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Tests in the Compressed Air Tunnel on the Aerofoils NACA 0015 and NACA 0030 With and Without Split Flap and on other Aerofoils of Various Thicknesses With a Split Flap

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of the Aerodynamics Division, N.P.L.

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Summary.—Reasons for Inquiry.—To obtain information on the effect of thickness on the aerodynamic characteristics of aerofoils with and without a split flap.

Range of Investigation.—The following 4 ft. by 8 in. rectangular aerofoils were tested :—

NACA 0015 and NACA 0030 with and without a split flap $0 \cdot 1c$ wide at 90 deg. to wing surface and at $0 \cdot 1c$ from trailing edge.

NACA 0012, NACA 23012, RAF 28 and RAF 48 with flap.

The effect of rounding the edge of the flap was considered on NACA 0015.

A comparison made with a $0 \cdot 2c$ flap at 50 deg. to wing surface and at $0 \cdot 2c$ from trailing edge on NACA 0015 and RAF 48.

The effect of rounding the ends of NACA 0030 was also examined. C_L, C_D and C_m were obtained over a range of Reynolds numbers with additional C_D measurements at closer intervals of R on the two wings without flap. $C_{D,0}$ was also determined by the momentum method on NACA 0030.

Results.—Fig. 1 shows that $C_{D,0}$ on the NACA 0030 without flaps is much less when the ends are rounded. In that case the drag is in closer agreement with that obtained by momentum methods. The curve of $C_{D,0}$ against thickness ratio, Fig. 2, shows that balance measurements on square-ended models can only be relied upon for thicknesses up to about 14 per cent. ; beyond that, the ends should be rounded to minimise end effect. $C_{D,0}$ increases with thickness ratio, particularly at the higher values of t/c considered.

$dC_L/d\alpha$ decreases with thickness ratio. It is also less for thick models with round ends than with square ends.

$dC_m/d\alpha$ increases with thickness ratio. It is also greater for thick models with round ends than with square ends.

In common with other thick wings, NACA 0030 shows $C_{L\,\mathrm{max.}}$ falling as R increases. At $R = 7 \times 10^6$, $C_{L\,\mathrm{max.}}$ is considerably less on NACA 0030 than on NACA 0015. $\Delta C_{L\,\mathrm{max.}}$ due to flap is much greater on NACA 0030, resulting in only a comparatively small fall in $C_{L\,\mathrm{max.}}$ on NACA 0030 with flap, compared with NACA 0015 with flap. Fig. 3 gives $C_{L\,\mathrm{max.}}$ curves for a number of aerofoils and shows a slight increase in $\Delta C_{L\,\mathrm{max.}}$ due to rounding the edge of the flap. (This also has the effect of displacing the lift curve in the direction of increasing α.) Agreement between $0 \cdot 15c$ flap at 90 deg. and $0 \cdot 20c$ flap at 50 deg. is good. (Projection of the latter perpendicular to the wing surface is approximately equal to the former.) Agreement is also good between Compressed Air Tunnel results on NACA 0012, 0015 and 23012 and D.V.L. (Germany) and Full Scale Tunnel (America) results.

Fig. 4 gives $C_{L\,\mathrm{max.}}$ against thickness ratio at $R = 5 \times 10^6$. $C_{L\,\mathrm{max.}}$ rises both on models with and without flap as thickness increases to 15 per cent. approximately and then falls slightly for models with flaps and sharply for models with no flaps. $\Delta C_{L\,\mathrm{max.}}$ increases steadily with thickness ratio.

Note.—This report has been compiled from three unpublished reports, A.R.C. 4191, 4511 and 4607, and contains all the results incorporated in these reports except those relating to the Piercy wing 20 per cent. thick in A.R.C. 4511. Those results have been published in R & M 2459 together with corresponding results on a Piercy wing 12 per cent. thick.

1. *Introductory*.—The main object of the experiments, the results of which are presented in this report, was to obtain further information on the change in the aerodynamic characteristics of certain aerofoils of a conventional type as the thickness varied. Another object of the investigation was to obtain additional data on the effect of a split flap on the maximum lift coefficient of aerofoils of various thicknesses over a range of values of Reynolds number.

Tests with and without a flap were carried out on the two symmetrical aerofoils NACA 0015 and 0030 with t/c respectively $0 \cdot 15$ and $0 \cdot 30$. These aerofoils are members of the same family as the 12 per cent. thick NACA 0012 already tested in the Compressed Air Tunnel and reported on in R. & M. 1708[1].

The flap used in the tests was $0 \cdot 15c$ wide and placed at 90 deg. to the lower surface of the wing and $0 \cdot 15c$ from the trailing edge. It had a sharply bevelled edge and was of the same span as the aerofoil, viz., 4 ft.; it was the same flap as that used in previous experiments on the aerofoils RAF 69, 89, and 34, dealt with in R. & M. 1717[2] and R. & M. 1772[3].

In addition, during the present series of tests, observations were taken on NACA 0015, with the edge of the flap rounded while retaining the overall width of $0 \cdot 15c$. Also the sharp-edged flap at 90 deg. was compared on NACA 0015 and RAF 48 with another sharp-edged flap $0 \cdot 2c$ wide placed at $0 \cdot 2c$ from the trailing edge at an angle of 50 deg. The latter has roughly the same projected area on a plane perpendicular to the wing surface as the $0 \cdot 15c$ flap at 90 deg. The term flap, when used without qualification, will refer to the original 15 per cent. sharp-edged flap; when reference is made to the other two flaps, the rounding of the edge or the inclination to the wing will be specified.

Finally, the work was extended to include experiments with the flap fitted to other aerofoils tested earlier without a flap, viz., NACA 23012[4], RAF 28[5] and RAF 48[5] and to a second model of NACA 0012.

2. The range of investigation may be summarised thus:—

NACA 0012	with 15 per cent. sharp-edged flap,
NACA 0015	without flap and with a flap of each of the three types.
NACA 0030	without flap, with square and rounded ends (*see* below section 4) and with 15 per cent. sharp-edged flap,
NACA 23012, RAF 28 and RAF 48	with 15 per cent. sharp-edged flap,
RAF 48	with 20 per cent. sharp-edged flap at 50 deg.

The values of C_L, C_D and C_m were determined for several values of R from $0 \cdot 3$ to 7 millions, approximately, and over a range of incidence from below zero to above the stalling angle. The results are given in the tables, an index to which precedes Table 1.

In addition, the minimum drag coefficient of NACA 0015 and NACA 0030 were found by balance measurements and by the momentum method at closer intervals of R.

