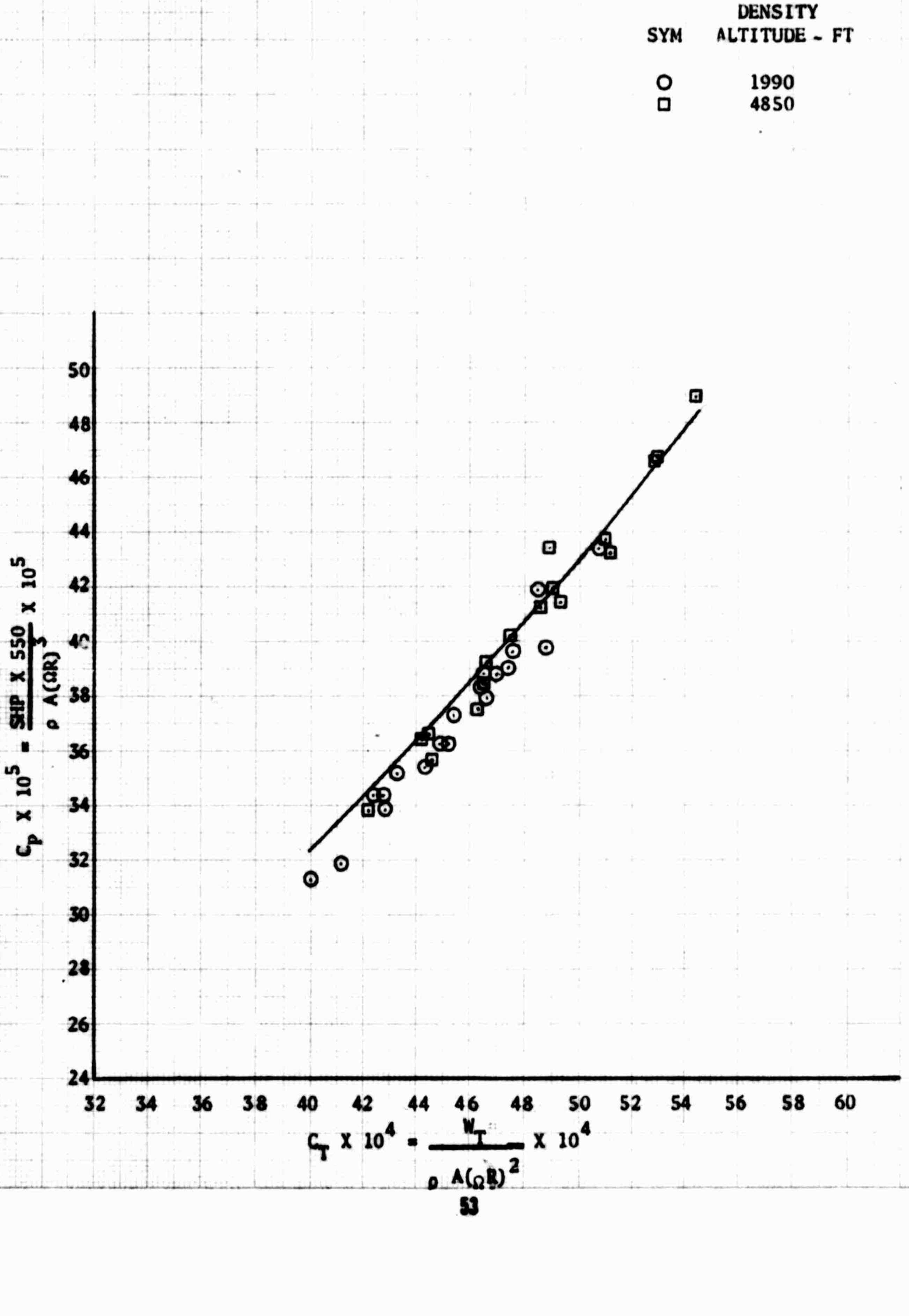


FIGURE NO. 15
NON-DIMENSIONAL HOVERING PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
SKID HEIGHT = 55 FT.

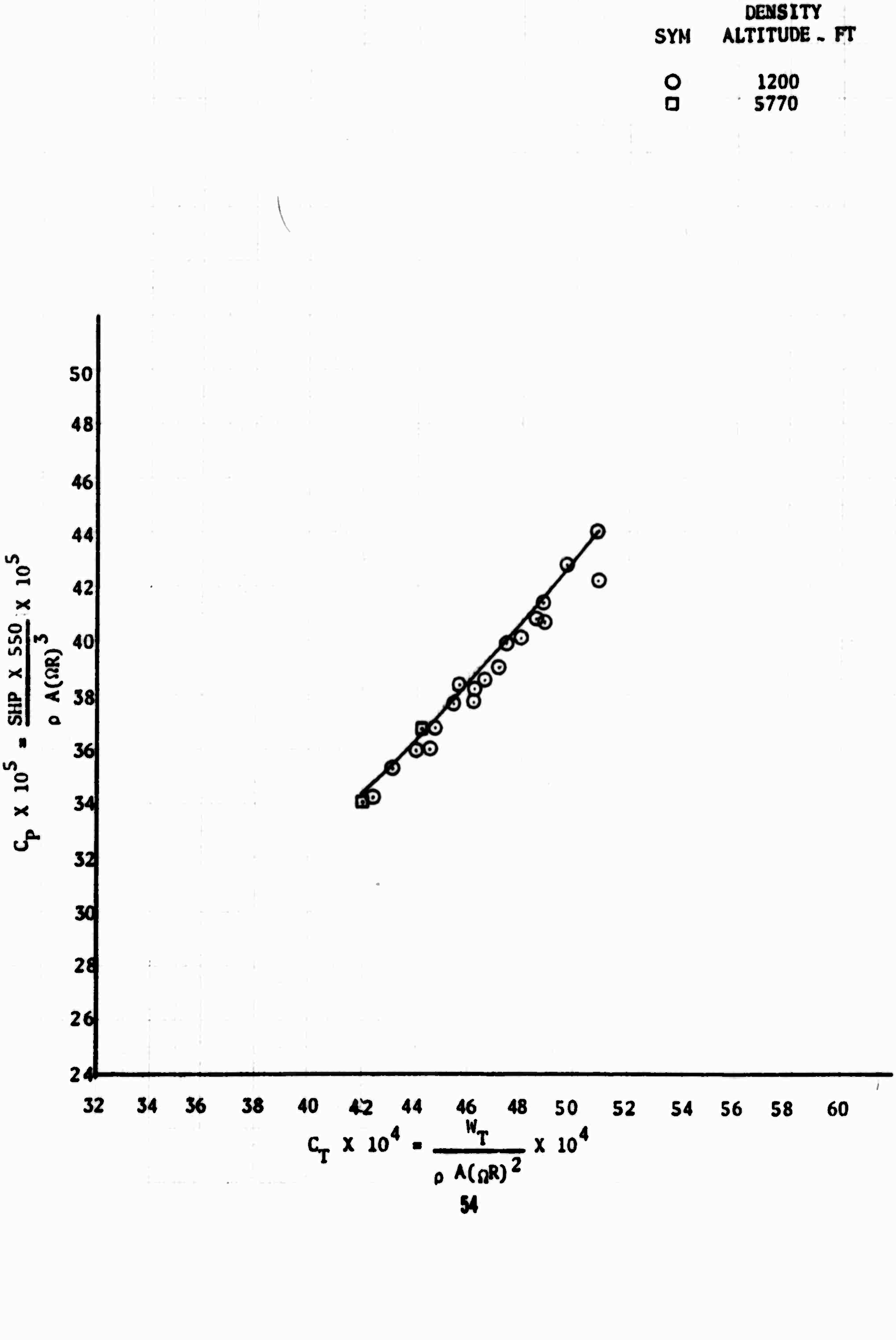


FIGURE NO. 16
SUMMARY TAKEOFF DISTANCE REQUIRED
TO CLEAR A 50 FOOT OBSTACLE
OH-6A S/N 65-12967

ROTOR SPEED	= 483 RPM	CLEAN CONFIGURATION
GROSS WEIGHT	= 2163 LB	TAKEOFF POWER
WIND VELOCITY	≤ 2 KNOTS	LEVEL ACCELERATION FROM
N_2	= 103%	A 2 FOOT HOVER

35°C DAY

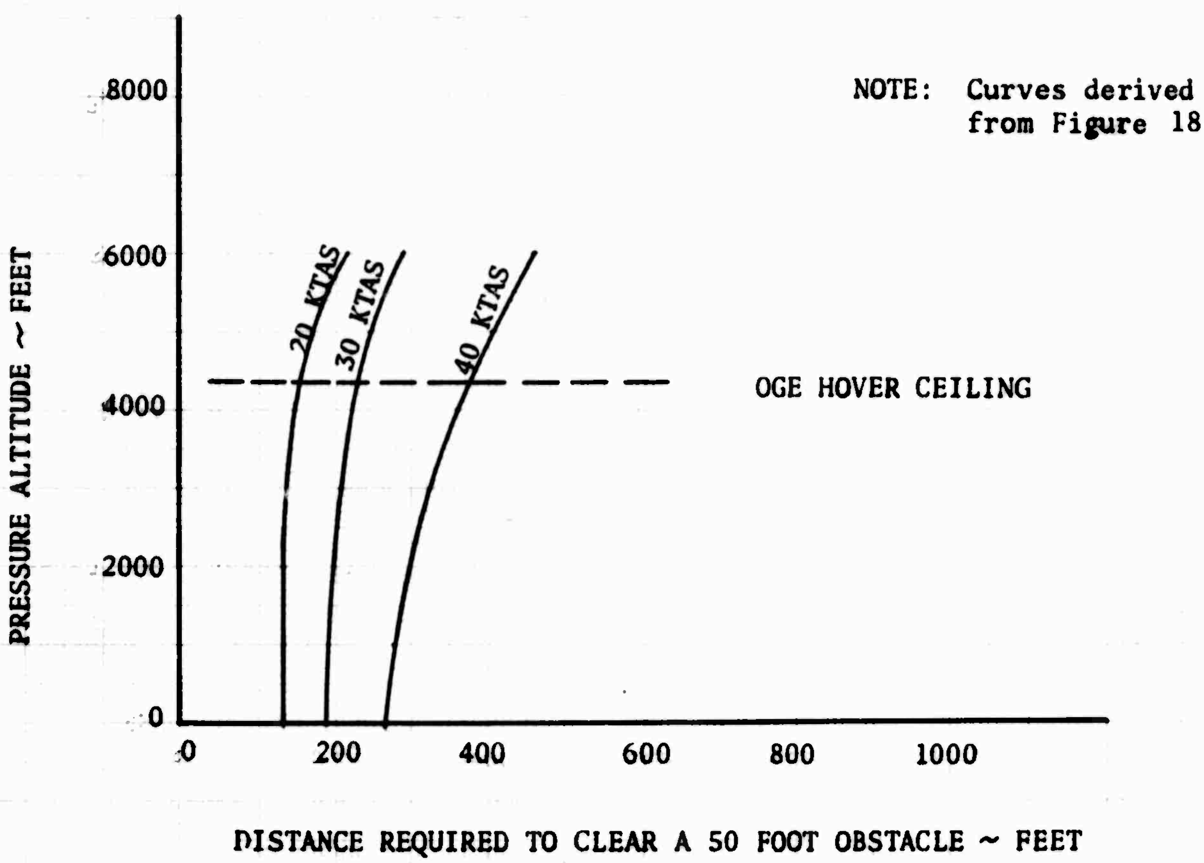


FIGURE NO. 17
SUMMARY TAKEOFF DISTANCE REQUIRED
TO CLEAR A 50 FOOT OBSTACLE
OH-6A S/N 65-12967

ROTOR SPEED	=	483 RPM	CLEAN CONFIGURATION
GROSS WEIGHT	=	2400 LB	TAKEOFF POWER
WIND VELOCITY	≤	2 KNOTS	LEVEL ACCELERATION FROM
N_2	=	103 %	A 2 FOOT HOVER

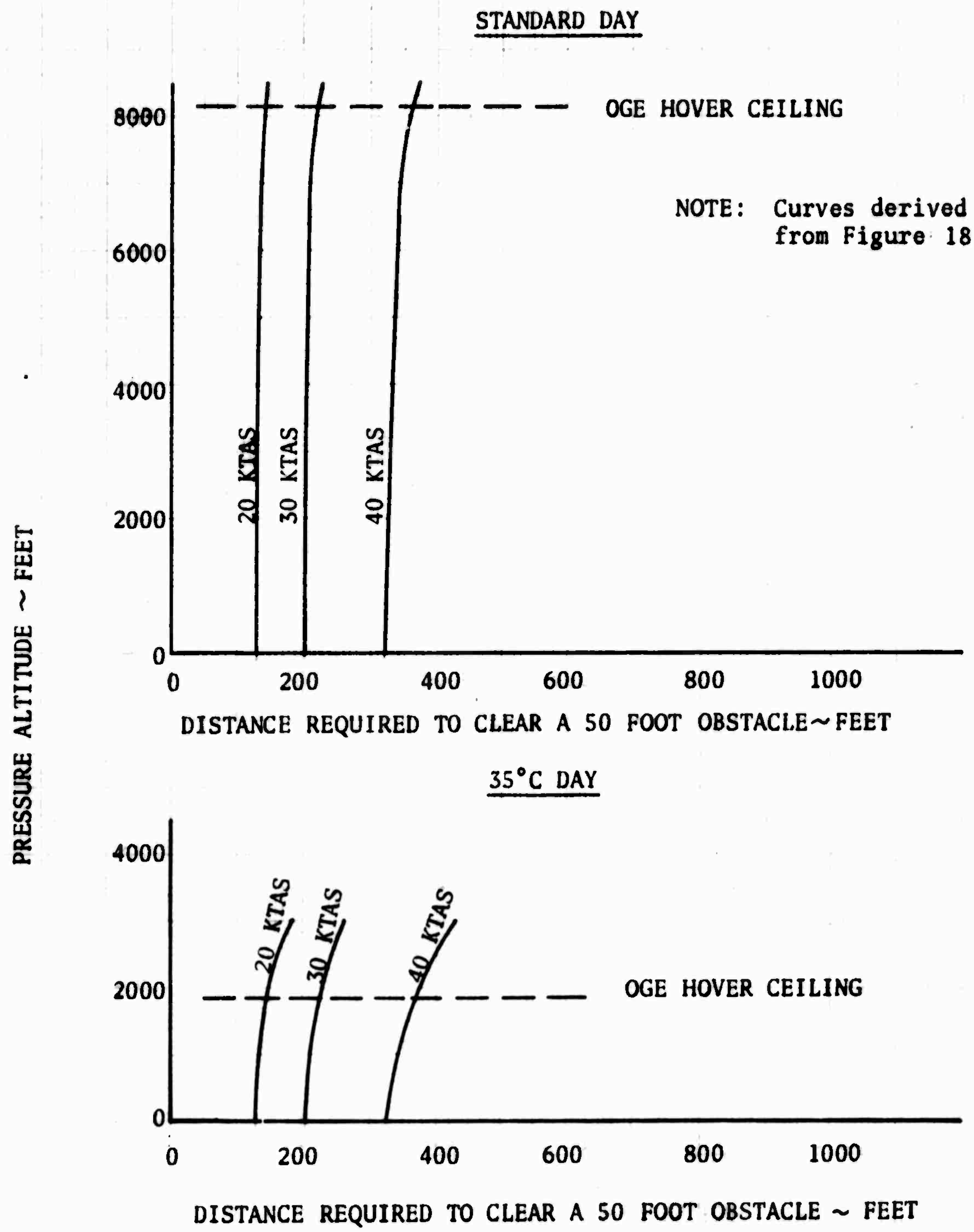


FIGURE NO. 18
VARIATION OF TAKEOFF DISTANCE WITH
CLIMB-OUT AIRSPEED AND ΔC_p

OH-6A S/N 65-12967

CLEAN CONFIGURATION
WIND VELOCITY
TECHNIQUE: LEVEL ACCELERATION FROM A 2 FOOT HOVER

ROTOR SPEED = 483 RPM
TAKEOFF POWER
N_2 = 103%

NOTES:
1. ΔC_p fairings based on Figures19through 22
2. $\Delta C_p = C_p$ at takeoff - C_p to hover at 2 feet.
3. C_p at takeoff based on power available under takeoff atmospheric conditions.
4. C_p to hover at 2 feet based on power required to hover at 2 feet under takeoff atmospheric conditions.

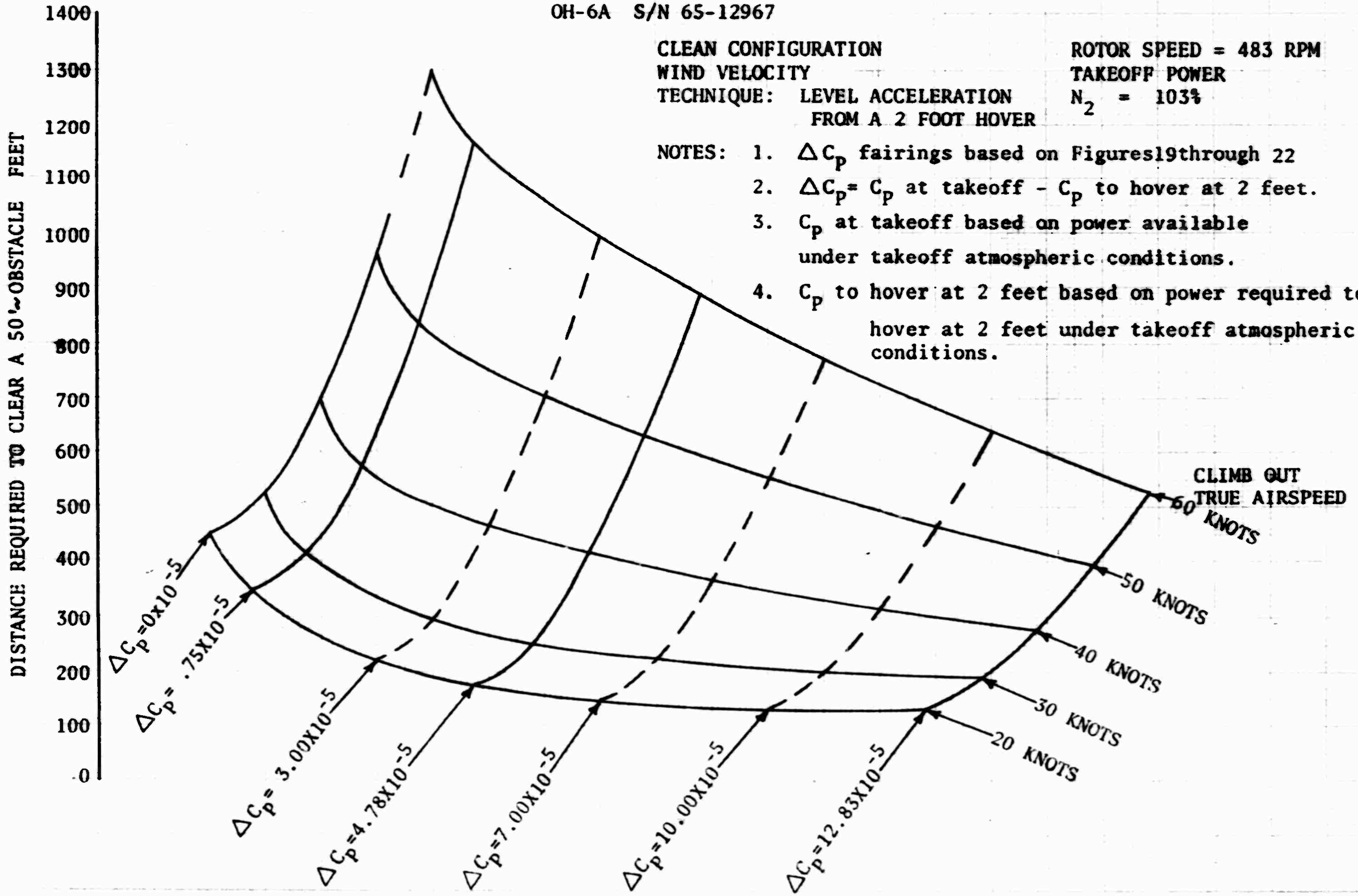


FIGURE NO. 19
TAKEOFF DISTANCE REQUIRED
TO CLEAR A 50' OBSTACLE
OH-6A S/N 65-12967

ROTOR SPEED = 483 RPM
GROSS WEIGHT = 2310 LB
FREE AIR TEMP. = 10 °C
WIND ≤ 2 KNOTS
ΔC_P = 0.0
PRESSURE ALTITUDE = 9475 FT
TECHNIQUE = LEVEL ACCELERATION FROM A 2 FT HOVER

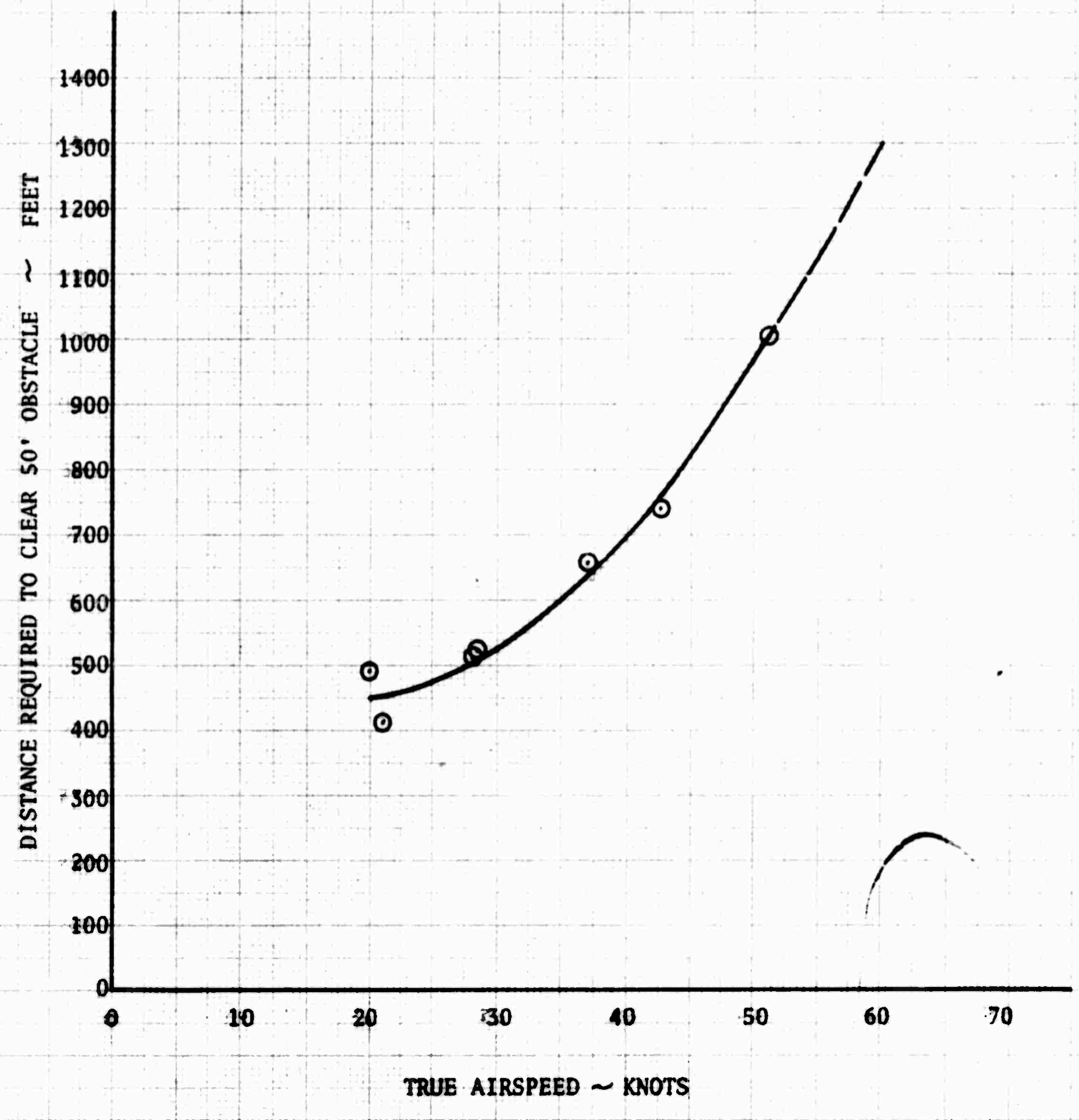


FIGURE NO. 20
TAKEOFF DISTANCE REQUIRED
TO CLEAR A 50' OBSTACLE
OH-6A S/N 65-12967

ROTOR SPEED = 483 RPM
GROSS WEIGHT = 2600 LB
FREE AIR TEMP. = 22.0 °C
WIND $\leq$ 2 KNOTS
ΔC_P = $.75 \times 10^{-5}$
PRESSURE ALTITUDE = 4010 FT
TECHNIQUE = LEVEL ACCELERATION FROM A 2 FT HOVER

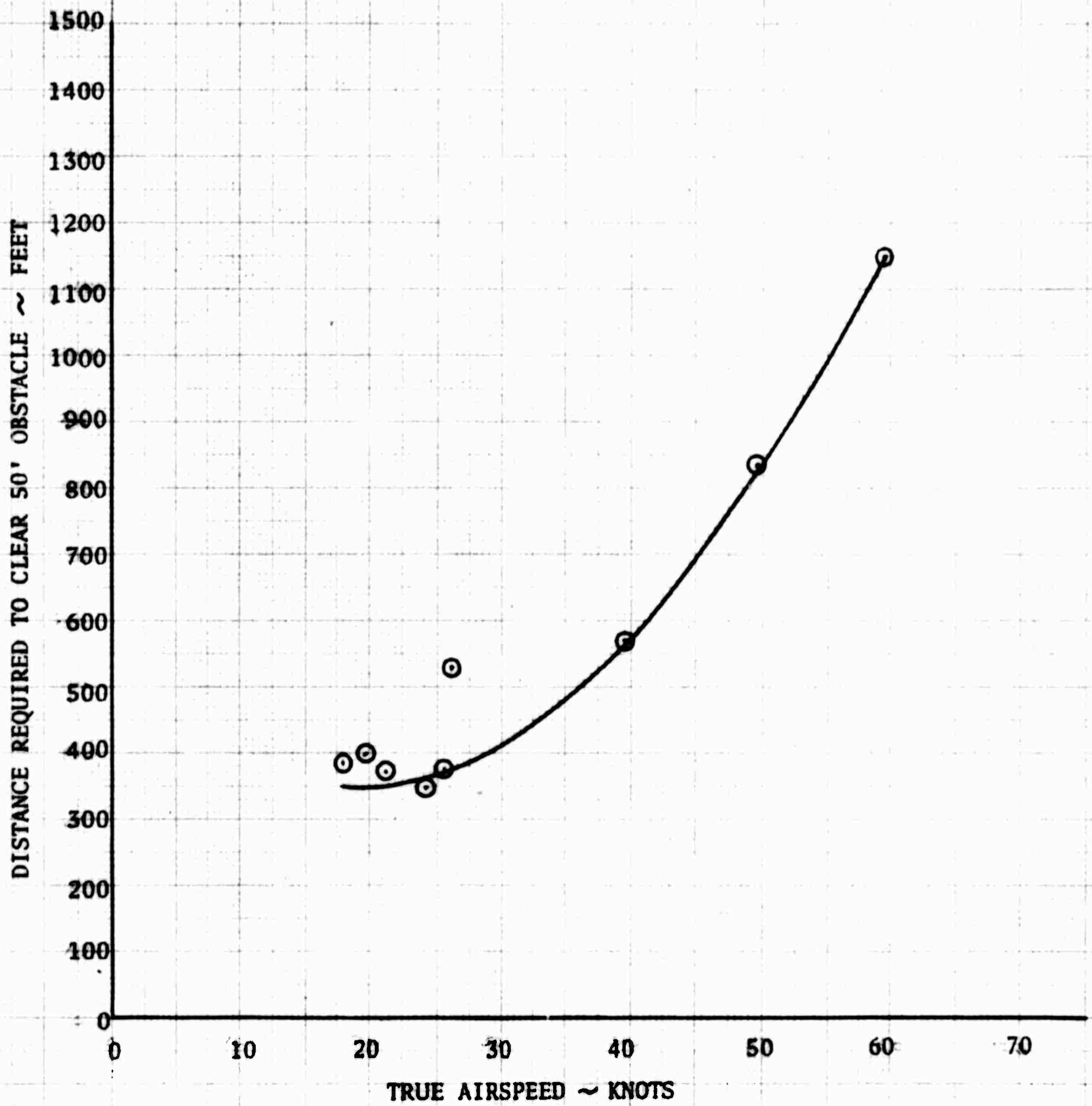


FIGURE NO. 21
TAKEOFF DISTANCE REQUIRED
TO CLEAR A 50' OBSTACLE
OH-6A S/N 65-12967

ROTOR SPEED = 483 RPM
GROSS WEIGHT = 2300 LB
FREE AIR TEMP. = 18 °C
WIND ≤ 2 KNOTS
ΔC_P = 4.78×10^{-5}
PRESSURE ALTITUDE = 4000 FT
TECHNIQUE = LEVEL ACCELERATION FROM A 2 FT HOVER

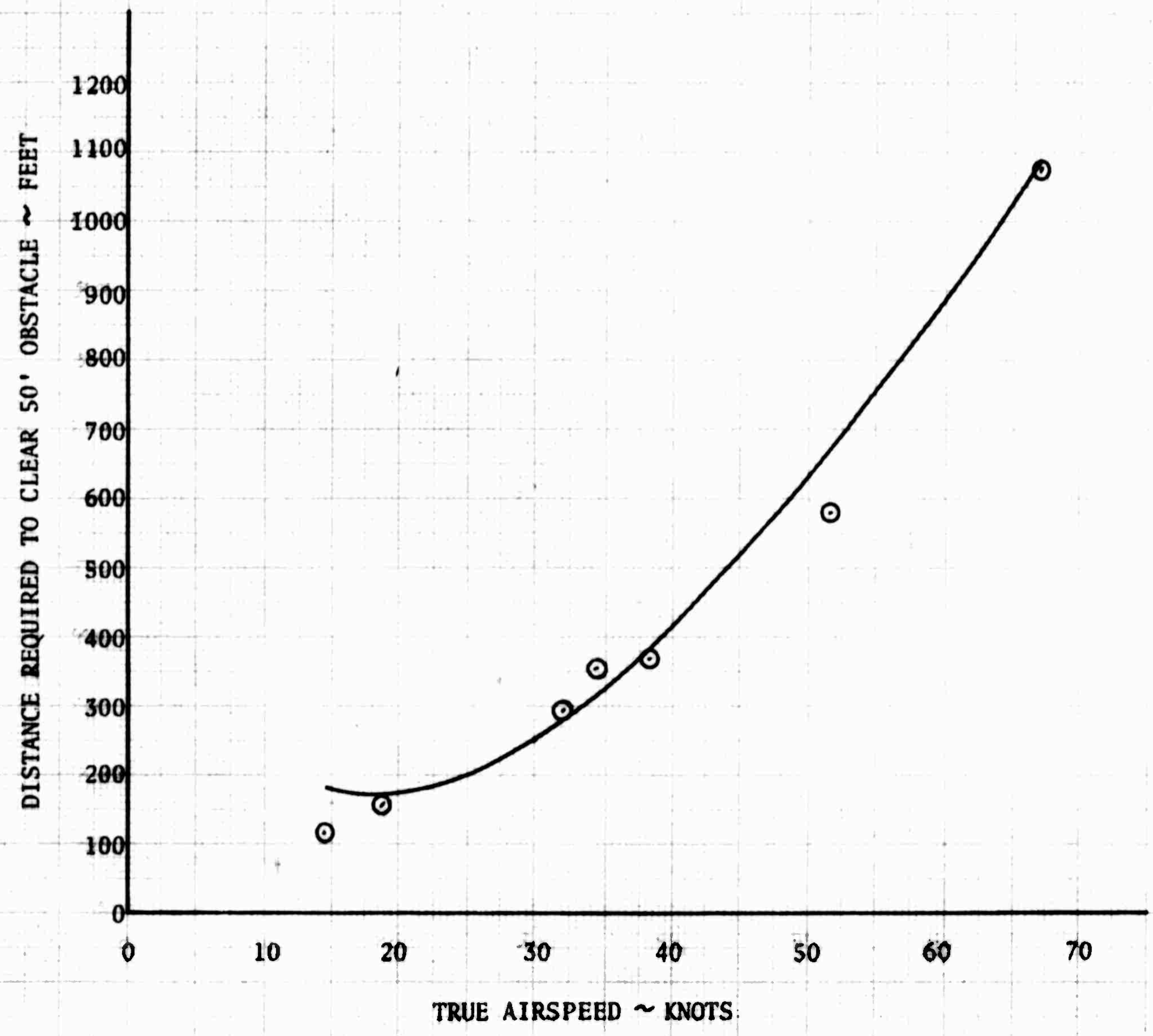


FIGURE NO. 22
TAKEOFF DISTANCE REQUIRED
TO CLEAR A 50' OBSTACLE
OH-6A S/N 65-12967

ROTOR SPEED	=	483 RPM
GROSS WEIGHT	=	2190 LB
FREE AIR TEMP.	=	12.5°C
WIND	$\leq$	2 KNOTS
ΔC_p	=	12.83×10^{-5}
PRESSURE ALTITUDE	=	4000 FEET
TECHNIQUE	=	LEVEL ACCELERATION FROM A 2 FT HOVER

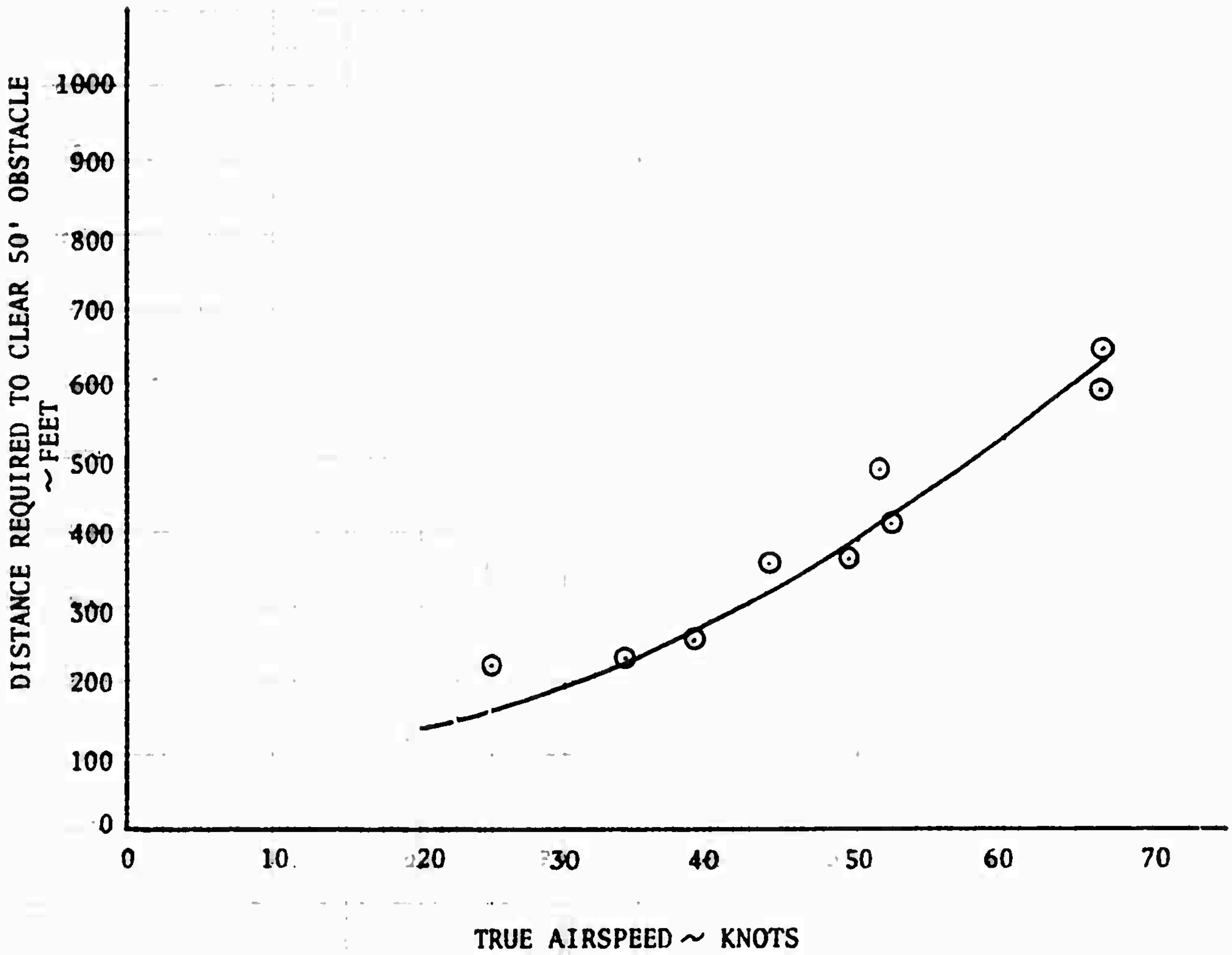


FIGURE NO. 23
CLIMB PERFORMANCE
OH-6A S/N 65-12967

CLEAN CONFIGURATION
TAKEOFF POWER
STANDARD DAY

ROTOR SPEED = 483 RPM
C. G. LOCATION = 100 (MID)
N_2 = 103%

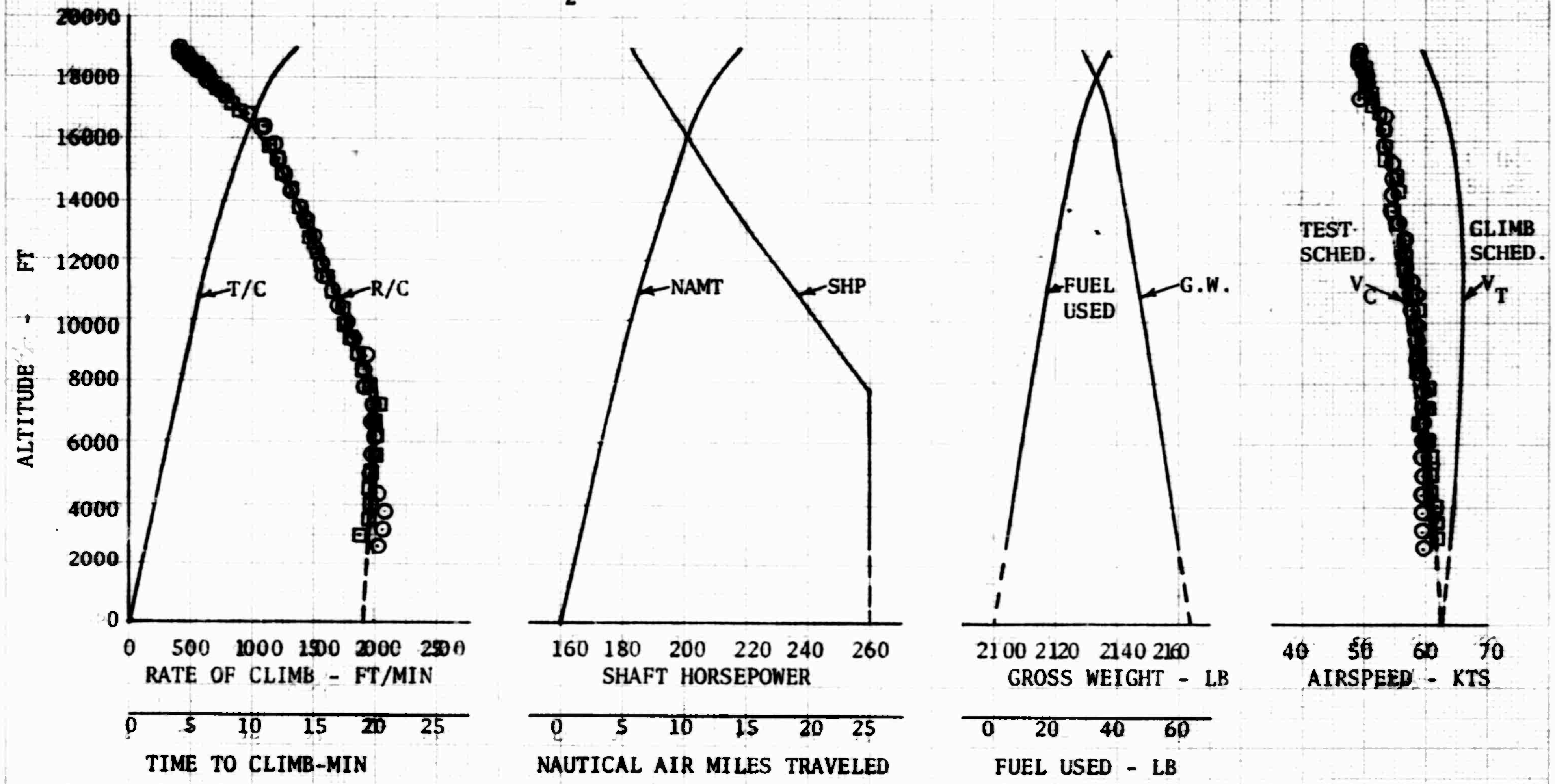


FIGURE NO. 24
CLIMB PERFORMANCE
OH-6A S/N 65-12967

CLEAN CONFIGURATION
TAKEOFF POWER
STANDARD DAY

ROTOR SPEED	=	483 RPM
C.G. LOCATION	=	100(MID)
N_2	=	103%

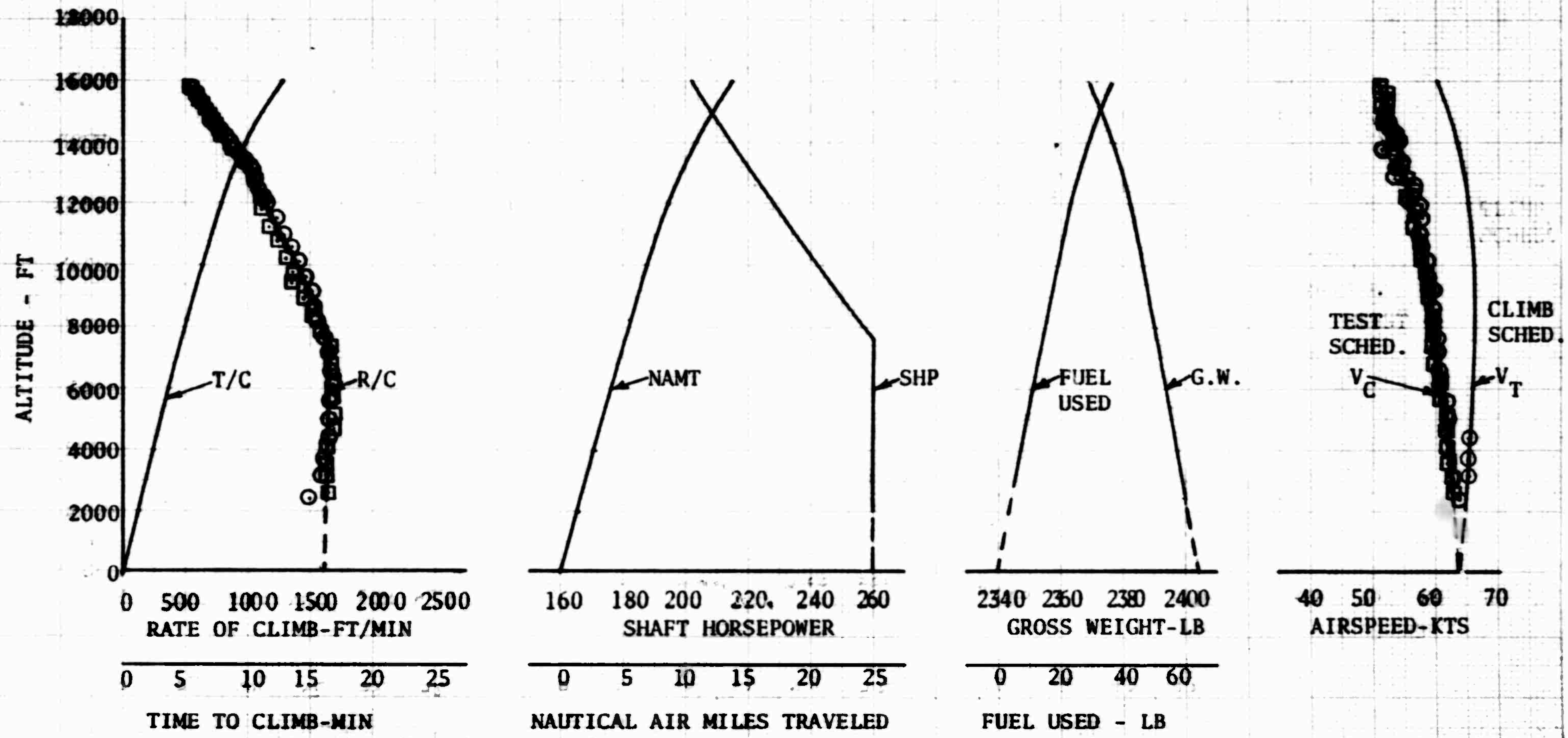
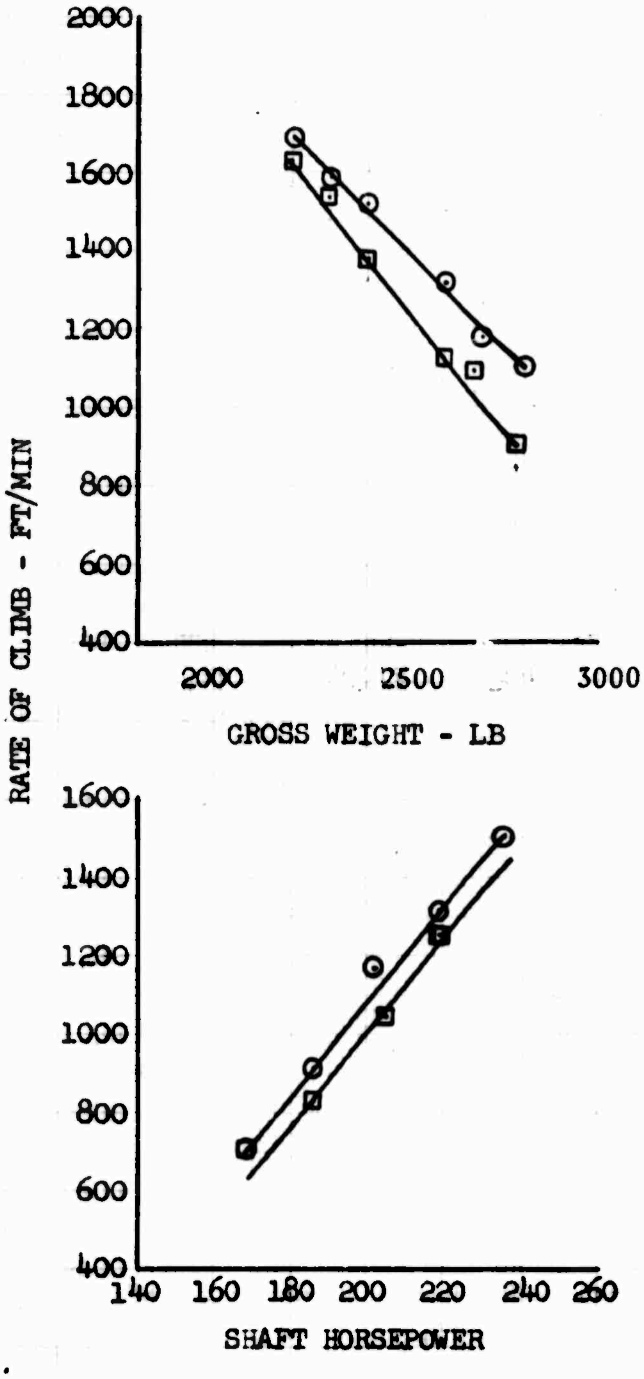
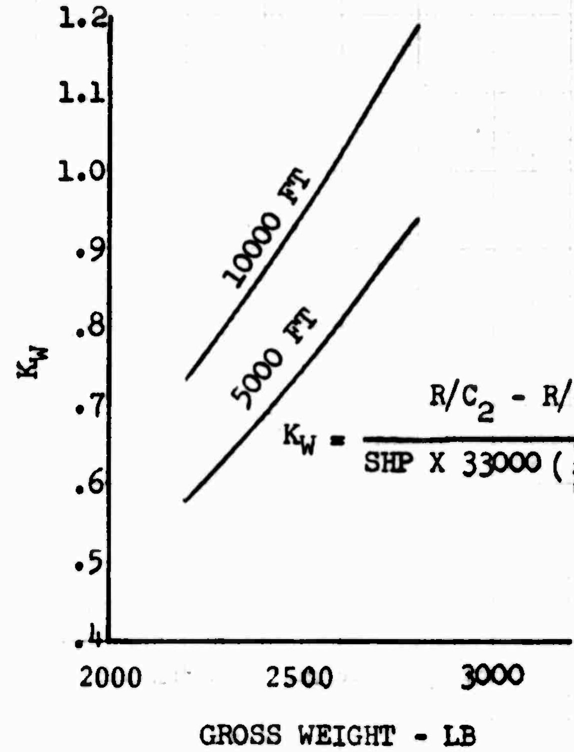


FIGURE NO. 26
VARIATION IN RATE OF CLIMB
AS A FUNCTION OF GROSS WEIGHT
AND SHAFT HORSEPOWER
OH-6A S/N 65-12967

SYM	DENSITY ALTITUDE FT	SHP	ROTOR SPEED RPM
○	5000	260.0	483
□	10000	239.5	483





$$K_W = \frac{R/C_2 - R/C_1}{SHP \times 33000 \left(\frac{1}{GW_2} - \frac{1}{GW_1}\right)}$$

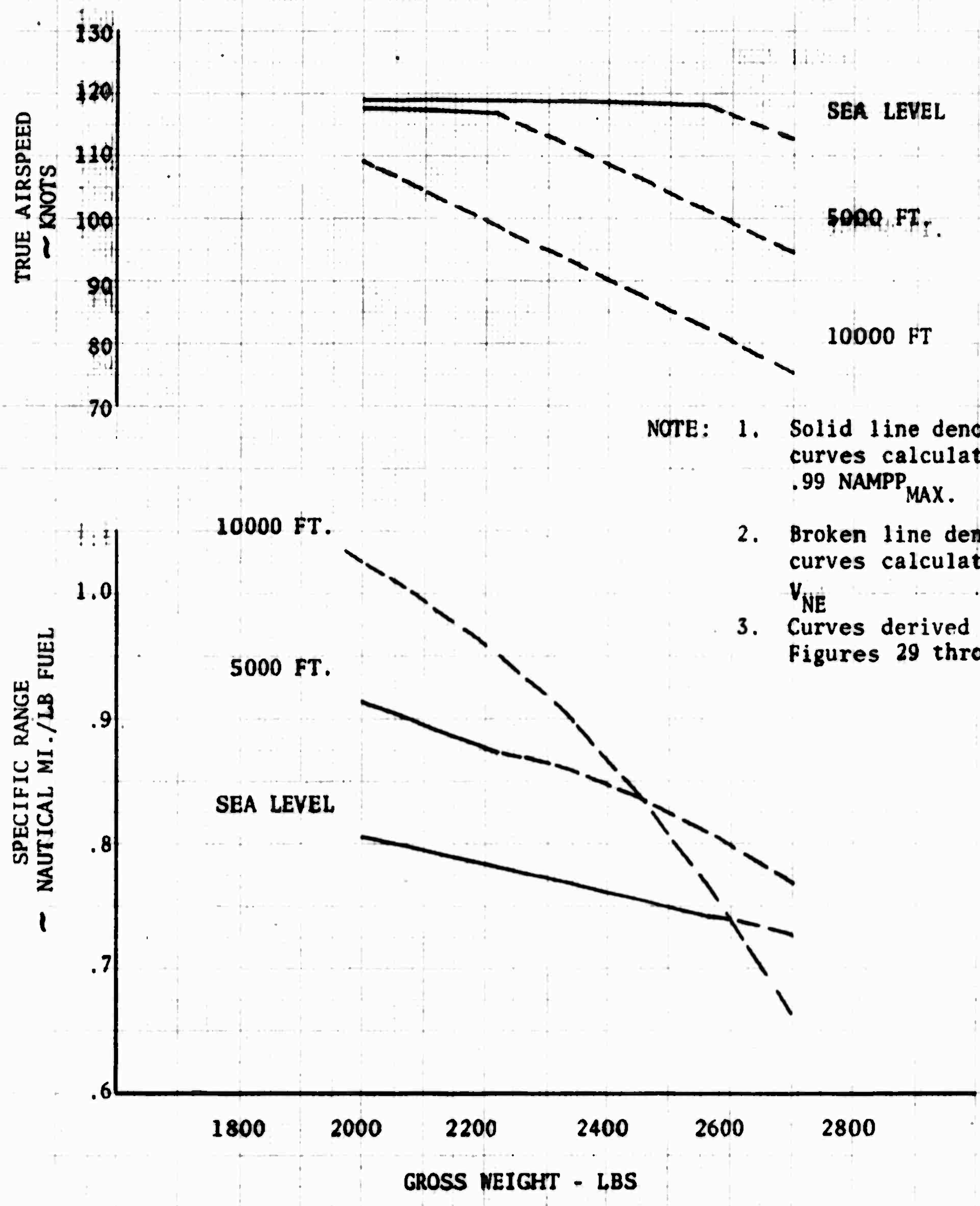
SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM
○	5000	2240	483
□	10000	2240	483

$$K_P = \frac{\Delta R/C}{\Delta SHP} \times \frac{GW}{33000}$$

$K_P = .8145$

FIGURE NO. 27
RANGE PERFORMANCE
OH-6A S/N 65-12919

CLEAN CONFIGURATION
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.1 (mid)

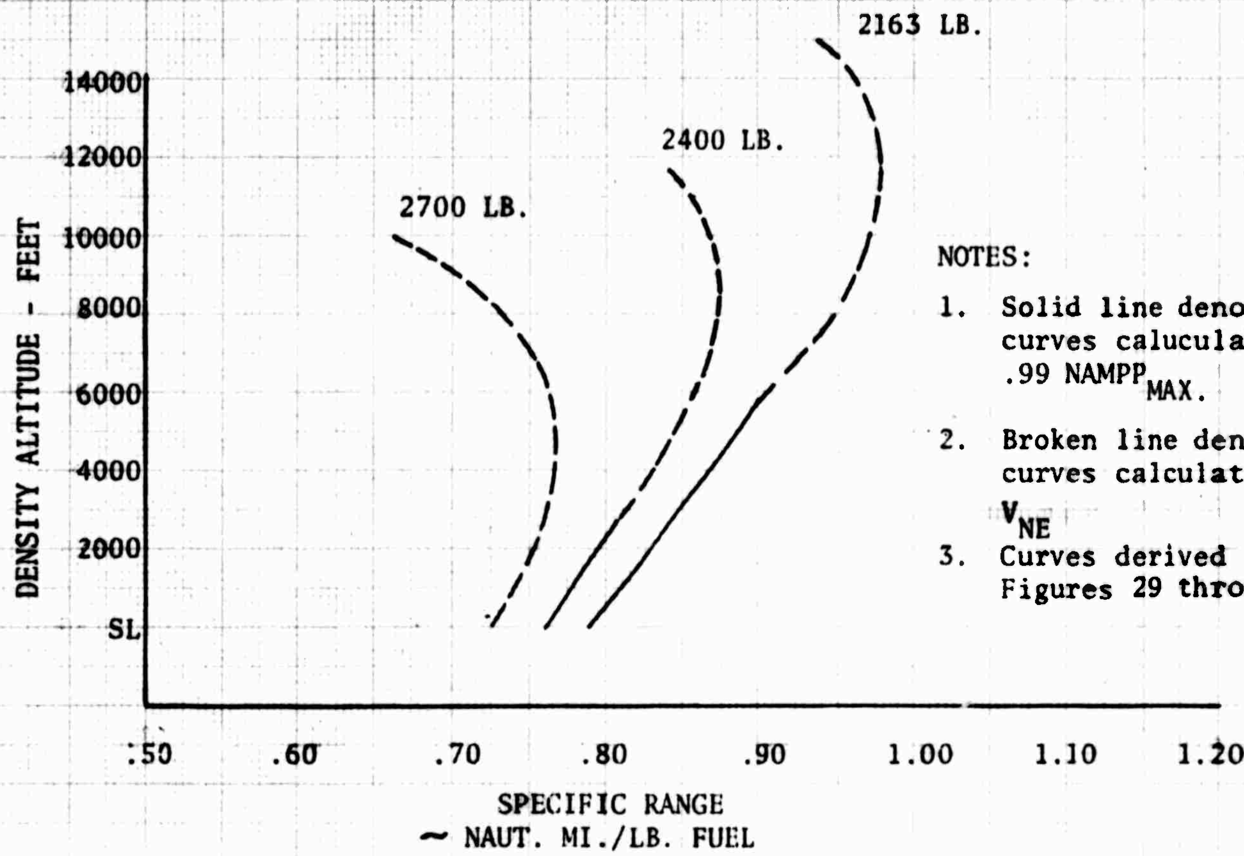


NOTE: 1. Solid line denotes curves calculated at .99 $NAMPP_{MAX}$.

2. Broken line denotes curves calculated at V_{NE}

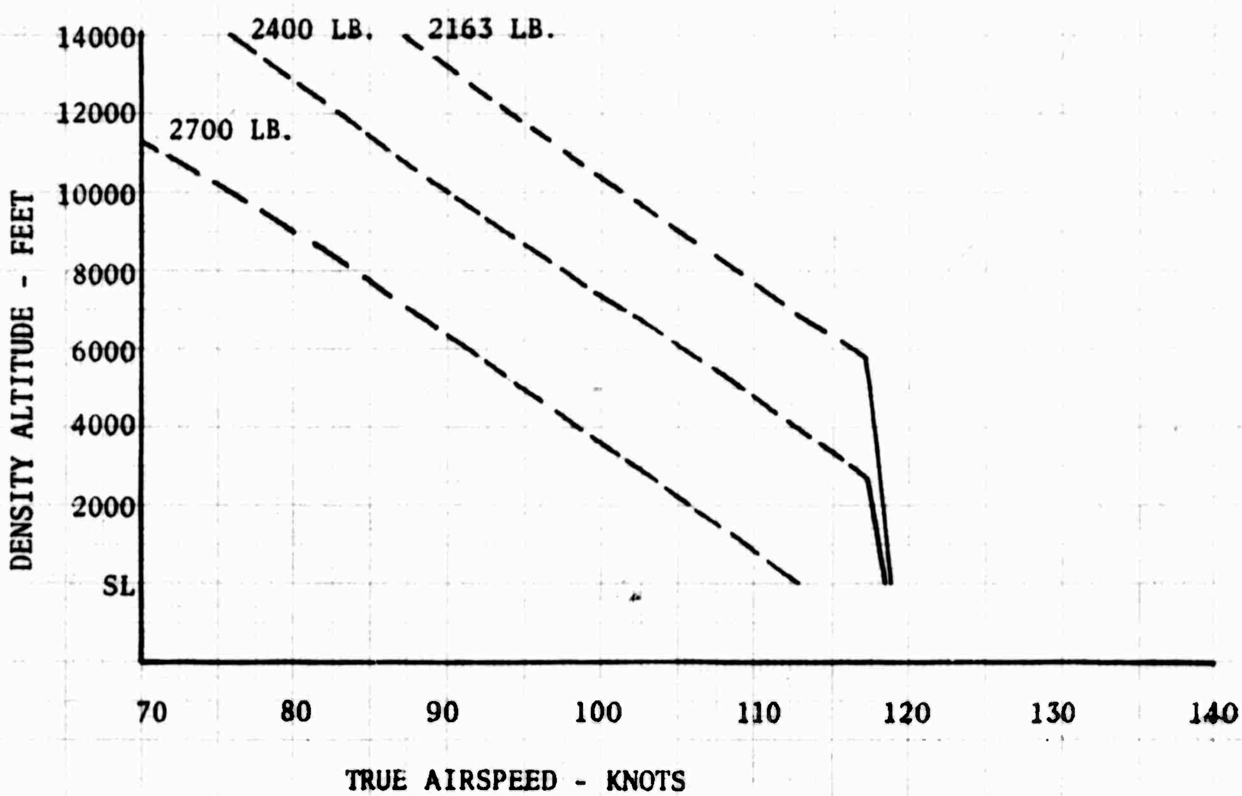
3. Curves derived from Figures 29 through 31

FIGURE NO. 28
RANGE SUMMARY
OH-6A S/N 65-12919
CLEAN CONFIGURATION
ROTOR SPEED = 483 RPM
CG LOCATION = STA. 100.1 (MID)



NOTES:

1. Solid line denotes curves caluculated at .99 $NAMPP_{MAX}$.
2. Broken line denotes curves calculated at V_{NE}
3. Curves derived from Figures 29 through 31



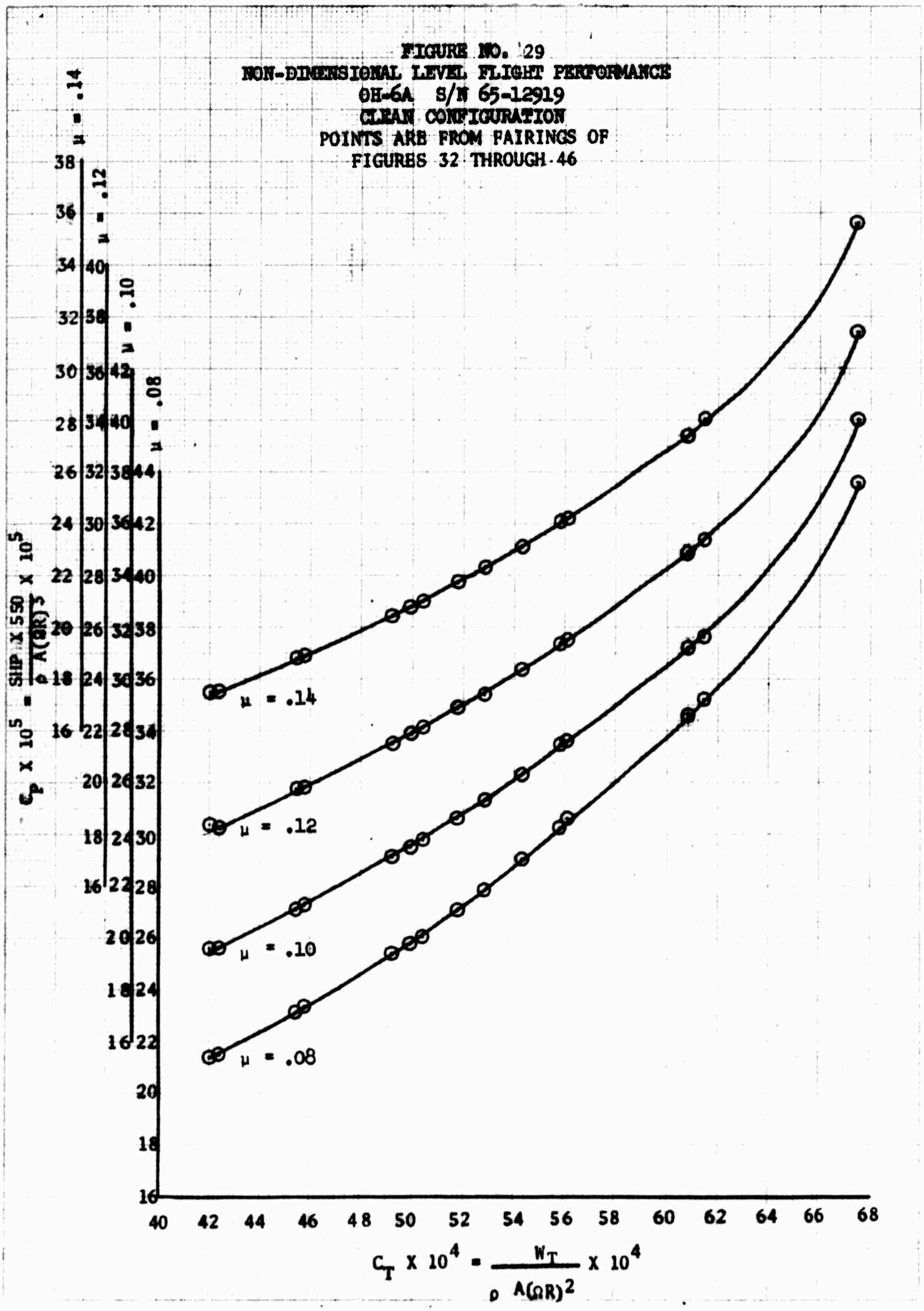


FIGURE NO. 29
NON-DIMENSIONAL LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION
POINTS ARE FROM FAIRINGS OF
FIGURES 32 THROUGH 46
μ = .14
μ = .12
μ = .10
μ = .08
$C_P \times 10^5 = \frac{SHP \times 550}{\rho A(\Omega R)^3} \times 10^5$
$C_T \times 10^4 = \frac{W_T}{\rho A(\Omega R)^2} \times 10^4$

FIGURE NO. 30
NON-DIMENSIONAL LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION
POINTS ARE FROM FAIRINGS OF
FIGURES 32 THROUGH 46

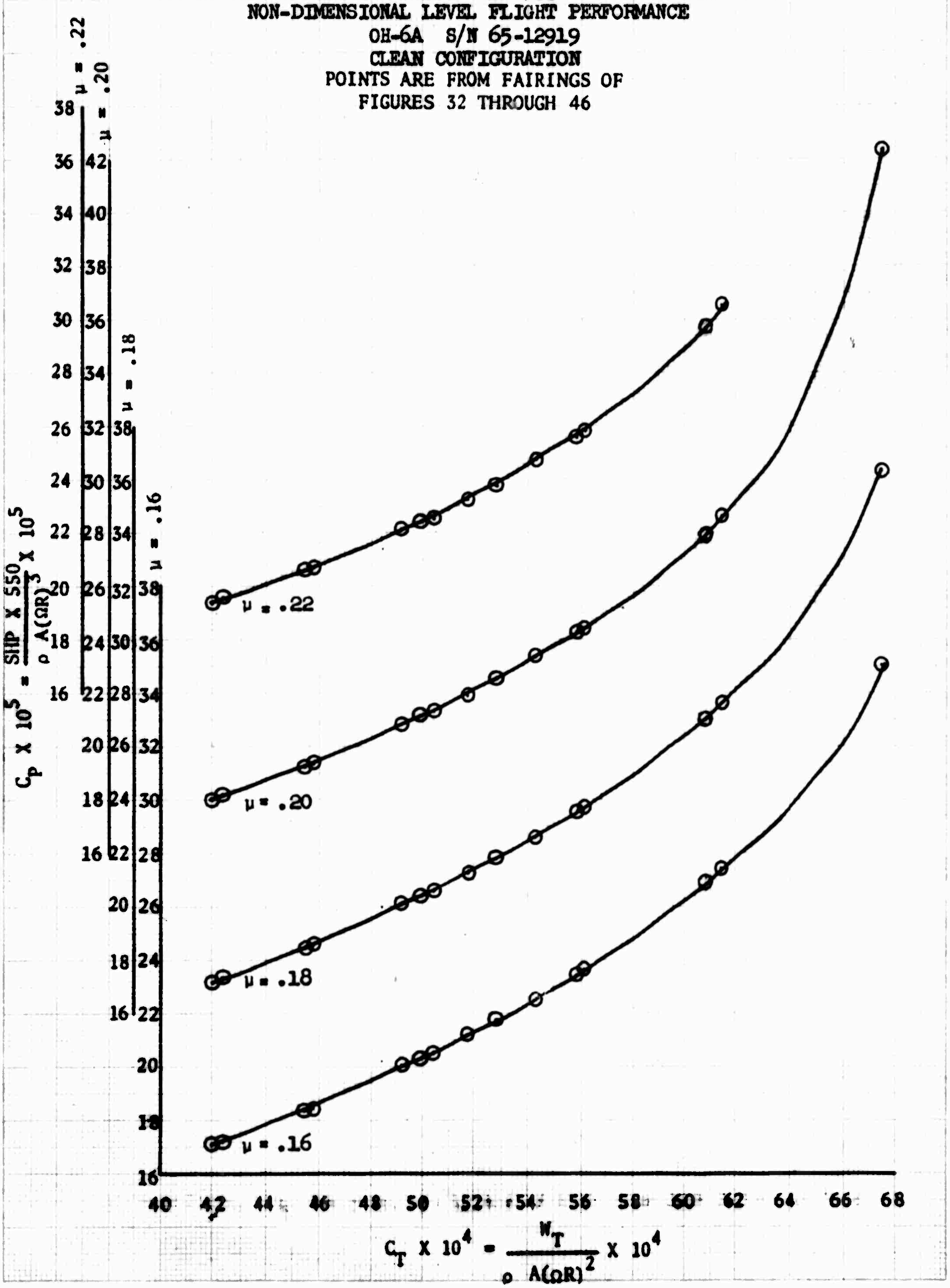


FIGURE NO. 31
NON-DIMENSIONAL LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION
POINTS ARE FROM FAIRINGS OF
FIGURES 32 THROUGH 46

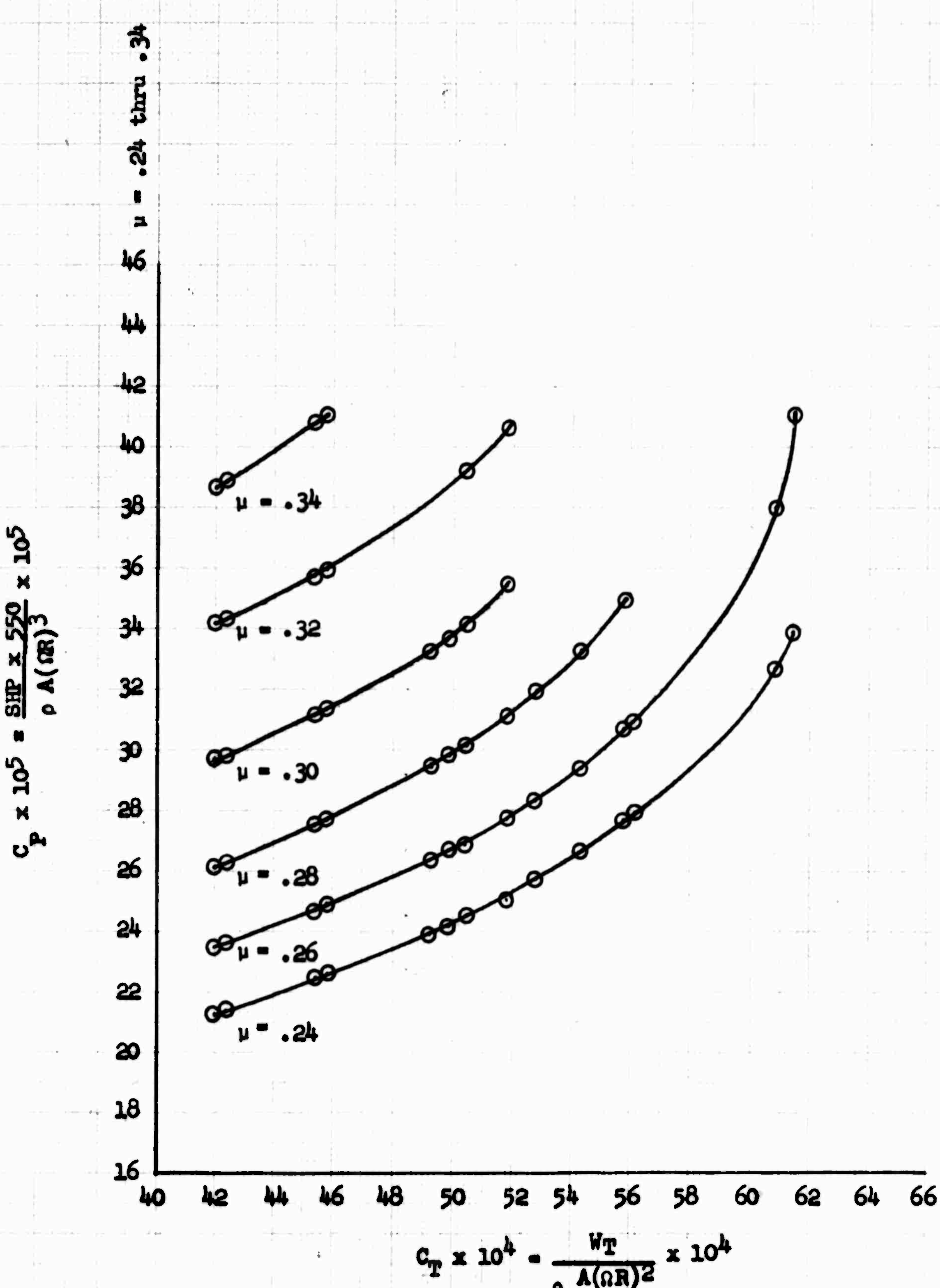


FIGURE NO. 32
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2412 LB
DENSITY ALTITUDE = Sea Level
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.2 (MID)
C_T = .004197

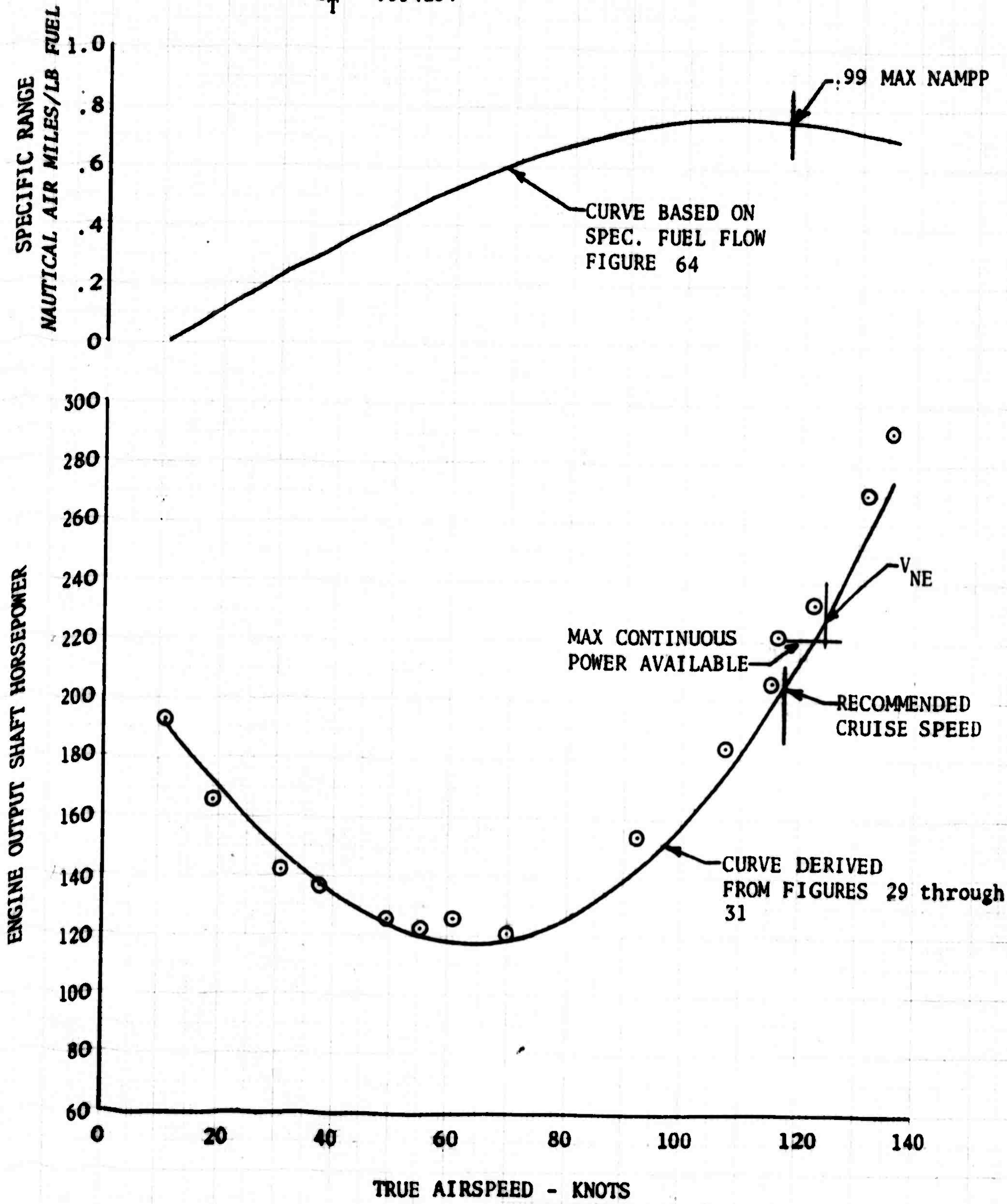


FIGURE NO. 33
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 1980 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 469 RPM
C.G. LOCATION = Sta. 100.16 (MID)
C_T = .004236

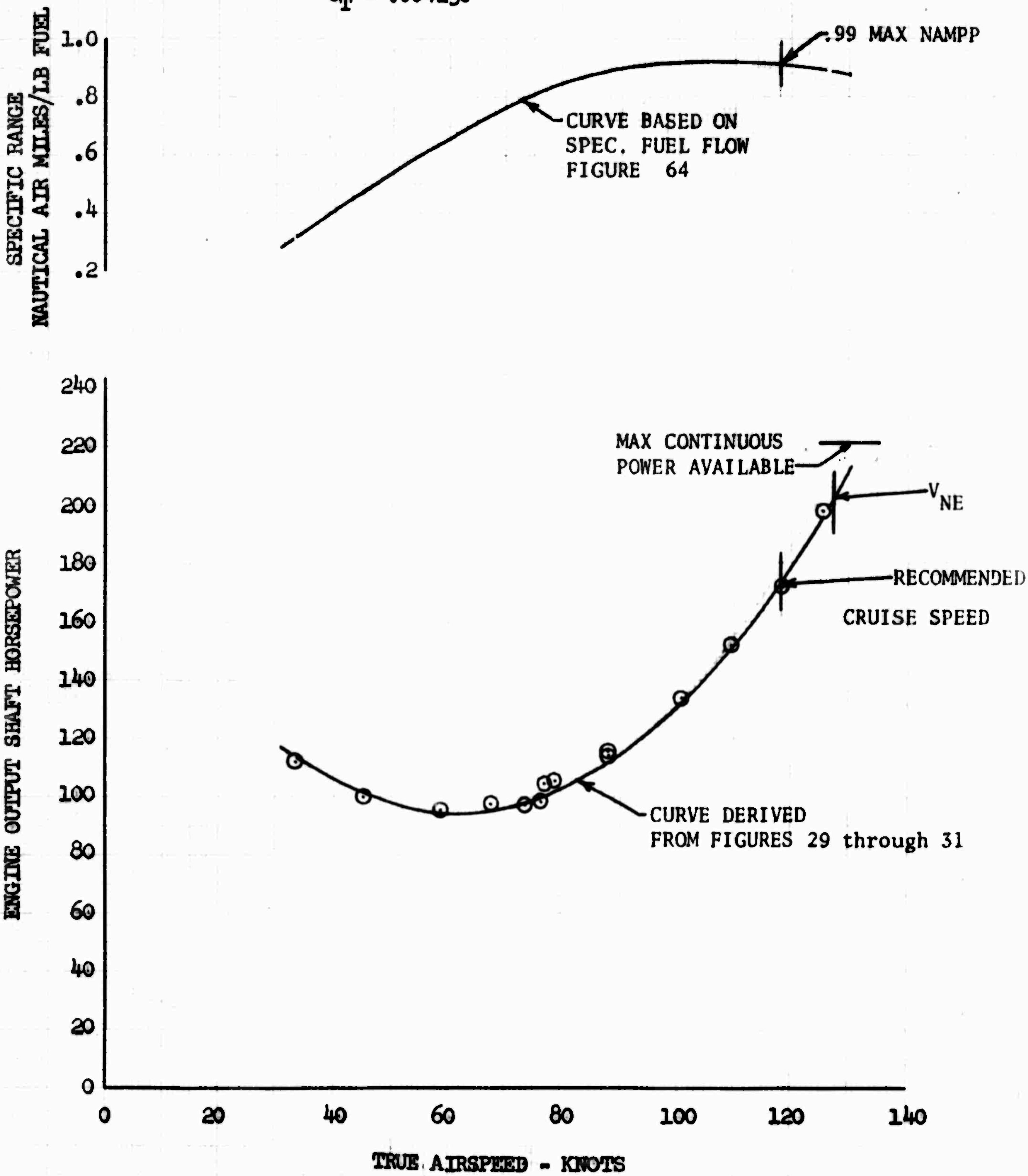


FIGURE NO. 34
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2090 LB
DENSITY ALTITUDE = 7500 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.16 (MID)
C_T = .004545

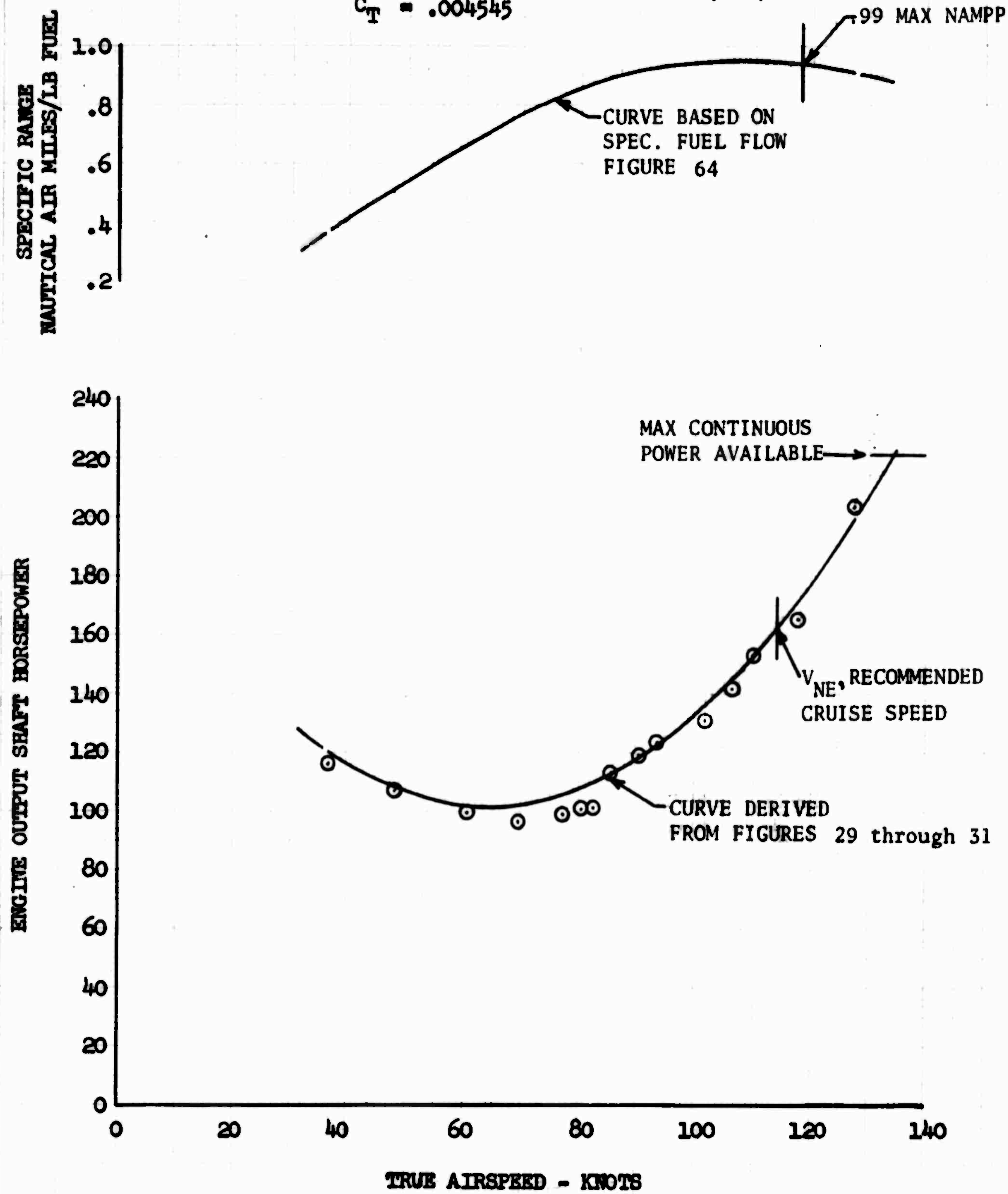


FIGURE NO. 35
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2140 LB
DENSITY ALTITUDE = 5420 FT
ROTOR SPEED = 469 RPM
C.G. LOCATION = Sta. 100.16 (MID)
C_T = .004573

