NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

WARTIME REPORT

ORIGINALLY ISSUED

November 1944 as
Advance Confidential Report 4H15

WIND-TUNNEL INVESTIGATION OF AILERONS ON A LOW-DRAG AIRFOIL

III - THE EFFECT OF TABS

By Ralph W. Holtzclaw and Robert M. Crane

Ames Aeronautical Laboratory
Moffett Field, California

WASHINGTON

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

ADVANCE CONFIDENTIAL REPORT

WIND-TUNNEL INVESTIGATION OF AILERONS ON A LOW-DRAG AIRFOIL

III - THE EFFECT OF TABS

By Ralph W. Holtzclaw and Robert M. Crane

SUMMARY

An investigation was made of the effects of 0.20-aileron-chord tabs on an NACA 66,2-216 ($a = 0.6$) airfoil equipped with a 0.20-airfoil-chord plain sealed aileron. The aileron profiles considered consisted of one profile conforming to the normal NACA 66,2-216 ($a = 0.6$) ordinates and a profile consisting of straight-line surfaces from the trailing edge to the hinge-line ordinates of the aileron.

Basic data are presented from which the effect of tabs can be calculated for specific cases. The data are sufficient for the solution of problems of fixed tabs with a differential linkage, as well as simple and spring-linked balancing tabs.

INTRODUCTION

With every increase in size and speed of airplanes, the problem of attaining adequate lateral control without excessive control forces becomes less amenable to solution by simple aerodynamic balancing methods. Of the various methods of aerodynamic balance available, one of the most efficient is the sealed internal nose balance. However, sufficient lightness of control frequently cannot be attained by the use of an internal nose balance alone. The necessary balance may be so large that the required control-surface deflection cannot be obtained, or structural requirements of the main surfaces may be such that adequate balance cannot be incorporated in the design. The aerodynamic effects of adjusting aileron hinge moments by alterations to the aileron profile by thinning and thickening the control surface have been shown in reference 1, and in reference 2 by thickening and beveling the control-surface trailing edge. Results of tests reported in references 3 to 5 have shown tabs to be an effective means of adjusting hinge-moment characteristics when used as fixed tabs in conjunction with a differential linkage, or as simple or spring-linked balancing tabs.

The purpose of the tests reported herein was to obtain quantitative data on the effect of tabs on the characteristics of ailerons on a low-drag airfoil in two-dimensional flow.

The tests were made in the 7- by 10-foot wind tunnel at Ames Aeronautical Laboratory.

COEFFICIENTS AND CORRECTIONS

The coefficients used in the presentation of results follow:

c_l	airfoil section lift coefficient (l/qc)
c_m	airfoil section pitching-moment coefficient (m/qc^2)
c_{h_a}	aileron section hinge-moment coefficient $(h_a/qc_a{}^2)$
c_{h_t}	tab section hinge-moment coefficient $(h_t/qc_t{}^2)$
P/q	internal static pressure at aileron nose divided by dynamic pressure (fig. 1)
Δc_l	increment of c_l due to deflecting the aileron from neutral
$\Delta P/q$	increment of pressure coefficient across aileron nose seal (pressure below seal minus pressure above seal divided by dynamic pressure)

where

l	airfoil section lift
m	airfoil section pitching moment about quarter chord of airfoil
h_a	airfoil section hinge moment
h_t	tab section hinge moment
c	chord of airfoil with surfaces neutral
c_a	chord of aileron aft of aileron hinge line
c_t	chord of tab aft of tab hinge line
q	dynamic pressure of air stream $\left(\frac{1}{2}\rho V^2\right)$
V	free-stream velocity

In addition to the preceding, the following symbols are employed:

α_0	angle of attack for airfoil of infinite aspect ratio
δ_a	aileron deflection with respect to the airfoil
δ_t	tab deflection with respect to the aileron

The lift coefficients have been corrected for tunnel-wall effects. A comparison of force-test and pressure-distribution measurements of section lift coefficient and section pitching-moment coefficient indicated that the end plates had no effect on the coefficients with the surfaces neutral. No corrections have been applied to section hinge-moment coefficients and no end-plate correction has been applied to Δc_l. Because of possible tip losses, it is believed that the measured aileron effectiveness is slightly low and rates of roll computed from these data will be conservative. By comparison of these data with section data on a similar airfoil (reference 6), it is estimated that the decrease in the value of Δc_l due to this effect is not more than 12 percent.

MODEL AND APPARATUS

The airfoil was constructed of laminated mahogany to the NACA 66,2-216 (a = 0.6) profile of 4-foot chord and 5-foot span. The airfoil ordinates are given in table I. The ailerons were constructed of laminated mahogany and had a plain radius nose and a nose-gap seal of dental rubber dam. The aileron ordinates are given in table II. The ordinates of the normal-profile aileron are the same as the corresponding ordinates of the NACA 66,2-216 (a = 0.6) airfoil, and the ordinates of the straight-sided profile are the same as those of the straigh-sided aileron of reference 1. The full-span tabs were constructed of steel in four sections to minimize the spanwise bending. The tabs had a radius nose and an unsealed nose gap of 0.0008c. The ordinates of the tabs are the same as the corresponding ordinates of the ailerons. Details of the ailerons and tabs are shown in figures 1 and 2.

TEST INSTALLATION

The airfoil was mounted vertically in the test section of the AAL 7- by 10-foot wind tunnel No. 1 as shown in the photograph of figure 3. End plates were attached to the 5-foot-span section. Fairings of the same airfoil section as the wing were fastened to the tunnel floor and ceiling turntables and were used to shield the connections between the model and balance frame. These fairings were not equipped with ailerons. Provisions were made for changing the angle of attack and the aileron angle while the tunnel was in operation. Aileron and tab hinge moments were measured by means of electrical resistance-type strain gages which were mounted on members restraining the torque tubes of the surfaces from rotation.

TESTS

For each of the two aileron profiles, aileron characteristics were obtained at a Reynolds number of 9,000,000 for angles of attack of -4.13°, -2.06°, 0.01°, 2.07°, and 4.14°. These data covered a range of aileron angles of $\pm 20^\circ$ and a range of tab angles of $\pm 25^\circ$. Similar data were obtained at angles of attack of 8.27° and 12.37° at test Reynolds numbers of 6,700,000 and 5,500,000, respectively. With the aileron neutral, section characteristics were obtained for tab deflections from -25° to 25° at a Reynolds number of 8,200,000.

RESULTS

The basic section data, with aileron and tab deflected and neutral, are presented in figures 4 to 11 for the normal-profile aileron and in figures 12 to 19 for the straight-sided profile aileron. These data may be utilized to predict the section characteristics of ailerons with internal nose balance by means of the equation

$$(c_h)_B = c_h + \Delta P/q \, \frac{(B^2 - R^2)}{2}$$

where

$(c_h)_B$ aileron section hinge-moment coefficient of aileron with sealed internal nose balance

c_h aileron section hinge-moment coefficient of plain sealed aileron

B nose balance (expressed as fraction of c_a)

R nose radius of plain aileron (expressed as fraction of c_a)

While the basic data are useful for purposes of design, the prediction and comparison of the effects of tabs may be conveniently demonstrated by means of section parameters. These section parameters as taken from the data contained herein are summarized in table III.

Ames Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Moffett Field, Calif.

REFERENCES

1. Crane, Robert M., and Holtzclaw, Ralph W.: Wind-Tunnel Investigations of Ailerons on a Low-Drag Airfoil. I – The Effect of Aileron Profile. NACA ACR No. 4A14, 1944.

2. Crane, Robert M., and Holtzclaw, Ralph W.: Wind-Tunnel Investigation of Ailerons on a Low-Drag Airfoil. II – The Effect of Thickened and Beveled Trailing Edges. NACA ACR No. 4A15, 1944.

3. Soulé, H. A., and Hootman, James A.: A Flight Investigation of the Reduction of Aileron Operating Force by Means of Fixed Tabs and Differential Linkage with Notes on Linkage Design. NACA TN No. 653, June 1938.

4. Rogallo, F. M., and Purser, Paul E.: Wind-Tunnel Investigation of a Plain Aileron with Various Trailing-Edge Modifications on a Tapered Wing. III – Ailerons with Simple and Spring-Linked Balancing Tabs. NACA ARR, Jan. 1943.

5. Morgan, M. B., Morris, D. E., and Bethwaite, C. F.: Flight Tests of Spring Tab Ailerons on a Spitfire. Rep. Aero. 1771, British R.A.E., Aug. 1942.

6. Denaci, H. G., and Bird, J. D.: Wind-Tunnel Tests of Ailerons at Various Speeds. II – Ailerons of 0.20 Airfoil Chord and True Contour with 0.60 Aileron-Chord Sealed Internal Balance on the NACA 66,2-216 Airfoil. NACA ACR No. 3F18, 1943.

A-18

TABLE I.- NACA 66,2-216 (a = 0.6) AIRFOIL
(Stations and ordinates are given in percent of the airfoil chord)

Upper surface		Lower surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.371	1.242	.629	-1.112
.607	1.501	.893	-1.319
1.091	1.886	1.409	-1.608
2.317	2.615	2.683	-2.127
4.794	3.701	5.206	-2.869
7.284	4.563	7.716	-3.441
9.781	5.308	10.219	-3.934
14.788	6.500	15.212	-4.702
19.806	7.428	20.194	-5.290
24.832	8.155	25.168	-5.741
29.862	8.708	30.138	-6.080
34.897	9.098	35.103	-6.312
39.936	9.356	40.064	-6.462
44.978	9.471	45.022	-6.523
50.023	9.431	49.977	-6.483
55.073	9.224	54.927	-6.336
60.141	8.800	59.859	-6.048
65.191	8.084	64.809	-5.574
70.198	7.068	69.802	-4.866
75.181	5.889	74.819	-4.037
80.148	4.585	79.852	-3.107
85.106	3.265	84.894	-2.177
90.061	1.937	89.939	-1.235
95.021	.762	94.979	-.432
100	0	100	0
Leading-edge radius: 1.575		Trailing-edge radius: 0.0625	

TABLE II.- ORDINATES OF THE 0.20c AILERONS USED ON THE NACA 66,2-216 (a = 0.6) AIRFOIL

Wing Station	Normal profile		Straight-sided profile	
	Upper	Lower	Upper	Lower
81.25	4.27	-2.85	4.27	-2.85
83.33	3.77	-2.45	3.80	-2.55
85.42	3.21	-2.07	3.33	-2.24
87.50	2.65	-1.67	2.88	-1.93
89.58	2.08	-1.28	2.40	-1.61
91.67	1.54	-.91	1.93	-1.30
93.75	1.06	-.58	1.44	-.99
95.83	.63	-.33	.98	-.68
97.92	.31	-.17	.51	-.36
100	0	0	0	0
Nose radius: 3.75 Trailing-edge radius: 0.0625				

TABLE III.- SECTION PARAMETERS OF THE NACA 66,2-216 (a = 0.6) AIRFOIL EQUIPPED WITH 0.20c PLAIN SEALED AILERONS AND 0.20c_a PLAIN UNSEALED TABS

Parameter	Reynolds number	Normal profile	Straight-sided profile
$\partial\alpha/\partial\delta_a$	----------	0.4055	0.377
$\partial\alpha/\partial\delta_t$	----------	.0998	.0854
$(\partial c_l/\partial\alpha)_{\delta_a = \delta_t = 0^\circ}$	8,200,000	.1053	.0995
$(\partial c_l/\partial\delta_a)_{\alpha_0 = \delta_t = 0^\circ}$	9,000,000	.0427	.0375
$(\partial c_l/\partial\delta_t)_{\alpha_0 = \delta_a = 0^\circ}$	9,000,000	.0105	.0085
$(\partial c_{h_a}/\partial\alpha)_{\delta_a = \delta_t = 0^\circ}$	8,200,000	-.0048	.0017
$(\partial c_{h_a}/\partial\delta_a)_{\alpha_0 = \delta_t = 0^\circ}$	9,000,000	-.0096	-.0050
$(\partial c_{h_a}/\partial\delta_t)_{\alpha_0 = \delta_a = 0^\circ}$	9,000,000	-.0085	-.0075
$(\partial c_{h_t}/\partial\alpha)_{\delta_a = \delta_t = 0^\circ}$	8,200,000	-.0028	.0024
$(\partial c_{h_t}/\partial\delta_a)_{\alpha_0 = \delta_t = 0^\circ}$	9,000,000	-.0044	.0010
$(\partial c_{h_t}/\partial\delta_t)_{\alpha_0 = \delta_a = 0^\circ}$	9,000,000	-.0074	-.0039
$\left(\frac{\partial\Delta P/q}{\partial\alpha}\right)_{\delta_a = \delta_t = 0^\circ}$	8,200,000	.009	.009
$\left(\frac{\partial\Delta P/q}{\partial\delta_a}\right)_{\alpha_0 = \delta_t = 0^\circ}$	9,000,000	.06	.06
$\left(\frac{\partial\Delta P/q}{\partial\delta_t}\right)_{\alpha_0 = \delta_a = 0^\circ}$	9,000,000	.0055	.003