3. *Remarks on the Models*.—All the models had a chord of 8 in. and (except NACA 0030 with rounded ends) a span of 4 ft. The previously tested models (NACA 23012, RAF 28 and RAF 48) and the model of NACA 0015 made specially for these tests, were of aluminium alloy, hand-finished with a good smooth surface. The model of NACA 0030, also made for these tests, was of cast aluminium alloy; the surface was slightly pitted in places and did not polish up as well as the other aerofoils, but there was no reason for supecting that the surface was not aerodynamically smooth even up to the highest Reynolds numbers of the tests.

With regard to the NACA 0012 section, the model used for the experiments of R. & M. 1870 was of chromium plated steel. It is regarded as a standard, of which special care is taken so that it can be used for overall calibration of tunnel and balance when occasion demands. It was considered undesirable to deface the model by drilling holes in it for attaching the flap. Therefore, use was made of another steel aerofoil of approximately the same section. This was the base for the copper covering used when examining the effect of rivets (R. & M. 1855)[6]. After removing the copper sheet to prepare the basic wing for test, the latter was found to be so badly pitted as to be totally unsuitable for the experiments. Therefore, a thick layer of zinc was deposited on it by spraying and the model subsequently finished by hand. Measurements of the section at a few places showed that the dimensions were not exactly the same as those of the standard model; they were, however, regarded as being sufficiently close to justify the model being used, especially as a few tests on the model without flaps agreed with those on the standard model.

4. *Square and Rounded Ends.*—In previous experiments balance measurements of the profile drag coefficients. $C_{D,0}$, on thick aerofoils had yielded higher values than the momentum method. Accordingly NACA 0030 was tested with rounded tips added to the rectangular aerofoil. The tips were such that a spanwise section in a plane perpendicular to the chord at any point was a semi-circle of diameter equal to the wing thickness at that point. When, however, the tips were attached to the model it was no longer possible to mount the model on the balance by means of the spigots fitting into holes in the ends of the wing near the leading edge (pip support). The alternative V method was therefore used. With this method, the model is supported from the top of the balance with two V-shaped beams which are attached to the upper surface of the model in the tunnel*. The two methods were applied to the model with square ends as they afforded a check on the corrections normally applied to allow for drag and interference of supports. One set of results only is given for the tests on the square-ended model as the agreement between the two series was in general very good. The flap was fitted to the square-ended model only.

5. *Results.*—The results are given in detail in Tables 2 – 16; Table 1, which is preceded by an index to the tables, gives the dimensions of the sections of the aerofoils.

The values of $C_{D,0}$ have been calculated from the formula

$C_{D,0} = C_D - 0{\cdot}0555\ C_L^2$ for the square ended aerofoils and from

$C_{D,0} = C_D - 0{\cdot}0525\ C_L^2$ for NACA 0030 with rounded ends.

C_m is given with respect to an axis through the chord line $c/4$ from the leading edge.

The main features of the results have been plotted in the figures as follows:—

Fig. 1, $C_{D,0}$ against R for NACA 0012, 0015 and 0030.

Fig. 2, $C_{D,0}$ at $R = 7 \times 10^6$ against wing-thickness ratio.

Fig. 3, $C_{L\,\max.}$ against R.

3(a) NACA 0012

3(b) NACA 0015

3(c) NACA 0030

3(d) NACA 23012 together with RAF 34 also 12 per cent. thick.

3(e) RAF 28 and 48.

3(f) RAF 69 and 89 two aerofoils 21 and 25 per cent. thick based on RAF 28.

These figures include sketches of the sections of the models. Figs. 3(a), 3(b) and 3(d) also contain curves obtained in the large wind tunnel of the D.V.L. (Germany) and in the Full Scale Tunnel (America)[8].

Fig. 4, $C_{L\,\max.}$ against thickness ratio at $R \times 5 \times 10^6$. Wing with and without flap.

6. *Remarks on the Results.*—(*a*) *Drag.* (i) *End Effect.*—Fig. 1 shows that the balance measurements of drag on NACA 0030 are appreciably greater on the square-ended model than on the model with rounded ends. The results on the latter are, however, in fairly close agreement with those obtained by the momentum method, in fact the momentum method yields slightly

* The model being upside down in the tunnel, this is the lower surface of the wing in flight.

higher values of $C_{D,0}$ at Reynolds numbers greater than $0 \cdot 8 \times 10^6$. On a thinner wing, Joukowski $12 \cdot 7$ per cent. thick[9], balance measurements on a square-ended model agreed particularly well with momentum measurements. The agreement gradually deteriorates as thickness increases. At $t/c = 0 \cdot 2$, $C_{D,0}$ may be 10 per cent. greater than the momentum drag, this figure increasing to 17 per cent. when $t/c = 0 \cdot 3$. This is shown in Fig. 2, which applies to a Reynolds number of 7×10^7.

It may probably be assumed that the momentum method gives a truer determination of the profile drag than balance measurements on square-ended wings.

The above considerations regarding agreement between momentum results and balance measurements on thicker models with rounded ends and on thinner models with square ends, lead to the conclusion that balance measurements yield reliable values of $C_{D,0}$ on rectangular wings up to, say, 15 per cent. thick, but that, owing to excessive end-effect, the ends should be rounded on thicker wings in order that balance measurements should be sufficiently accurate.

(ii) *Effect of Thickness.*—Fig. 2 also shows the manner in which the profile drag varies with thickness at $R = 7 \times 10^6$ in the C.A.T.; the curve has been drawn through the values obtained for rounded ends or by the momentum method. The rate of change in $C_{D,0}$ with thickness is fairly small for thin wings but increases appreciably as the thickness increases. For tabulated results see Tables, 6, 10 and 10a.

(*b*) *Lift and Moment.*—Curves giving C_L and C_m against incidence have not been included in the report. The main features of the results can be appreciated from Table 11 giving $dC_L/d\alpha$ and $dC_m/d\alpha$ and from Fig. 3, giving $C_{L\,\max.}$ against R.

(i) *End Effect* on C_L and C_m does not appear to be as important as it is on drag. The value of $dC_L/d\alpha$ is, however, slightly less and the value of $dC_m/d\alpha$ greater on the round ended model. This was also observed in the experiments on the 20 per cent. thick Piercy wing[10] and on the $23 \cdot 6$ per cent. thick Joukowski wing[9]. End effect on $C_{L\,\max.}$ is small.