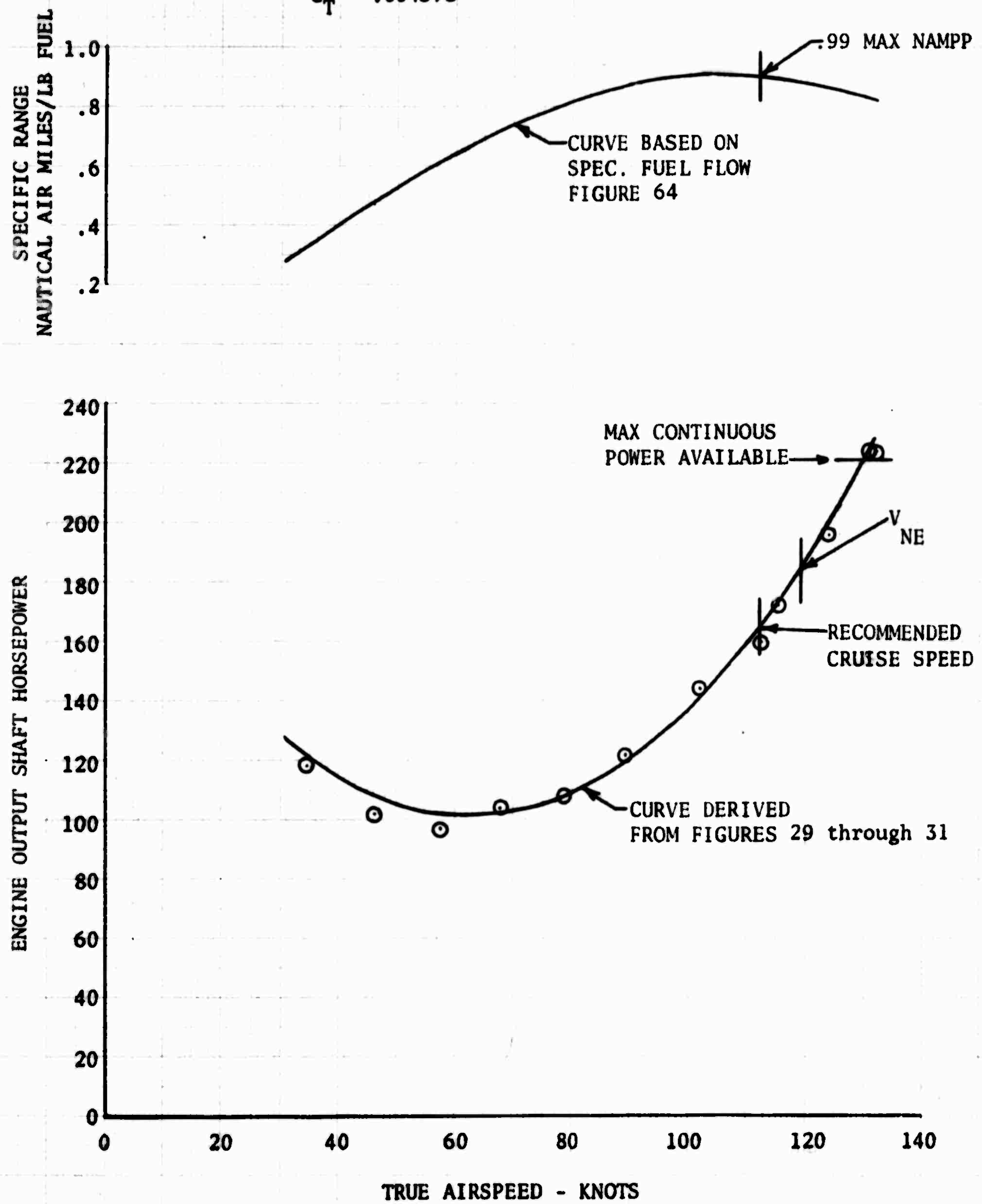


FIGURE NO. 36
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2440 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.57 (MID)
C_T = .004924

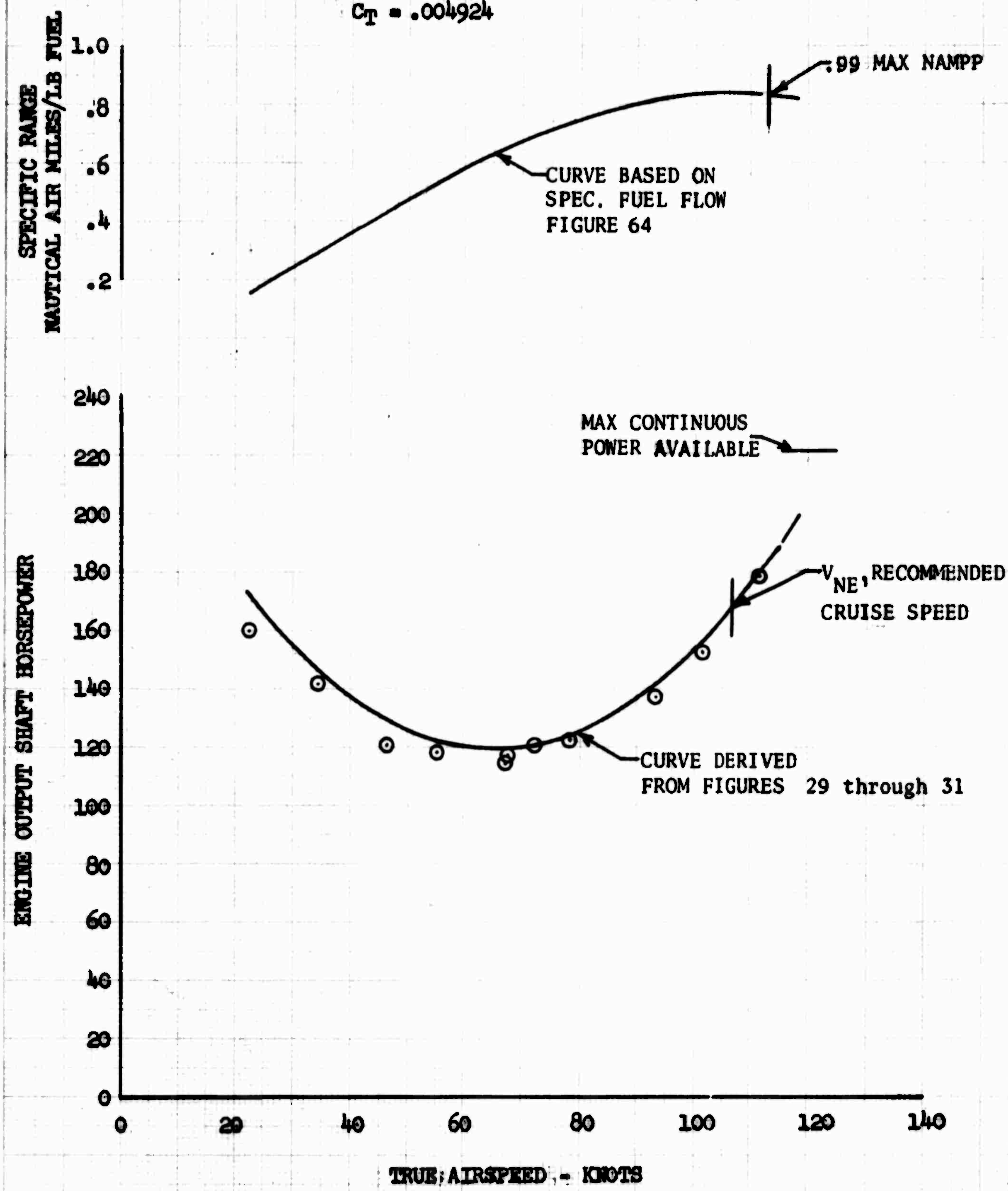


FIGURE NO. 37
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2470 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 99.3 (MID)
C_T = .004991

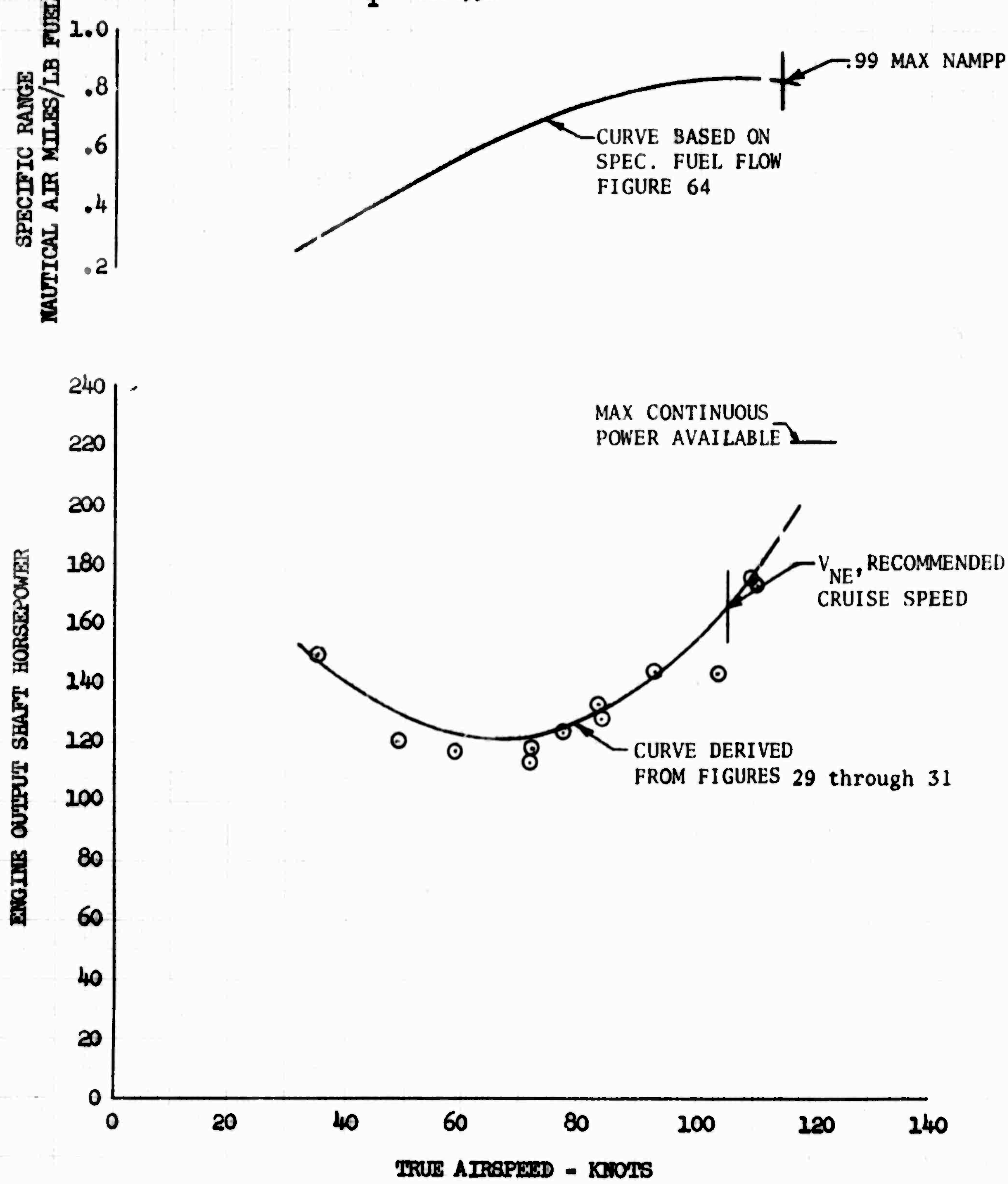


FIGURE NO. 38
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2385 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 469 RPM
C.G. LOCATION = Sta. 99.33 (MID)
C_T = .005108

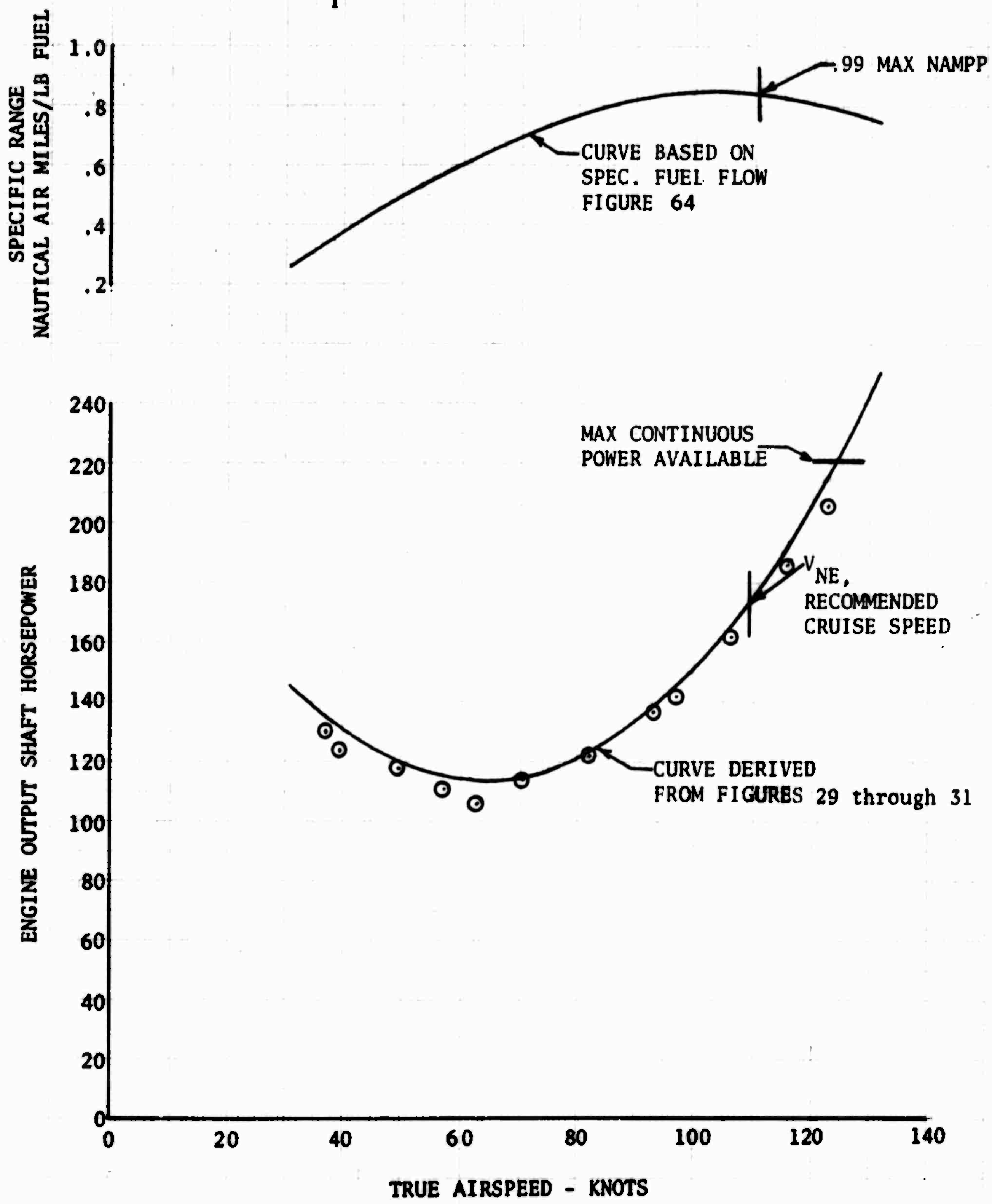


FIGURE NO. 39
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2415 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 469 RPM
C.G. LOCATION = Sta. 100.1 (MID)
C_T = .005173

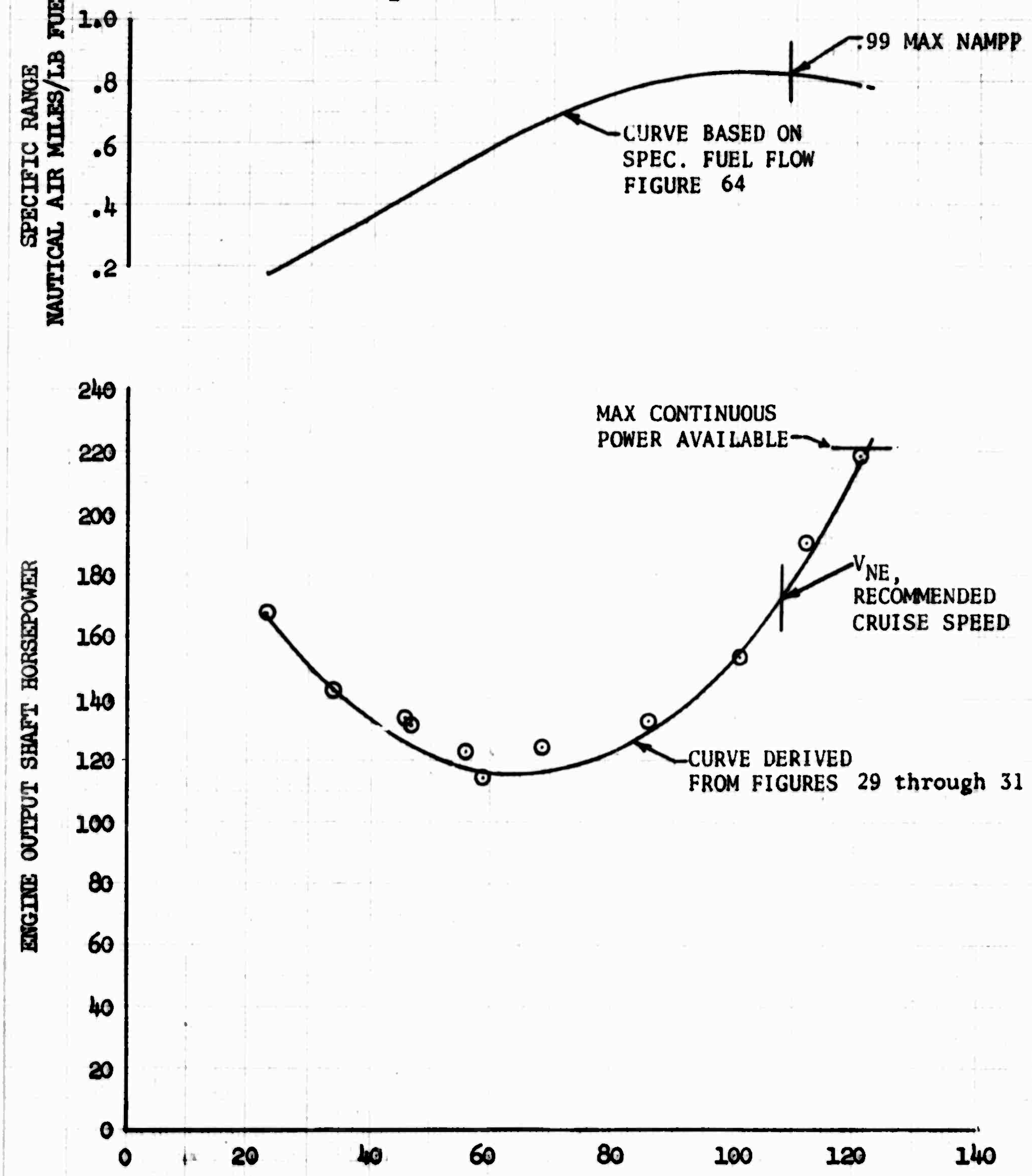


FIGURE NO. 40
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2140 LB
DENSITY ALTITUDE = 10000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 99.34 (MID)
C_T = .005281

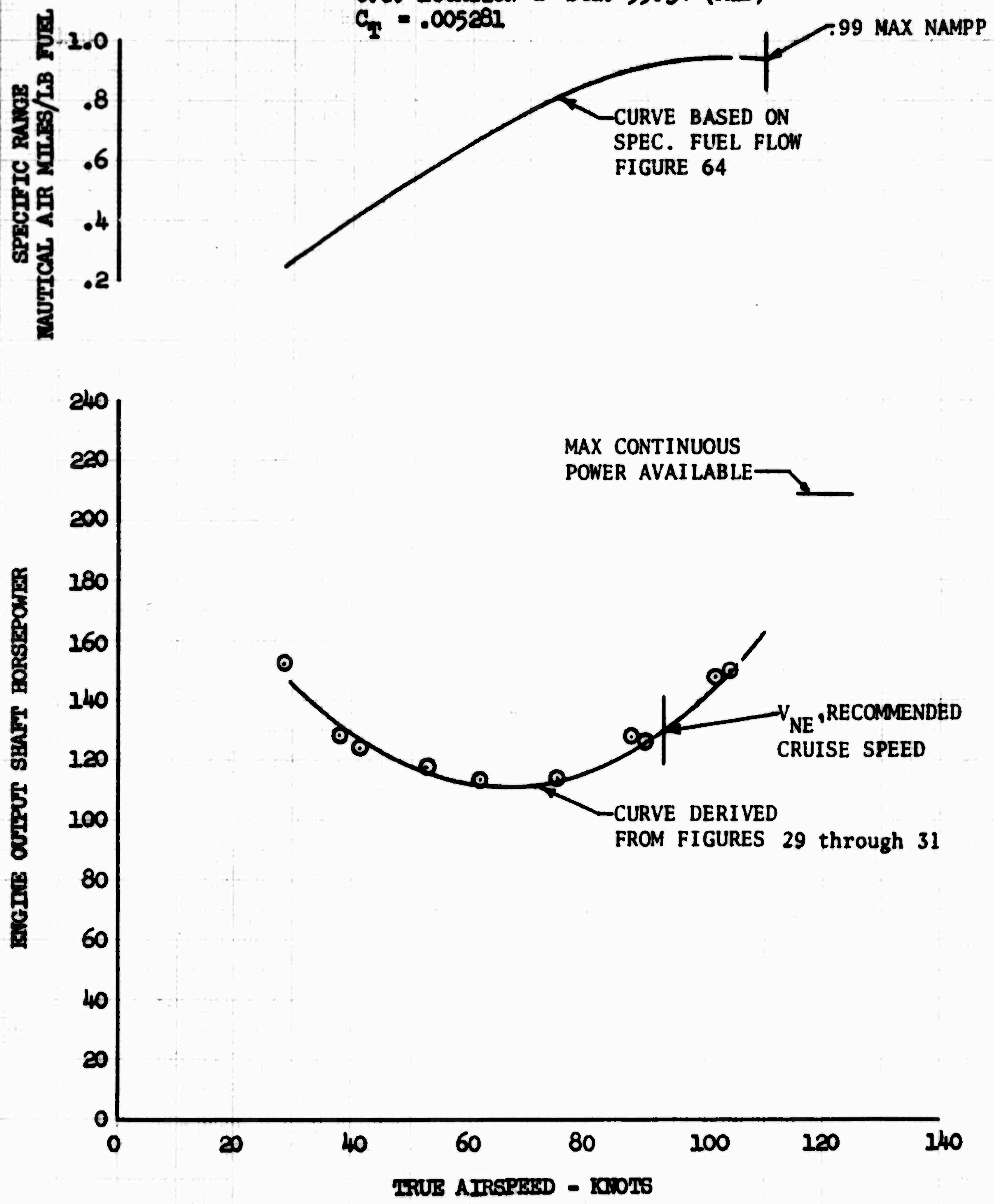


FIGURE NO 41
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION

GROSS WEIGHT = 2690 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 99.8 (MID)
C_T = .005431

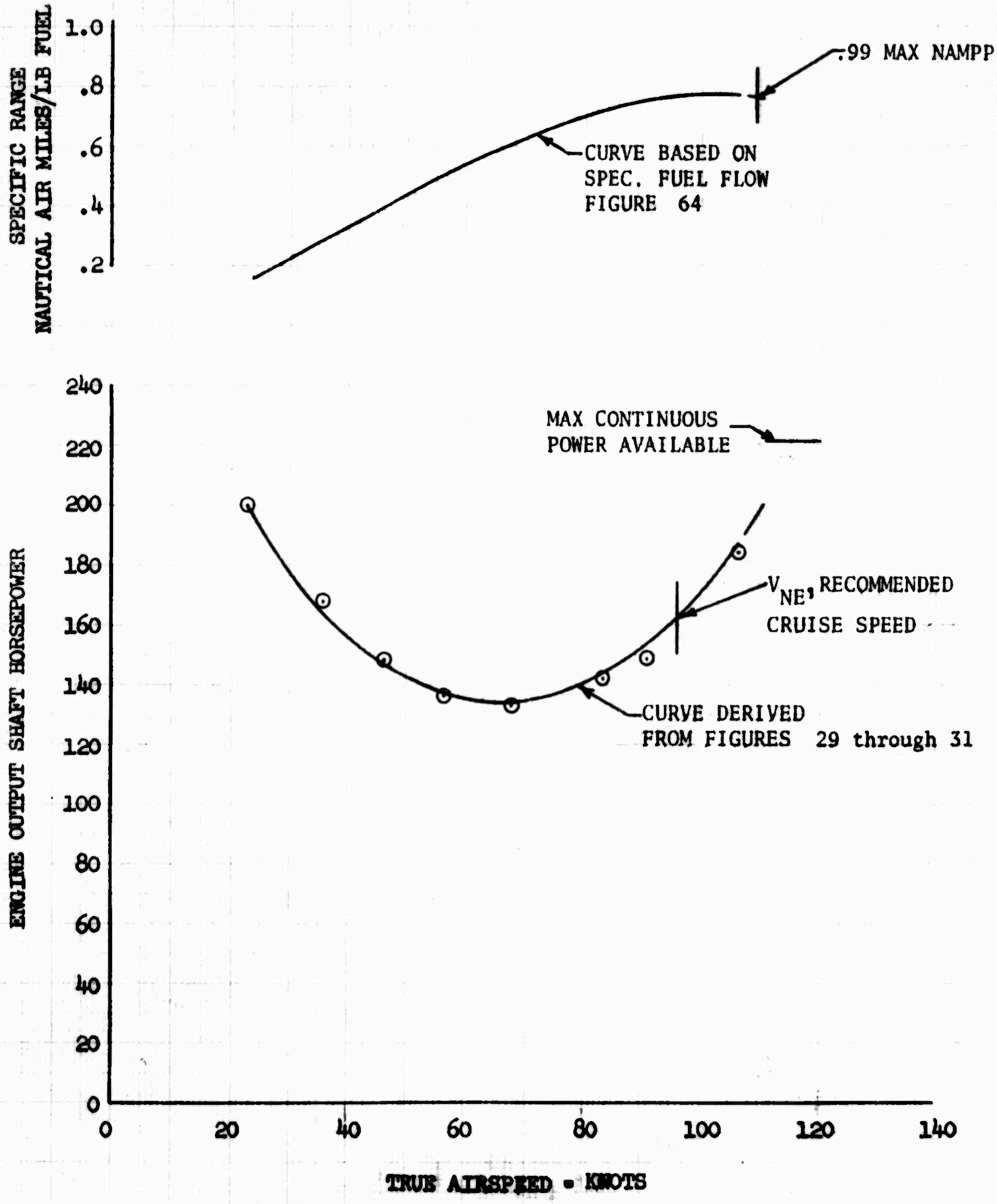


FIGURE NO. 42
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

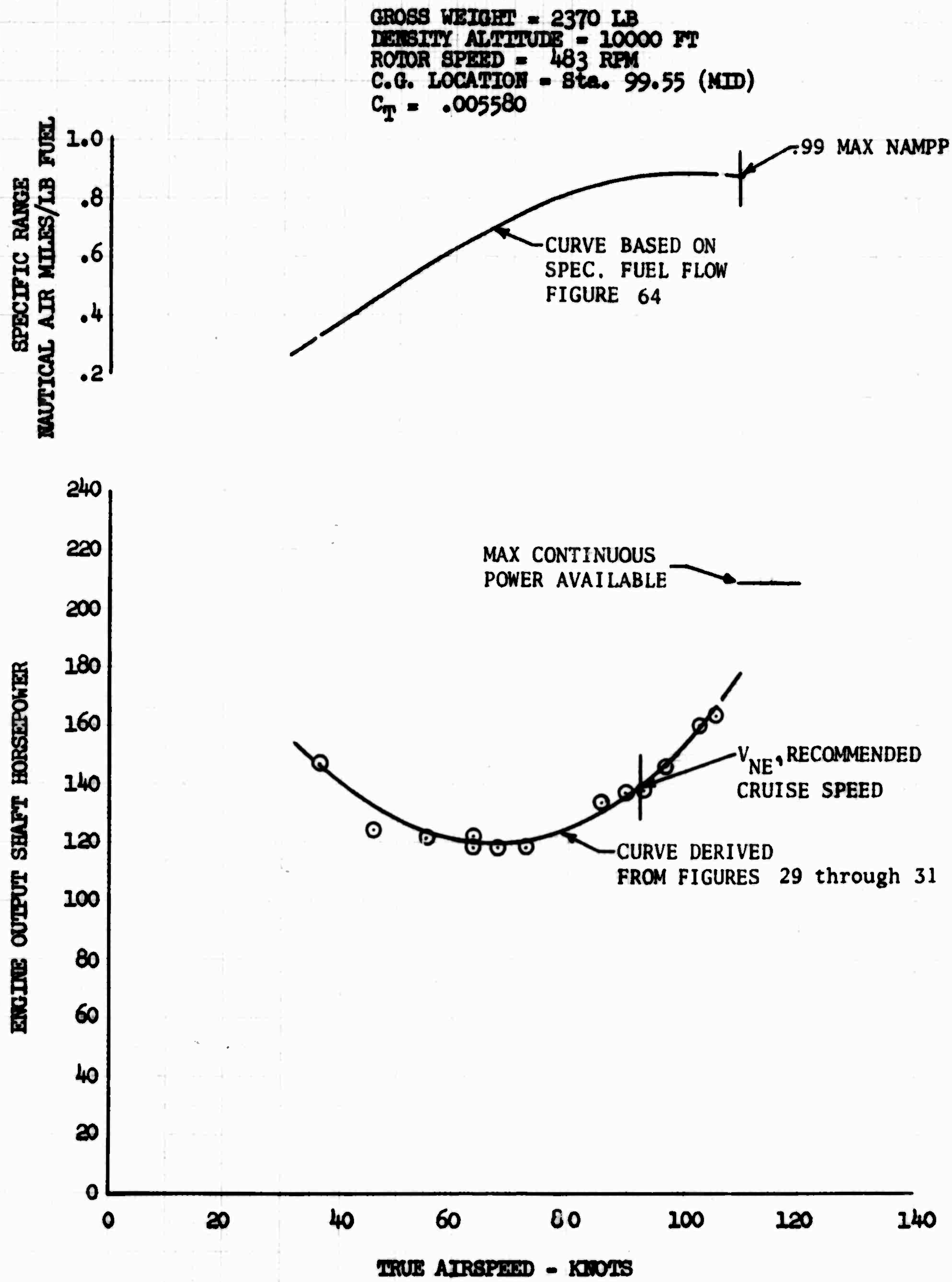
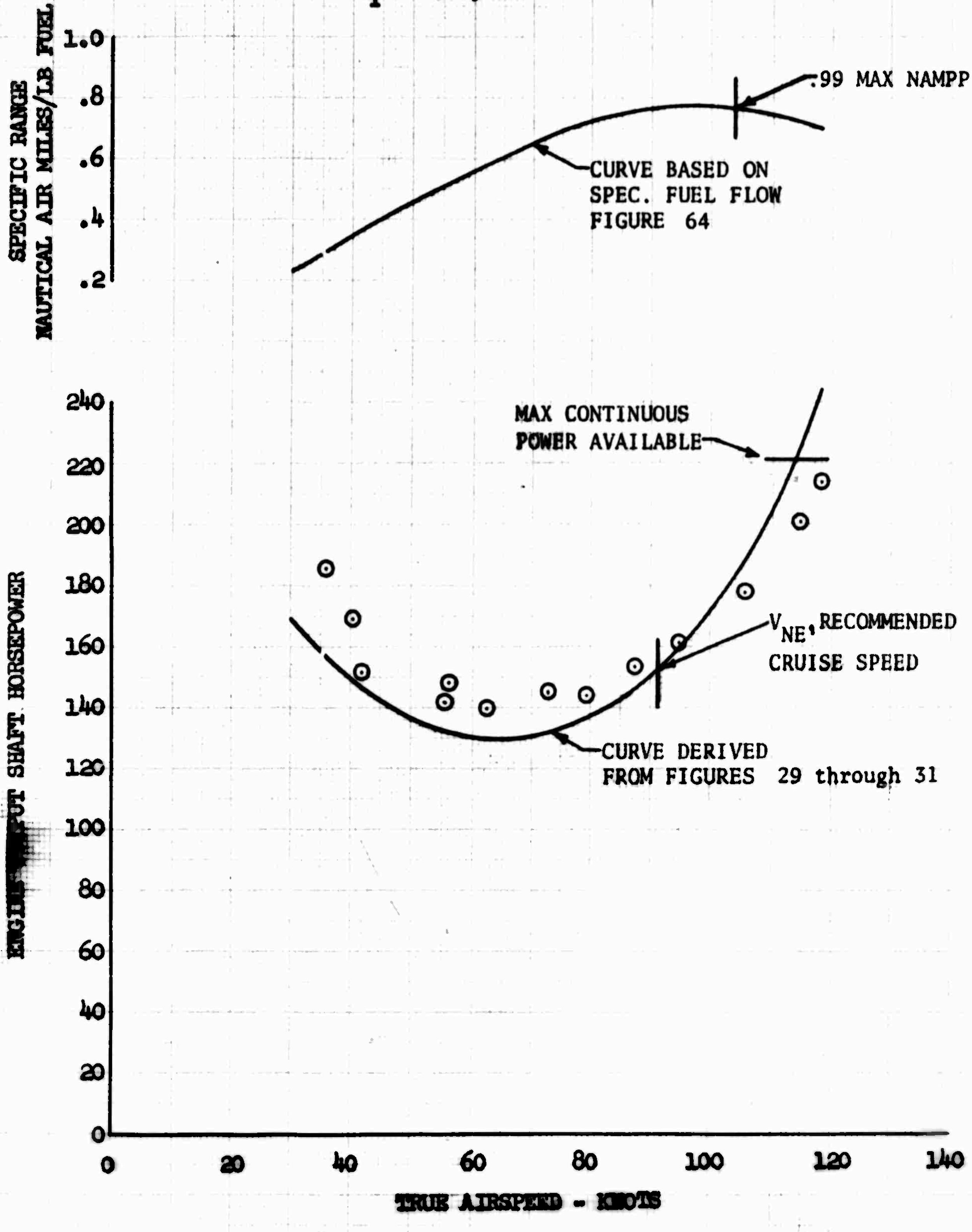


FIGURE NO. 43
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2780 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.5 (MID)
C_T = .005610



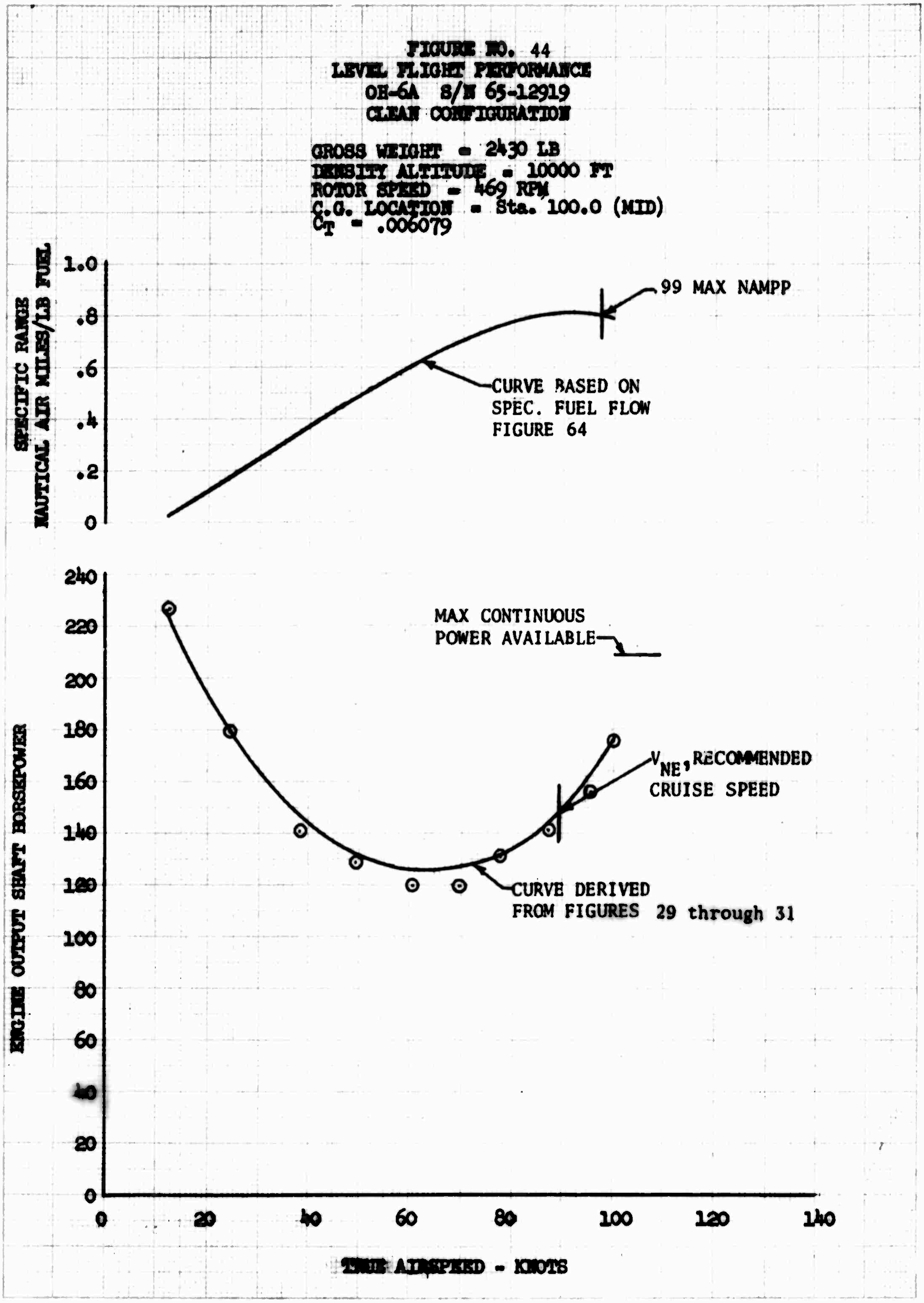


FIGURE NO. 44
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION
GROSS WEIGHT = 2430 LB
DENSITY ALTITUDE = 10000 FT
ROTOR SPEED = 469 RPM
C.G. LOCATION = Sta. 100.0 (MID)
C_T = .006079
SPECIFIC RANGE
NAUTICAL AIR MILES/LB FUEL
1.0
.8
.6
.4
.2
0
99 MAX NAMPP
CURVE BASED ON
SPEC. FUEL FLOW
FIGURE 64
ENGINE OUTPUT SHAFT HORSEPOWER
240
220
200
180
160
140
120
100
80
60
40
20
0
MAX CONTINUOUS
POWER AVAILABLE
V_{NE}, RECOMMENDED
CRUISE SPEED
CURVE DERIVED
FROM FIGURES 29 through 31
0
20
40
60
80
100
120
140
TRUE AIRSPEED - KNOTS

FIGURE NO. 45
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION

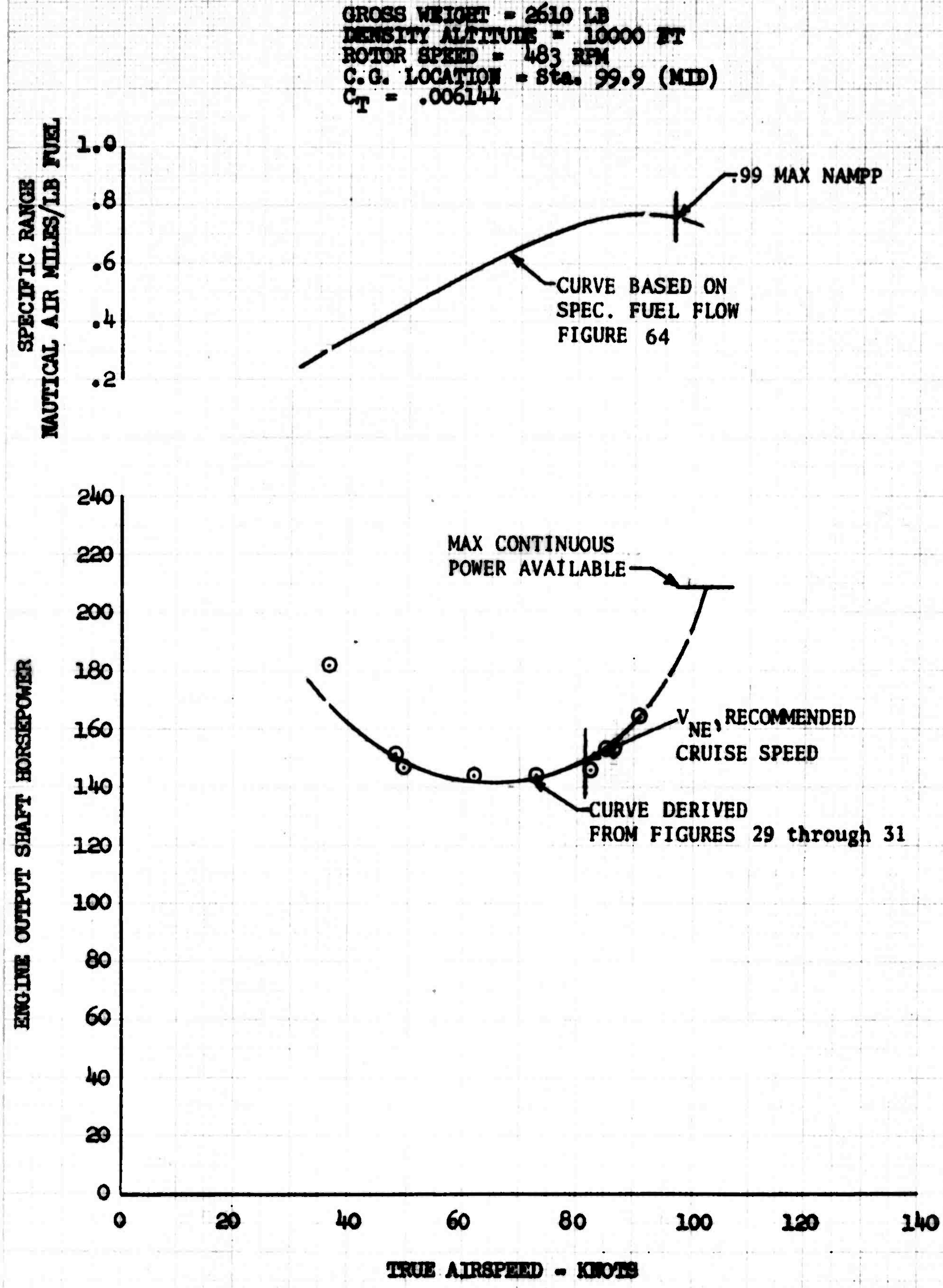


FIGURE NO. 46
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

GROSS WEIGHT = 2440 LB
DENSITY ALTITUDE = 15000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.0 (MID)
C_T = .006749

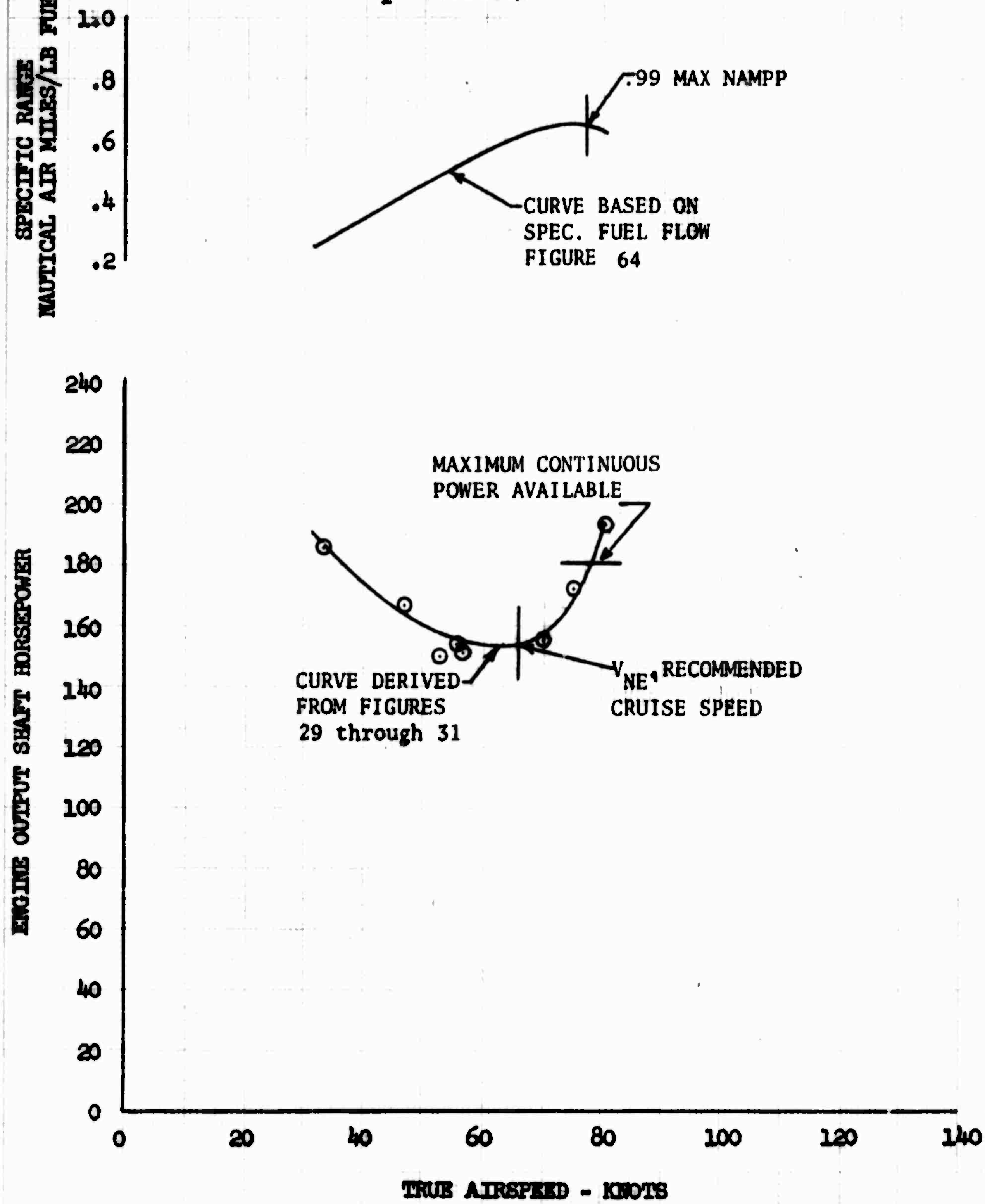


FIGURE NO. 47
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
FRONT DOORS REMOVED

GROSS WEIGHT = 2270 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 99.9 (MID)
C_T = .004588

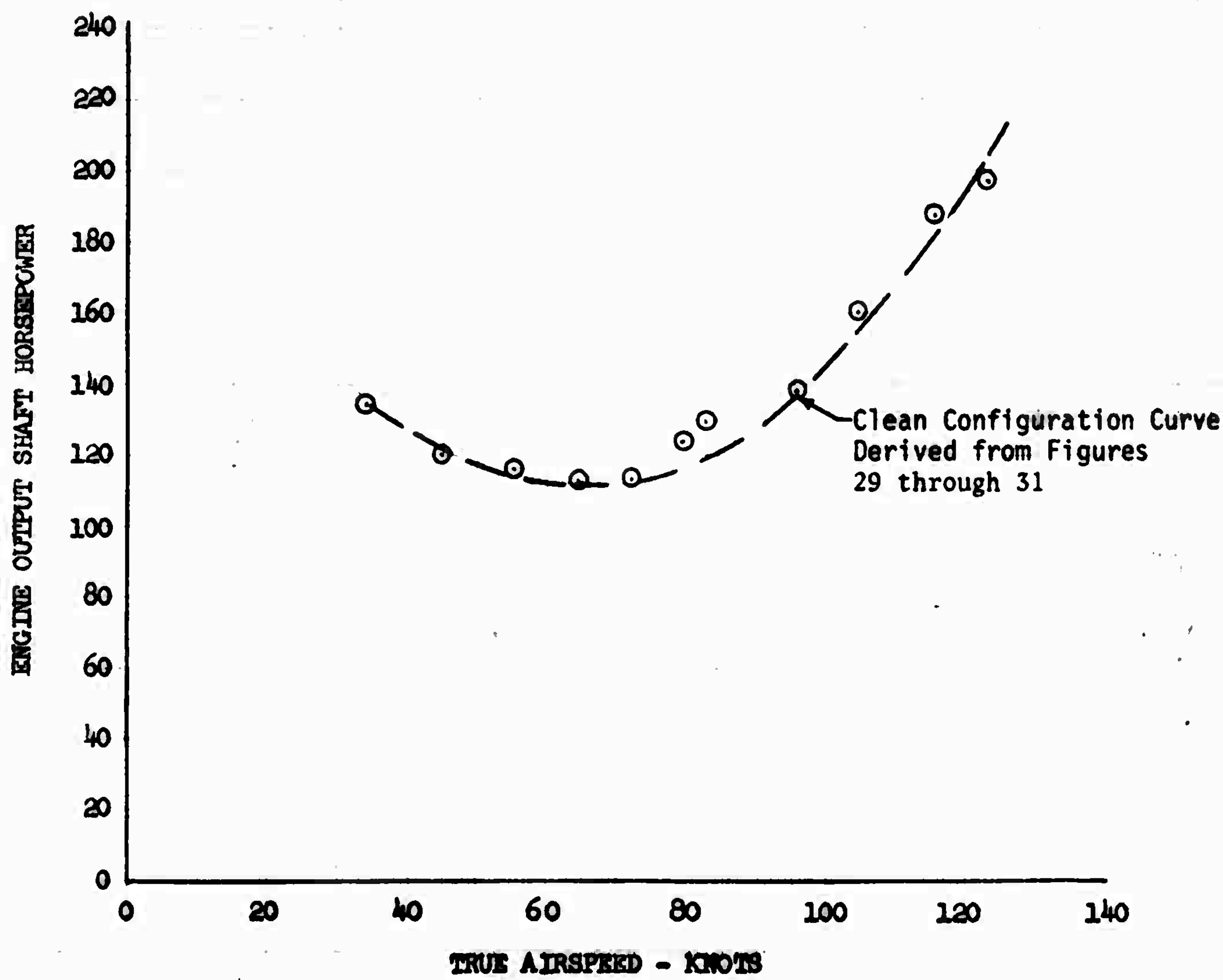


FIGURE NO. 48
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
BACK DOORS REMOVED

GROSS WEIGHT = 2410 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.0 (MID)
C_T = .004868

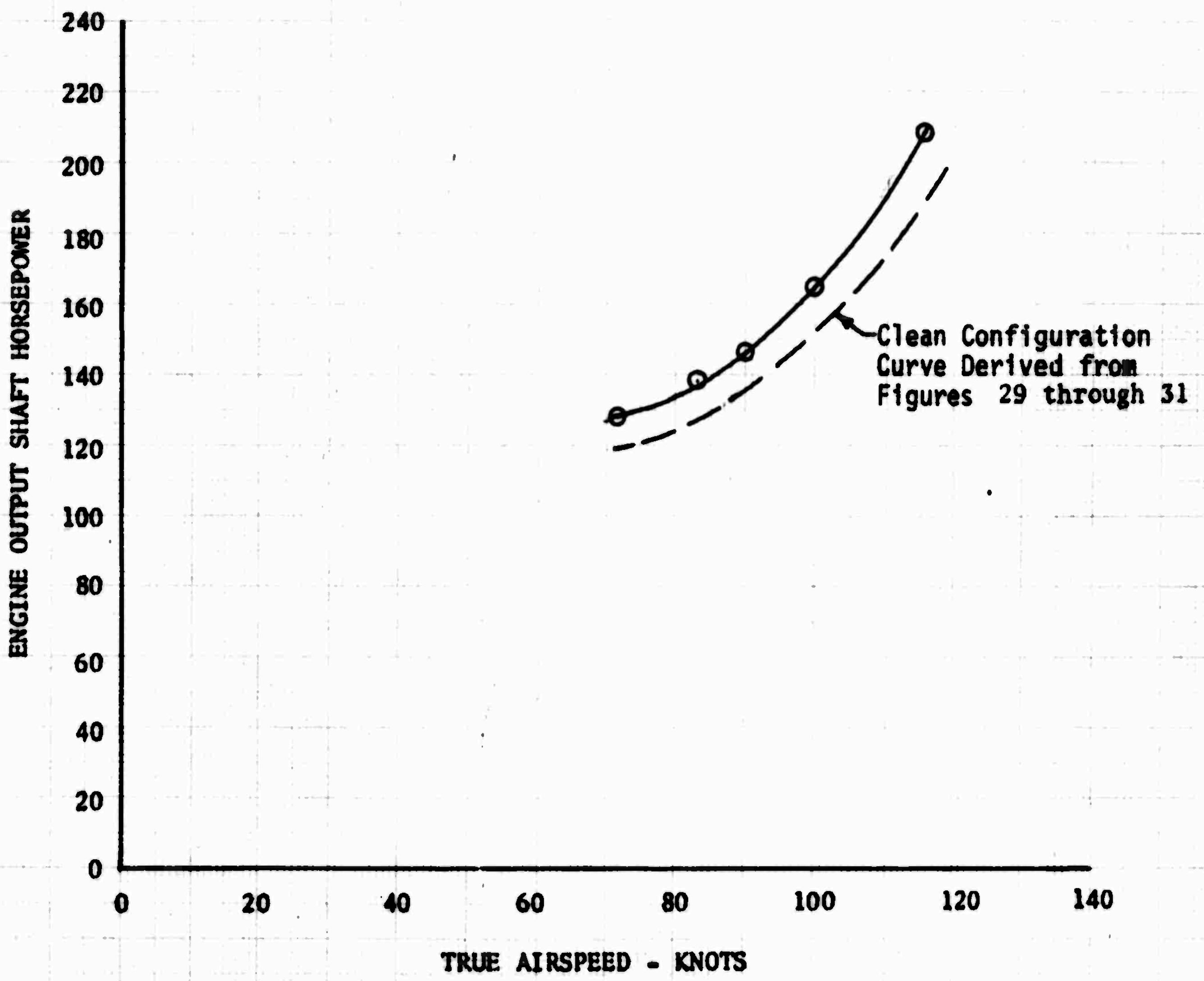


FIGURE NO. 49
LEVEL FLIGHT PERFORMANCE
OH-6A S/N 65-12967
CLEAN CONFIGURATION
ALL DOORS REMOVED

GROSS WEIGHT = 2280 LB
DENSITY ALTITUDE = 5000 FT
ROTOR SPEED = 483 RPM
C.G. LOCATION = Sta. 100.1 (MID)
C_T = .004599

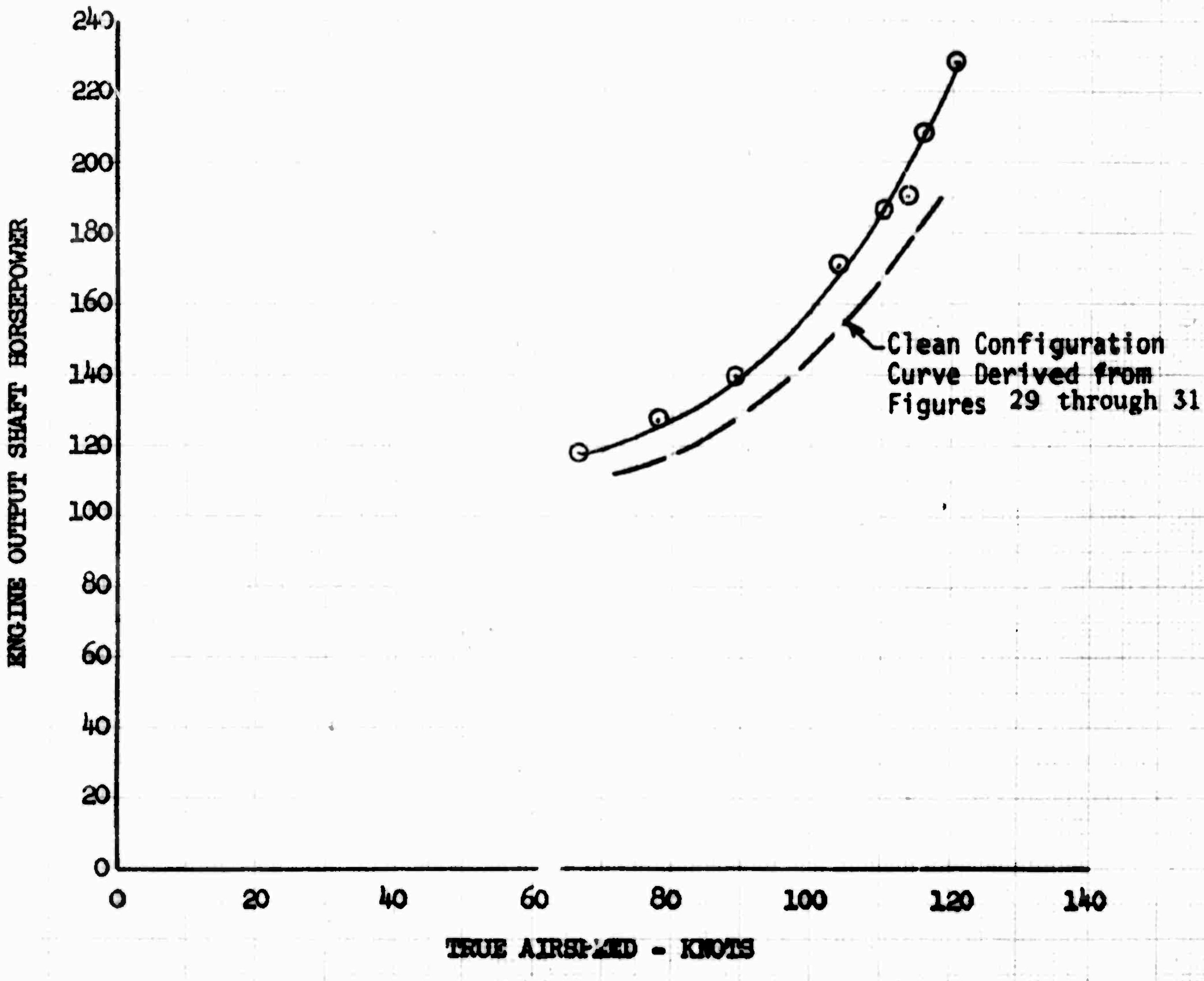


FIGURE NO. 50
BLADE STALL
OH-6A S/N 65-12967

CLEAN CONFIGURATION
GROSS WEIGHT = 2100 LB
C.G. LOCATION = 100.0 IN (MID)

SYM	ROTOR SPEED RPM	BLADE STALL
○	483	LIGHT
●	483	HEAVY
□	469	LIGHT
■	469	HEAVY

NOTES:

1. Light blade stall defined at 4/Rev cyclic control feedback

2. Heavy blade stall defined at 4/Rev at cyclic control and heavy collective control feedback

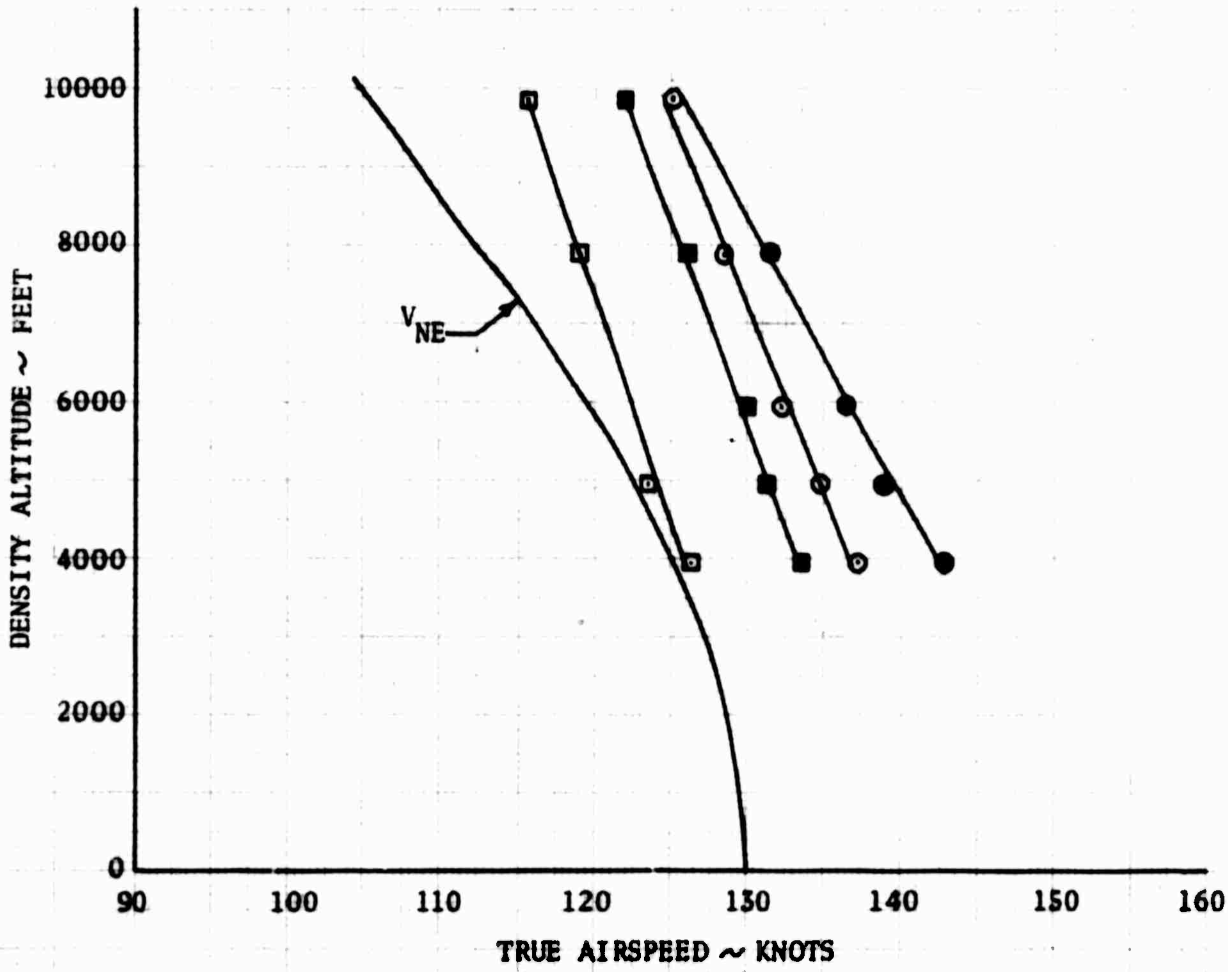


FIGURE NO. 51
BLADE STALL
OH-6A S/N 65-12967

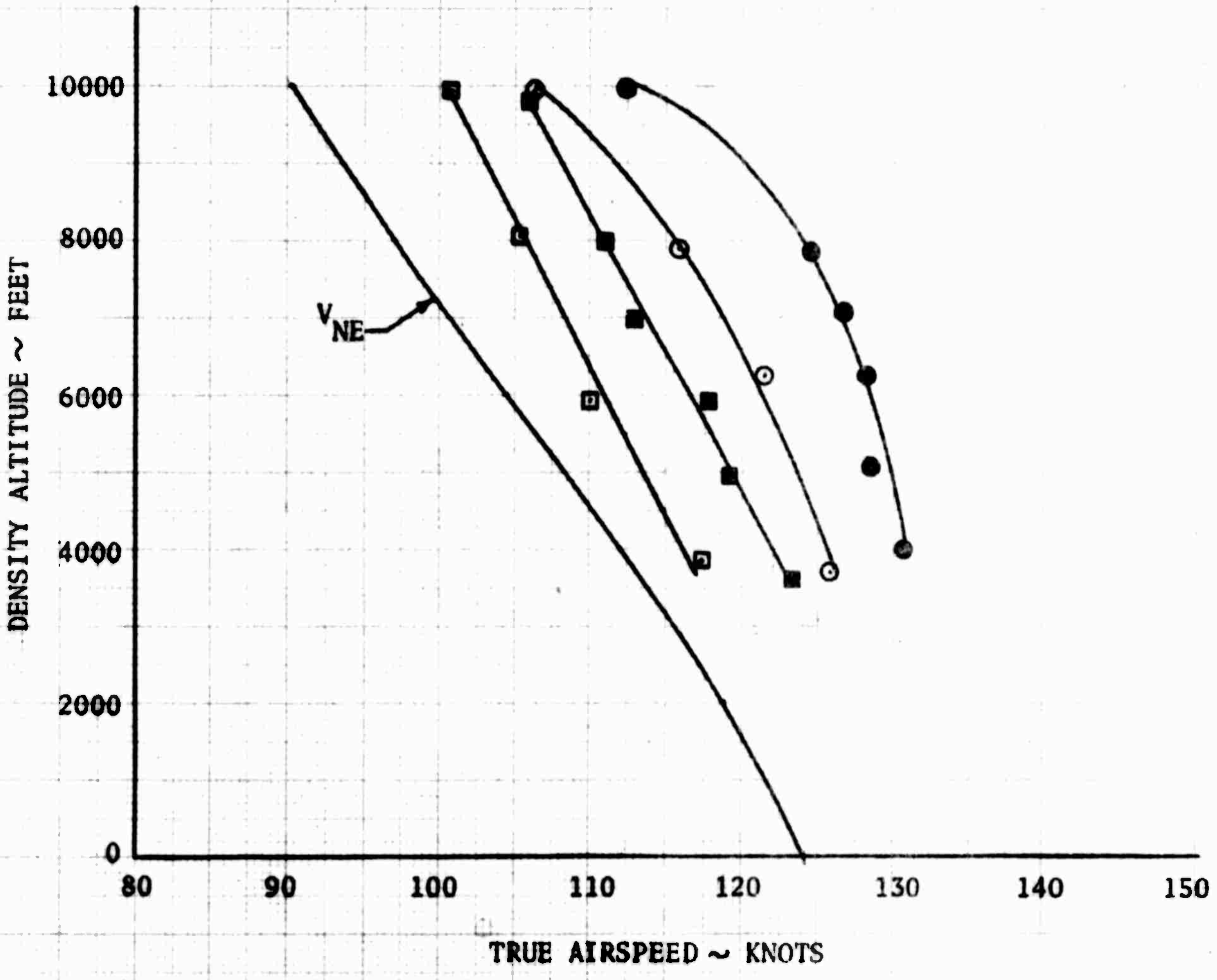
CLEAN CONFIGURATION
GROSS WEIGHT = 2400 LB
C.G. LOCATION = 100.0 IN (MID)

SYM	ROTOR SPEED RPM	BLADE STALL
○	483	LIGHT
●	483	HEAVY
□	469	LIGHT
■	469	HEAVY

NOTES:

1. Light blade stall defined at 4/Rev cyclic control feedback

2. Heavy blade stall defined at 4/Rev at cyclic control and heavy collective control feedback



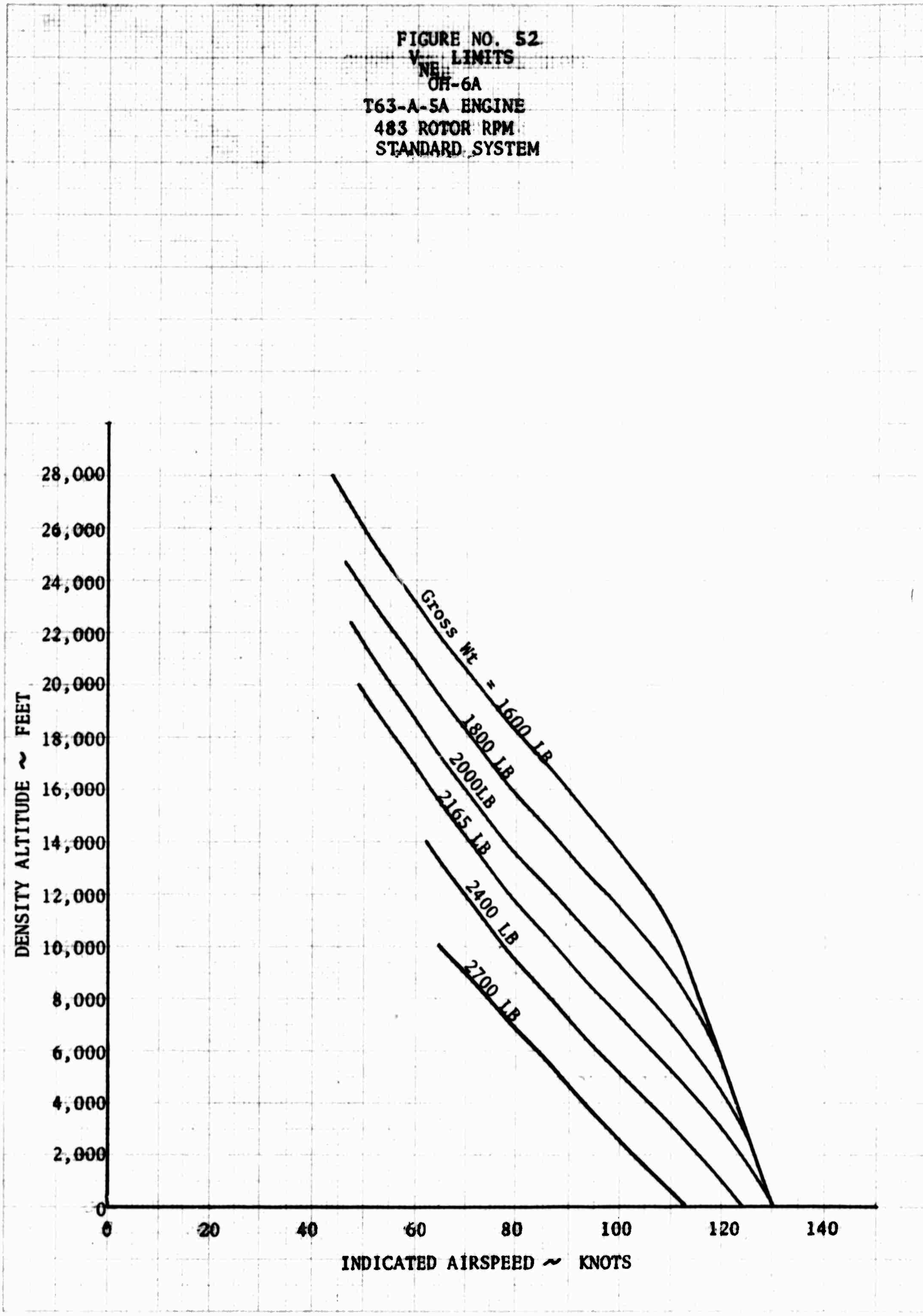


FIGURE NO. 52
V_{NE} LIMITS
OH-6A
T63-A-5A ENGINE
483 ROTOR RPM
STANDARD SYSTEM
DENSITY ALTITUDE ~ FEET
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Gross Wt = 1600 LB
1800 LB
2000LB
2165 LB
2400 LB
2700 LB
0
20
40
60
80
100
120
140
INDICATED AIRSPEED ~ KNOTS

FIGURE NO. 53
AUTOROTATION DESCENTS
OH-6A S/N 65-12919

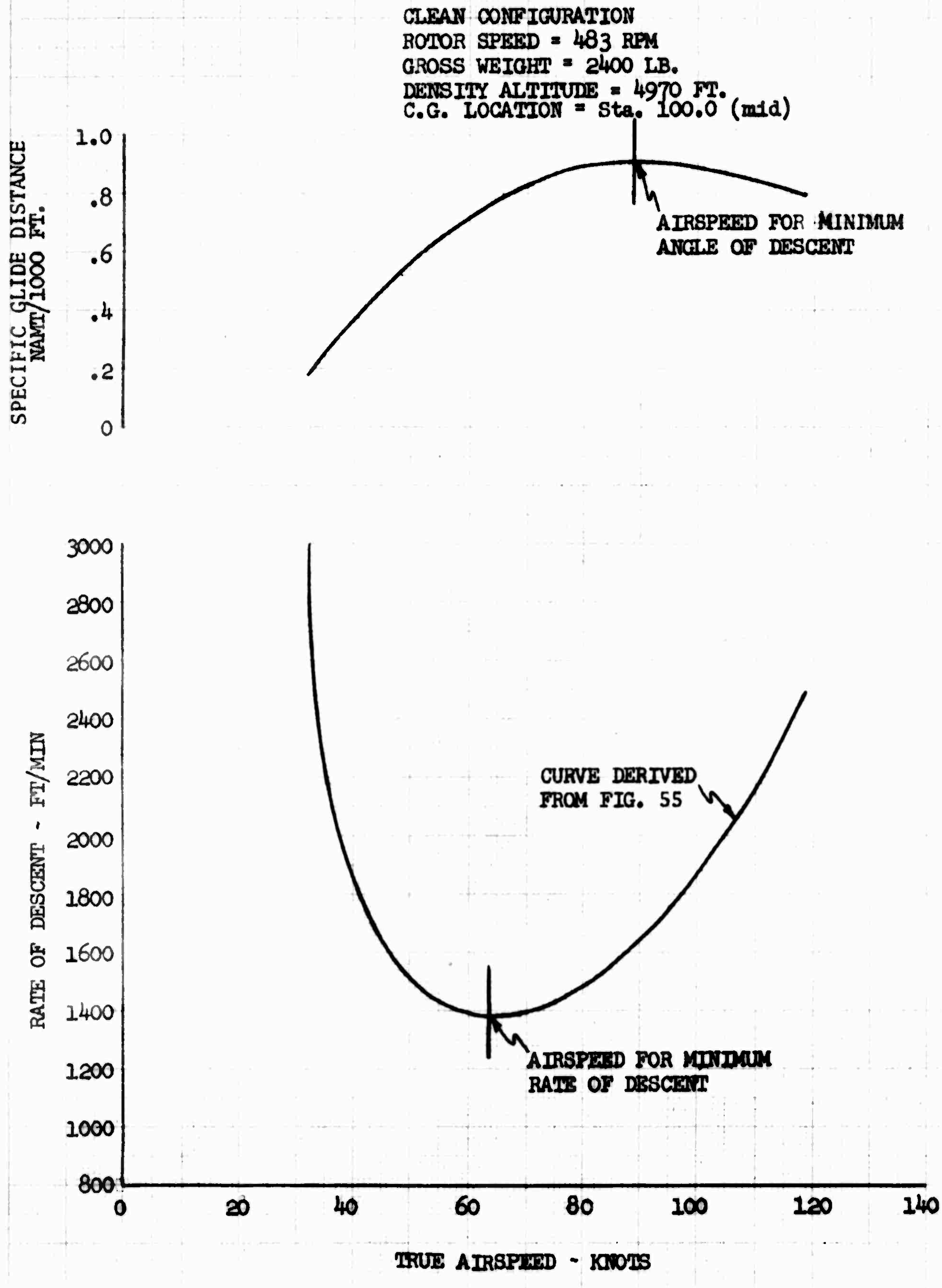


FIGURE NO. 54
AUTOROTATION DESCENTS
OH-6A S/N 65-12919

CLEAN CONFIGURATION
CALIBRATED AIRSPEED = 58.8 KNOTS
C.G. LOCATION = Sta. 100.2 (mid)
DENSITY ALTITUDE = 4970 FT.
GROSS WEIGHT = 2380 LB.

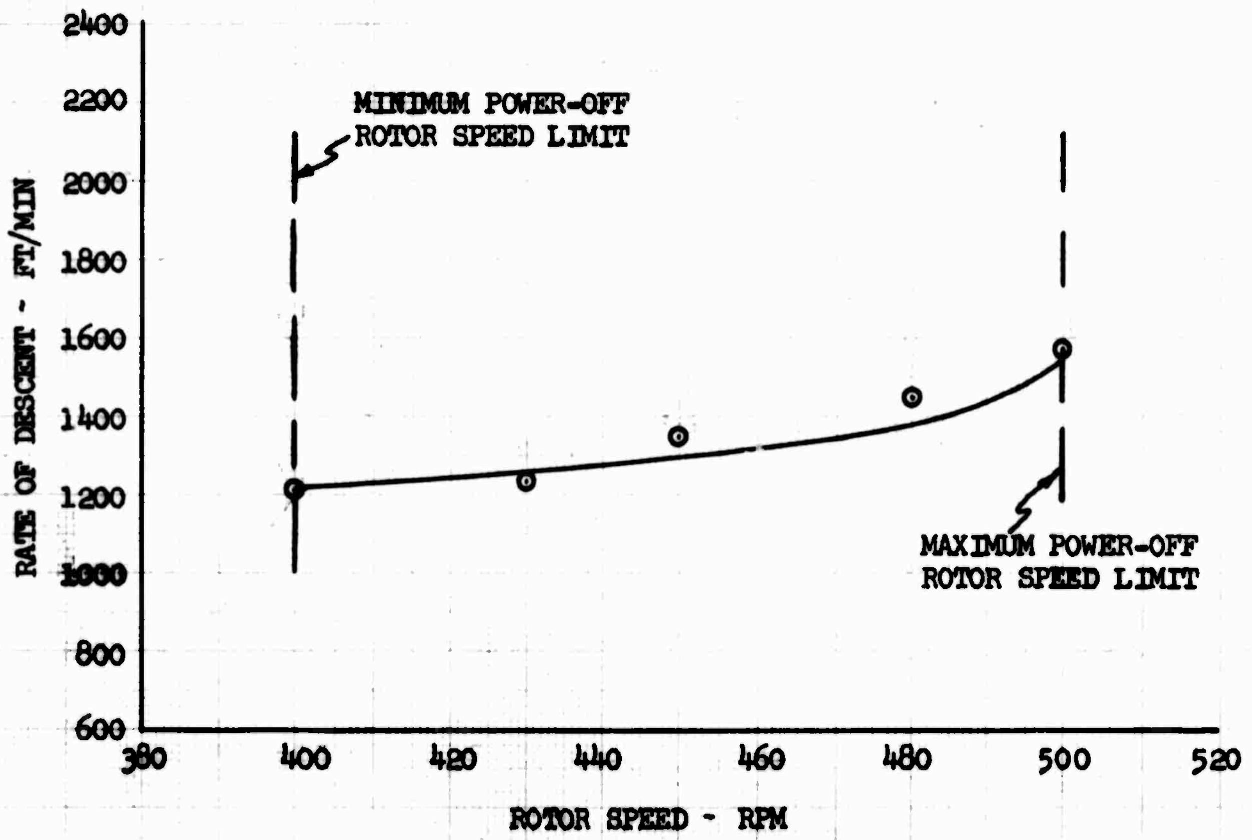


FIGURE NO. 55
AUTOROTATION DESCENTS
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN
○	4970	2400	483	100.0 (mid)
□	5000	2400	483	100.0 (mid)

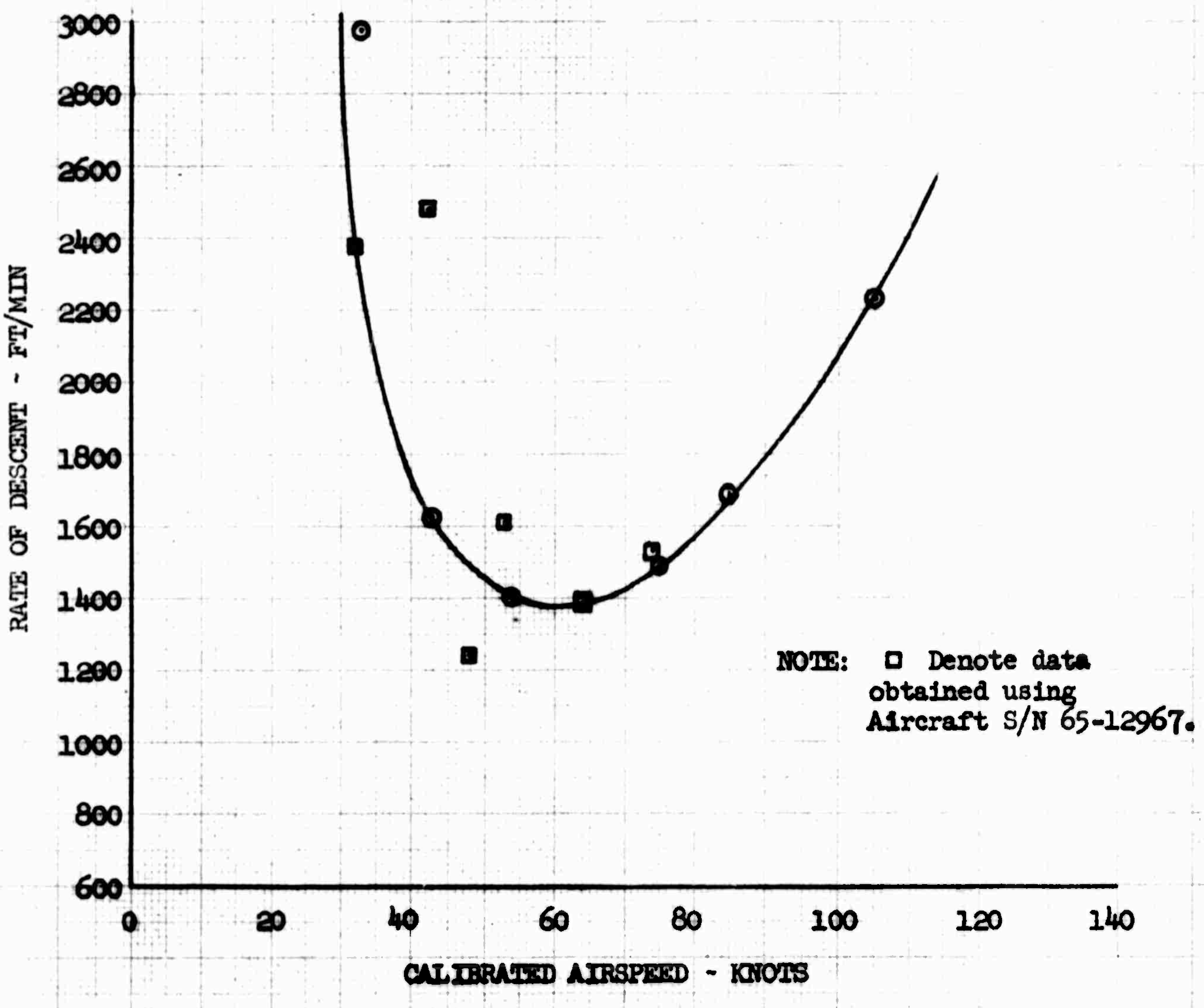


FIGURE NO. 56
AIRSPEED CALIBRATION
OH-6A S/N 65-12919
CLEAN CONFIGURATION
BOOM SYSTEM

DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
3540	2120	483	100.0 (Mid)	Level Flight

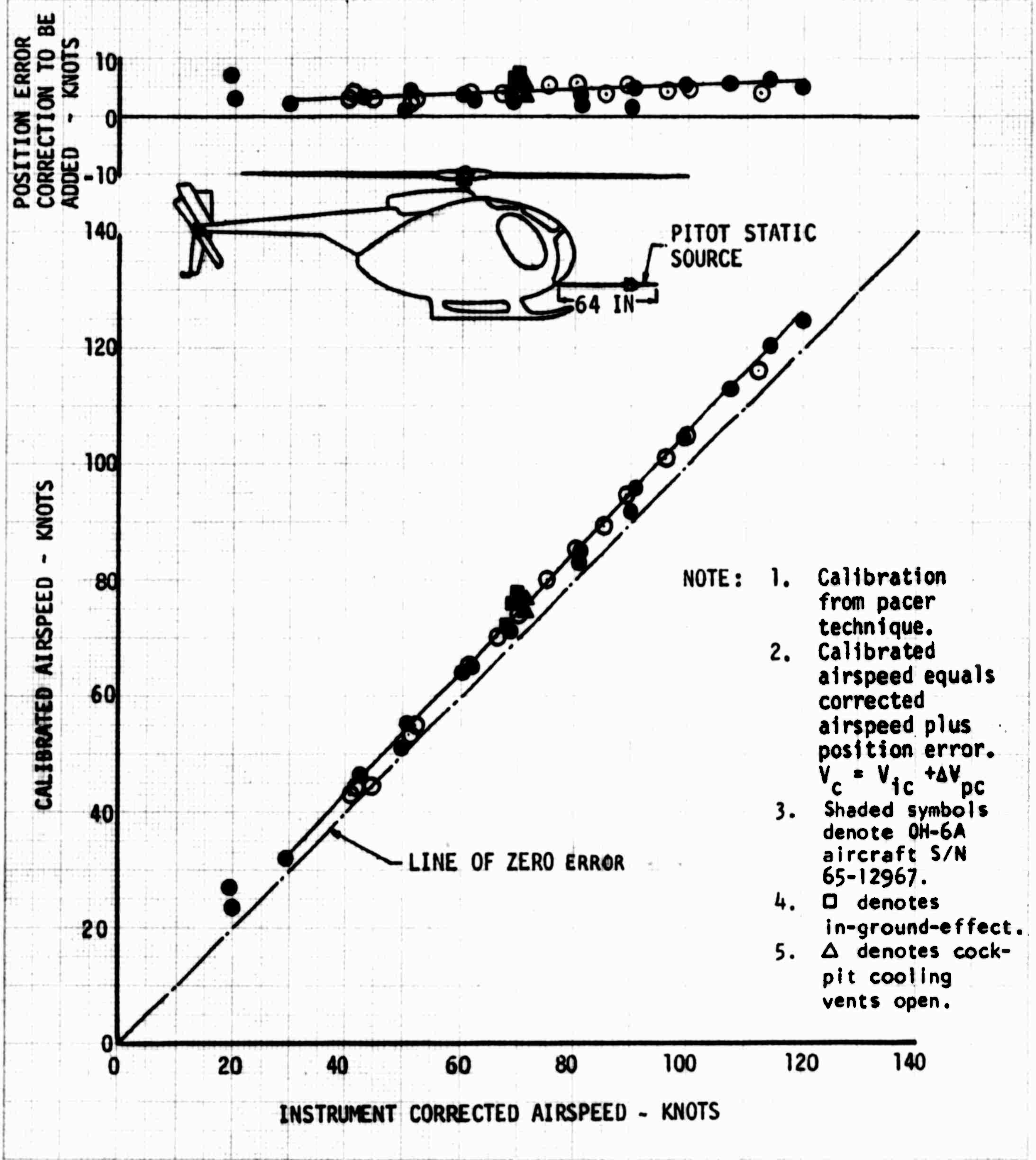


FIGURE NO. 57
AIRSPEED CALIBRATION
OH-6A S/N 65-12919
STANDARD SYSTEM
CLEAN CONFIGURATION

DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
3540	2120	483	100.0 (Mid)	Level Flight

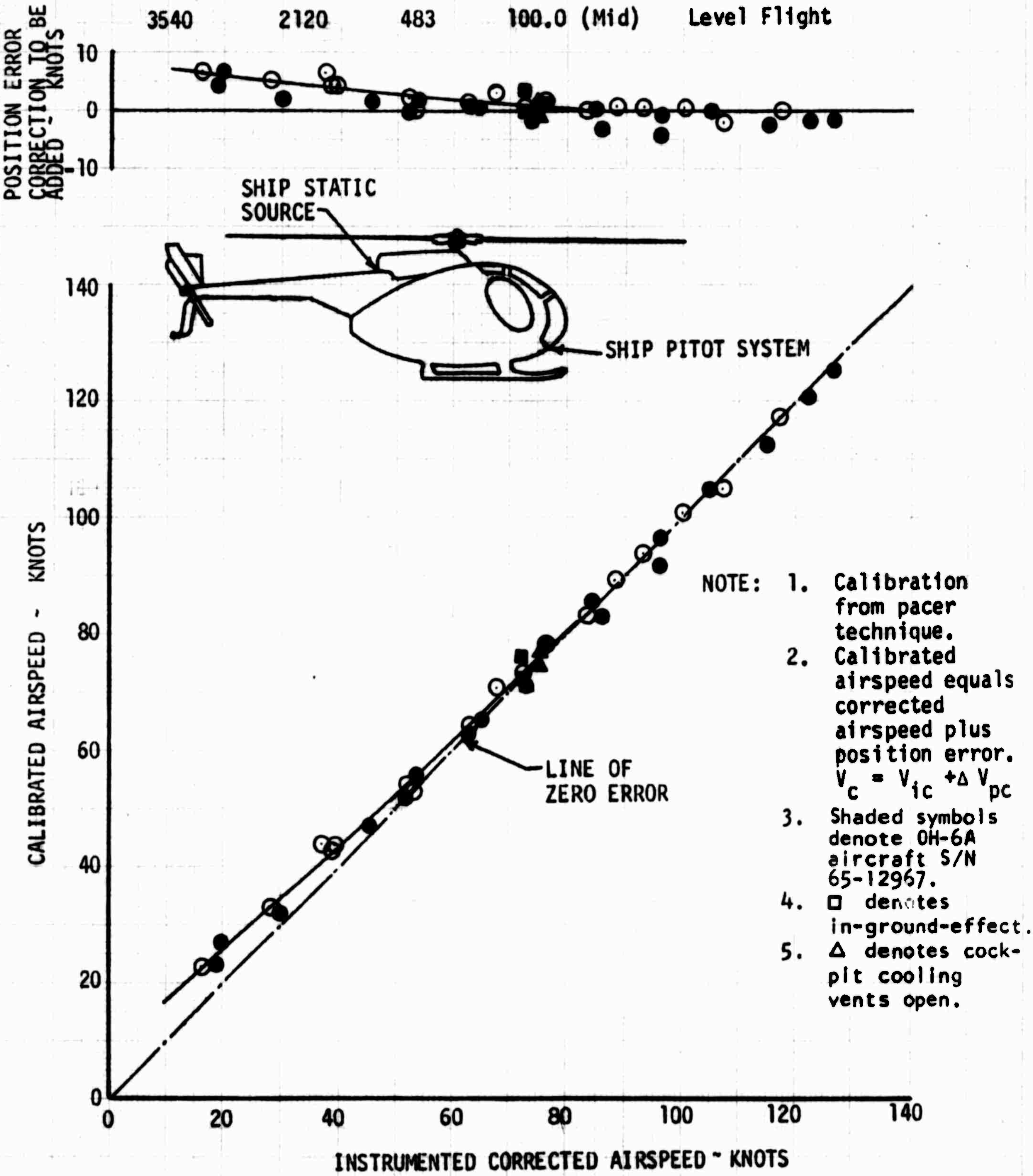


FIGURE NO. 58
SHAFT HORSEPOWER AVAILABLE
OH-6A S/N 65-12967

TAKEOFF POWER
T_{T_5} = 749°C
N_2 = 100%

NOTES:
1. Based on compressor inlet condition as defined in Figure 62 at zero airspeed.
2. Shaft horsepower derived from Engine Model Specification 580-F. (REF 9)
3. Power extracted equals 1.2 SHP.
4. P_{S_7} obtained from Figure 63
5. 0 Bleed.