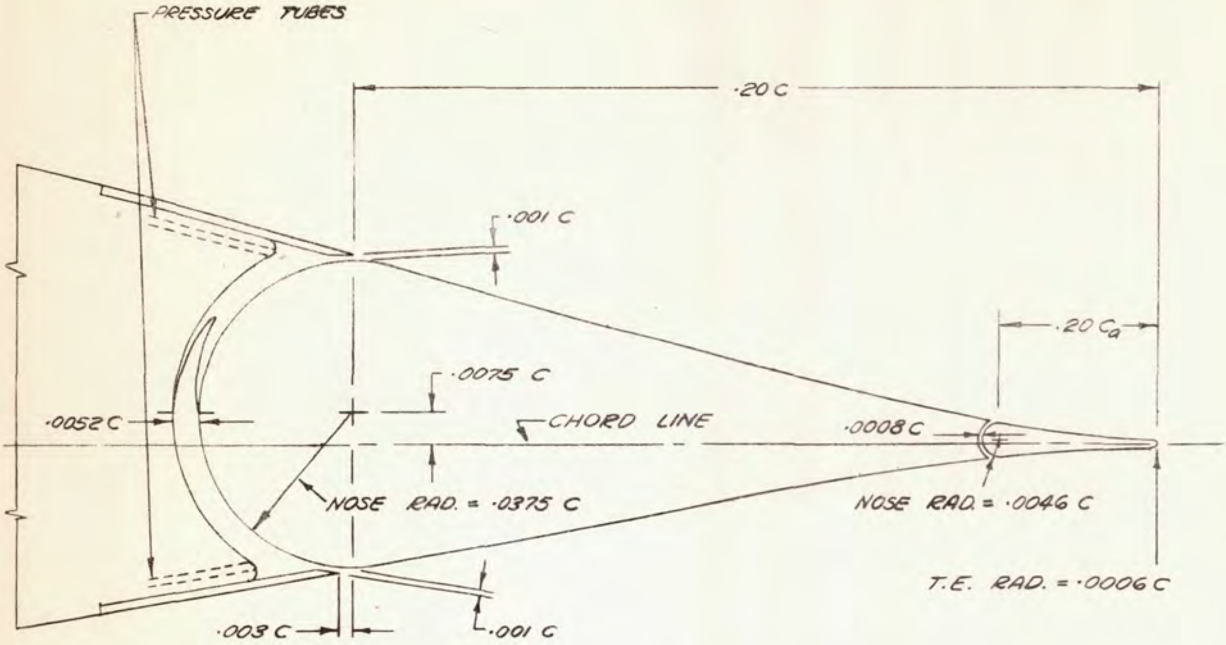


FIGURE 1.- THE 0.20 AILERON CHORD TAB ON THE NORMAL - PROFILE AILERON

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

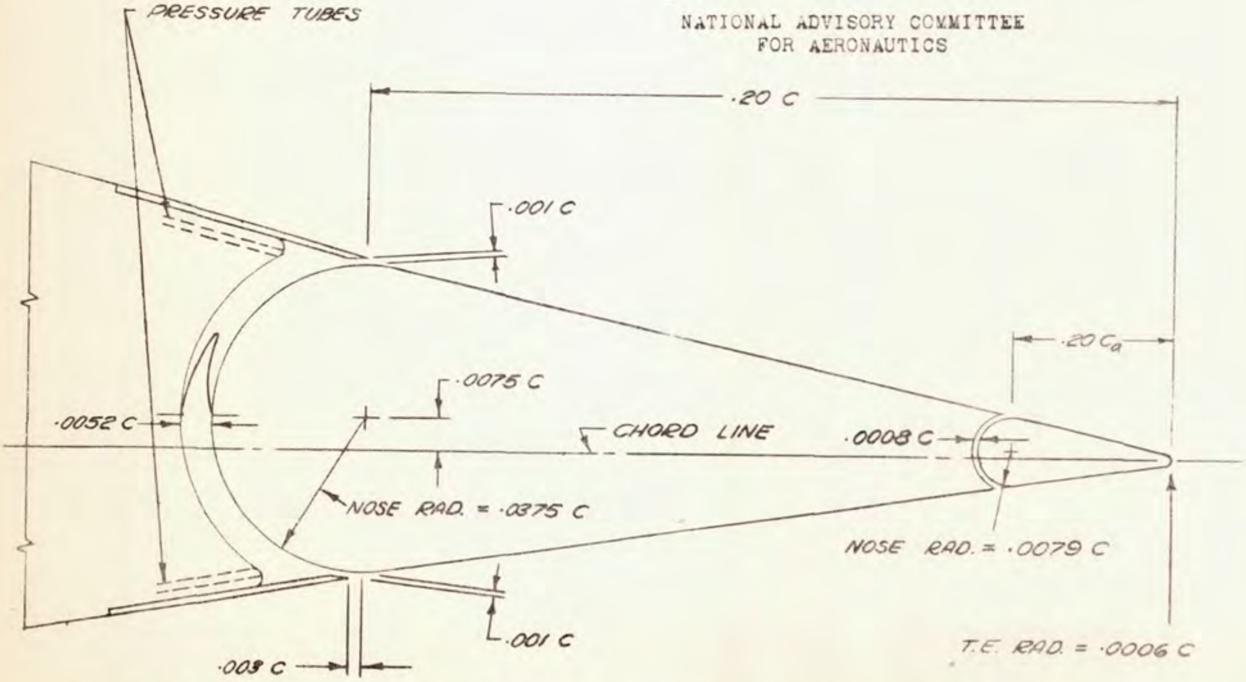


FIGURE 2.- THE 0.20 AILERON CHORD TAB ON THE STRAIGHT - SIDED PROFILE AILERON

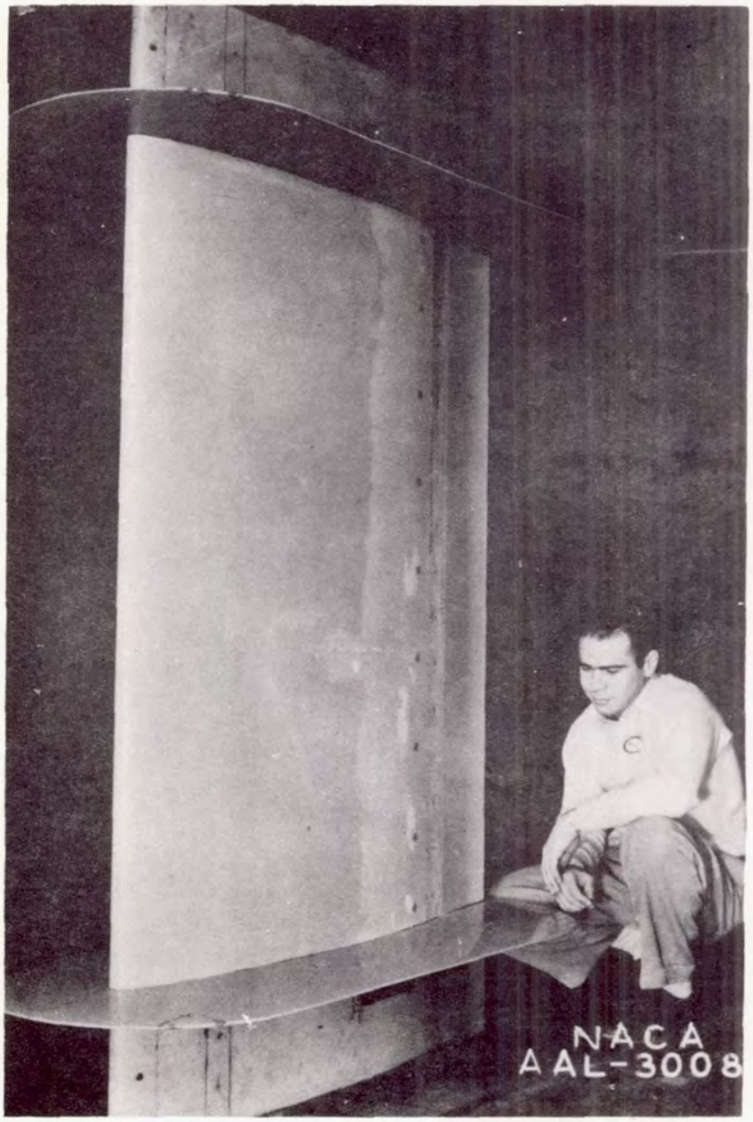
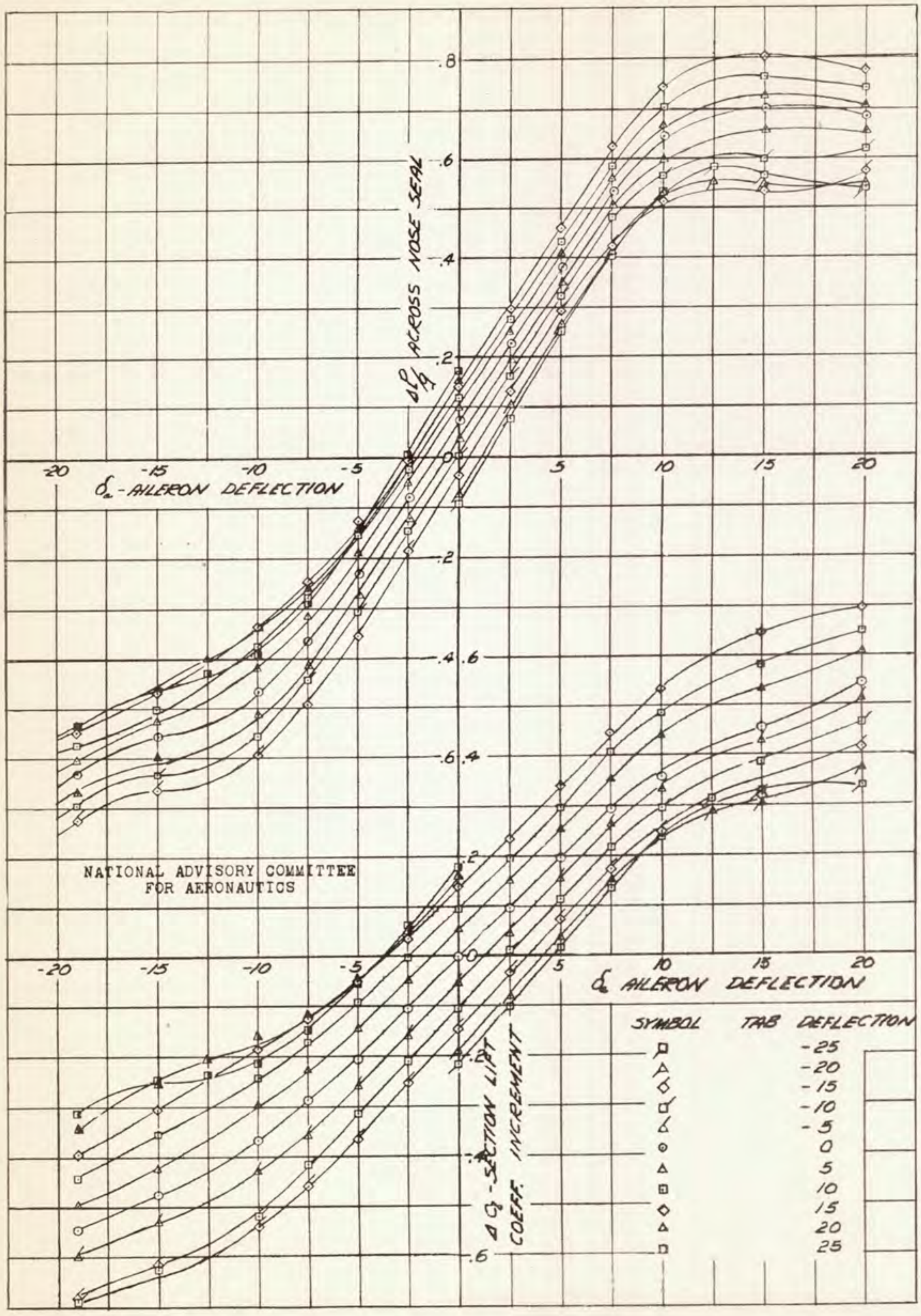
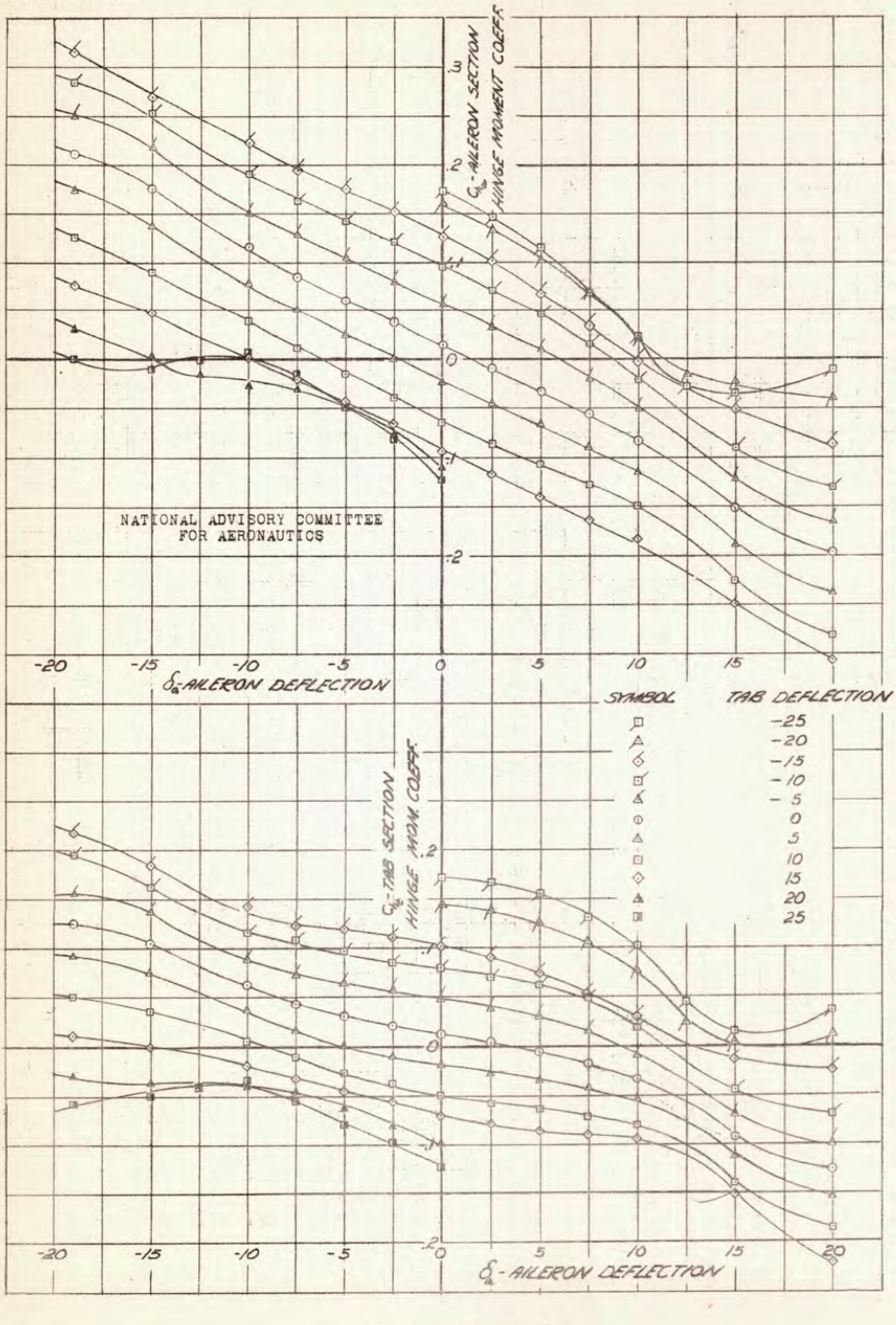


Figure 3.- The NACA 66,2-216 (a = 0.6) airfoil mounted in the 7- by 10-foot wind tunnel.



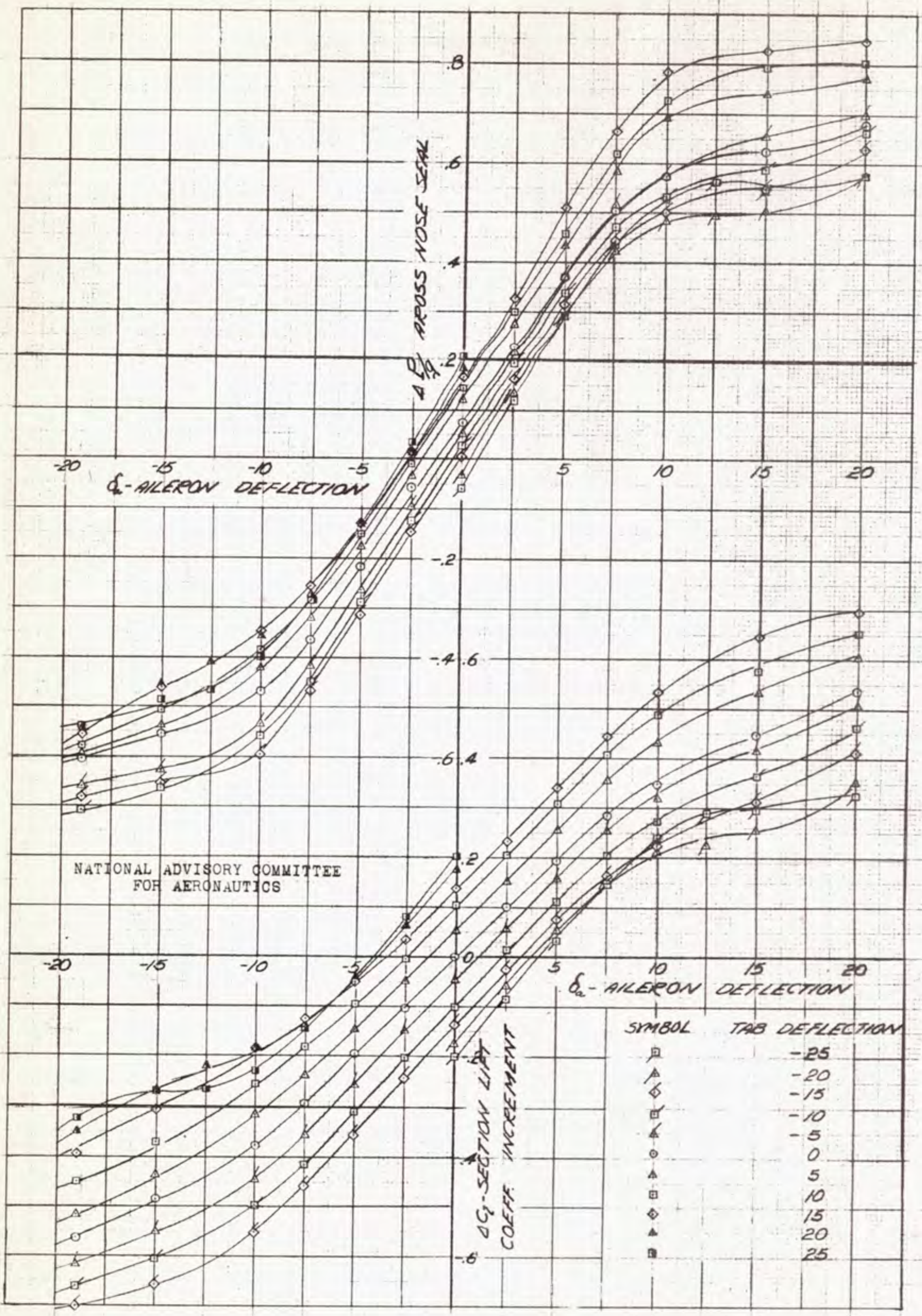
$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 4.(a)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66 2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20 CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 c_a PLAIN INSET TAB, q = 180 LB/SQ FT, R = 9,000,000; α_0 = -4.13°.



c_{h_a} AND c_{h_t} VS. δ_a

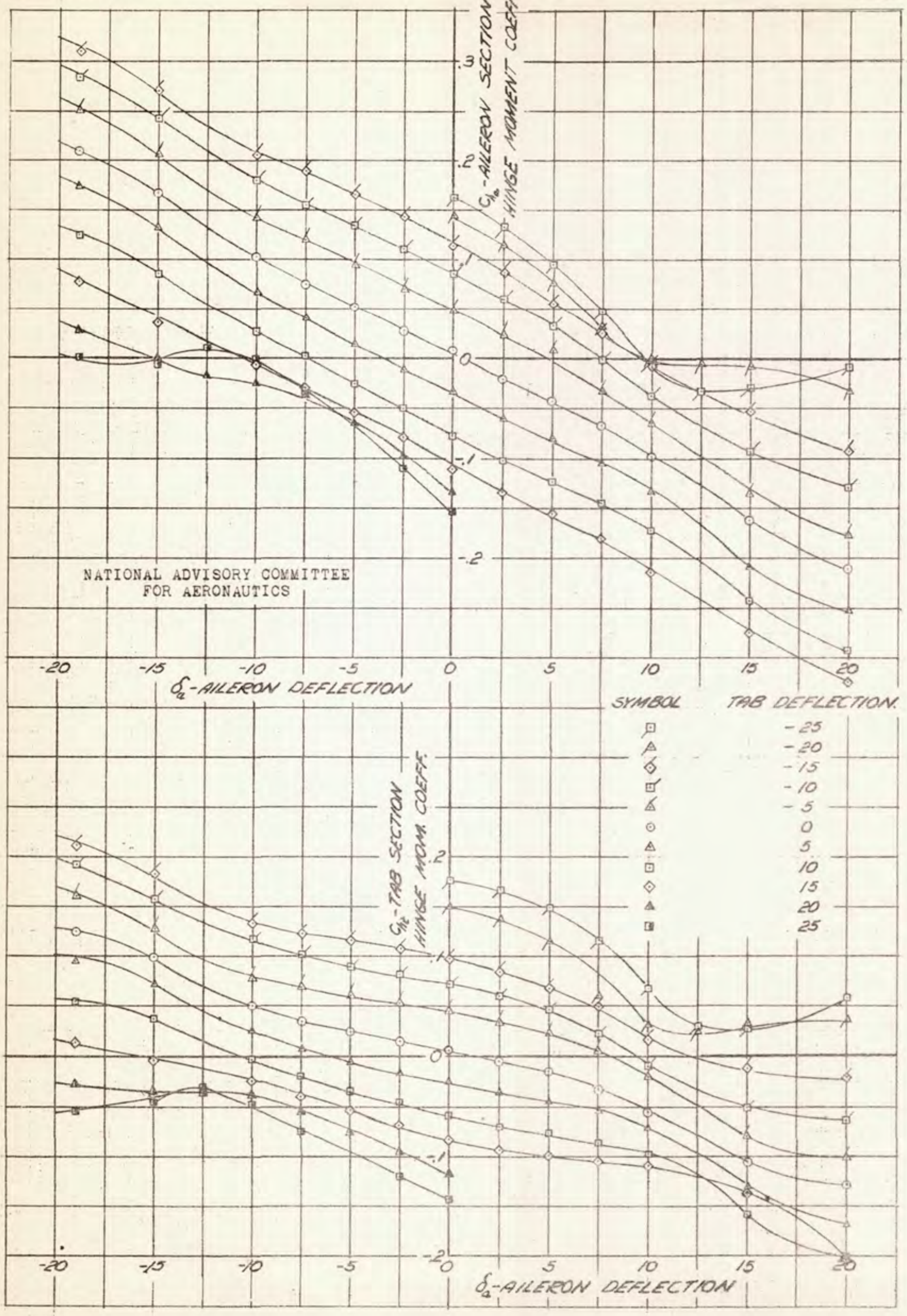
FIGURE 4(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED - GAP PLAIN AILERON OF NORMAL PROFILE. WITH A 0.20c_a PLAIN INSET TAB; q = 180 LB/SQ FT; R = 9,000,000; $\alpha_o = -4.13°$