(ii) The effect of increasing thickness on the two quantities is small between $t/c = 0 \cdot 12$ and $0 \cdot 15$, but a thickness increase from 15 to 30 per cent. results in a decrease in the value of $dC_L/d\alpha$ from $0 \cdot 072$ to $0 \cdot 052$ and at $R = 7 \times 10^6$ an increase in $dC_m/d\alpha$ from $0 \cdot 0013$ to $0 \cdot 0055$. This corresponds to a marked movement of the centre of pressure towards the leading edge as thickness increases. This also is in accordance with results previously obtained on the Piercy[10] and Joukowski[9] wings (*see* R. & M. No. 2459 for the former, and the table on p. 3 of R. & M .No. 1870 for the latter).

(iii) $C_{L\,\max.}$—Turning now to $C_{L\,\max.}$, the results on NACA 0030 show the same characteristics as those served on other thick aerofoils, namely, a marked fall in $C_{L\,\max.}$ as R increases. Reference to Fig. 3(f) shows that on RAF 69 and 89, respectively 21 and 25 per cent. thick, $C_{L\,\max.}$ falls with increasing R up to $R = 3$ or 4×10^6, but rises later. In the case of NACA 0030, the curve is falling over the entire range. With the flap, however, the variation of $C_{L\,\max.}$ with R is small within the range covered by the C.A.T. At first, $C_{L\,\max.}$ increases with R, then falls slightly giving a much greater $\Delta C_{L\,\max.}$, due to flap, than on the thinner wings. Taking values at $R = 5 \times 10^6$, $C_{L\,\max.}$ is plotted against thickness ratio for a number of wings in Fig. 4 and it is immediately evident that $\Delta C_{L\,\max.}$, due to flap, increases steadily with thickness ratio over the range of thickness considered. Indeed, the effect of flap on NACA 0030 is such that, in spite of the low value of $C_{L\,\max.}$ for the bare wing, the value for the wing with flap is but little less than the best observed, viz. on NACA 0015. The effect of increasing wing thickness can be summarised briefly thus :—

$C_{D,0}$ increases slowly at first and then rapidly.

$C_{L\,\max.}$ increases slowly at first and then falls steadily.

$C_{L\,\max.}$ with flap increases rapidly at first and then falls slowly.

It is interesting to note here the good agreement between the C.A.T. results at $R = 5 \times 10^6$ and those obtained in the F.S.T. (America) and at the D.V.L. (Germany) (NACA 0012, 0015 and 23012; Figs. 3(a), (b) and (d)).

It should also be mentioned that the effect of the 20 per cent. flap at 50 deg. is very nearly the same as that of the 15 per cent. flap at 90 deg. As stated above, the projected area of the former perpendicular to the wing surface is nearly equal to the latter.

Finally, the effect on $C_{L\,\max.}$ of rounding-off the edge of the 15 per cent. flap is seen in Fig 3(b). There is a slight diminution in value at the higher Reynolds numbers and plotting C_L against α shows the lift curve to have been displaced in the direction of greater α when the flap was rounded.

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10	D. H. Williams, A. H. Bell and W. G. Raymer.	Experiments on Two Piercy Aerofoils in the C.A.T. R. & M. 2459. August, 1939.

LIST OF TABLES

The flap in all cases except in Table 3 had a sharp edge.

The $0 \cdot 15c$ flap was $0 \cdot 15$ chord from the trailing edge.

The $0 \cdot 20c$ flap was $0 \cdot 2$ chord from the trailing edge.

For results on the last four models without flaps *see* R. & M. No. 1708 (NACA 0012), R. & M. No. 1898 (NACA 23012) and R. & M. No. 1706 (RAF 28 and 48).

TABLE 1

Dimensions of Aerofoils in Terms of Chord

Distance from Leading Edge	NACA 0012	NACA 0015	NACA 0030	NACA 23012		RAF 28		RAF 48	
	$y_1 = y_2$	$y_1 = y_2$	$y_1 = y_2$	y_1	y_2	y_1	y_2	y_1	y_2
0	0	0	0	0	0	0	0	0	0
0·0125	0·0189	0·0238	0·0475	0·0267	0·0123	0·0137	0·0126	0·0260	0·0165
0·025	0·0261	0·0327	0·0654	0·0361	0·0171	0·0217	0·0168	0·0365	0·0234
0·05	0·0356	0·0444	0·0888	0·0491	0·0226	0·0314	0·0223	0·0520	0·0316
0·075	0·0420	0·0525	0·1050	0·0580	0·0261	0·0385	0·0255	0·0639	0·0369
0·10	0·0468	0·0586	0·1172	0·0643	0·0292	0·0444	0·0276	0·0730	0·0403
0·15	0·0534	0·0669	0·1337	0·0719	0·0350	0·0538	0·0304	0·0863	0·0441
0·20	0·0574	0·0717	0·1435	0·0750	0·0397	0·0600	0·0313	0·0953	0·0458
0·30	0·0600	0·0750	0·1500	0·0755	0·0446	0·0664	0·0311	0·1040	0·0456
0·40	0·0580	0·0725	0·1450	0·0714	0·0448	0·0670	0·0286	0·1020	0·0433
0·50	0·0530	0·0663	0·1325	0·0641	0·0417	0·0627	0·0251	0·0938	0·0390
0·60	0·0456	0·0570	0·1141	0·0547	0·0367	0·0540	0·0207	0·0794	0·0336
0·70	0·0367	0·0458	0·0916	0·0436	0·0300	0·0428	0·0160	0·0605	0·0265
0·80	0·0262	0·0328	0·0656	0·0308	0·0216	0·0302	0·0111	0·0402	0·0183
0·90	0·0145	0·0181	0·0362	0·0168	0·0123	0·0163	0·0064	0·0195	0·0100
0·95	0·0081	0·0102	0·0204	0·0092	0·0070	0·0091	0·0042	0·0105	0·0060
1·00	0	0	0	0	0	0	0	0	0

y_1 = ordinate of upper surface with respect to nose-tail datum line.

y_2 = ordinate of lower surface with respect to nose-tail datum line.