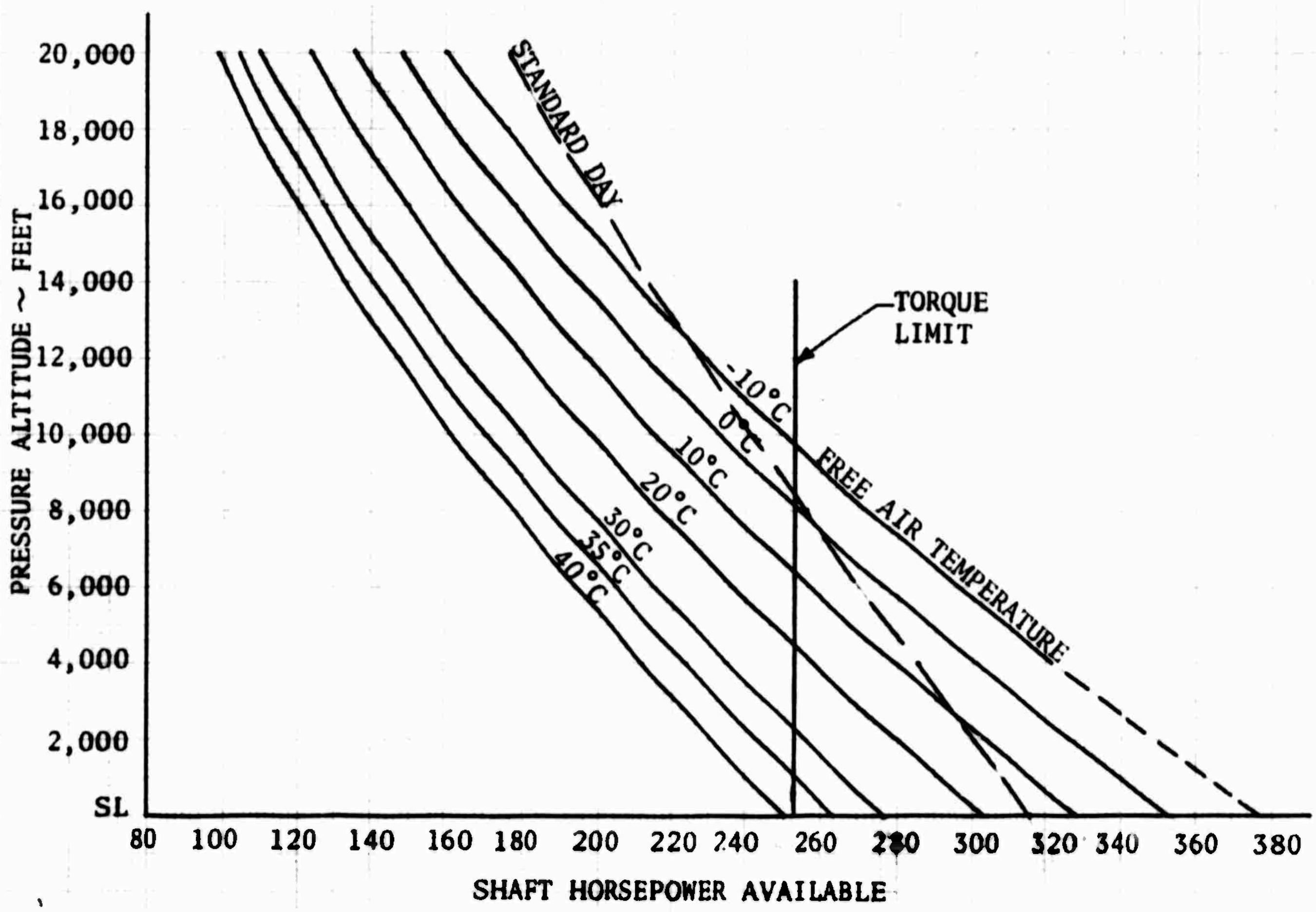


FIGURE NO. 59
SHAFT HORSEPOWER AVAILABLE
OH-6A S/N 65-12967

MAXIMUM CONTINUOUS POWER

T_{T_S} = 693°C

N_2 = 100%

NOTES:

1. Based on compressor inlet condition as defined in Figure 62 at zero airspeed.
2. Shaft horsepower derived from Engine Model Specification 580-F. (REF 9)
3. Power extracted equals 1.2 SHP.
4. P_{S_7} obtained from Figure 63
5. 0 Bleed.

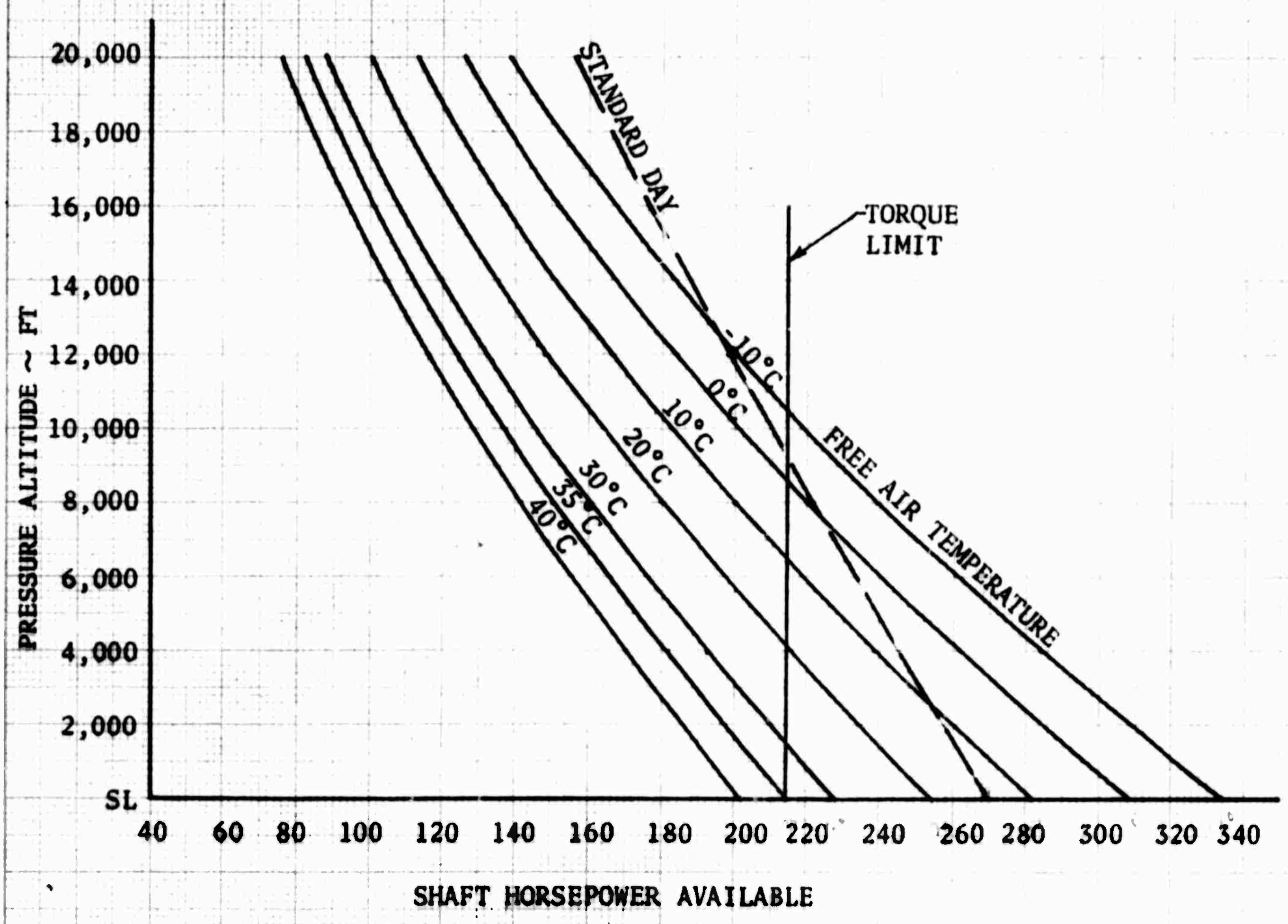


FIGURE NO. 60
SHAFT HORSEPOWER AVAILABLE
OH-6A S/N 65-12967

TAKEOFF POWER
$T_{T_5} = 749°C$
$N_2 = 103\%$

NOTES:

1. Based on compressor inlet condition as defined in Figure 62 at zero airspeed..
2. Shaft horsepower derived from Engine Model Specification 580-F.(REF 9)
3. Power extracted equals 1.2 SHP.
4. P_{S_7} obtained from Figure 63
5. 0 Bleed

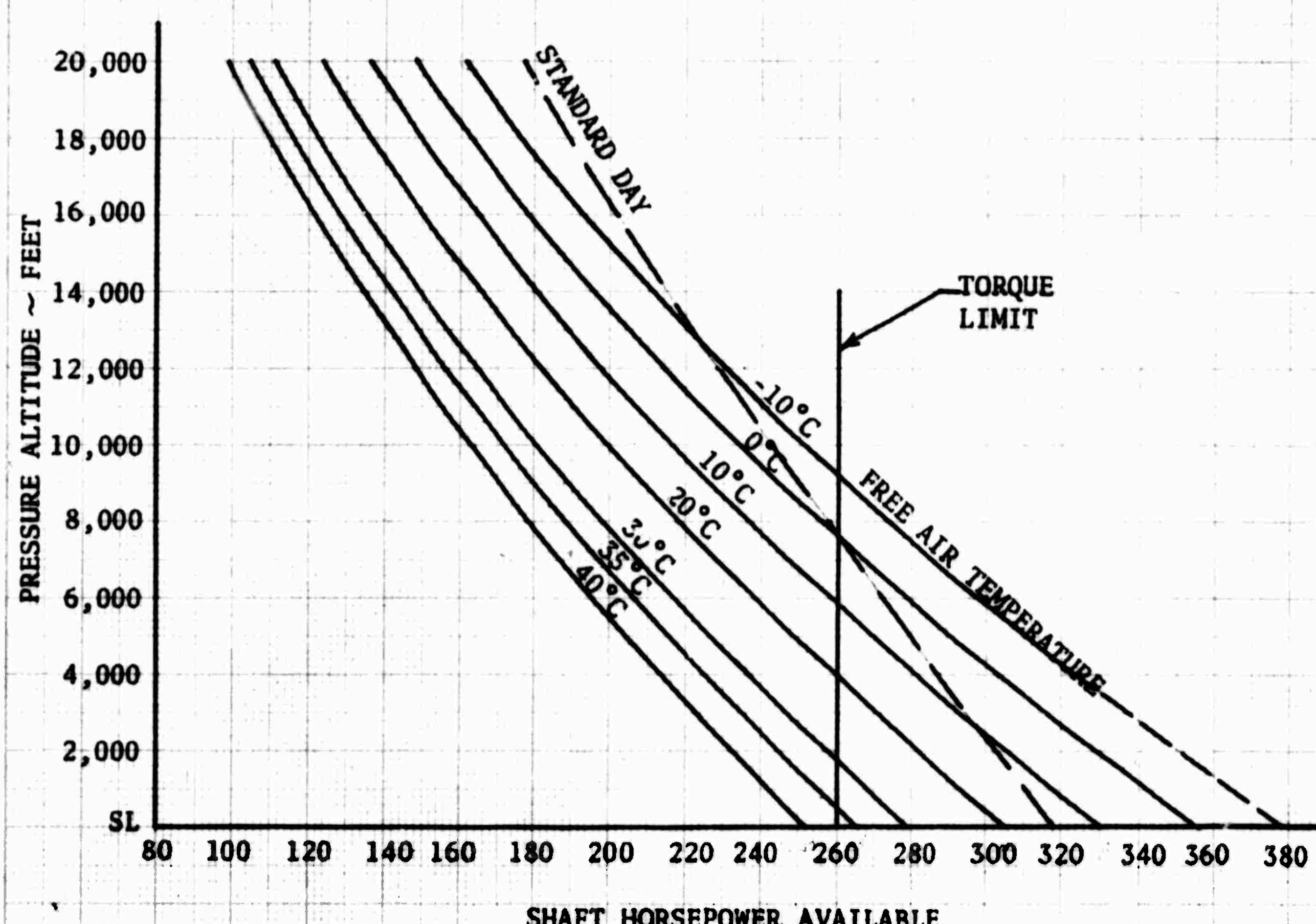


FIGURE NO. 61
SHAFT HORSEPOWER AVAILABLE
OH-6A S/N 65-12967

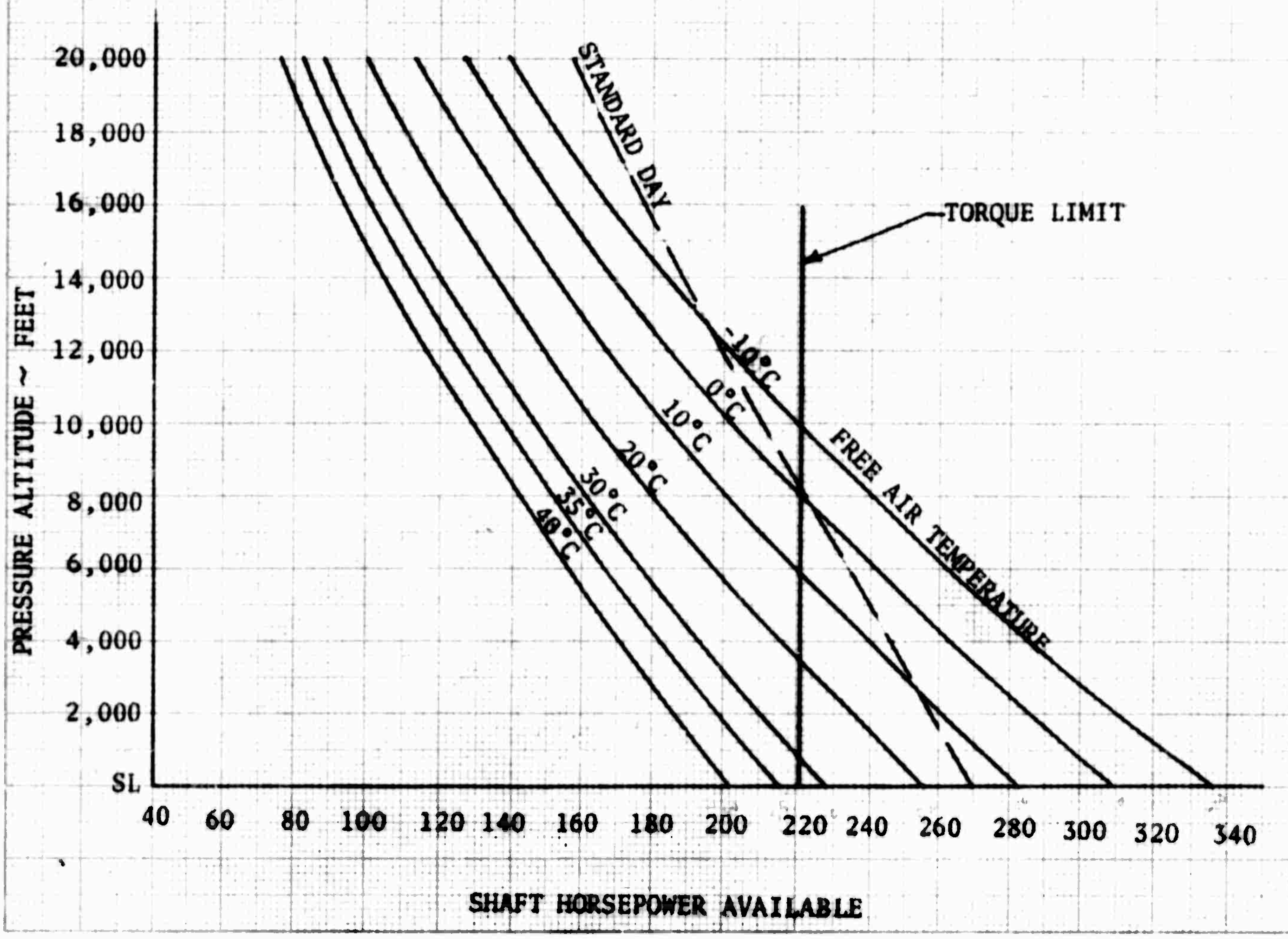
MAXIMUM CONTINUOUS POWER

$T_{T_S} = 693°C$

$N_2 = 103\%$

NOTES:

1. Based on compressor inlet condition as defined in Figure 62 at zero airspeed.
2. Shaft horsepower derived from Engine Model Specification 580-F. (REF 9)
3. Power extracted equals 1.2 SHP.
4. P_{S_7} obtained from Figure 63
5. 0 Bleed



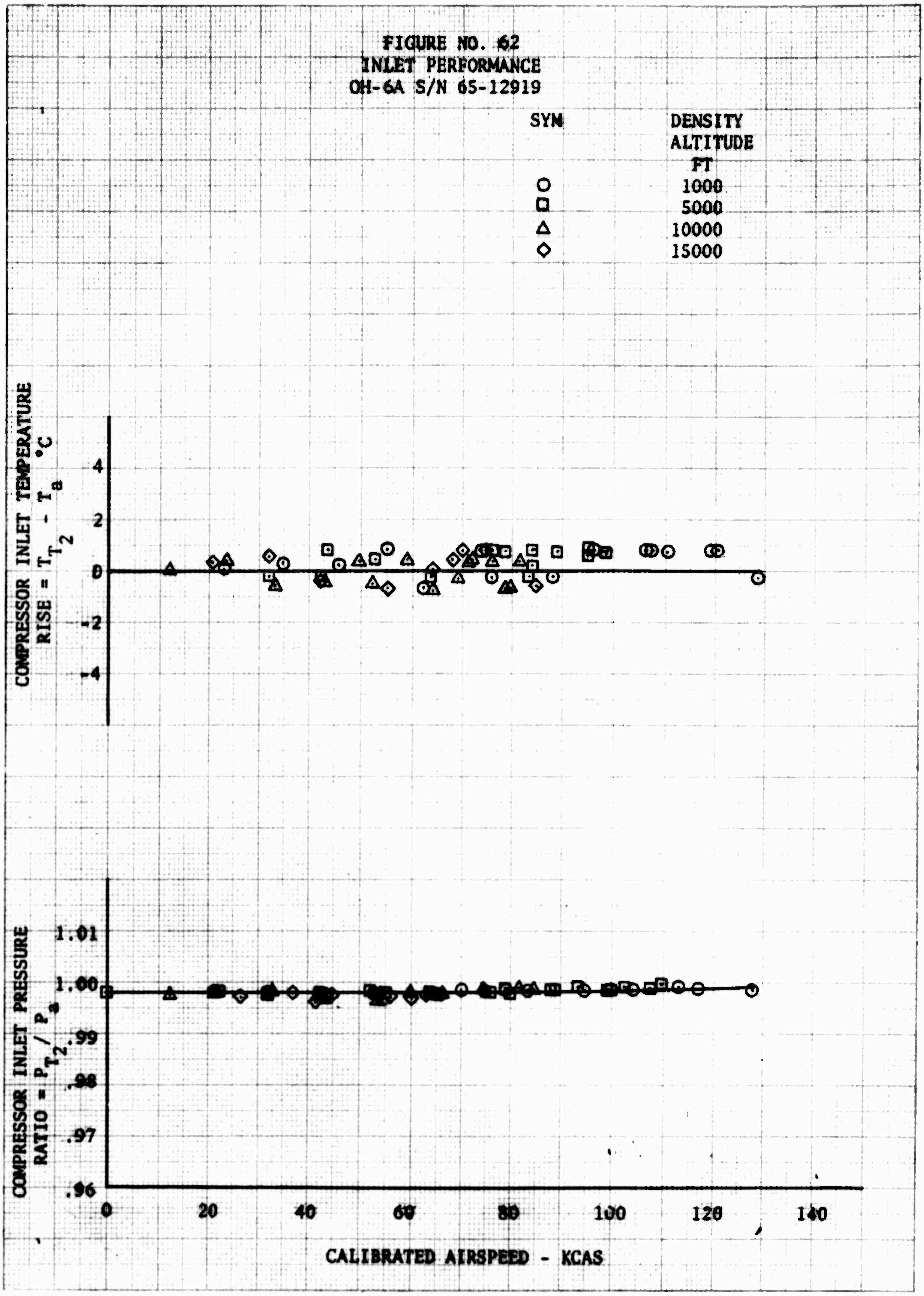
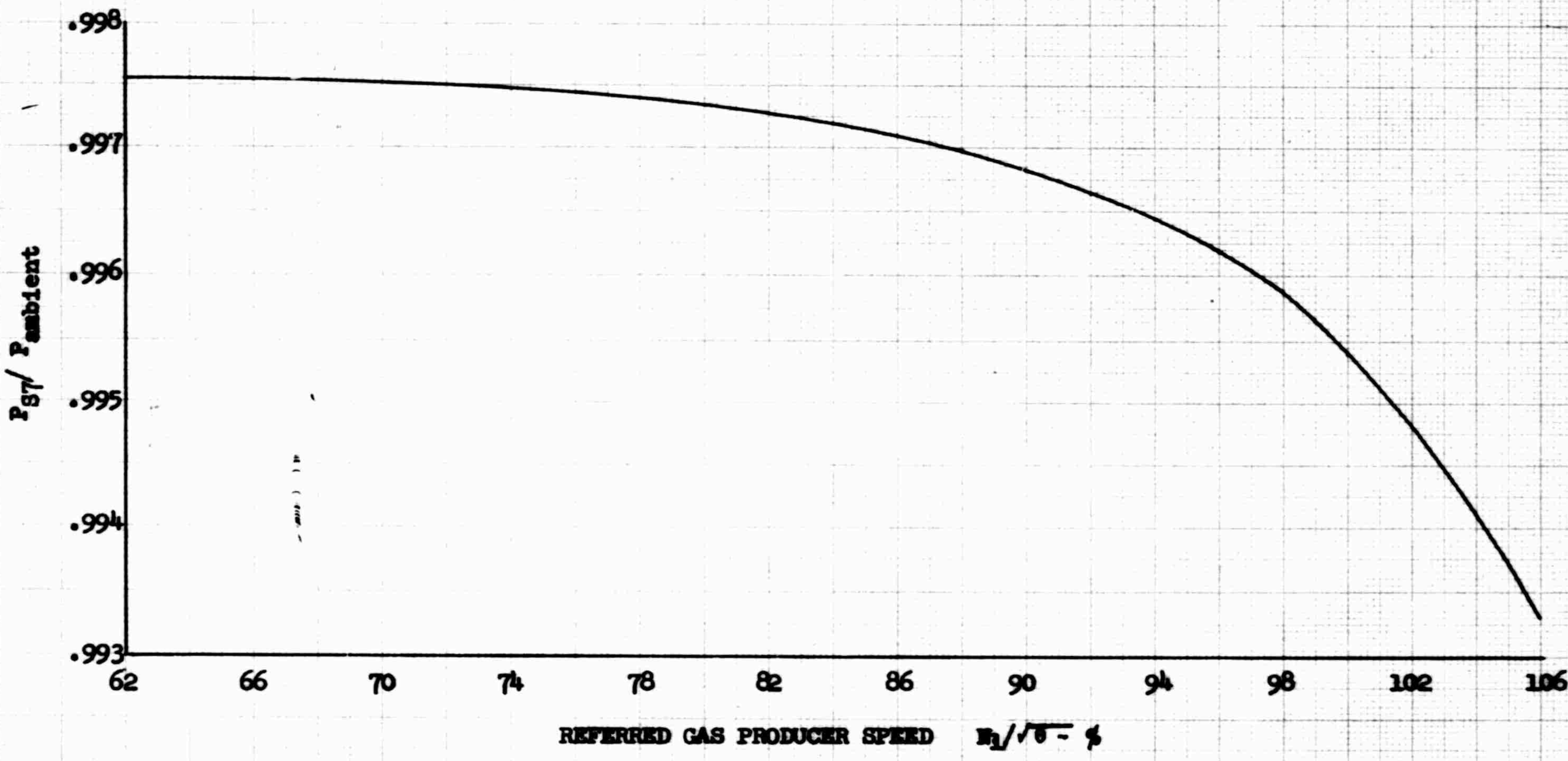


FIGURE NO. 62
INLET PERFORMANCE
OH-6A S/N 65-12919
SYM
DENSITY ALTITUDE FT
1000
5000
10000
15000
COMPRESSOR INLET TEMPERATURE RISE = $T_{T_2} - T_a$ °C
4
2
0
-2
-4
COMPRESSOR INLET PRESSURE RATIO = P_{T_2} / P_a
1.01
1.00
.99
.98
.97
.96
0
20
40
60
80
100
120
140
CALIBRATED AIRSPEED - KCAS

FIGURE NO. 63
EFFECT OF HUGHES EXHAUST EXTENSION
ON T63-A-5A EXHAUST STATIC PRESSURE

NOTES:
1. Based on Allison Test Stand Calibration
2. P_{S7} = Static Pressure at Exit of Engine
3. $P_{ambient}$ = Static Pressure at Exit of Hughes Exhaust Extension.



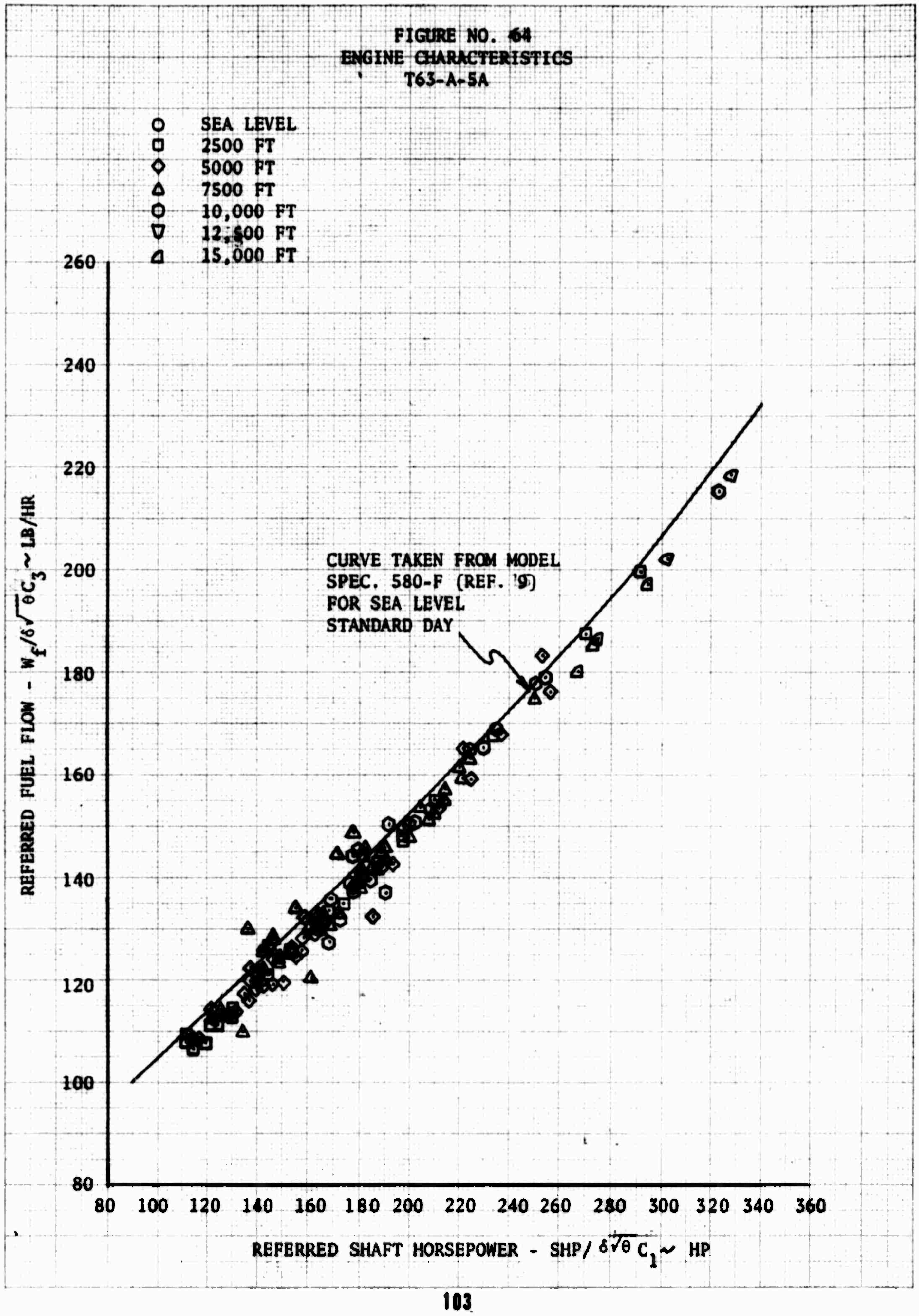
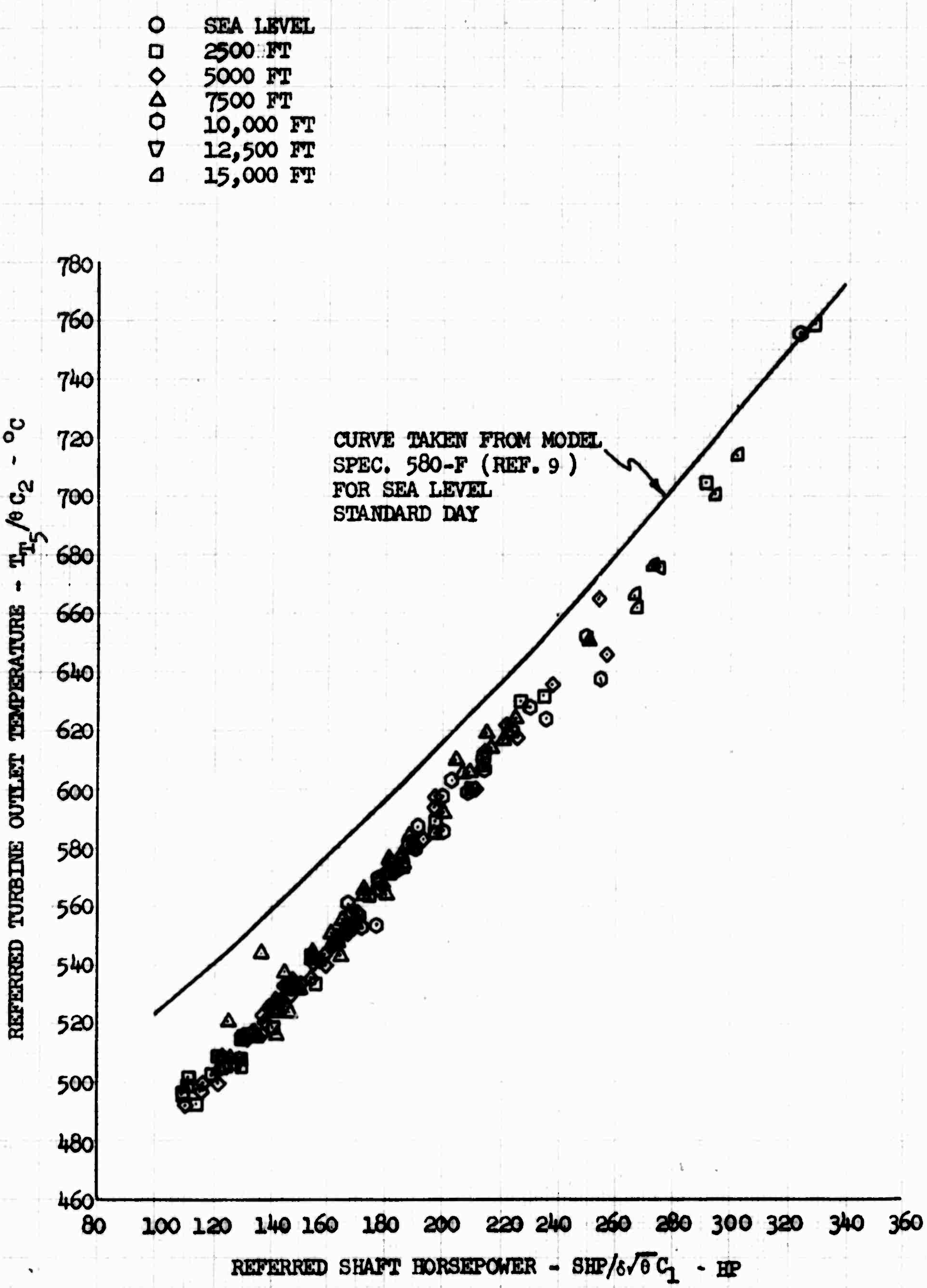


FIGURE NO. 64
ENGINE CHARACTERISTICS
T63-A-5A
SEA LEVEL
2500 FT
5000 FT
7500 FT
10,000 FT
12,500 FT
15,000 FT
CURVE TAKEN FROM MODEL SPEC. 580-F (REF. 9) FOR SEA LEVEL STANDARD DAY
REFERRED FUEL FLOW - $W_f/\delta\sqrt{\theta}\,C_3$ ~ LB/HR
REFERRED SHAFT HORSEPOWER - SHP/$\delta\sqrt{\theta}\,C_1$ ~ HP
260
240
220
200
180
160
140
120
100
80
80 100 120 140 160 180 200 220 240 260 280 300 320 340 360

FIGURE NO. 65
ENGINE CHARACTERISTICS
T63-A-5A



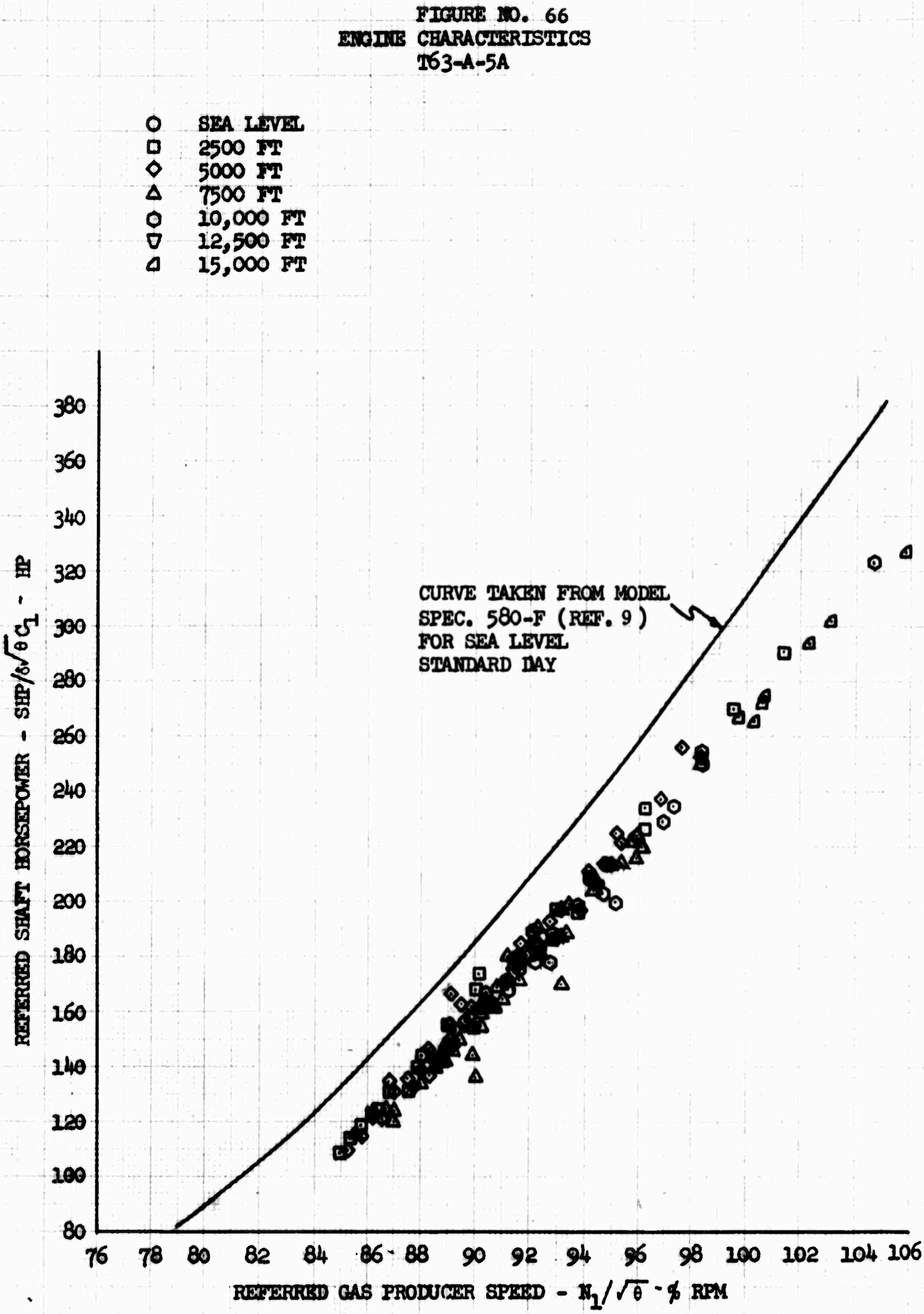


FIGURE NO. 66
ENGINE CHARACTERISTICS
T63-A-5A
SEA LEVEL
2500 FT
5000 FT
7500 FT
10,000 FT
12,500 FT
15,000 FT
CURVE TAKEN FROM MODEL SPEC. 580-F (REF. 9) FOR SEA LEVEL STANDARD DAY
REFERRED SHAFT HORSEPOWER - $SHP/\delta\sqrt{\theta}C_1$ - HP
REFERRED GAS PRODUCER SPEED - $N_1/\sqrt{\theta}$ - % RPM
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
76
78
80
82
84
86
88
90
92
94
96
98
100
102
104
106

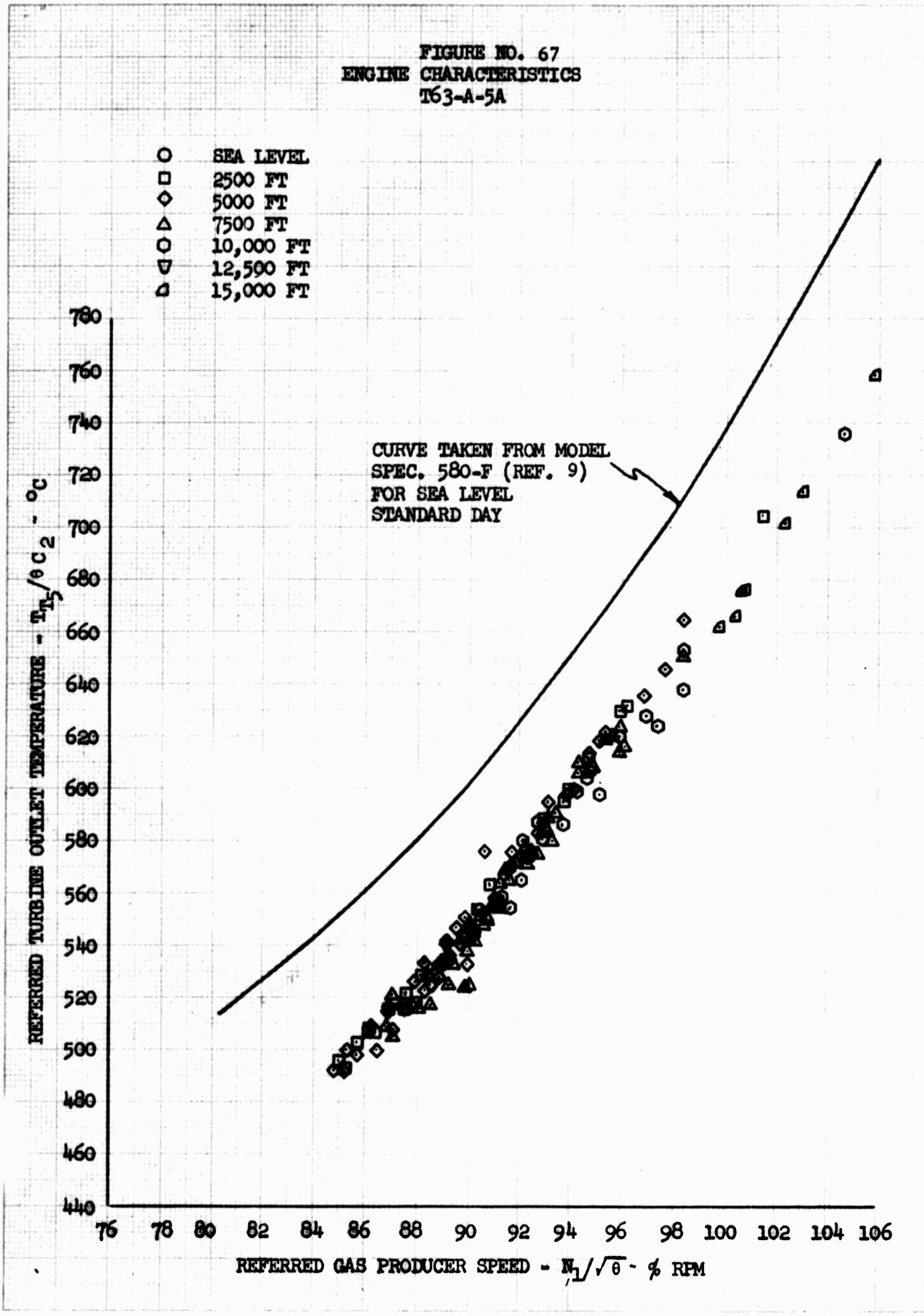


FIGURE NO. 67
ENGINE CHARACTERISTICS
T63-A-5A
SEA LEVEL
2500 FT
5000 FT
7500 FT
10,000 FT
12,500 FT
15,000 FT
CURVE TAKEN FROM MODEL SPEC. 580-F (REF. 9) FOR SEA LEVEL STANDARD DAY
REFERRED TURBINE OUTLET TEMPERATURE - T_{T5}/θ_{C2} - °C
780
760
740
720
700
680
660
640
620
600
580
560
540
520
500
480
460
440
76
78
80
82
84
86
88
90
92
94
96
98
100
102
104
106
REFERRED GAS PRODUCER SPEED - $N_1/\sqrt{\theta}$ - % RPM

FIGURE NO. 68
CONTROL POSITION TRIM CURVES
OH-6A S/N 62-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	15,220	2400	483	100.0(Mid)	Level Flight
□	10,540	2390	483	99.6(Mid)	Level Flight
△	5100	2370	483	100.0(Mid	Level Flight
◇	Sea Level	2390	483	100.0(Mid)	Level Flight

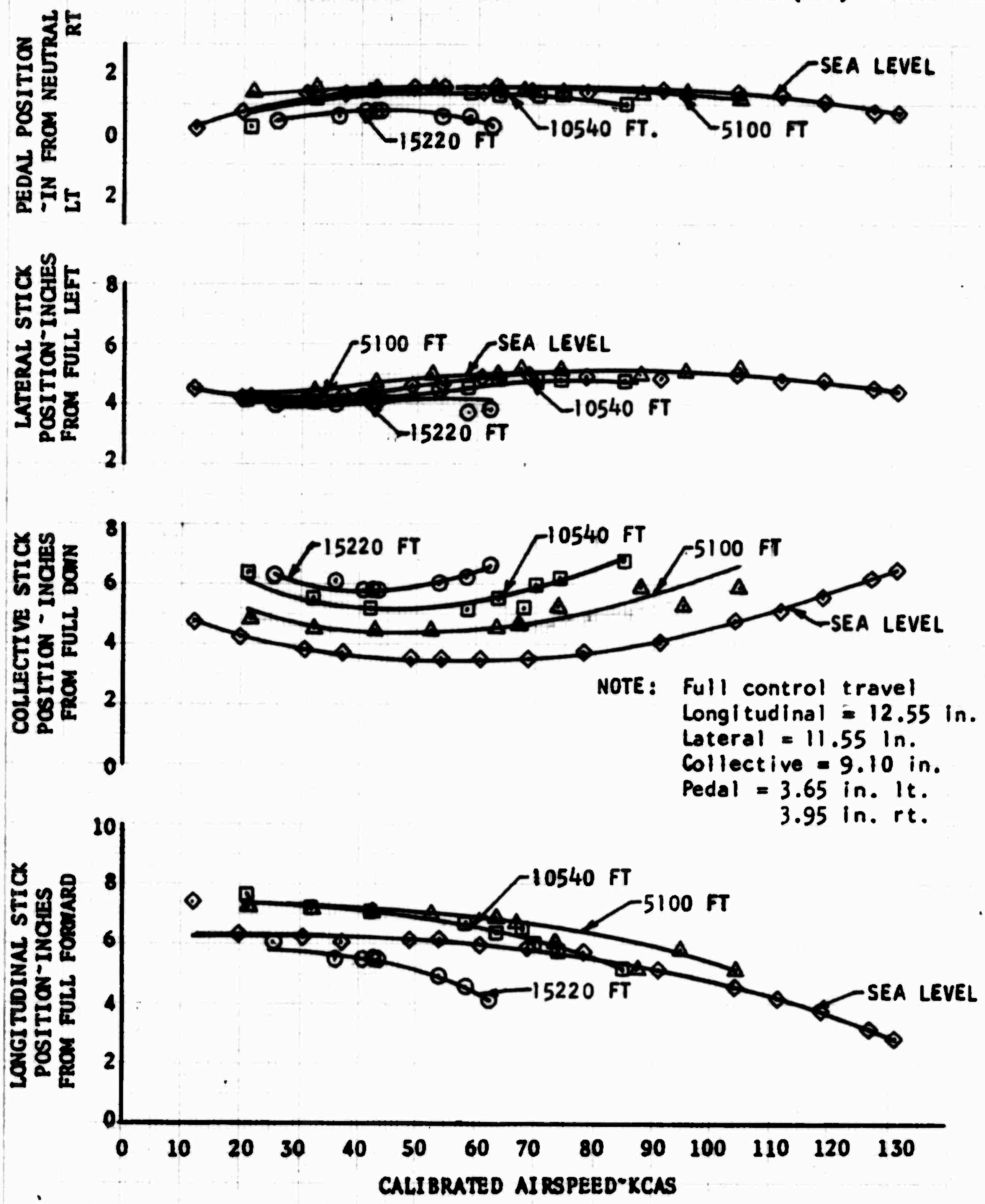


FIGURE NO. 69
CONTROL POSITION TRIM CURVES
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	6180	2670	483	100.5(mid)	Level Flight
□	5100	2370	483	100.0(mid)	Level Flight

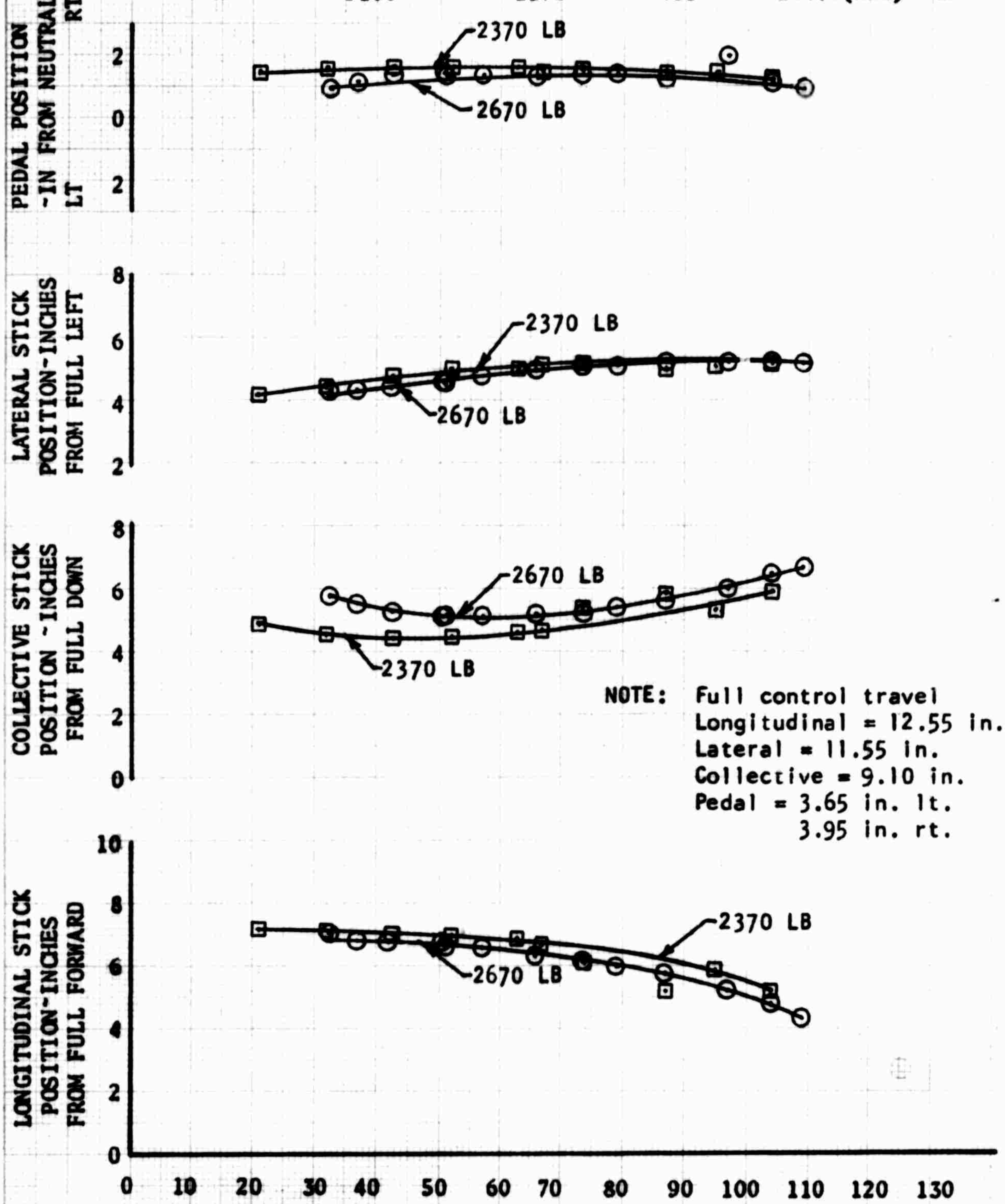


FIGURE NO. 70
CONTROL POSITION TRIM CURVES
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	5060	2400	469	100.0 (mid)	Level Flight
□	5100	2370	483	100.0 (mid)	Level Flight

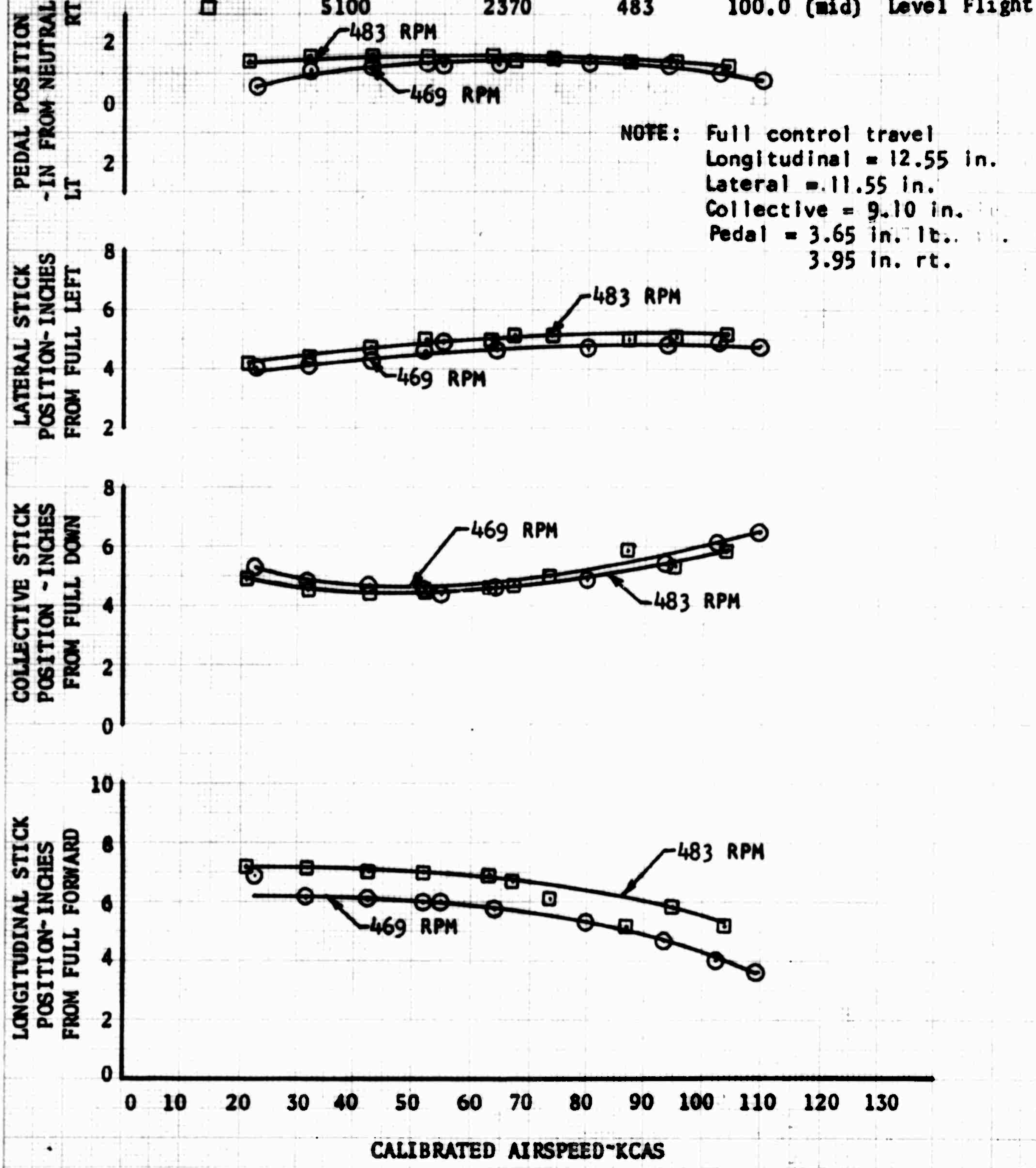


FIGURE NO. 71
CONTROL POSITION TRIM CURVES
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	-60	2430	483	97.0 (fwd)	Level Flight
□	-80	2380	483	104.0 (aft)	Level Flight

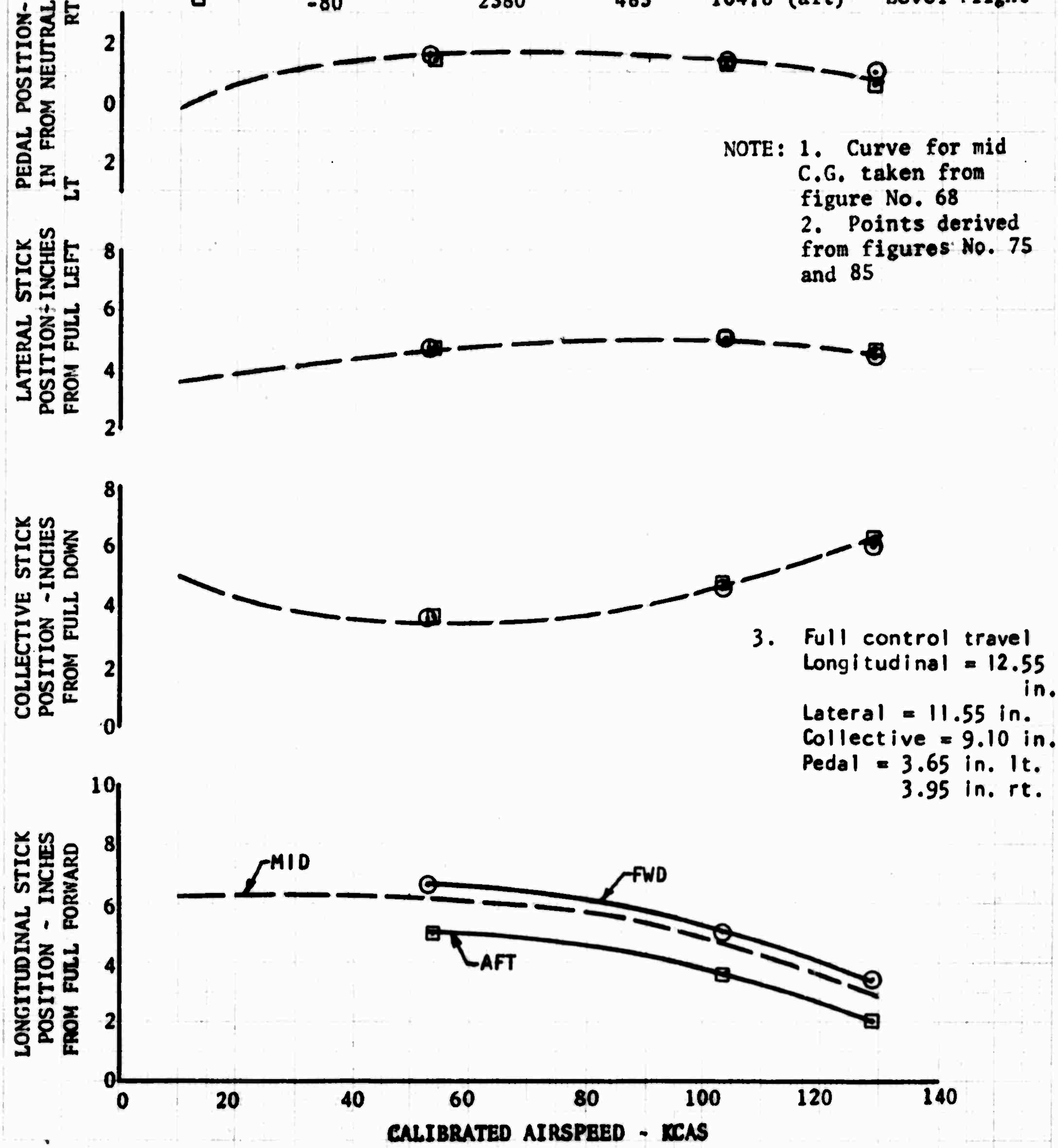


FIGURE NO. 72
CONTROL POSITION TRIM CURVES
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
O	5150	2370	483	97.2 (fwd)	Level Flight
□	4790	2380	483	103.0 (aft)	Level Flight

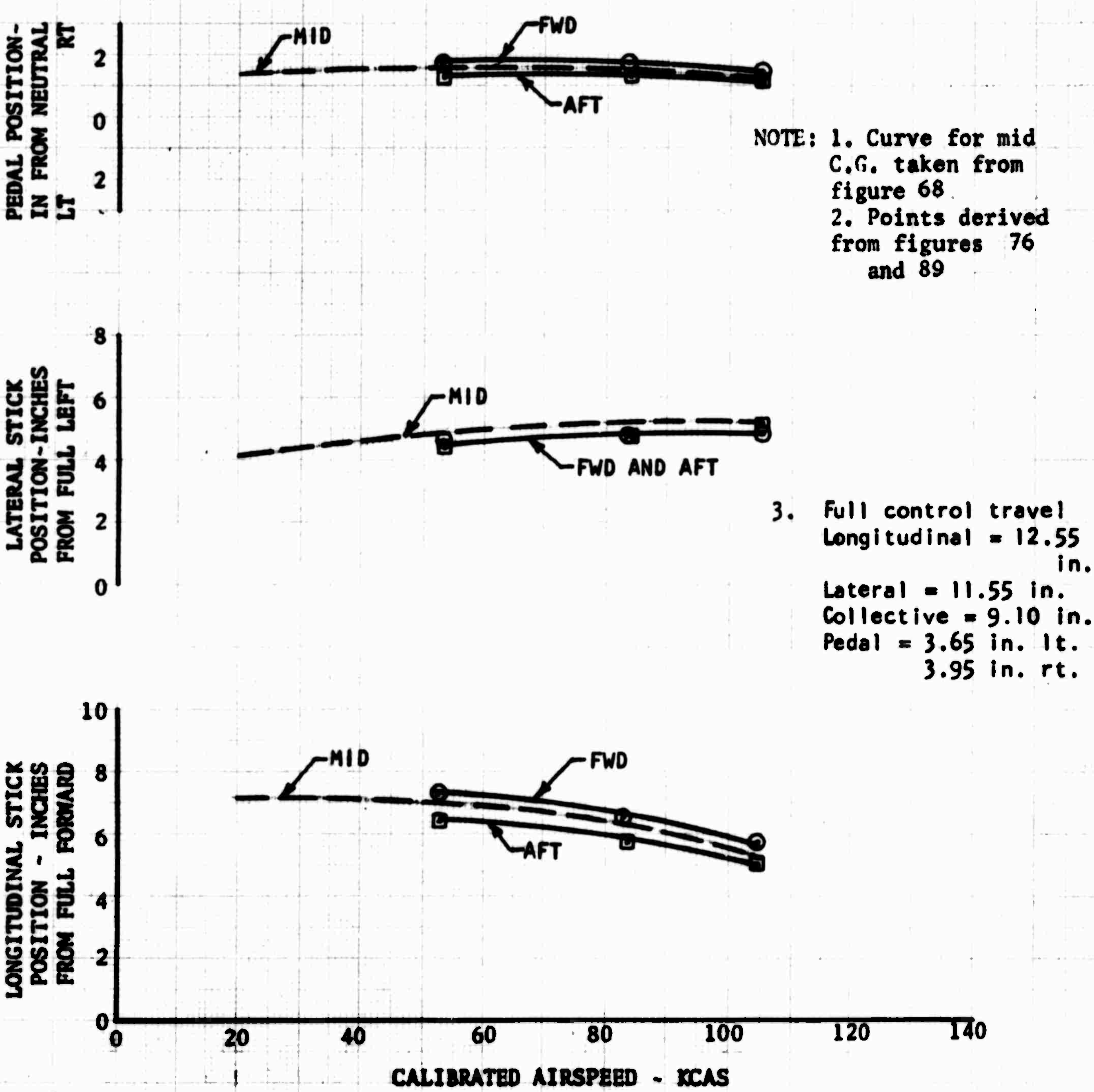
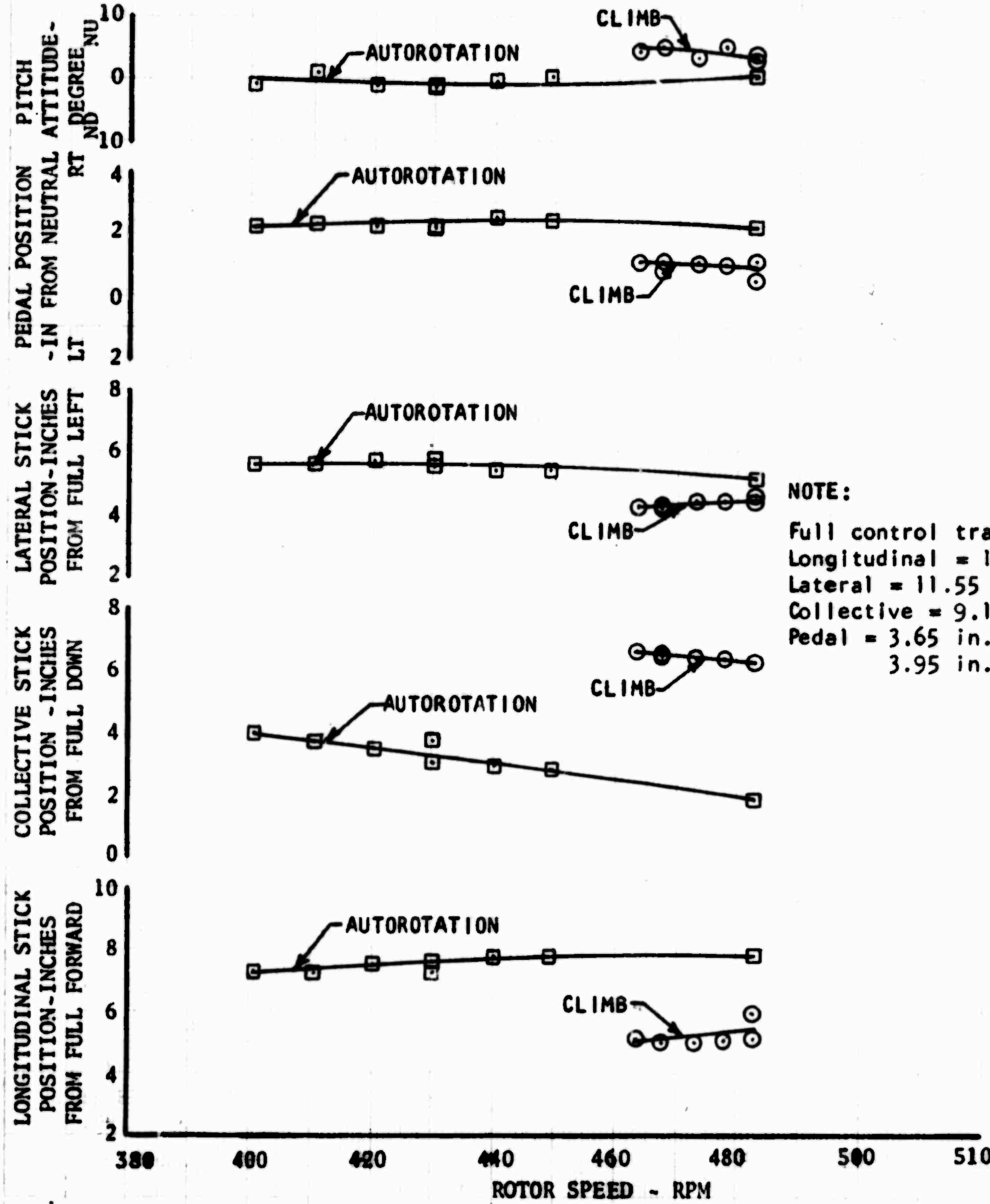


FIGURE NO. 73
CONTROL POSITION TRIM CURVES
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	SHAFT HORSEPOWER HP	DENSITY ALTITUDE FT	GROSS WEIGHT LB	CALIBRATED AIRSPEED KT	C.G. LOCATION IN	FLIGHT CONDITION
○	253	4950	2380	47.5	100.0 (mid)	Climb
□	15	4920	2390	47.5	100.0 (mid)	Autorotation



NOTE:

Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

FIGURE NO. 74
CONTROL POSITION TRIM CURVES
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	SHAFT HORSEPOWER HP	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
O	257	4890	2400	483	99.6(mid)	Climb
□	17	4960	2390	483	99.6(mid)	Autorotation

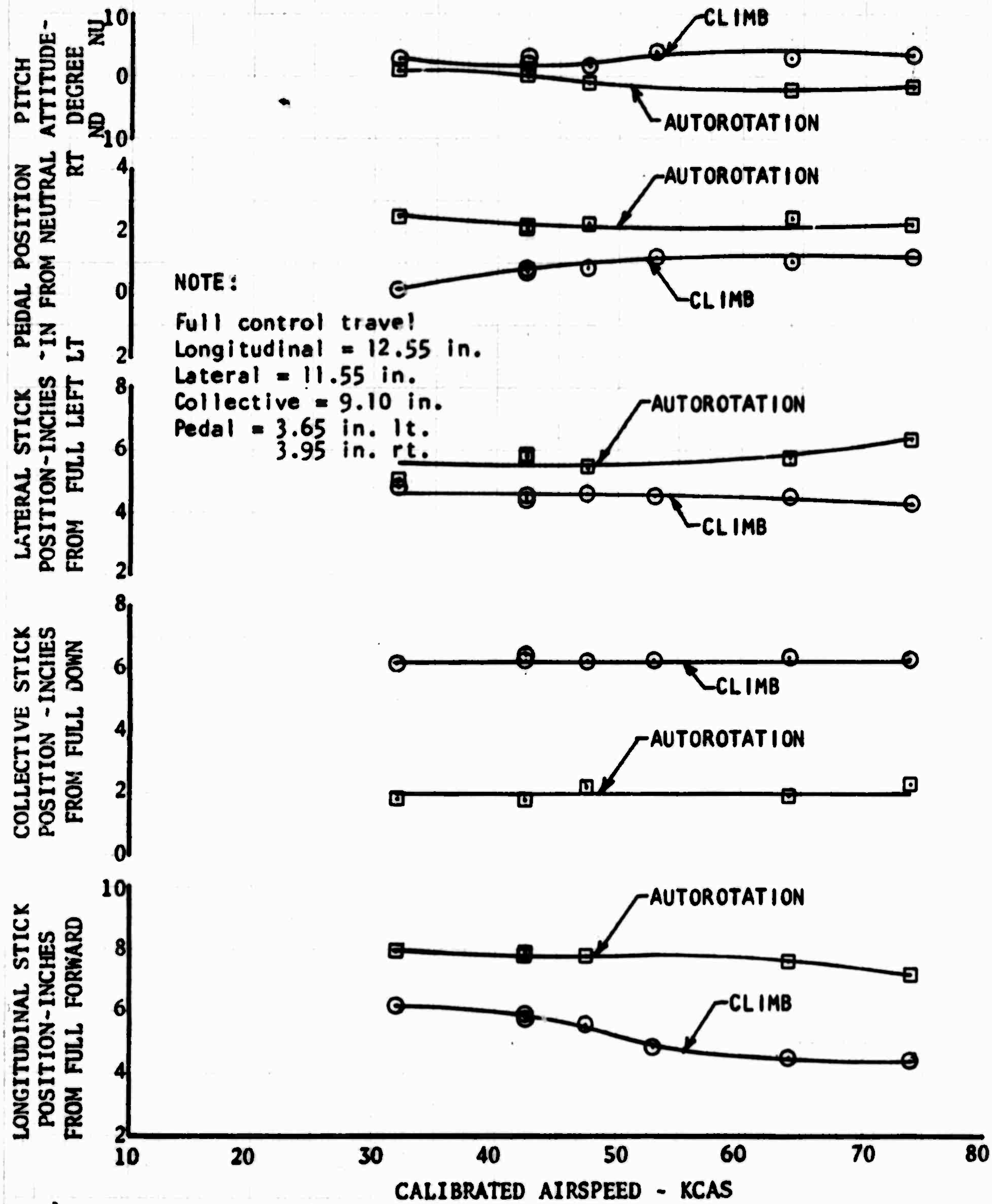


FIGURE NO. 75
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	54.0	Sea Level	2360	483	104.0(Aft)	Level Flight
□	103.5	Sea Level	2370	483	104.0(Aft)	Level Flight
△	129.0	Sea Level	2400	483	104.0(Aft)	Level Flight

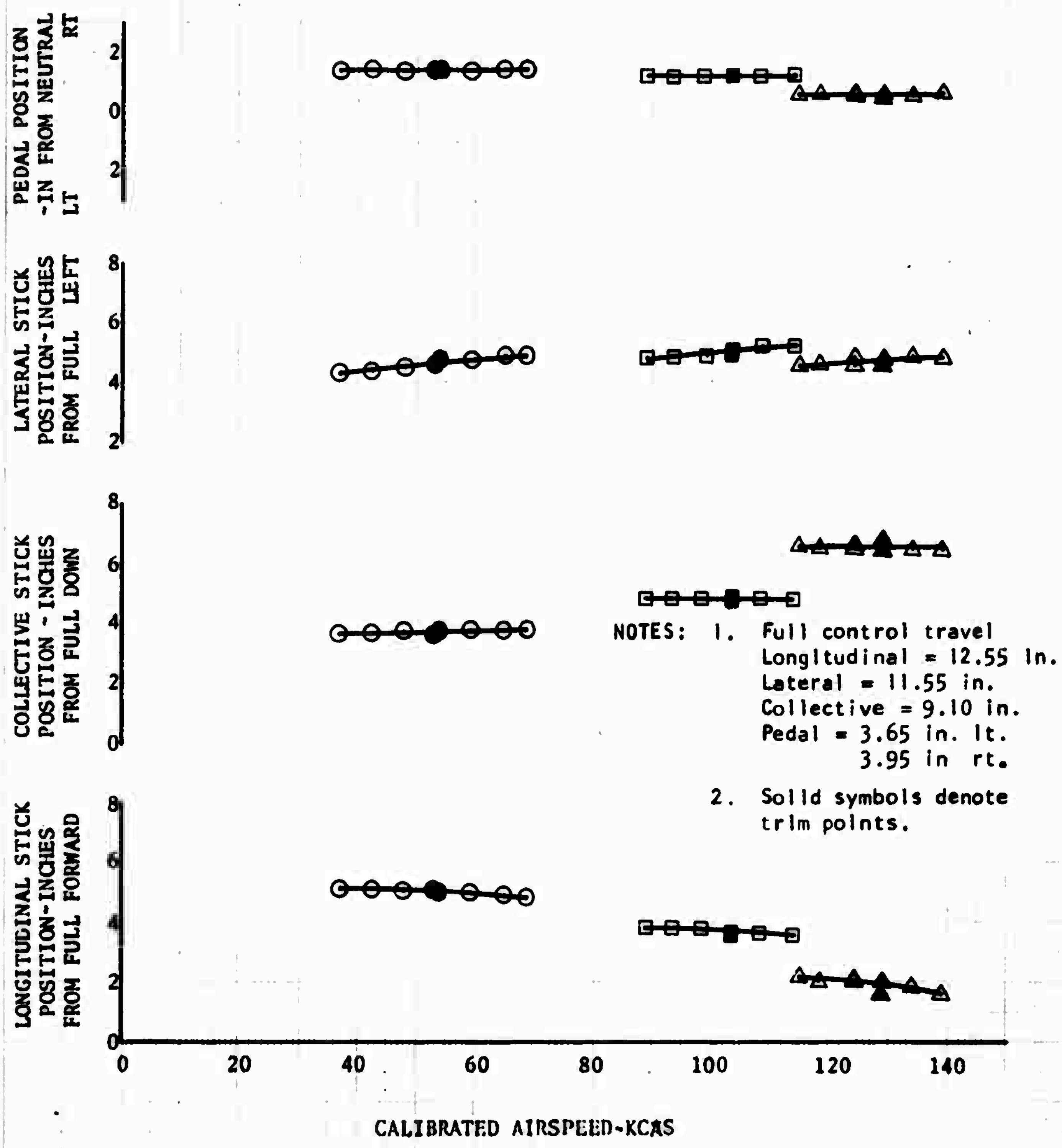


FIGURE NO. 76
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	5040	2420	483	103.0(Aft)	Level Flight
□	83.5	5000	2380	483	103.0(Aft)	Level Flight
△	104.0	5040	2400	483	103.0(Aft)	Level Flight

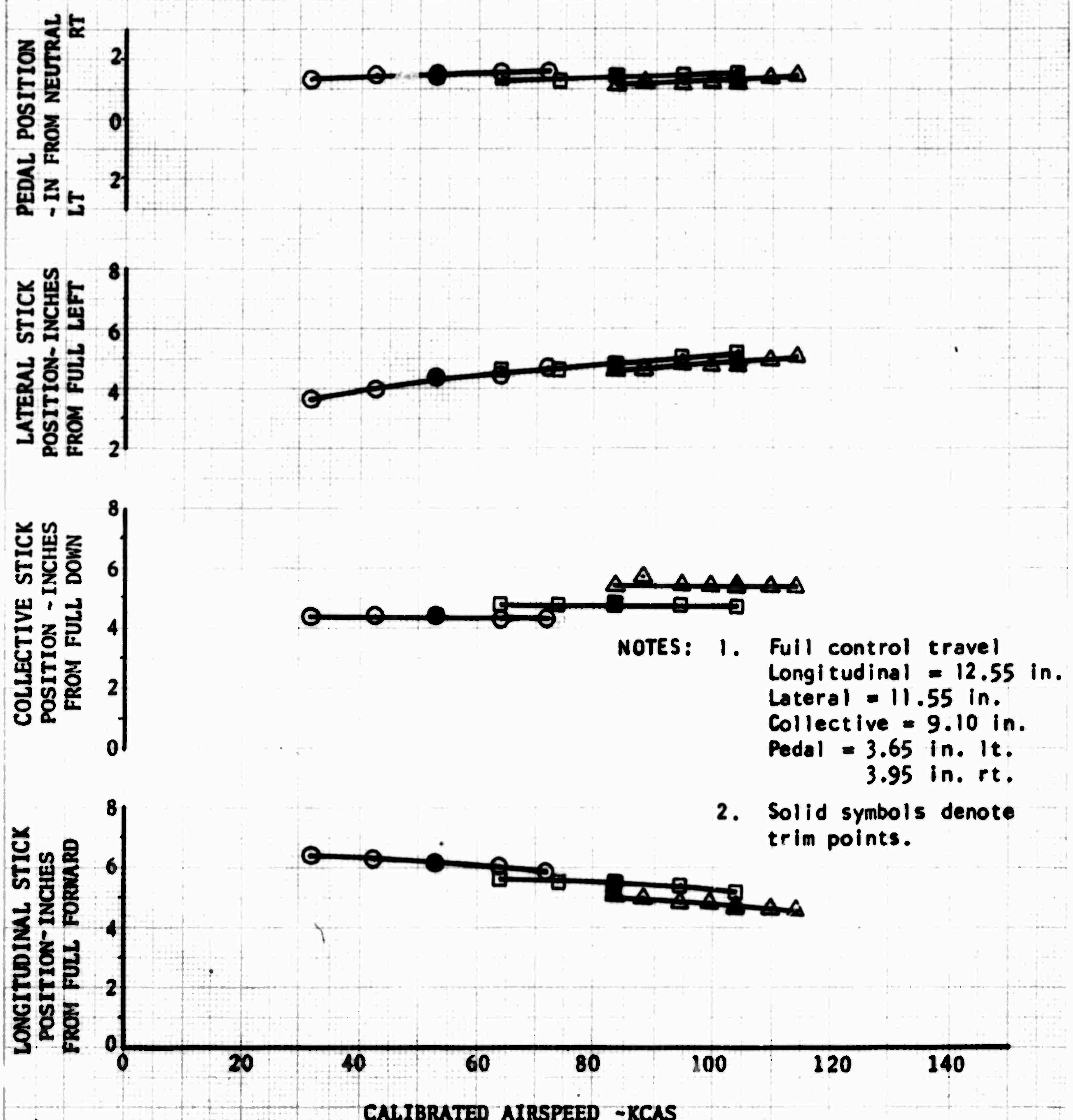
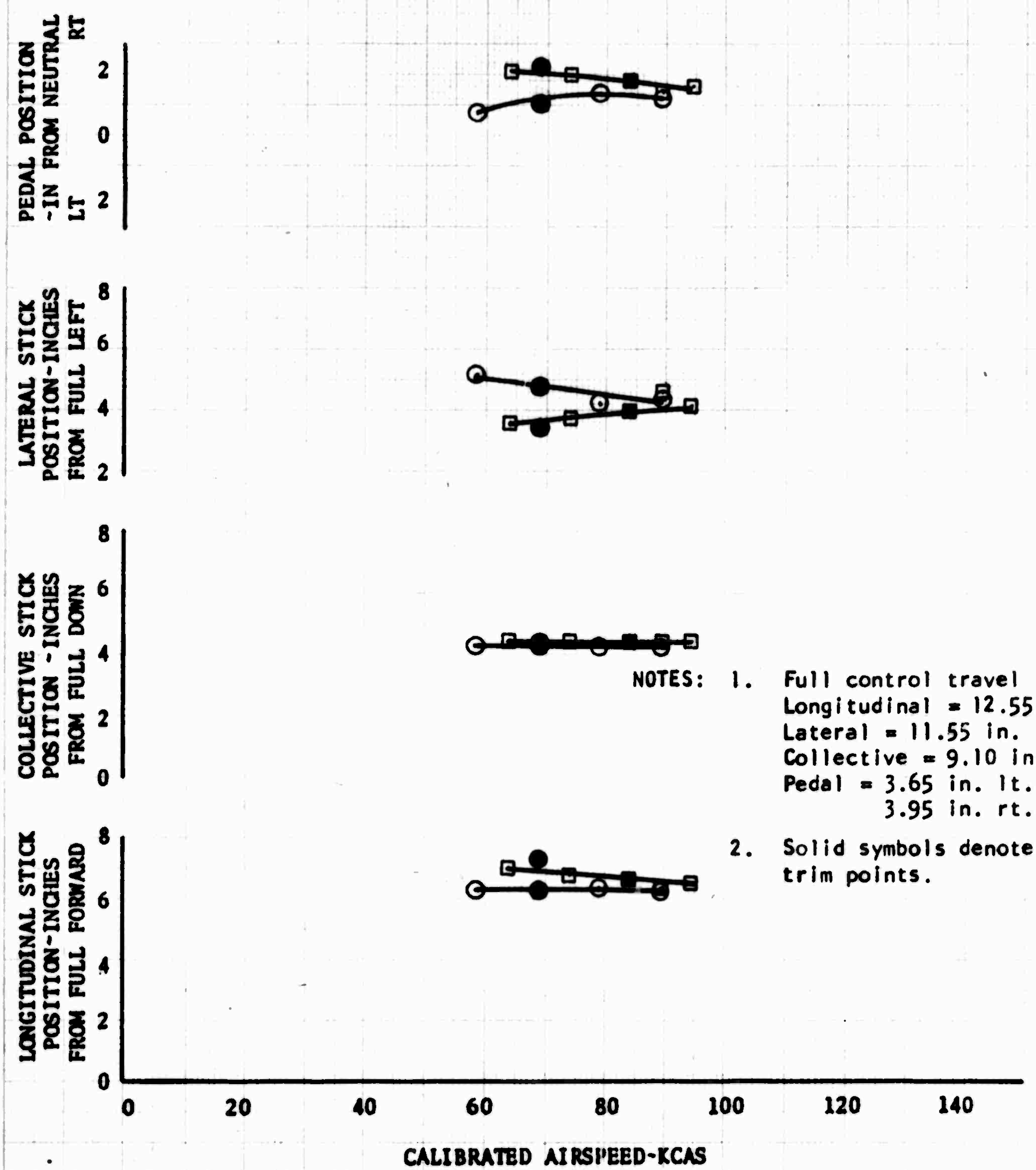


FIGURE NO. 77
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	69.0	10,100	2330	483	103.0(Aft)	Level Flight
□	84.0	10,200	2350	483	103.0(Aft)	Level Flight



NOTES:
1. Full control travel
   Longitudinal = 12.55 in.
   Lateral = 11.55 in.
   Collective = 9.10 in.
   Pedal = 3.65 in. lt.
   3.95 in. rt.
2. Solid symbols denote trim points.