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 5(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 c_a PLAIN INSET TAB

q = 180 LBS/SQ FT R = 9,000,000 α_0 = -2.06°

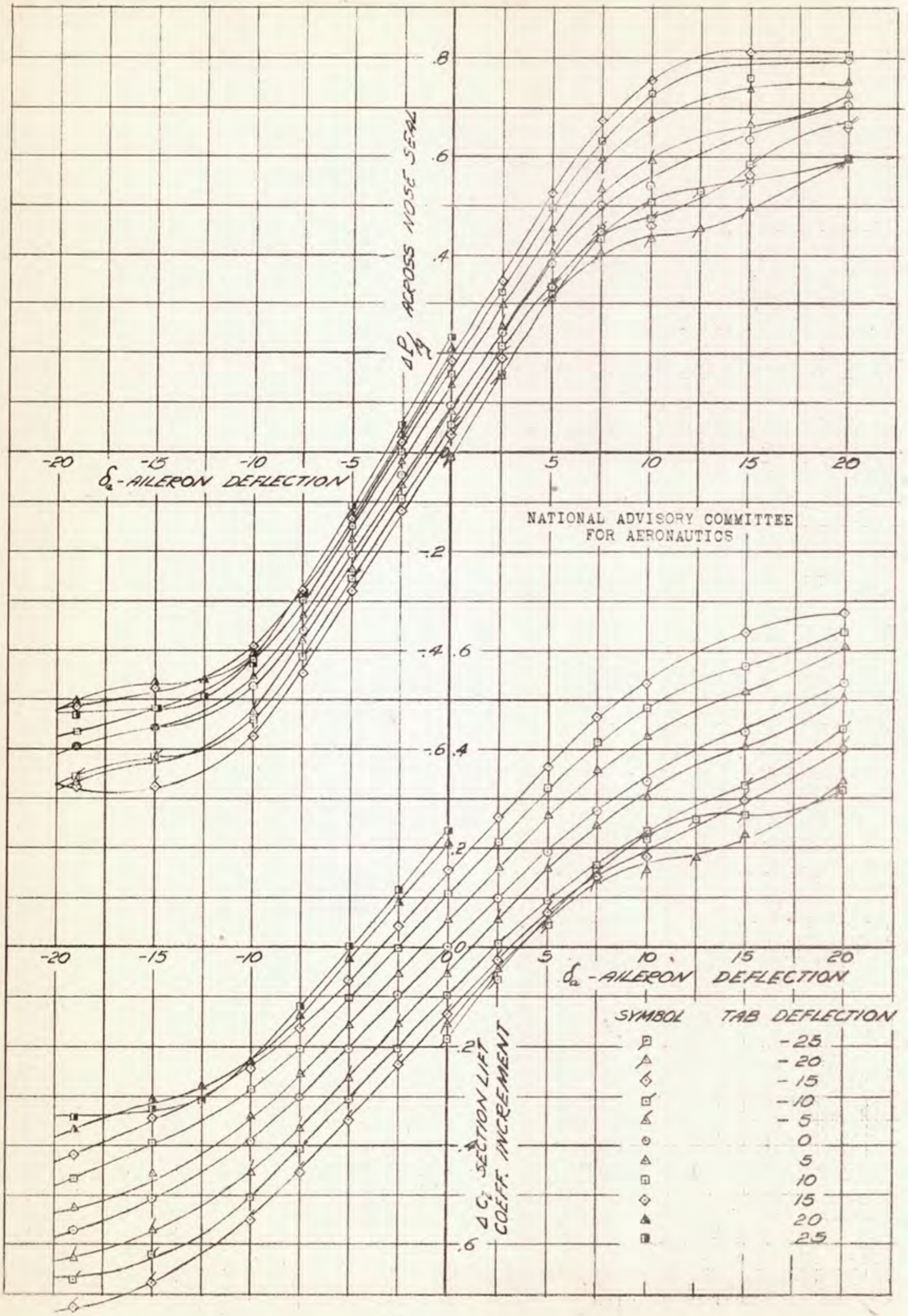


NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

c_{h_a} AND c_{h_t} VS. δ_a

FIGURE 5(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a = 0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20c_a PLAIN INSET TAB.

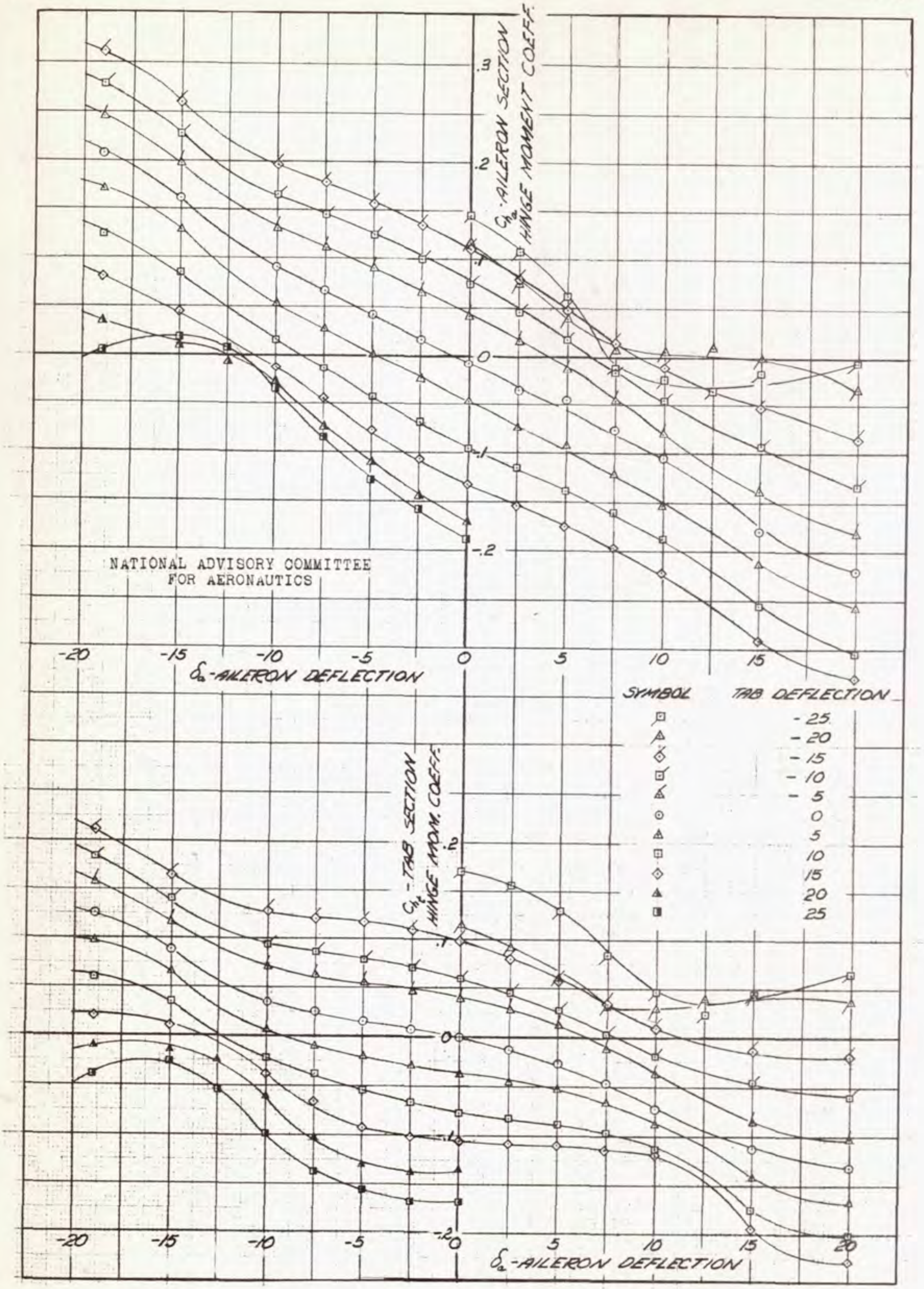
q = 180 LB/SQ FT. R = 9,000,000 α_0 = -2.06°



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 6(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20c_a PLAIN INSET TAB

q = 180 LB/SQ FT. R = 9,000,000 oc_t = 0.01c

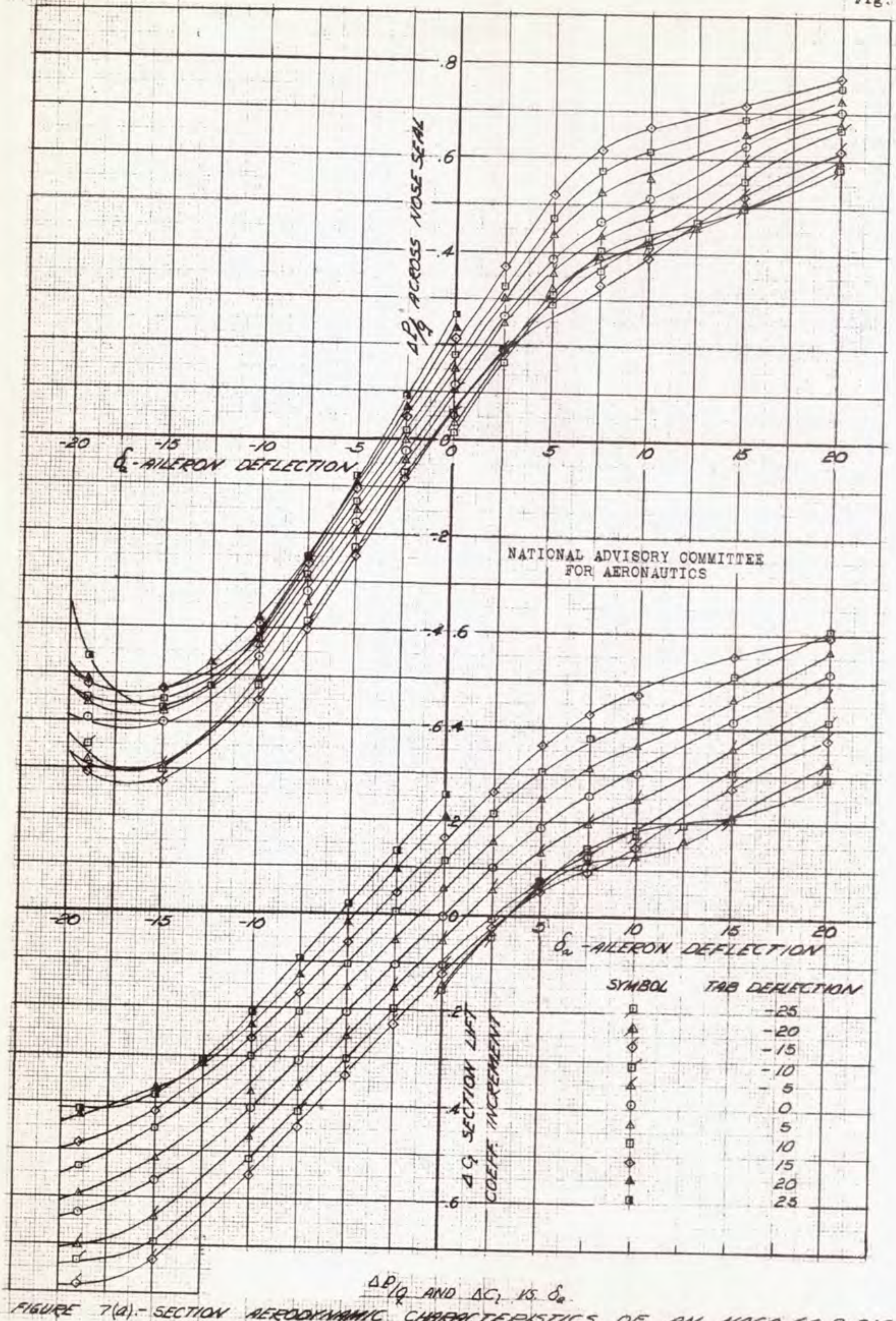


NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

C_{h_a} AND C_{h_t} VS δ_a

FIGURE 6(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A $0.20c_a$ PLAIN INSET TAB.

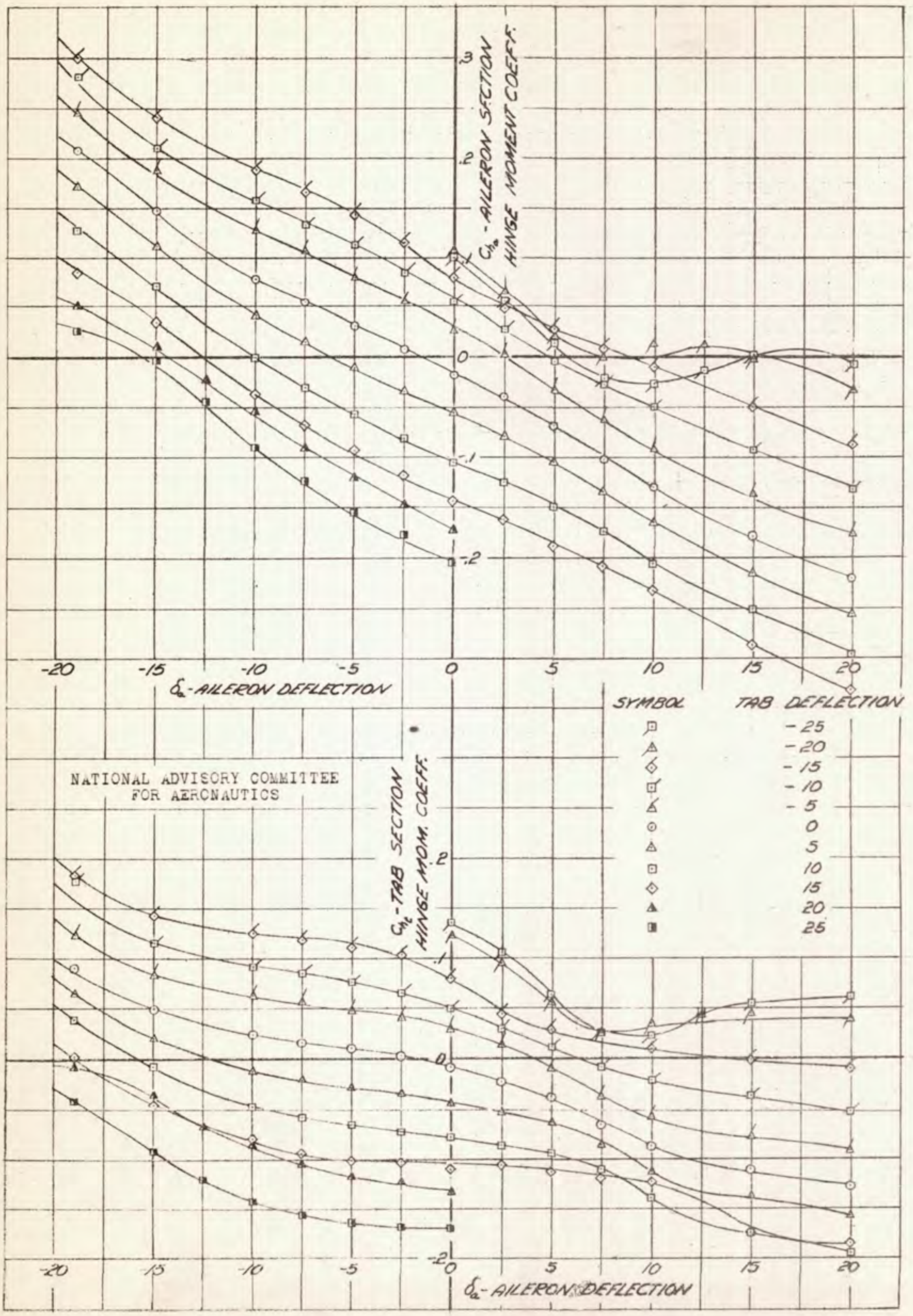
$q = 180$ LB/SQ FT. $R = 9,000,000$ $\alpha_0 = 0.01°$



ΔP/q AND ΔC_l VS. δ_a

FIGURE 7(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66, 2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 C_a PLAIN INSET TAB.