TABLE 2

NACA 0015 without flap

$R = 0{\cdot}30 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6{\cdot}62$, $V = 76{\cdot}3$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 2·9	−0·216	0·0137	0·0111	−0·0081
− 0·8	−0·068	0·0113	0·0110	−0·0021
$+ 0{\cdot}2_5$	+0·005	0·0107	0·0107	+0·0006
$1{\cdot}2_5$	0·076	0·0108	0·0105	0·0033
$3{\cdot}3_5$	0·222	0·0134	0·0107	0·0092
6·4	0·451	0·0236	0·0123	0·0127
$9{\cdot}5_5$	0·710	0·0438	0·0158	0·0024
$11{\cdot}5_5$	0·817	0·0570	0·0200	0·0118
$13{\cdot}6_5$	0·905	0·0704	0·0251	0·0244
$14{\cdot}6_5$	0·956	0·0780	0·0273	0·0287
15·7	0·948	0·090		+0·0281
$16{\cdot}9_5$	0·580	0·210		−0·0518
18·1	0·543	0·229		−0·0547
$19{\cdot}1_5$	0·540	0·244		−0·0575
21·3	0·539	0·273		−0·0623
23·4	0·553	0·306		−0·0659
24·5	0·554	0·326		−0·0681
$25{\cdot}5_5$	0·565	0·340		−0·0710
$14{\cdot}7_5$*	0·827	0·165		−0·0484
$15{\cdot}8_5$*	0·656	0·192		−0·0481

$R = 0{\cdot}67 \times 10^6$, $P = 2{\cdot}28$ atmos., $\frac{1}{2}\rho V^2 = 13{\cdot}5$, $V = 71{\cdot}4$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 2·9	−0·219	0·0116	0·0090	−0·0059
− 0·8	−0·070	0·0089	0·0086	−0·0015
$+ 0{\cdot}2_5$	+0·003	0·0085	0·0085	+0·0006
1·3	0·075	0·0087	0·0084	0·0028
$3{\cdot}3_5$	0·220	0·0114	0·0087	0·0073
$6{\cdot}4_5$	0·437	0·0210	0·0104	0·0134
$9{\cdot}5_5$	0·658	0·0378	0·0138	0·0149
$12{\cdot}5_5$	0·857	0·0587	0·0189	0·0201
14·7	0·982	0·0749	0·0214	0·0251
$15{\cdot}7_5$	0·994	0·0851	0·0303	0·0265
$16{\cdot}7_5$	1·010	0·104		0·0147
$17{\cdot}8_5$	1·016	0·120		+0·0095
$18{\cdot}9_5$	0·993	0·140		−0·0013
21·3	0·542	0·271		−0·0625
$24{\cdot}4_5$	0·557	0·318		−0·0682
15·8*	0·784	0·156		−0·0256
$16{\cdot}9_5$*	0·645	0·197		−0·0426
18·1*	0·597	0·220		−0·0502
$19{\cdot}1_5$*	0·569	0·240		−0·0544

C_m is given throughout with reference to the quarter-chord axis.
$\frac{1}{2}\rho V^2$ is given throughout in lb./sq. ft.

$R = 1{\cdot}27 \times 10^6$, $P = 4{\cdot}47$ atmos., $\frac{1}{2}\rho V^2 = 25{\cdot}4$, $V = 70{\cdot}3$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·8	−0·073	0·0081	0·0078	−0·0014
$+ 0{\cdot}2_5$	+0·002	0·0079	0·0079	+0·0005
1·3	0·066	0·0081	0·0079	0·0023
3·4	0·230	0·0110	0·0081	0·0061
$6{\cdot}4_5$	0·449	0·0205	0·0093	0·0109
9·6	0·665	0·0363	0·0118	0·0158
$12{\cdot}6_5$	0·875	0·0574	0·0149	0·0199
14·7	1·005	0·0746	0·0186	0·0227
15·8	1·062	0·0837	0·0212	0·0238
16·8	1·113	0·0946	0·0280	0·0247
$17{\cdot}8_5$	1·079	0·124		+0·0045
$18{\cdot}9_5$	1·072	0·140		−0·0004
21·1	1·007	0·187		−0·0231
24·4	0·807	0·310		−0·0565
$19{\cdot}0_5$*	0·879	0·165		+0·0034
21·2*	0·799	0·256		−0·0486

$R = 2{\cdot}19 \times 10^6$, $P = 7{\cdot}9$ atmos., $\frac{1}{2}\rho V^2 = 42{\cdot}3$, $V = 68{\cdot}0$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·8	−0·079	0·0081	0·0078	−0·0010
$+ 0{\cdot}2_5$	−0·002	0·0078	0·0078	+0·0006
1·3	+0·074	0·0081	0·0078	0·0025
3·4	0·226	0·0109	0·0081	0·0060
6·5	0·450	0·0204	0·0092	0·0107
9·7	0·679	0·0365	0·0109	0·0141
$12{\cdot}7_5$	0·900	0·0588	0·0139	0·0166
$14{\cdot}8_5$	1·039	0·0765	0·0166	0·0182
$15{\cdot}8_5$	1·106	0·0865	0·0187	0·0187
$16{\cdot}8_5$	1·176	0·0965		0·0194
$17{\cdot}9_5$	1·231	0·108		0·0199
19·0	1·282	0·119		+0·0200
20·1	1·136	0·165		−0·0108
22·2	1·008	0·215		−0·0360

* Decreasing incidence.

TABLE 2 (*contd.*)

NACA 0015 *without flap*

$R = 4{\cdot}26 \times 10^6$, $P = 12{\cdot}4$ atmos.,
$\frac{1}{2}\rho V^2 = 107{\cdot}0$ $V = 86{\cdot}9$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-\ 0{\cdot}8_5$	−0·077	0·0083	0·0080	−0·0014
$+\ 0{\cdot}2_5$	+0·005	0·0079	0·0079	+0·0002
$1{\cdot}3_5$	0·083	0·0083	0·0079	0·0017
3·5	0·244	0·0111	0·0078	0·0051
$6{\cdot}7_5$	0·480	0·0213	0·0085	0·0095
$9{\cdot}9_5$	0·718	0·0377	0·0091	0·0125
13·1	0·947	0·0616	0·0129	0·0143
$15{\cdot}2_5$	1·091	0·0808	0·0148	0·0148
17·3	1·235	0·102	0·0174	0·0152
$18{\cdot}4_5$	1·295	0·113	0·0200	0·0154
19·5	1·360	0·125		0·0156
$20{\cdot}5_5$	1·412	0·138		+0·0152
$21{\cdot}5_5$	1·187	0·195		−0·0220
$22{\cdot}5_5$	1·056	0·230		−0·0438
24·7	0·992	0·276		−0·0509

$R = 5{\cdot}54 \times 10^6$, $P = 17{\cdot}8$ atmos.,
$\frac{1}{2}\rho V^2 = 130{\cdot}0$, $V = 80{\cdot}7$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-\ 0{\cdot}8_5$	−0·078	0·0085	0·0082	−0·0013
$+\ 0{\cdot}2_5$	+0·005	0·0081	0·0081	+0·0003
$1{\cdot}3_5$	0·087	0·0083	0·0079	0·0019
$3{\cdot}5_5$	0·252	0·0114	0·0079	0·0049
$6{\cdot}7_5$	0·490	0·0217	0·0085	0·0091
$10{\cdot}0_5$	0·738	0·0383	0·0081	0·0120
$13{\cdot}2_5$	0·961	0·0622	0·0110	0·0134
$16{\cdot}4_5$	1·182	0·0914	0·0139	0·0139
18·6	1·324	0·115	0·0181	0·0140
19·7	1·369	0·126	0·0207	0·0144
$20{\cdot}7_5$	1·432	0·136		+0·0143
$21{\cdot}7_5$	1·216	0·189		−0·0274
22·7	1·182	0·236		−0·0467
$24{\cdot}7_5$	1·000	0·290		−0·0676