FIGURE NO. 78
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
O	53.5	5000	2180	483	103.3(Aft)	Level Flight
□	92.5	5000	2190	483	103.3(Aft)	Level Flight
Δ	115.0	5000	2200	483	103.3(Aft)	Level Flight

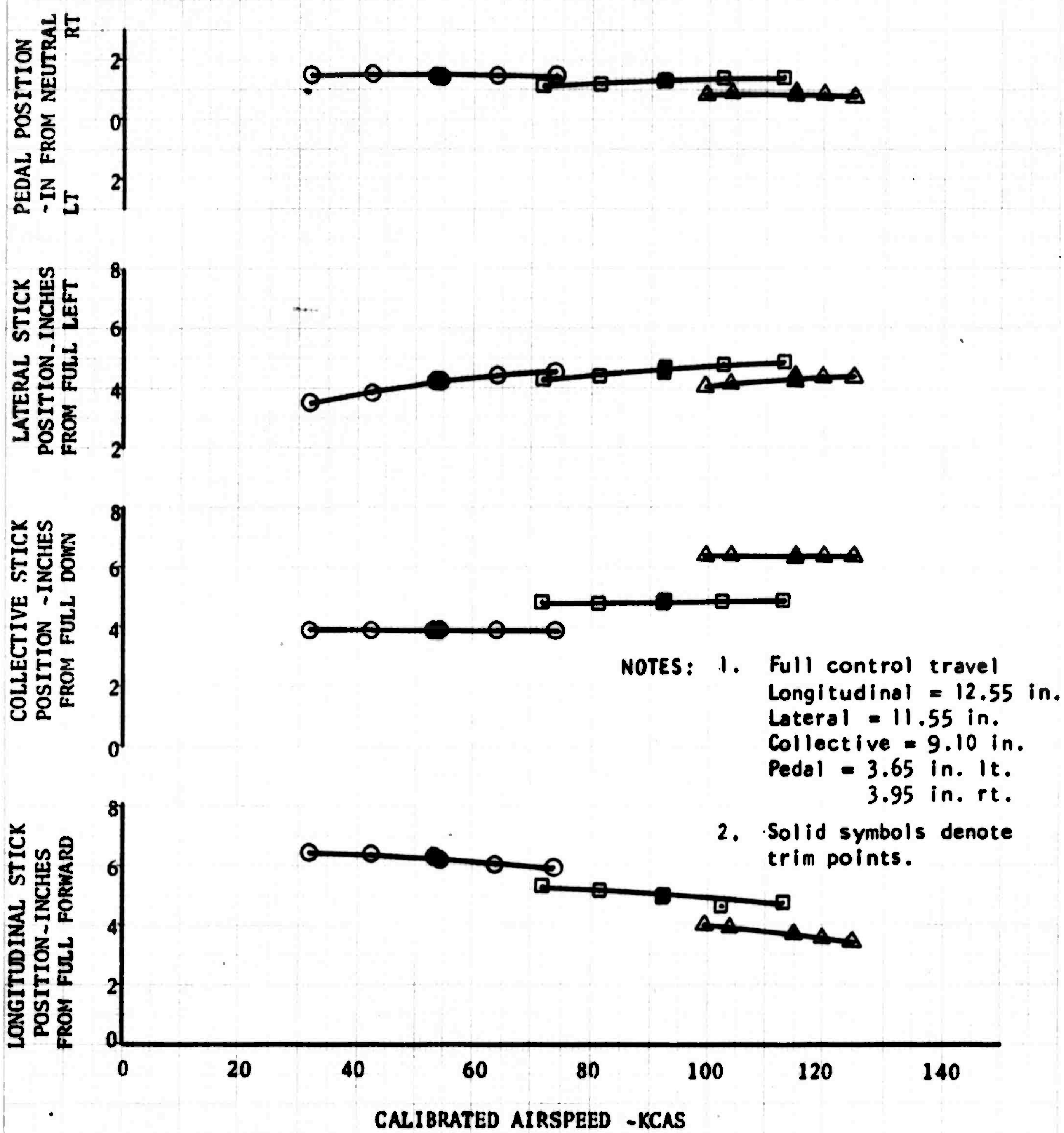
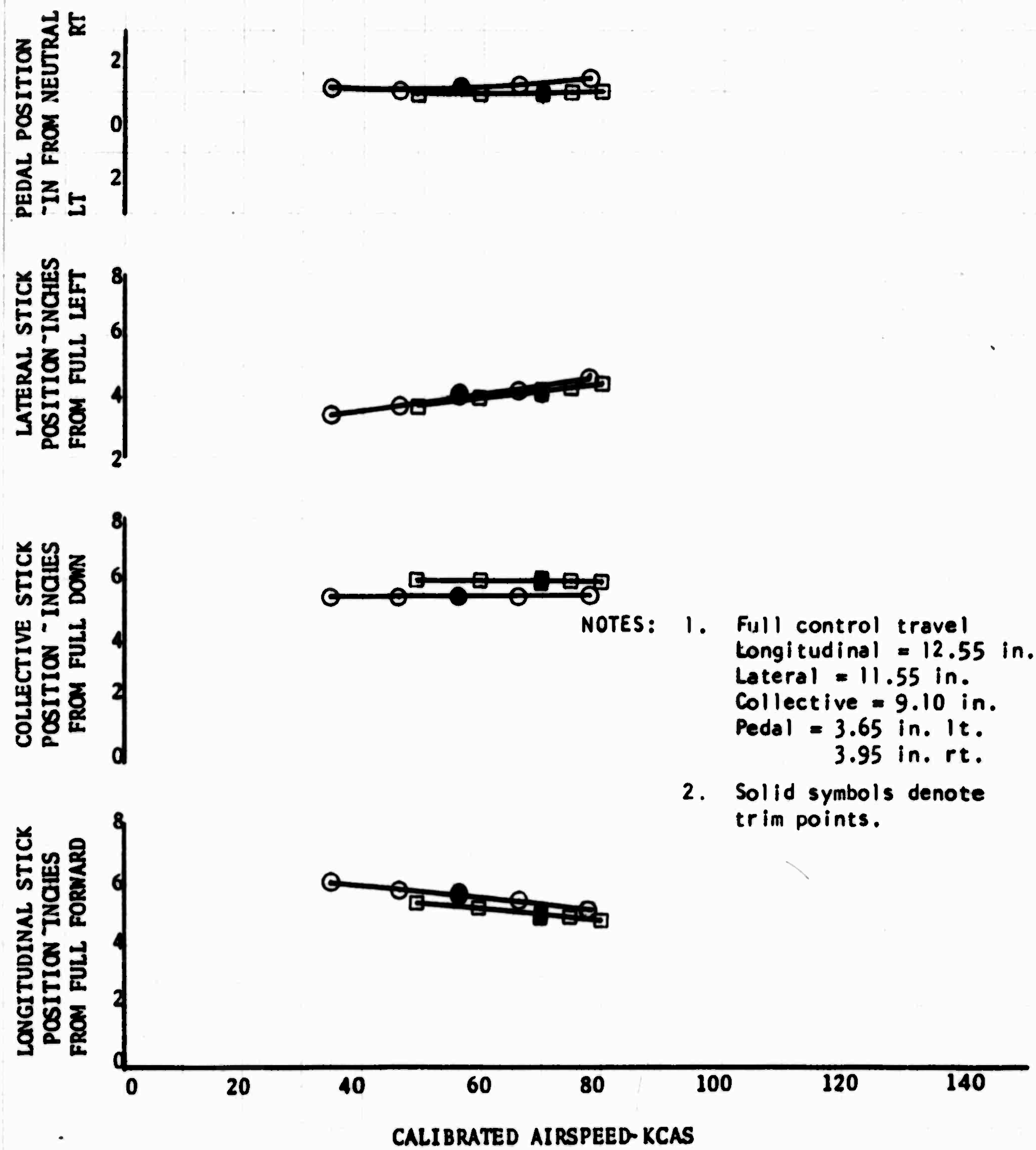


FIGURE NO. 79
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	56	10,100	2150	483	103.0(Aft)	Level Flight
□	70	9900	2160	483	103.0(Aft)	Level Flight



NOTES:
1. Full control travel
   Longitudinal = 12.55 in.
   Lateral = 11.55 in.
   Collective = 9.10 in.
   Pedal = 3.65 in. lt.
   3.95 in. rt.
2. Solid symbols denote trim points.

FIGURE NO. 80
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	5000	2440	469	103.5(AFT)	LEVEL FLIGHT
□	83.5	5000	2430	469	103.5(AFT)	LEVEL FLIGHT
△	104.5	5000	2420	469	103.5(AFT)	LEVEL FLIGHT

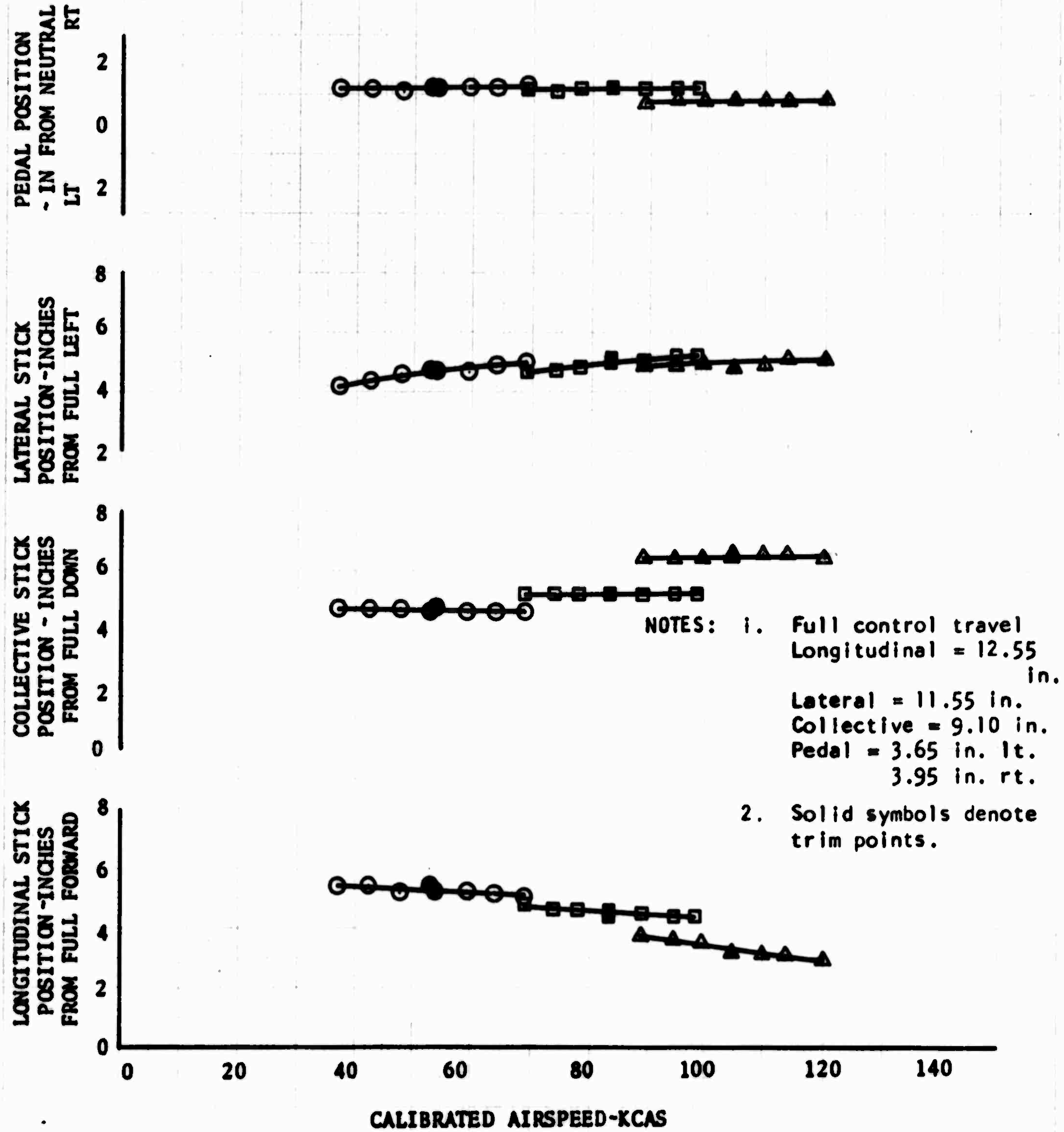
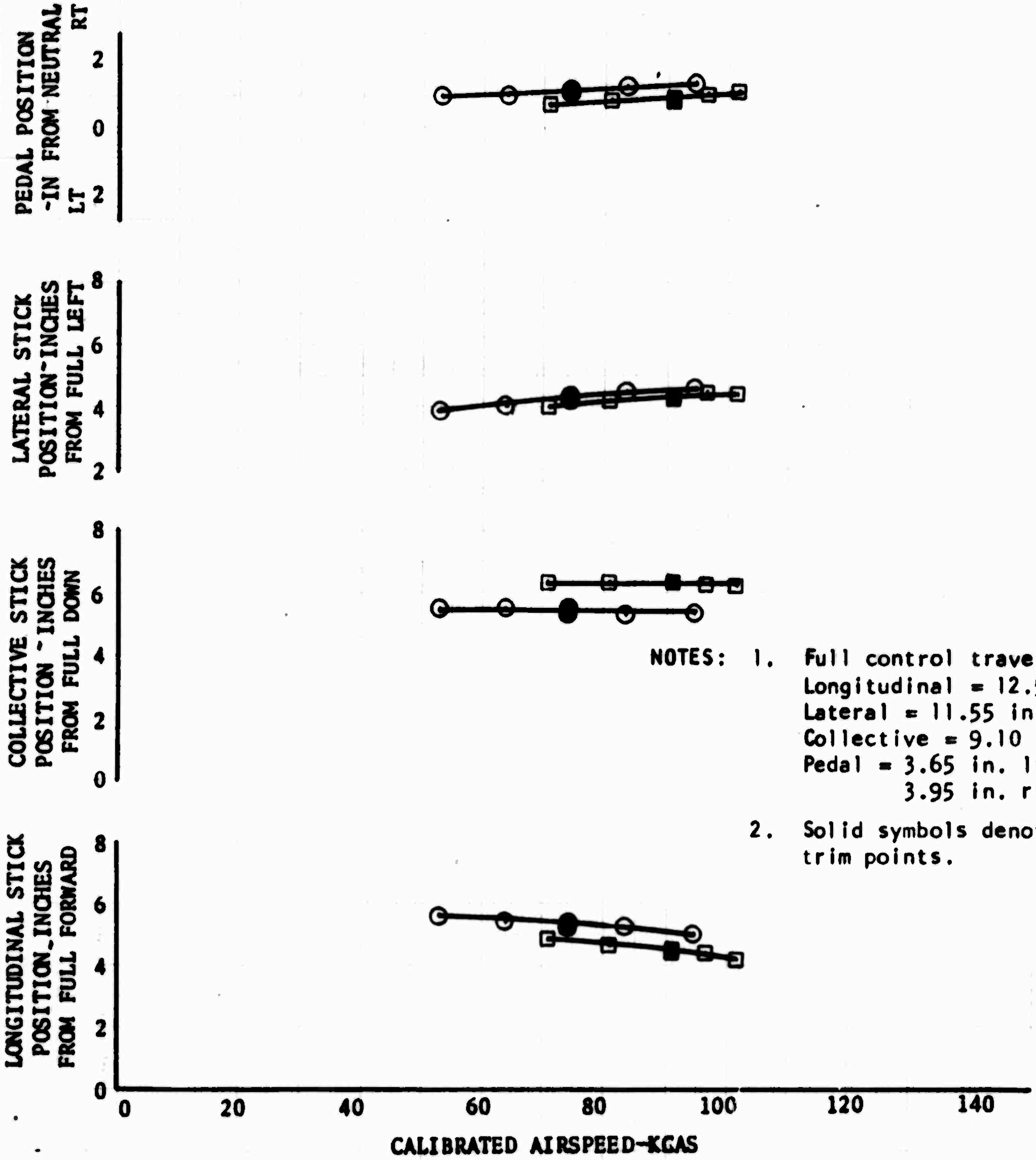


FIGURE NO. 81
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	74.5	10,060	2180	469	103.0(Aft)	Level Flight
□	91.0	10,250	2200	469	103.0(Aft)	Level Flight



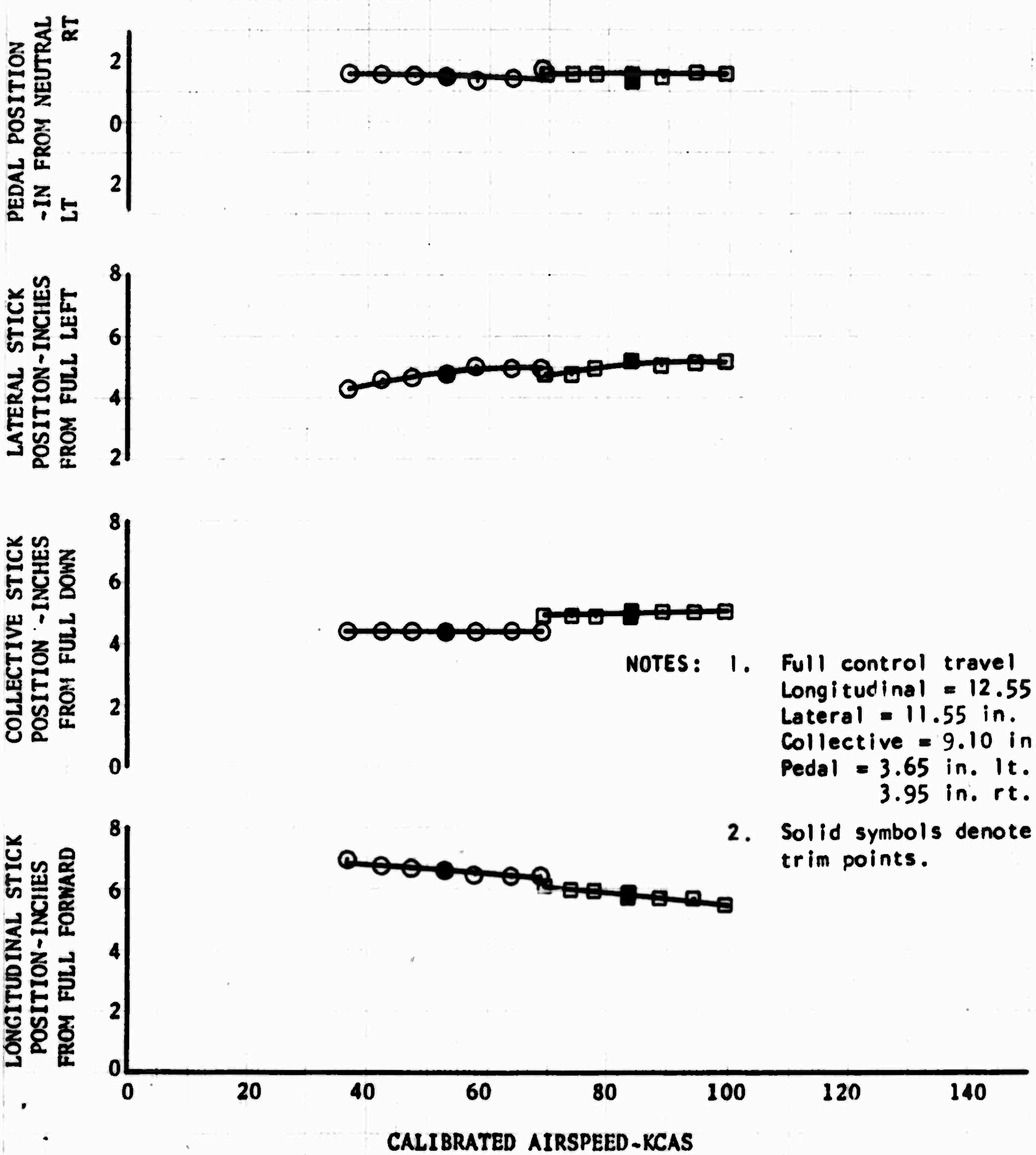
NOTES: 1. Full control travel
Longitudinal = 12.55 in
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 82
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	6220	2210	483	99.3(Mid)	Level Flight
□	84.0	6160	2230	483	99.3(Mid)	Level Flight



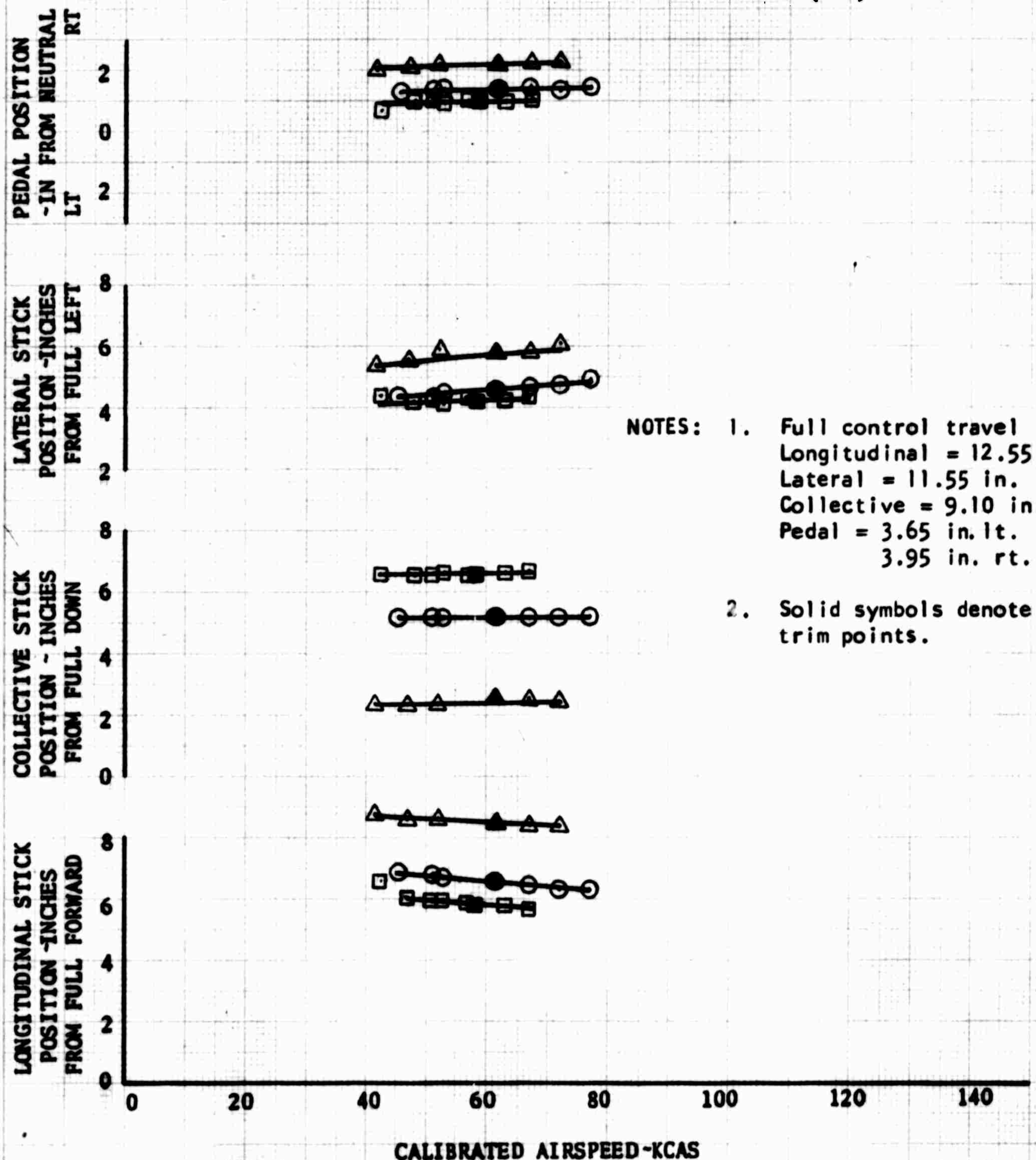
NOTES: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 83
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	61.5	9460	2380	483	99.4(Mid)	Level Flight
□	58.5	9820	2390	476	99.4(Mid)	Climb
△	61.5	9580	2410	476	99.4(Mid)	Autorotation



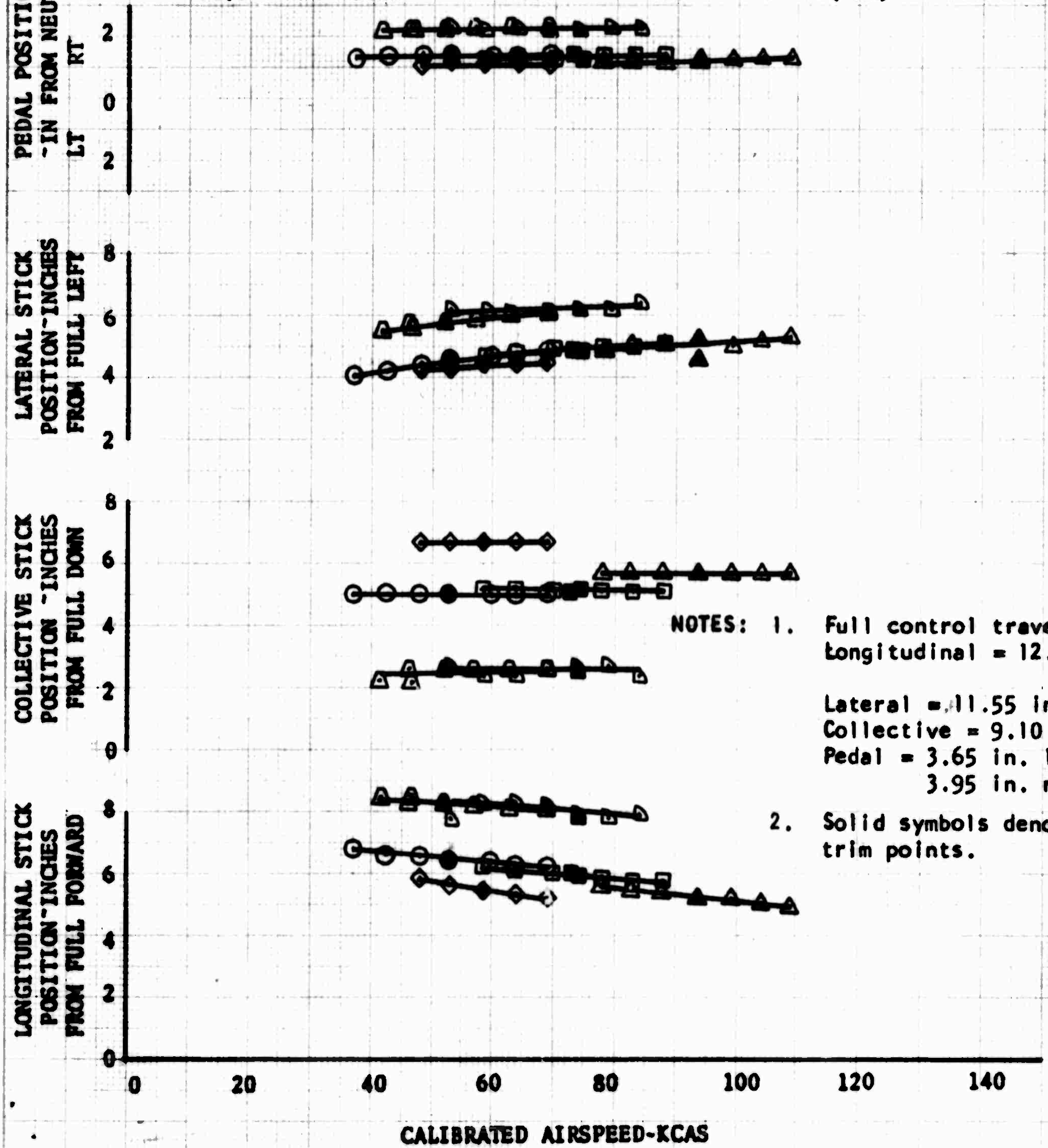
NOTES: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 84
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	4780	2690	483	100.5(Mid)	Level Flight
□	73.0	4920	2730	483	100.5(Mid)	Level Flight
△	93.5	5040	2710	483	100.5(Mid)	Level Flight
◇	58.5	5020	2660	483	100.5(Mid)	Climb
△	52.0	4960	2650	483	100.5(Mid)	Autorotation
▷	74.0	5000	2630	483	100.5(Mid)	Autorotation



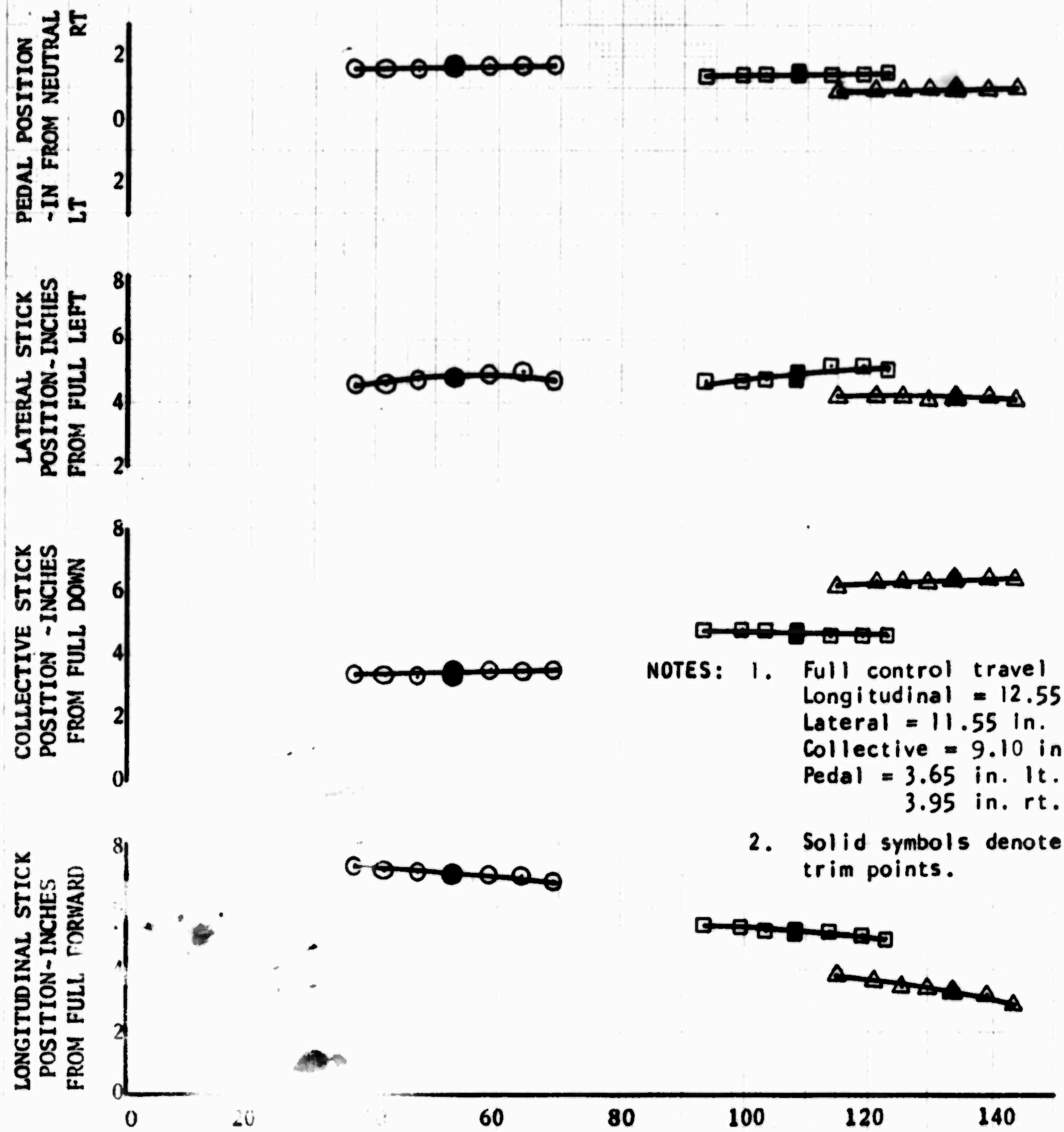
NOTES: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 85
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	- 70	2140	483	97.0(Fwd)	Level Flight
□	108.5	+150	2120	483	97.0(Fwd)	Level Flight
△	134.0	+460	2100	483	97.0(Fwd)	Level Flight



NOTES: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 86
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 65-12919

CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.5	4920	2130	483	97.4(Fwd)	Level Flight
□	92.5	5580	2150	483	97.4(Fwd)	Level Flight
△	115.0	5120	2160	483	97.4(Fwd)	Level Flight

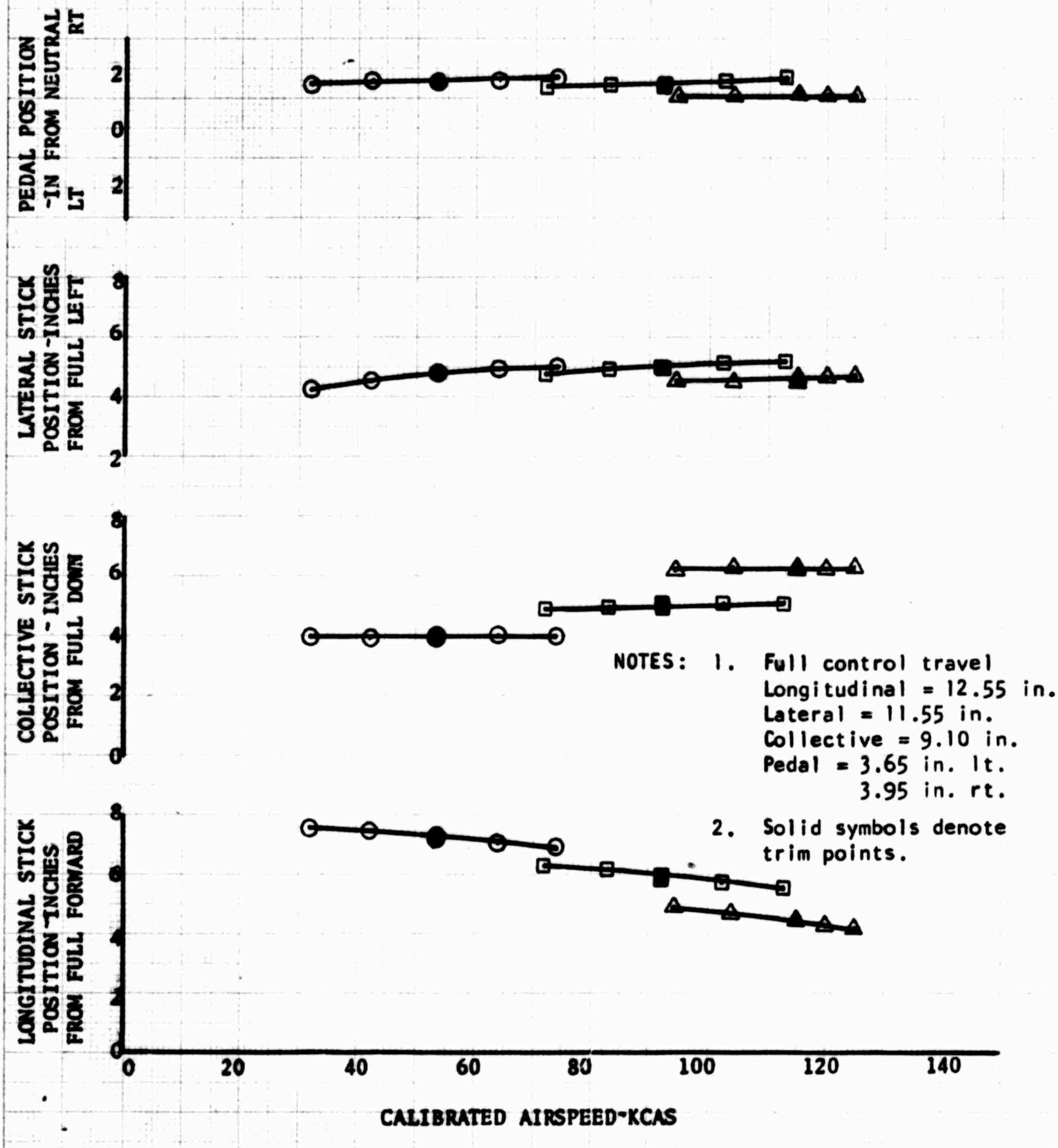


FIGURE NO. 87
STATIC LONGITUDINAL COLLECTIVE FIXED STABILITY
OH-6A S/N 62-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	-60	2420	483	97.0(Fwd)	Level Flight
□	104.0	-60	2430	483	97.0(Fwd)	Level Flight
△	129.0	-60	2440	483	97.0(Fwd)	Level Flight

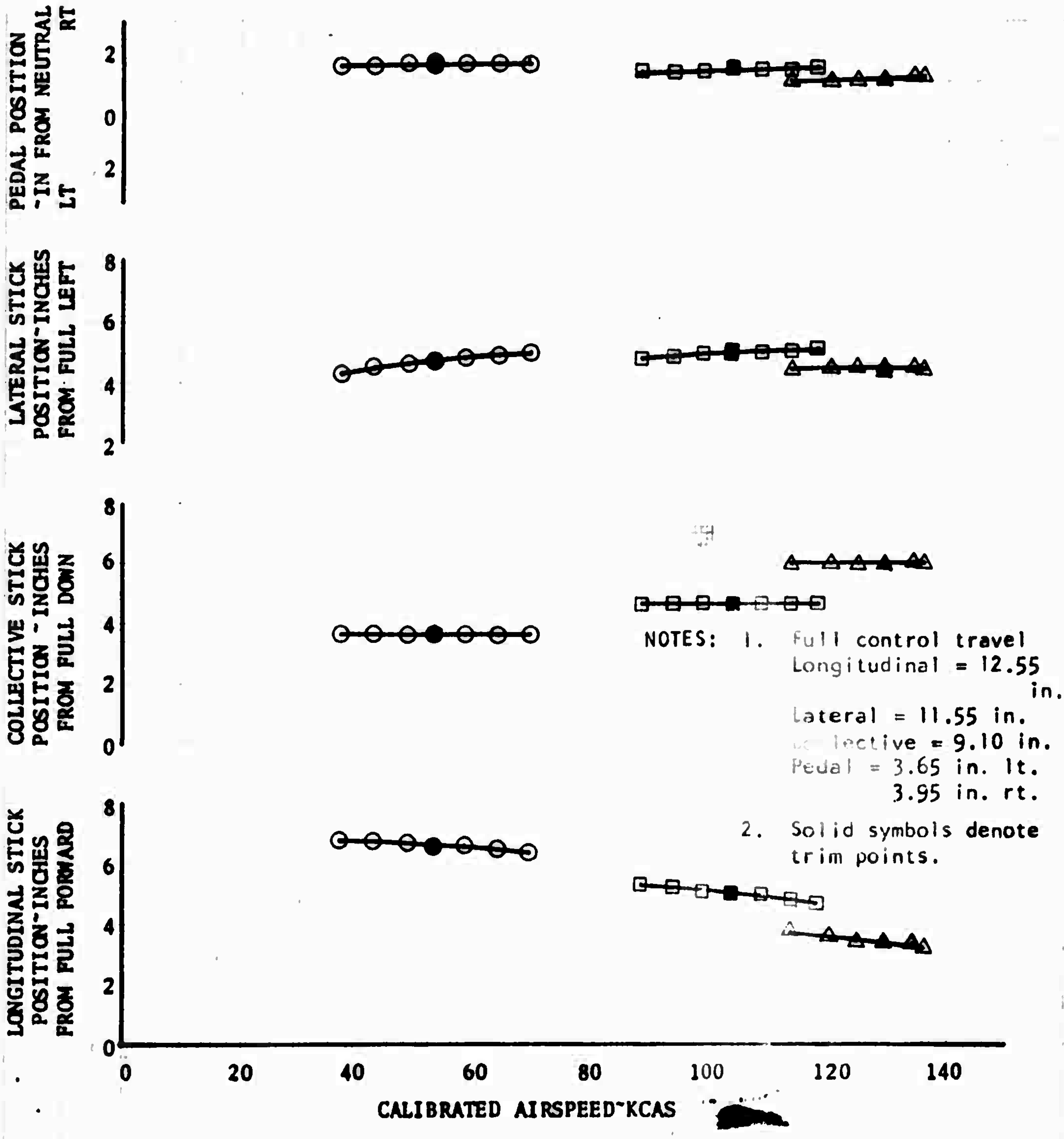


FIGURE NO. 88
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	5120	2160	469	103.0(Aft)	Level Flight
□	93.0	4960	2180	469	103.0(Aft)	Level Flight
△	116.0	5040	2200	469	103.0(Aft)	Level Flight

NOTE: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

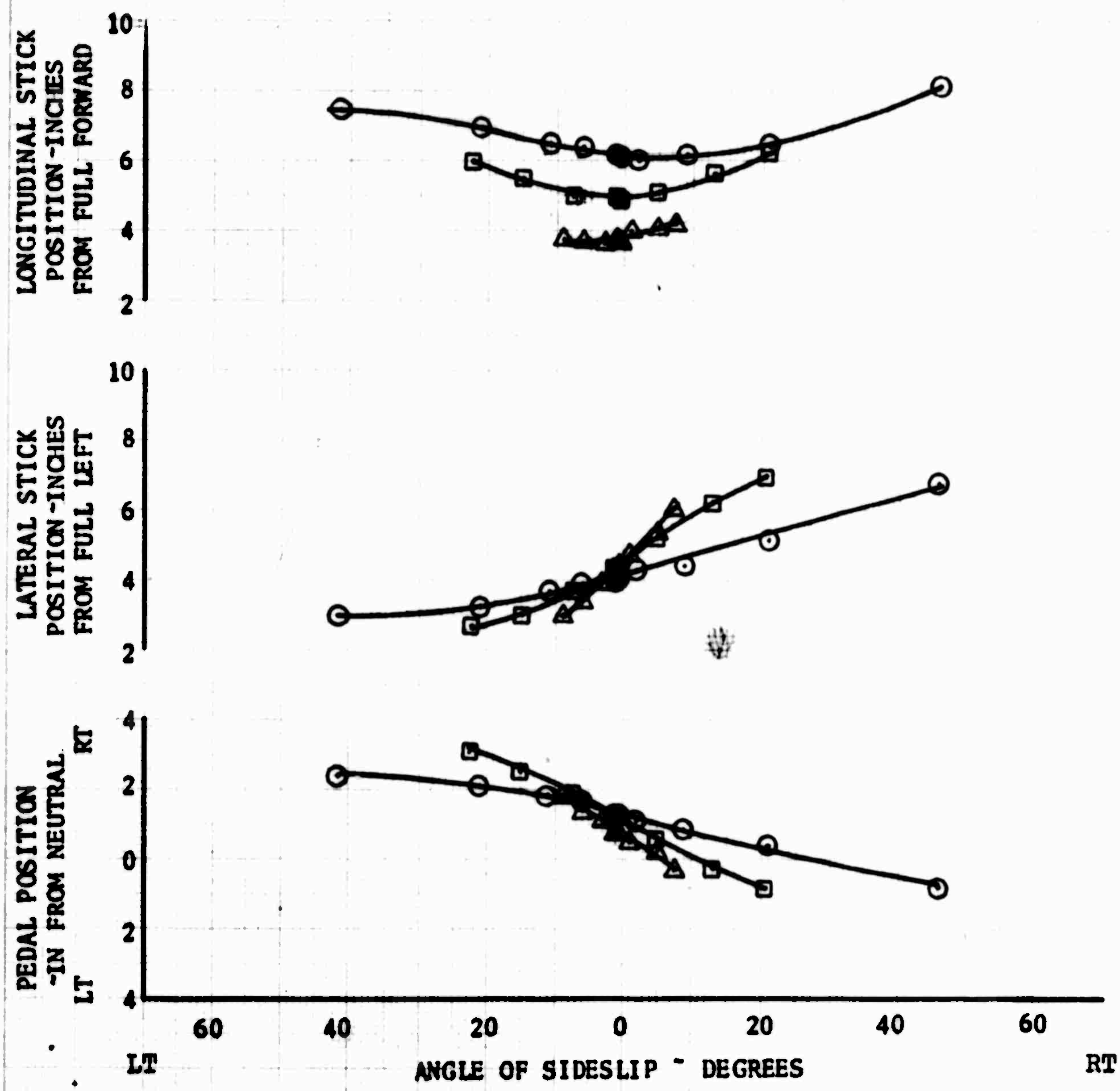
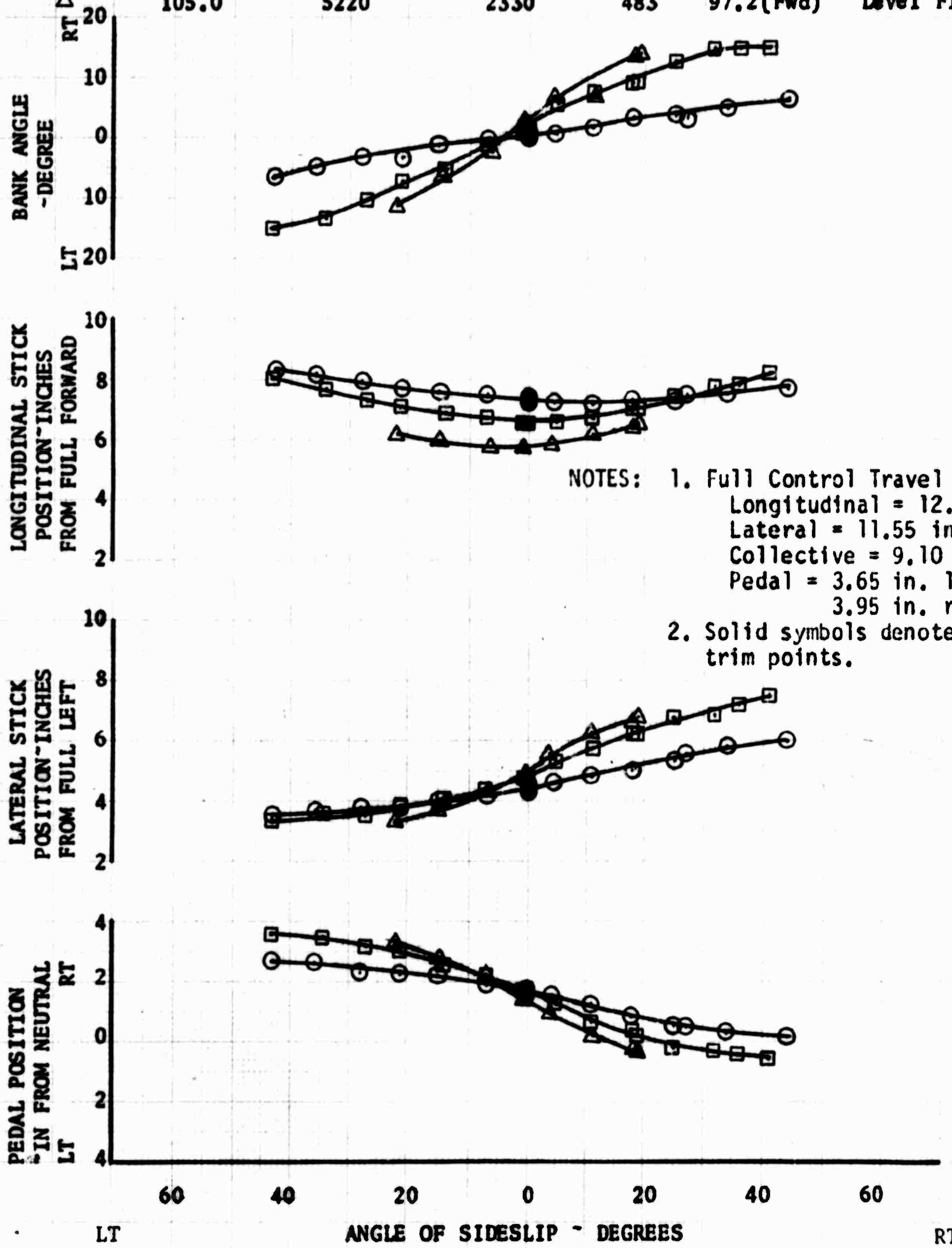


FIGURE NO. 89
STATIC-LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

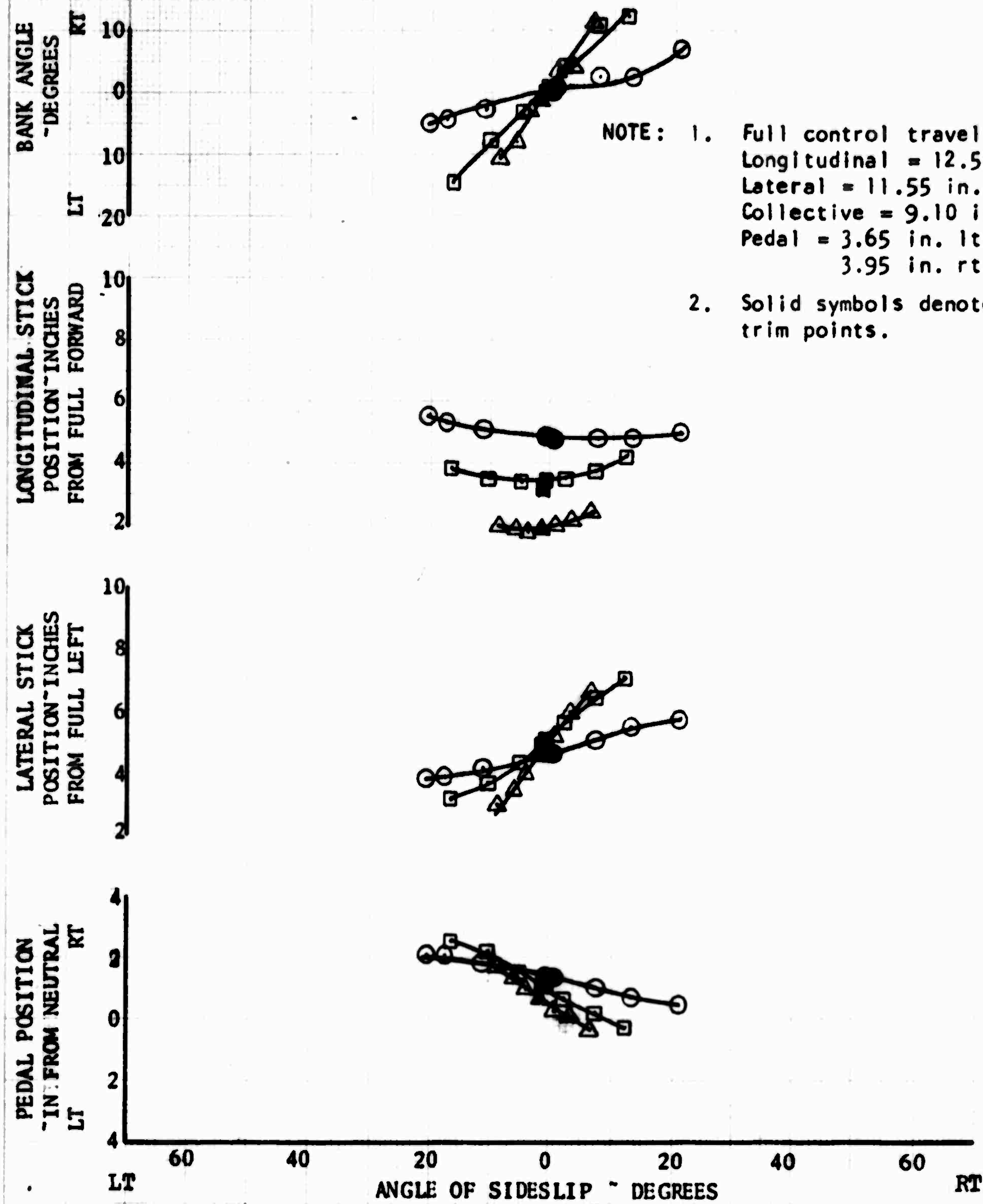
SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	5120	2410	483	97.2(Fwd)	Level Flight
□	83.5	5080	2360	483	97.2(Fwd)	Level Flight
△	105.0	5220	2330	483	97.2(Fwd)	Level Flight



NOTES: 1. Full Control Travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.
2. Solid symbols denote trim points.

FIGURE NO. 90
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	-300	2310	483	104(Aft)	Level Flight
□	104.0	-260	2320	483	104(Aft)	Level Flight
△	129.0	-410	2340	483	104(Aft)	Level Flight



NOTE: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 91
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53	4890	2410	483	103.0(Aft)	Level Flight
□	84	5250	2380	483	103.0(Aft)	Level Flight
△	105	4340	2350	483	103.0(Aft)	Level Flight

NOTE: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

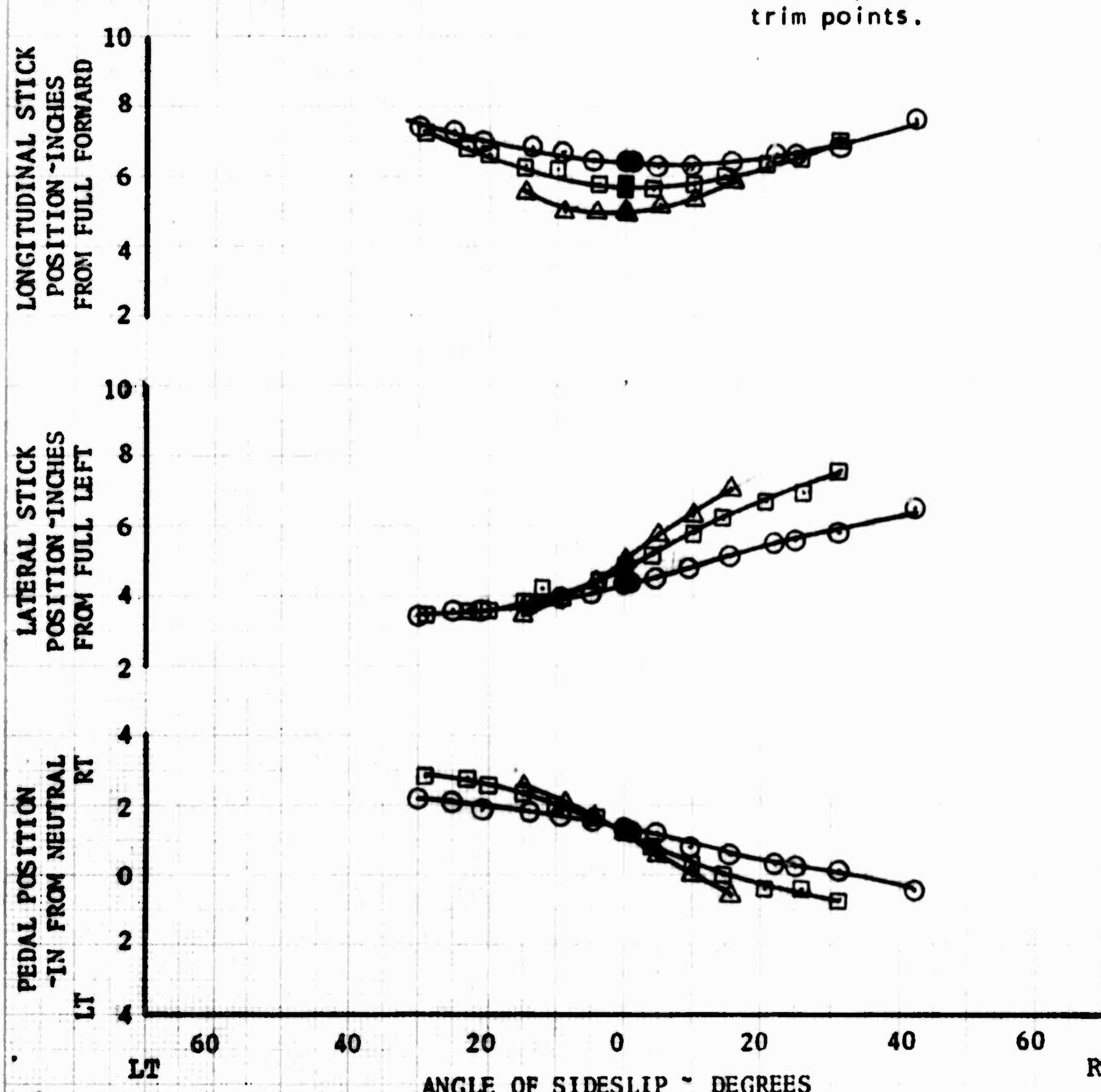


FIGURE NO. 92
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	69.0	10,230	2280	483	103.0(Aft)	Level Flight
□	84.0	9930	2340	483	103.0(Aft)	Level Flight

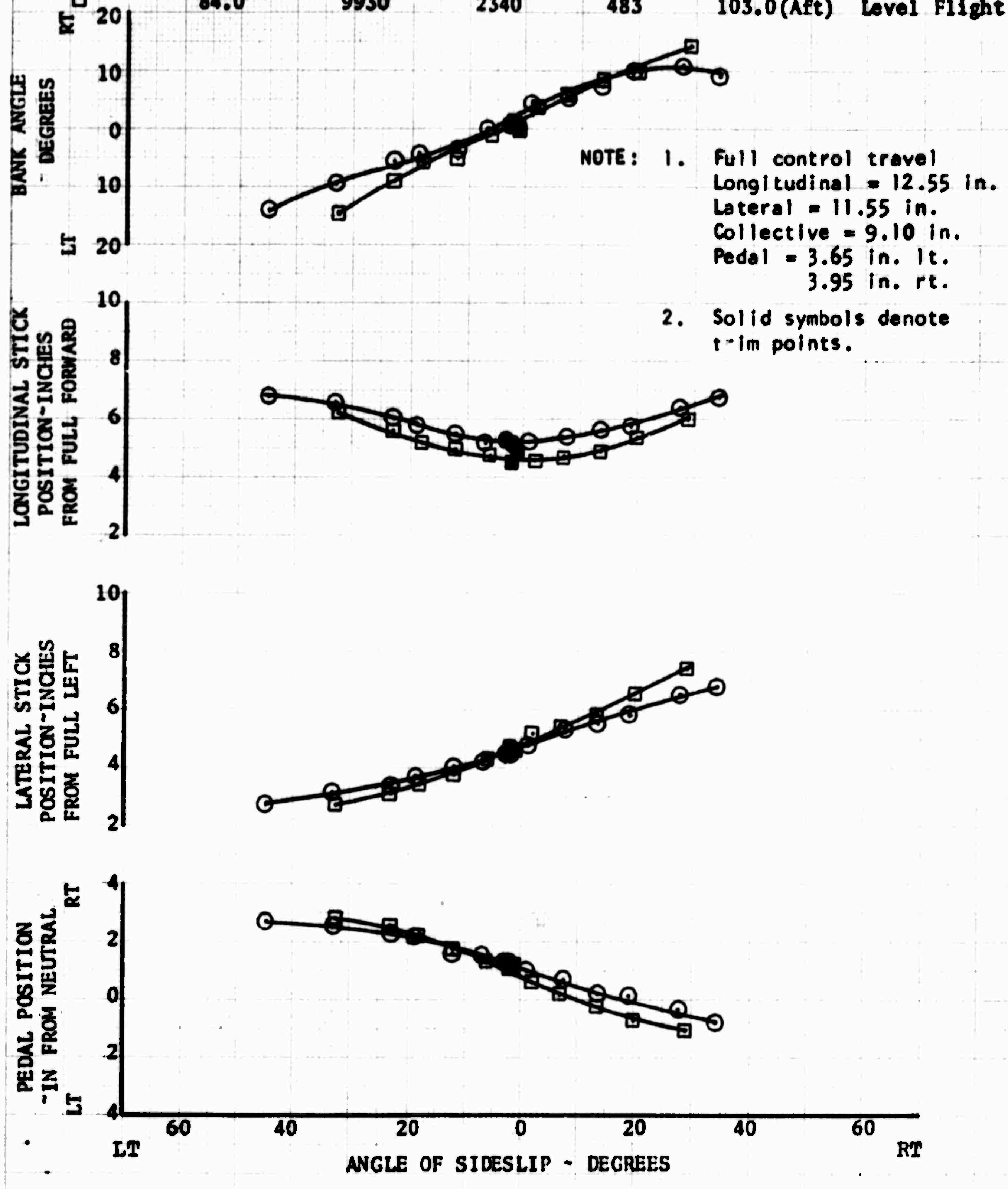


FIGURE NO. 93
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	74.0	9940	2130	469	103.0(Aft)	Level Flight
□	91.5	10,110	2150	469	103.0(Aft)	Level Flight

NOTE: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

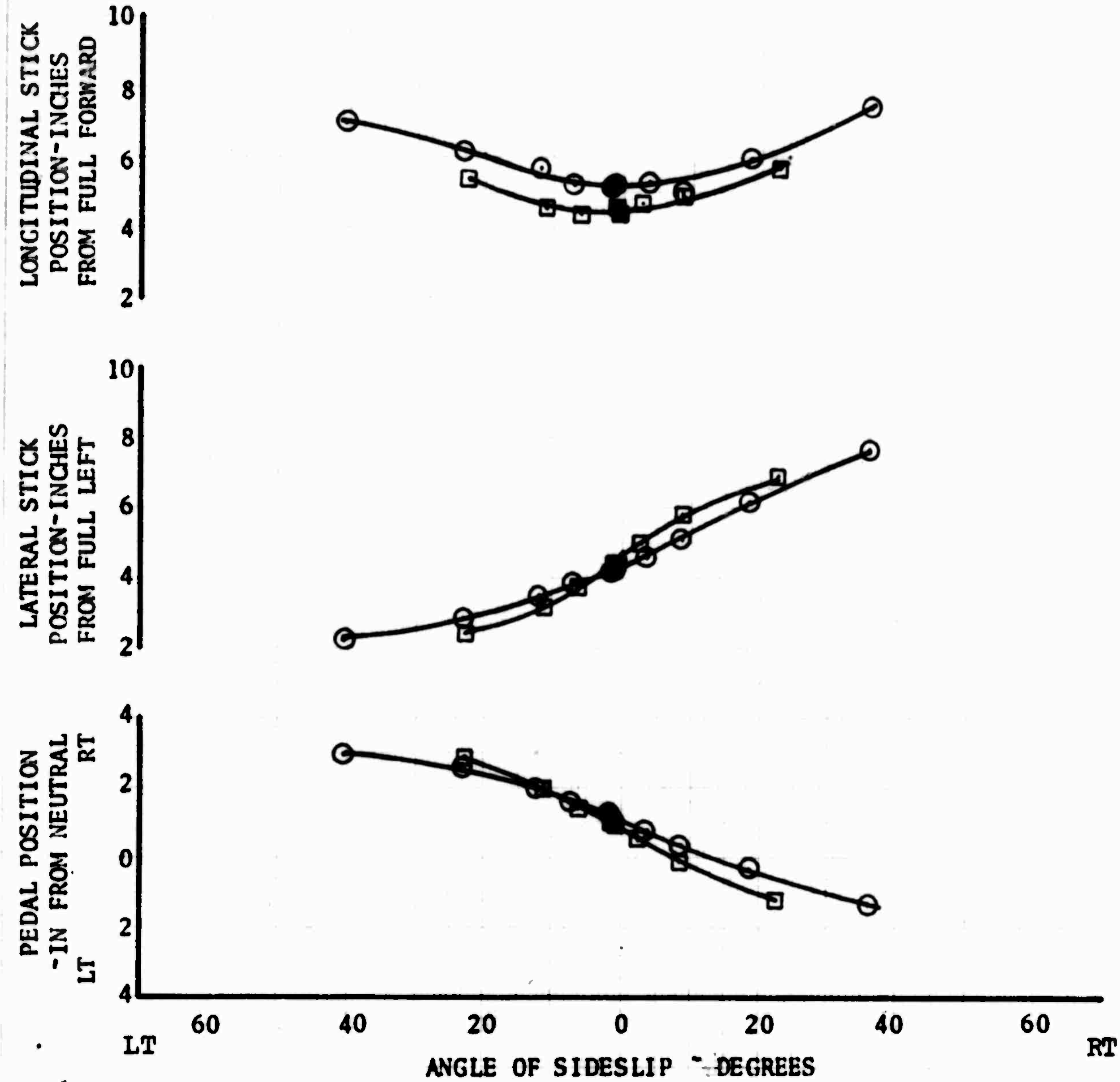


FIGURE NO. 94
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	5180	2350	469	103.5(Aft)	Level Flight
□	83.5	5000	2360	469	103.5(Aft)	Level Flight
△	104.0	5000	2380	469	103.5(Aft)	Level Flight

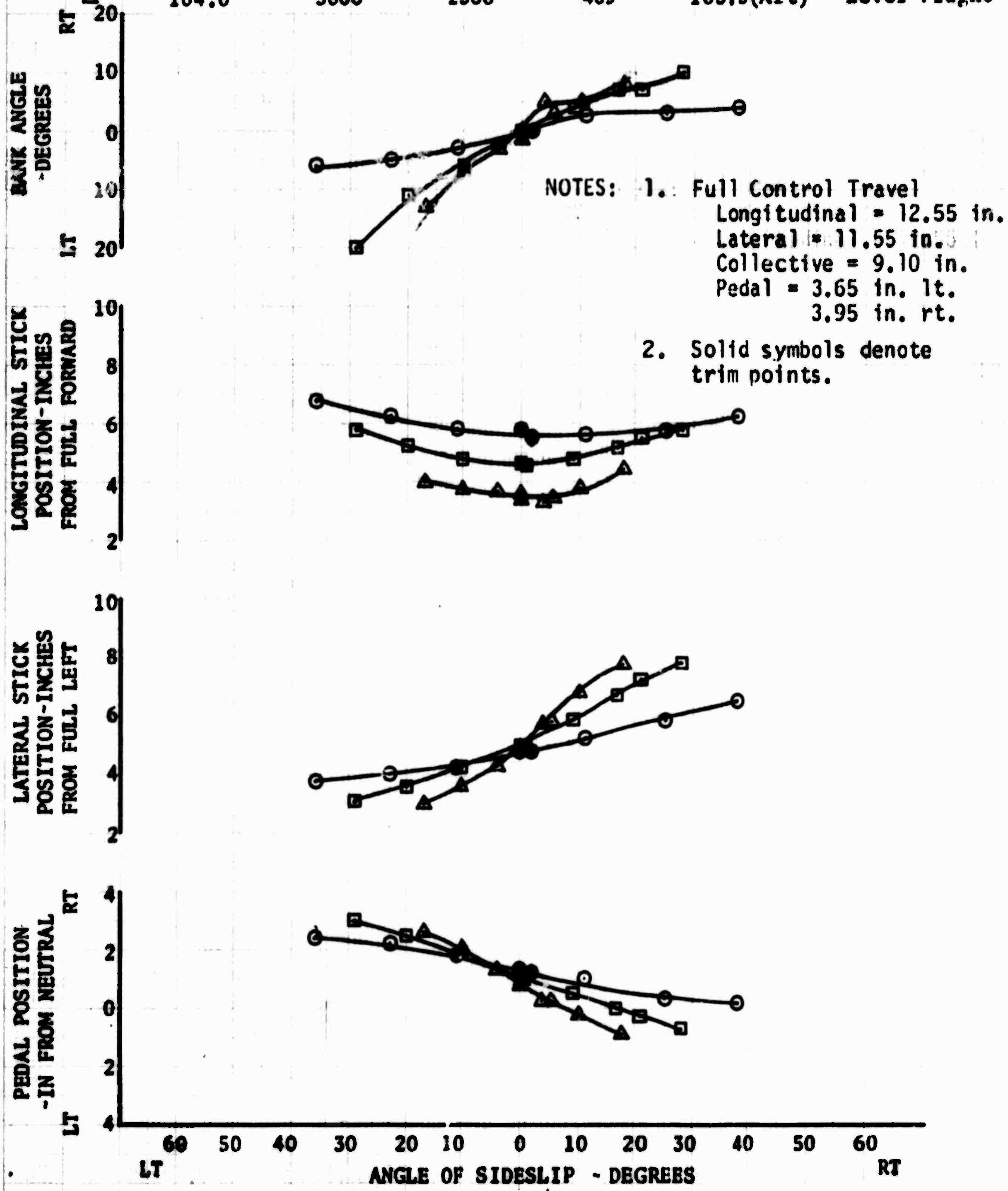


FIGURE NO. 95
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	5010	2150	483	100.0(Mid)	Level Flight
□	92.5	5160	2140	483	100.0(Mid)	Level Flight
△	115.0	5200	2130	483	100.0(Mid)	Level Flight

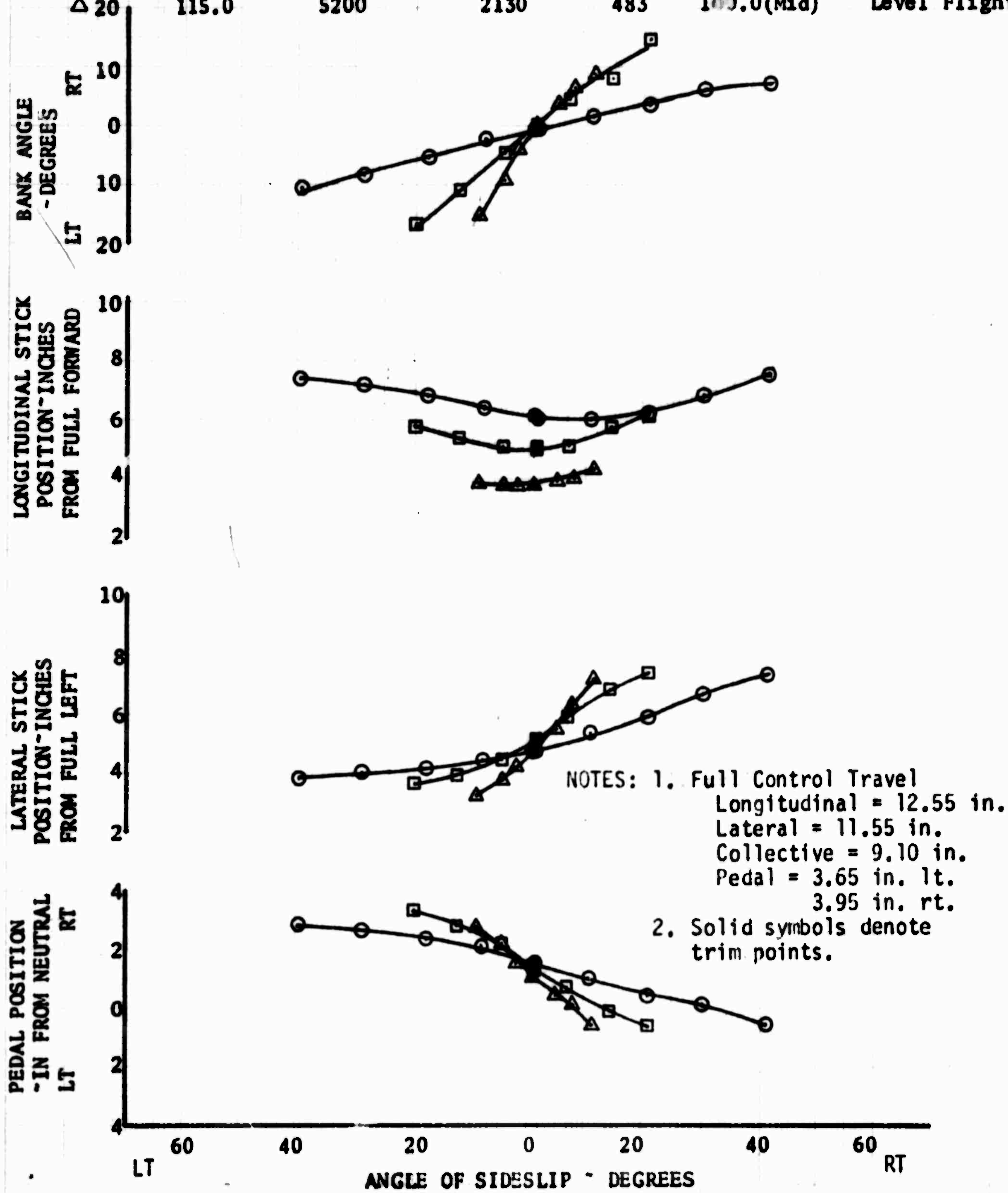


FIGURE NO. 96
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	4640	2440	483	99.3(Mid)	Level Flight
□	83.5	4780	2400	483	99.3(Mid)	Level Flight
△	105.0	5360	2360	483	99.3(Mid)	Level Flight

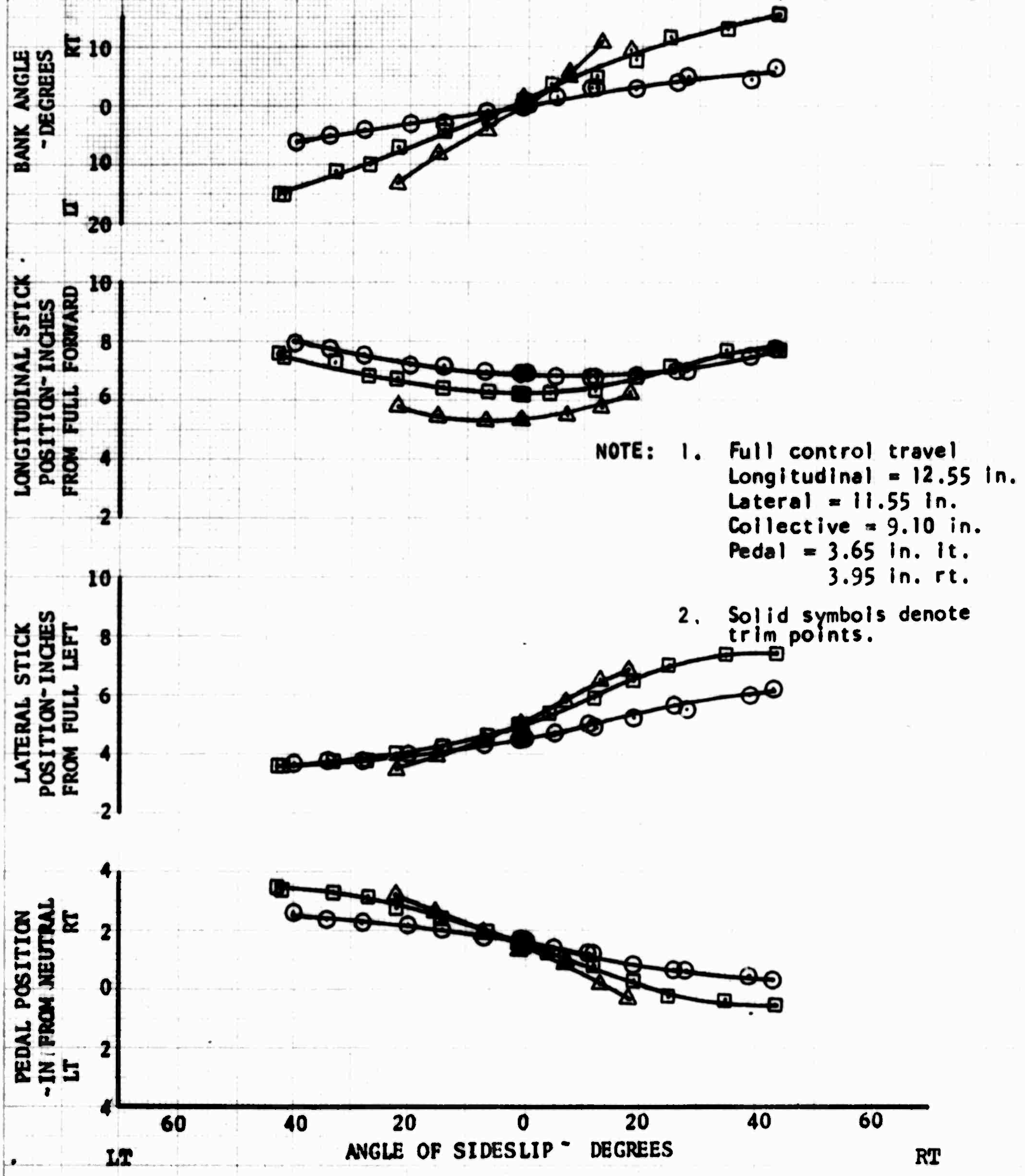
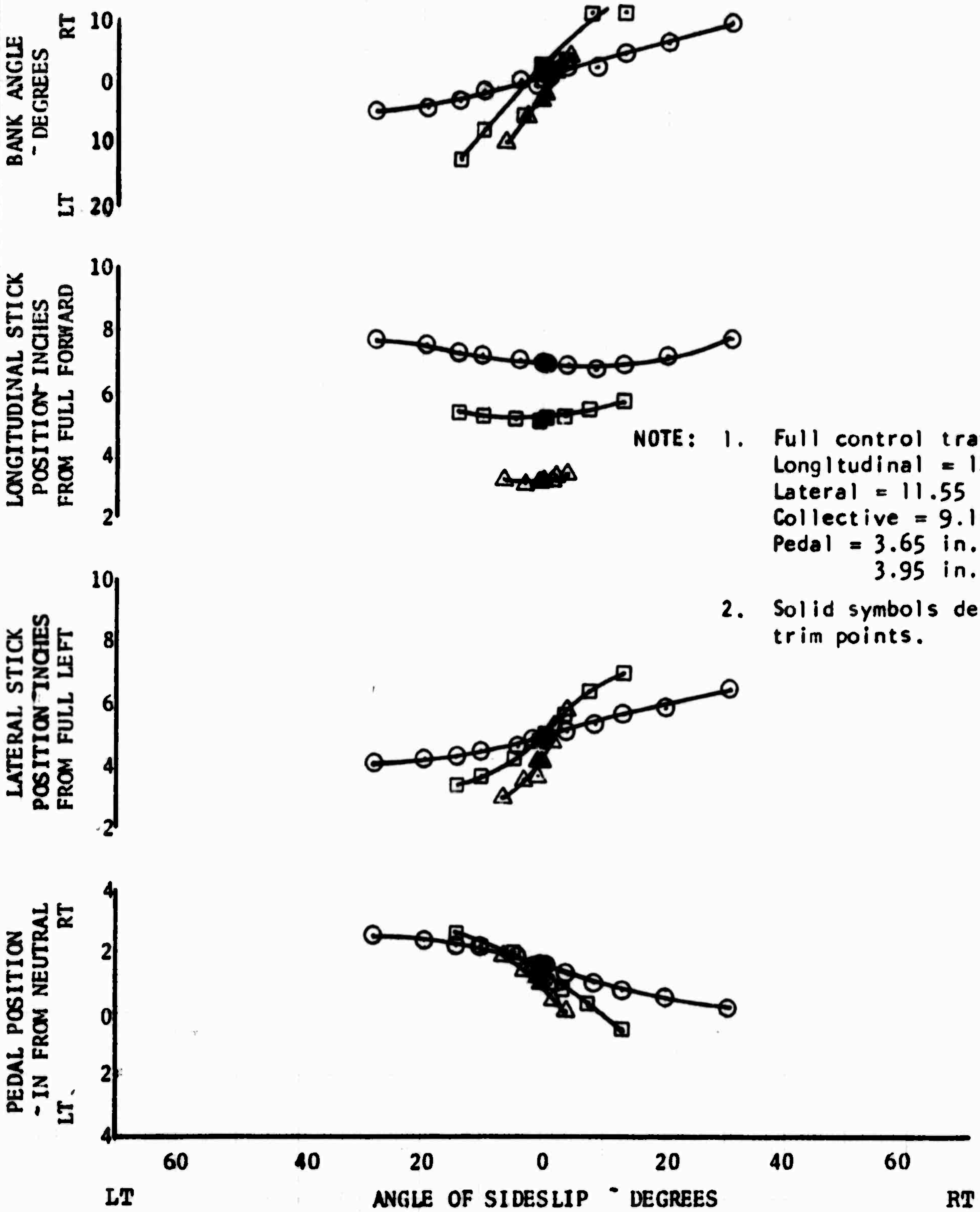


FIGURE NO. 97
STATIC LATERAL-DIRECTIONAL STABILITY

OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	+110	2080	483	97.0(Fwd)	Level Flight
□	104.0	-20	2050	483	97.0(Fwd)	Level Flight
△	131.0	+60	2030	483	97.0(Fwd)	Level Flight



NOTE: 1. Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

2. Solid symbols denote trim points.

FIGURE NO. 98
STATIC LATERAL-DIRECTIONAL STABILITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	TRIM AIRSPEED KCAS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	-60	2350	483	97.0(Fwd)	Level Flight
□	104.0	-60	2370	483	97.0(Fwd)	Level Flight
△	129.0	-60	2380	483	97.0(Fwd)	Level Flight