q = 180 LB/SQ. FT. R = 9,000,000 α_0 = 2.07°

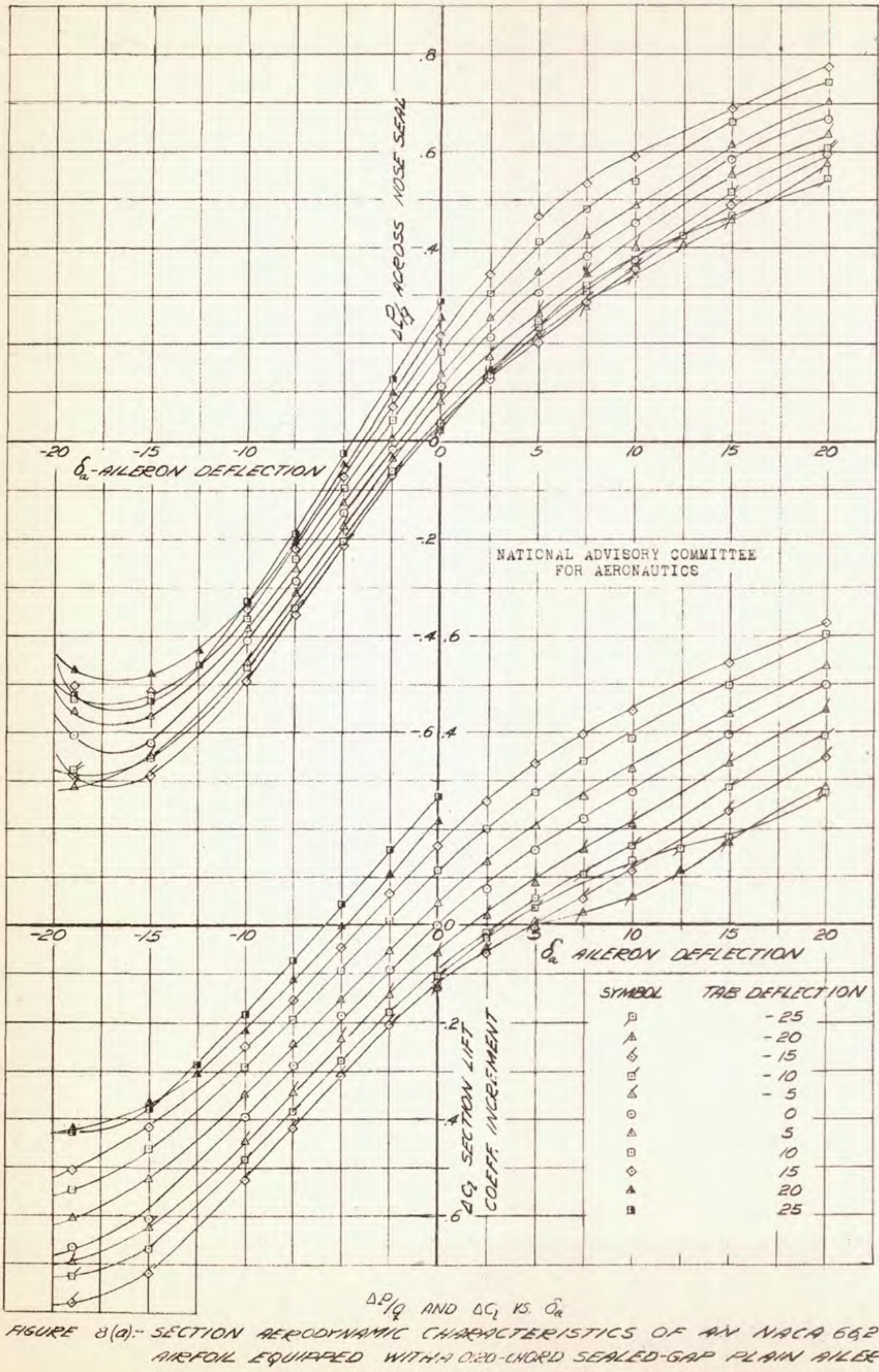


C_{h_a} AND C_{h_t} VS. δ_a

FIGURE 7(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 c_a PLAIN INSET TAB.

$q = 180$ LB/SQ FT. $R = 9,000,000$ $\alpha_0 = 2.07°$

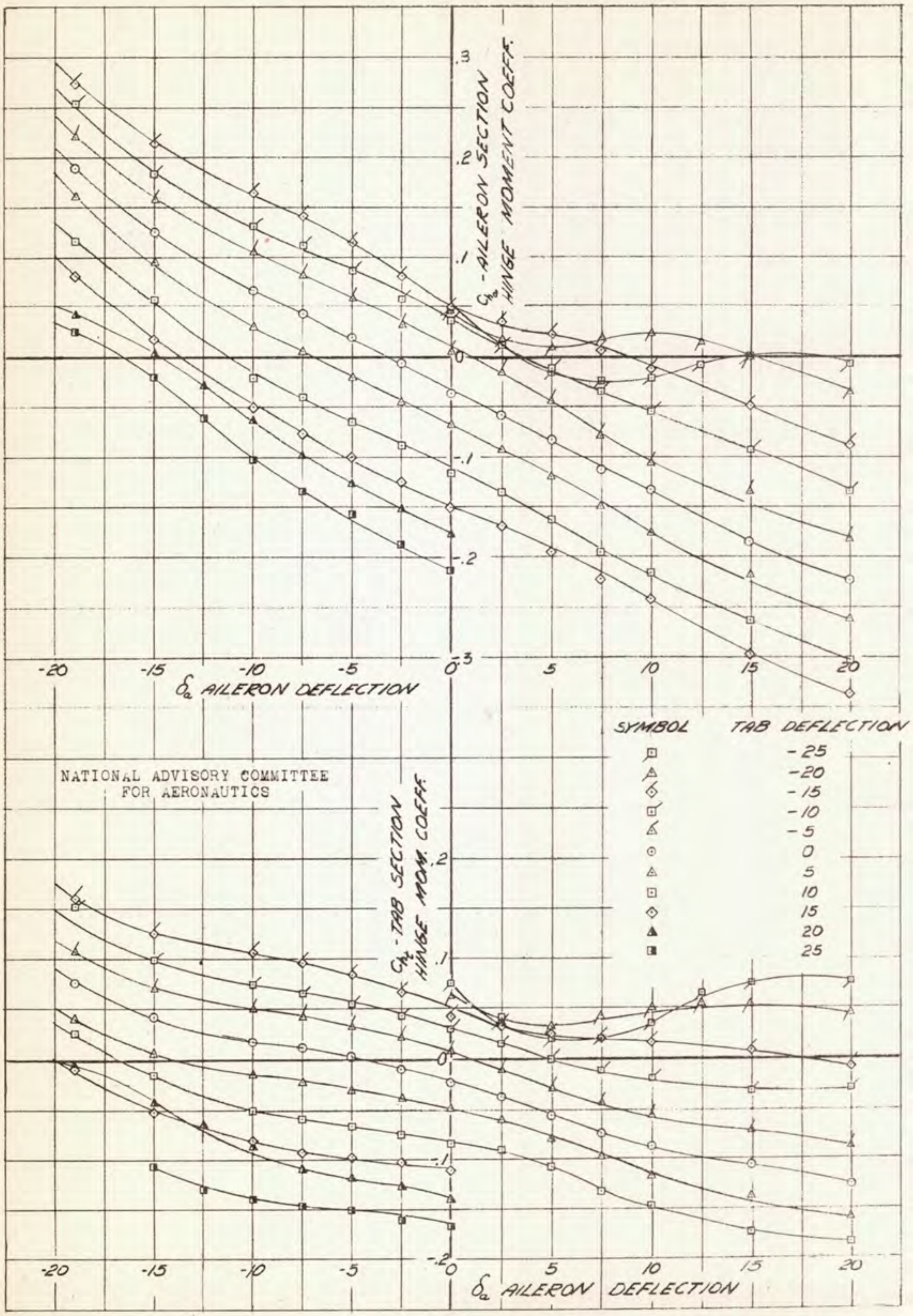
A-18



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 8(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 c_a PLAIN INSET TAB.
q = 180 LB/SQ FT. R = 9,000,000 α_0 = 4.14°

A-18

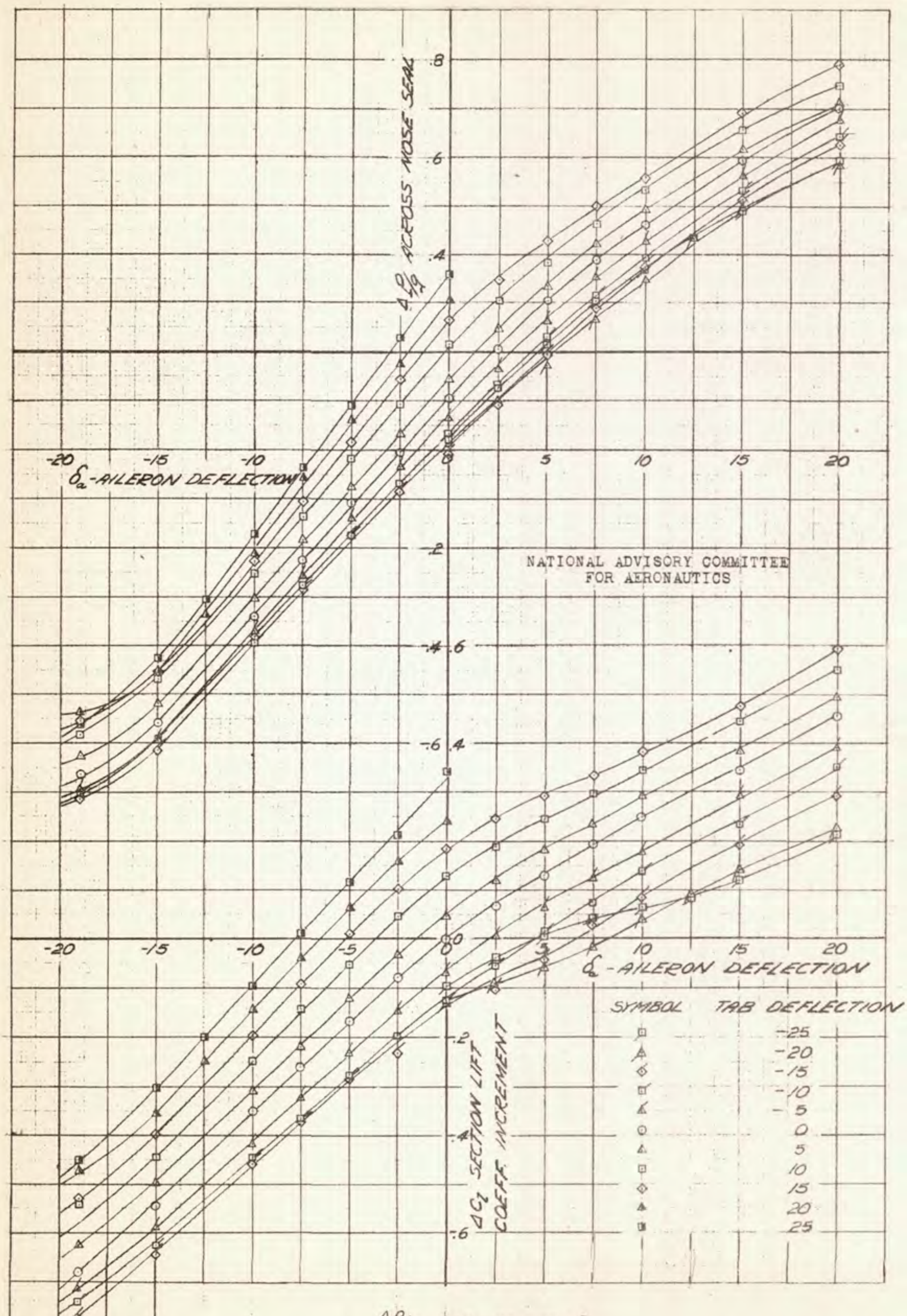


C_{h_a} AND C_{h_t} VS. δ_a

FIGURE 8(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6, AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 c_a PLAIN INSET TAB

q = 180 LB/SQ FT. R = 9,000,000 α_0 = 4.14°

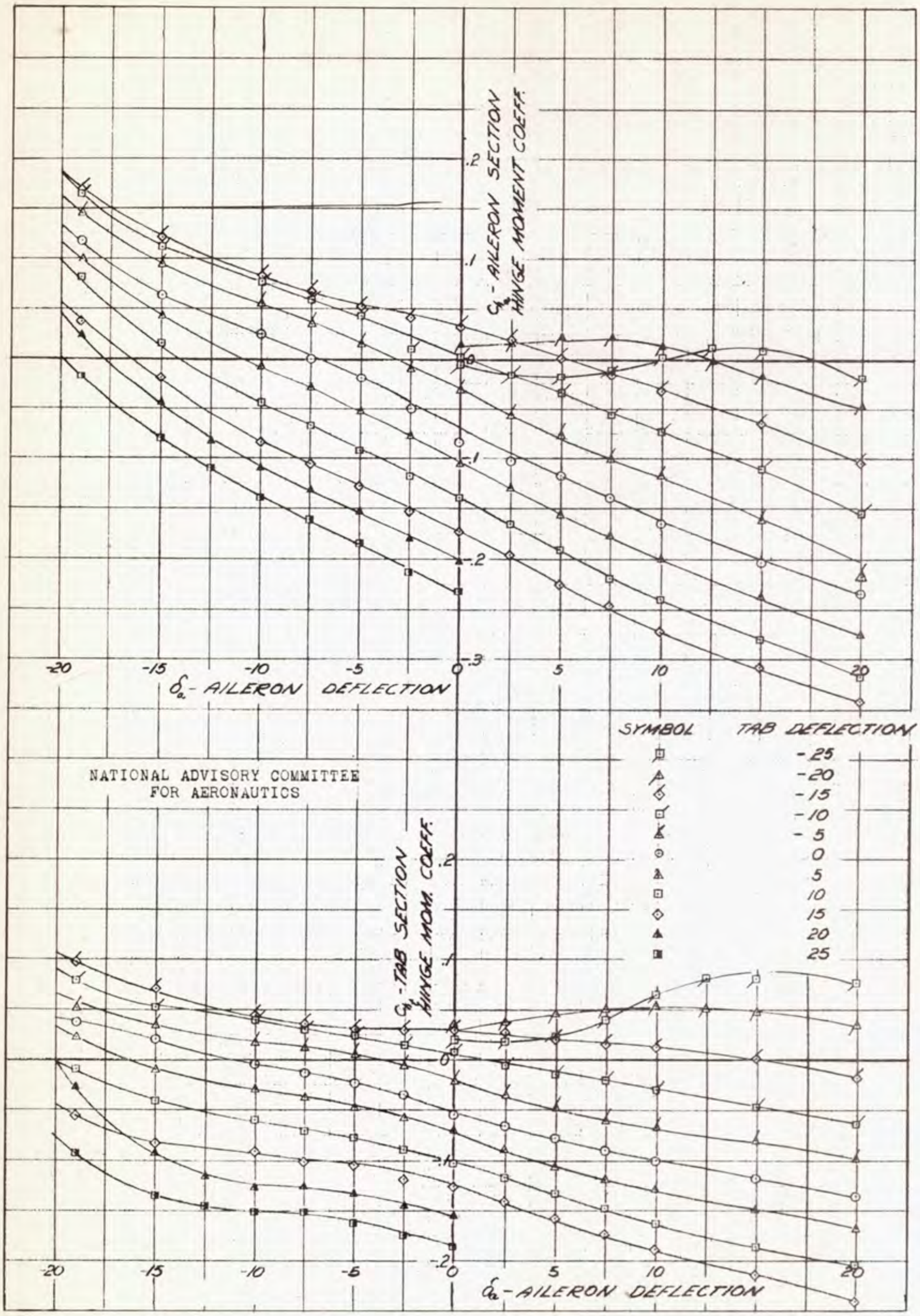
A-18



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 9(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE. WITH A 0.20 c_a PLAIN INSET TAB

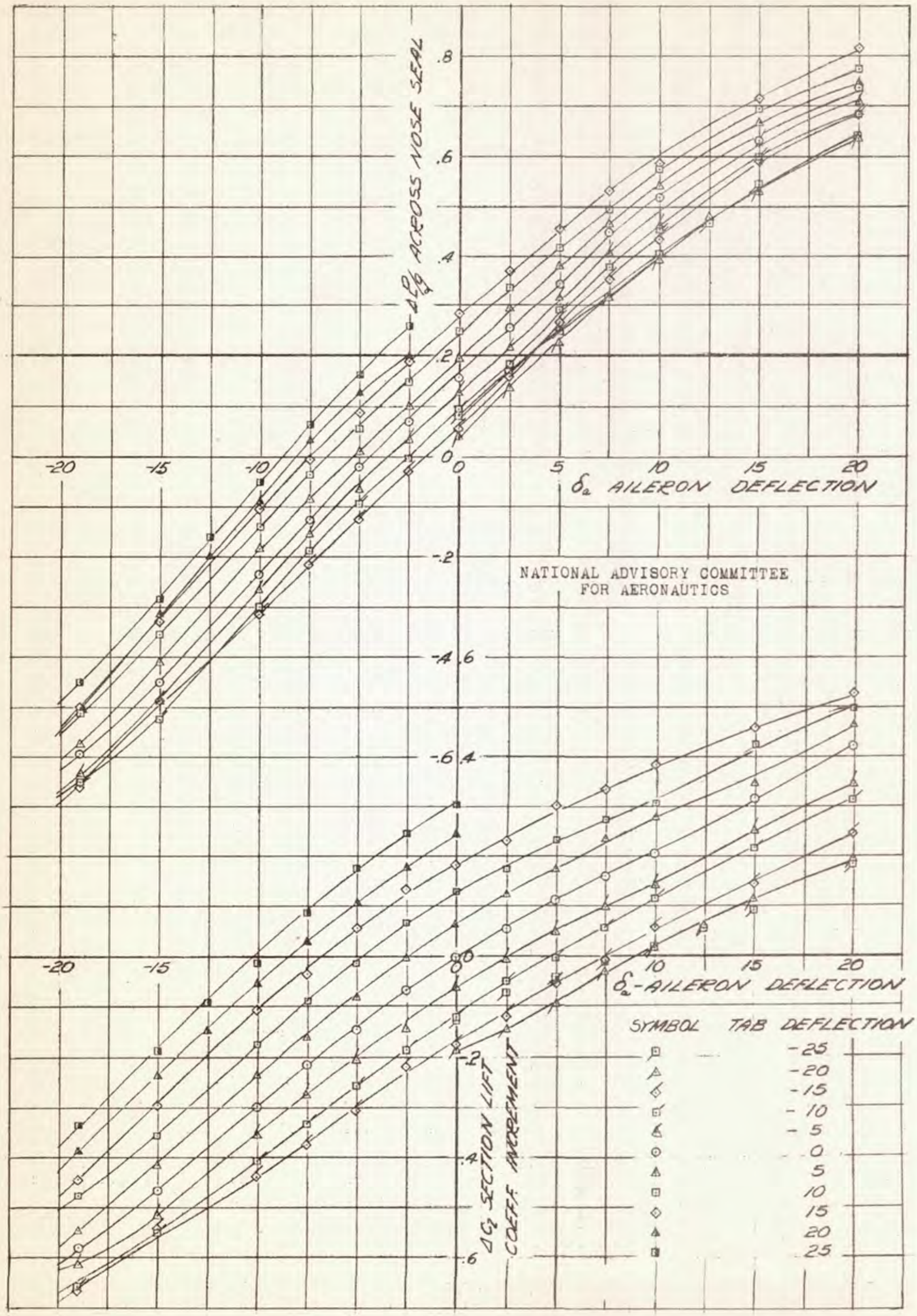
q = 90 LB/SQ FT. R = 6,700,000 α_0 = 8.27°



c_{h_a} AND c_{h_t} VS. δ_a

FIGURE 9(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216(a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A $0.20c_a$ PLAIN INSET TAB