$R = 7{\cdot}40 \times 10^6$, $P = 24{\cdot}4$ atmos.,
$\frac{1}{2}\rho V^2 = 171{\cdot}5$, $V = 79{\cdot}4$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·9	−0·083	0·0089	0·0085	−0·0011
$+\ 0{\cdot}2_5$	+0·001	0·0083	0·0083	+0·0004
1·4	0·085	0·0087	0·0083	0·0018
3·6	0·251	0·0116	0·0081	0·0050
6·9	0·498	0·0220	0·0083	0·0090
$10{\cdot}2_5$	0·745	0·0395	0·0087	0·0110
13·5	0·982	0·0639	0·0104	0·0118
$16{\cdot}7_5$	1·196	0·0965	0·0172	0·0124
$18{\cdot}9_5$	1·321	0·119	0·0225	0·0126
20·0	1·386	0·131	0·0251	0·0125
$21{\cdot}1_5$	1·436	0·143		+0·0127
22·0	1·260	0·206		−0·0239
23·0	1·234	0·236		−0·0374
24·9	1·015	0·304		−0·0697

TABLE 3

NACA 0015 *with* 15 *per cent. sharp edge flap at* 90 *deg.* *Aspect ratio* 6

$R = 0{\cdot}31 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6{\cdot}62$, $V = 75{\cdot}5$ ft./sec.

α deg.	C_L	C_D	C_m
−10·9$_5$	0·080	0·150	−0·170
− 8·8$_5$	0·265	0·159	−0·184
− 5·6$_5$	0·533	0·176	−0·190
− 2·5$_5$	0·770	0·196	−0·199
+ 1·6	1·069	0·230	−0·204
5·7	1·337	0·269	−0·199
8·9	1·542	0·304	−0·197
10·9$_5$	1·655	0·328	−0·197
12·0	1·711	0·341	−0·197
13·0	1·778	0·354	−0·198
14·5$_5$	1·037	0·503	−0·259
16·6$_5$	1·024	0·549	−0·247
11·1*	1·340	0·422	−0·259
12·3*	1·165	0·463	−0·268
13·4*	1·092	0·485	−0·266

$R = 0{\cdot}66 \times 10^6$, $P = 2{\cdot}25$ atmos., $\frac{1}{2}\rho V^2 = 13{\cdot}5$, $V = 71{\cdot}9$ ft./sec.

α deg.	C_L	C_D	C_m
−11·0	0·064	0·146	−0·156
− 8·9$_5$	0·247	0·155	−0·169
− 5·6$_5$	0·517	0·173	−0·185
− 2·5$_5$	0·757	0·192	−0·190
+ 1·6$_5$	1·056	0·227	−0·193
5·7$_5$	1·331	0·264	−0·191
8·9	1·527	0·299	−0·189
10·9$_5$	1·647	0·323	−0·187
12·0$_5$	1·712	0·337	−0·187
13·0$_5$	1·769	—	—
14·1	1·827	0·365	−0·187
15·1$_5$	1·887	—	—
16·1$_5$	1·935	0·391	−0·188
17·7	1·042	0·578	−0·254
18·8	1·032	0·606	−0·258
19·8	1·073	0·635	−0·263
12·3*	1·282	0·438	−0·243
13·4*	1·125	—	—
14·5$_5$*	1·067	0·497	−0·248
15·6*	1·045	—	—
16·6*	1·036	0·553	−0·253

$R = 1{\cdot}26 \times 10^6$, $P = 4{\cdot}40$ atmos., $\frac{1}{2}\rho V^2 = 25{\cdot}4$, $V = 71{\cdot}0$ ft./sec.

α deg.	C_L	C_D	C_m
−11·0	0·049	0·145	−0·152
− 8·9$_5$	0·239	0·157	−0·166
− 5·6$_5$	0·513	0·172	−0·180
− 2·5$_5$	0·760	0·192	−0·187
+ 1·6$_5$	1·065	0·224	−0·191
5·8	1·348	0·264	−0·190
9·0	1·546	0·295	−0·188
11·0	1·671	0·323	−0·186
13·1	1·786	0·350	−0·184
14·2	1·860	—	—
15·2	1·926	0·382	−0·184
16·2	1·981	—	—
17·2	2·045	0·406	−0·184
18·3	2·097	—	—
19·3	2·165	0·425	−0·183
20·3	2·203	—	—
21·9$_5$	1·105	0·692	−0·268
24·2	1·051	0·737	−0·262
16·4$_5$*	1·428	—	—
17·5$_5$*	1·337	0·566	−0·261
18·7$_5$*	1·206	—	—
19·7$_5$*	1·153	0·630	−0·263
20·8$_5$*	1·143	—	—

$R = 2{\cdot}14 \times 10^6$, $P = 7{\cdot}7$ atmos., $\frac{1}{2}\rho V^2 = 42{\cdot}3$, $V = 69{\cdot}0$ ft./sec.

α deg.	C_L	C_D	C_m
−11·0$_5$	0·053	0·144	−0·155
− 8·9	0·239	0·154	−0·167
− 5·7	0·504	0·171	−0·180
− 2·5$_5$	0·755	0·193	−0·187
+ 1·7	1·063	0·230	−0·191
5·8$_5$	1·351	0·269	−0·189
9·0$_5$	1·546	0·304	−0·187
11·1	1·677	0·328	−0·185
13·2$_5$	1·806	0·355	−0·183
15·3	1·932	0·385	−0·183
17·3$_5$	2·051	0·415	−0·182
18·4	2·117	0·431	−0·183
19·4$_5$	2·177	0·447	−0·183
20·5	2·248	0·464	−0·184
21·5$_5$	2·292	0·480	−0·183
22·6$_5$	2·337	0·496	−0·184
24·1	1·248	0·688	−0·259
25·2	1·212	0·718	−0·259
18·6$_5$*	1·593	0·473	−0·204
19·7$_5$*	1·412	—	—
20·8*	1·329	0·511	−0·216
21·9$_5$*	1·265	—	—
23·1*	1·216	0·556	−0·223$_5$

* Decreasing incidence.