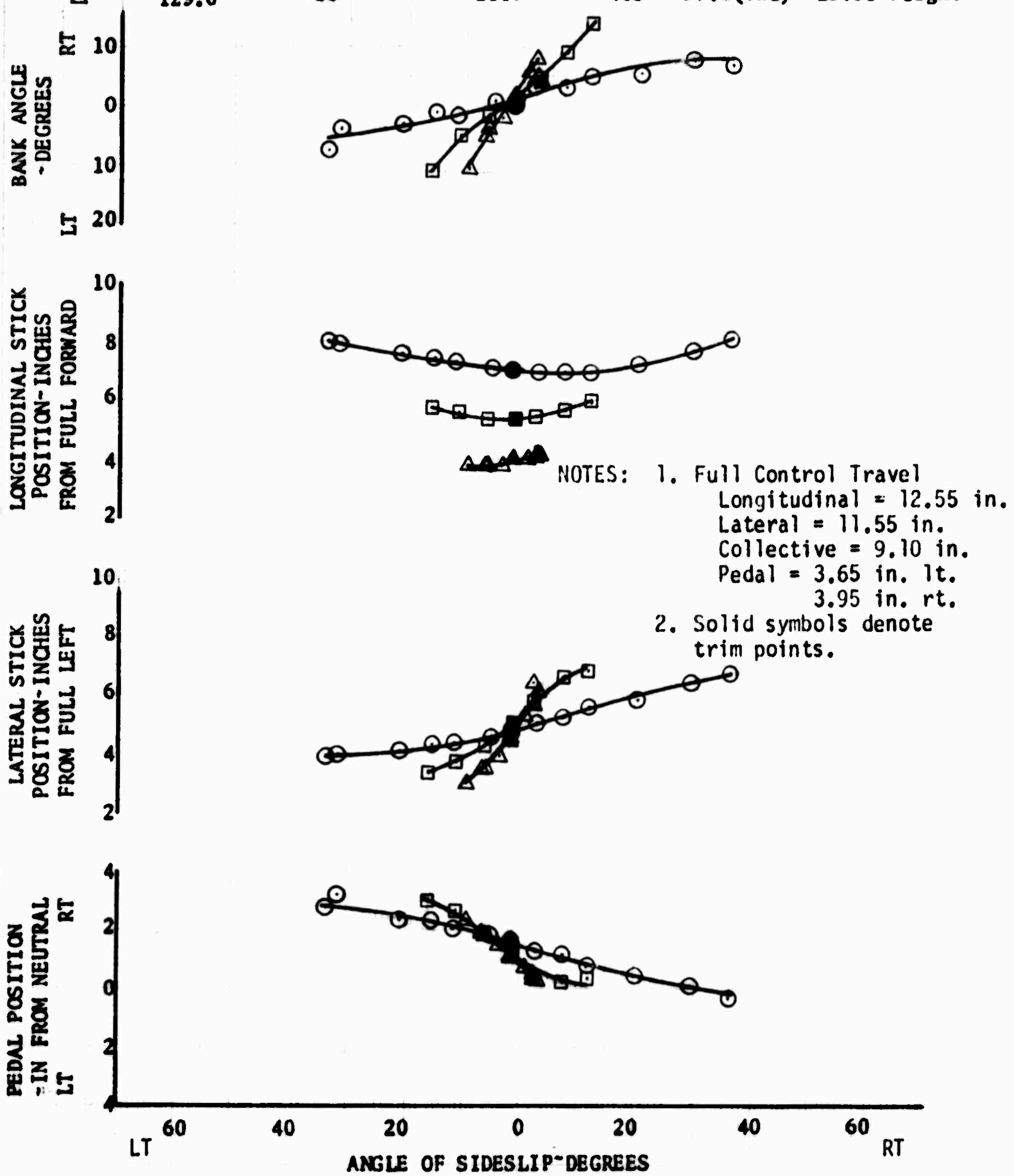


FIGURE NO. 99
FORWARD LONGITUDINAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53 KCAS
DENSITY ALTITUDE = 4690 FT

GROSS WEIGHT = 2110 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

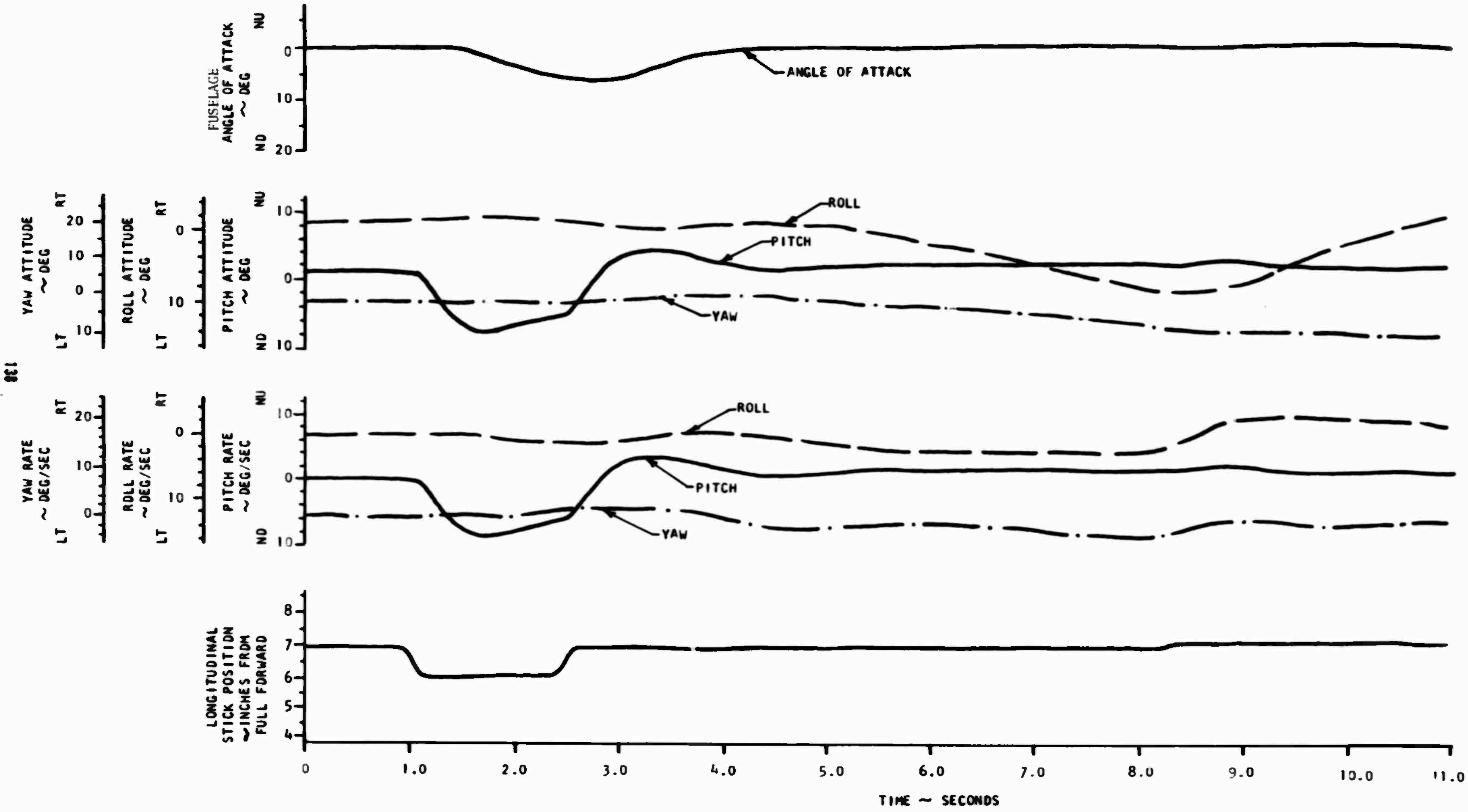


FIGURE NO. 100
AFT LONGITUDINAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53 KCAS
DENSITY ALTITUDE = 4720 FT

GROSS WEIGHT = 2130 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

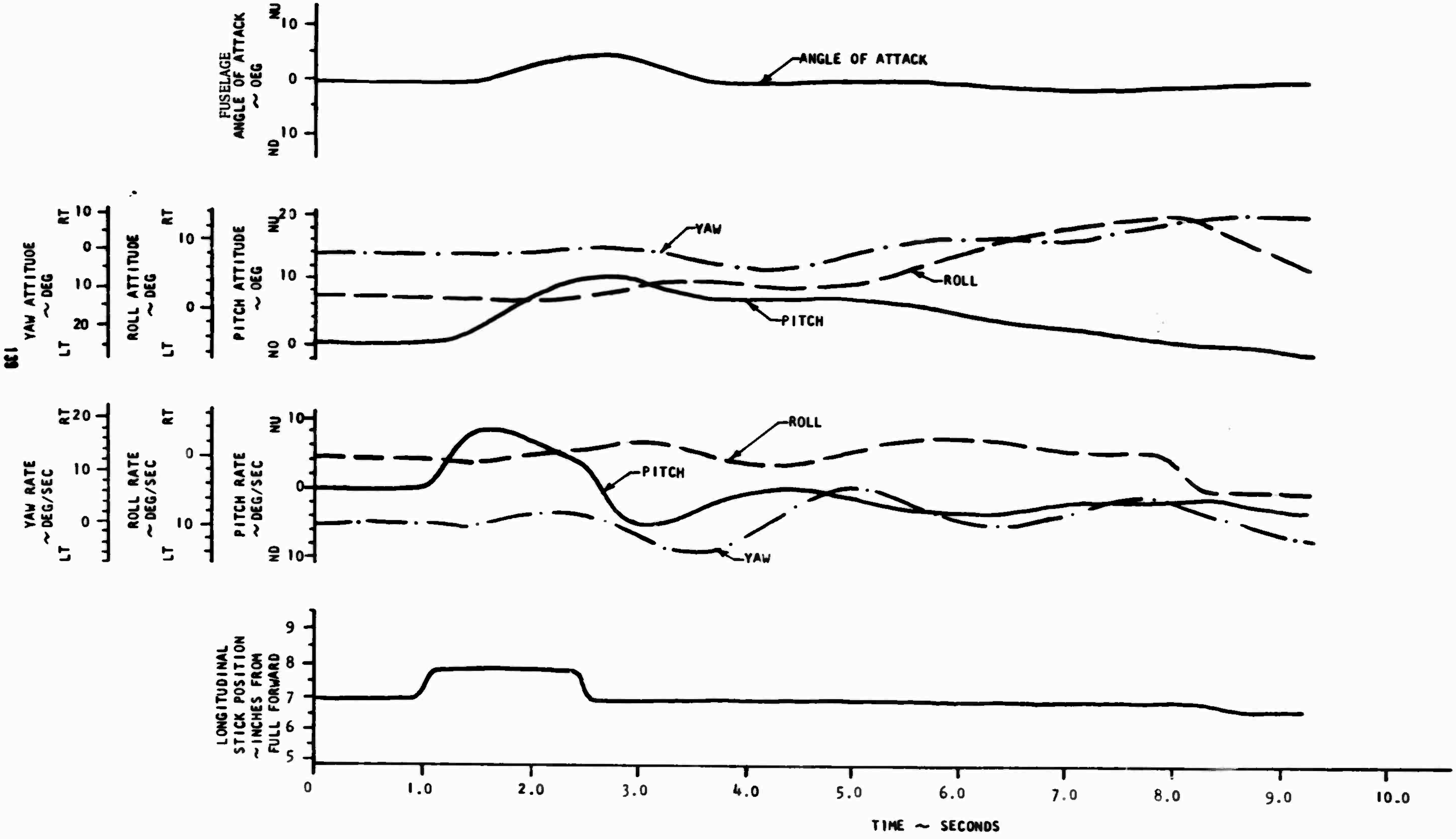


FIGURE NO. 101
FORWARD LONGITUDINAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
DENSITY ALTITUDE = 4900 FT
TRIM AIRSPEED = 104.0 KCAS

GROSS WEIGHT = 2050 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

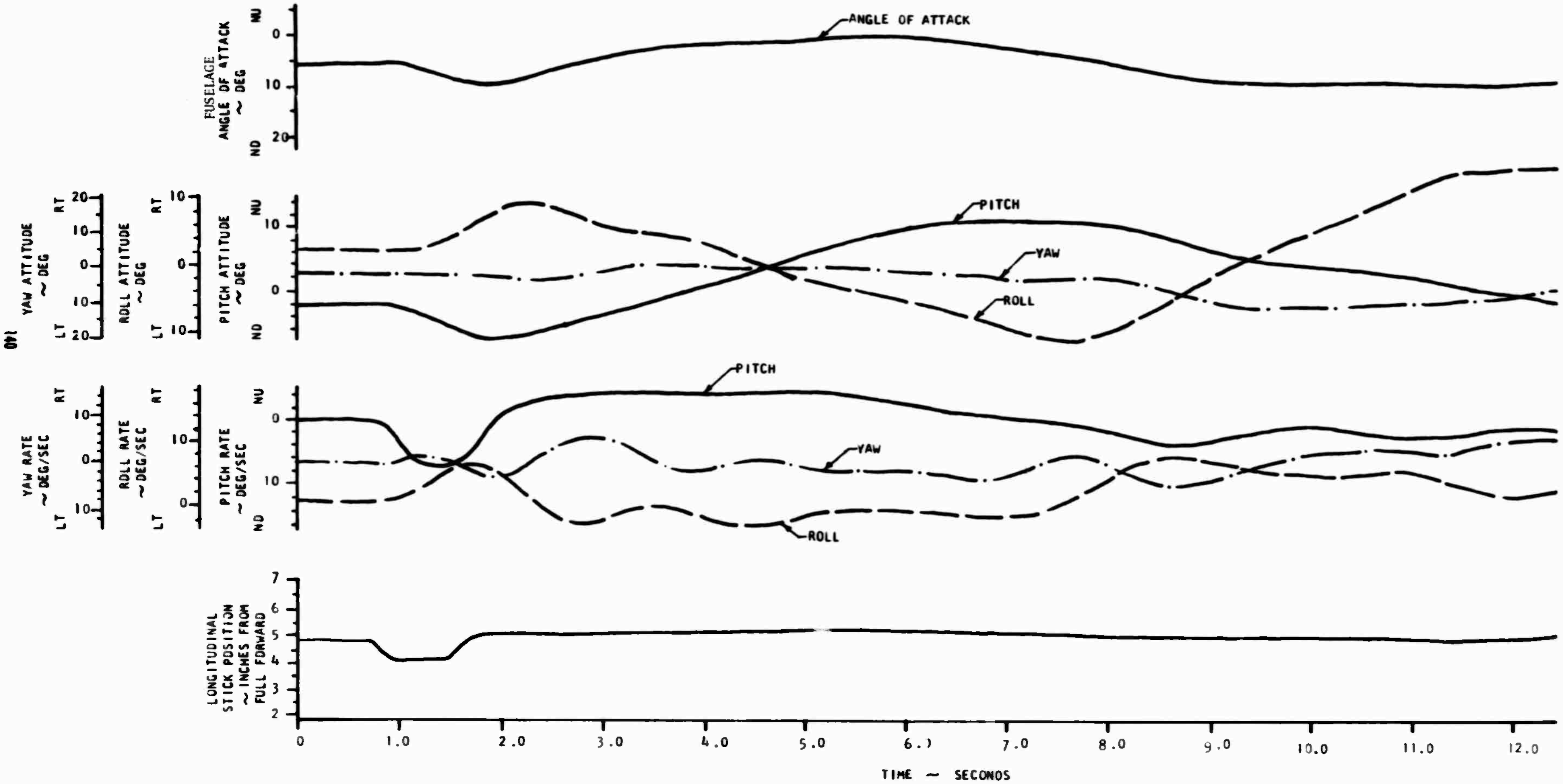


FIGURE NO. 102
AFT LONGITUDINAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 104.0 KCAS
DENSITY ALTITUDE = 4870 FT

GROSS WEIGHT = 2060 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

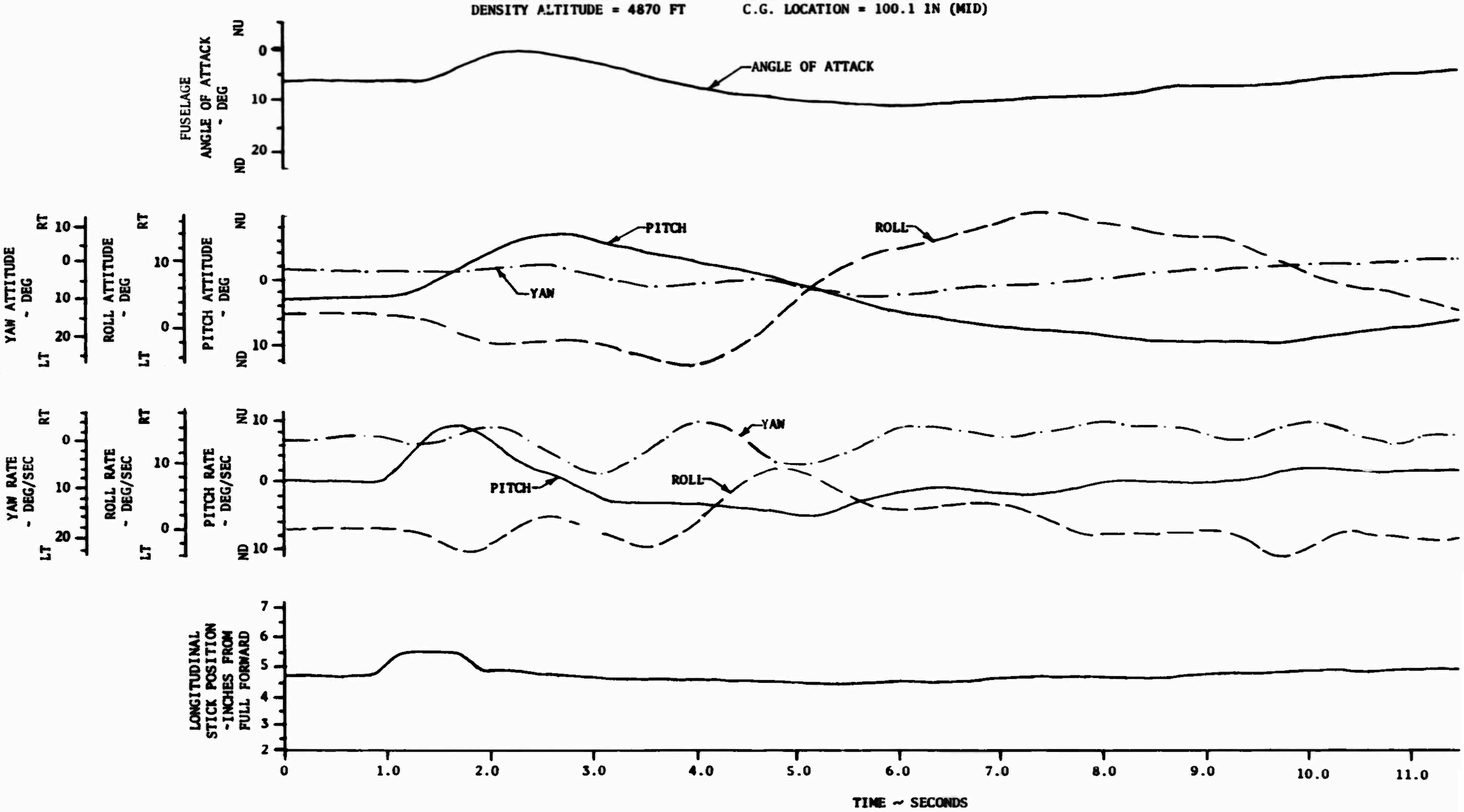


FIGURE NO. 103
LEFT LATERAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53 KCAS
DENSITY ALTITUDE = 4710 FT

GROSS WEIGHT = 2090 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

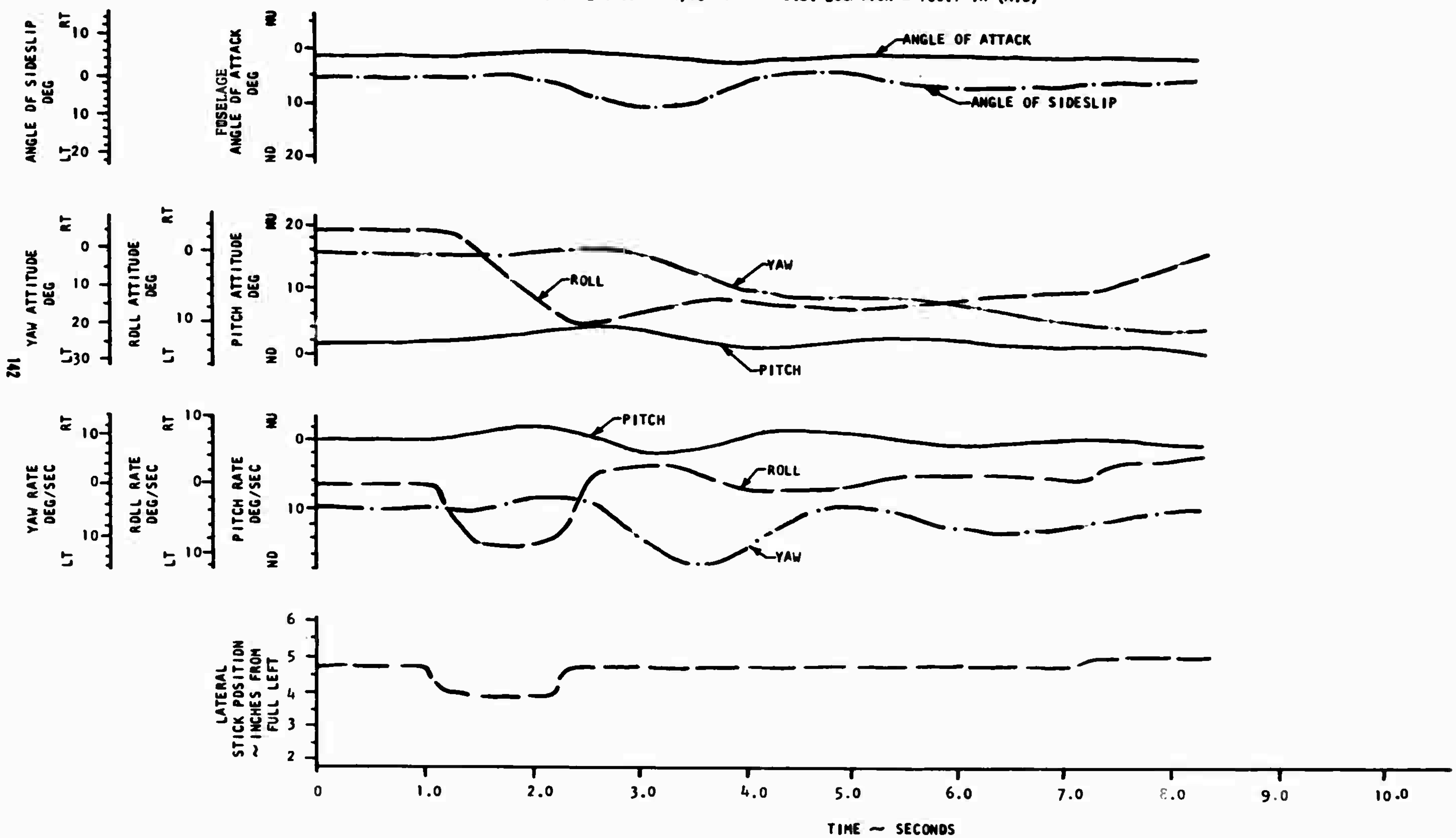


FIGURE NO. 104
RIGHT LATERAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53KCAS
DENSITY ALTITUDE = 4700 FT

GROSS WEIGHT = 2100 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

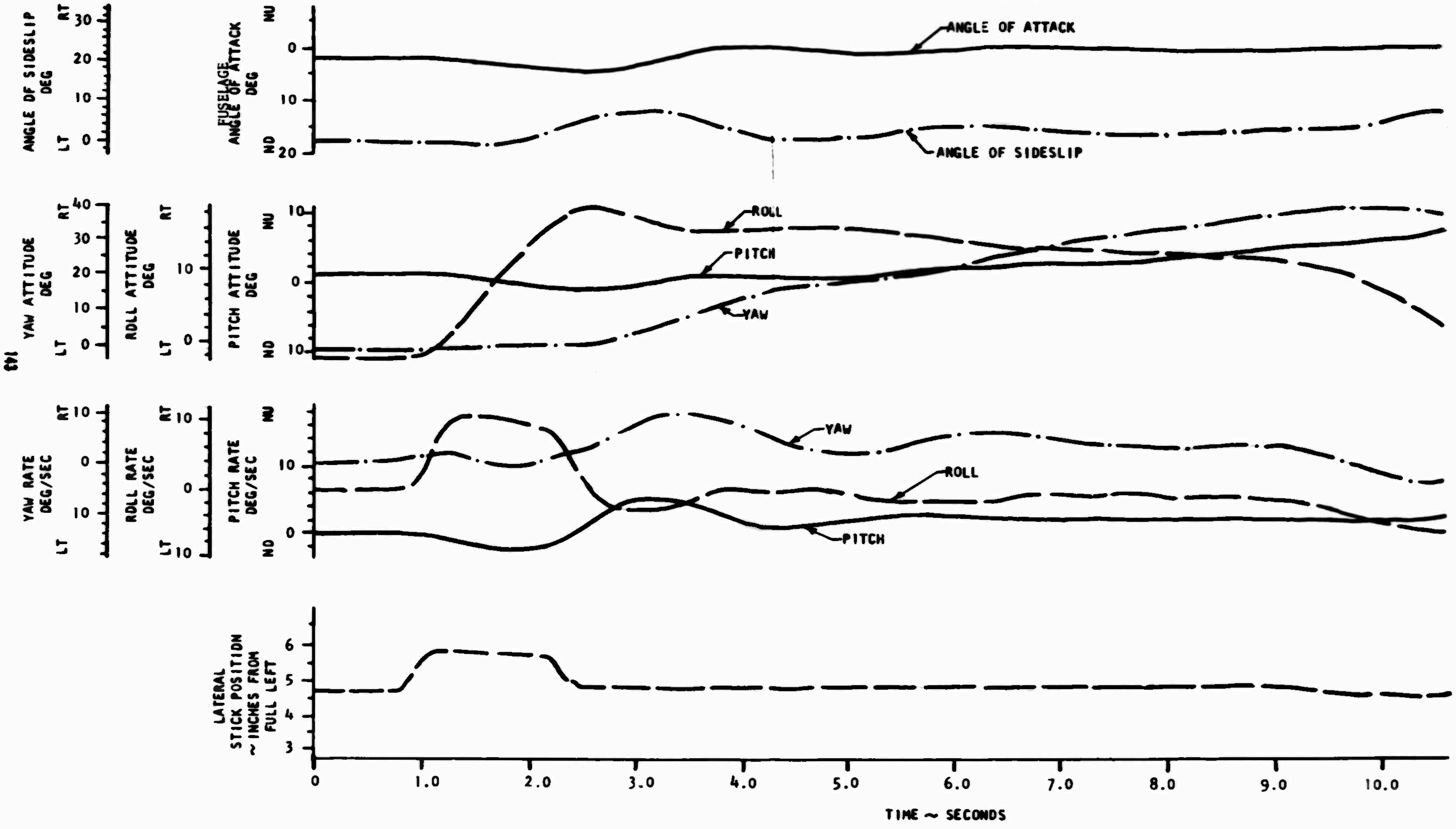


FIGURE NO. 105
LEFT LATERAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT	GROSS WEIGHT = 2040 LB
TRIM AIRSPEED = 104.0 KCAS	ROTOR SPEED = 483 RPM
DENSITY ALTITUDE = 6410 FT	C.G. LOCATION = 100.1 IN (MID)

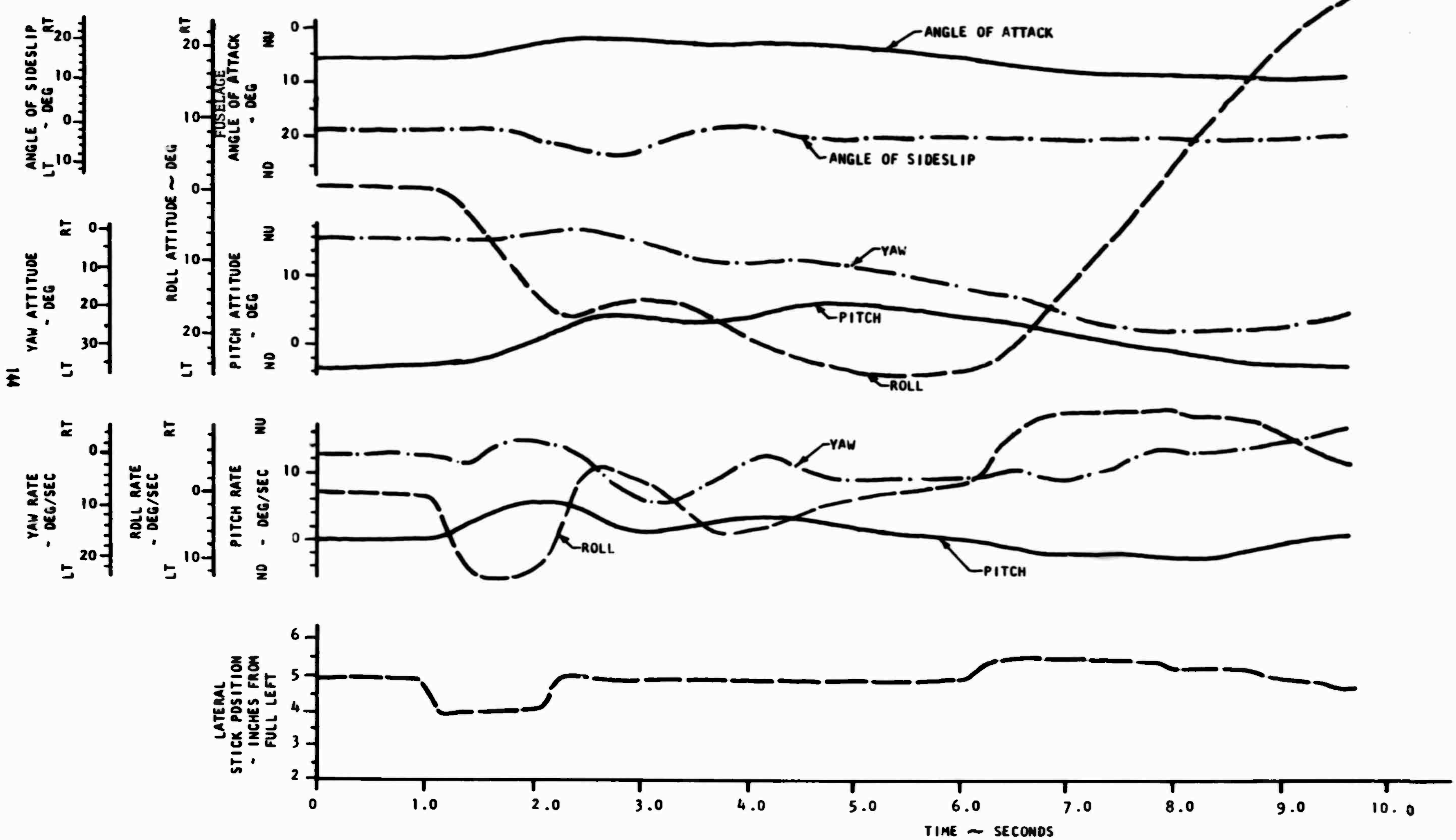


FIGURE NO. 105A
RIGHT LATERAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 104.0 KCAS
DENSITY ALTITUDE = 6430 FT

GROSS WEIGHT = 2030 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

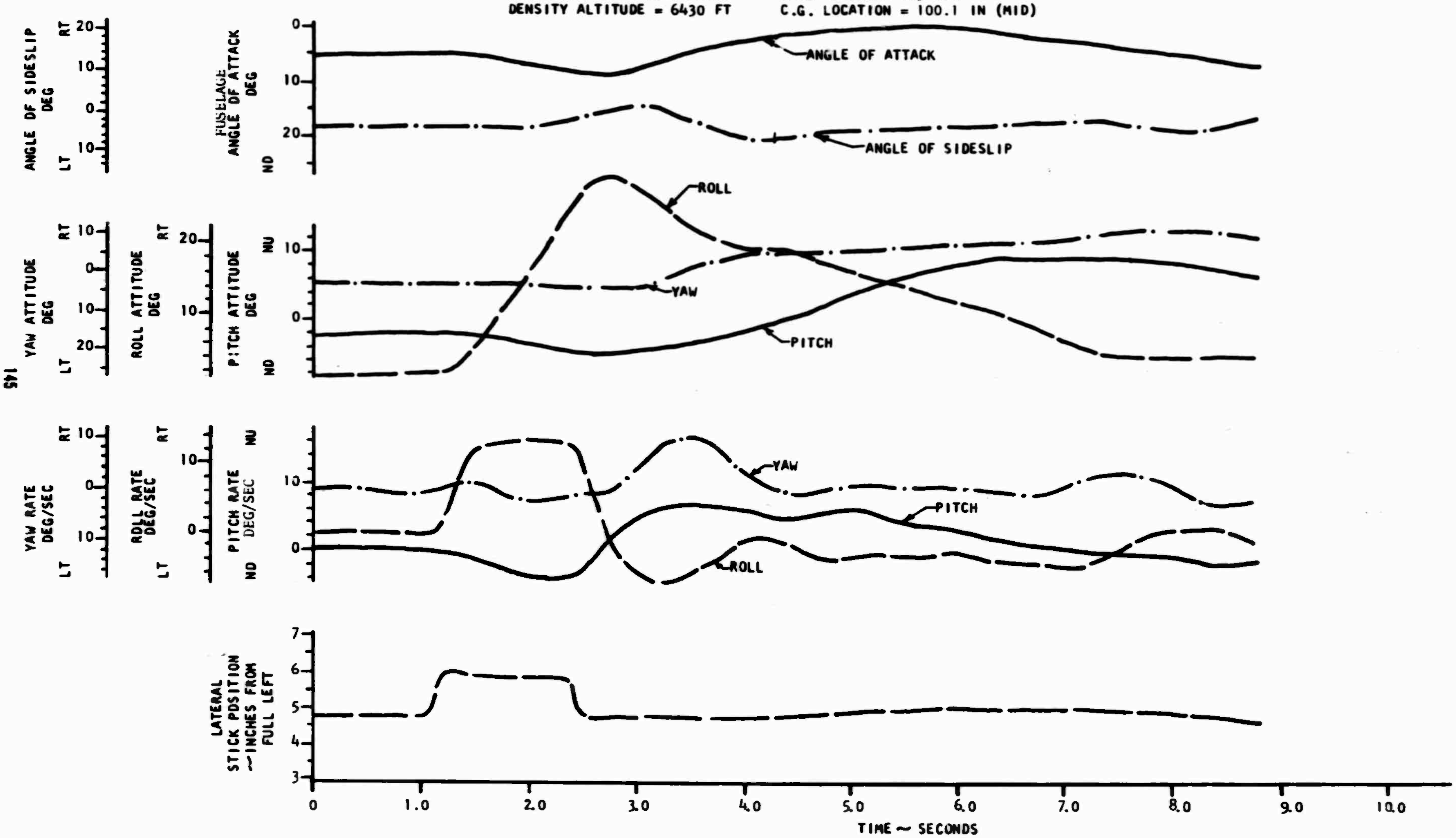


FIGURE NO. 106
LEFT DIRECTIONAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53 KCAS
DENSITY ALTITUDE = 5100 FT

GROSS WEIGHT = 2090 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

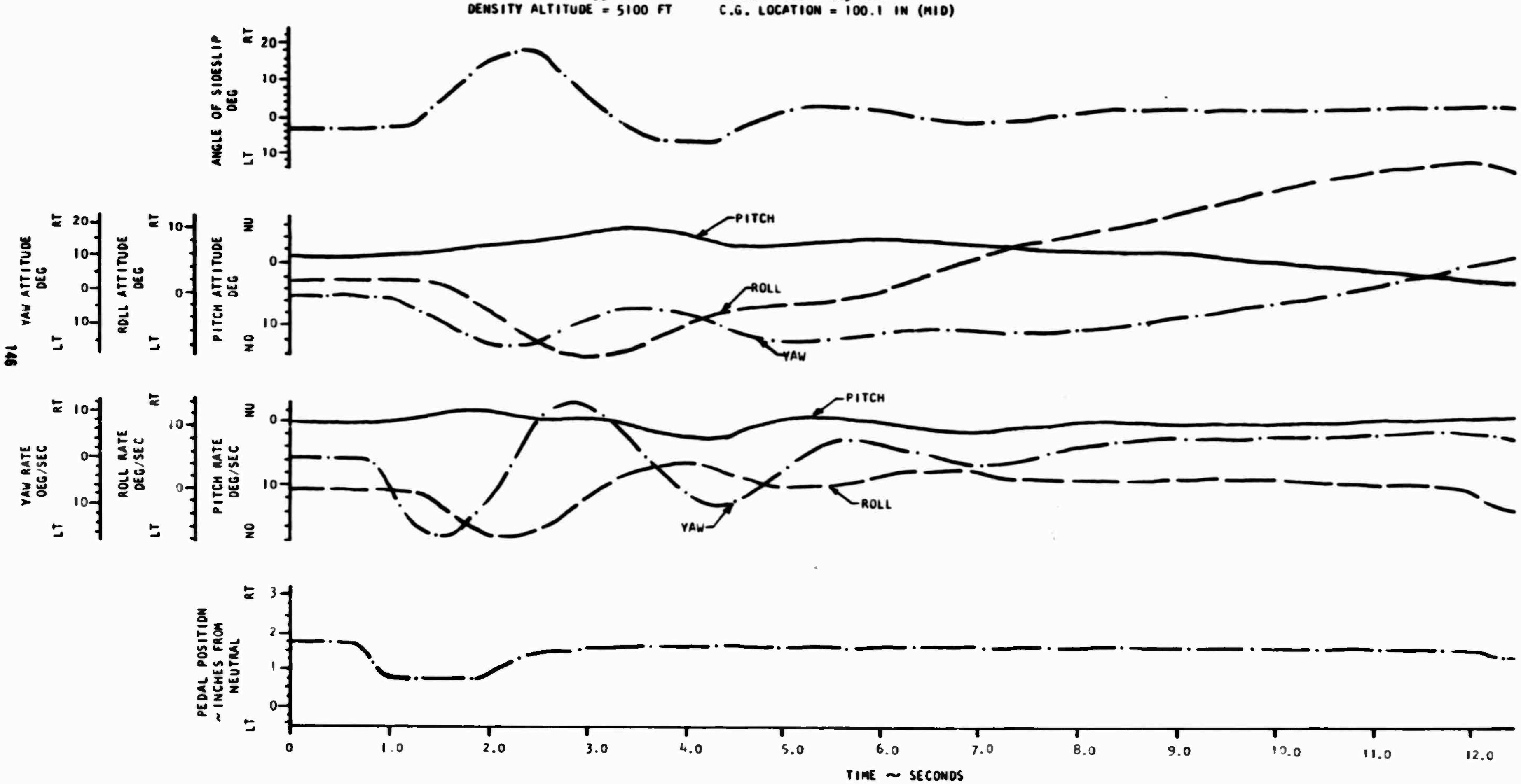


FIGURE NO. 107
LEFT DIRECTIONAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT	GROSS WEIGHT = 2010 LB
TRIM AIRSPEED = 104.0 KCAS	ROTOR SPEED = 483 RPM
DENSITY ALTITUDE = 6400 FT	C.G. LOCATION = 100.1 IN (MID)

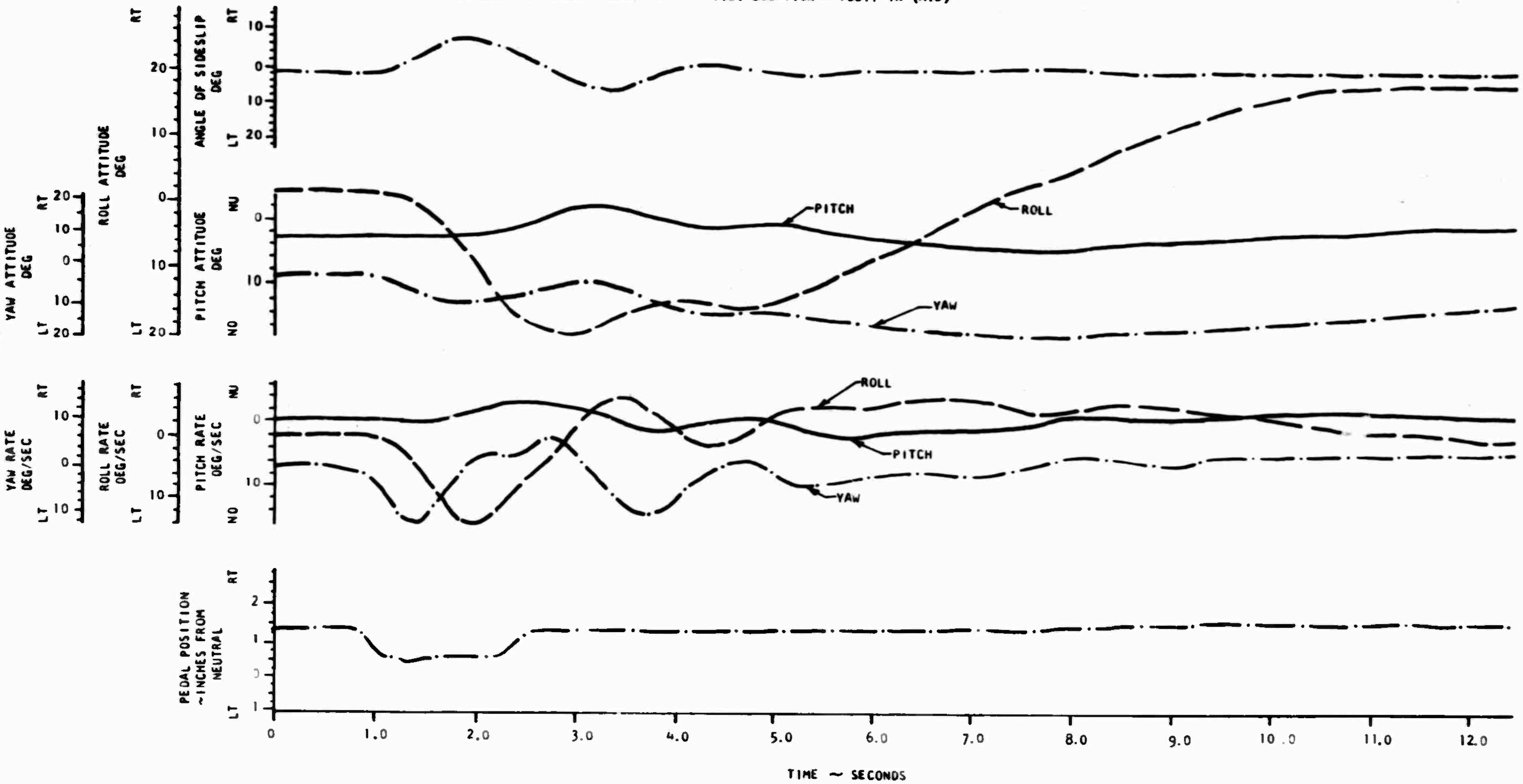


FIGURE NO. 107A
RIGHT DIRECTIONAL PULSE
OH-6A [illegible] 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53.0 KCAS
DENSITY ALTITUDE = 5220 FT

GROSS WEIGHT = 2080 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

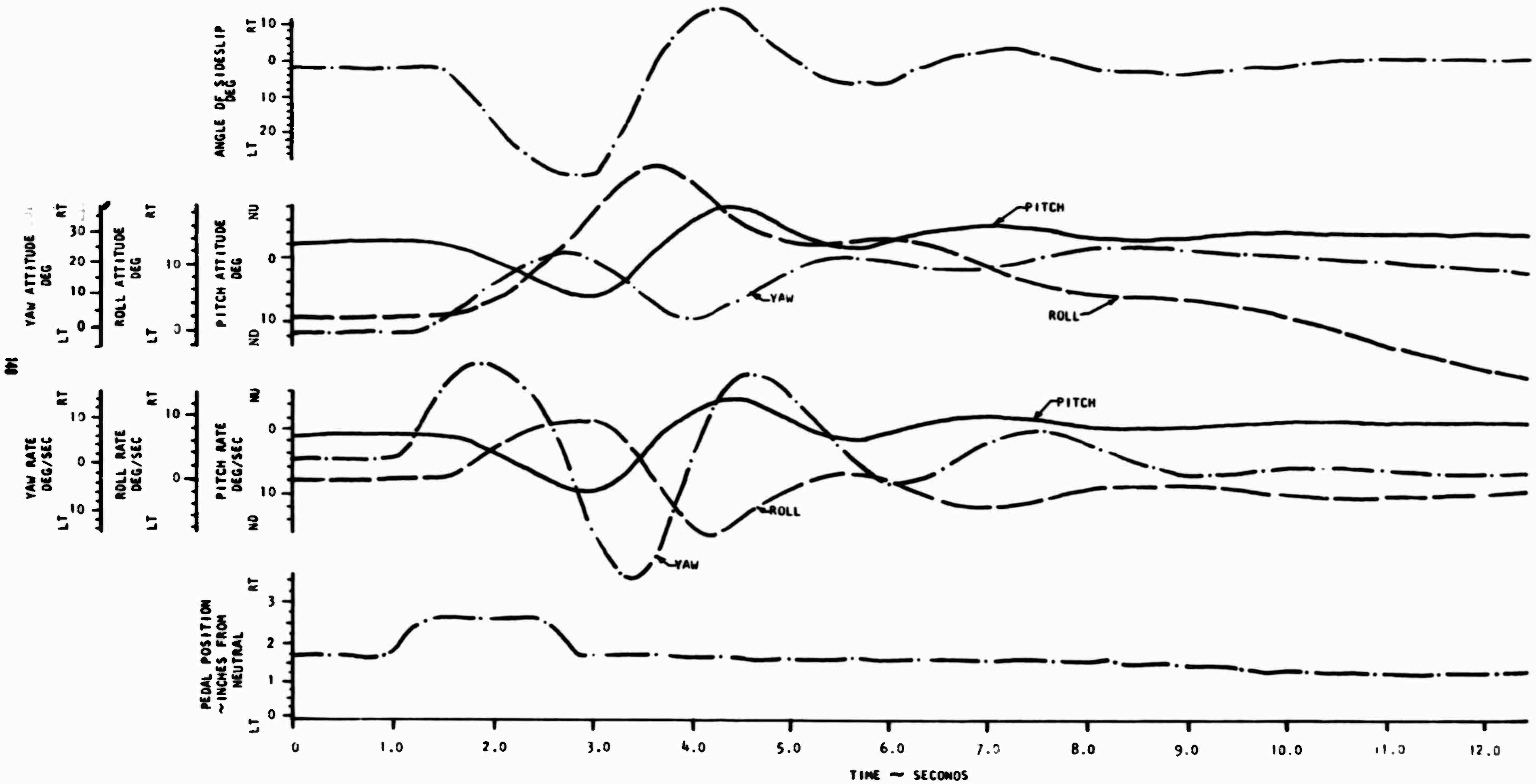


FIGURE NO. 108
RIGHT DIRECTIONAL PULSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 104.0 KCAS
DENSITY ALTITUDE = 6350 FT

GROSS WEIGHT = 2000 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

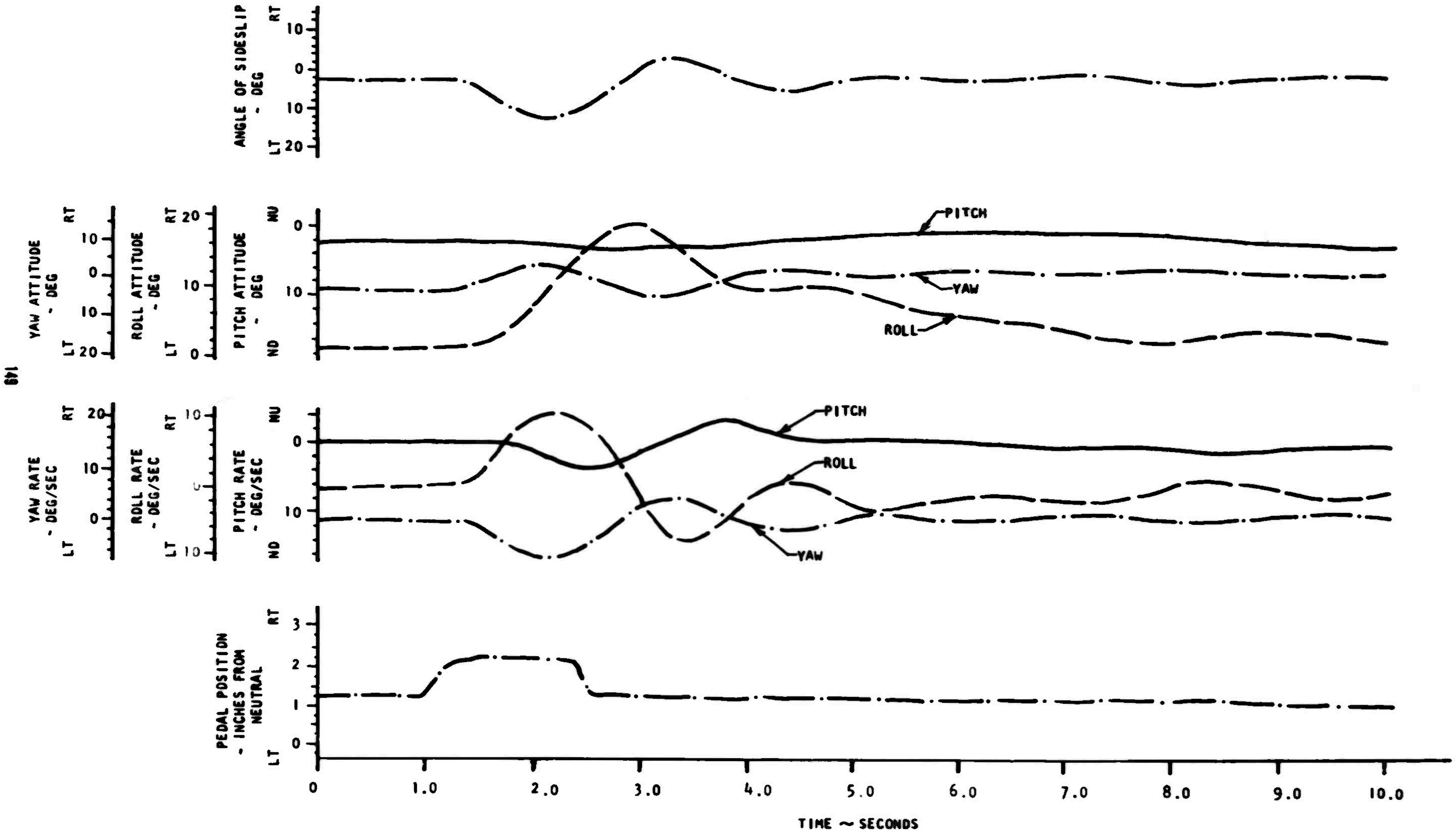


FIGURE NO. 109
SUMMARY OF CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN
○	6500	2400	483	97.0 (fwd)
□	10000	2400	483	97.1 (fwd)
△	5000	2400	469	97.3 (fwd)

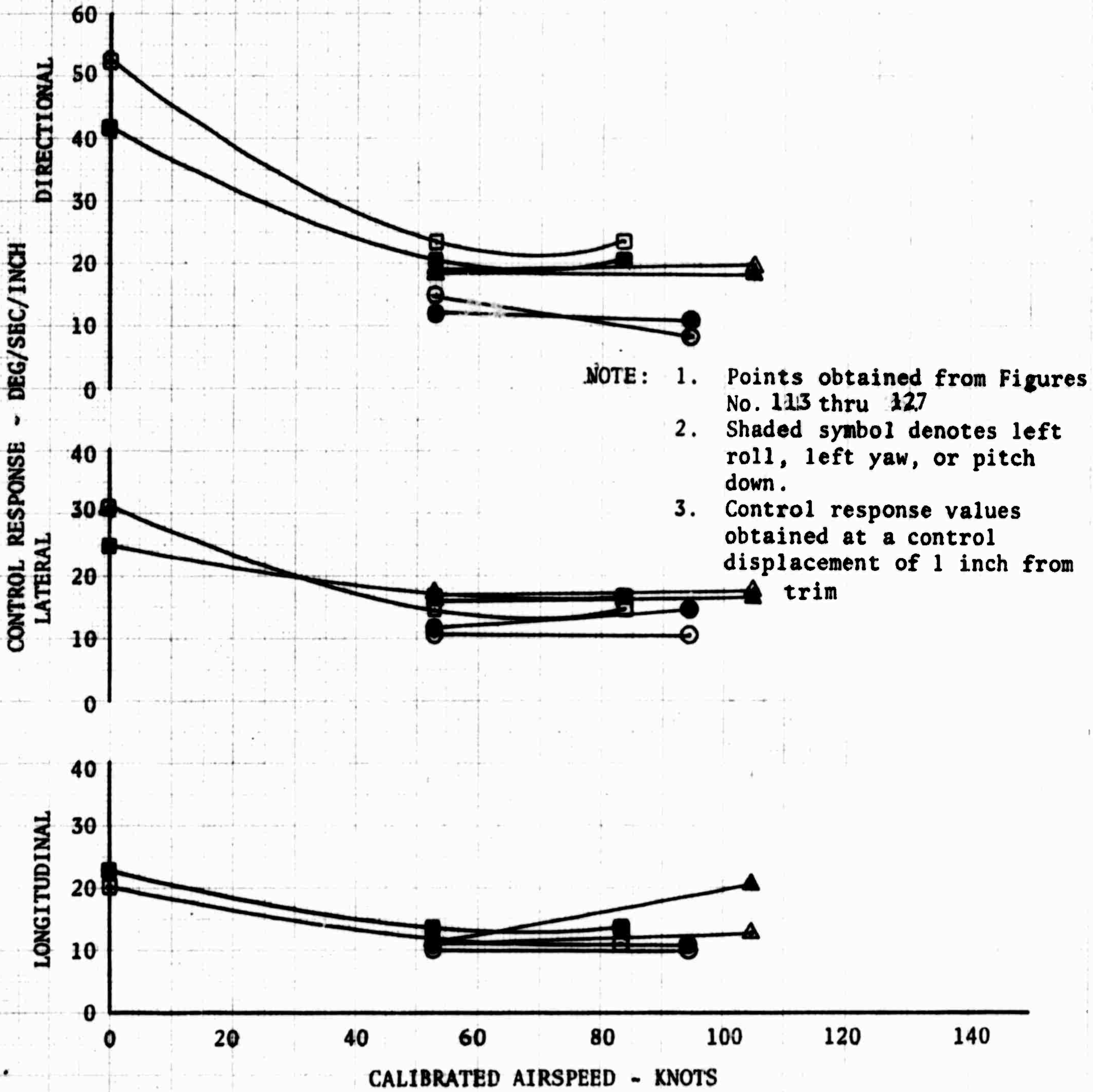


FIGURE NO. 110
SUMMARY OF CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN
○	6500	2400	483	97.0 (fwd)
◇	5000	2100	483	100.0 (mid)
△	5000	2400	483	103.0 (aft)

NOTE:
1. Points obtained from Figures No. 113thru 127
2. Shaded symbol denotes left roll, left yaw, or pitch down
3. Control response values obtained at a control displacement of 1 inch from trim.

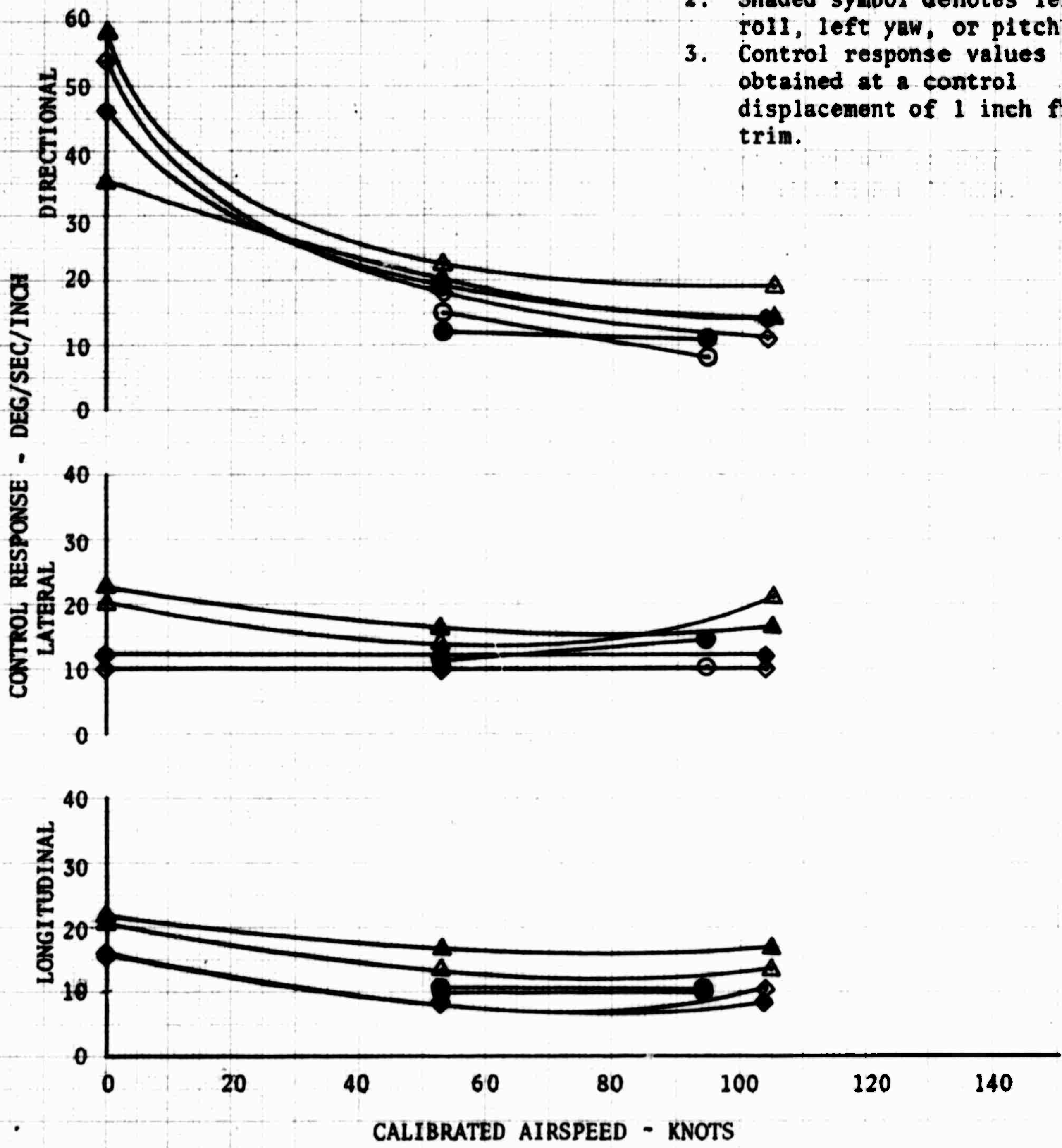


FIGURE NO. 111
SUMMARY OF CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN
○	6500	2400	483	97.0 (fwd)
□	10000	2400	483	97.1 (fwd)
△	5000	2400	469	97.3 (fwd)

NOTE:
1. Points obtained from Figures No. 128 through 141
2. Shaded symbol denotes left roll, left yaw, or pitch down.
3. Control sensitivity values obtained at a control displacement of 1 inch from trim.

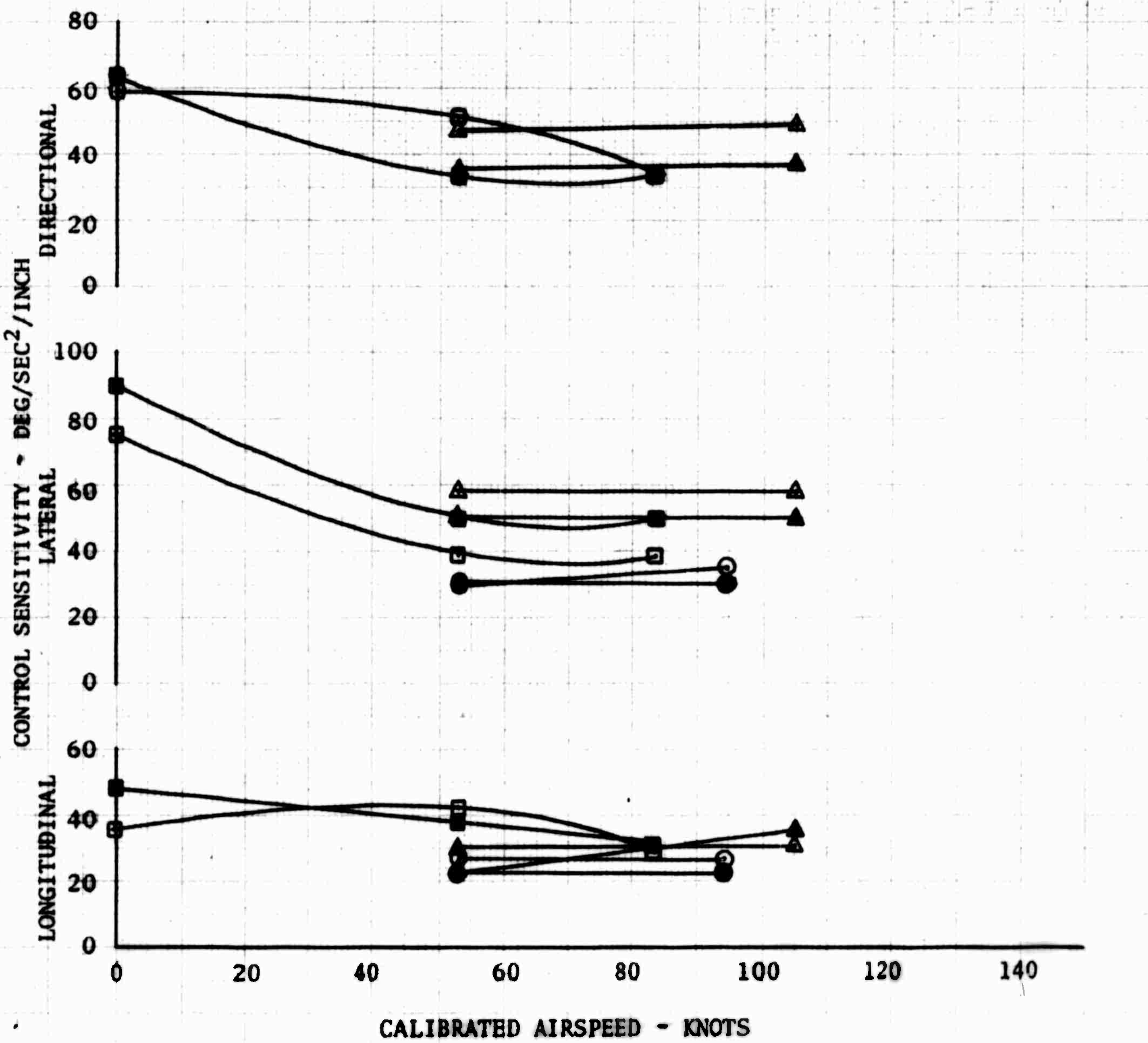


FIGURE NO. 112
SUMMARY OF CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN
○	6500	2400	483	97.0 (fwd)
□	5000	2100	483	100.0 (mid)
△	5000	2400	483	103.0 (aft)

NOTE:
1. Points obtained from Figures No. 128 through 141
2. Shaded symbol denotes left roll, left yaw, or pitch down.
3. Control sensitivity values obtained at a control displacement of 1 inch from trim.

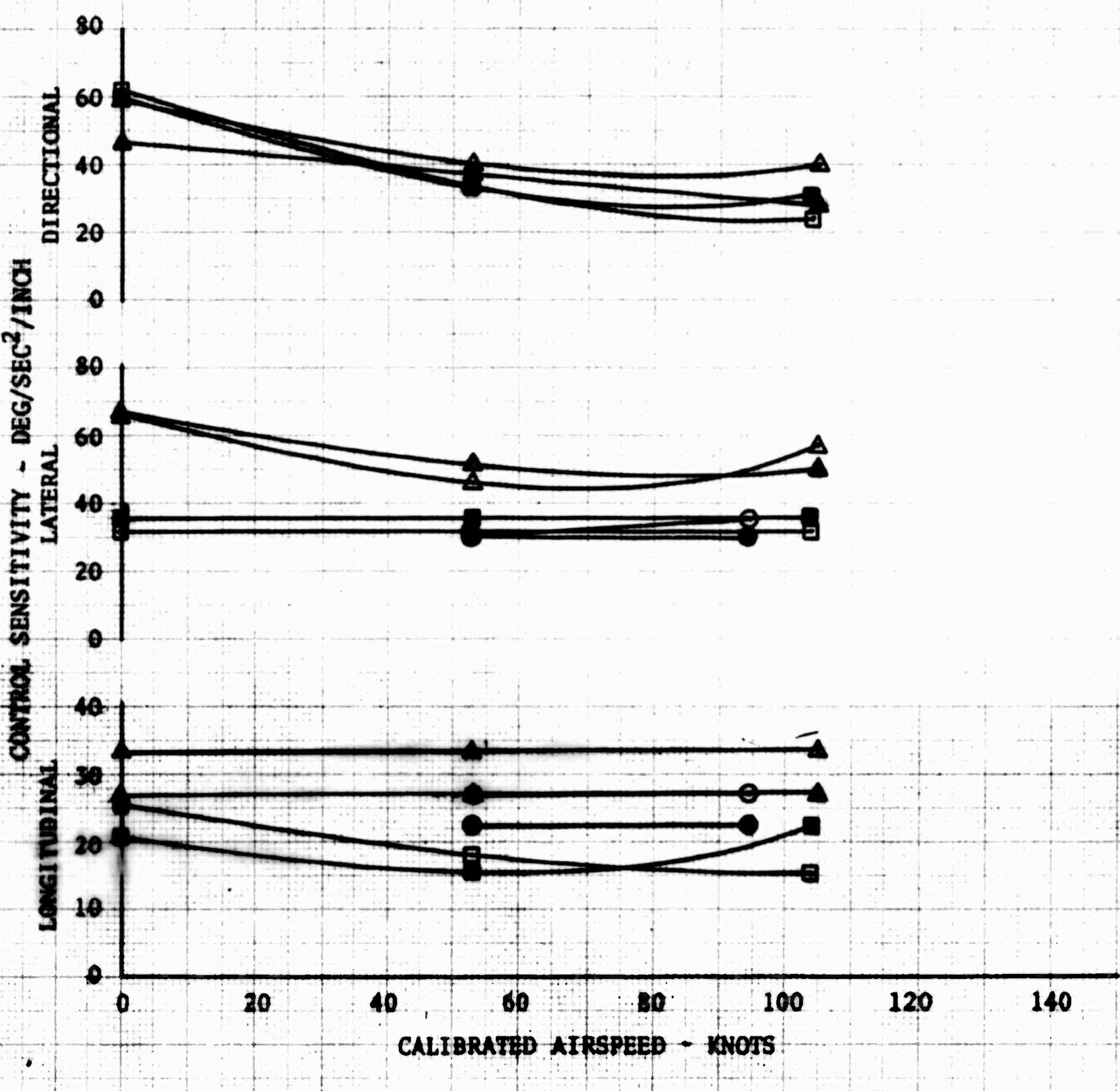


FIGURE NO. 113
LONGITUDINAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	6380	2430	483	97.0 (fwd)	Level Flight
□	94.5	6700	2340	483	97.0 (fwd)	Level Flight

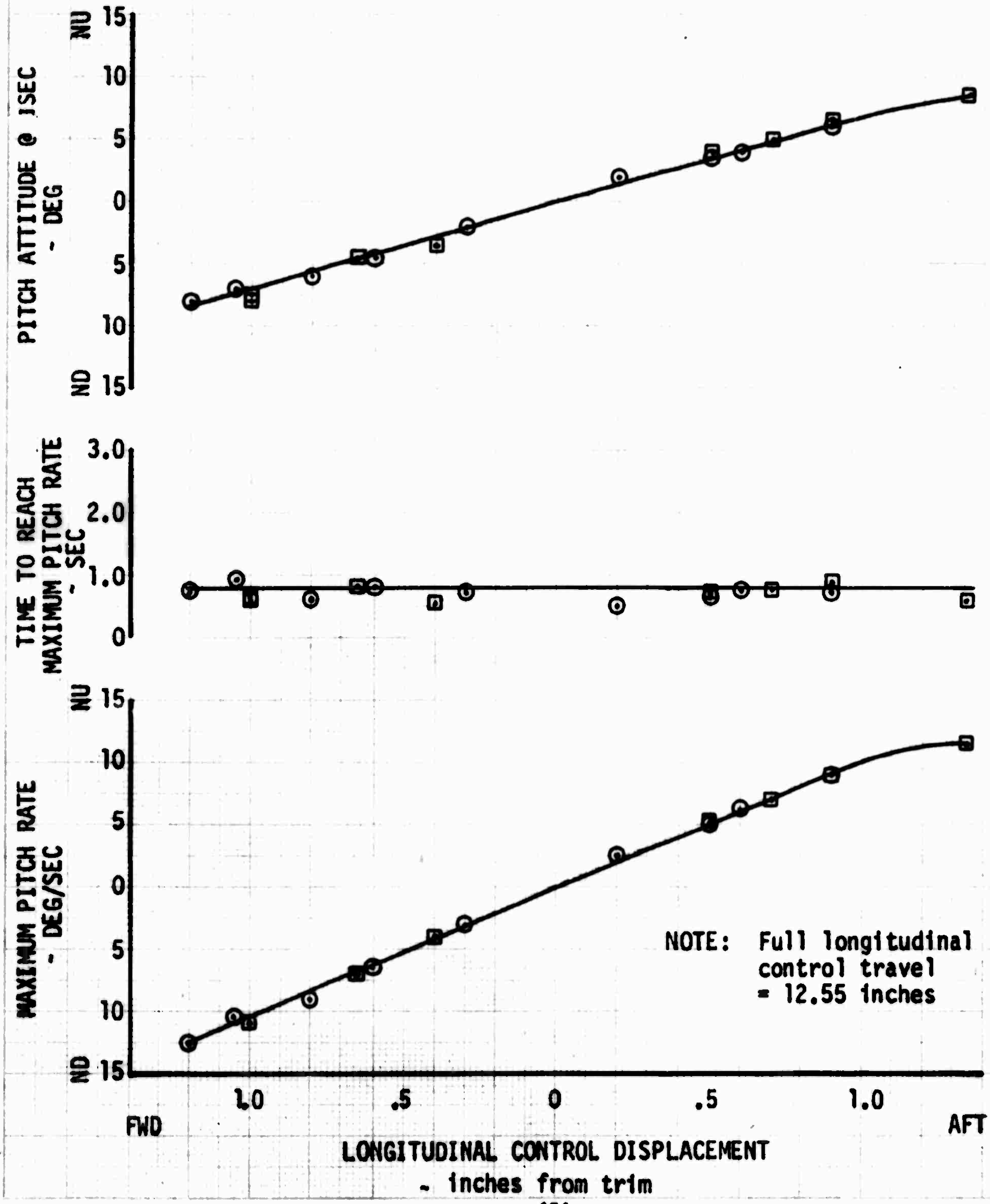


FIGURE NO. 114
LONGITUDINAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2000	2430	483	97.1 (fwd)	Level Flight
□	53.0	9700	2380	483	97.1 (fwd)	Level Flight
△	83.5	9930	2340	483	97.1 (fwd)	Level Flight

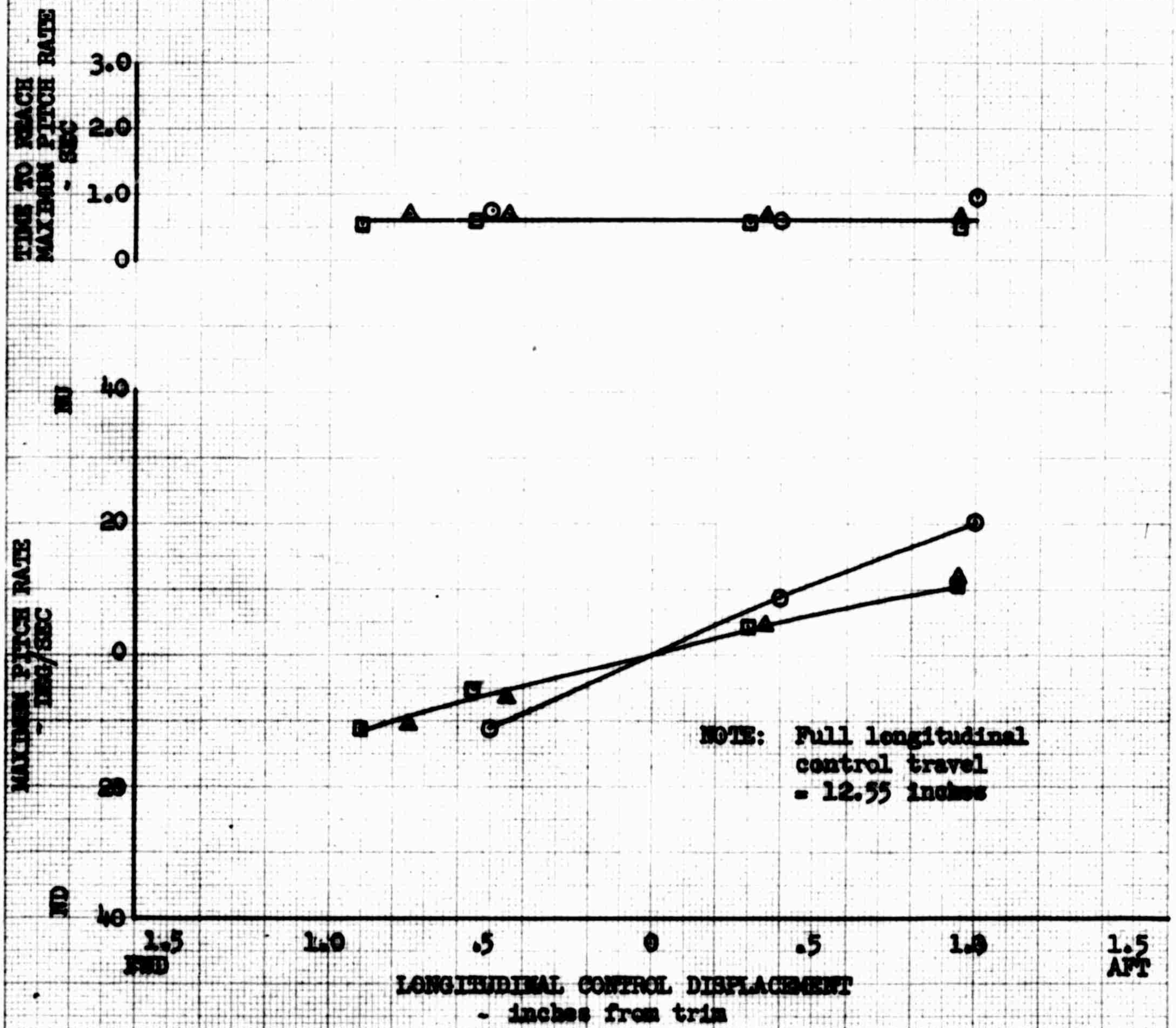


FIGURE NO. 115
LONGITUDINAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
□	53.0	5310	2420	469	97.3 (fwd)	Level Flight
△	105.0	5160	2360	469	97.3 (fwd)	Level Flight

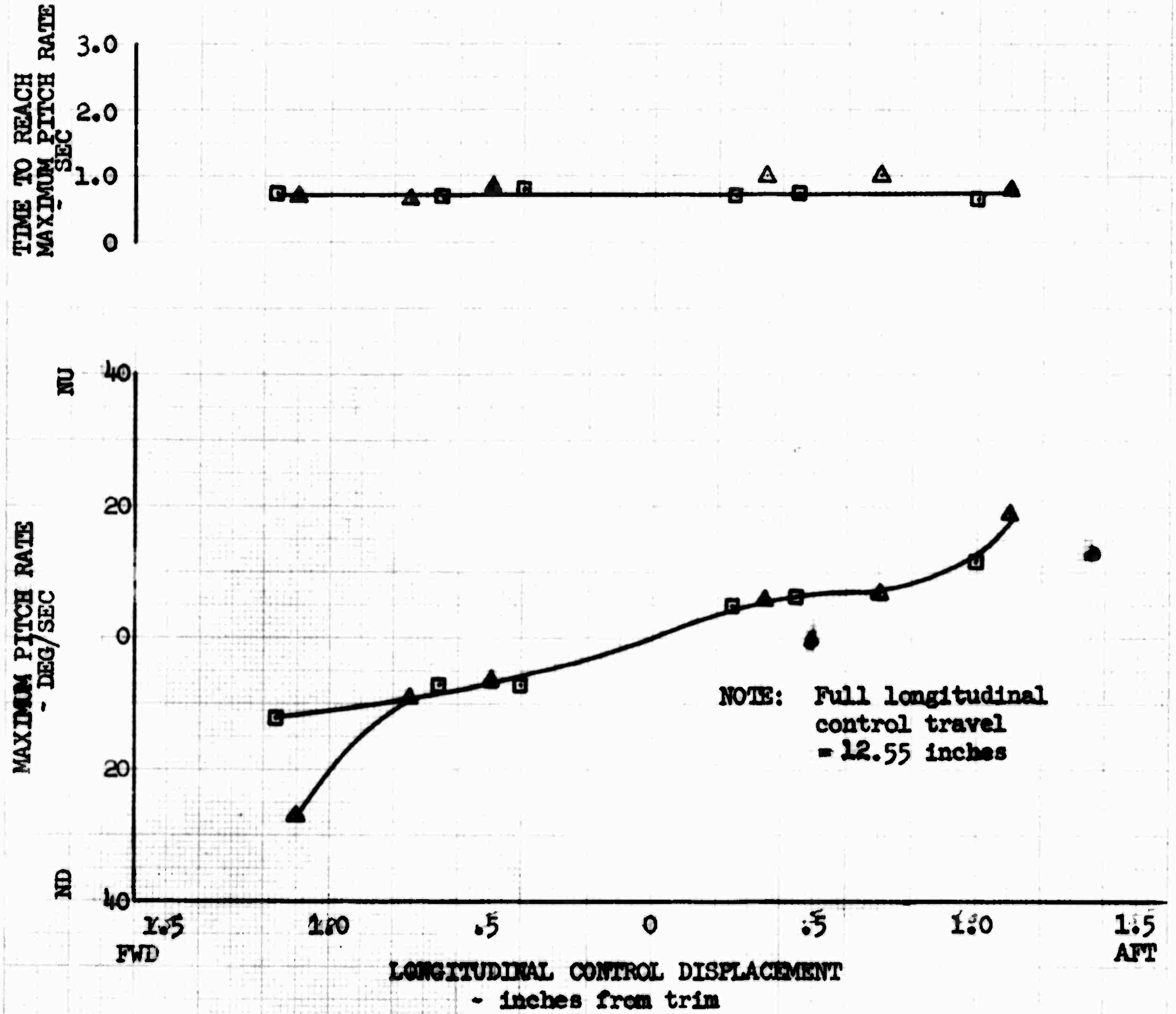


FIGURE NO. 116
LONGITUDINAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	1310	2150	483	100.0 (mid)	Hover
□	53.0	4720	2090	483	100.0 (mid)	Level Flight
△	104.0	6380	2020	483	100.0 (mid)	Level Flight

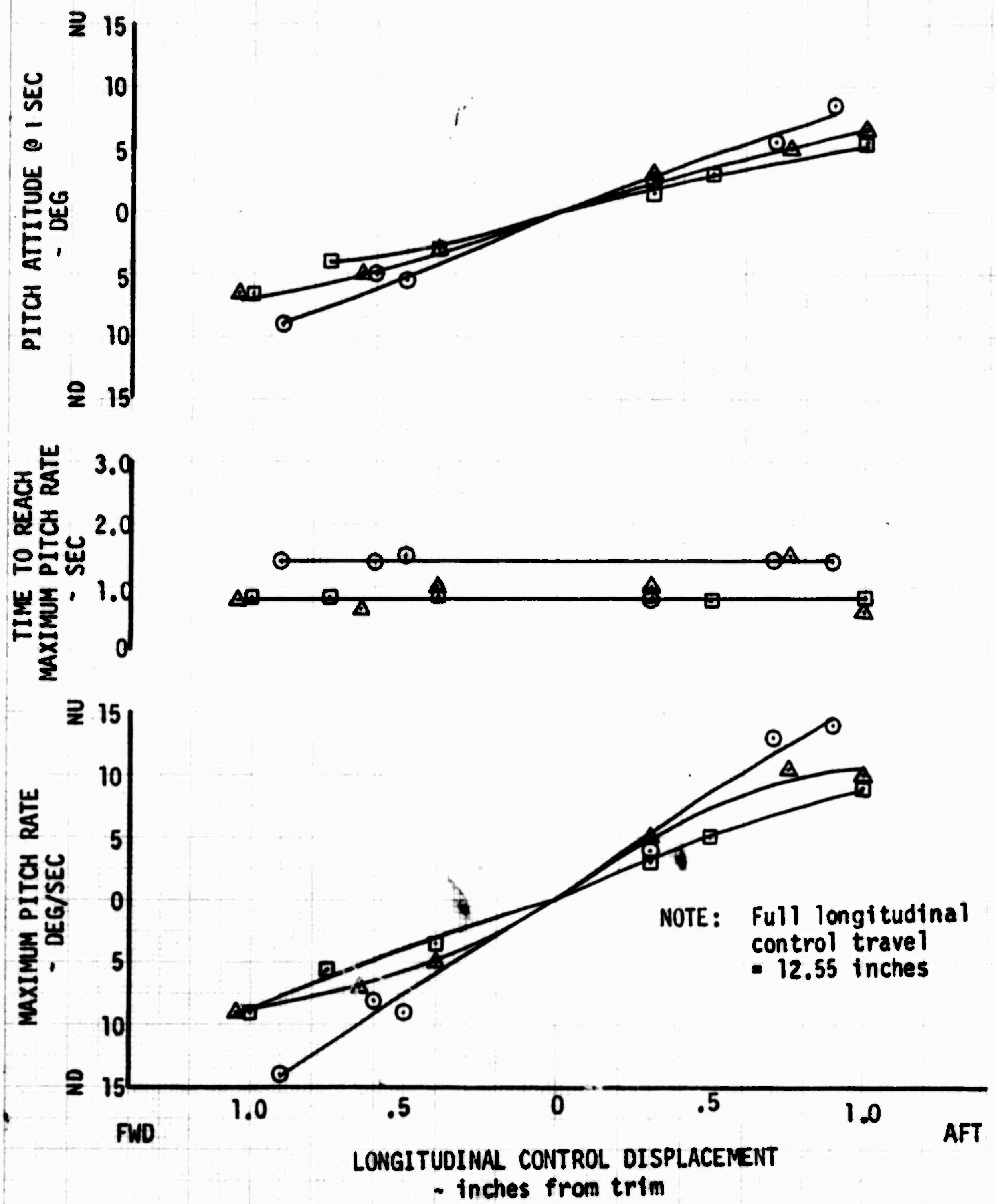


FIGURE NO. 117
LONGITUDINAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2400	2430	483	103.0 (aft)	Level Flight
□	53.0	5310	2370	483	103.0 (aft)	Level Flight
△	105.0	4980	2310	483	103.0 (aft)	Level Flight

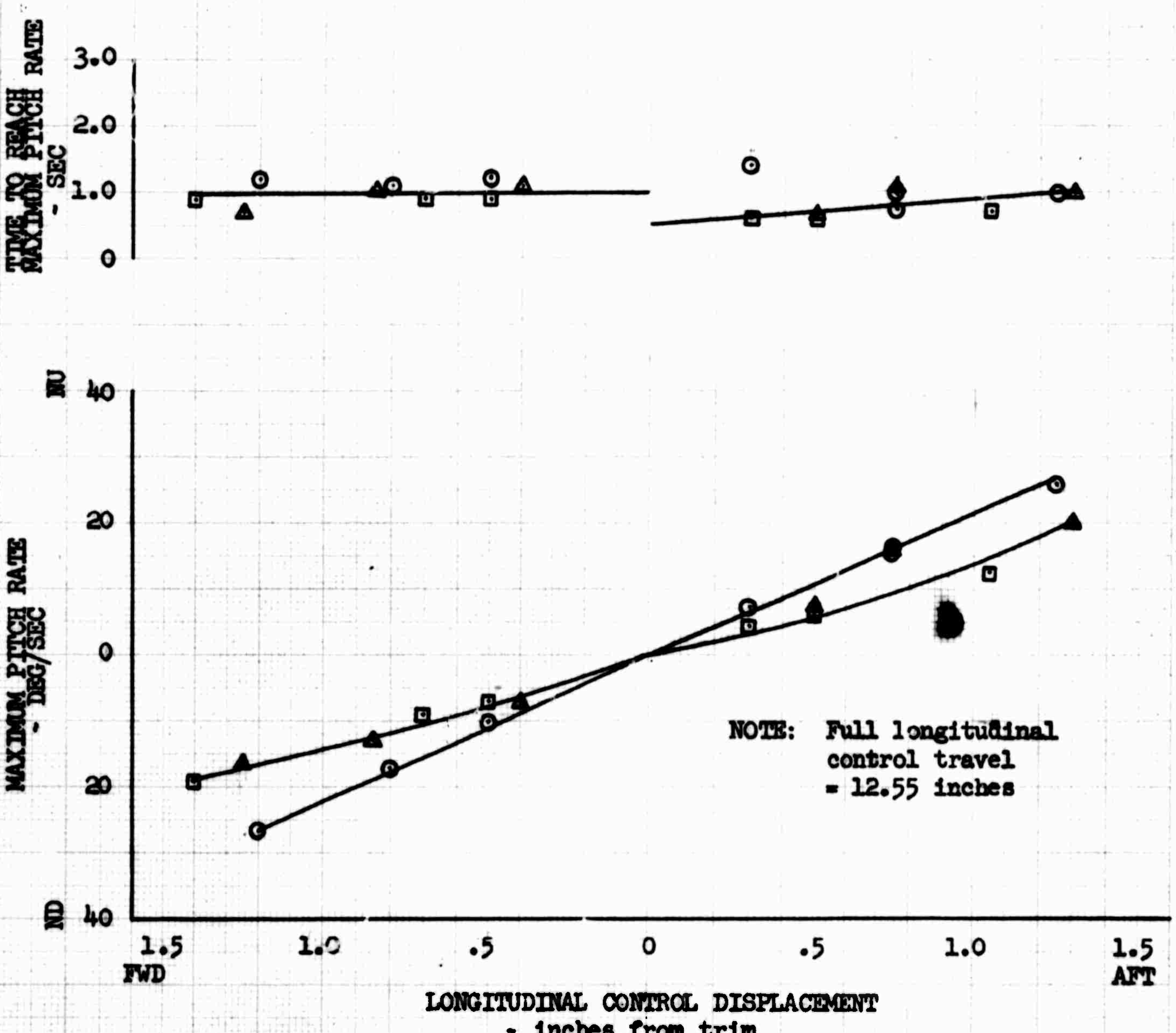


FIGURE NO. 118
LATERAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	6210	2410	483	97.0 (fwd)	Level Flight
□	94.5	6560	2320	483	97.0 (fwd)	Level Flight

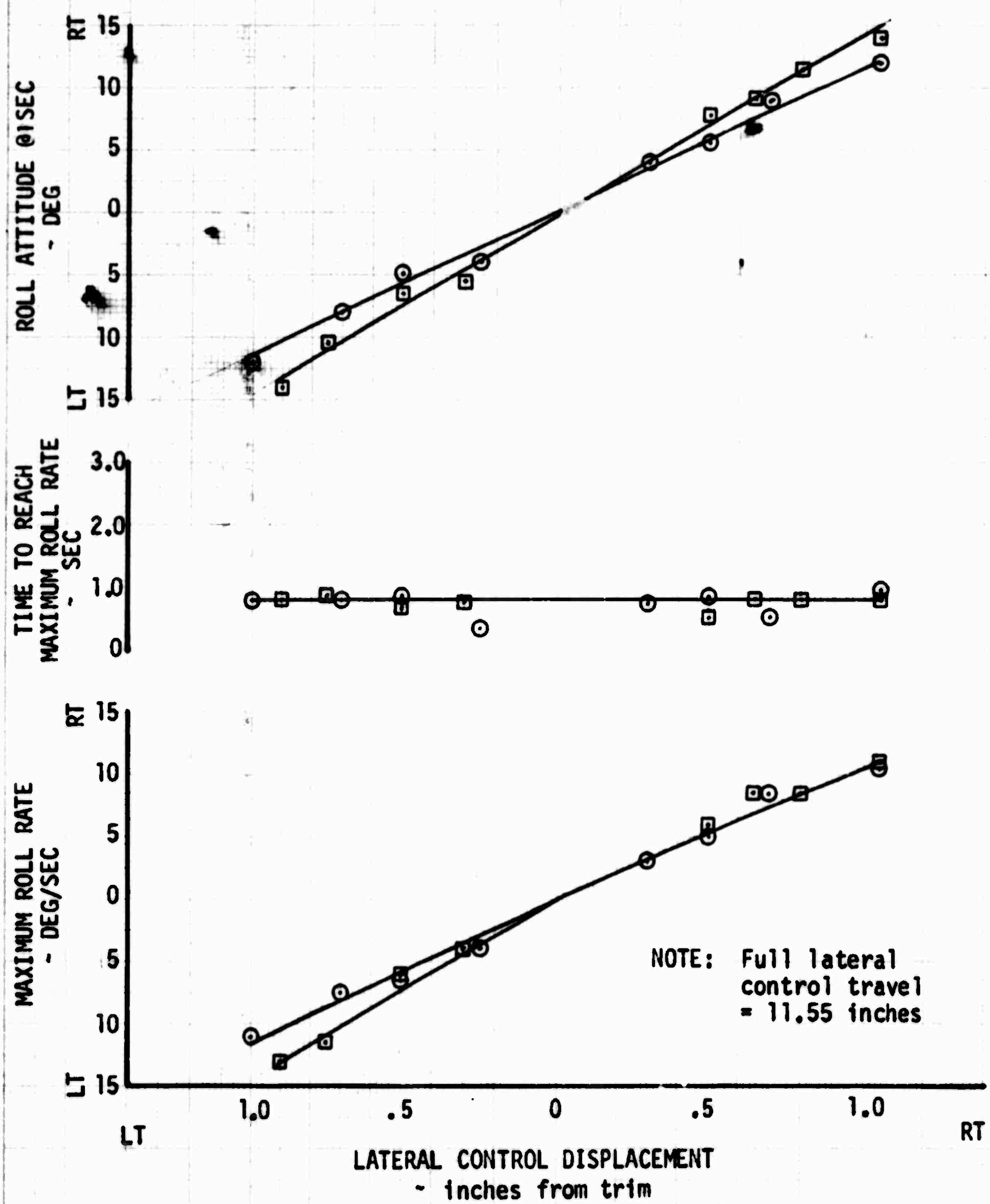


FIGURE NO. 119
LATERAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2000	2430	483	97.1 (fwd)	Level Flight
□	53.0	9700	2370	483	97.1 (fwd)	Level Flight
△	83.5	9930	2340	483	97.1 (fwd)	Level Flight