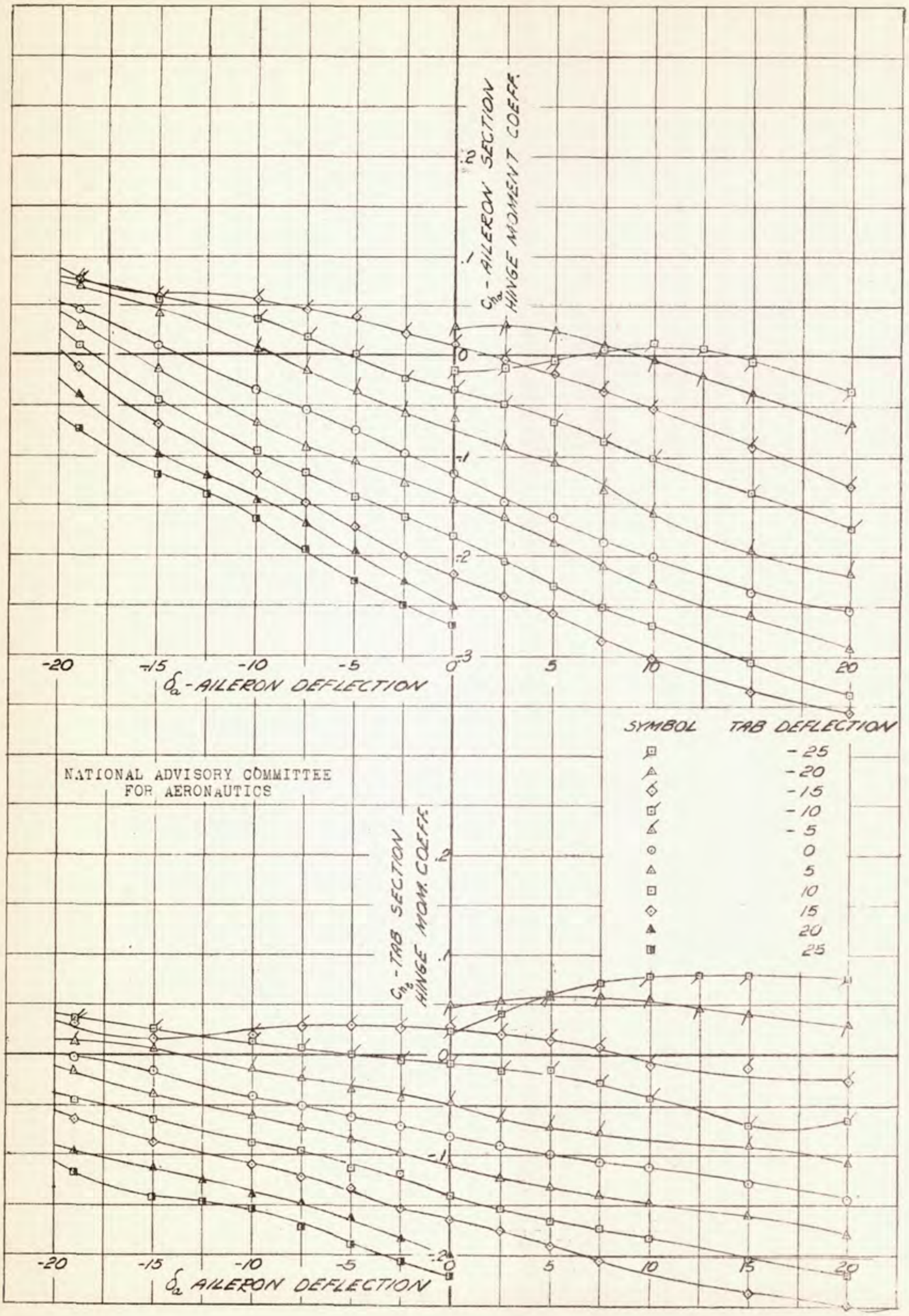
q = 90 LB/SQ FT R = 6,700,000 $\alpha_0 = 8.27°$



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 10(a)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20 c_a PLAIN INSET TAB

q = 60 LB/SQ FT. R = 5,500,000 α_o = 12.37°



c_{h_a} AND c_{h_t} VS δ_a

FIGURE 10(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF NORMAL PROFILE WITH A 0.20c_a PLAIN INSET TAB

q = 60 LB/SQ FT. R = 5,500,000 α_0 = 12.37°

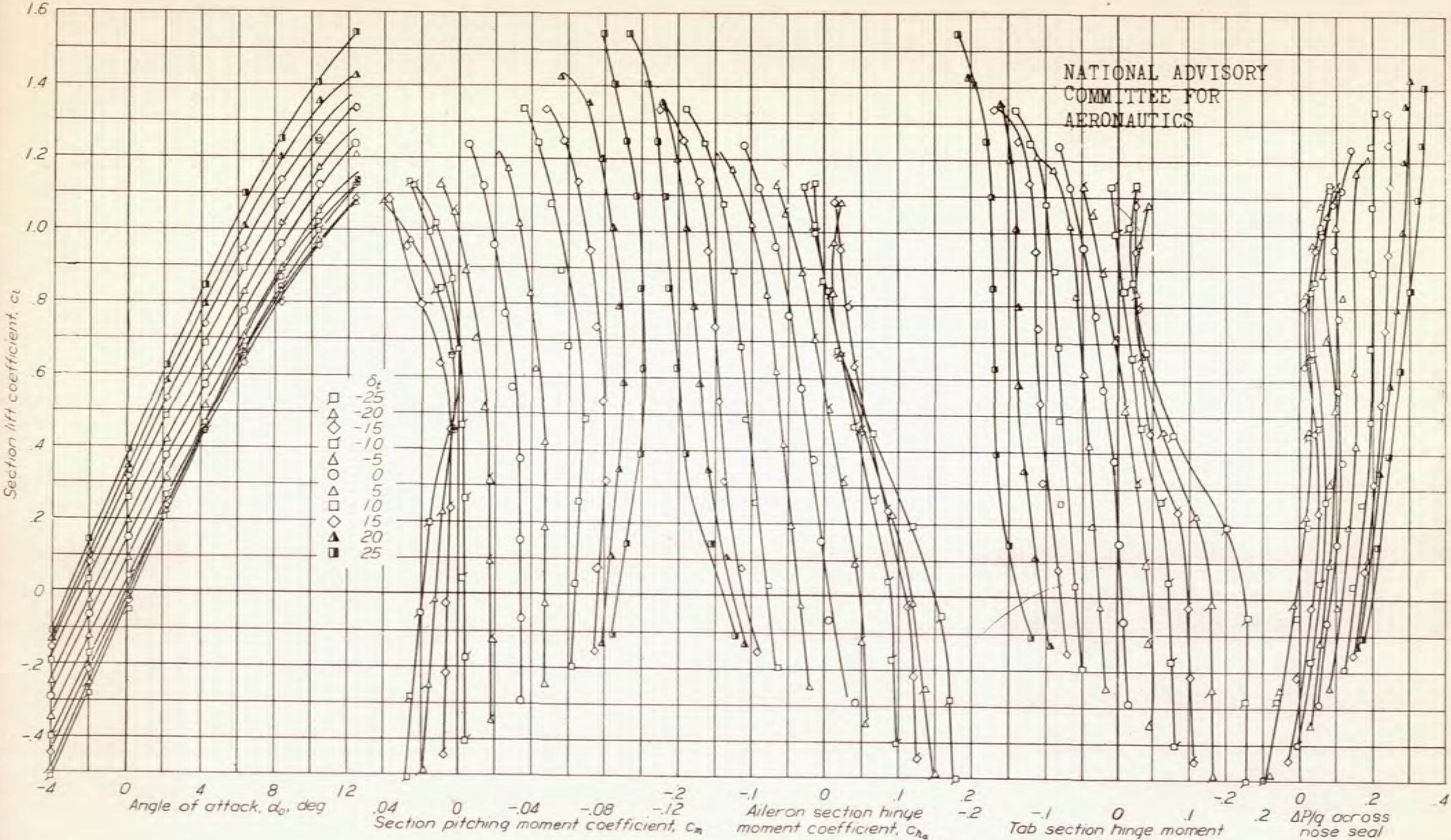
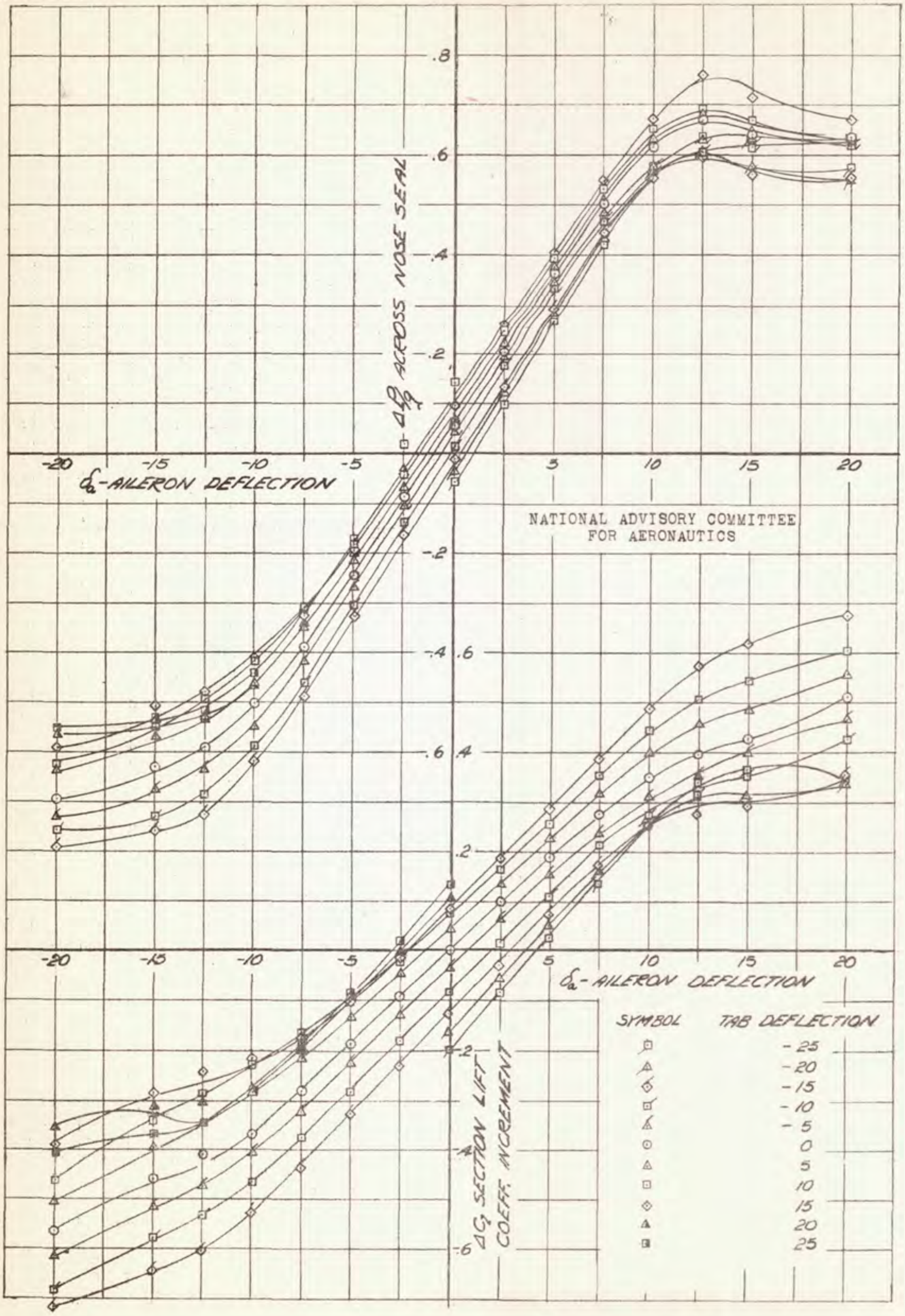


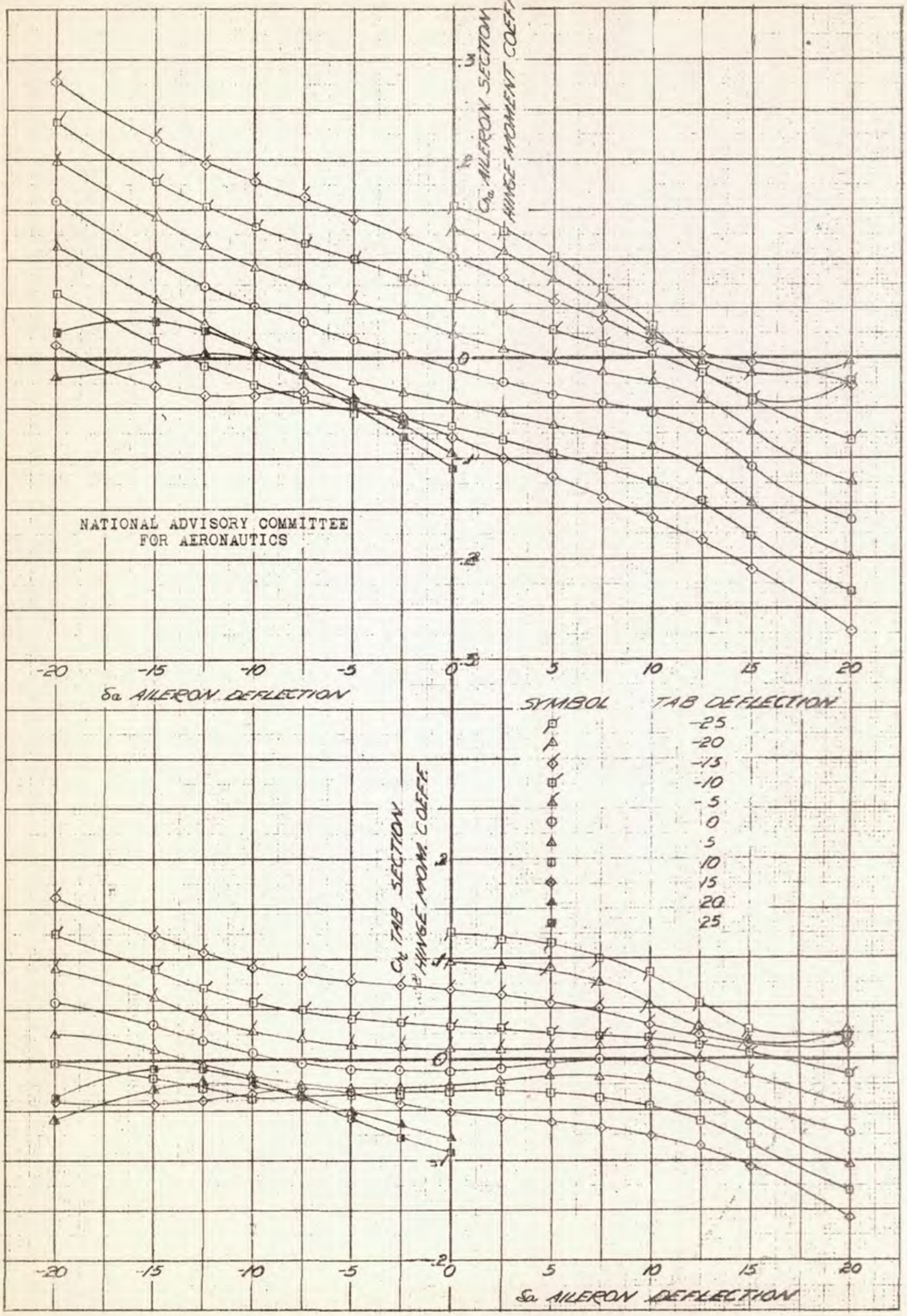
Figure 11.- Section aerodynamic characteristics of an NACA 66,2-216 (a = .6) airfoil equipped with a .20-chord sealed-gap plain aileron of normal profile with a .20c_a plain inset tab; q = 150 lb/sq ft, R = 8.200.000, aileron undeflected.