TABLE 3 (*contd.*)

$R = 4\cdot17 \times 10^6$, $P = 12\cdot3$ atmos.,
$\frac{1}{2}\rho V^2 = 107\cdot0$, $V = 87\cdot8$ ft./sec.

α deg.	C_L	C_D	C_m
$-11\cdot2_5$	0·044	0·144	−0·158
$-\ 9\cdot0_5$	0·223	0·151	−0·166
$-\ 5\cdot7_5$	0·494	0·170	−0·178
$-\ 1\cdot4_5$	0·825	0·198	−0·185
$+\ 2\cdot9_5$	1·141	0·237	−0·187
7·2	1·428	0·278	−0·185
11·5	1·688	0·328	−0·184
15·8	1·953	0·389	−0·184
$18\cdot9_5$	2·143	0·436	−0·183
$21\cdot0_5$	2·267	0·471	−0·184
22·2	2·325	0·485	−0·184
$23\cdot2_5$	2·380	0·505	−0·183
$24\cdot2_5$	1·198	0·616	−0·239
$25\cdot2_5$	1·170	0·665	−0·251
18·9*	1·609	0·503	−0·213
21·0*	1·430	0·536	−0·232
$22\cdot0_5$*	1·342	0·555	−0·233
$23\cdot1_5$*	1·252	0·574	−0·233

$R = 5\cdot39 \times 10^6$, $P = 17\cdot6$ atmos.,
$\frac{1}{2}\rho V^2 = 130\cdot0$, $V = 81\cdot9$ ft./sec.

α deg.	C_L	C_D	C_m
$-11\cdot3_5$	0·043	0·145	−0·160
$-\ 9\cdot1$	0·221	0·154	−0·169
$-\ 5\cdot7_5$	0·490	0·171	−0·178
$-\ 1\cdot4_5$	0·823	0·198	−0·183
$+\ 3\cdot0_5$	1·127	0·236	−0·185
$7\cdot3_5$	1·420	0·279	−0·186
$11\cdot6_5$	1·698	0·325	−0·182
16·0	1·946	0·387	−0·182
$19\cdot1_5$	2·140	0·436	−0·184
21·3	2·272	0·467	−0·187
22·4	2·323	0·487	−0·187
23·5	2·374	0·507	−0·183
$24\cdot2_5$	1·198	0·631	−0·243
$25\cdot2_5$	1·202	0·685	−0·261
$20\cdot0_5$*	1·619	0·511	−0·214
$21\cdot0_5$*	1·428	0·540	−0·223
$22\cdot1_5$*	1·348	0·565	−0·231
23·2*	1·260	0·588	−0·235

TABLE 4

NACA 0015 *with* 15 *per cent. rounded edge flap at* 90 *deg.* *Aspect ratio* 6

$R = 0\cdot68 \times 10^6$, $P = 2\cdot35$ atmos.,
$\frac{1}{2}\rho V^2 = 13\cdot5$, $V = 70\cdot3$ ft./sec.

α deg.	C_L	C_D	C_m
$-10\cdot9_5$	0·036	0·138	−0·148
$-\ 8\cdot8_5$	0·221	0·146	−0·162
$-\ 5\cdot6_5$	0·483	0·163	−0·175
$-\ 2\cdot5_5$	0·727	0·183	−0·181
$+\ 1\cdot6_5$	1·028	0·217	−0·185
5·8	1·308	0·255	−0·181
$8\cdot9_5$	1·494	0·289	−0·180
$12\cdot0_5$	1·668	0·329	−0·180
$14\cdot1_5$	1·807	0·352	−0·178
$15\cdot1_5$	1·862	0·367	−0·177
$16\cdot1_5$	1·928	0·382	−0·177
17·7	1·028	0·566	−0·239
$19\cdot8_5$	1·044	0·623	−0·251
20·0	1·056	0·683	−0·261
12·3*	1·292	0·419	−0·231
$14\cdot5_5$*	1·059	0·483	−0·241
15·6*	1·034	0·507	−0·238
$16\cdot6_5$*	1·027	0·532	−0·242

$R = 1\cdot28 \times 10^6$, $P = 4\cdot40$ atmos.,
$\frac{1}{2}\rho V^2 = 25\cdot4$, $V = 70\cdot3$ ft./sec.

α deg.	C_L	C_D	C_m
$-10\cdot9_5$	0·016	0·136	−0·145
$-\ 8\cdot8_5$	0·203	0·145	−0·157
$-\ 5\cdot6$	0·474	0·162	−0·171
$-\ 2\cdot5_5$	0·725	0·183	−0·179
$+\ 1\cdot6_5$	1·028	0·214	−0·179
5·8	1·311	0·257	−0·181
$9\cdot0_5$	1·517	0·290	−0·178
$11\cdot0_5$	1·651	0·314	−0·176
14·2	1·834	0·355	−0·175
$16\cdot2_5$	1·961	0·381	−0·171
18·3	2·006	0·413	−0·175
$19\cdot3_5$	2·149	0·426	−0·177
$20\cdot3_5$	2·203	0·442	−0·178
21·9	1·152	0·679	−0·260
23·1	1·072	0·679	−0·249
16·4*	1·532	0·483	−0·222
$18\cdot6_5$*	1·366	0·556	−0·235
19·7*	1·330	0·575	−0·232
$20\cdot8_5$*	1·206	0·643	−0·255

* Decreasing incidence.

TABLE 4 (*contd.*)

$R = 2{\cdot}13 \times 10^6$, $P = 7{\cdot}7$ atmos.,
$\frac{1}{2}\rho V^2 = 42{\cdot}3$, $V = 69{\cdot}3$ ft./sec.

α deg.	C_L	C_D	C_m
$-11{\cdot}0_5$	0·009	0·133	−0·146
$-\ 8{\cdot}9$	0·195	0·143	−0·157
$-\ 5{\cdot}6_5$	0·460	0·161	−0·169
$-\ 1{\cdot}5$	0·789	0·192	−0·179
$+\ 2{\cdot}7_5$	1·087	0·227	−0·178
$7{\cdot}0$	1·368	0·269	−0·177
$11{\cdot}1_5$	1·636	0·318	−0·175
$15{\cdot}3$	1·895	0·372	−0·173
$18{\cdot}4_5$	2·074	0·417	−0·172
$20{\cdot}5$	2·197	0·450	−0·172
$21{\cdot}6$	2·243	0·488	−0·173
$22{\cdot}6_5$	2·293	0·484	−0·172
$24{\cdot}1_5$	1·177	0·576	−0·222
$25{\cdot}2$	1·172	0·612	−0·222
$18{\cdot}6_5$*	1·581	0·451	−0·195
$20{\cdot}8_5$*	1·336	0·504	−0·210
$21{\cdot}9_5$*	1·266	0·524	−0·215
$23{\cdot}1$*	1·217	0·550	−0·218

$R = 4{\cdot}36 \times 10^6$, $P = 12{\cdot}7$ atmos.,
$\frac{1}{2}\rho V^2 = 107{\cdot}0$, $V = 85{\cdot}8$ ft./sec.