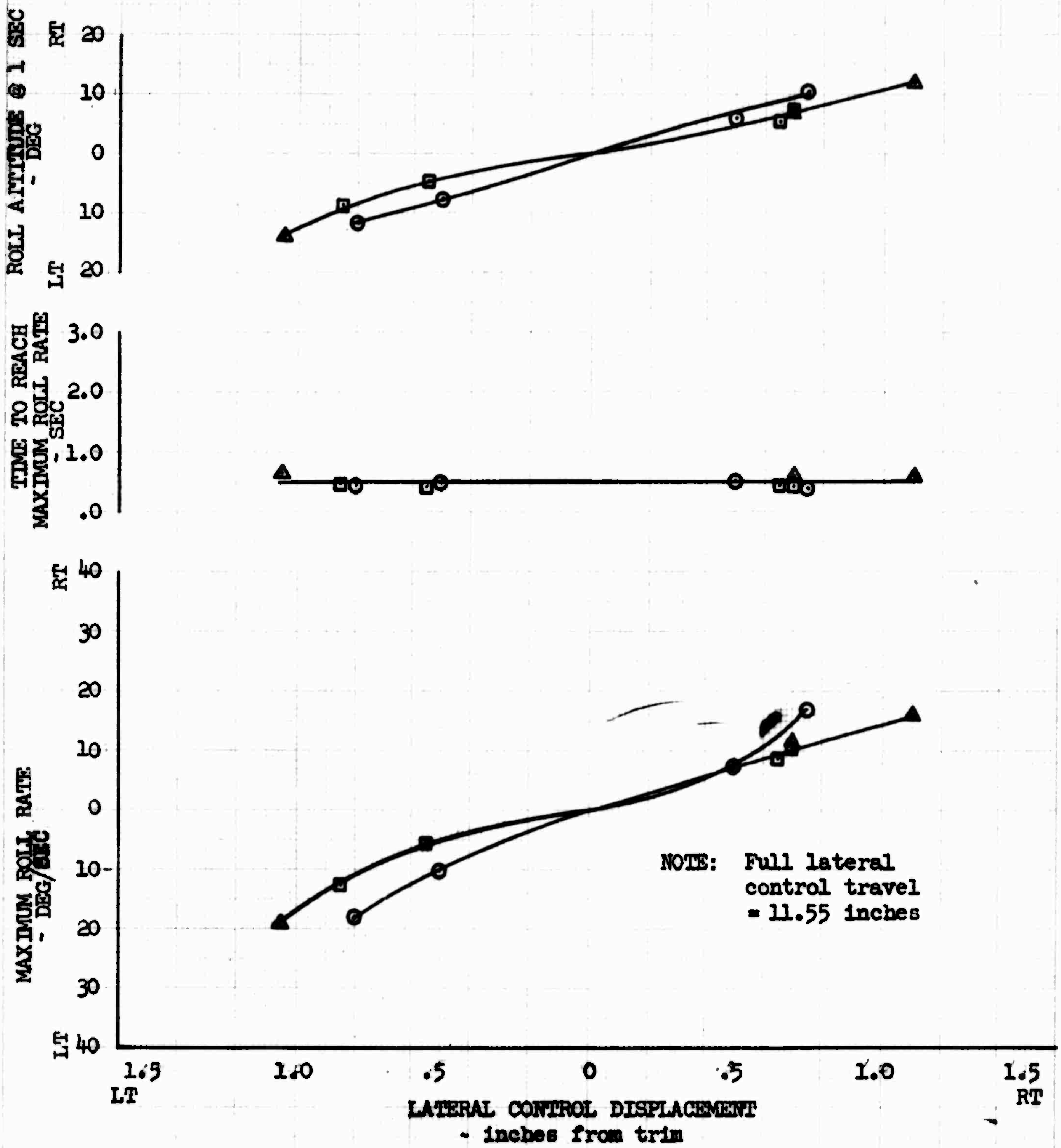


FIGURE NO. 120
LATERAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
□	53.0	5310	2410	469	97.3 (fwd)	Level Flight
△	105.0	5310	2340	469	97.3 (fwd)	Level Flight

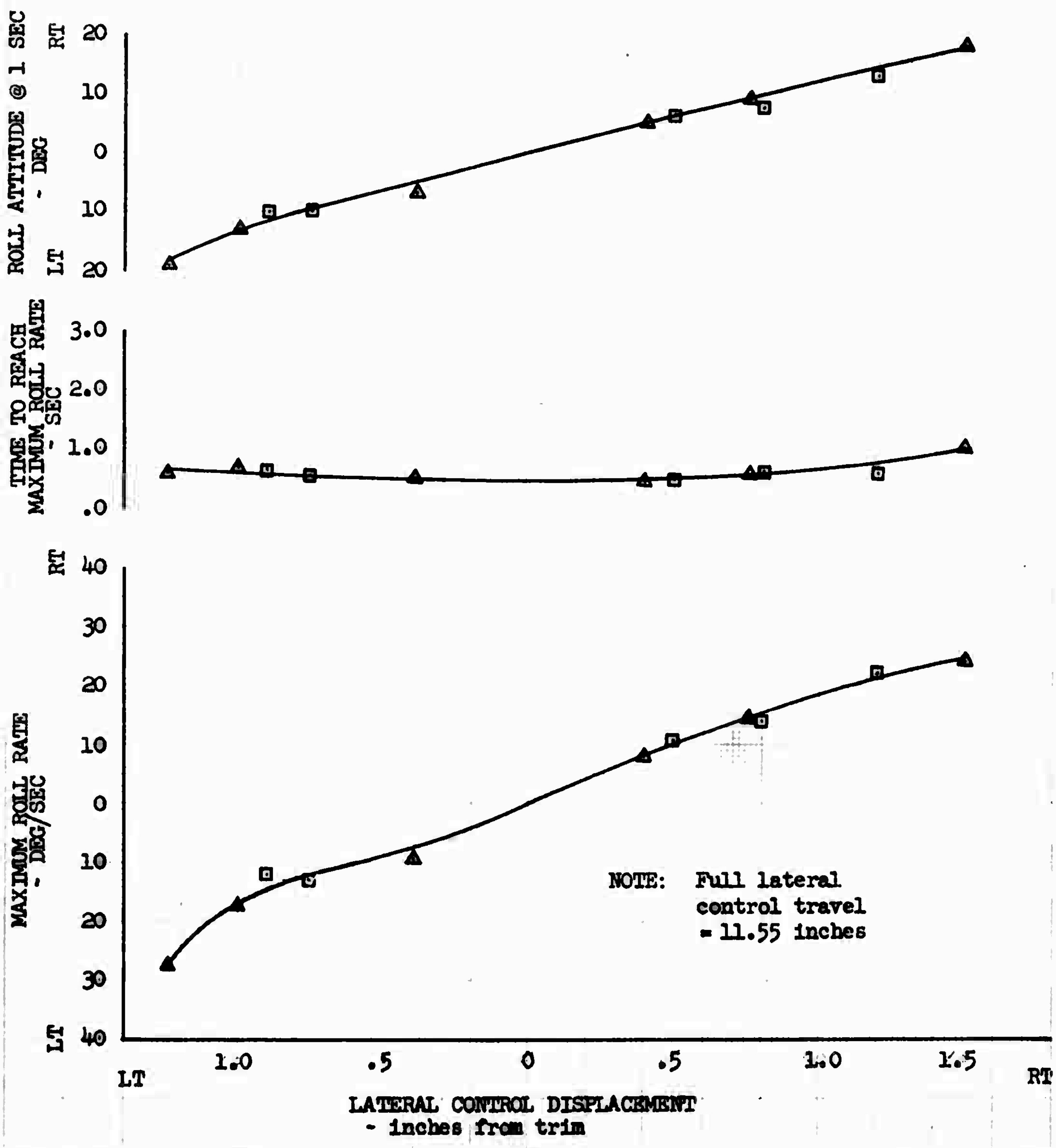


FIGURE NO. 121
LATERAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	1310	2180	483	100.1 (mid)	Hover
□	53.0	5130	2080	483	100.1 (mid)	Level Flight
△	104.0	6460	2010	483	100.1 (mid)	Level Flight

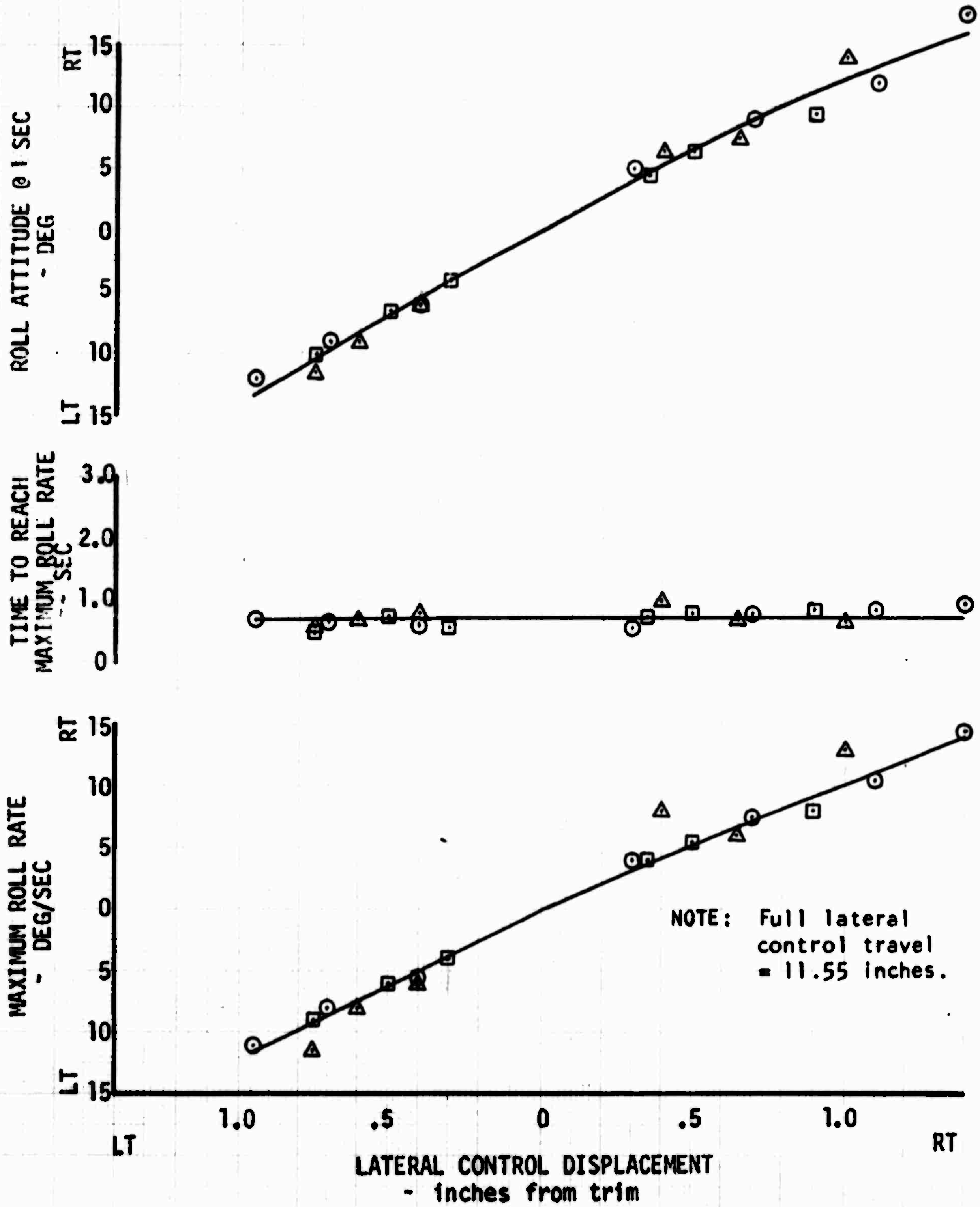


FIGURE NO. 122
LATERAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2400	2410	483	103.0 (aft)	Level Flight
□	53.0	5310	2370	483	103.0 (aft)	Level Flight
△	105.0	4980	2300	483	103.0 (aft)	Level Flight

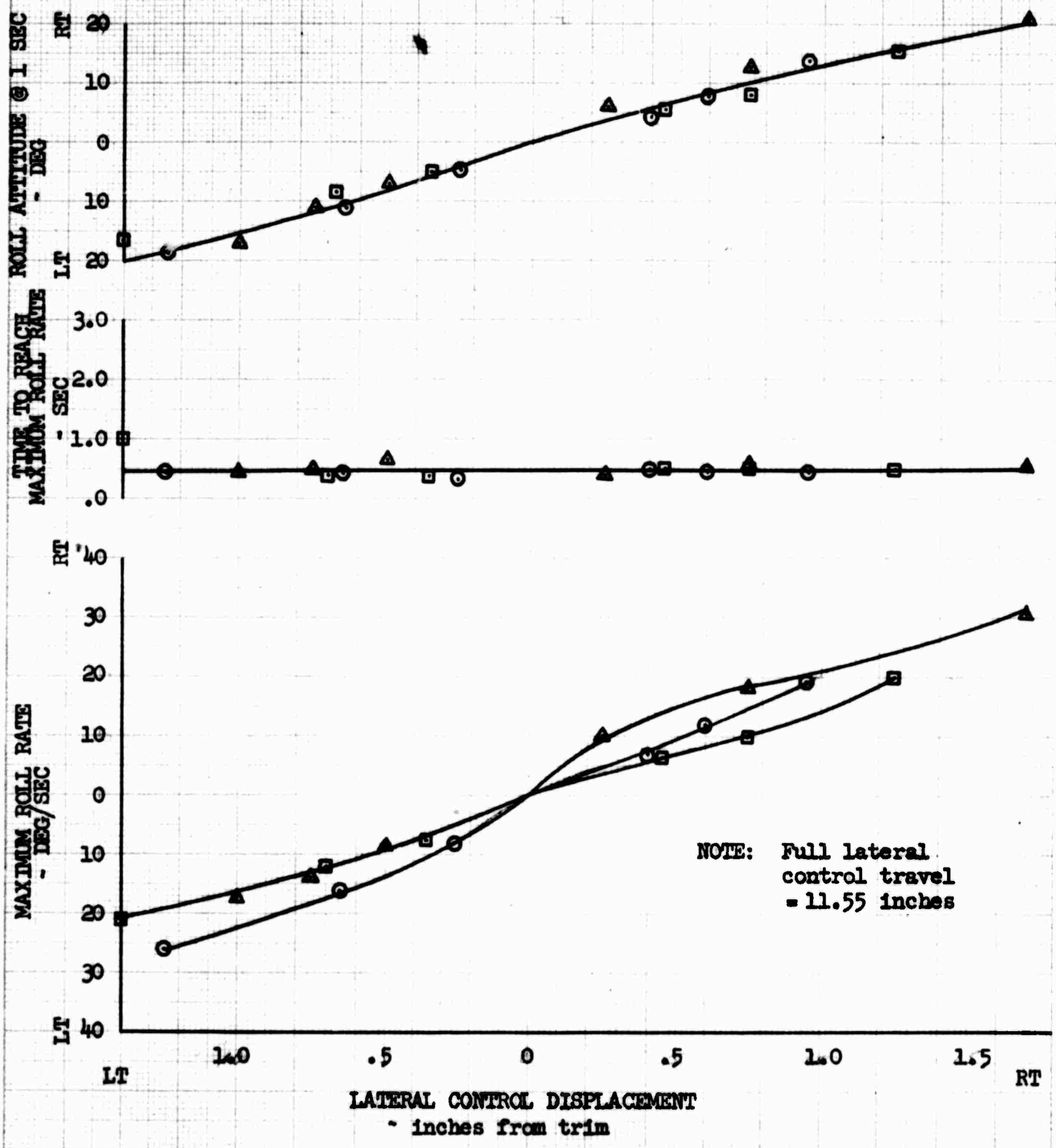


FIGURE NO. 123
DIRECTIONAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	6180	2390	483	97.1 (fwd)	Level Flight
□	94.5	6490	2300	483	97.2 (fwd)	Level Flight

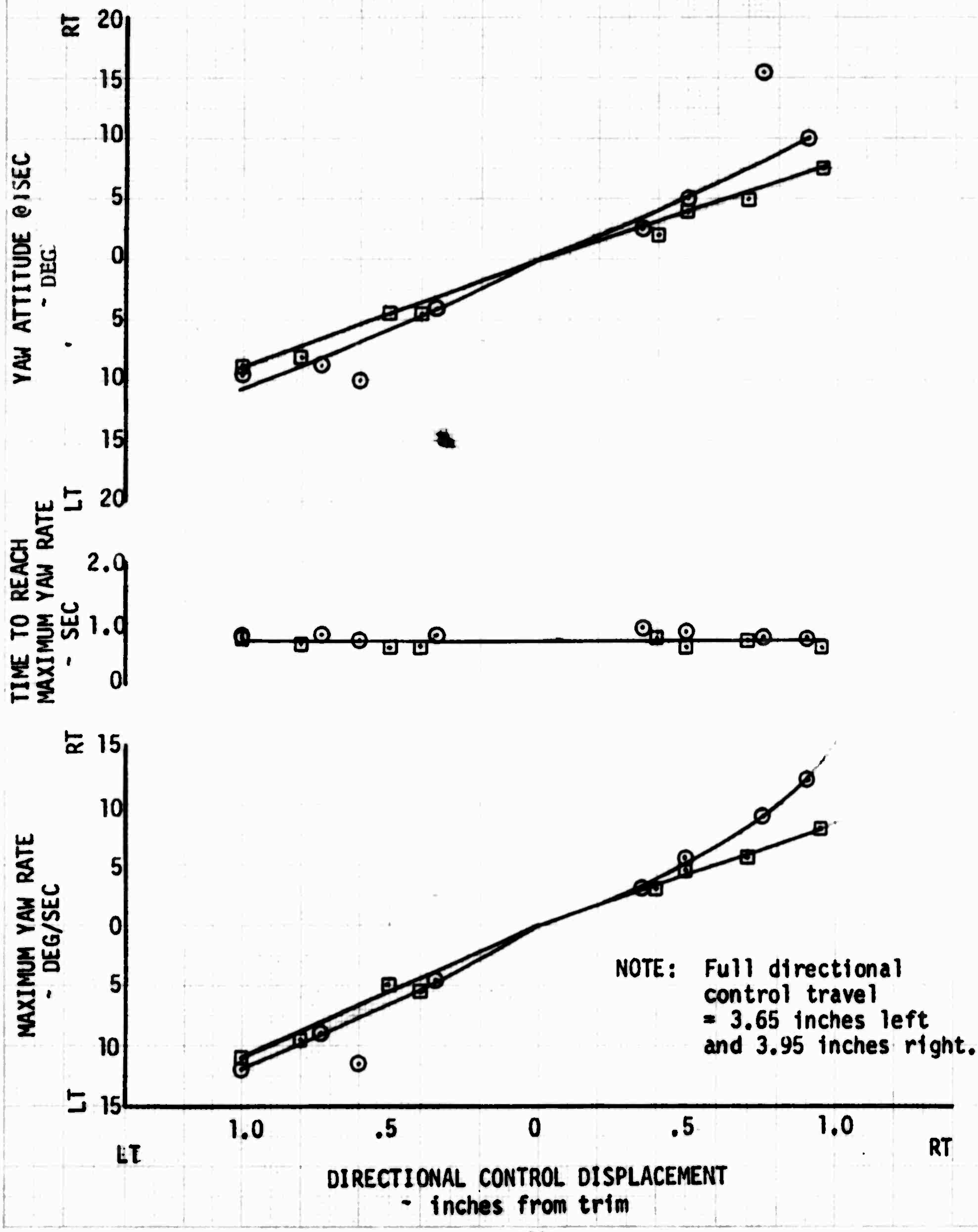


FIGURE NO. 124
DIRECTIONAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT.	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2000	2420	483	97.1 (fwd)	Level Flight
□	53.0	9700	2360	483	97.1 (fwd)	Level Flight
△	83.5	9930	2330	483	97.1 (fwd)	Level Flight

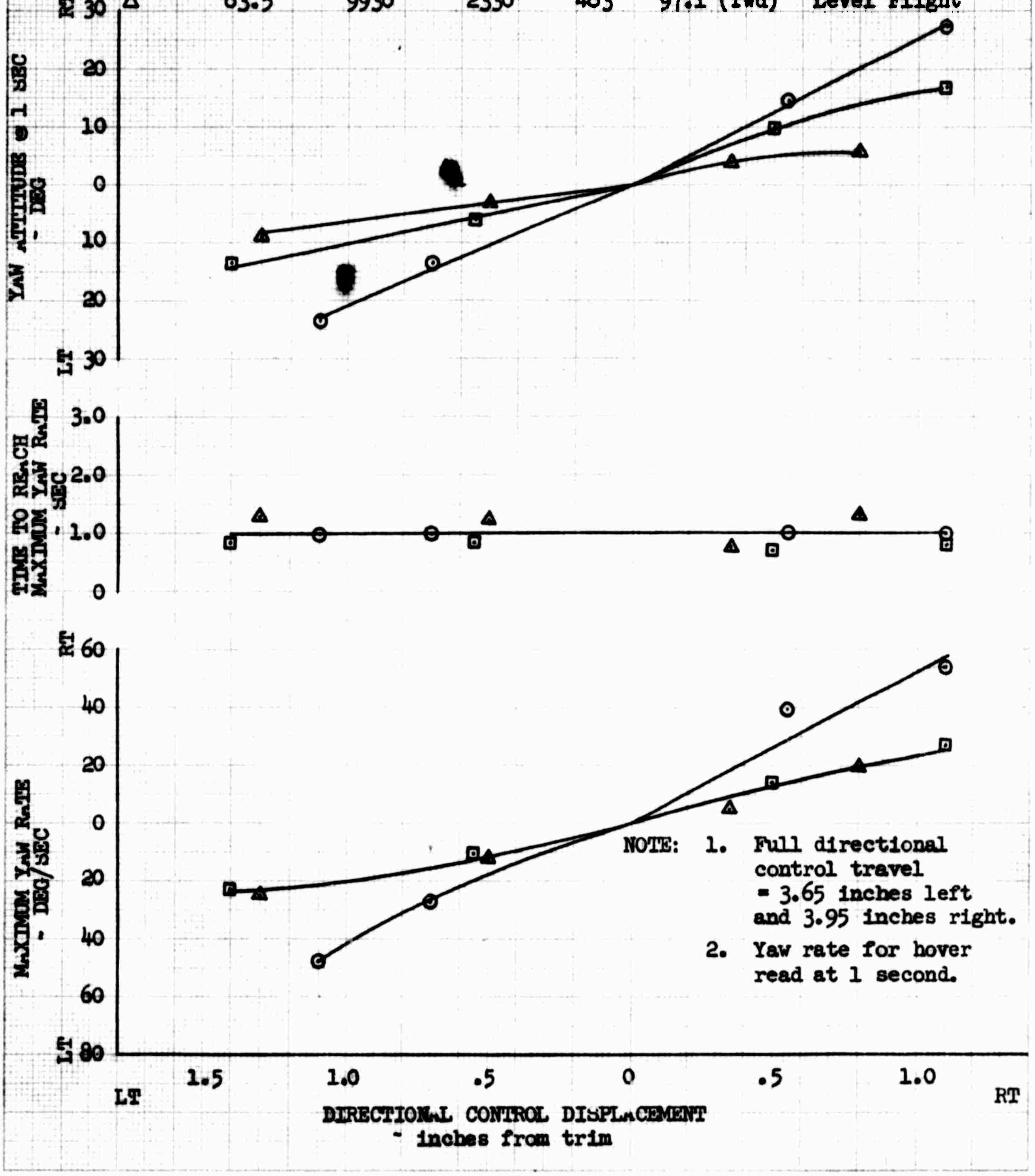


FIGURE NO. 125
DIRECTIONAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
□	53.0	5240	2410	469	97.3 (fwd)	Level Flight
△	105.0	5310	2330	469	97.3 (fwd)	Level Flight

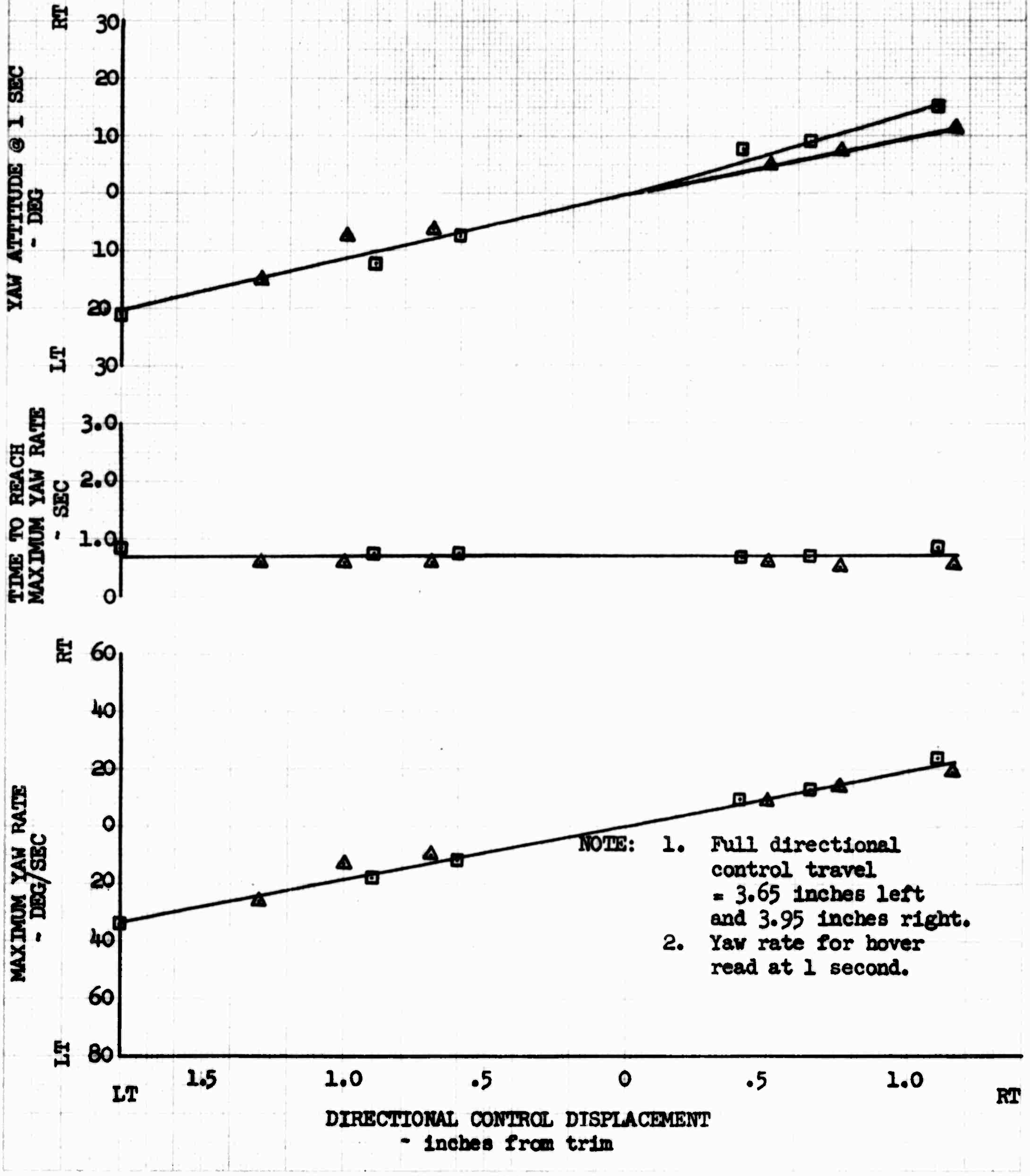


FIGURE NO. 126
DIRECTIONAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	1310	2130	483	100.1 (mid)	Hover
□	53.0	5100	2070	483	100.1 (mid)	Level Flight
△	104.0	6380	2000	483	100.1 (mid)	Level Flight

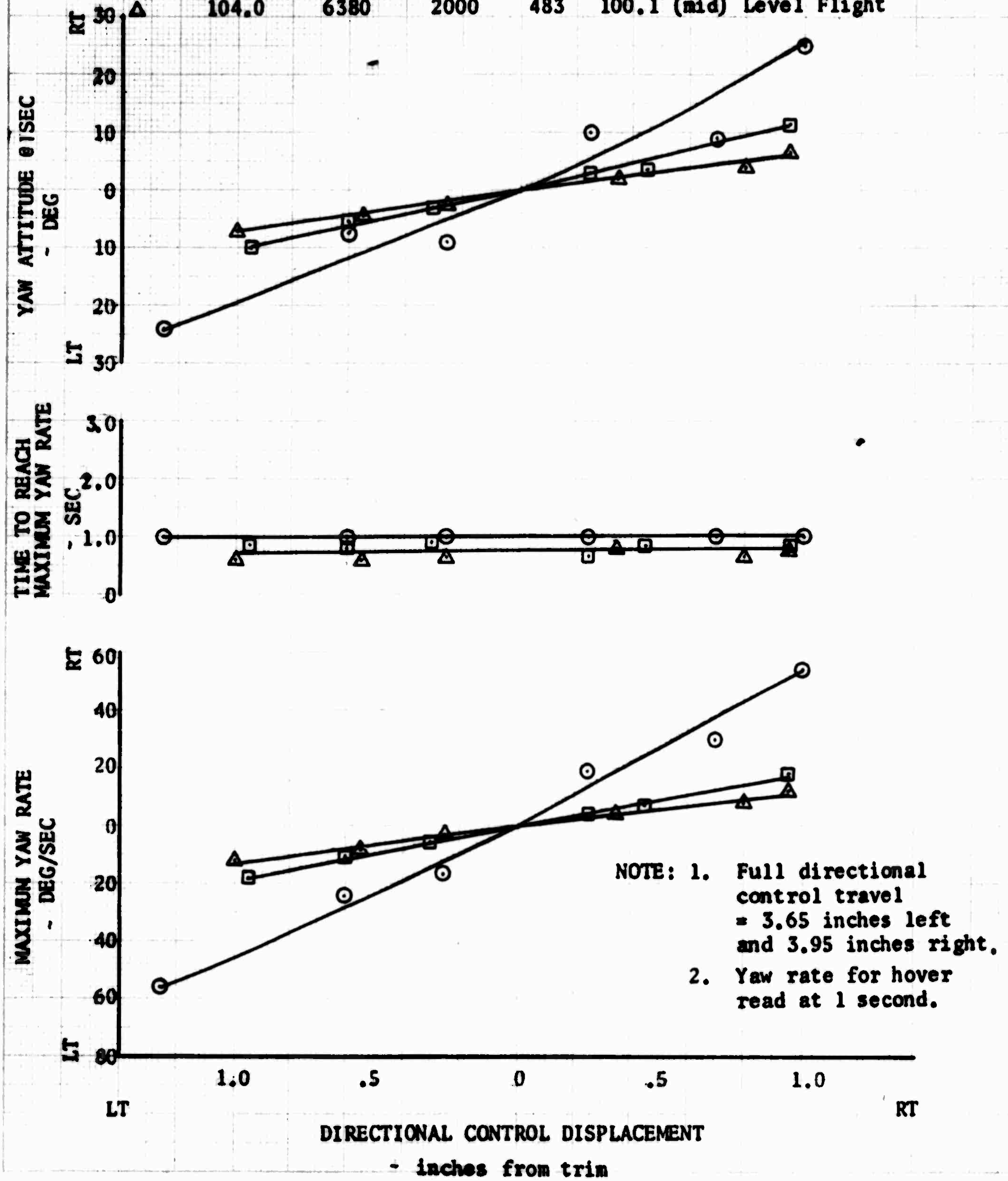


FIGURE NO. 127
DIRECTIONAL CONTROL RESPONSE
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2390	2410	483	103.0 (aft)	Level Flight
□	53.0	5310	2350	483	103.0 (aft)	Level Flight
△	105.0	4980	2280	483	103.0 (aft)	Level Flight

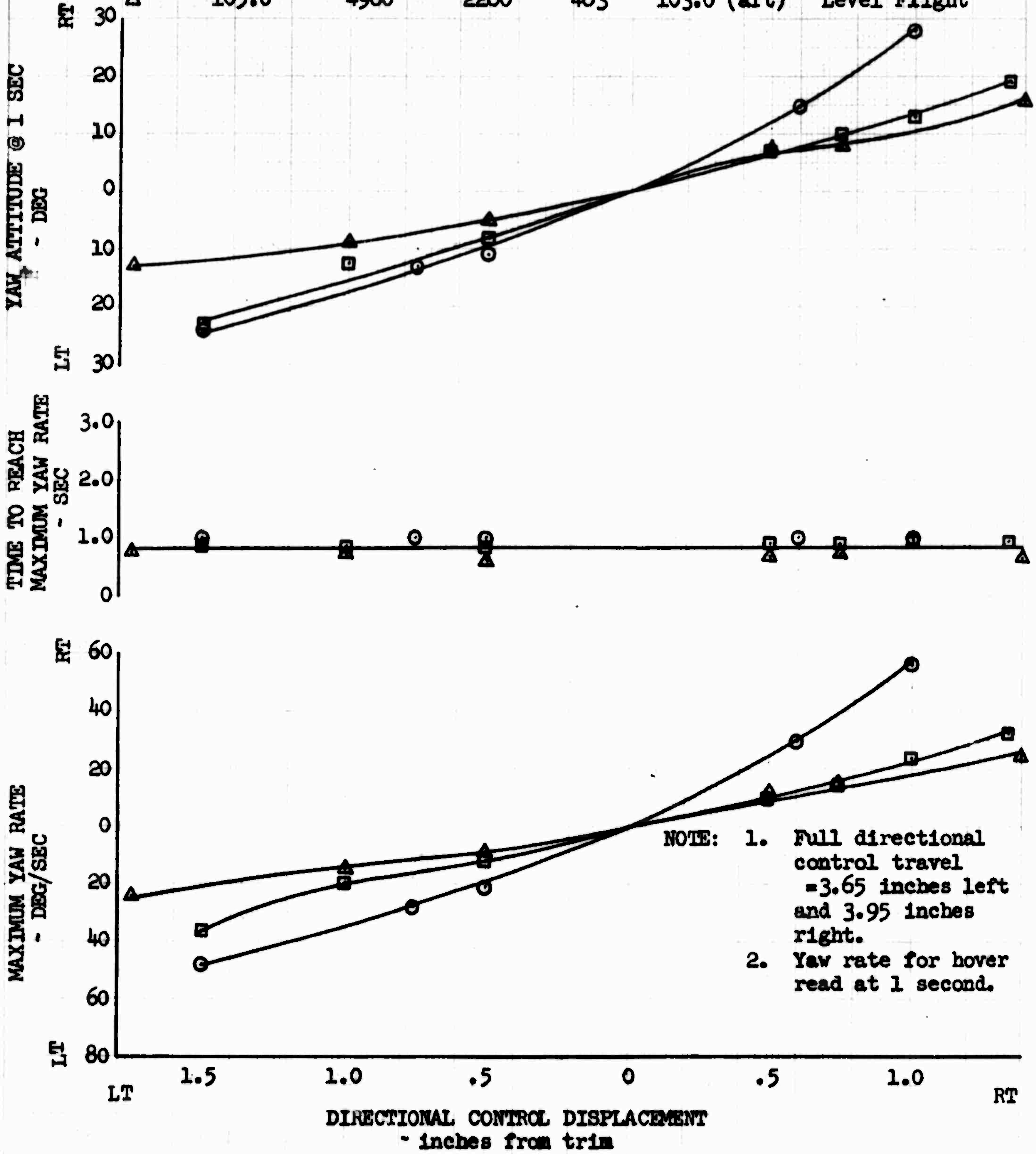


FIGURE NO. 128
LONGITUDINAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	6370	2430	483	97.0 (fwd)	Level Flight
⊡	94.5	6700	2340	483	97.0 (fwd)	Level Flight

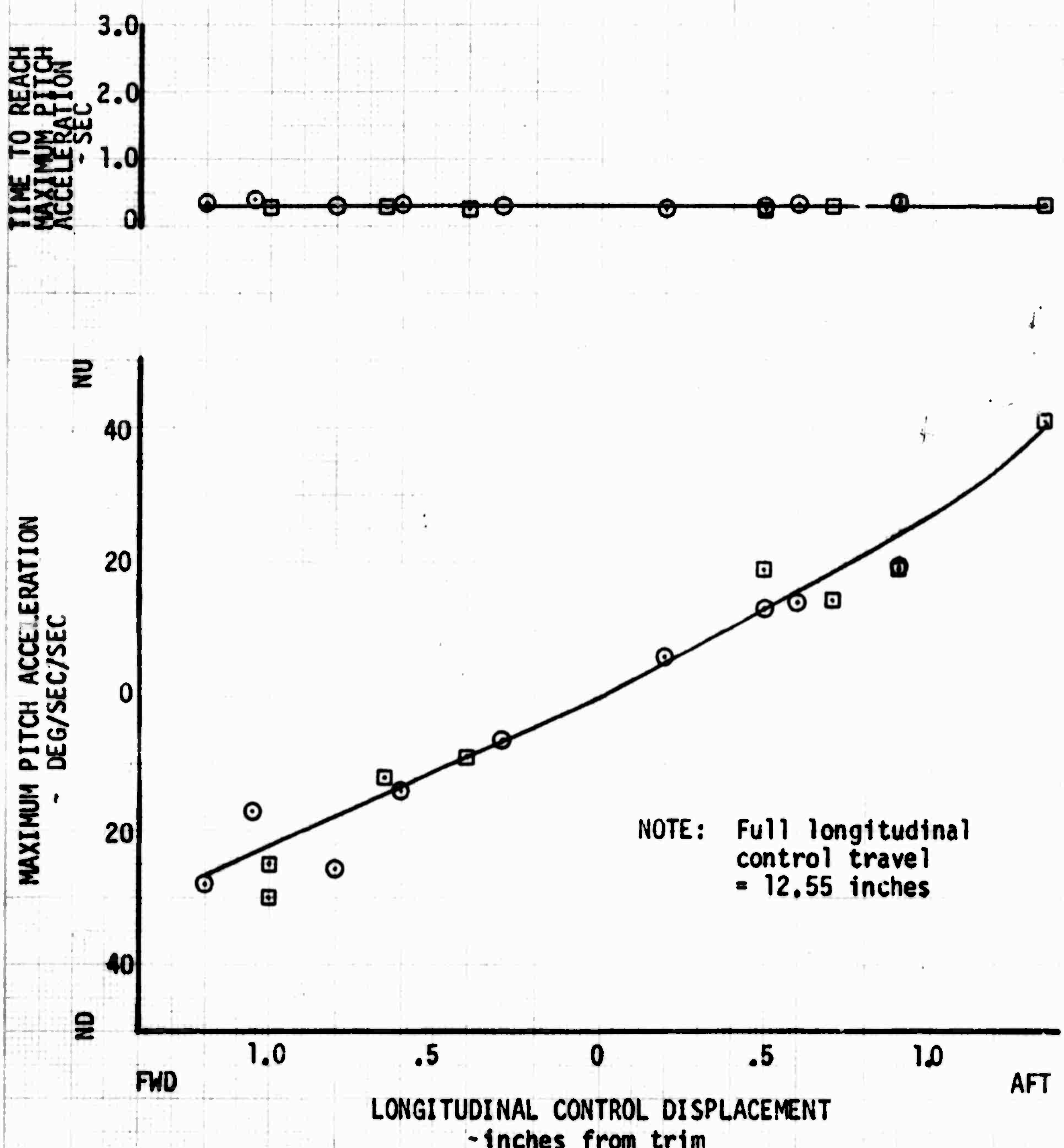


FIGURE NO. 129
LONGITUDINAL CONTROL SENSIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2000	2430	483	97.1 (fwd)	Level Flight
□	53.0	9700	2380	483	97.1 (fwd)	Level Flight
△	83.5	9930	2340	483	97.1 (fwd)	Level Flight

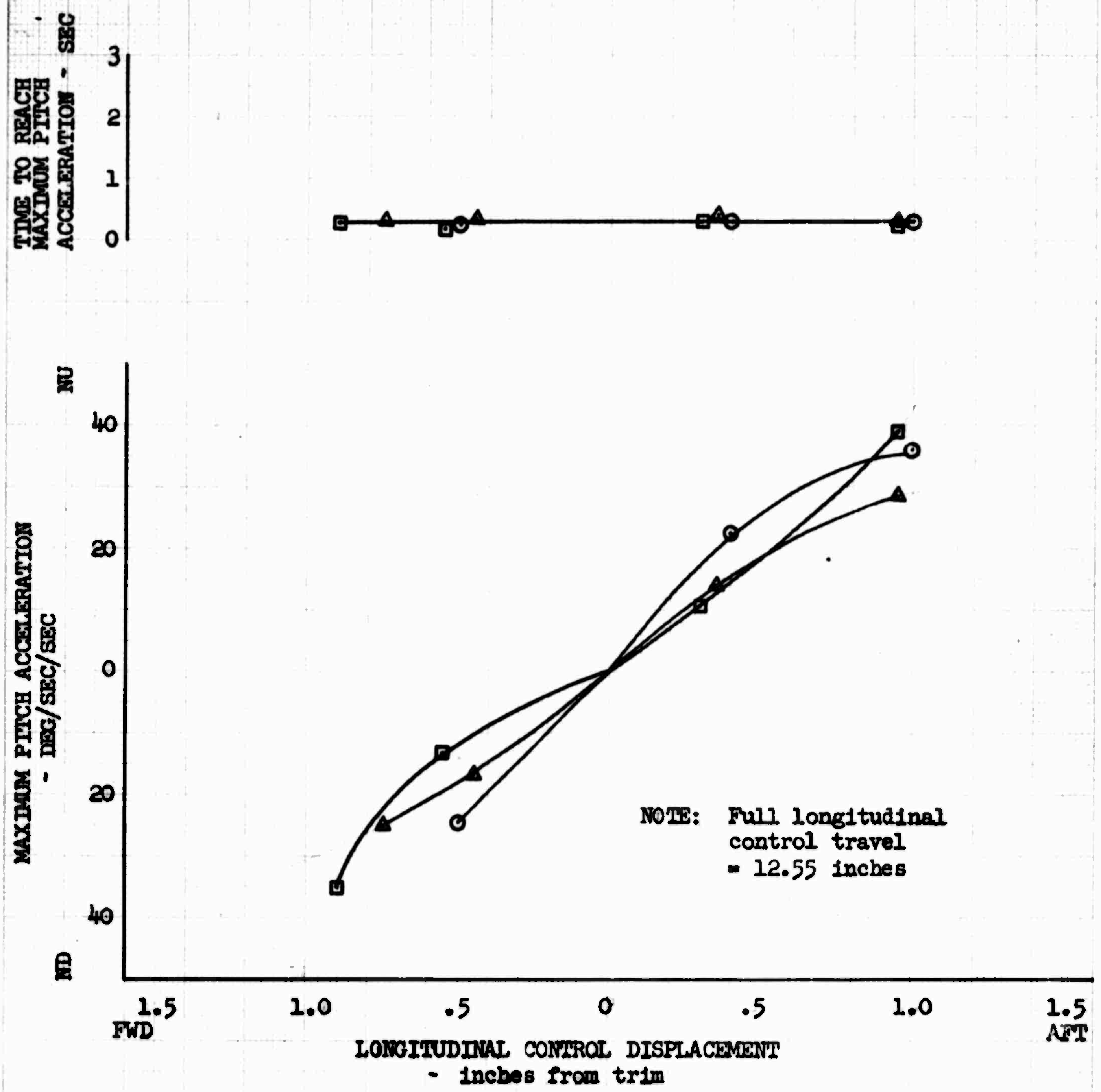


FIGURE NO. 130
LONGITUDINAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
□	53.0	5310	2420	469	97.3 (fwd)	Level Flight
△	105.0	5160	2360	469	97.3 (fwd)	Level Flight

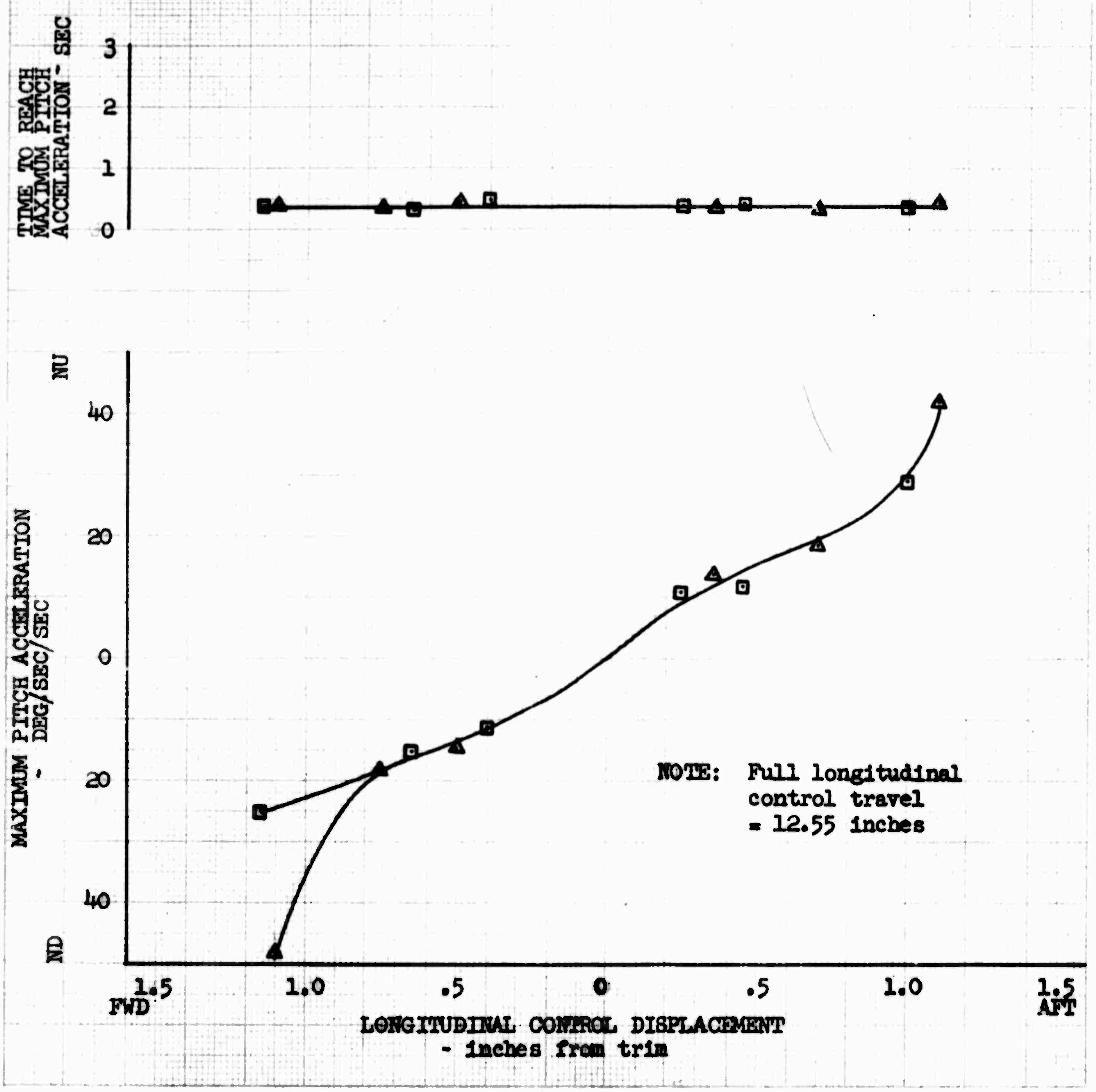


FIGURE NO. 131
LONGITUDINAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	1310	2150	483	100.0 (mid)	Hover
□	53.0	4720	2090	483	100.0 (mid)	Level Flight
△	104.0	6380	2020	483	100.0 (mid)	Level Flight

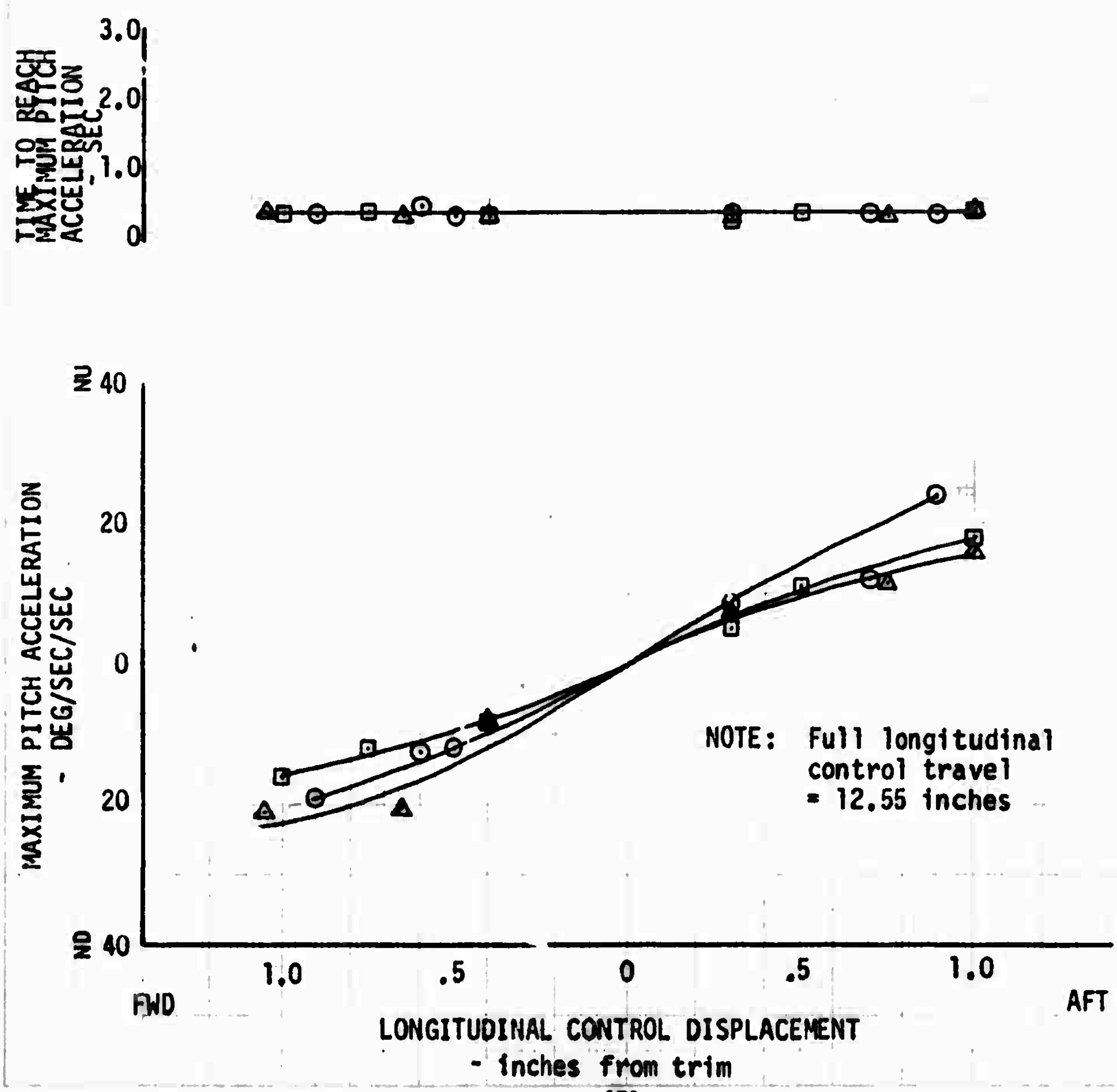


FIGURE NO. 132
LONGITUDINAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2400	2430	483	103.0 (aft)	Level Flight
□	53.0	5310	2370	483	103.0 (aft)	Level Flight
△	105.0	4980	2310	483	103.0 (aft)	Level Flight

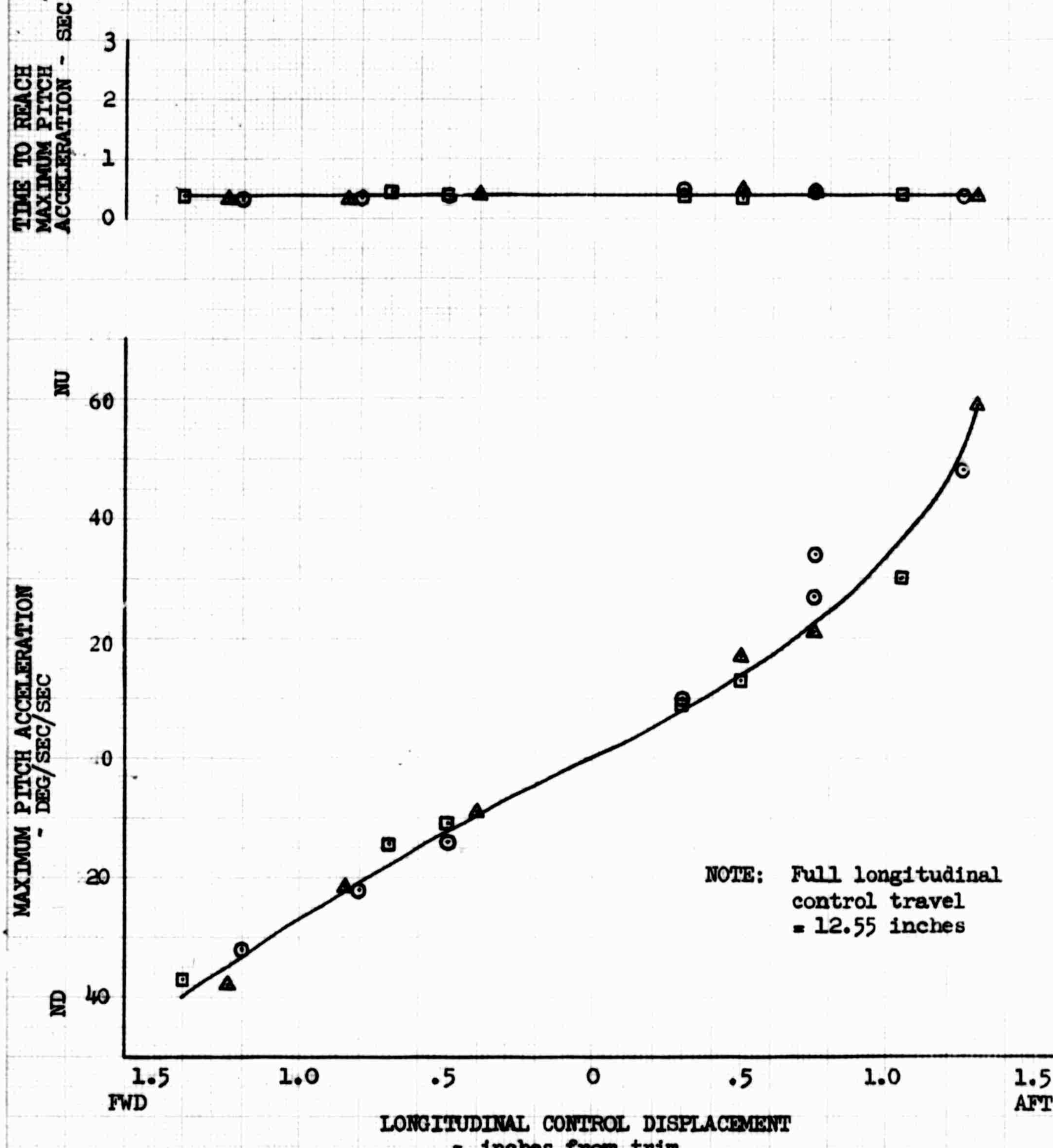


FIGURE NO. 133
LATERAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	53.0	6210	2410	483	97.0 (fwd)	Level Flight
□	94.5	6560	2320	483	97.0 (fwd)	Level Flight

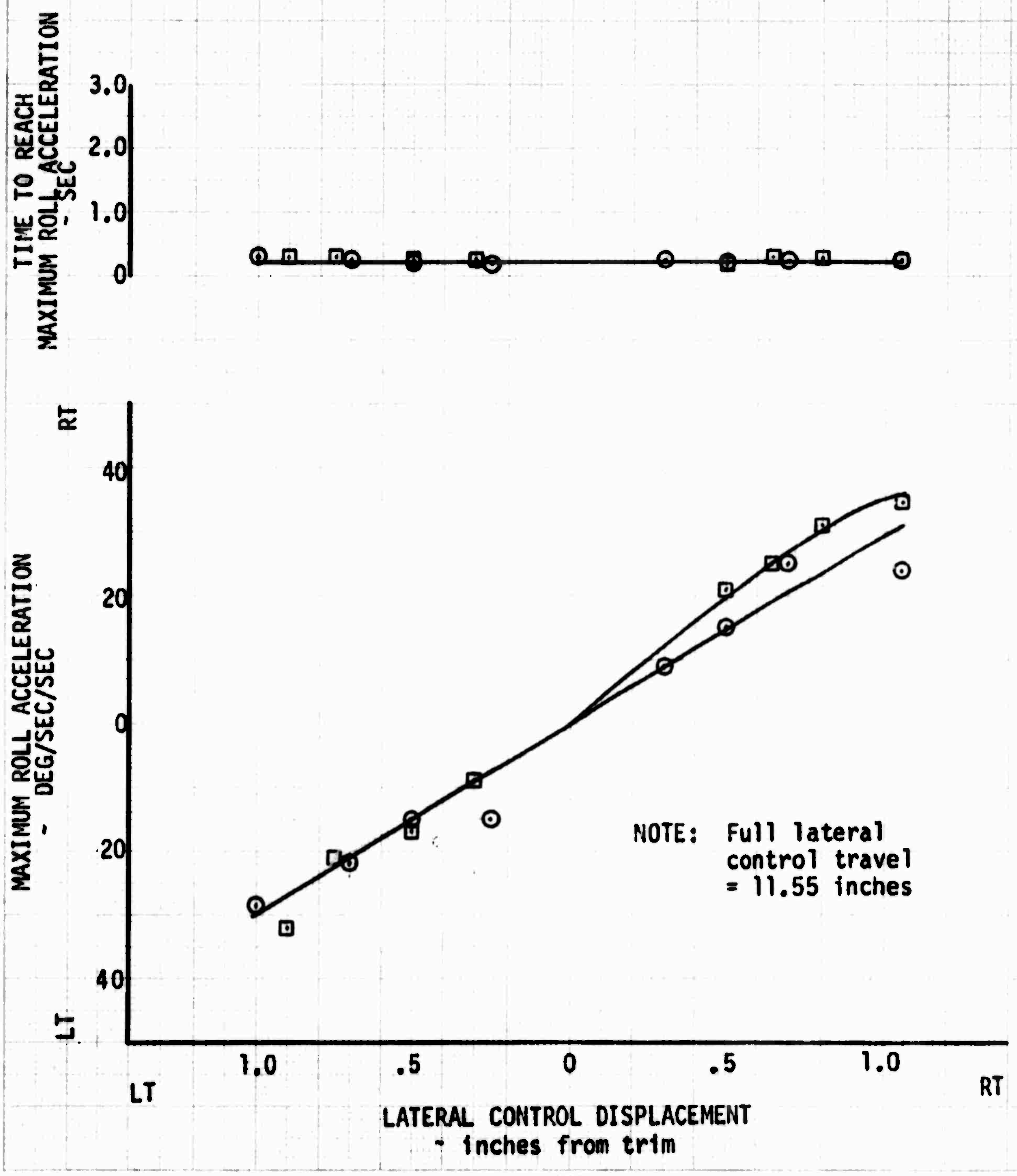


FIGURE NO. 134
LATERAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2000	2430	483	97.1 (fwd)	Level Flight
□	53.0	9700	2370	483	97.1 (fwd)	Level Flight
△	83.5	9930	2340	483	97.1 (fwd)	Level Flight

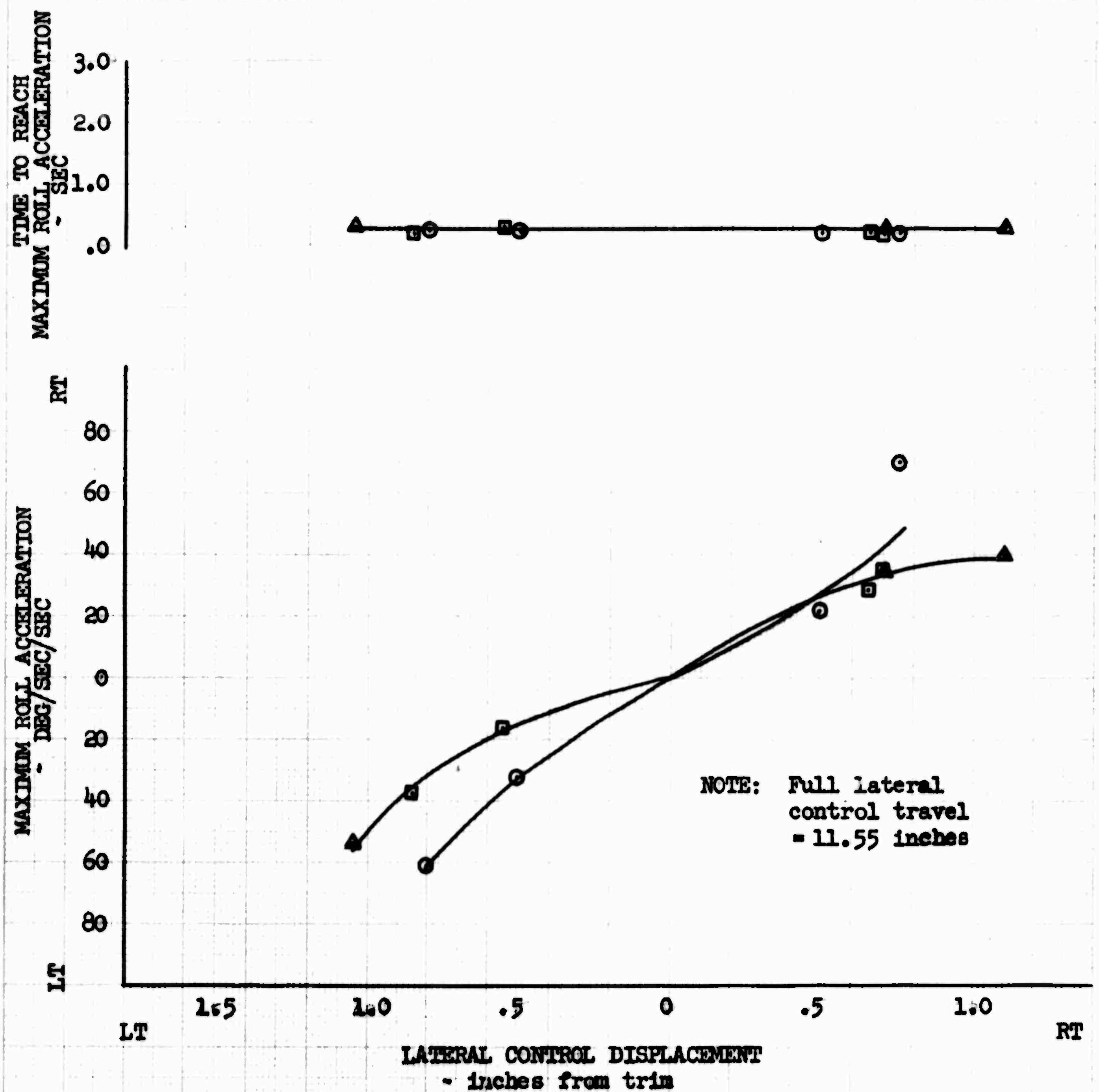


FIGURE NO. 135
LATERAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
□	53.0	5310	2410	469	97.3 (fwd)	Level Flight
△	105.0	5310	2340	469	97.3 (fwd)	Level Flight

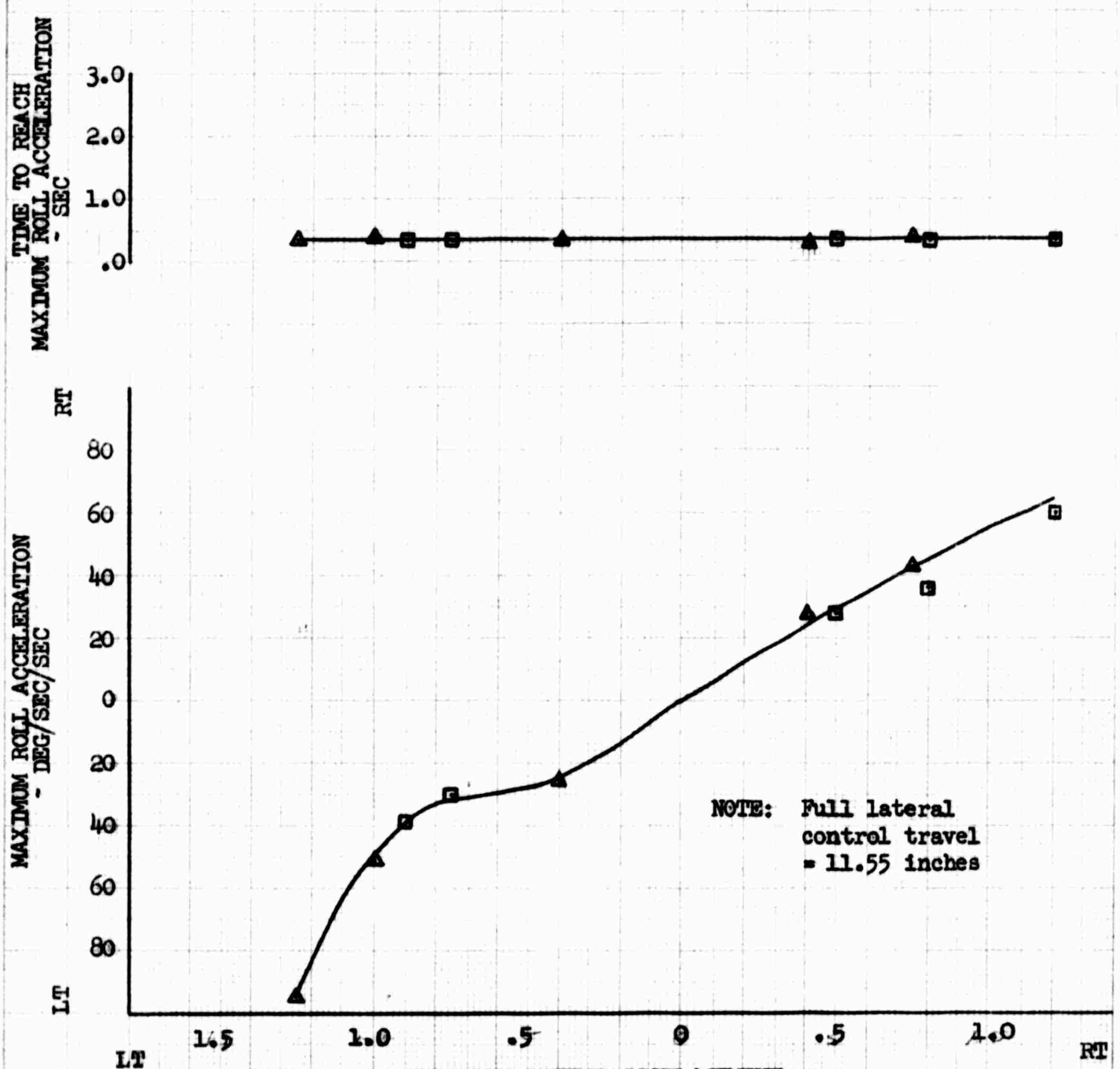


FIGURE NO. 136
LATERAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	1310	2140	483	100.1 (mid)	Hover
□	53.0	5130	2080	483	100.1 (mid)	Level Flight
△	104.0	6460	2010	483	100.1 (mid)	Level Flight

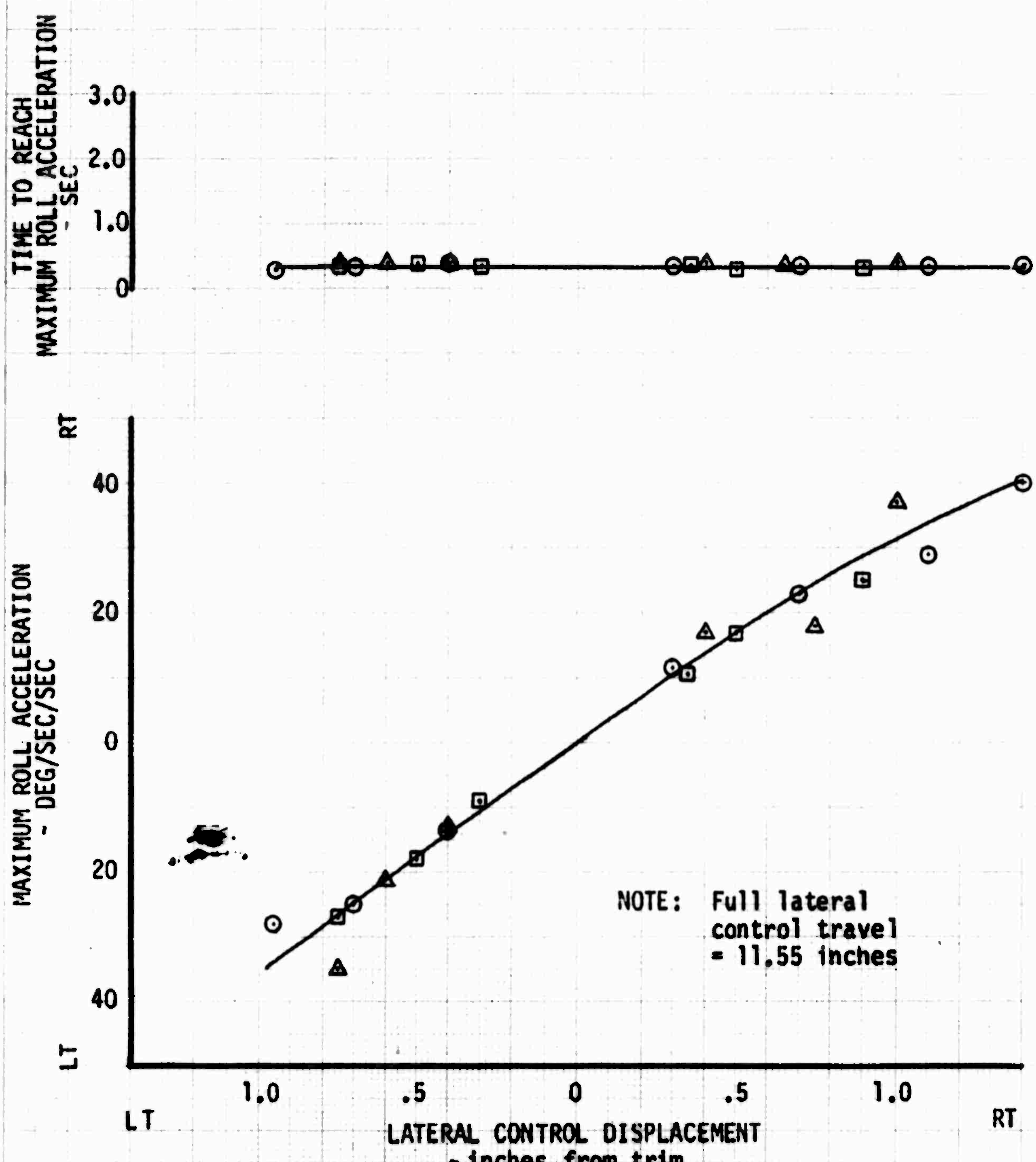


FIGURE NO. 137
LATERAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2400	2410	483	103.0 (aft)	Level Flight
□	53.0	5310	2370	483	103.0 (aft)	Level Flight
△	105.0	4980	2300	483	103.0 (aft)	Level Flight

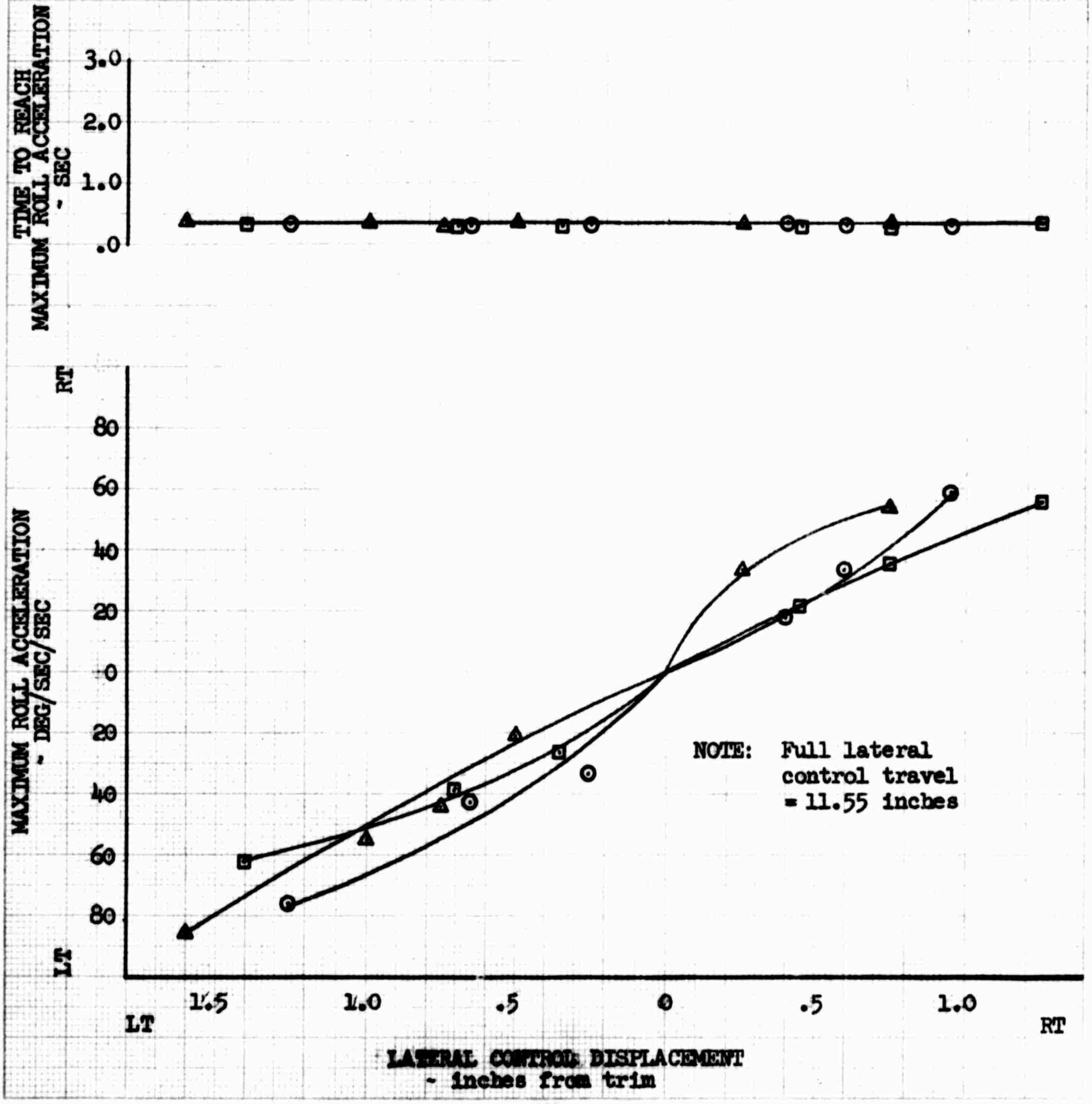


FIGURE NO. 138
DIRECTIONAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2000	2420	483	97.1 (fwd)	Level Flight
□	53.0	9700	2360	483	97.1 (fwd)	Level Flight
△	83.5	9930	2330	483	97.1 (fwd)	Level Flight

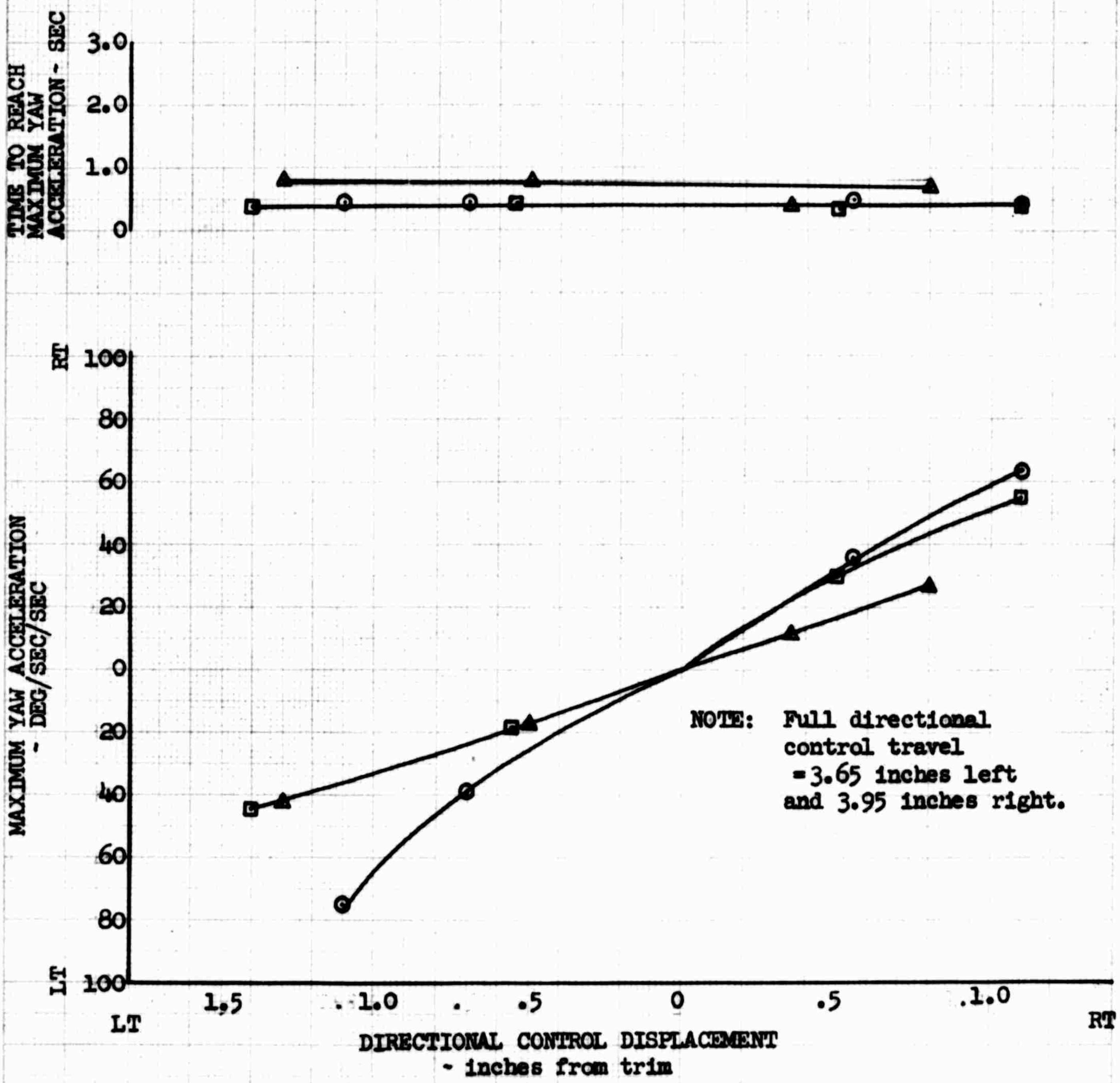


FIGURE NO. 139
DIRECTIONAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
□	53.0	5240	2410	469	97.3 (fwd)	Level Flight
△	105.0	5310	2330	469	97.3 (fwd)	Level Flight

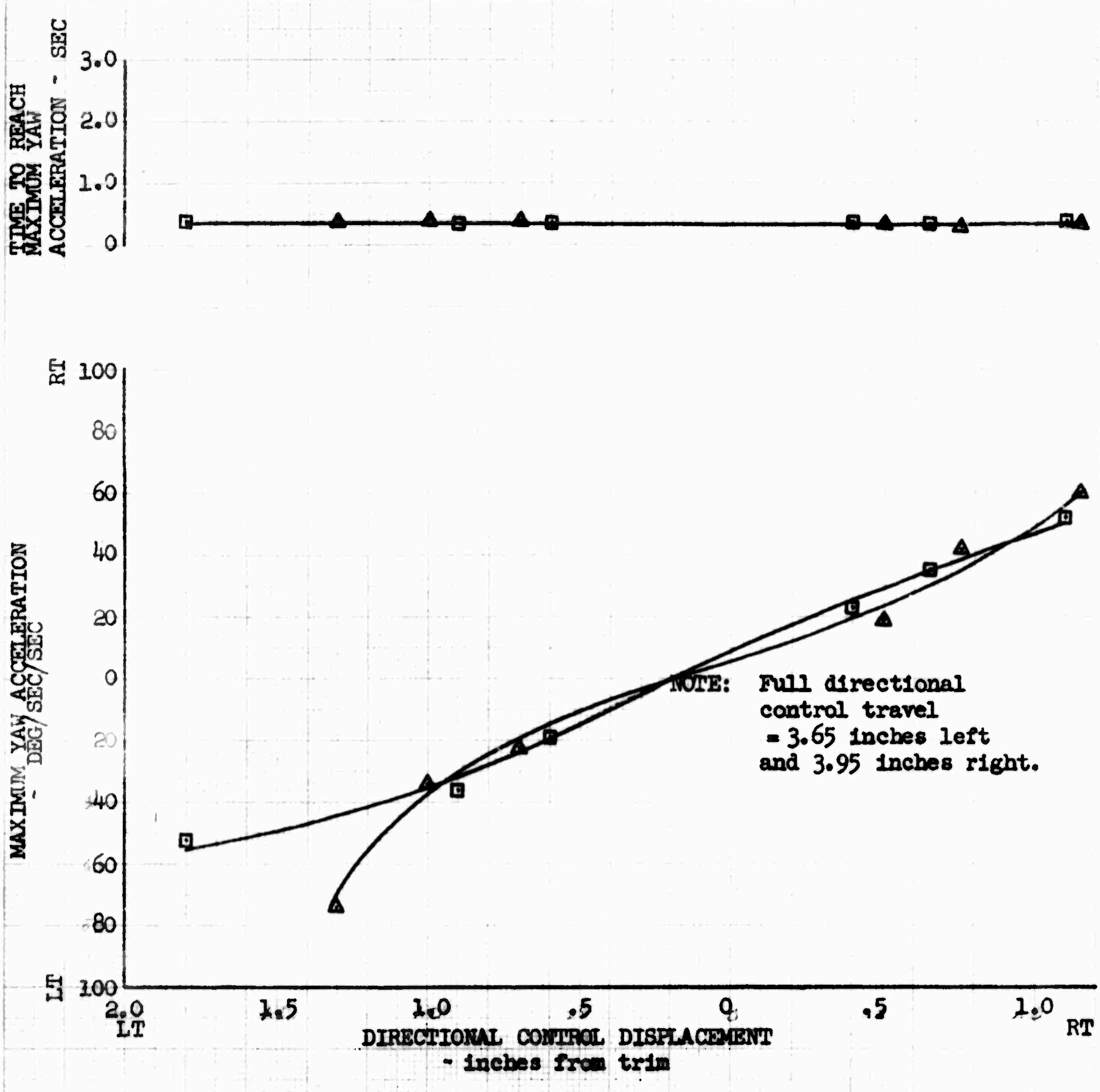


FIGURE NO. 140
DIRECTIONAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	1310	2130	483	100.1 (mid)	Hover
□	53.0	5100	2070	483	100.1 (mid)	Level Flight
△	104.0	6380	2000	483	100.1 (mid)	Level Flight

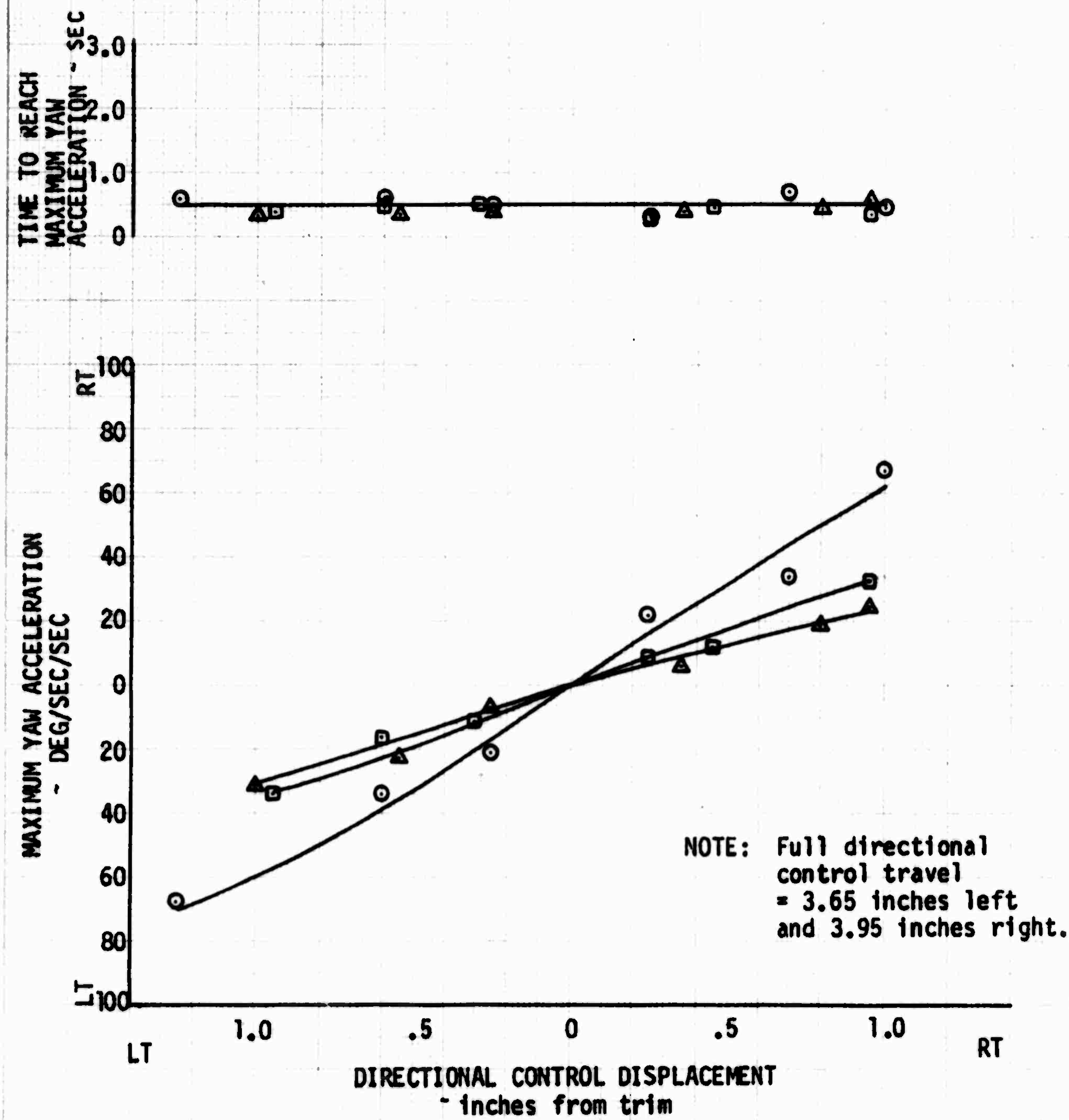


FIGURE NO. 141
DIRECTIONAL CONTROL SENSITIVITY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	CALIB. AIRSPEED KNOTS	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN	FLIGHT CONDITION
○	0	2390	2410	483	103.0 (aft)	Level Flight
□	53.0	5310	2350	483	103.0 (aft)	Level Flight
△	105.0	4980	2280	483	103.0 (aft)	Level Flight