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 12(a)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20c_a PLAIN INSET TAB

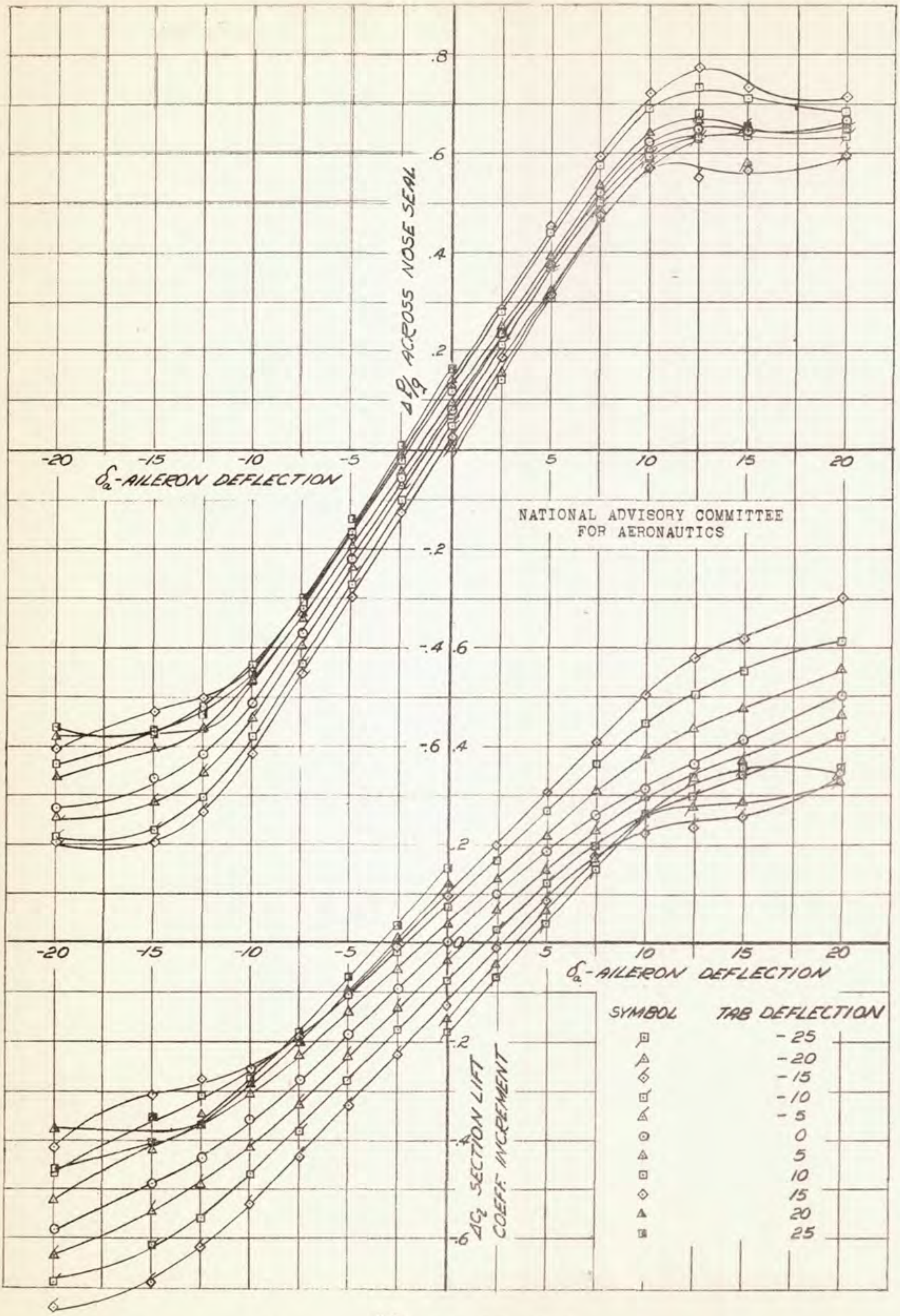
q=180 LB/SQ FT. R=9,000,000 α_0=-4.13°



c_{h_a} AND c_{h_t} VS. δ_a

FIGURE 12(b)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB

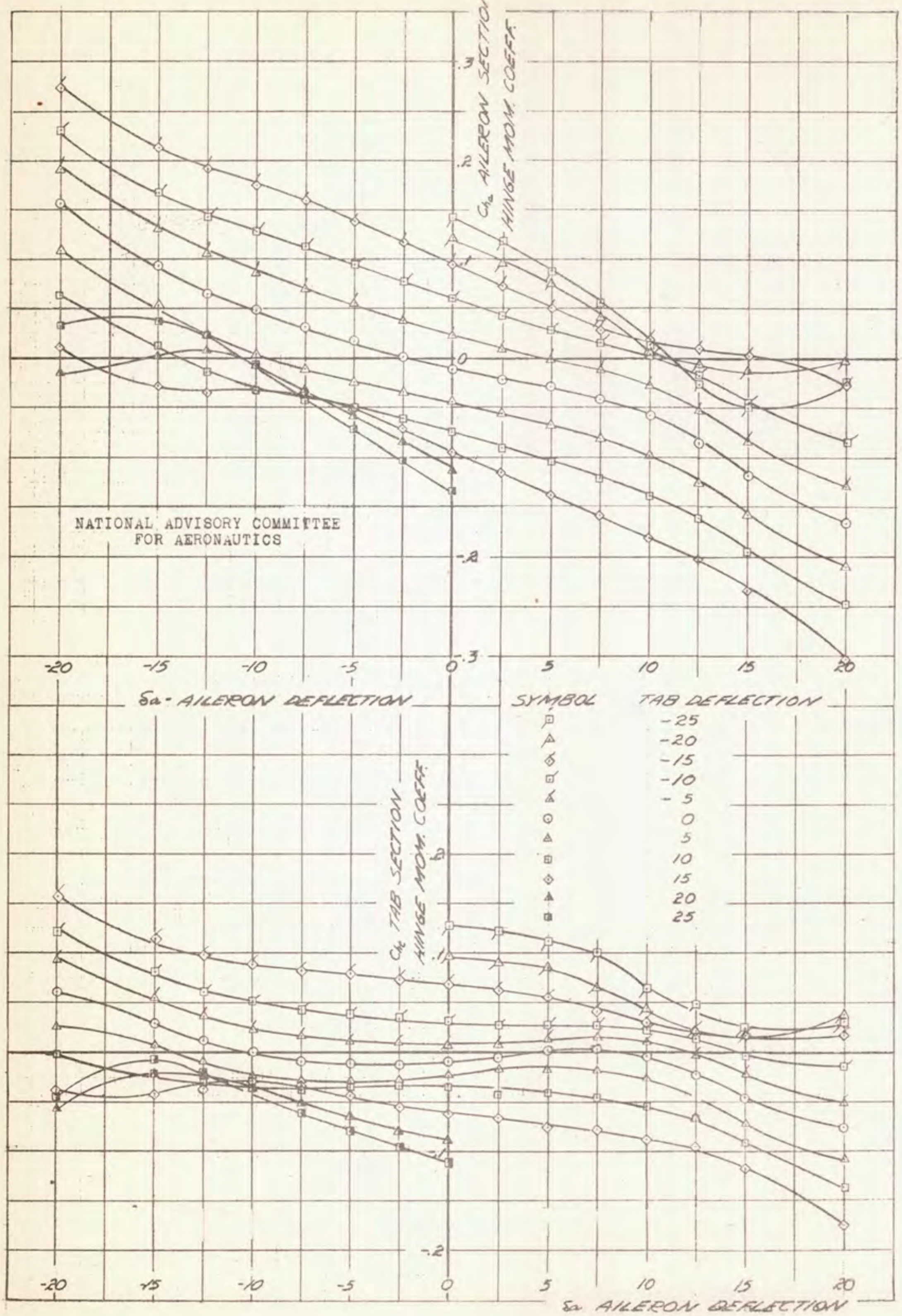
q = 180 LB/SQ FT. R = 9,000,000 $\alpha_0 = -4.15°$



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 13(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB

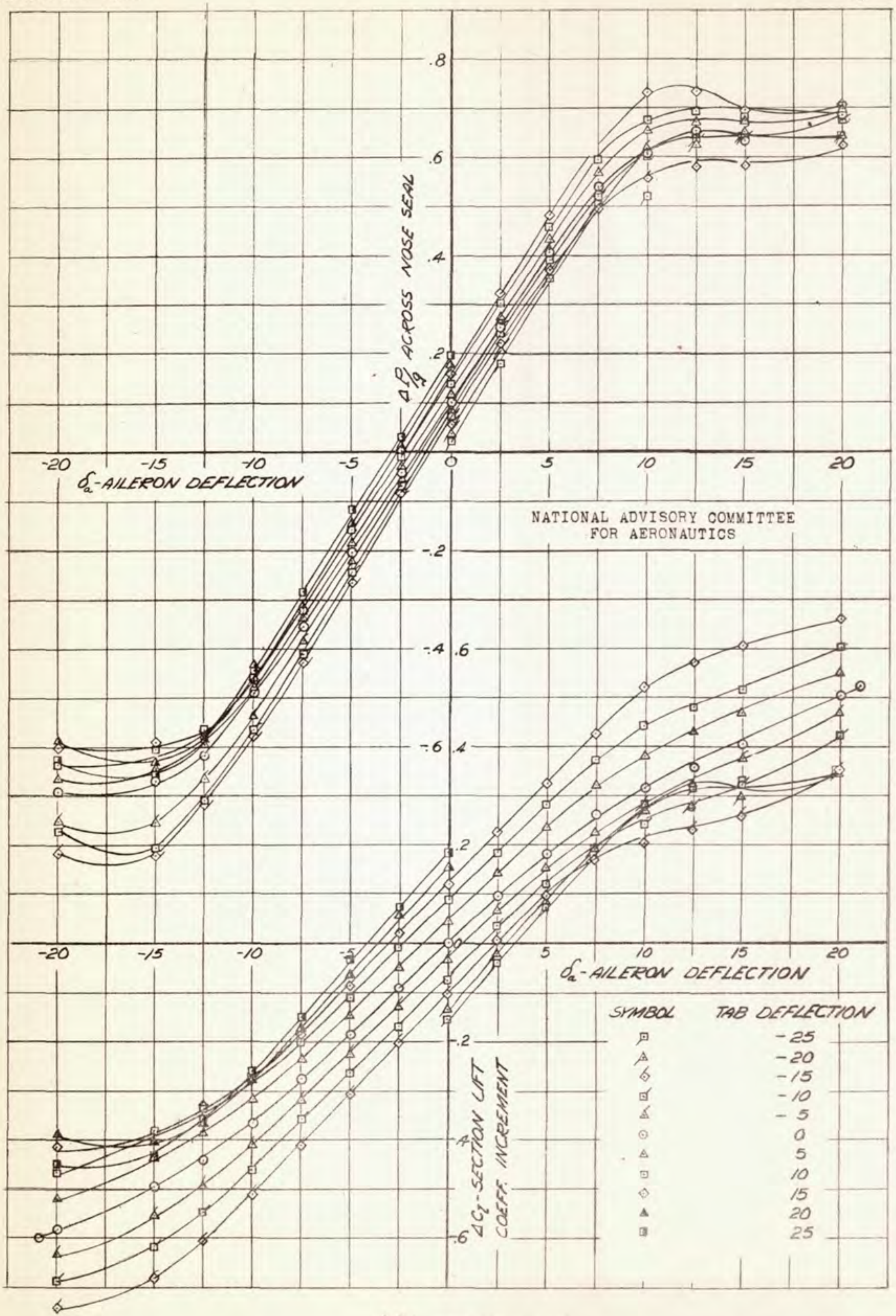
q = 180 LB/SQ FT. R = 9,000,000 α_0 = -2.06°



C_{h_a} AND C_{h_t} VS. δ_a

FIGURE 13(b)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216(a=0.6) AIRFOIL EQUIPPED WITH A 0.30-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20c_a PLAIN INSET TAB

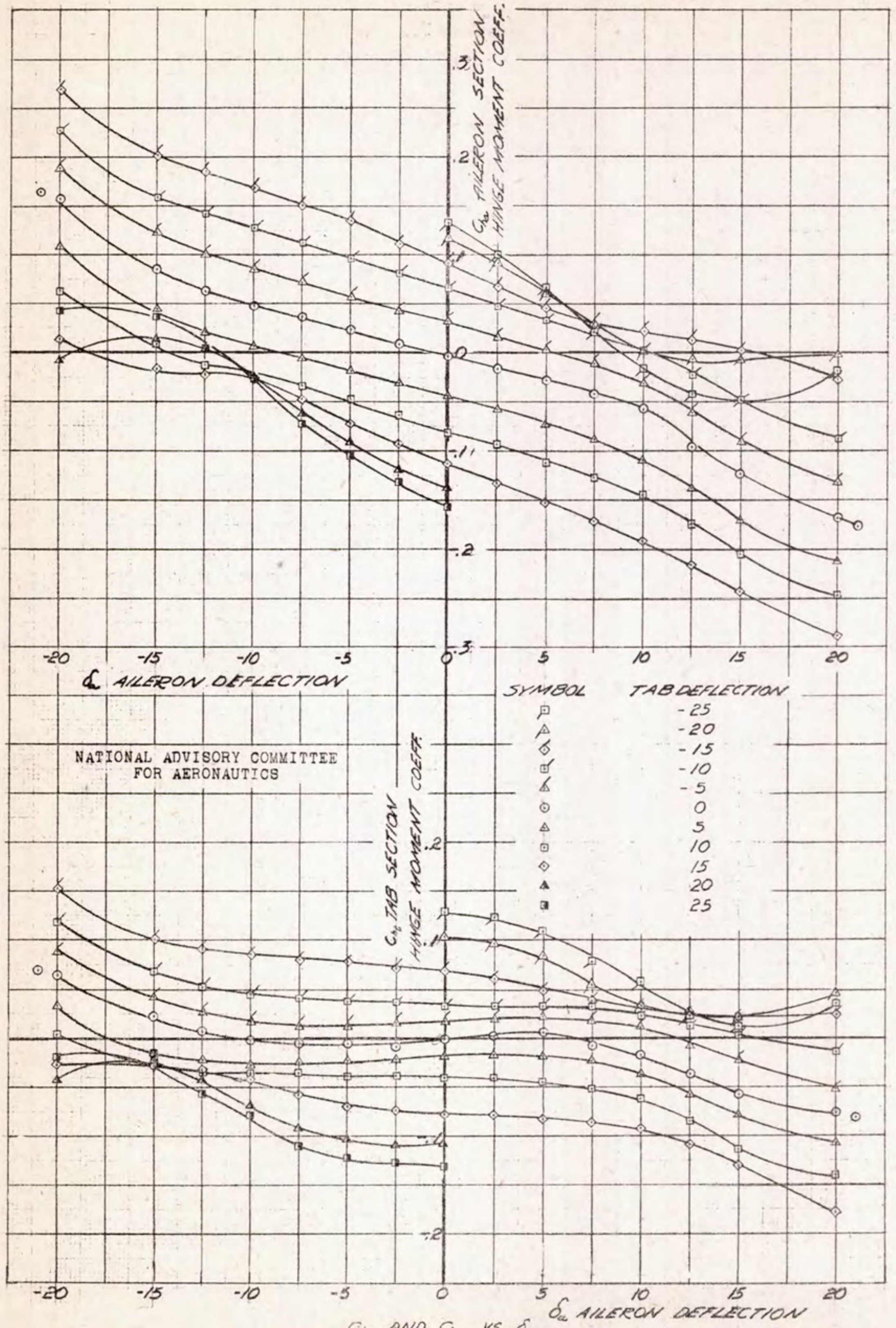
q=180 LB/SQ FT.   R=9,000,000 α_o=-2.06°