α deg.	C_L	C_D	C_m
$-11{\cdot}2$	−0·004	0·131	−0·146
$-\ 9{\cdot}0$	+0·171	0·139	−0·155
$-\ 5{\cdot}7$	0·438	0·155	−0·164
$-\ 1{\cdot}4$	0·777	0·184	−0·170
$+\ 3{\cdot}0$	1·088	0·220	−0·172
$7{\cdot}2$	1·379	0·262	−0·173
$11{\cdot}5_5$	1·645	0·312	−0·170
$15{\cdot}8$	1·896	0·367	−0·170
$19{\cdot}0_5$	2·090	0·417	−0·170
$20{\cdot}0_5$	2·152	0·433	−0·171
$21{\cdot}1$	2·218	0·452	−0·172
$22{\cdot}1_5$	2·273	0·569	−0·174
$23{\cdot}1_5$	1·228	0·580	−0·227
$25{\cdot}2$	1·226	0·691	−0·255
$18{\cdot}9_5$*	1·631	0·471	−0·200
$19{\cdot}9_5$*	1·598	0·511	−0·218
$21{\cdot}0$*	1·414	0·535	−0·225
$22{\cdot}1$*	1·252	0·551	−0·222

$R = 5{\cdot}71 \times 10^6$, $P = 18{\cdot}4$ atmos.,
$\frac{1}{2}\rho V^2 = 130{\cdot}0$, $V = 79{\cdot}1$ ft./sec.

α deg.	C_L	C_D	C_m
$-11{\cdot}3$	−0·020	0·129	−0·144
$-\ 9{\cdot}0_5$	+0·156	0·135	−0·151
$-\ 5{\cdot}7$	0·423	0·151	−0·159
$-\ 1{\cdot}3_5$	0·765	0·180	−0·167
$+\ 3{\cdot}0$	1·082	0·216	−0·169
$7{\cdot}3_5$	1·376	0·258	−0·170
$11{\cdot}7$	1·652	0·308	−0·167
$16{\cdot}0$	1·918	0·366	−0·169
$19{\cdot}2_5$	2·103	0·416	−0·170
$21{\cdot}3$	2·232	0·449	−0·172
$22{\cdot}4$	2·278	0·469	−0·173
$23{\cdot}2$	1·236	0·588	−0·224
$25{\cdot}2_5$	1·179	0·680	−0·251
$20{\cdot}1$*	1·647	0·470	−0·199
$21{\cdot}1_5$*	1·465	0·511	−0·199
$22{\cdot}1_5$*	1·333	0·551	−0·223

* Decreasing incidence.

TABLE 5

NACA 0015 *with* 20 *per cent. flap at* 50 *deg fixed at* 0·2*c from the trailing edge. Aspect ratio* 6

$R = 0{\cdot}30 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6{\cdot}63$, $V = 76{\cdot}5$ ft./sec.

α deg.	C_L	C_D	C_m
− 2·5	0·742	0·160	−0·223
+ 0·5	0·973	0·184	−0·221
3·6	1·200	0·213	−0·221
$6{\cdot}6_5$	1·421	0·248	−0·220
9·7	1·627	0·282	−0·219
11·7	1·744	0·305	−0·216
$12{\cdot}6_5$	1·807	0·316	−0·215
$14{\cdot}1_5$	1·091	0·465	−0·275
15·3	1·059	0·484	−0·282
16·4	1·038	0·506	−0·271
12·0*	1·257	0·417	−0·277
13·0*	1·154	0·444	−0·279

$R = 0{\cdot}65 \times 10^6$, $P = 2{\cdot}40$ atmos., $\frac{1}{2}\rho V^2 = 13{\cdot}3$, $V = 70{\cdot}7$ ft./sec.

α deg.	C_L	C_D	C_m
− 2·5	0·738	0 156	−0·218
+ 0·5	0·968	0·178	−0·219
$3{\cdot}6_5$	1·192	0·208	−0·219
6·7	1·413	0·243	−0·219
9·7	1·629	0·279	−0·220
$12{\cdot}6_5$	1·820	0·316	−0·218
$13{\cdot}7_5$	1·877	0·329	−0·217
14·8	1·936	0·342	−0·214
$15{\cdot}8_5$	1·965	0·355	−0·212
$17{\cdot}4_5$	1·141	0·524	−0·277
$18{\cdot}5_5$	1·137	0·548	−0·277
13·0*	1·192	0·436	−0·273
15·2*	1·182	0·483	−0·278
16·4*	1·044	0·509	−0·277

$R = 1{\cdot}22 \times 10^6$, $P = 4{\cdot}60$ atmos., $\frac{1}{2}\rho V^2 = 24{\cdot}9$, $V = 70{\cdot}3$ ft./sec.

α deg.	C_L	C_D	C_m
− 2·5	0·727	0·155	−0·218
+ $0{\cdot}5_5$	0·955	0·177	−0·218
$3{\cdot}6_5$	1·189	0·210	−0·221
$6{\cdot}7_5$	1·404	0·243	−0·221
$9{\cdot}7_5$	1·627	0·280	−0·221
$12{\cdot}7_5$	1·808	0·318	−0·218
14·9	1·946	0·345	−0·217
17·0	2·057	0·372	−0·214
18·1	2·108	0·387	−0·213
$19{\cdot}1_5$	2·144	0·401	−0·212
$20{\cdot}5_5$	1·442	0·562	−0·261
$21{\cdot}7_5$	1·411	0·591	−0·259
17·3*	1·512	0·486	−0·259
$18{\cdot}5_5$*	1·137	0·532	−0·252
$19{\cdot}6_5$*	1·121	0·543	−0·255

$R = 2{\cdot}11 \times 10^6$, $P = 8{\cdot}0$ atmos., $\frac{1}{2}\rho V^2 = 41{\cdot}6$, $V = 67{\cdot}9$ ft./sec.