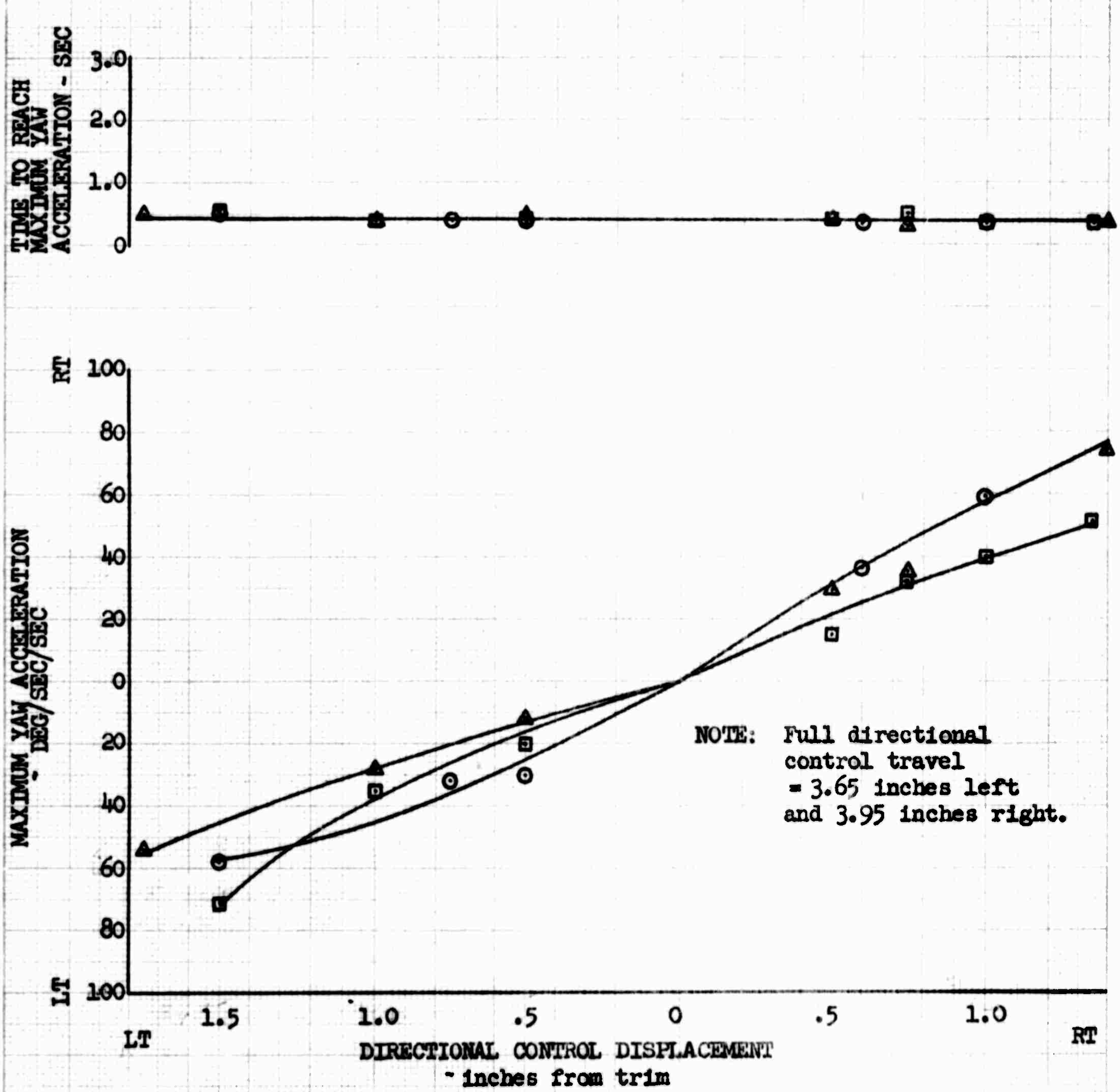


FIGURE NO. 142
FORWARD LONGITUDINAL STEP
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT	GROSS WEIGHT = 2030 LB
TRIM AIRSPEED = 104 KCAS	ROTOR SPEED = 483 RPM
DENSITY ALTITUDE = 6210 FT	C.G. LOCATION = 100.1 IN (MID)

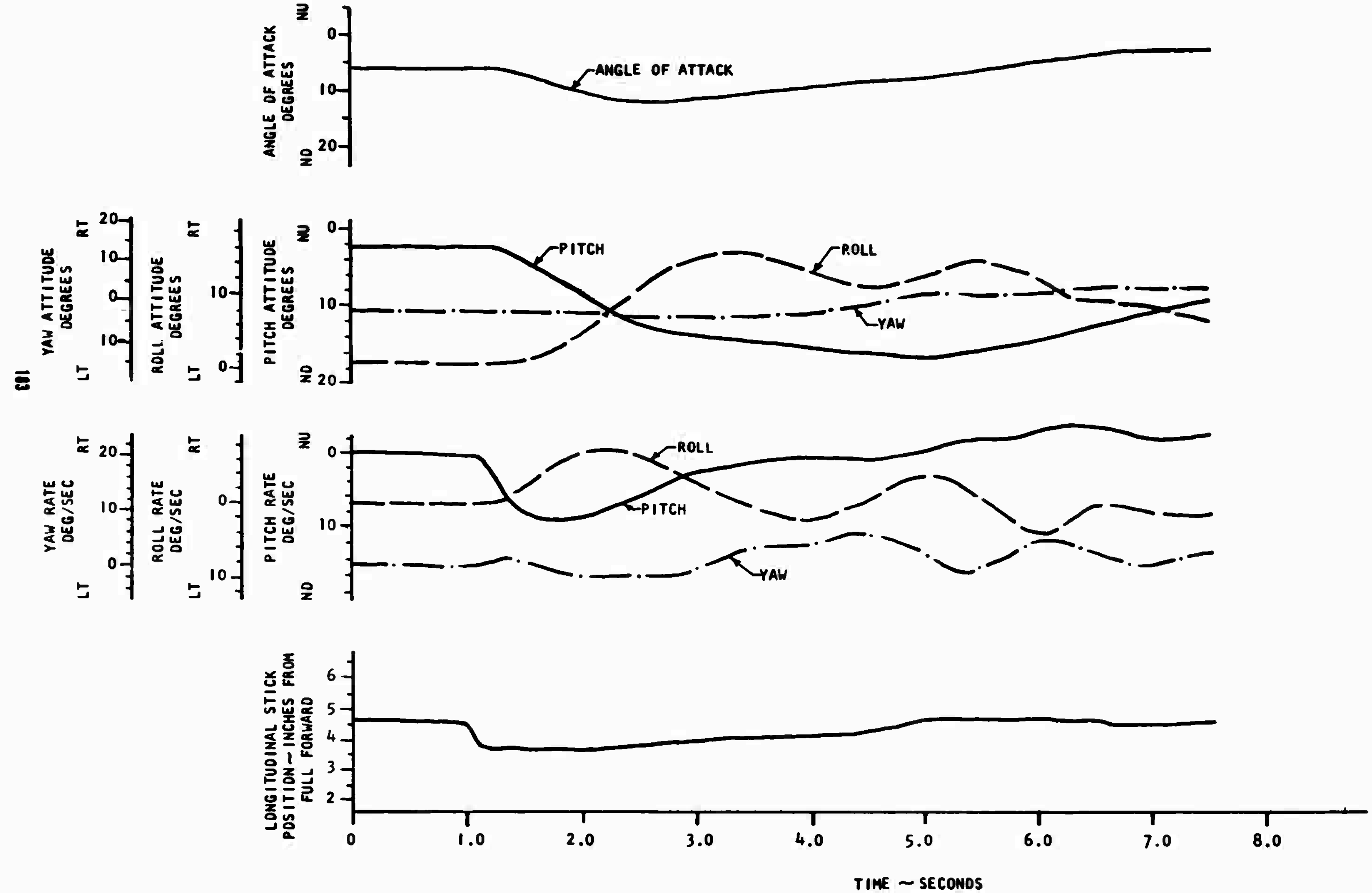


FIGURE NO. 143
FORWARD LONGITUDINAL STEP
OH-6A S/N 65-12919
CLEAN CONFIGURATION

LEVEL FLIGHT
TRIM AIRSPEED = 53 KCAS
DENSITY ALTITUDE = 4870 FT

GROSS WEIGHT = 2090 LB
ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.1 IN (MID)

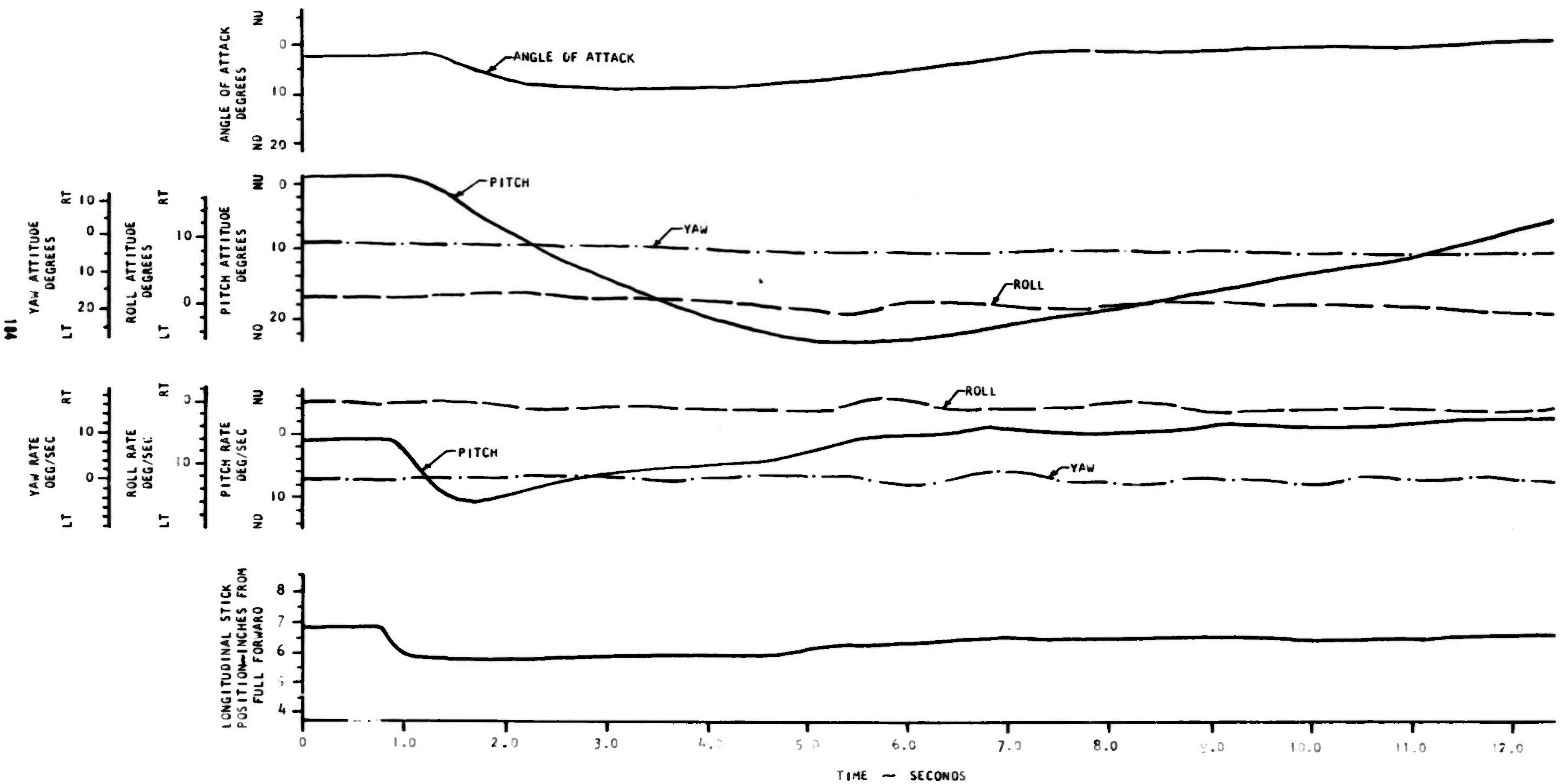


FIGURE NO. 144
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION | IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	-200	2170	483	100.2(MID)	0(MID)
□	-150	2400	483	100.0(MID)	0(MID)

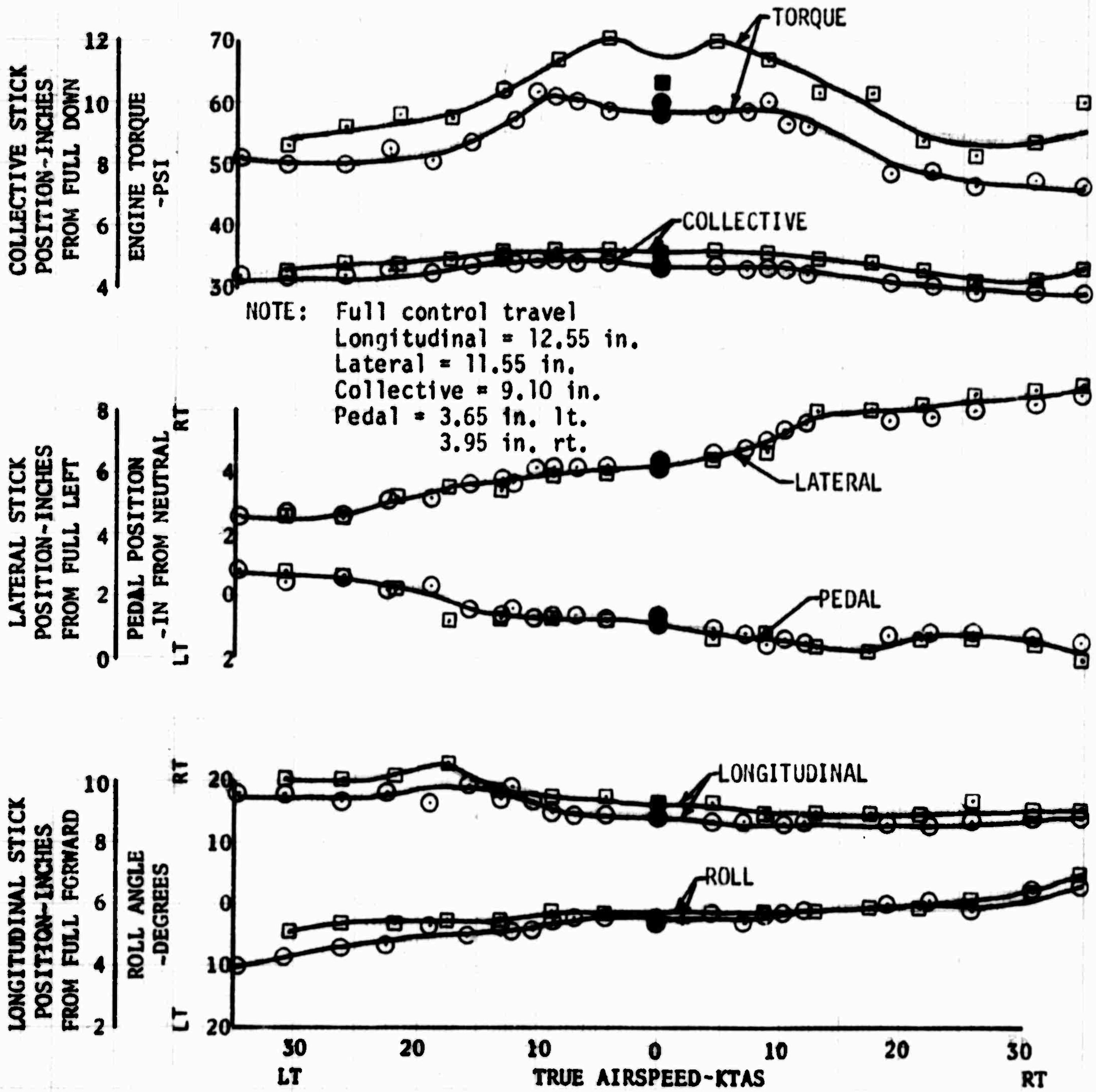


FIGURE NO. 145
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
O	-400	2700	483	97.1(FWD)	4.2(LT)
□	-100	2710	483	97.1(FWD)	4.2(LT)

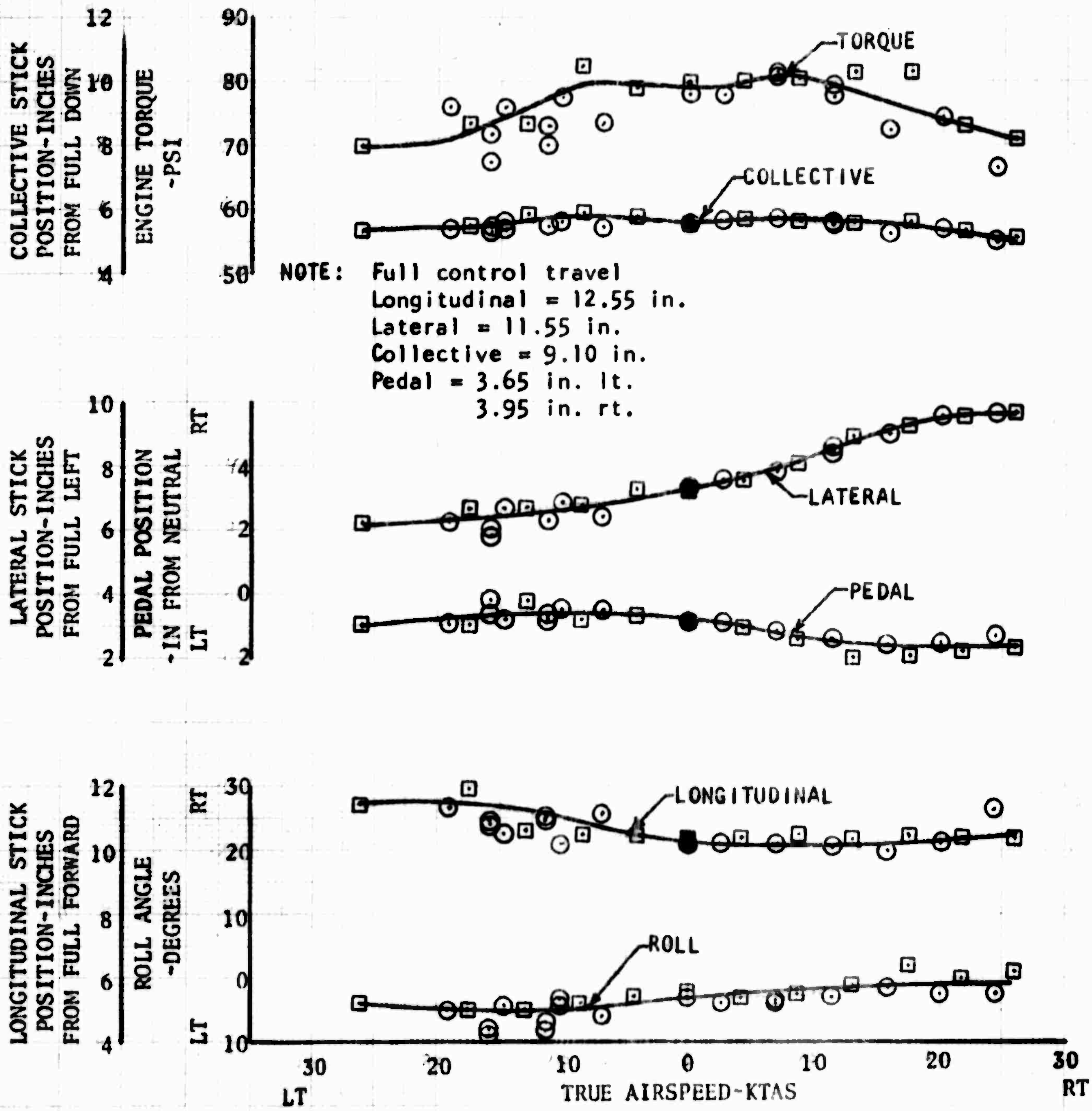


FIGURE NO. 146
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	700	2590	483	103.0(AFT)	4.8(LT)
□	60	2670	483	103.1(AFT)	4.8(RT)

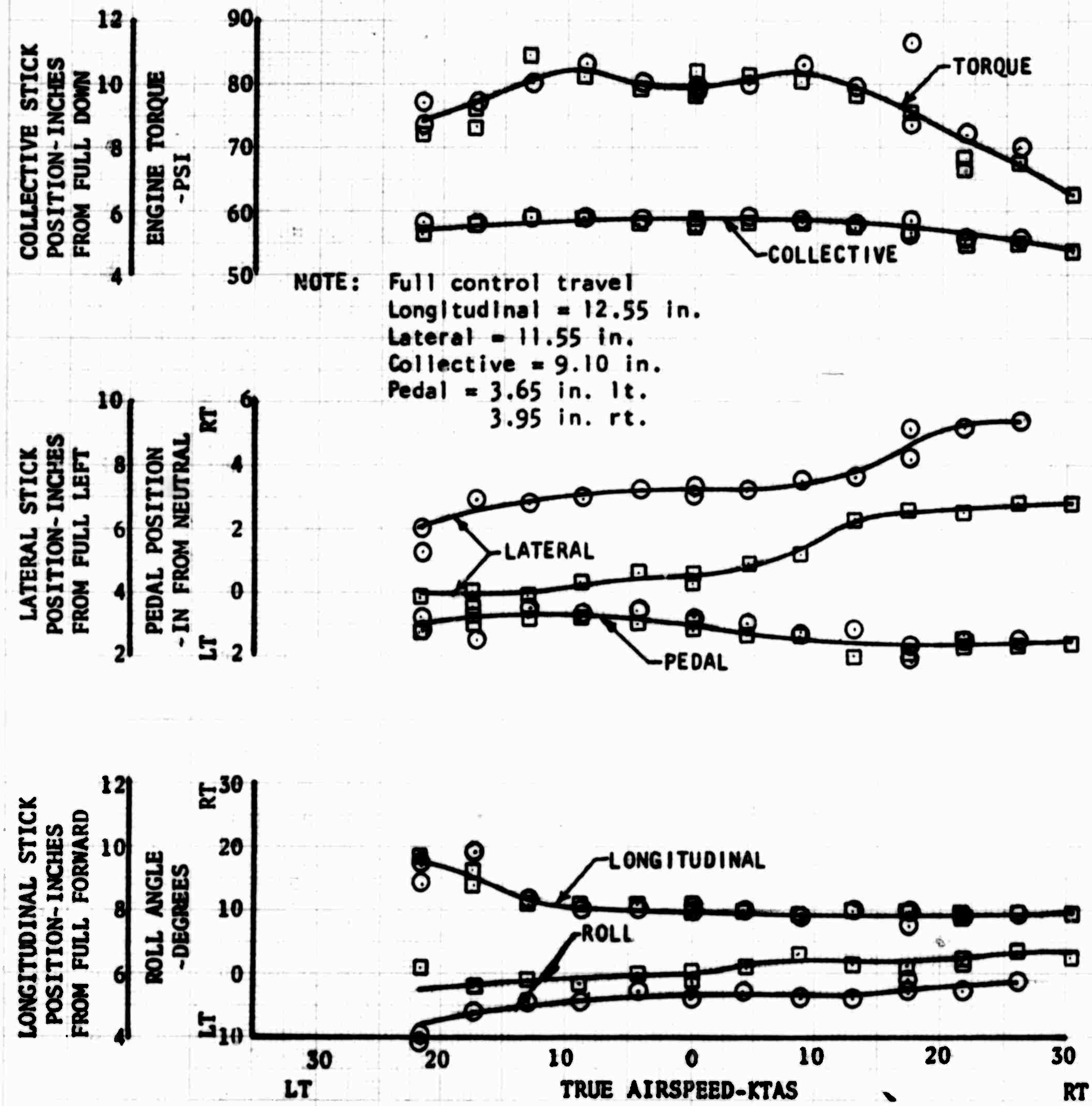
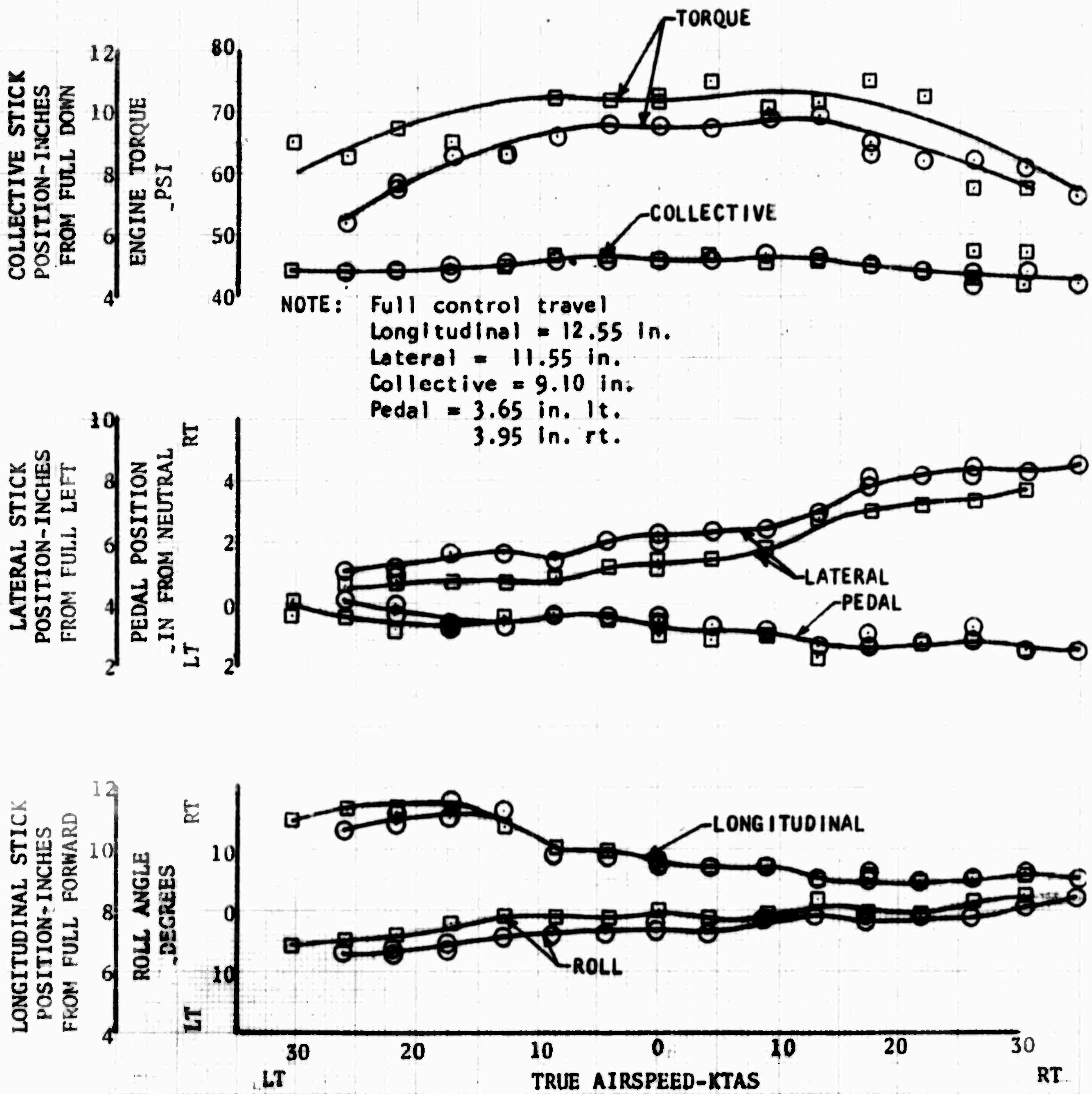


FIGURE NO. 147
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	600	2420	483	97.0(FWD)	0(MID)
□	1000	2430	483	97.0(FWD)	3.0(LT)



CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
○	990	2710	483	100.0(MID)	0(MID)
□	830	2560	483	102.8(AFT)	0(MID)

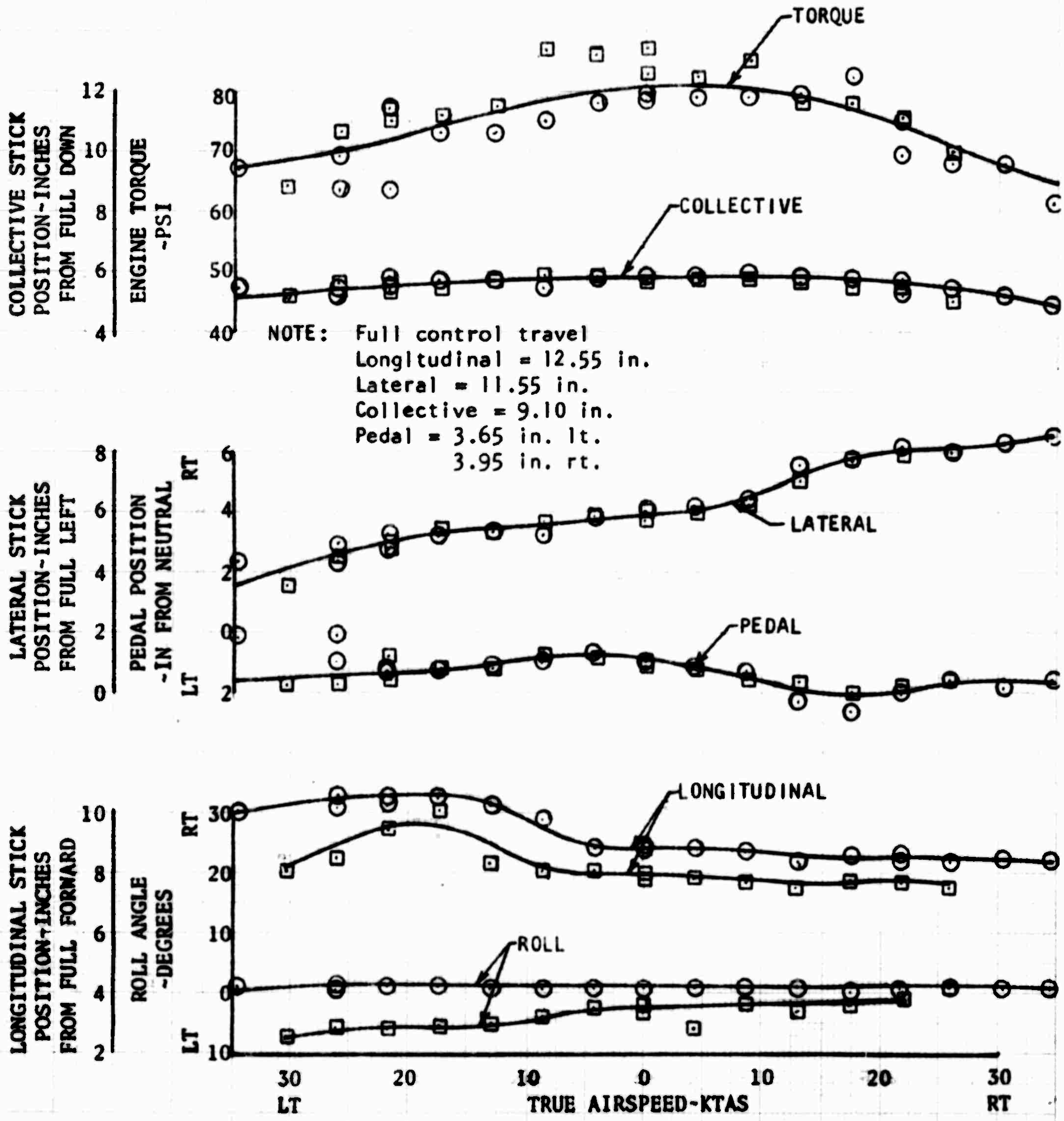


FIGURE NO. 149
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
O	10	2420	469	100.0(MID)	0(MID)

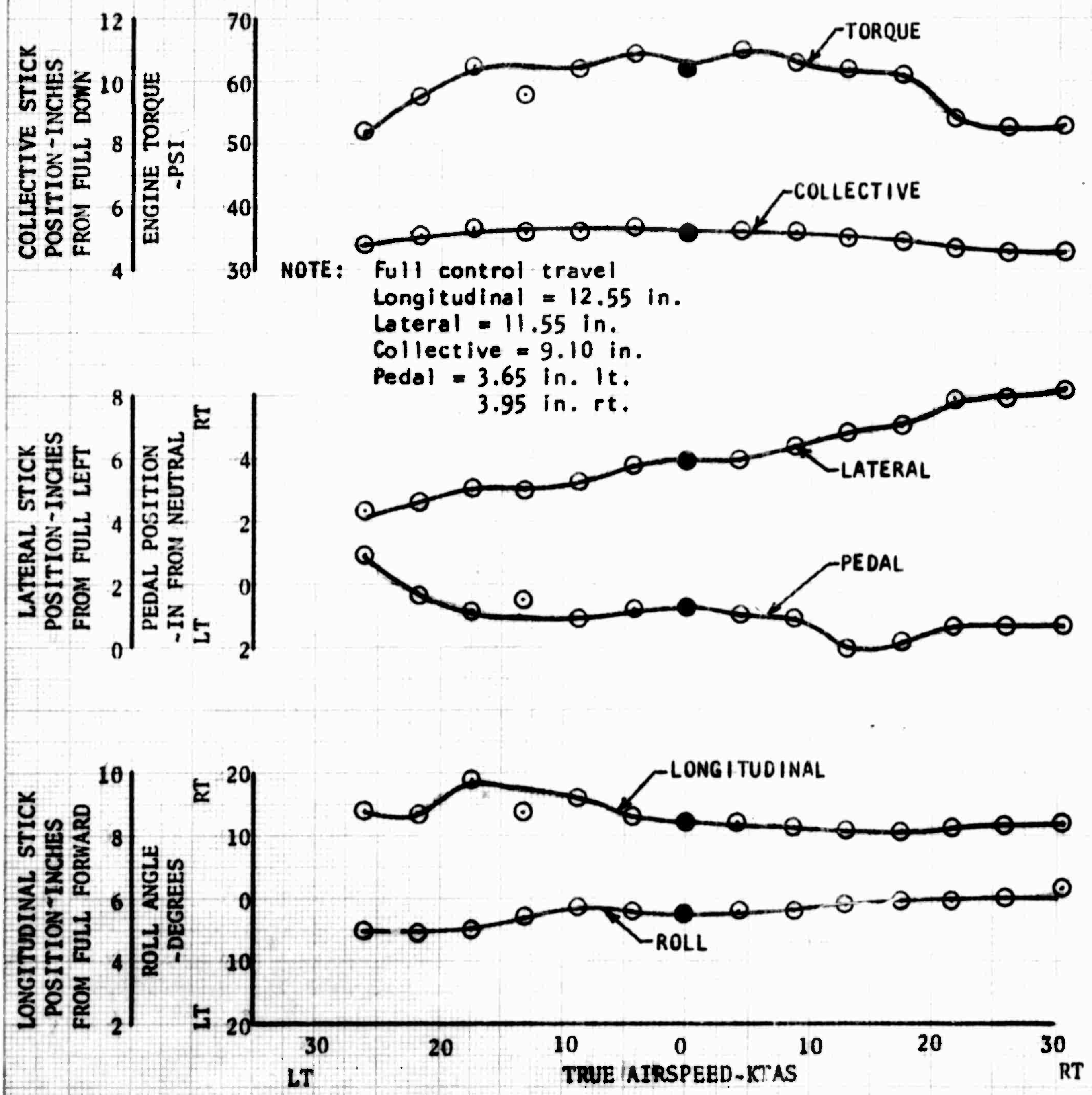


FIGURE NO. 150
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION OGE (50 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
O	-130	2390	483	99.8(MID)	0(MID)

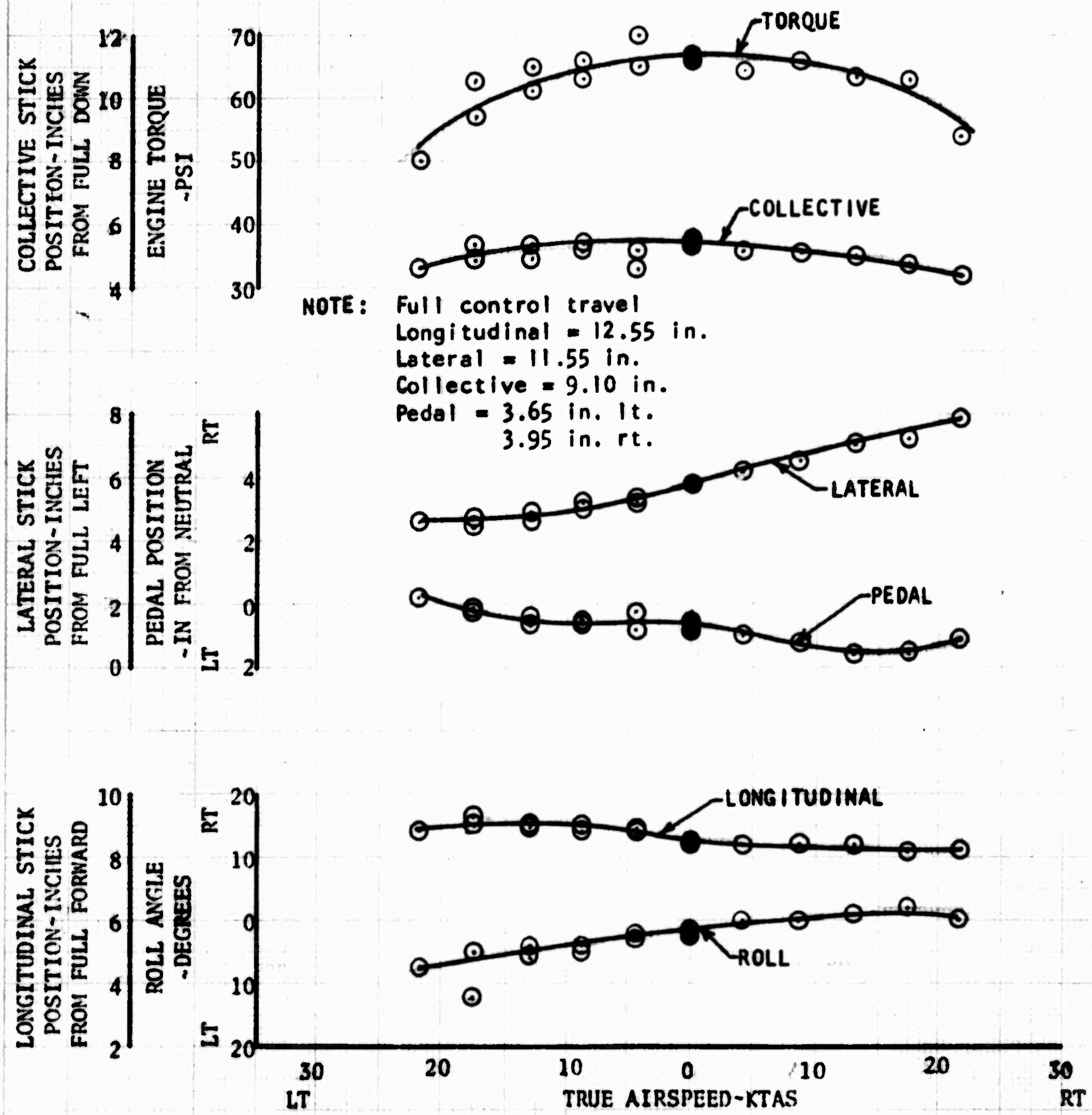


FIGURE NO. 151
CONTROL POSITION VARIATIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919
CLEAN CONFIGURATION

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION INCHES LONG.	C.G. LOCATION INCHES LAT.
○	-400	2480	483	97.0(Fwd)	-2.33(Lt)
□	-100	2720	483	97.1(Fwd)	-4.21(Lt)

IGE (10 FEET)

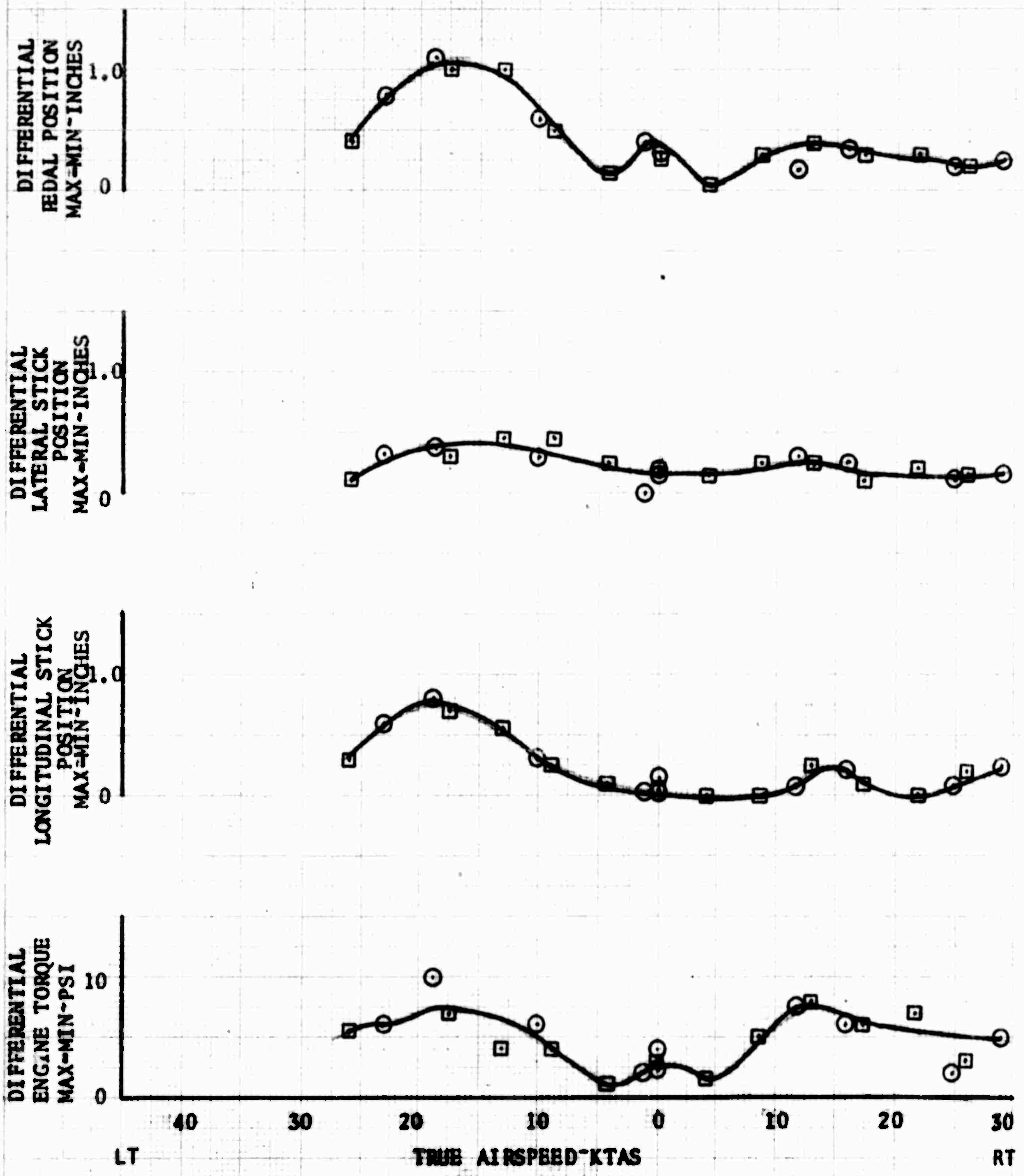


FIGURE NO. 152
CONTROL POSITIONS DURING SIDEWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	CONTROL RIGGING	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
○	OLD	-100	2470	483	97.0(FWD)	2.3(LT)
□	NEW	-400	2470	483	97.0(FWD)	2.3(LT)

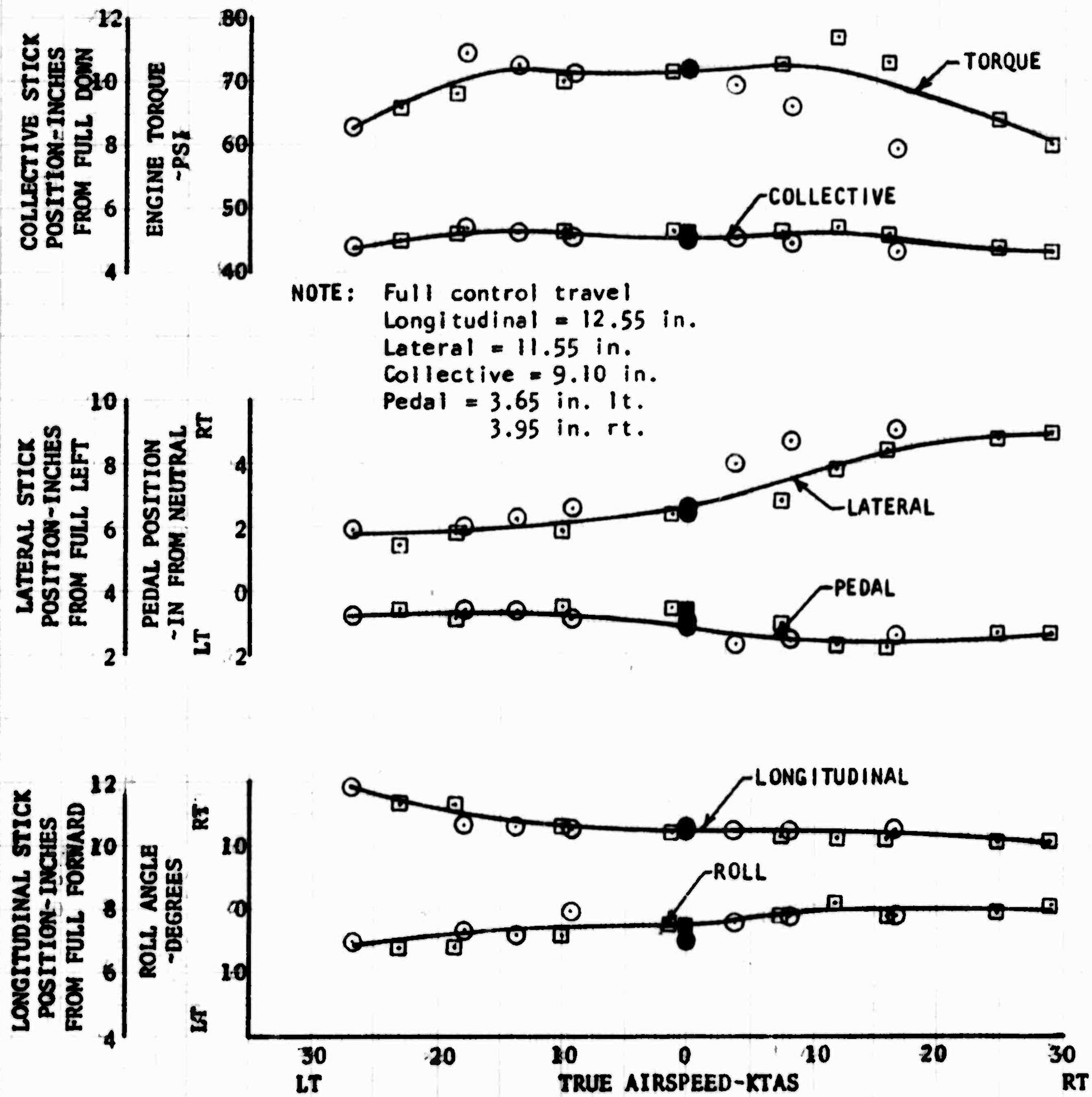
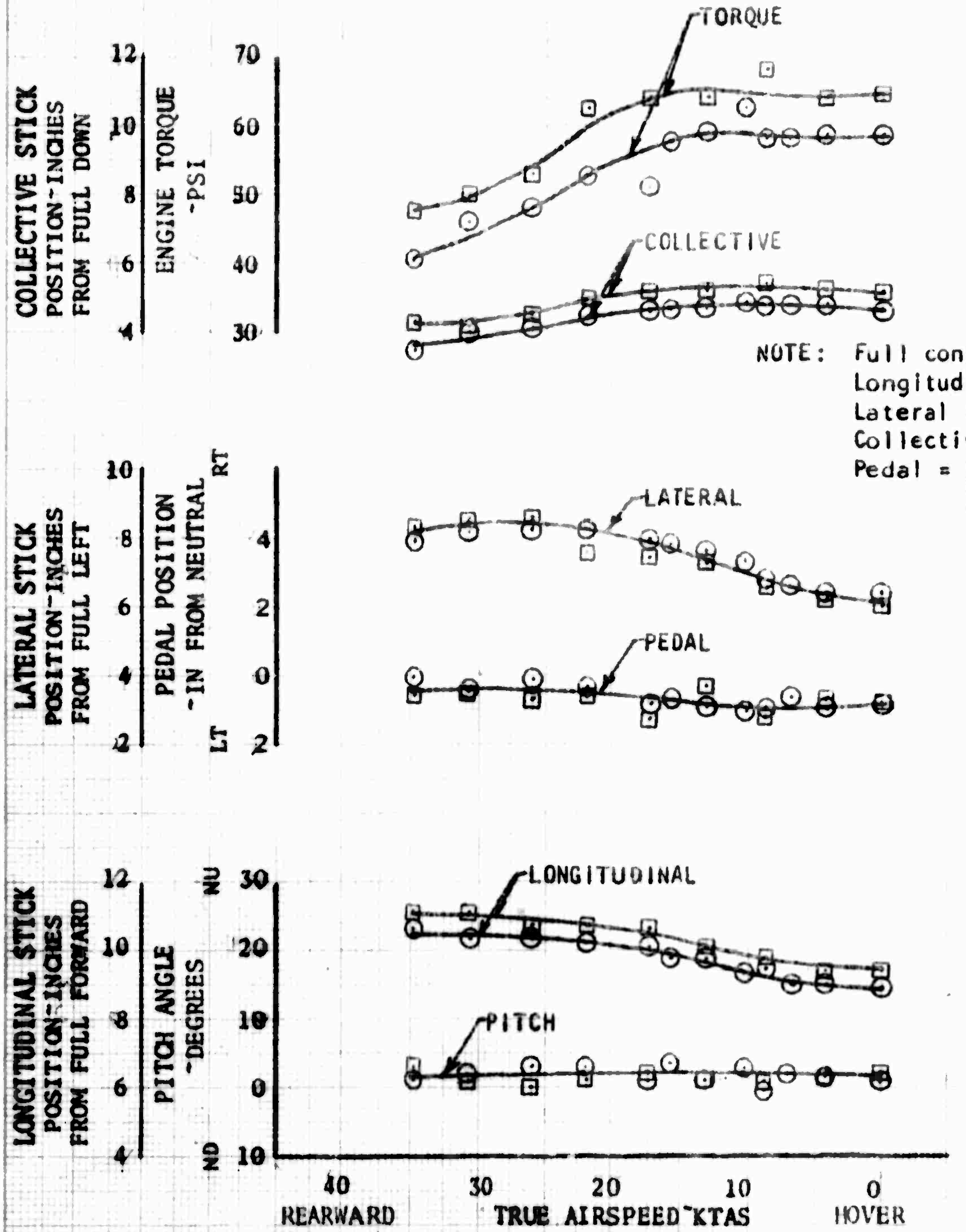


FIGURE NO. 153
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919
CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	-200	2170	483	100.2 (mid)	0 (mid)
□	-150	2400	483	100.0 (mid)	0 (mid)



NOTE: Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

FIGURE NO. 154
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	-400	2700	483	97.1 (fwd)	-4.2 (LT)
□	-100	2710	483	97.1 (fwd)	-4.2 (LT)

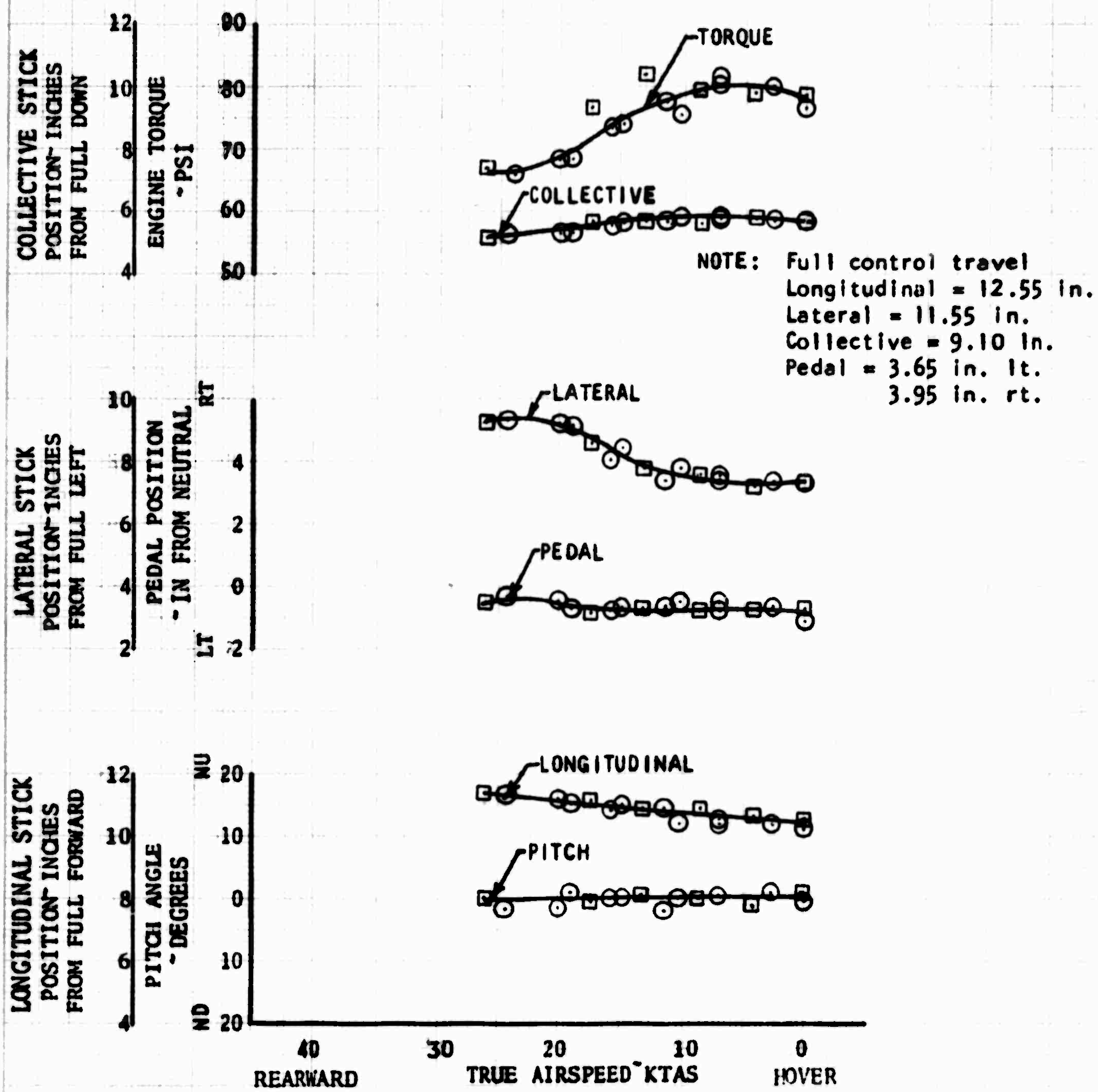


FIGURE NO. 155
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
O	700	2590	483	103.0 (aft)	-4.8 (LT)
□	60	2670	483	103.1 (aft)	-4.8 (LT)

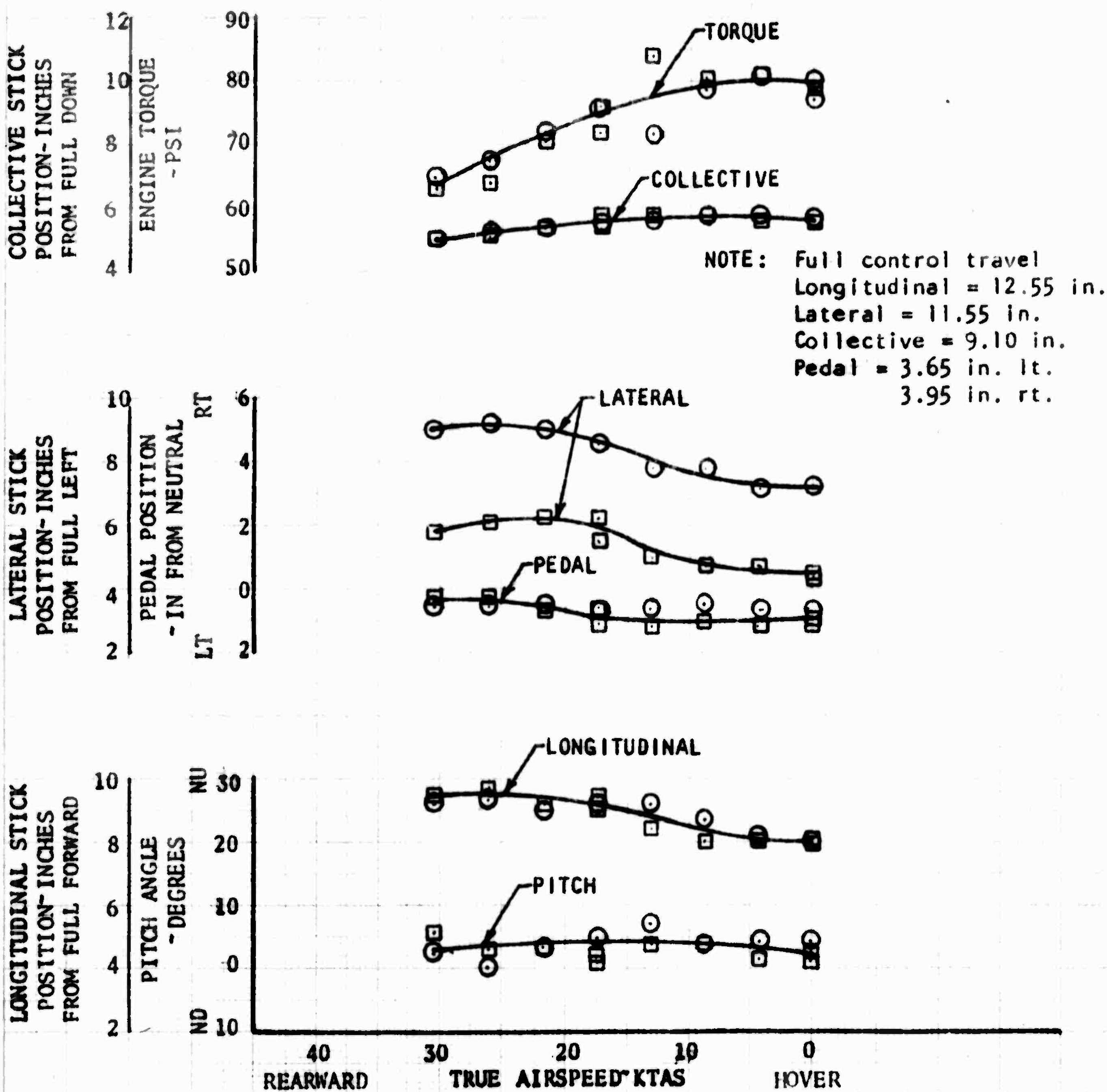


FIGURE NO. 156
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
○	990	2710	483	100.0 (mid)	0 (mid)
□	830	2560	483	102.8 (aft)	0 (mid)

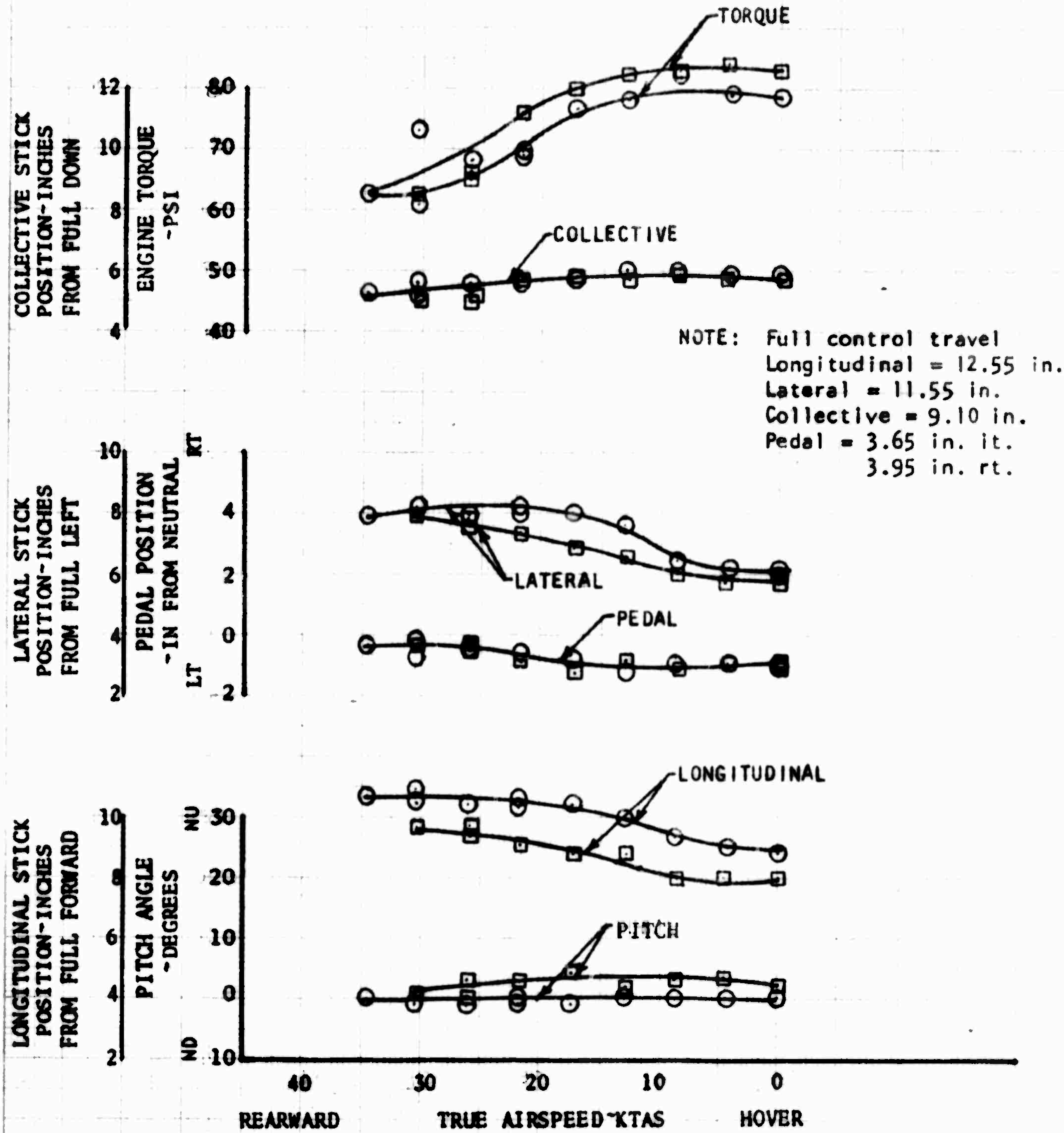
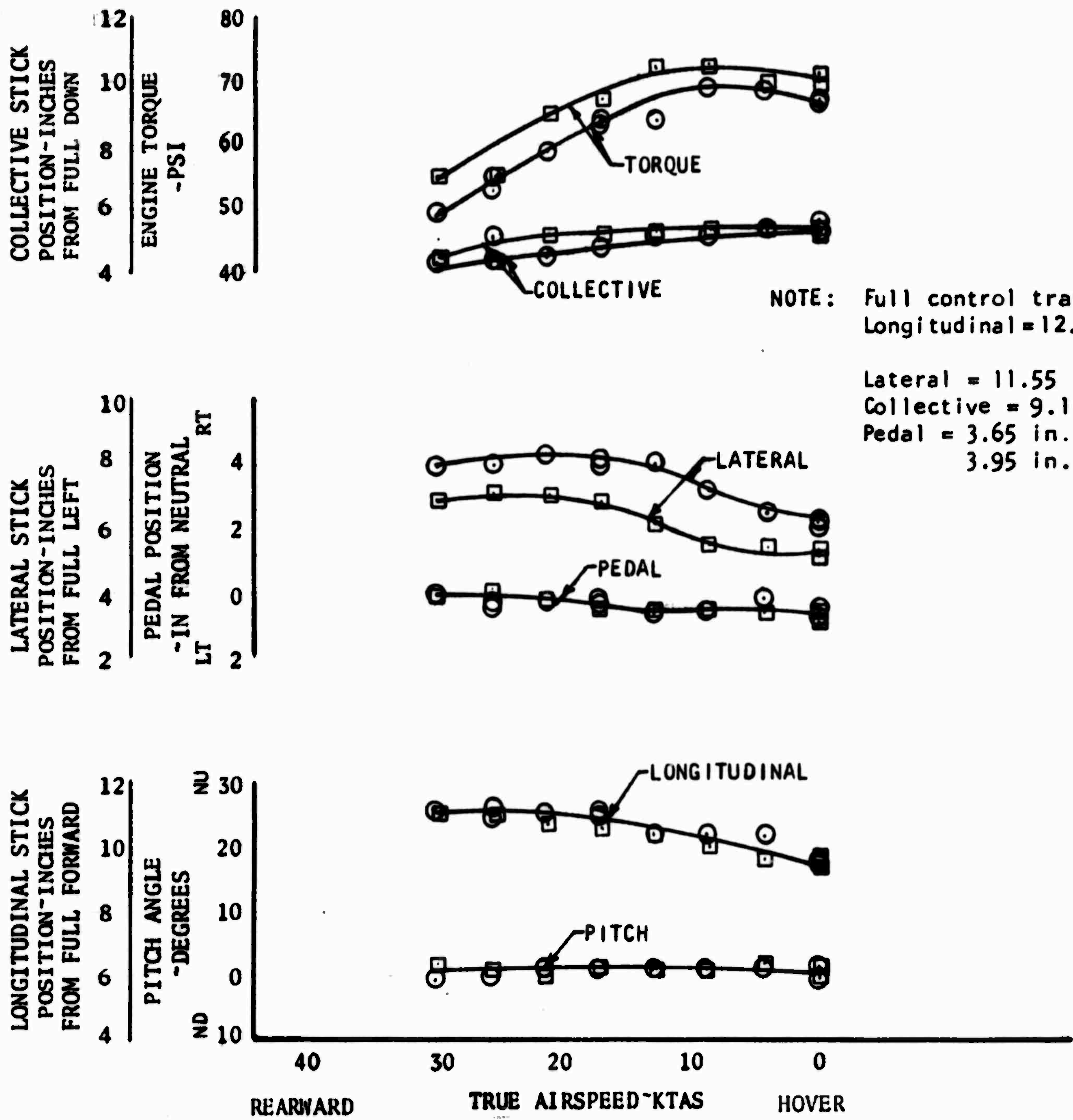


FIGURE NO. 157
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE(10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	600	2420	483	97.0 (Fwd)	0 (mid)
□	1000	2430	483	97.0 (Fwd)	3.0 (RT)



NOTE: Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

FIGURE NO. 158
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE(10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
○	10	2420	469	100.0 (mid)	0 (mid)

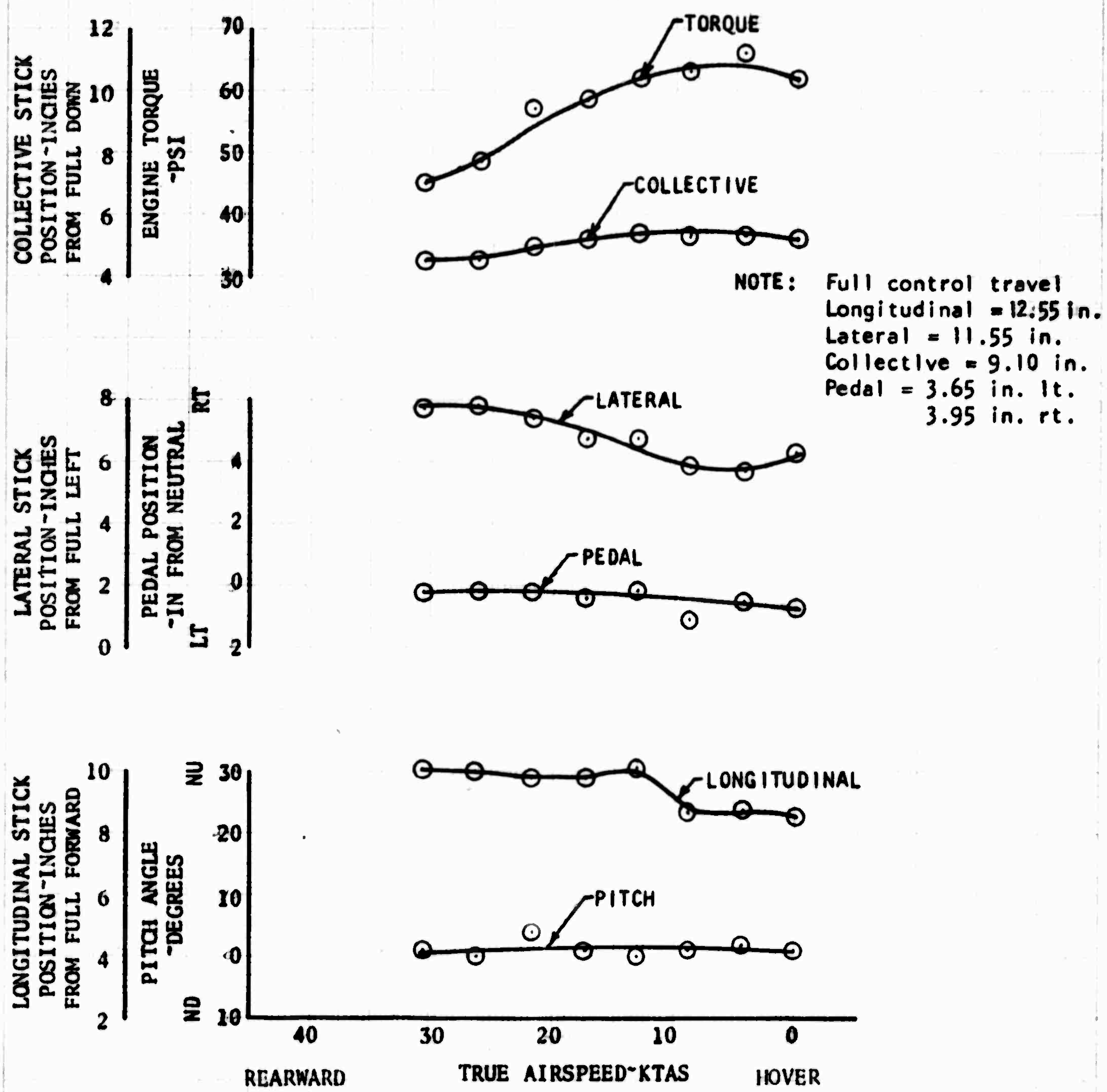


FIGURE NO. 159
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION OGE (50 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	C.G. LOCATION IN LAT.
⊙	-130	2390	483	99.8 (mid)	0 (mid)

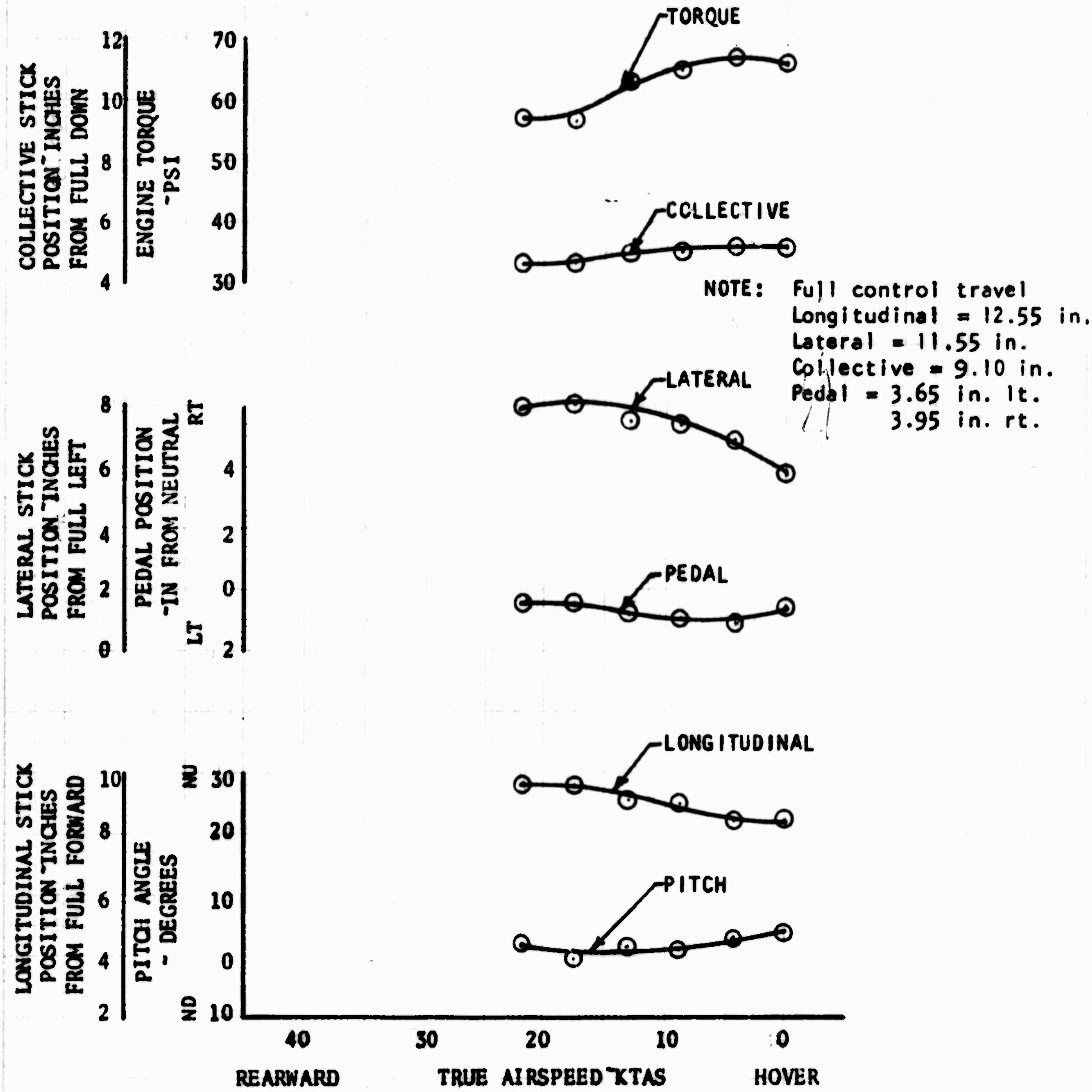
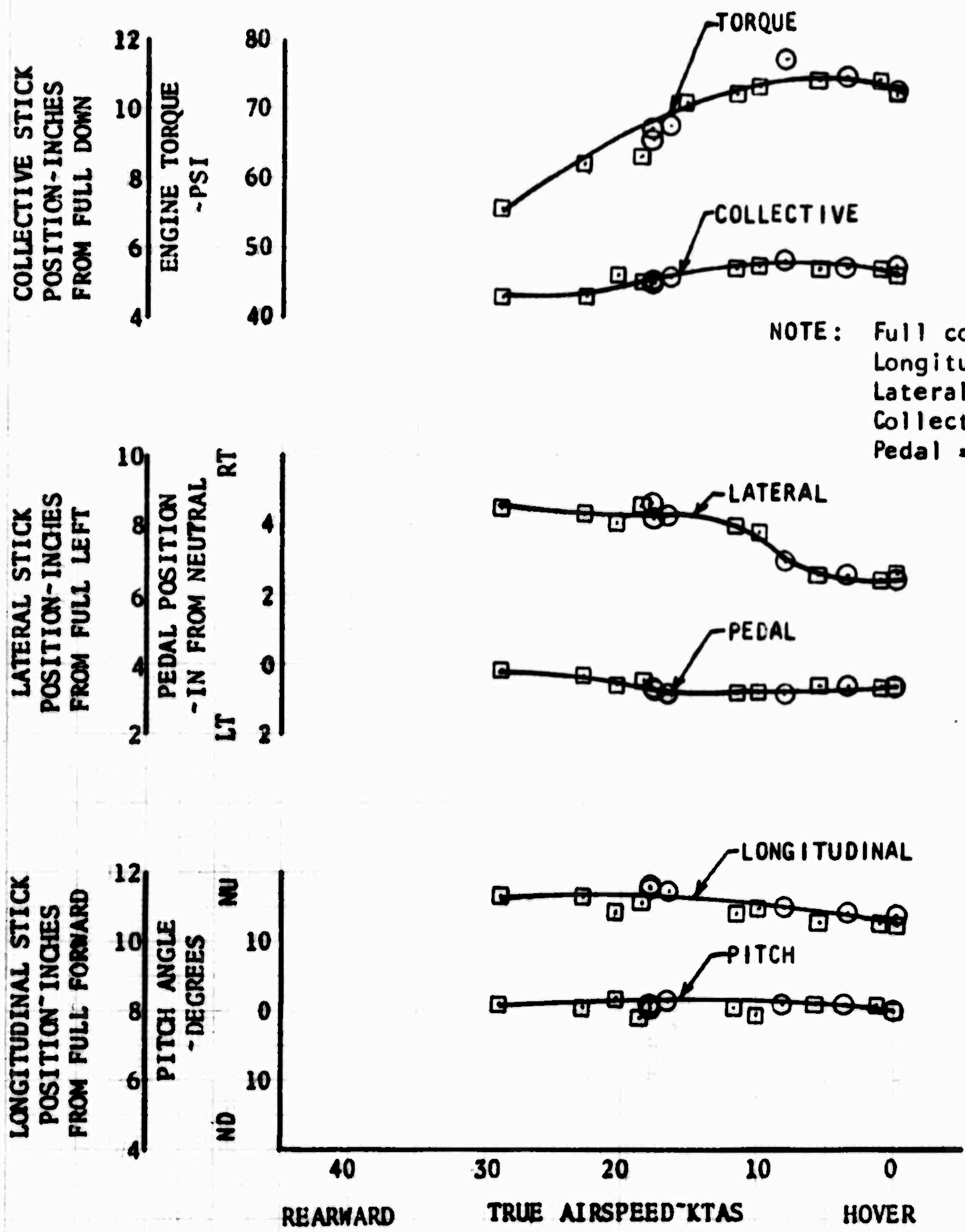


FIGURE NO. 160
CONTROL POSITIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919

CLEAN CONFIGURATION IGE (10 FEET)

SYM	CONTROL RIGGING	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION IN LONG.	LAT.
○	OLD	-100	2470	483	97.0 (fwd)	-2.3 (LT)
□	NEW	-400	2470	483	97.0 (fwd)	-2.3 (LT)



NOTE: Full control travel
Longitudinal = 12.55 in.
Lateral = 11.55 in.
Collective = 9.10 in.
Pedal = 3.65 in. lt.
3.95 in. rt.