$\Delta P/q$ AND Δc_l VS. δ_a

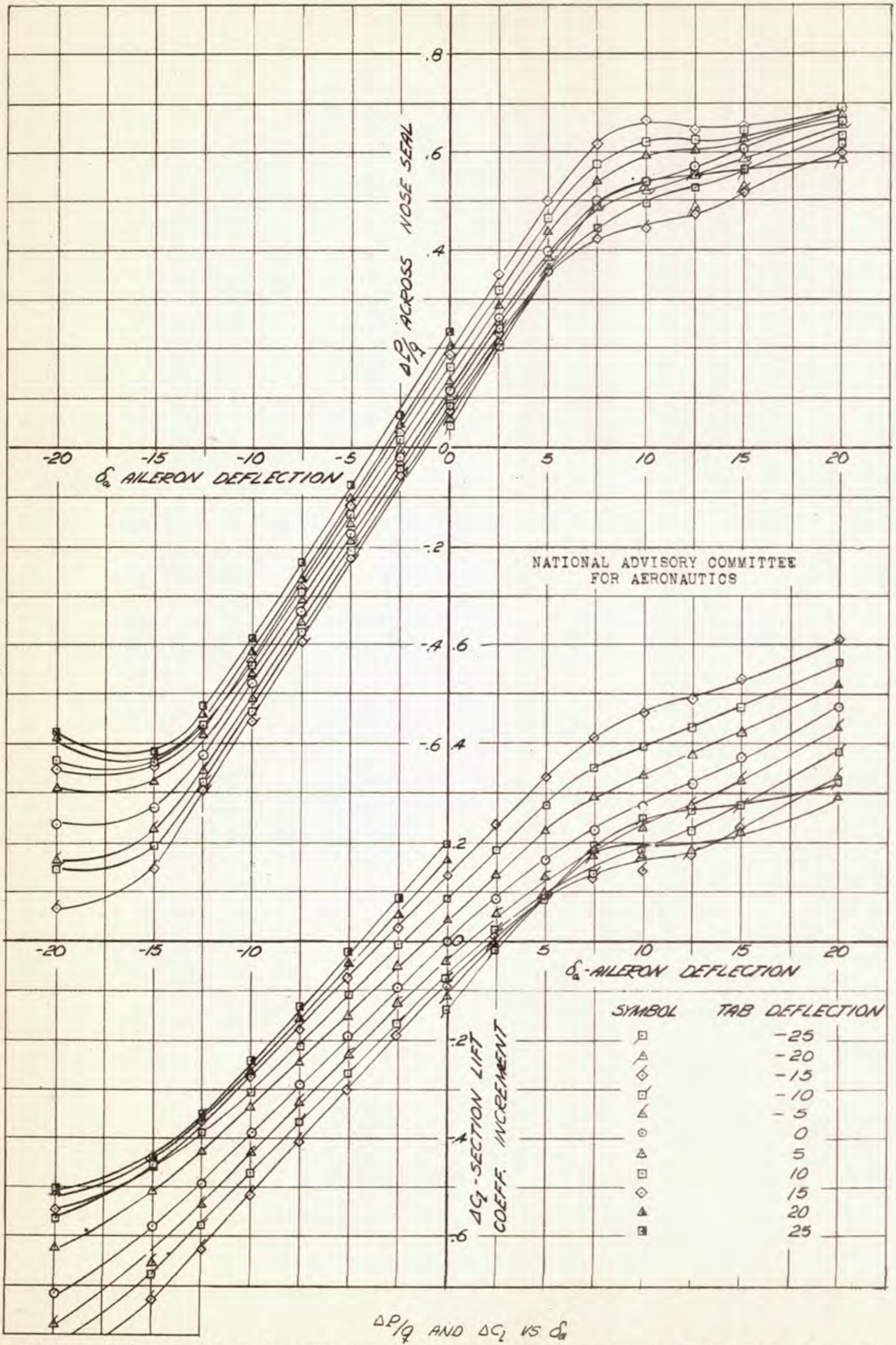
FIGURE 14(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20c_a PLAIN INSET TAB

q=180 LB/SQ FT R=9,000,000 α_0= 0.01°



C_{h_a} AND C_{h_t} VS. δ_a

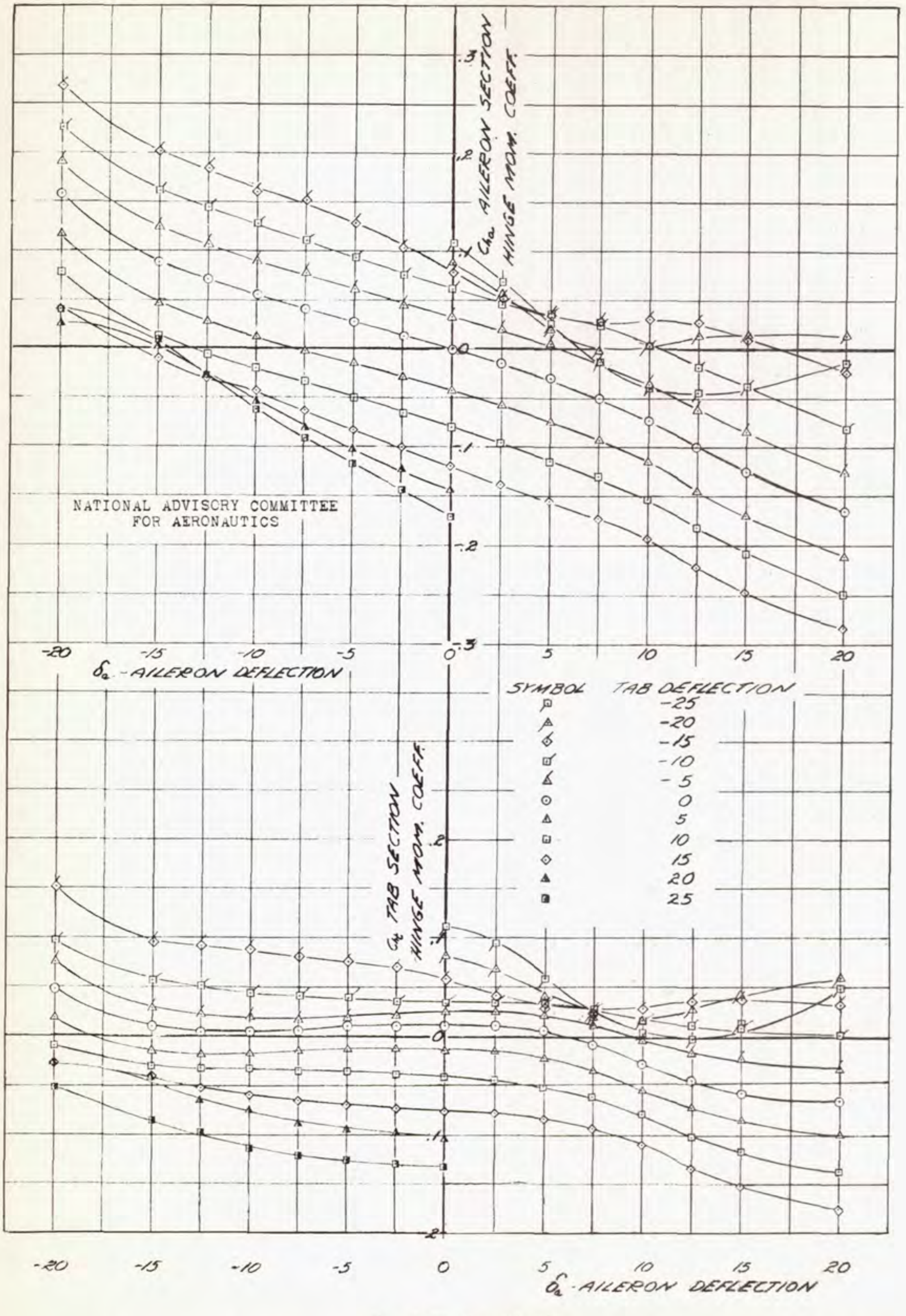
FIGURE 14(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0. AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB $q = 180$ LB/SQ FT. $R = 9,000,000$ $\alpha_0 = 0.01°$



$\Delta P/q$ AND Δc_l VS. δ_a

FIGURE 15(a).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 ($a = 0.6$) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20c_a PLAIN INSET TAB.

$q = 180$ LB/SQ FT. $R = 9,000,000$ $\alpha_0 = 2.07°$

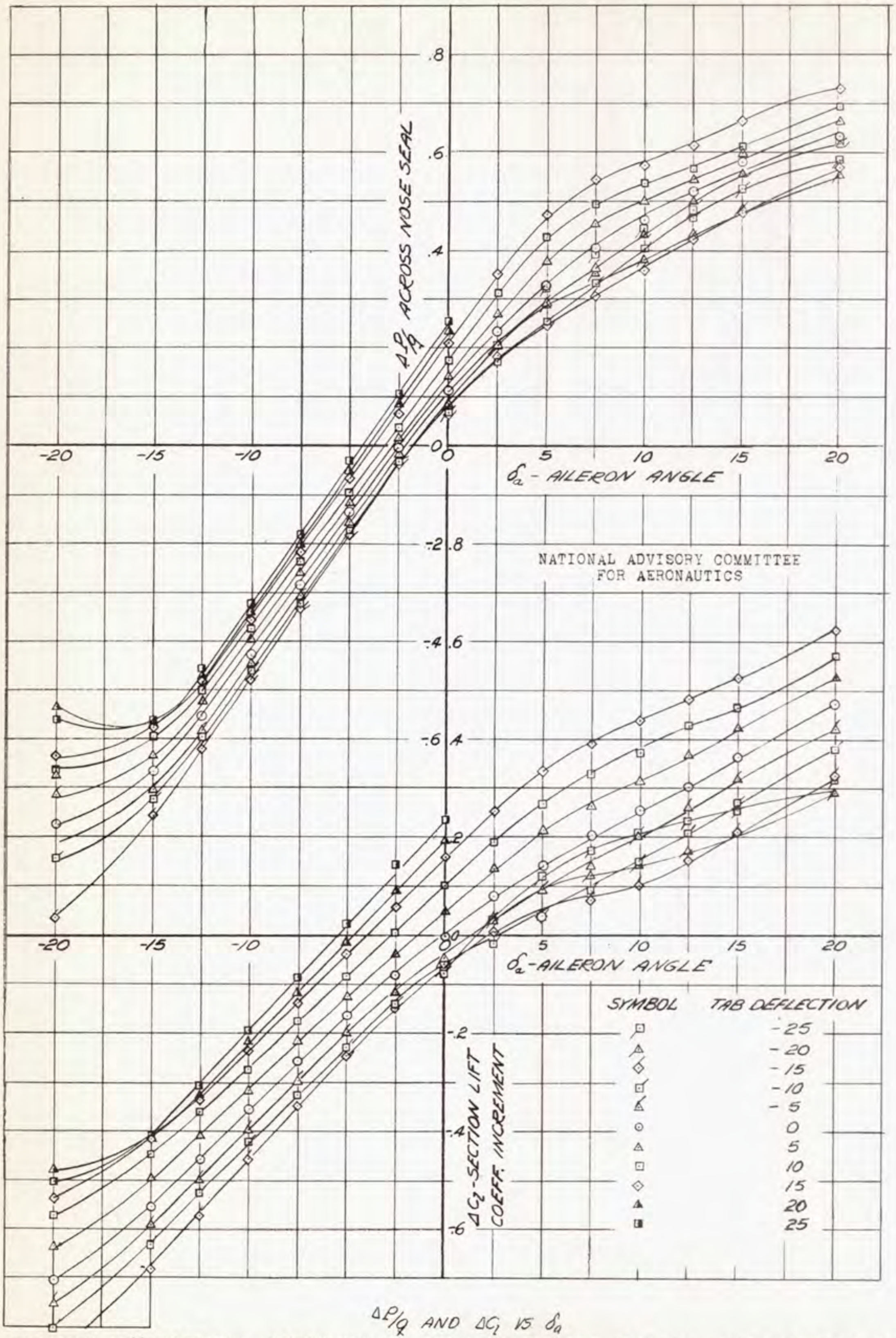


NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

C_{h_a} AND C_{h_t} VS. δ_a

FIGURE 15(b): SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE, WITH A 0.20 C_a PLAIN INSET TAB

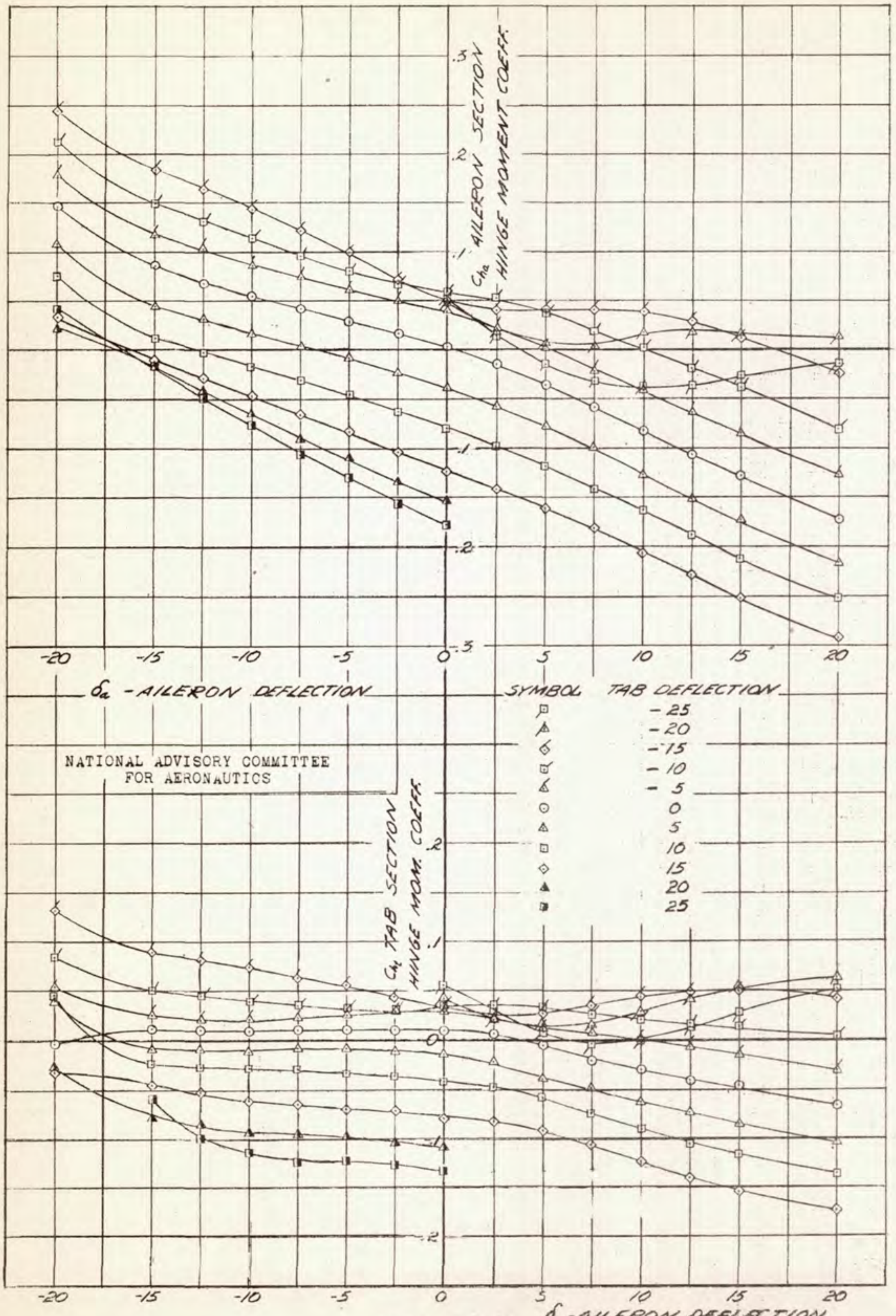
q = 180 LB/SQ FT. R = 9,000,000 α_o = 2.07°



$\Delta P/q$ AND Δc_l VS δ_a

FIGURE 16(a)-SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB.

q=180 LB/SQ FT. R=9,000,000 α_0=4.14°



C_{h_a} AND C_{h_t} VS. δ_a

FIGURE 16(b)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 C_a PLAIN INSET TAB

q = 180 LB/SQ FT. R = 9,000,000 α_0 = 4.14°

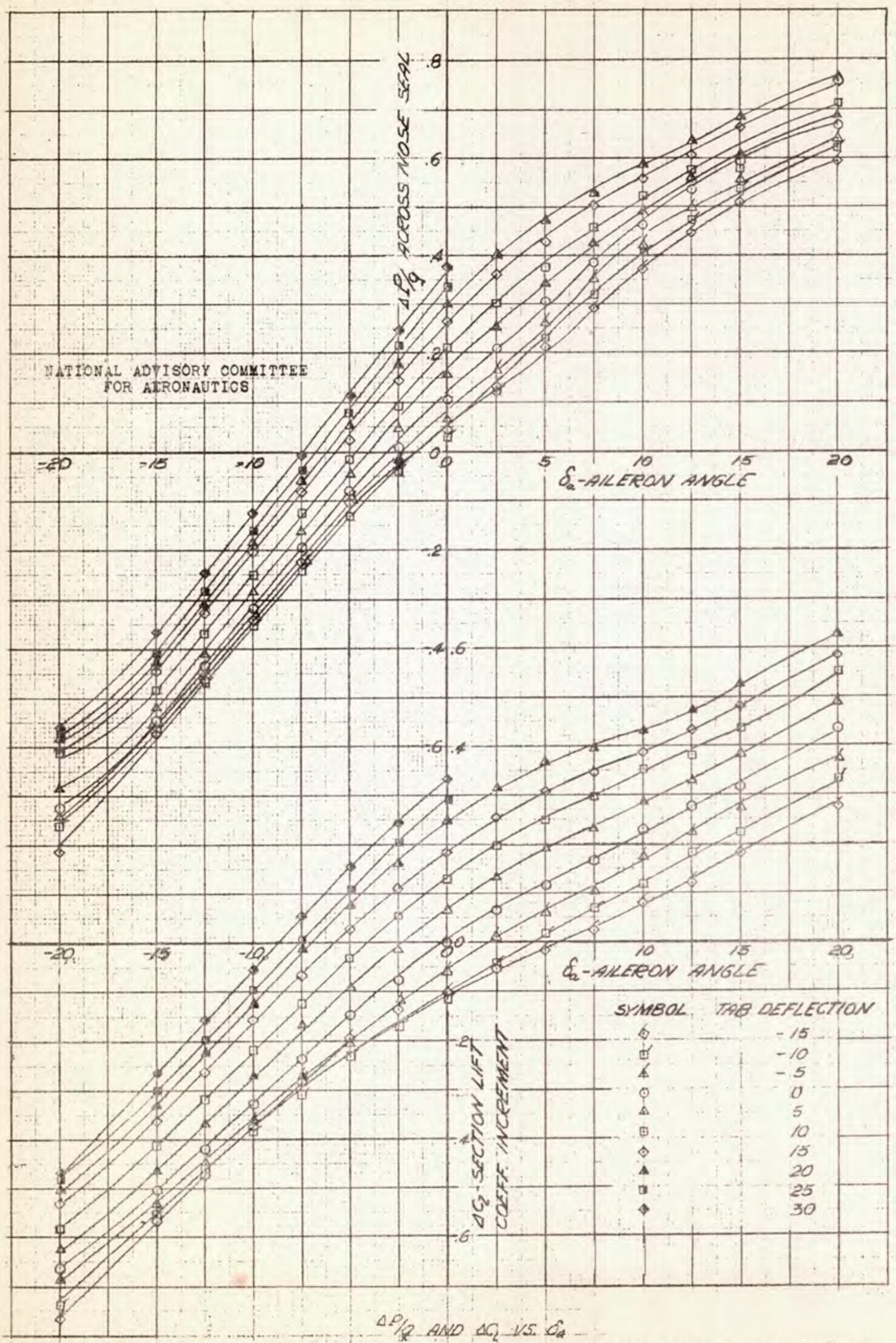
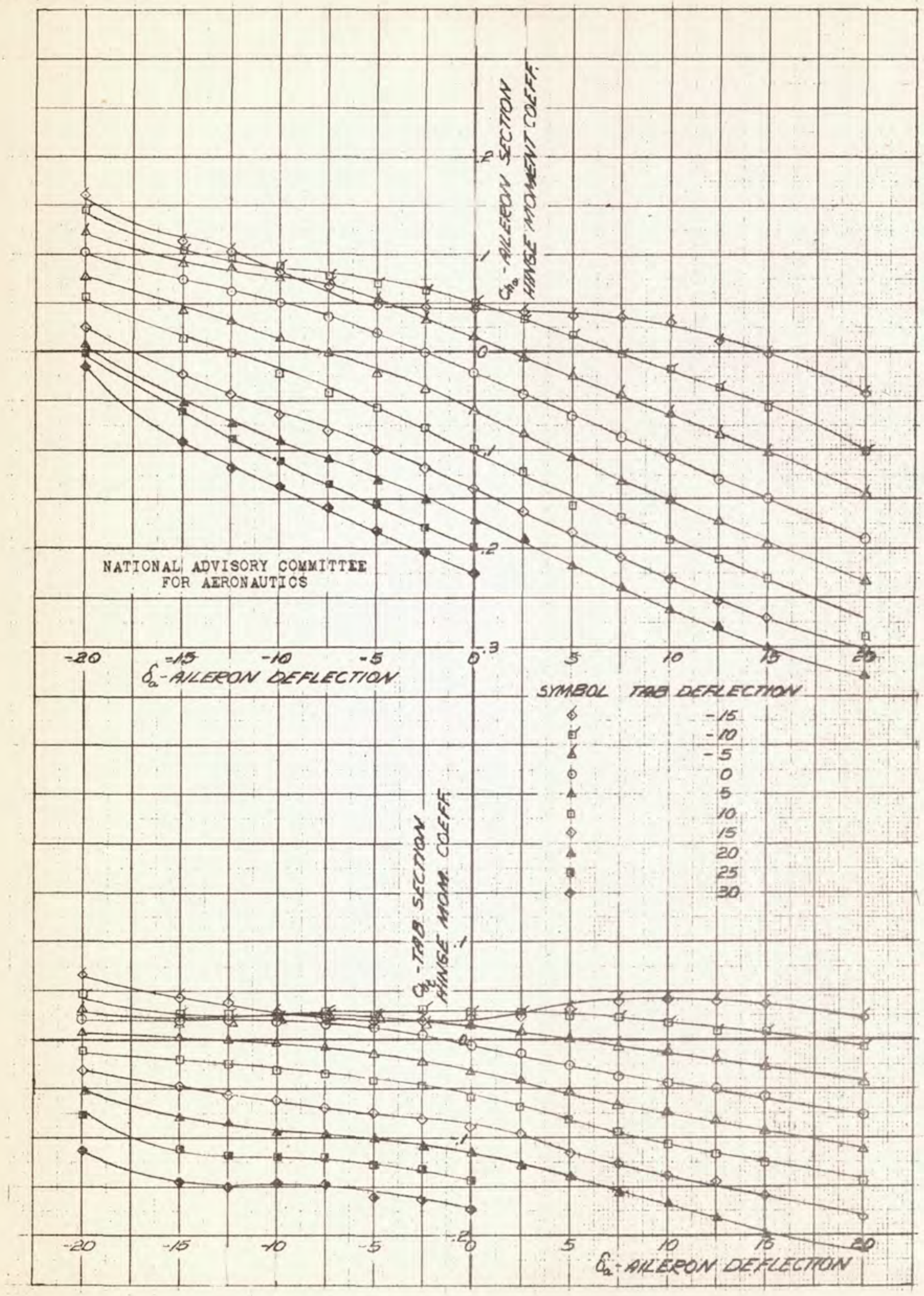