FIGURE NO. 161
CONTROL POSITION VARIATIONS DURING REARWARD FLIGHT
OH-6A S/N 65-12919
CLEAN CONFIGURATION
IGE (10 FEET)

SYM	DENSITY ALTITUDE FT	GROSS WEIGHT LB	ROTOR SPEED RPM	C.G. LOCATION INCHES LONG.	C.G. LOCATION INCHES LAT.
○	-400	2470	483	97.0(Fwd)	-2.33 (Lt)
□	-100	2710	483	97.1(Fwd)	-4.21 (Lt)

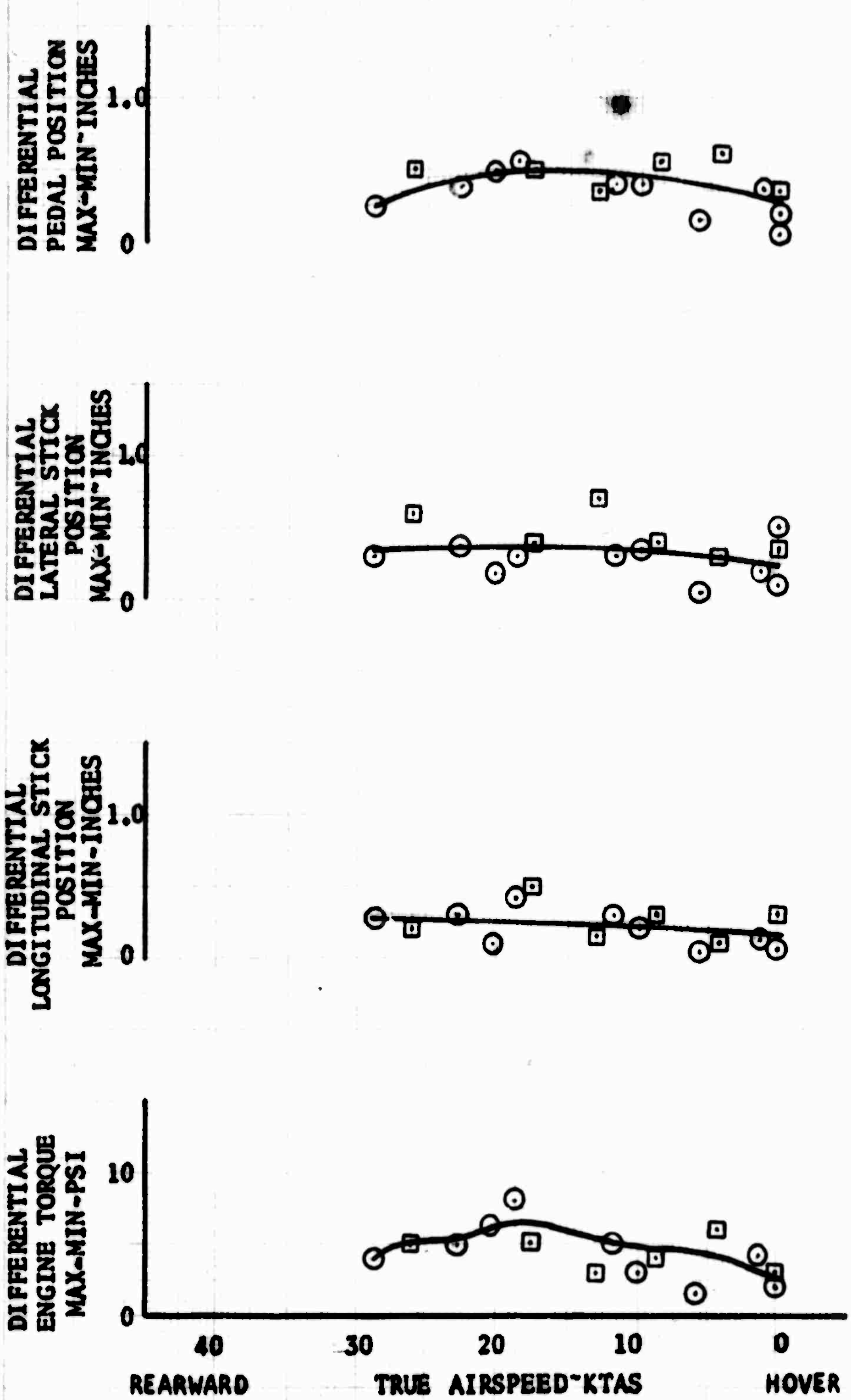


FIGURE NO. 162
LEFT SIDEWARD FLIGHT
OH-6A S/N 65-12919
CLEAN CONFIGURATION

TRIM AIRSPEED = 15 KTAS LEFT GROSS WEIGHT = 2430 LB
DENSITY ALTITUDE = -120 FT ROTOR SPEED = 483 RPM
SKID HEIGHT = IGE (10 FT)
C.G. LOCATION: LONGITUDINAL = 97.0 IN (FWD)
LATERAL = 2.33 IN (LT)

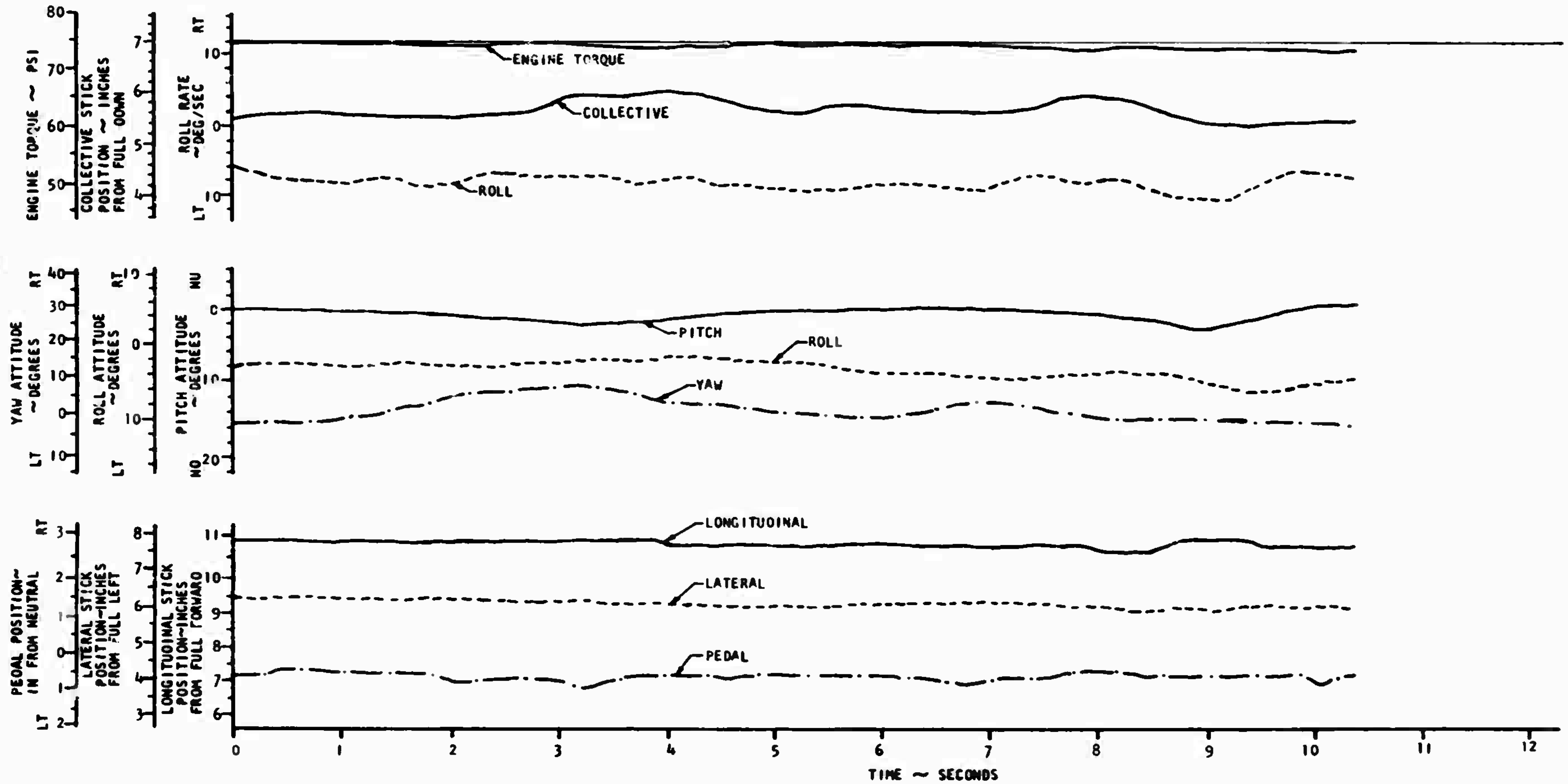


FIGURE NO. 163
LEFT CROSSWIND APPROACH
OH-6A S/N 65-12919
CLEAN CONFIGURATION

WIND VELOCITY = 16 KTS (GUSTING TO 22 KTS)
DENSITY ALTITUDE = 2860 FT
SKID HEIGHT: VARYING FROM OGE APPROACH TO 10 FT HOVER
C.G. LOCATION: LONGITUDINAL = 99.7 IN (MID)
LATERAL = .77 IN RT (MID)

GROSS WEIGHT = 2380 LB.
ROTOR SPEED = 483 RPM
OLD CYCLIC CONTROL RIGGING

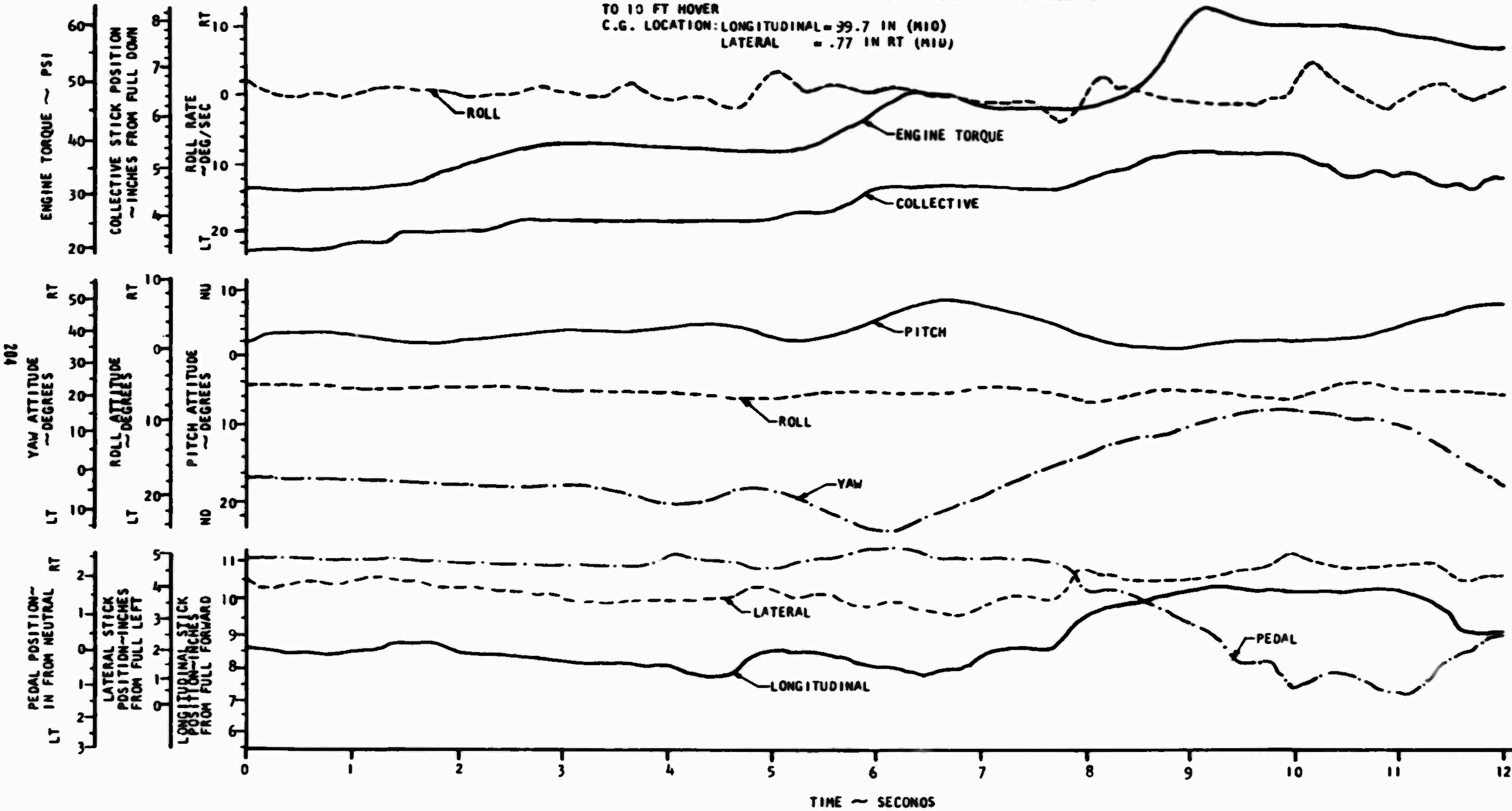


FIGURE NO. 163 (CONTINUED)

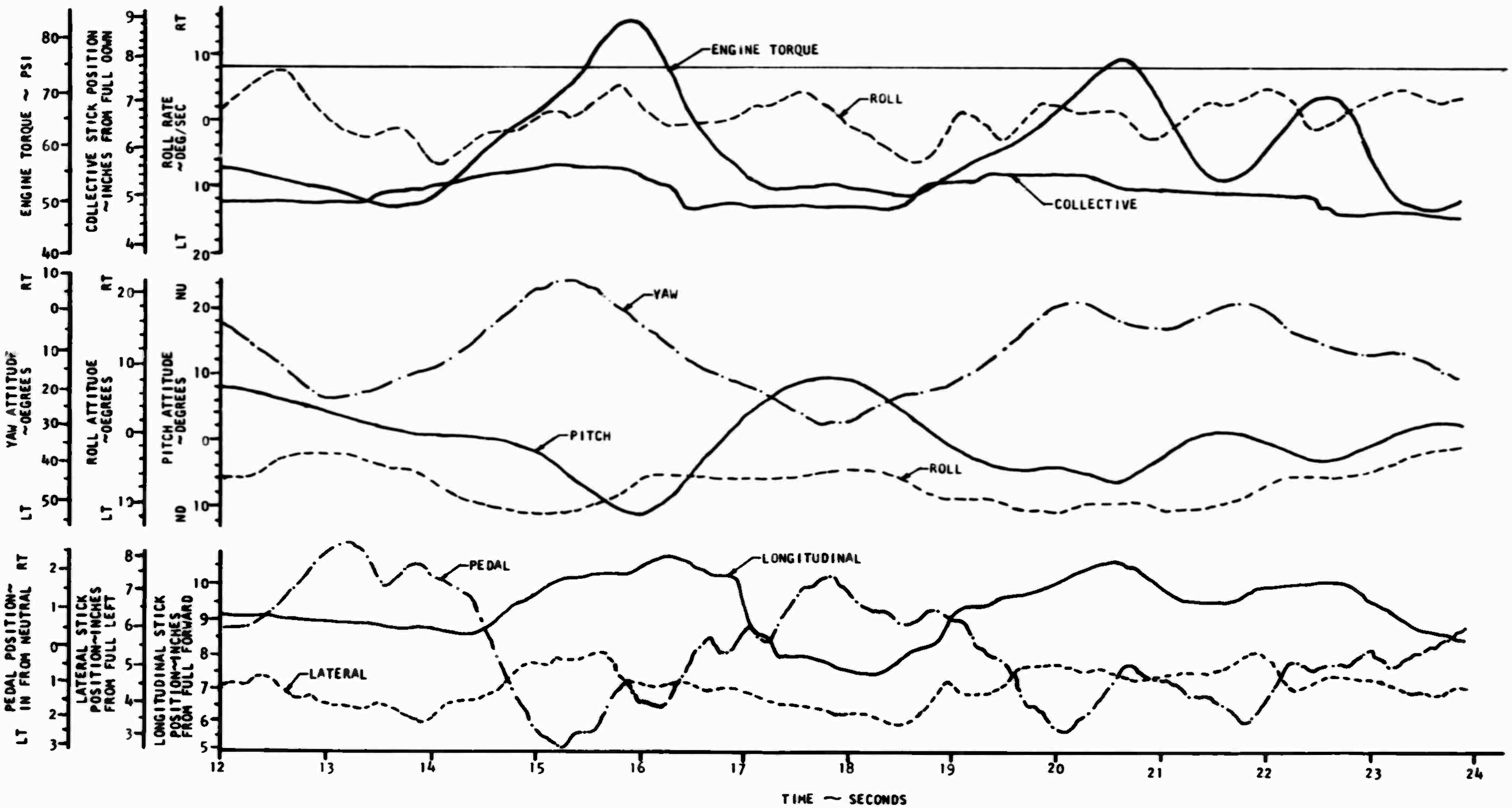


FIGURE NO. 164
REARWARD FLIGHT
OH-6A S/N 65-12919
CLEAN CONFIGURATION

TRIM AIRSPEED = 18 KTAS
DENSITY ALTITUDE = -130 FT
C.G. LOCATION: LONGITUDINAL = 97.0 IN (FWD)
LATERAL = 2.33 IN (LT)

GROSS WEIGHT = 2410 LB
ROTOR SPEED = 483 RPM
SKID HEIGHT = IGE (10 FT)

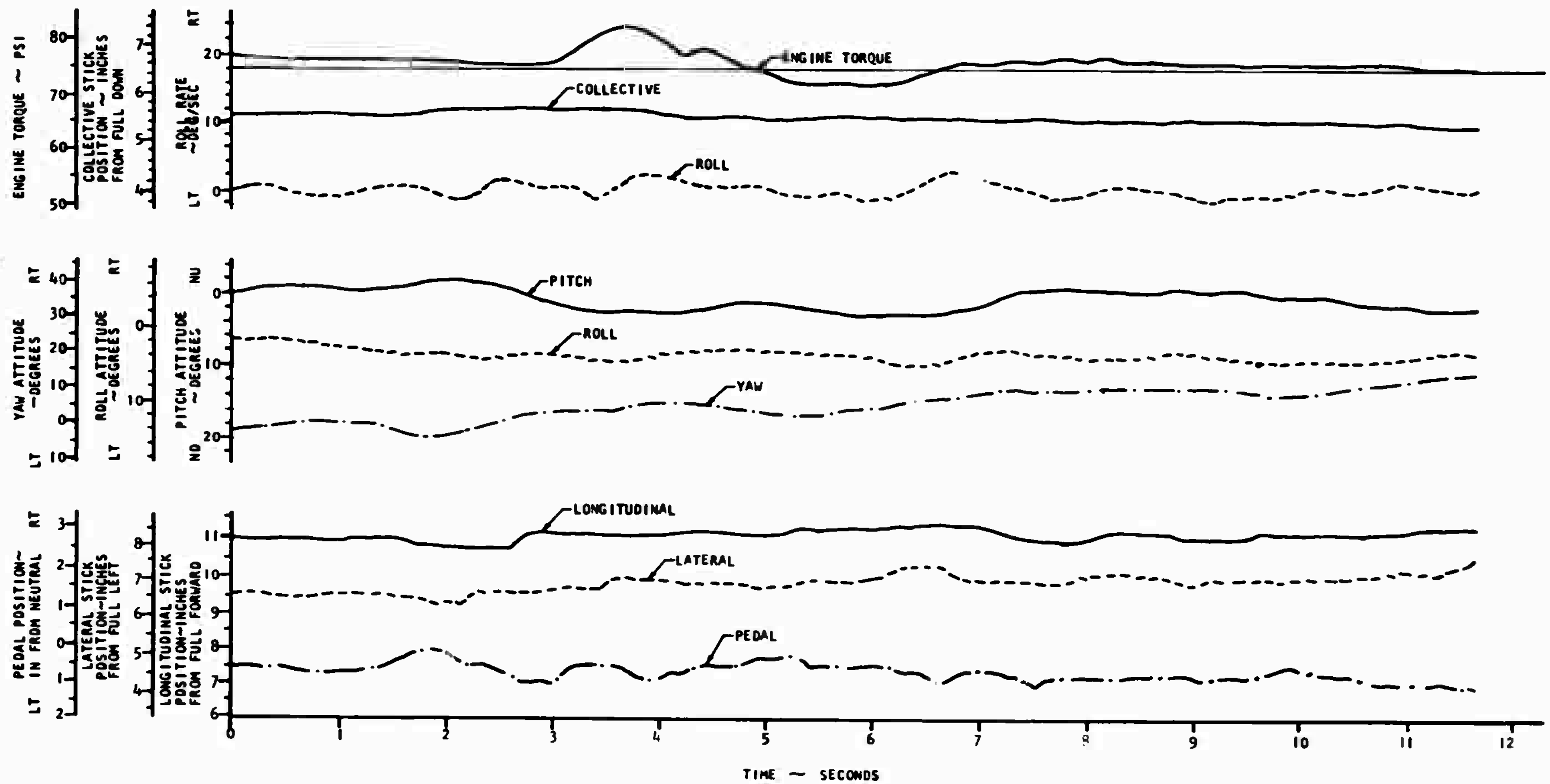


FIGURE NO. 164A
FORWARD LONGITUDINAL PULSE IN REARWARD FLIGHT
OH-6A S/N 65-12919

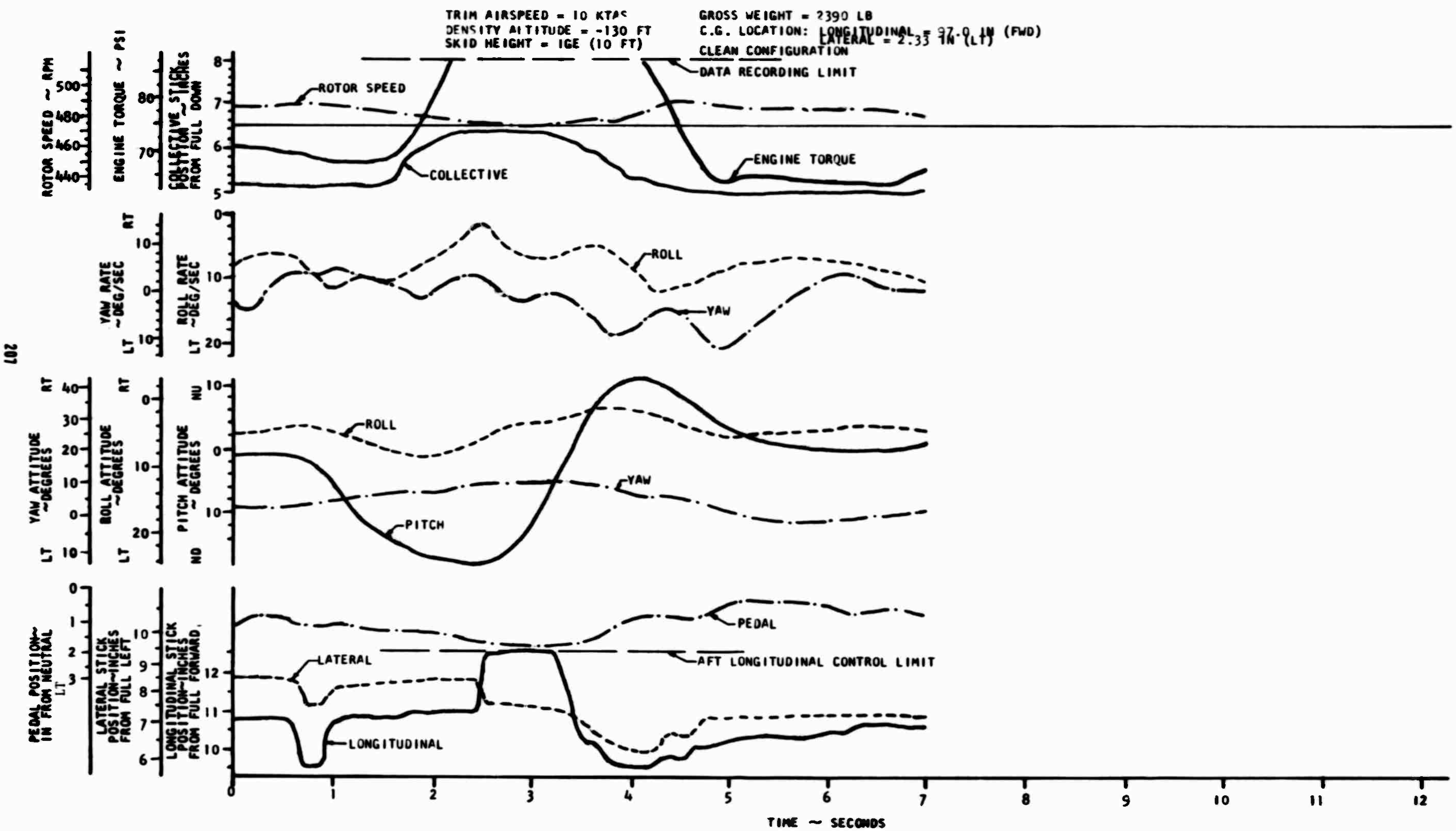


FIGURE NO. 165
RIGHT CROSSWIND APPROACH
OH-6A S/N 65-12919
CLEAN CONFIGURATION

WIND VELOCITY = 16 KTS (GUSTING TO 22 KTS)
DENSITY ALTITUDE = 2860 FT
SKID HEIGHT: VARYING FROM OGE APPROACH TO 10 FT HOVER.
C.G. LOCATION: LONGITUDINAL = 99.7 IN (MID)
LATERAL = .77 IN RT (MID)

GROSS WEIGHT = 2380 LB
ROTOR SPEED = 483 RPM
OLD CYCLIC CONTROL RIGGING

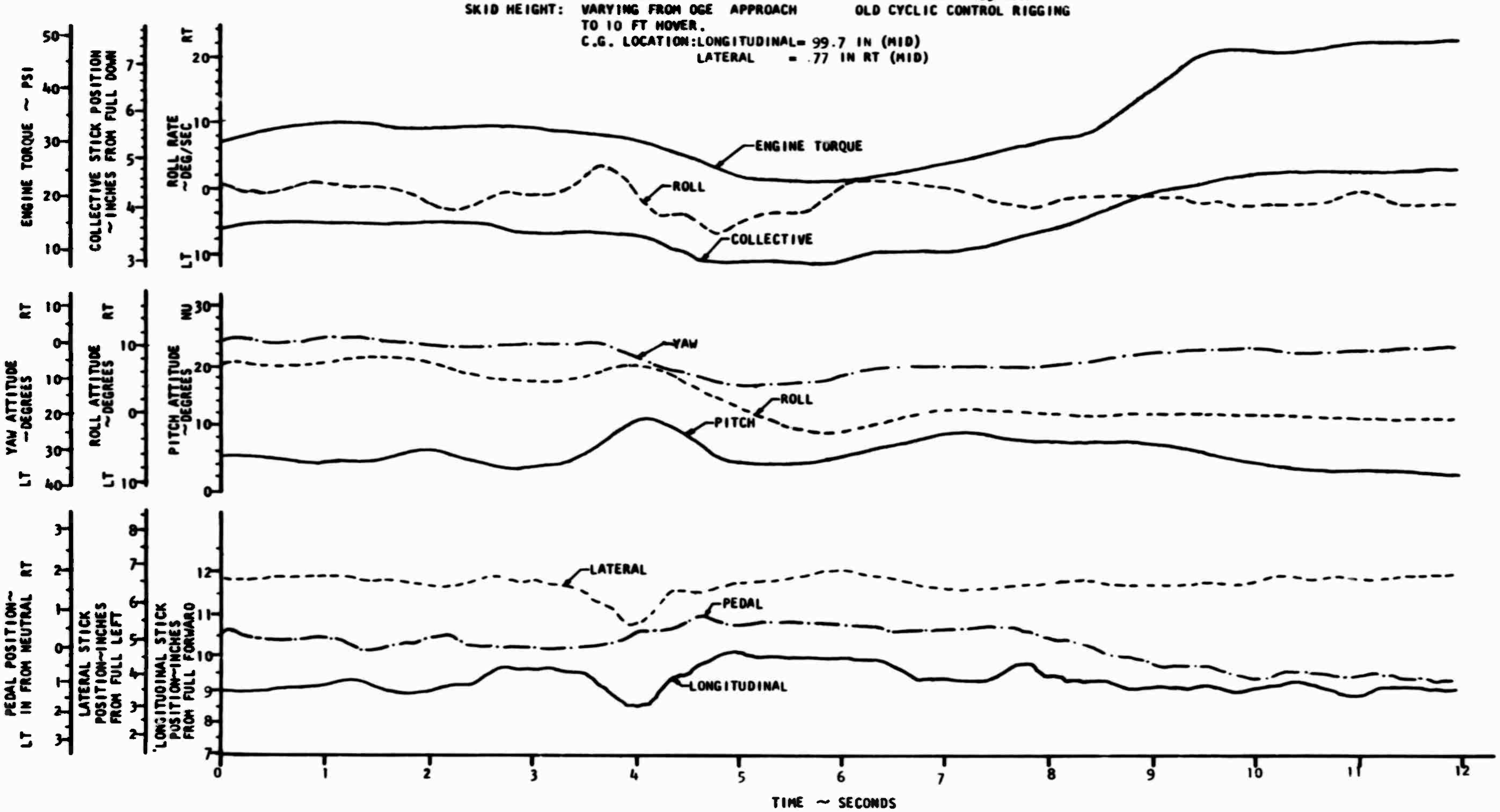


FIGURE NO. 166
DOWNWIND APPROACH
OH-6A S/N 65-12919
CLEAN CONFIGURATION

WIND VELOCITY = 16 KTS (GUSTING TC 22 KTS)
DENSITY ALTITUDE = 2860 FT
SKID HEIGHT: VARYING FROM OGE APPROACH TO 10 FT HOVER.
C.G. LOCATION: LONGITUDINAL = 99.7 IN (MID)
LATERAL = .77 IN RT (MID)

GROSS WEIGHT = 2360 LB
ROTOR SPEED = 483 RPM
OLD CYCLIC CONTROL RIGGING

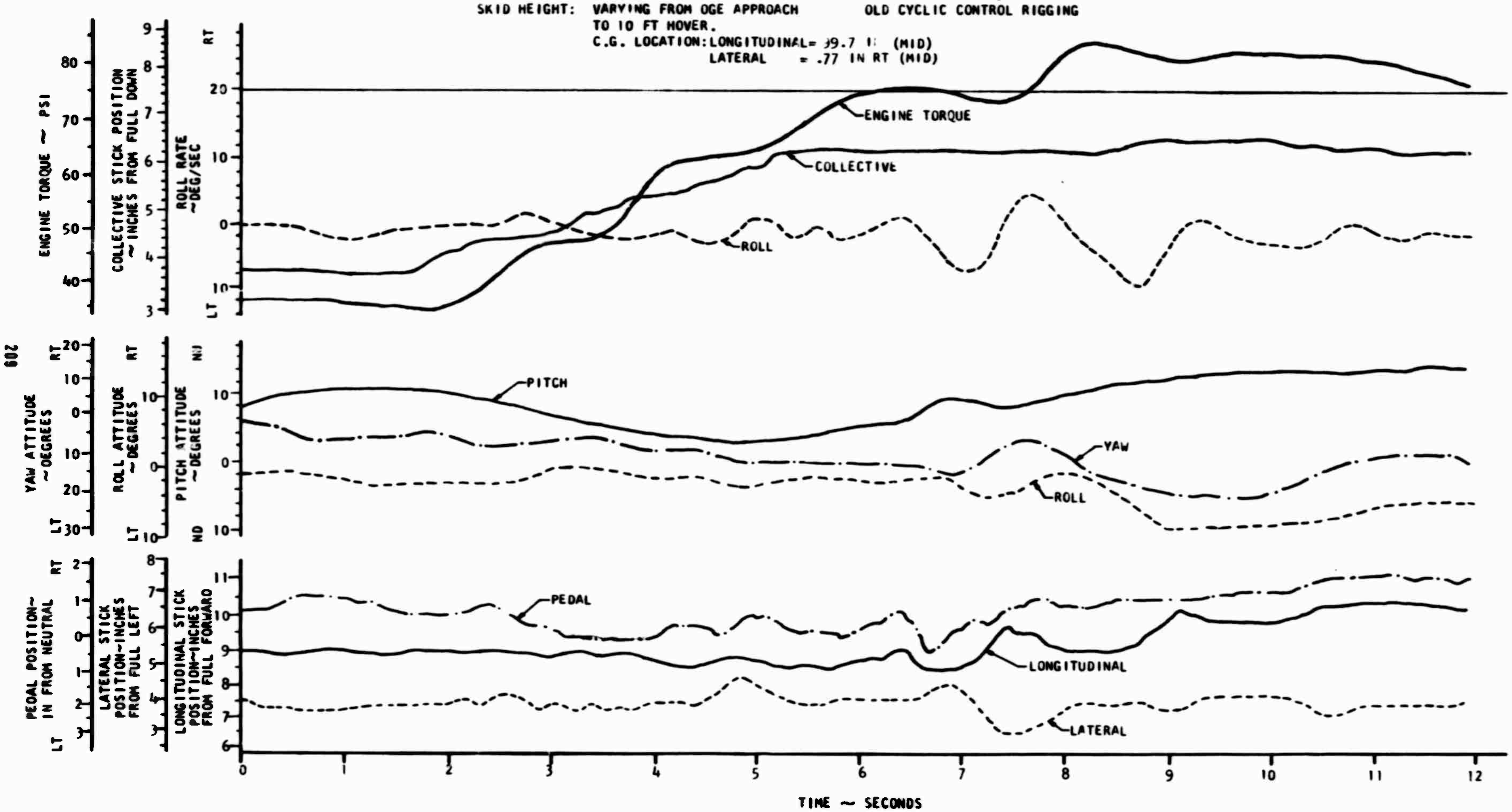


FIGURE NO. 166 (CONTINUED)

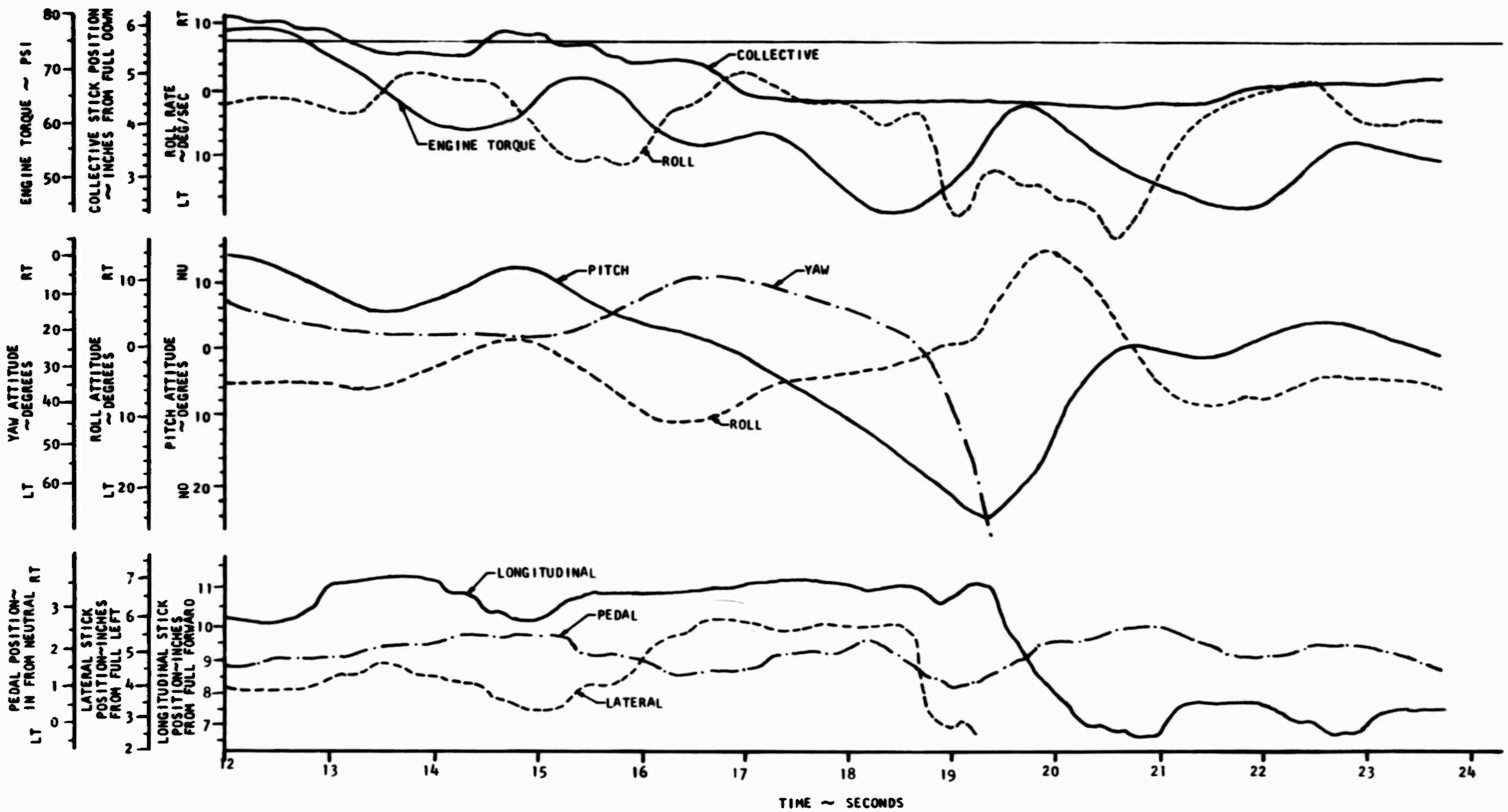


FIGURE NO. 167
AUTOROTATIONAL ENTRY CHARACTERISTICS
OH-6A S/N 65-12919
CLEAN CONFIGURATION

DENSITY ALTITUDE = 2500 FT   ROTOR SPEED = 483 RPM
GROSS WEIGHT = 2410 LB   C.G. LOCATION = 99.8 IN (MID)
LEVEL FLIGHT

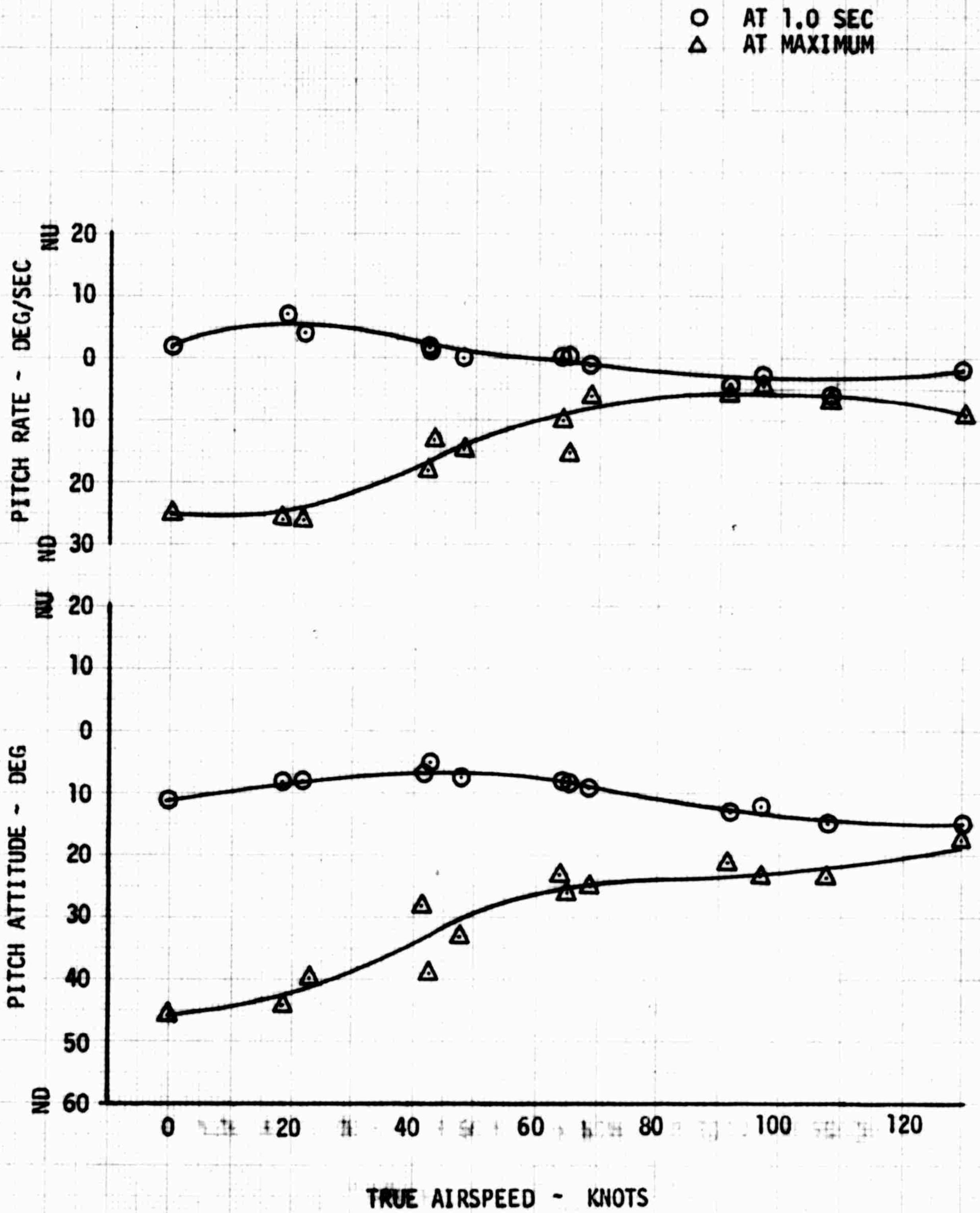


FIGURE NO. 168
AUTOROTATIONAL ENTRY CHARACTERISTICS
OH-6A S/N 65-12919
CLEAN CONFIGURATION

DENSITY ALTITUDE = 2500 FT
C.G. LOCATION = 99.8 IN (MID)
GROSS WEIGHT = 2410 LB
ROTOR SPEED = 483 RPM
LEVEL FLIGHT

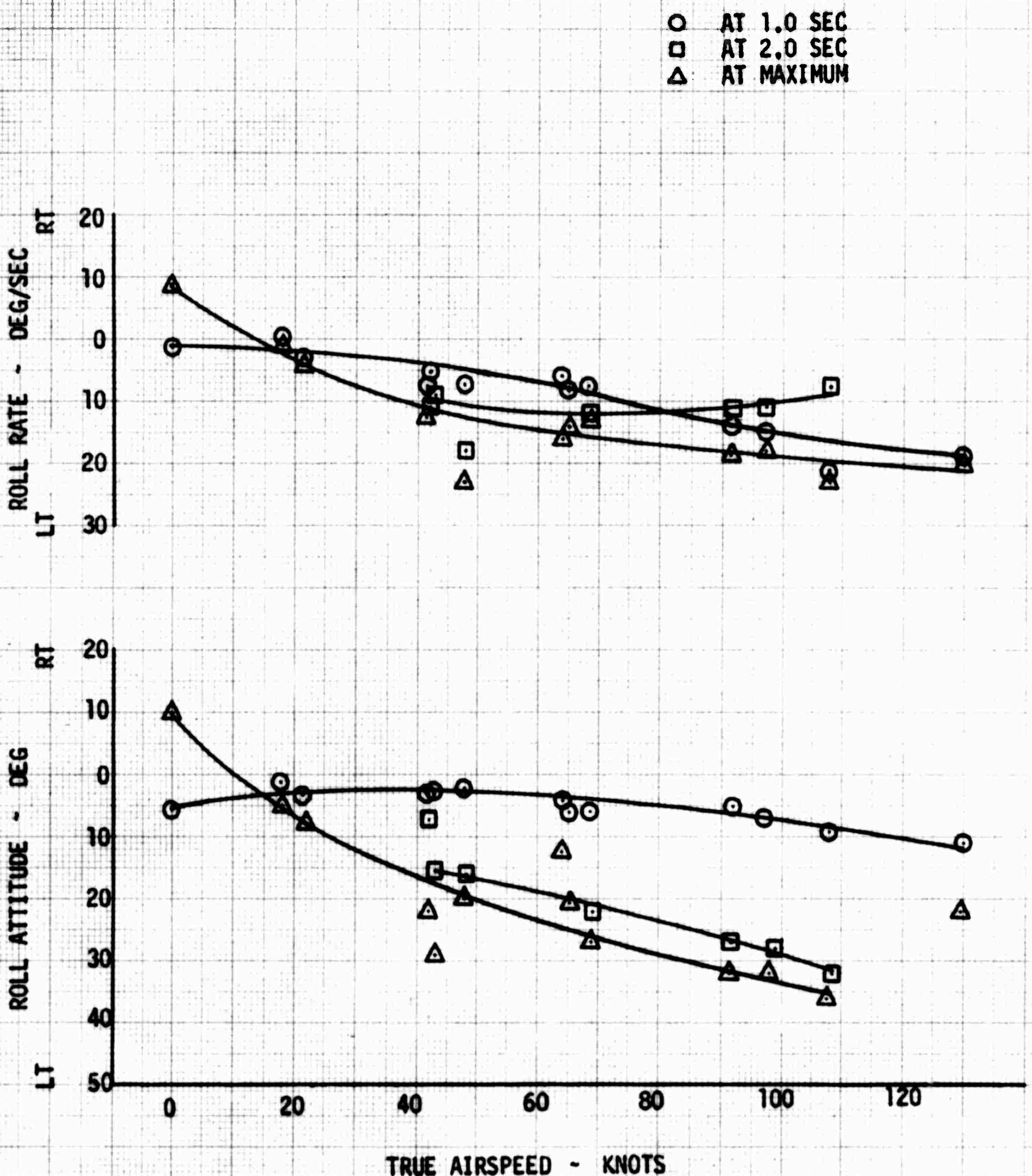


FIGURE NO. 169
AUTOROTATIONAL ENTRY CHARACTERISTICS
OH-6A S/N 65-12919
CLEAN CONFIGURATION

DENSITY ALTITUDE = 2500 FT   ROTOR SPEED = 483 RPM

GROSS WEIGHT = 2410 LB   C.G. LOCATION = 99.8 IN (MID)

LEVEL FLIGHT

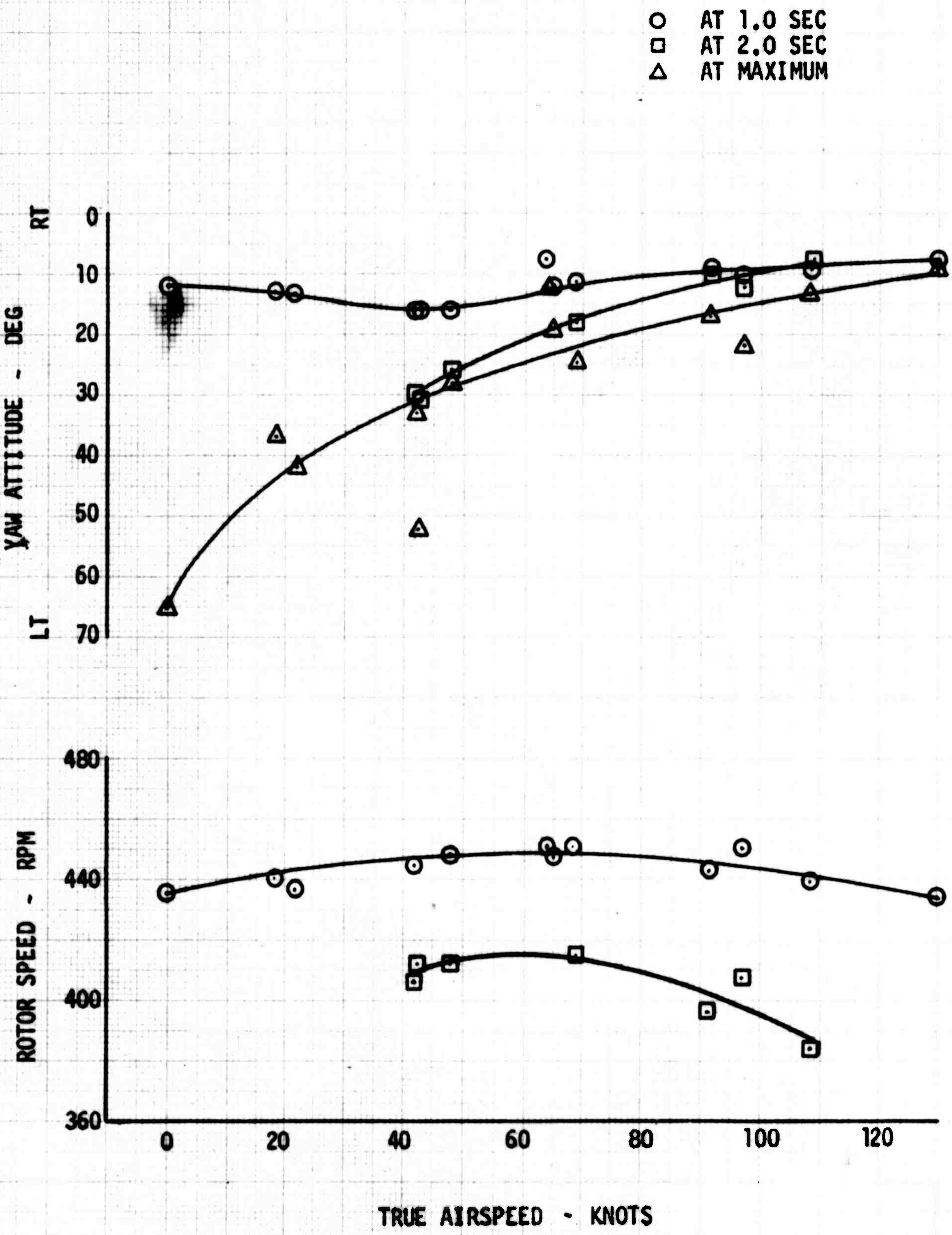


FIGURE NO. 170
AUTOROTATIONAL ENTRY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

TRIM AIRSPEED = 0 KCAS
DENSITY ALTITUDE = 2490 FT
C. G. LOCATION = 100.0 IN (MID)

GROSS WEIGHT = 2390 LB
ROTOR SPEED = 483 RPM
2 SECOND DELAY

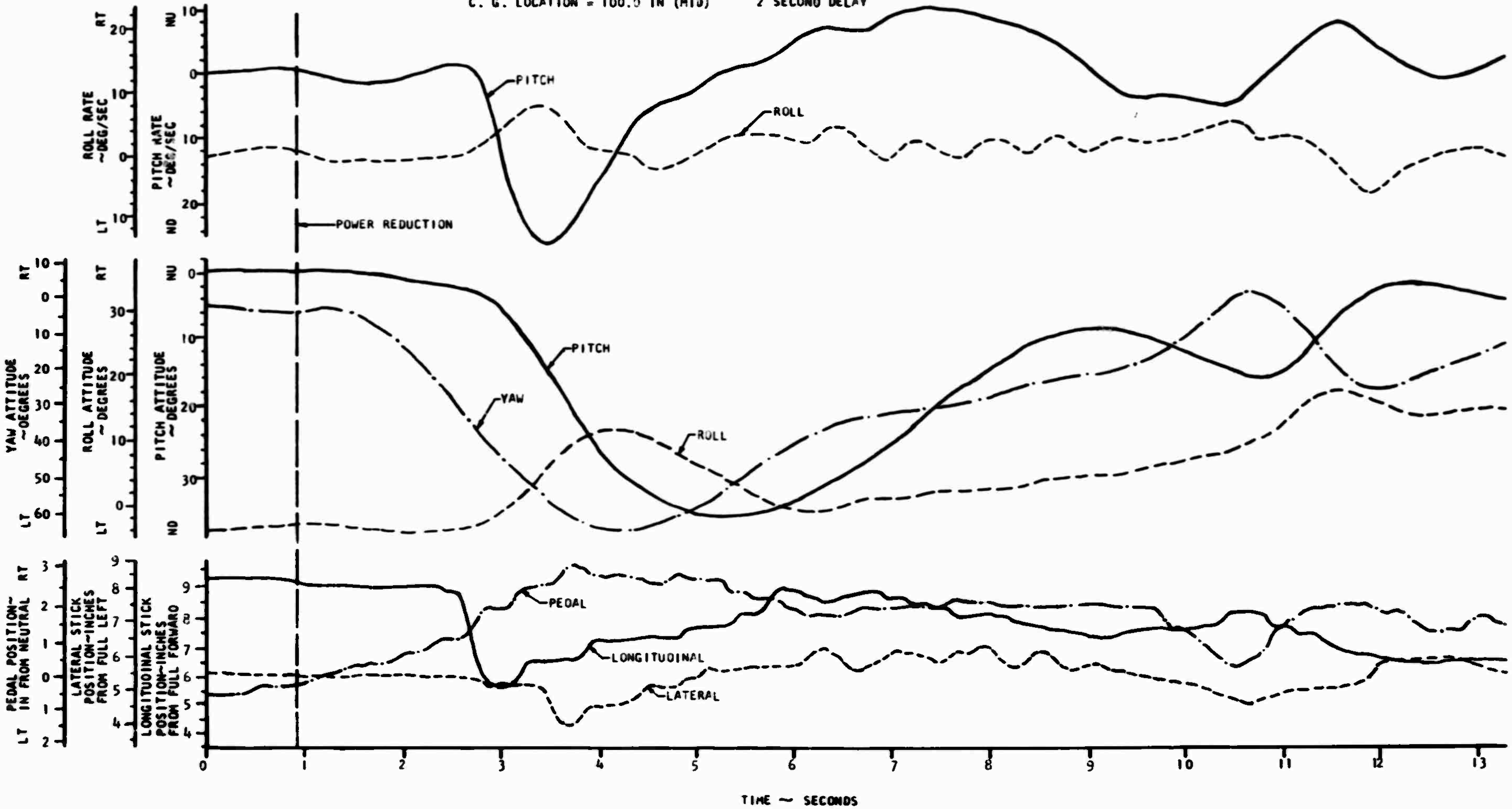


FIGURE NO. 170 (CONTINUED)

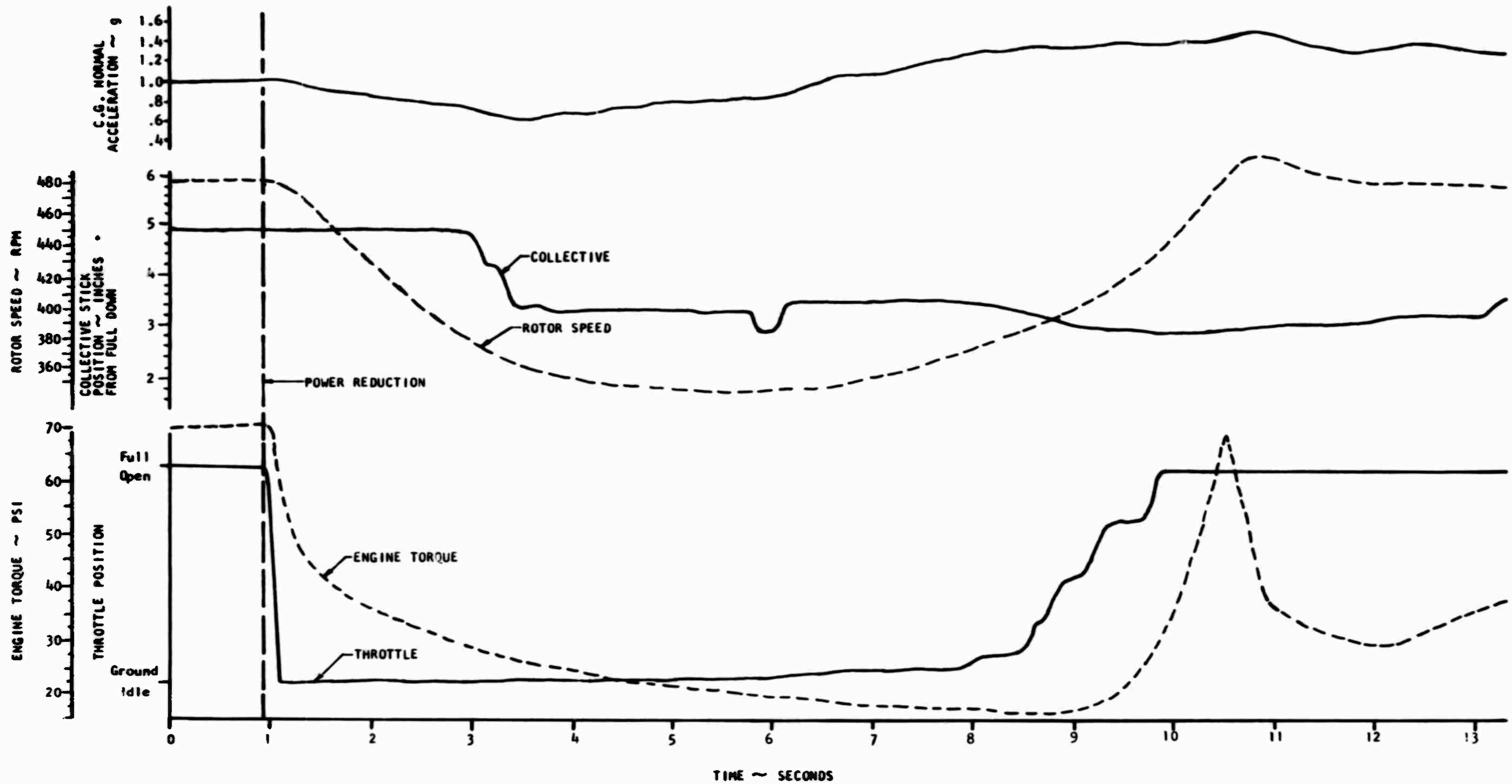


FIGURE NO. 171
AUTOROTATIONAL ENTRY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

TRIM AIRSPEED = 120 KCAS GROSS WEIGHT = 2220 LB
DENSITY ALTITUDE = 2300 FT ROTOR SPEED = 483 RPM
C.G. LOCATION = 100.0 IN (MID) 2 SECOND DELAY

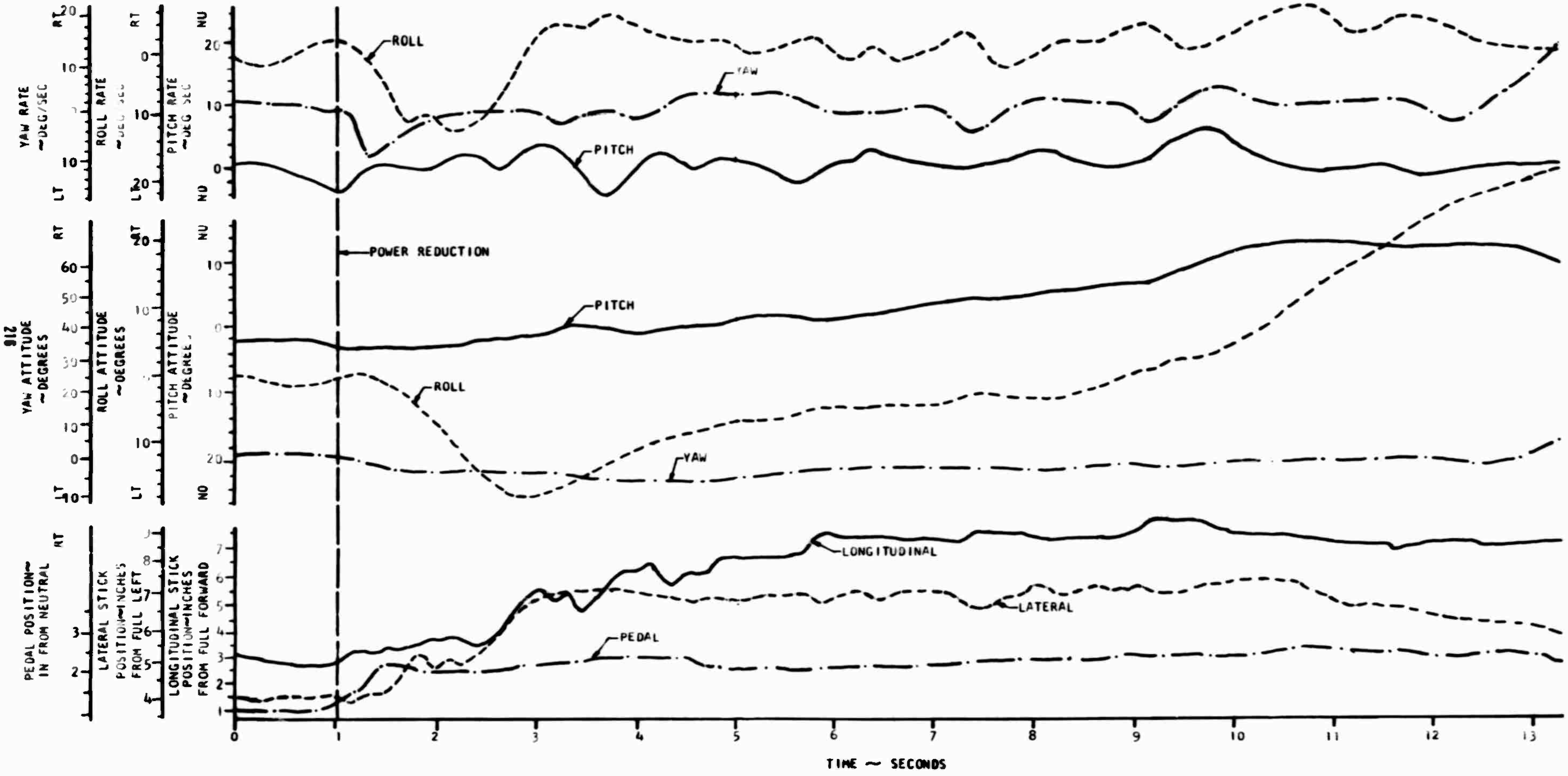


FIGURE NO. 171 (CONTINUED)

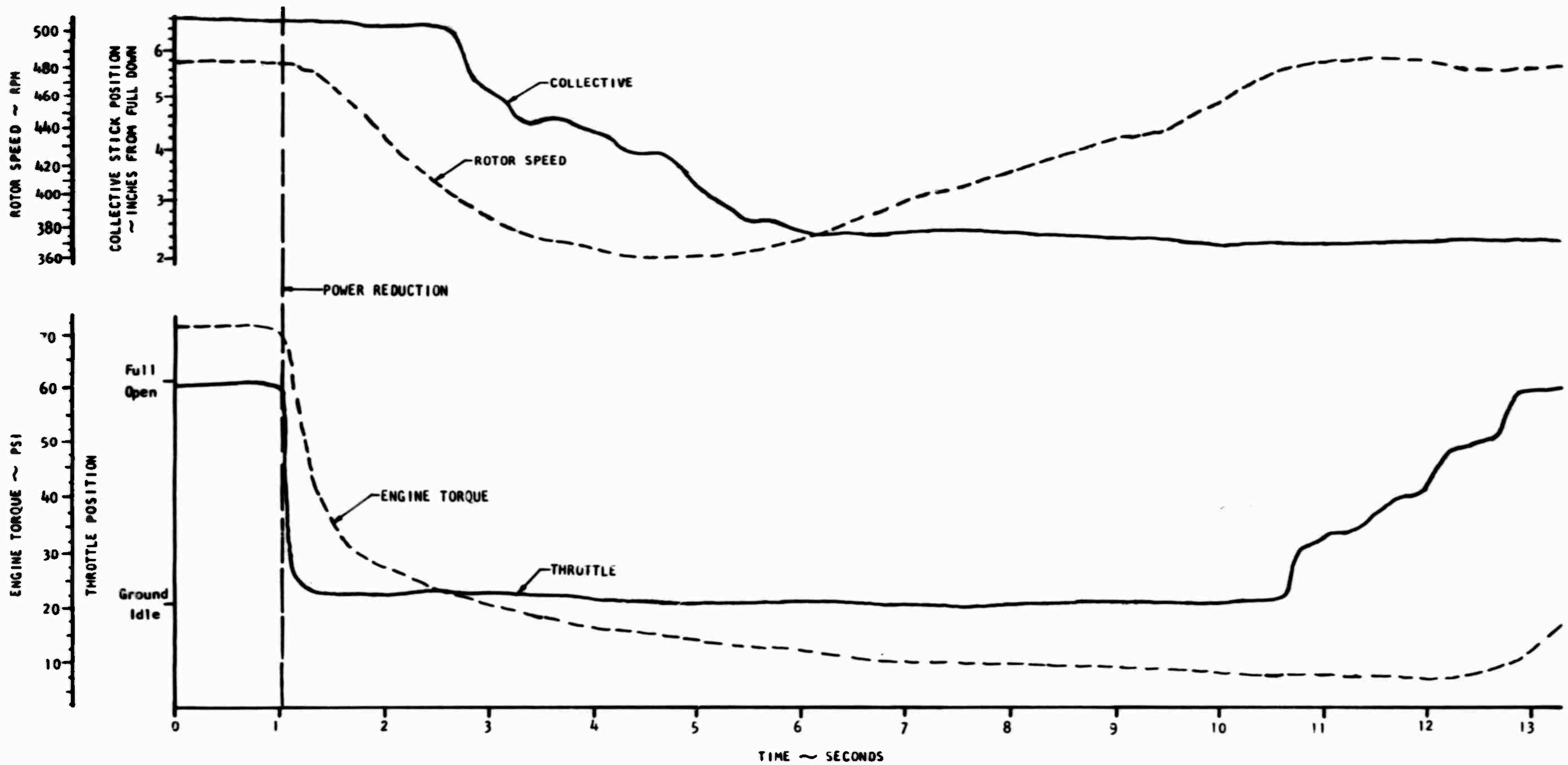


FIGURE NO. 172
AUTOROTATIONAL ENTRY
OH-6A S/N 65-12919
CLEAN CONFIGURATION

TRIM AIRSPEED = 125.5 KCAS   GROSS WEIGHT = 2420 LB
DENSITY ALTITUDE = 2620 FT   ROTOR SPEED = 483 RPM
C.G. LOCATION = 100 IN (MID)   1 SECOND DELAY

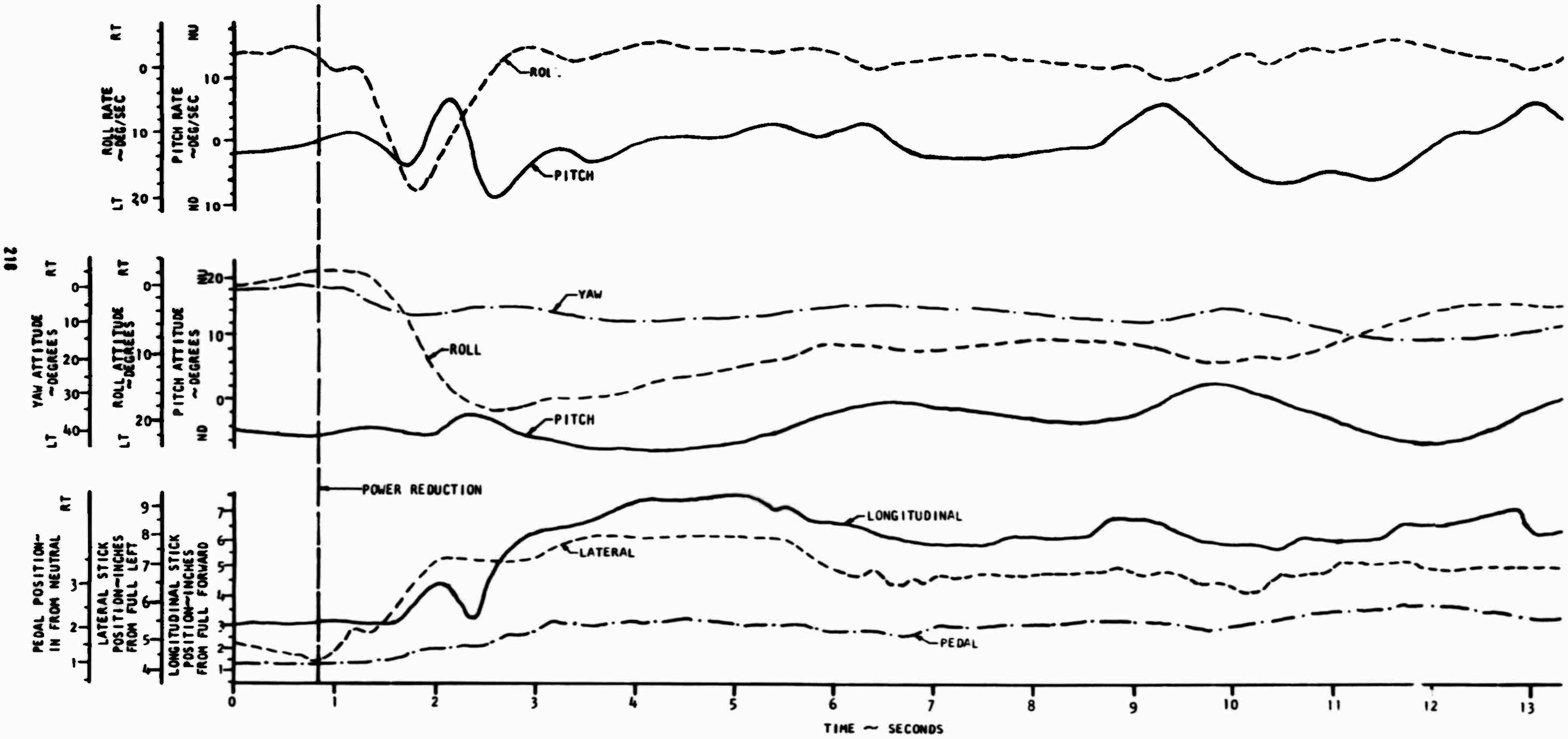
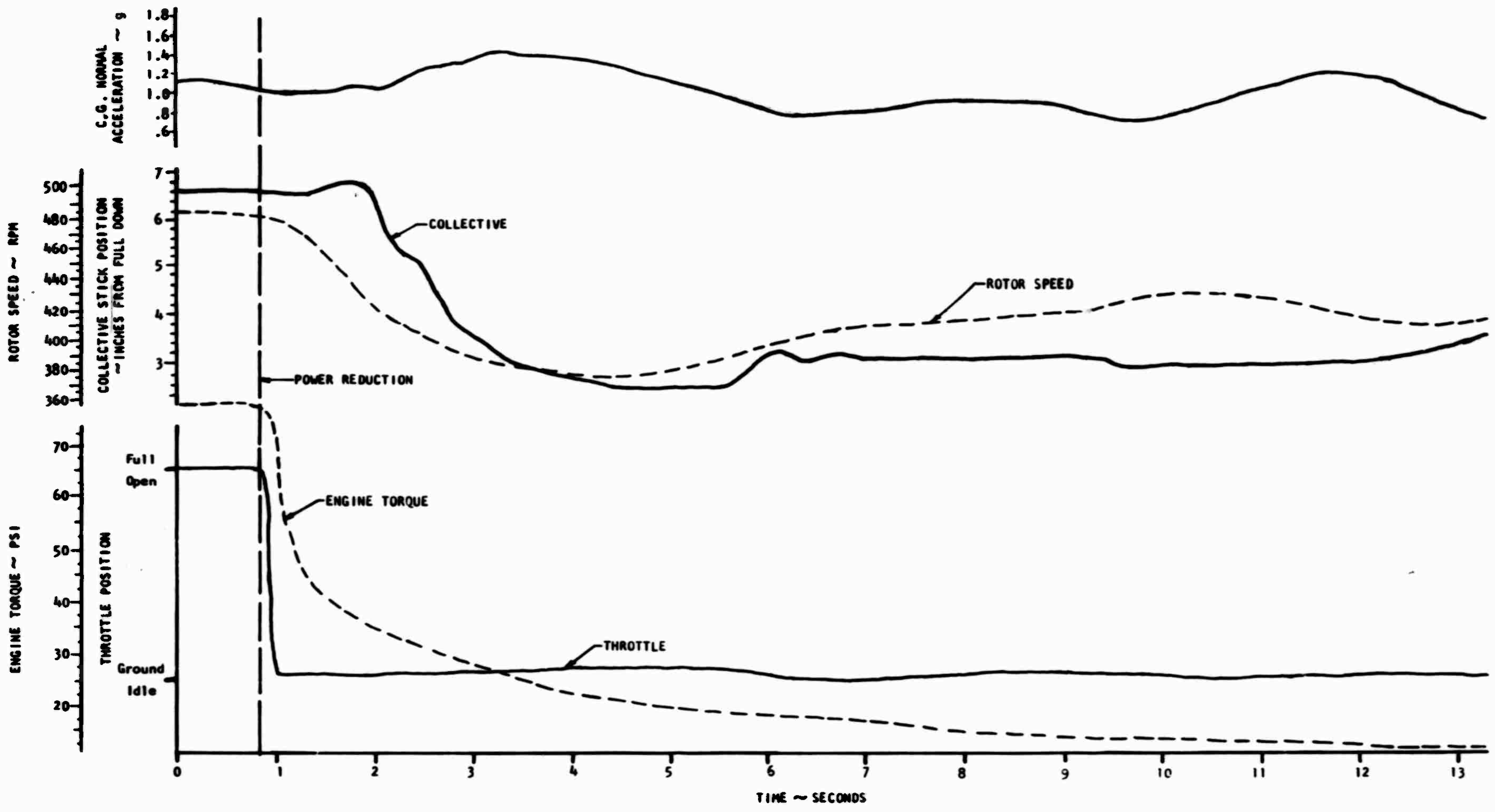


FIGURE NO. 172 (CONTINUED)



APPENDIX II. REFERENCES

1. Letter, Test Directive, US Army Materiel Command (USAMC), Commanding General, subject: "Engineering Flight Tests of the Production OH-6A Helicopter in the Armed and Unarmed Configuration," 10 June 1966.

2. Specification Report, Hughes Tool Company, Aircraft Division, HTC-AD 369-Y-8003, "Detail Specification for a Single Engine, Single Main Rotor Light Observation Helicopter, Army Model Designation OH-6A," 21 April 1965, with revision 26 April 1965.

3. Operator's Manual, TM 55-1520-214-10, "Helicopter, Observation OH-6A (Hughes)," January 1967.

4. Letter, USAAVNTA, SAVTE-M, subject: "OH-6A XM-27 Structural Integrity Program - Contract DA 23-204-AMC-03260(T) DO 23-204-06-00074(T)," 22 December 1967.

5. Letter, Hughes Tool Company, Aircraft Division, subject: "OH-6A Operating Limitations above 2400 Pounds Gross Weight," 21 June 1967.

6. Military Specification MIL-H-8501A, "General Requirements for Helicopter Flying and Ground Handling Qualities," Amendment No. 1, 3 April 1962.

7. Report, USAAVNTA, Project No. 63-25, PART ONE of TWO PARTS, "Report of the Engineering Flight Test - Stability and Control Phase of the OH-6A Helicopter, Unarmed (Clean) and Armed With the XM-7 or XM-8 Weapon Subsystem," August 1964.

8. Report, USAAVNTA, Project No. 63-25, PART TWO of TWO PARTS, "Report of the Engineering Flight Test - Performance Phase of the OH-6A Helicopter, Unarmed (Clean) and Armed With the XM-7 or XM-8 Weapon Subsystem," August 1964.

9. Model Specification, Allison Division of General Motors, No. 580F, "T63-A-5A (250-C10B) Turbine Engine," 1 December 1964.

APPENDIX III. GENERAL AIRCRAFT INFORMATION

DIMENSION AND DESIGN DATA

Overall Dimension

Aircraft length (rotors static)	23.00	ft
Aircraft length (rotors turning)	30.30	ft
Height to top of rotor mast	8.20	ft
Height to top of vertical stabilizer	8.50	ft
Skid width (compressed)	6.80	ft

Main Rotor Group

Rotor diameter	26.33	ft
Total blade area (4 blades)	29.63	ft^2
Disc area	544.63	ft^2
Number of blades	4	
Blade airfoil (root to tip)	NACA 0015	
Blade chord (root to tip)	6.75	in.
Blade twist (root to tip)	$-7^{\circ}\ 58'$	
Solidity ratio	0.0544	

Tail Rotor Group

Rotor diameter	4.25	ft
Total blade area (2 blades)	1.72	ft^2
Disc area	14.20	ft^2
Number of blades	2	
Blade airfoil (root to tip)	NACA 0014	(modified)
Blade chord (root to tip)	4.81	in.
Blade twist (root to tip)	$-5^{\circ}\ 22'$	

Control Travel

Cyclic stick (measured at center of grip)		
Longitudinal	12.55	in.
Lateral	11.55	in.
Collective stick (measured at center of grip)	9.10	in.

Main Rotor Blade Movements

Range of cyclic pitch blade angles from neutral rigging position (collective pitch, mid position)	15°-17°	forward
	8°-9°	aft
	6.5°-8°	left
	5.5°-7°	right
Range of collective pitch blade angles from neutral collective	7°-8.5°	

Pedal (from neutral)		
Left pedal	3.65	in.
Right pedal	3.95	in.

Gear Ratio

Engine to main rotor	12.806:1
Engine to tail rotor	1.987:1

Transmission Limits	75	psi

Operating Limitations

Power turbine speed (N_2)	100% to 103%	
Turbine outlet temperature (TOT)	698°C cont, 749°C for 5 min	
Rotor rpm (power off)	400 to 514 rpm	
Rotor rpm (power on)	465 to 483 rpm	
Maximum airspeed at 2400 pounds gross weight	124	KIAS

POWER PLANT

1. Aircraft power is provided by an Allison T63-A-5A free turbine engine which has a nominal rating of 270 shp derated to 252.5 shp at 100 percent N_2. As installed in the OH-6A, the engine is limited by either the output shaft torque or the gas producer, turbine outlet temperature (TOT). For maximum continuous operation, these limits are 184 ft-lb torque (214.5 shp) at 6000 rpm or 693 degrees Centigrade (°C) TOT, whichever is reached first. For take-off power (maximum of five minutes continuous operation), the limits are 220 ft-lb torque (252.2 shp) or 749 degrees C. The engine is composed of a compressor, combustion chamber and a turbine assembly.

2. The compressor assembly is a multi-stage, axial-centrifical flow compressor. The assembly contains six axial stages and one centrifical stage. Two compressor stages raise the static air pressure by a 6.2:1 ratio and the temperature of the air by approximately 227 °C.

3. The combustion chamber receives the compressed air, which is

4. The turbine assembly contains four turbine stages composing two separate sections. The first and second stages are the gas producer (N_1) turbine, and the third and fourth stages are the power (N_2) turbine. The gas producer turbine drives the rotor of the

compressor section and its related engine accessories through the accessory gearbox. The power turbine is a "free turbine" in that it is free to rotate at a different speed than the gas producer turbine. This is accomplished by N_1 and N_2 being gas coupled rather than mechanically linked. The power turbine develops the torque necessary to drive the power-turbine-accessory gear train and the engine output shaft. The reduction gear train reduces the power turbine speed from 35,000 rpm at 100 percent to an engine output shaft speed of 6000 rpm. Torque is measured from the power-turbine gear train, which provides a hydraulic pressure signal proportional to the output shaft torque.

TRANSMISSION

5. The main transmission is basically a 2-stage, speed-reduction unit utilizing the first reduction stage as output for the tail-rotor drive system, and the second stage to further reduce the rpm to the main rotor. Spiral-bevel type gears are used for speed reduction of the tail and main rotor system. The input gear shaft connected to the engine transmits power to a second gear, concentrically mounted on the tail rotor gear shaft, which in turn drives the output gear connected to the main rotor drive shaft. The transmission is lubricated by a self-contained lubrication system and the oil supply is air cooled. In the event of an internal transmission seizure, an area at the lower end of the main-rotor drive shaft will shear, allowing it to "free wheel."

FLIGHT CONTROL SYSTEM

6. There are three primary flight control systems. They are the cyclic, collective and pedals. All these controls are unboosted.

7. The cyclic stick is mechanically linked by push-pull rods to the main rotor swash plate. Lateral and longitudinal friction of the cyclic stick is adjusted by manually turning a knob at the lower end of the stick, which in turn applies pressure against a slide mechanism. The cyclic stick forces can be trimmed by actuating an electrically-operated, reversible trim motor. The trim motor controls a spring to apply force in the desired direction.

8. The collective stick is mechanically linked to the main rotor swash plate to control the rotor blade pitch. The collective grip allows selection of the engine operation in either the governed or ungoverned range. The beeper switch allows selection of the desired power turbine speed. A friction adjustment grip is provided to vary the force required to move the collective. A knurled twist grip friction nut varies the force to rotate or locks the grip.

9. The pedals are mechanically linked to the tail rotor assembly to control the pitch of the blades. The pedals can be adjusted by removing the pins, located on the top of the pedal arms, and repositioning the pedals. There are no friction adjustments or trim motors to control pedal force.

ELECTRICAL SYSTEM

10. The aircraft electrical systems consist of a primary, 28-volt, direct current (DC) single wire installation and a secondary, 115-volt, 400-cycle alternating current (AC) system.

11. The 28-volt, DC power is supplied by a battery and starter-generator, or from an external, auxiliary power unit connected to the 28-volt DC bus, through the external power receptable. The battery is a rechargeable, 24-volt, 19-cell, nickel-cadium battery which uses a 30 percent (by weight) solution of potassium hydroxide (KOH) and distilled water as the electrolyte. The starter-generator is used to start the aircraft engine and to provide primary 28-volt, DC power for the aircraft electrical system. When performing as a generator, the starter-generator has a maximum continuous-duty rating of 30 volts, 150 amperes over a range of 7200-13,000 rpm.

12. The alternating current system consists of two solid state static inverters, either of which converts the primary 28-volts DC to 115-volts AC. The AC is used to energize the bank attitude and directional gyros.

FUEL SYSTEM

13. The fuel system is composed of two fuel storage cells, a shutoff valve, an engine driven pump and a fuel filter.

14. Two fuel cells are located under the floor of the cargo compartment. The top section of each fuel cell is constructed of a neoprene coated nylon bladder. The bottom section is constructed from two nylon cloth covers impregnated with synthetic rubber. Between the two covers, rubber material is inserted. The usable fuel capacity of both cells is 61.5 gallons. The cells are interconnected by an aluminum fitting and have vents located in the forward and aft end of each cell. The forward end of each cell is interconnected by a vent-crossover fitting that also connects to the emergency shutoff valve. This valve remains open as long as it is within 30 degrees of the vertical. If this angle is exceeded, the valve will close. A drain valve is attached to an aluminum sump on the left cell; since no boost pump is incorporated in the fuel system, drainage is accomplished by gravity feed.

15. The fuel shutoff valve is located on the left cell and is mechanically actuated by a fuel-valve control knob in the cockpit.

16. The fuel-pump and filter assembly incorporates two gear-type pumping elements, arranged in tandem and driven by a common drive shaft. The gear elements are arranged in parallel and each pumping element has sufficient capacity for takeoff-power operations. Two discharge check valves are provided in the assembly to prevent reverse flow in the event one gear pump fails. A bypass valve in the pump assembly allows fuel to bypass a clogged filter element.

APPENDIX IV. TEST INSTRUMENTATION

GENERAL

Sensitive instruments were installed and maintained by USAASTA. The following parameters were recorded:

Pilot's Panel (Visual)

Boom system airspeed
Boom system altimeter
Rotor speed
Angle of sideslip
Longitudinal cyclic stick positon
Lateral cyclic stick position
Collective stick position
Pedal position

Engineer's Panel (Visual)

Ship system airspeed
Ship system altimeter
Fuel flow
Fuel totalizer
Torque pressure
G Force
Compressor inlet pressure
Compressor inlet temperature
Free air temperature
Fuel temperature
Exhaust gas temperature
Oscillograph counter number
Photo counter number

Photo Panel

Boom system airspeed
Boom system altimeter
Torque pressure
Rotor speed
Exhaust gas temperature
Gas producer speed
Free air temperature
Clock
Fuel totalizer
Oscillograph counter number
Photo counter number

Oscillograph

Throttle position
Collective stick position
Linear rotor speed
Power turbine speed
Torque pressure
Gas producer speed
Fuel pressure
Excitation voltage
Longitudinal stick position
Pitch angle
Pitch rate
Pitch acceleration
Angle of attack
Lateral stick position
Roll angle
Roll rate
Roll acceleration
Pedal position
Yaw angle
Yaw rate
Yaw acceleration
Angle of sideslip

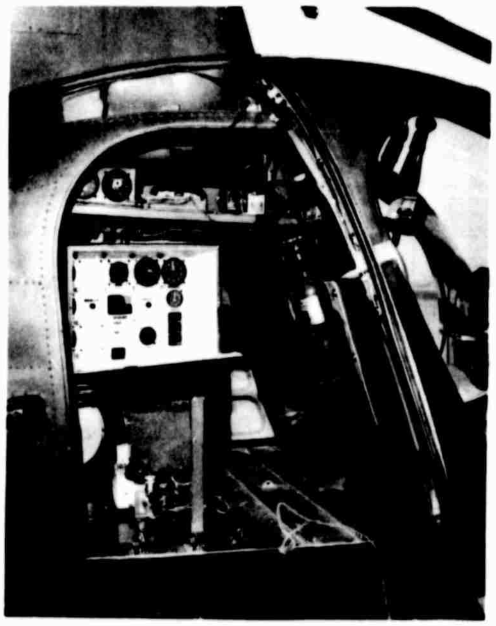


Photo 1.

Photopanel Location.

Photo 2.

Oscillograph Location.

APPENDIX V. PILOT RATING SCALE

<table>
<tr><td rowspan="9">CONTROLLABLE
CAPABLE OF BEING CONTROLLED OR MANAGED IN CONTEXT OF MISSION, WITH AVAILABLE PILOT ATTENTION</td><td rowspan="6">ACCEPTABLE
MAY HAVE DEFICIENCIES WHICH WARRANT IMPROVEMENT, BUT ADEQUATE FOR MISSION.
PILOT COMPENSATION, IF REQUIRED TO ACHIEVE ACCEPTABLE PERFORMANCE, IS FEASIBLE.</td><td rowspan="3">SATISFACTORY
MEETS ALL REQUIREMENTS AND EXPECTATIONS, GOOD ENOUGH WITHOUT IMPROVEMENT
CLEARLY ADEQUATE FOR MISSION.</td><td>EXCELLENT, HIGHLY DESIRABLE</td><td>A1</td></tr>
<tr><td>GOOD, PLEASANT, WELL BEHAVED</td><td>A2</td></tr>
<tr><td>FAIR. SOME MILDLY UNPLEASANT CHARACTERISTICS.
GOOD ENOUGH FOR MISSION WITHOUT IMPROVEMENT.</td><td>A3</td></tr>
<tr><td rowspan="3">UNSATISFACTORY
RELUCTANTLY ACCEPTABLE. DEFICIENCIES WHICH WARRANT IMPROVEMENT. PERFORMANCE ADEQUATE FOR MISSION WITH FEASIBLE PILOT COMPENSATION.</td><td>SOME MINOR BUT ANNOYING DEFICIENCIES. IMPROVEMENT IS REQUESTED. EFFECT ON PERFORMANCE IS EASILY COMPENSATED FOR BY PILOT.</td><td>A4</td></tr>
<tr><td>MODERATELY OBJECTIONABLE DEFICIENCIES. IMPROVEMENT IS NEEDED. REASONABLE PERFORMANCE REQUIRES CONSIDERABLE PILOT COMPENSATION.</td><td>A5</td></tr>
<tr><td>VERY OBJECTIONABLE DEFICIENCIES. MAJOR IMPROVEMENTS ARE NEEDED. REQUIRES BEST AVAILABLE PILOT COMPENSATION TO ACHIEVE ACCEPTABLE PERFORMANCE.</td><td>A6</td></tr>
<tr><td rowspan="3">UNACCEPTABLE
DEFICIENCIES WHICH REQUIRE MANDATORY IMPROVEMENT.
INADEQUATE PERFORMANCE FOR MISSION EVEN WITH MAXIMUM FEASIBLE PILOT COMPENSATION.</td><td rowspan="3"></td><td>MAJOR DEFICIENCIES WHICH REQUIRE MANDATORY IMPROVEMENT FOR ACCEPTANCE. CONTROLLABLE. PERFORMANCE INADEQUATE FOR MISSION, OR PILOT COMPENSATION REQUIRED FOR MINIMUM ACCEPTABLE PERFORMANCE IN MISSION IS TOO HIGH.</td><td>U7</td></tr>
<tr><td>CONTROLLABLE WITH DIFFICULTY. REQUIRES SUBSTANTIAL PILOT SKILL AND ATTENTION TO RETAIN CONTROL AND CONTINUE MISSION.</td><td>U8</td></tr>
<tr><td>MARGINALLY CONTROLLABLE IN MISSION. REQUIRES MAXIMUM AVAILABLE PILOT SKILL AND ATTENTION TO RETAIN CONTROL.</td><td>U9</td></tr>
<tr><td colspan="3">UNCONTROLLABLE
CONTROL WILL BE LOST DURING SOME PORTION OF MISSION.</td><td>UNCONTROLLABLE IN MISSION.</td><td>10</td></tr>
</table>

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* US Army Aviation Systems Test Activity (USAASTA) Edwards Air Force Base, California	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE
ENGINEERING FLIGHT TEST OF THE OH-6A HELICOPTER (CAYUSE) PHASE D

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
Final Report, July 1966 through April 1969

5. AUTHOR(S) *(First name, middle initial, last name)*
John I. Nagata, Project Engineer
John J. Shapley, Jr., Project Pilot

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
April 1969	232	9

8a. CONTRACT OR GRANT NO. b. PROJECT NO. USATECOM Project No. 4-6-0250-01 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) USAASTA Project No. 65-37 9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)* N/A

10. DISTRIBUTION STATEMENT
This document may be further distributed by any holder only with specific prior approval obtained through the Commanding General, HQ, USAMC, ATTN: AMCPM-LH, PO Box 209, St. Louis, Missouri 63166.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Commanding General US Army Materiel Command, ATTN: AMCPM-LH P.O. Box 209, St. Louis, Missouri 63166

13. ABSTRACT

Performance and stability and control tests were conducted on the OH-6A helicopter to determine compliance with the detail specification HTC-AD 369-Y-8003 and to provide information for the operator's manual. Testing was performed by the US Army Aviation Systems Test Activity, Edwards Air Force Base, California. The testing consisted of 136 productive flight hours and was conducted from November 1966 to February 1968. The testing was conducted at Edwards Air Force Base, California and at auxiliary test sites at Bakersfield and Bishop, California. The OH-6A met all performance guarantees except for the OGE Standard Day, 2613 pound gross weight, sea level hover guarantee. For this condition the hover height was 15 feet. The overall stability and control characteristics were considered satisfactory and complied with the requirements of military specification 8501-A with the allowed deviations in the detail specification with the exception of the maximum roll rate allowed in paragraph 3.3.15, which was exceeded but was satisfactory. Three deficiencies, the emergency door release, the battery location and the absence of an electrical disconnect and the inability of balancing the tail rotor, were found during the program. There were also seventeen shortcomings, which, if corrected, would improve the aircraft's operation and mission capabilities.

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Performance						
Stability and control						
OH-6A						
OGE Standard day						
2613 pound gross weight						
Sea Level hover guarantee						
Maximum roll rate						
Deficiencies						
Emergency door release						
Battery location						
Electrical disconnect						
Balancing of tail rotor						
Shortcomings						