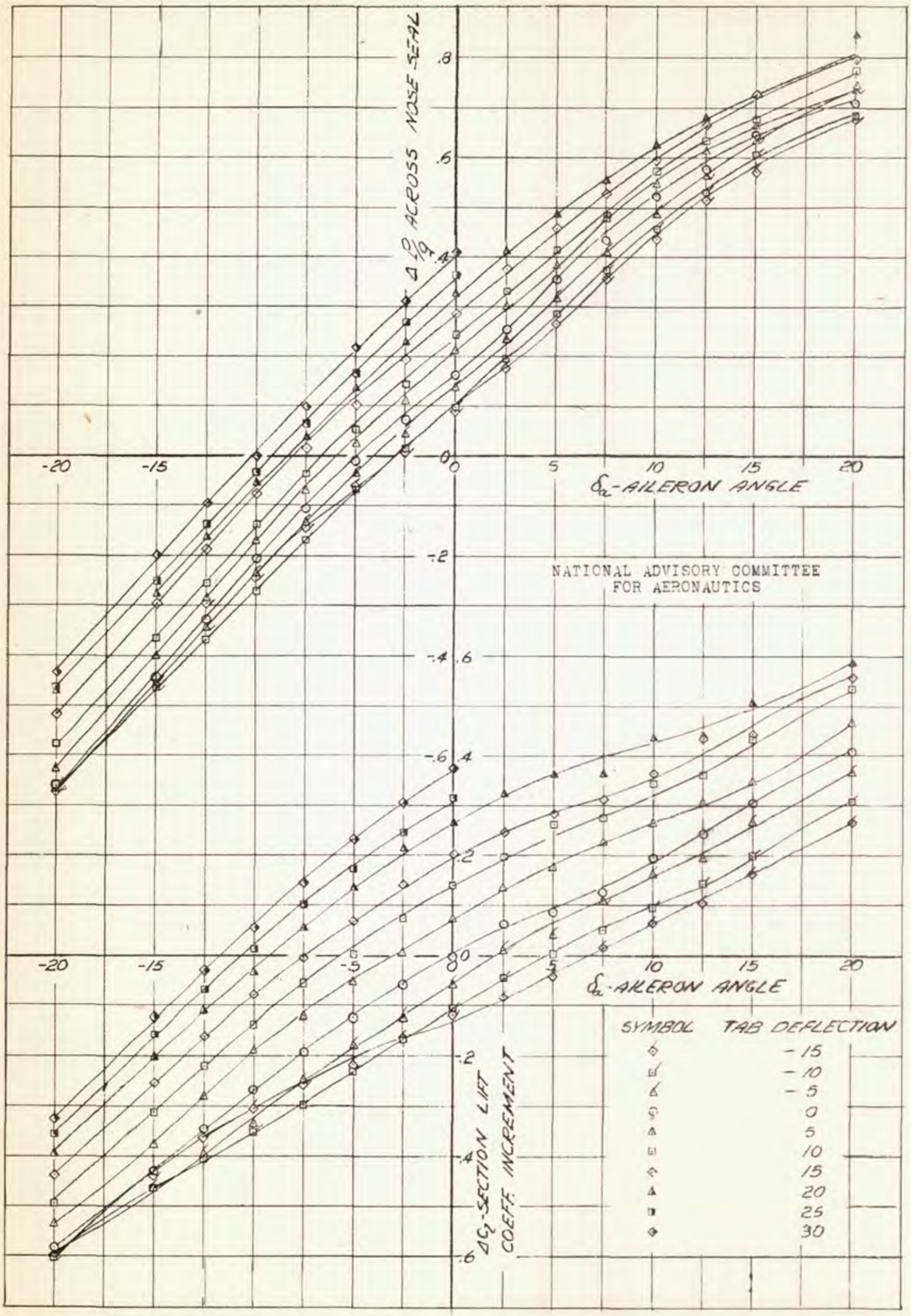
FIGURE 17(a)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA $65_1$2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB.
q=90 LB/SQ FT. R=5,700,000 α_0 = 8.27°



c_{h_a} AND c_{h_t} VS. δ_a

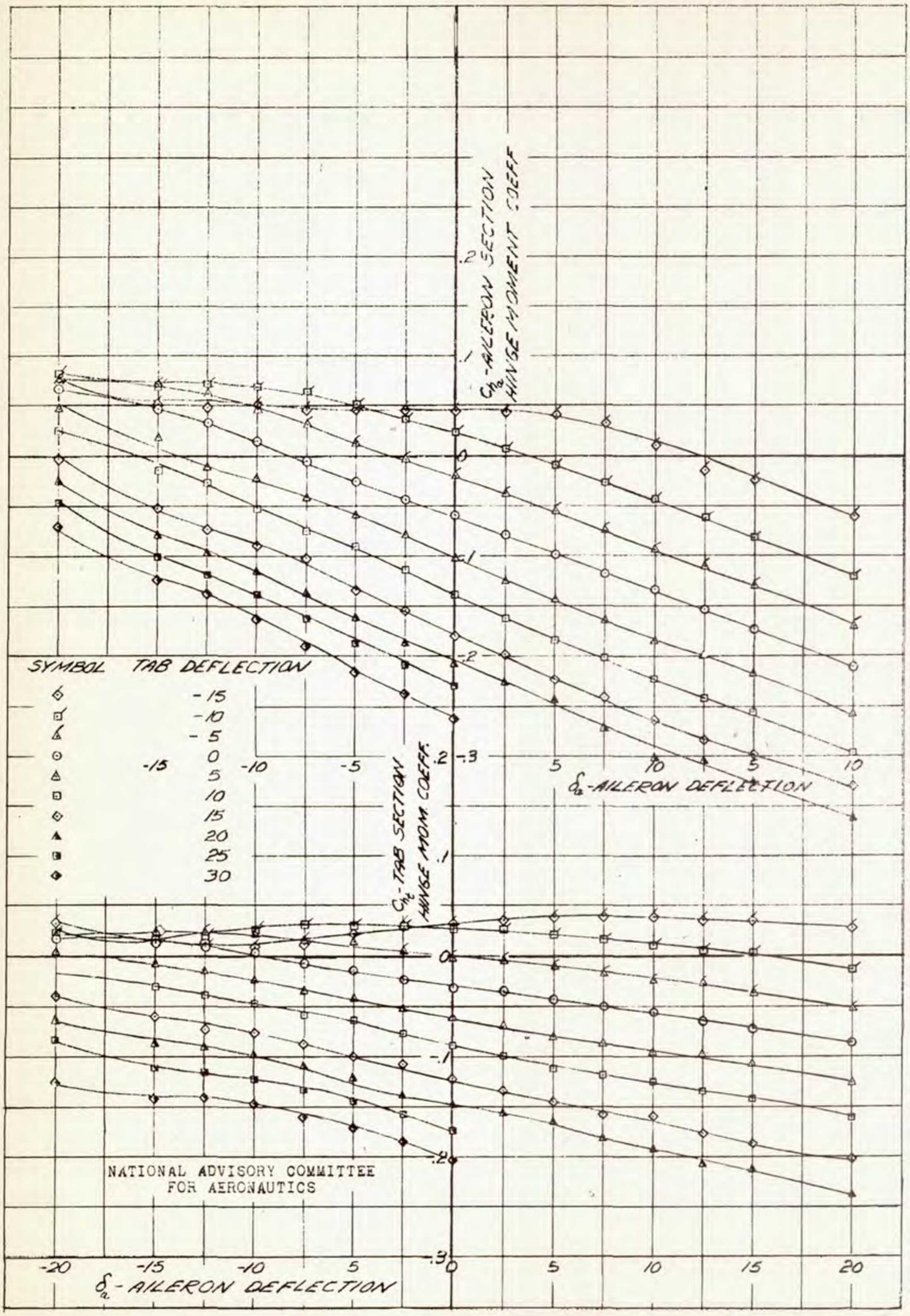
FIGURE 17(b)-SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20c_a PLAIN INSET TAB

$q = 90$ LB/SQ FT. $R = 6,700,000$ $\alpha_0 = 0.27°$



$\Delta P/q$ AND Δc_l VS δ_a

FIGURE 18(a)- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB.
q = 60 LB/SQ FT R = 5,500,000 $\alpha_{c_{l_i}} = 12.37°$



C_{h_a} AND C_{h_t} VS. δ_a

FIGURE 18(b).- SECTION AERODYNAMIC CHARACTERISTICS OF AN NACA 66,2-216 (a=0.6) AIRFOIL EQUIPPED WITH A 0.20-CHORD SEALED-GAP PLAIN AILERON OF STRAIGHT-SIDED PROFILE WITH A 0.20 c_a PLAIN INSET TAB.

$q = 60$ LB/SQ FT $R = 5,500,000$ $\alpha_0 = 12.37°$

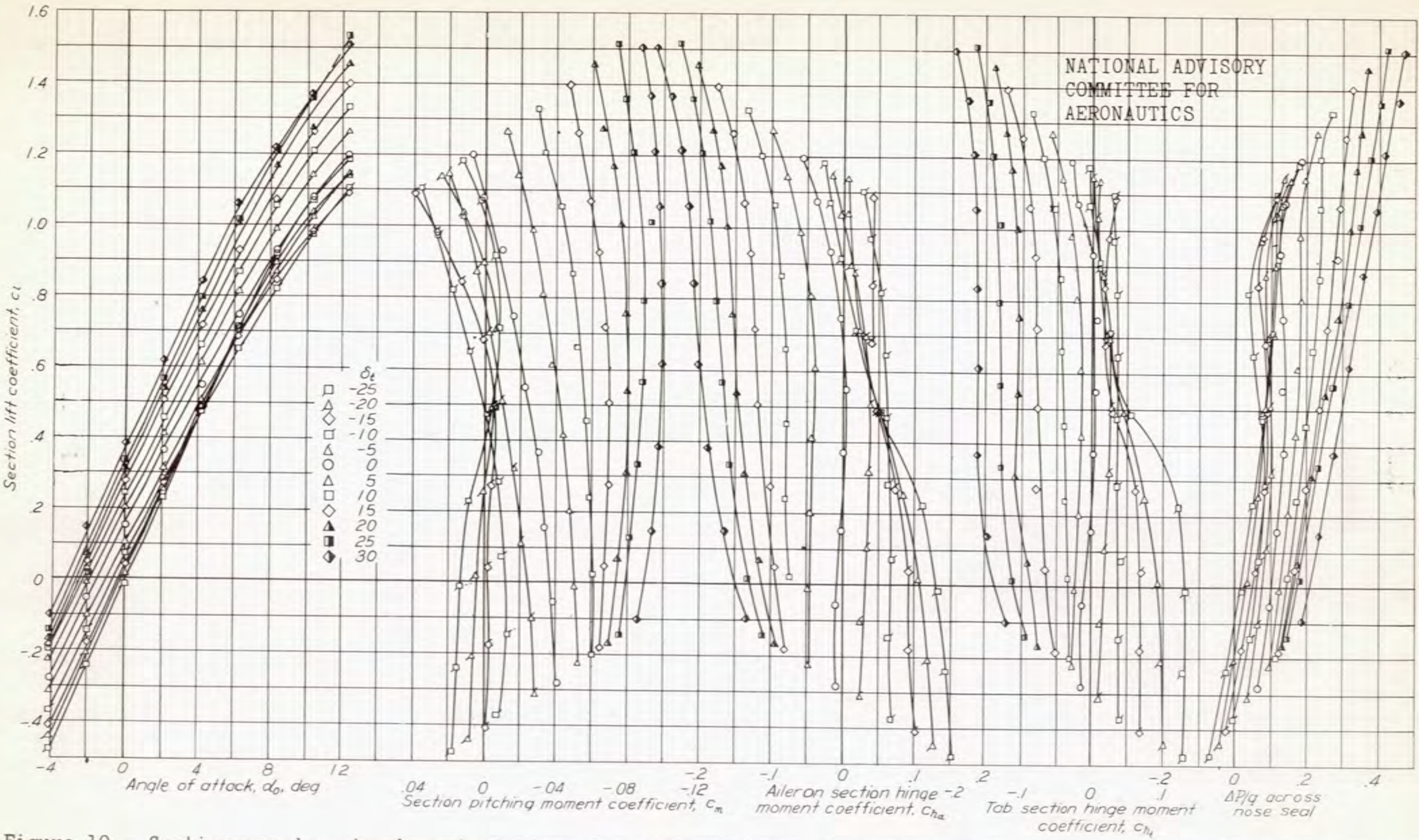


Fig. 19

Figure 19.- Section aerodynamic characteristics of an NACA 66,2-216 (a = .6) airfoil equipped with a .20-chord sealed-gap plain aileron of straight-sided profile with a .20c_a plain inset tab; q = 150 lb/sq ft, R = 8,200,000, aileron undeflected.

[illegible] FORM ([illegible] 47)

Backer, John V.

AUTHOR(S)

DIVISION: Aerodynamics (2)
SECTION: Wings and Airfoils (6)
CROSS REFERENCES: Airfoils - Aerodynamics (07710); Wings - Pitching moment characteristics (99173.8)

ATI- 13455
ORIG. AGENCY NUMBER
ACR-L-357
REVISION

AMER. TITLE: High-speed wind-tunnel tests of the NACA 23012 and 23012-64 airfoils

FORG'N. TITLE:

ORIGINATING AGENCY: National Advisory Committee for Aeronautics, Washington, D. C.
TRANSLATION:

COUNTRY	LANGUAGE	FORG'N.CLASS	U. S.CLASS.	DATE	PAGES	ILLUS.	FEATURES
U.S.	Eng.		Unclass.	Feb'41	14	6	photo, table, graphs

ABSTRACT

Force tests of NACA 23012 and 23012-64 airfoils of 24-in. chord were conducted in the 8-ft high-speed wind tunnel at Mach numbers ranging from 0.10 to 0.75. Supplementary tests of a 5-in.-chord NACA 23012 airfoil were made in the 24-in. high-speed tunnel to obtain pitching-moment data at higher loadings than could be attained with the 8-ft tunnel models. Results show the variation with Mach number of lift, drag, and pitching-moment coefficients at angles of attack from -4° to 6°. Description of test apparatus and procedure is included.

NOTE: Requests for copies of this report must be addressed to: N.A.C.A., Washington, D. C.

T-2, HQ., AIR MATERIEL COMMAND   AIR TECHNICAL INDEX   WRIGHT FIELD, OHIO, USAAF

[illegible]

768