α deg.	C_L	C_D	C_m
− 2·5	0·723	0·154	−0·216
+ $0{\cdot}5_5$	0·959	0·178	−0·217
3·7	1·183	0·208	−0·218
6·8	1·407	0·241	−0·218
$9{\cdot}8_5$	1·618	0·281	−0·219
$12{\cdot}8_5$	1·812	0·320	−0·218
15·0	1·947	0·351	−0·216
17·1	2·065	0·378	−0·214
19·3	2·180	0·408	−0·213
$20{\cdot}3_5$	2·250	0·424	−0·212
$21{\cdot}4_5$	2·298	0·440	−0·210
$22{\cdot}4_5$	2·336	0·450	−0·207
$23{\cdot}9_5$	1 231	0·547	−0·252
$25{\cdot}0_5$	1·193	0·571	−0·257
$19{\cdot}5_5$*	1·485	0·449	−0·235
$20{\cdot}6_5$*	1·384	0·472	−0·239
21·8*	1·319	0·497	−0·242
22·9*	1·276	0·522	−0·248

* Decreasing incidence.

TABLE 5 (*contd.*)

$R = 4\cdot31 \times 10^6$, $P = 13\cdot4$ atmos., $\frac{1}{2}\rho V^2 = 104\cdot2$, $V = 83\cdot1$ ft./sec.

α deg.	C_L	C_D	C_m
$-2\cdot5$	0·718	0·156	−0·215
$+0\cdot6$	0·965	0·181	−0·219
3·9	1·201	0·209	−0·219
7·05	1·422	0·245	−0·219
10·2	1·633	0·283	−0·218
$13\cdot2_5$	1·843	0·322	−0·218
$15\cdot4_5$	1·979	0·351	−0·216
$17\cdot6_5$	2·103	0·381	−0·215
19·8	2·225	0·414	−0·217
20·9	2·285	0·432	−0·217
22·0	2·347	0·446	−0·216
$23\cdot0_5$	2·388	0·465	−0·214
24·0	1·226	0·573	−0·258
25·1	1·191	0·596	−0·267
$20\cdot8_5$*	1·516	0·493	−0·252
21·9*	1·394	0·525	−0·257
$22\cdot9_5$*	1·323	0·550	−0·261

$R = 6\cdot23 \times 10^6$, $P = 23\cdot9$ atmos., $\frac{1}{2}\rho V^2 = 122\cdot4$, $V = 67\cdot6$ ft./sec.

α deg.	C_L	C_D	C_m
$-2\cdot5$	0·719	0·153	−0·214
$+0\cdot6$	0·941	0·178	−0·218
3·9	1·210	0·210	−0·218
7·05	1·432	0·244	−0·217
$10\cdot2_5$	1·644	0·279	−0·216
13·3	1·852	0·322	−0·217
15·5	1·990	0·353	−0·217
$17\cdot7_5$	2·097	0·382	−0·215
$19\cdot9_5$	2·222	0·418	−0·215
$21\cdot0_5$	2·293	0·432	−0·217
$22\cdot1_5$	2·357	0·449	−0·215
$22\cdot9_5$	1·336	0·573	−0·275
$24\cdot0_5$	1·251	0·598	−0·271
$20\cdot8_5$*	1·638	0·509	−0·259
$21\cdot9_5$*	1·458	0·543	−0·267

* Decreasing incidence.

TABLE 6

NACA 0015 *without flap. Minimum drag*

P atmos.	$R \times 10^{-6}$	C_L	C_D	$C_{D,0}$
2·26	0·36	−0·067	0·0106	0·0103
		+0·004	0·0100	0·0100
		0·072	0·0103	0·0100
2·26	0·51	−0·070	0·0097	0 0094
		+0·003	0·0094	0·0094
		0·073	0·0097	0·0094
2·26	0·80	−0·072	0·0085	0·0082
		+0·004	0·0083	0·0083
		0·067	0·0085	0·0083
4·48	0·72	−0·072	0·0089	0·0086
		−0·002	0·0083	0·0083
		0·074	0·0088	0·0085
4·47	0·94	−0·074	0·0083	0·0080
		+0·001	0·0080	0·0080
		0·076	0·0084	0·0081
4·46	1·52	−0·079	0·0084	0·0080
		+0·001	0·0080	0·0080
		+0·074	0·0083	0·0080

P atmos.	$R \times 10^{-6}$	C_L	C_D	$C_{D,0}$
7·68	1·25	−0·074	0·0083	0·0080
		+0·002	0·0079	0·0079
		0·076	0·0083	0·0080
7·68	1·60	−0·079	0·0083	0·0080
		−0·001	0·0078	0·0078
		+0·074	0·0083	0·0080
7·97	2·74	−0·082	0·0083	0·0079
		+0·002	0·0078	0·0078
		0·081	0·0082	0·0079
$12\cdot2_5$	1·98	−0·079	0·0084	0·0081
		−0·000	0·0079	0·0079
		+0·072	0·0083	0·0080
$12\cdot3_5$	2·59	−0·076	0·0081	0·0078
		+0·003	0·0079	0·0079
		0·077	0·0082	0·0079
12·4	3·45	−0·075	0·0083	0·0080
		+0·003	0·0079	0·0079
		0·082	0·0083	0·0079

TABLE 6 (*contd.*)

P atmos.	$R \times 10^{-6}$	C_L	C_D	$C_{D,0}$
17·3	3·51	—0·079 +0·001 0·079	0·0085 0·0080 0·0084	0·0082 0·0080 0·0081
17·5	4·76	—0·079 +0·003 0·084	0·0088 0·0081 0·0084	0·0085 0·0081 0·0080
17·7	5·90	—0·084 +0·003 0·086	0·0088 0·0082 0·0085	0·0084 0·0082 0·0081
23·3	4·67	—0·080 +0·001 0·080	0·0086 0·0082 0·0084	0·0083 0·0082 0·0081
23·7	6·86	—0·083 +0·002 0·085	0·0089 0·0085 0·0089	0·0085 0·0085 0·0085
24·2	7·95	—0·082 +0·002 0·085	0·0091 0·0085 0·0087	0·0087 0·0085 0·0083

TABLE 7

NACA 0030 *without flap. Square ends, on pips*

$R = 0 \cdot 31 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6 \cdot 56$, $V = 74 \cdot 9$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-0 \cdot 1_5$	−0·012	0·0209	0·0209	−0·0007
$+0 \cdot 8_5$	+0·042	0·0206	0·0205	+0·0046
$1 \cdot 9_5$	0·100	0·0213	0·0207	0·0098
5·0	0·270	0·0260	0·0220	0·0234
8·1	0·435	0·0348	0·0243	0·0348
$11 \cdot 1_5$	0·583	0·0477	0·0288	0·0471
$13 \cdot 2_5$	0·682	0·0603	0·0345	0·0523
$15 \cdot 2_5$	0·791	0·0799	0·0452	0·0499
$17 \cdot 3_5$	0·882	0·0995	0·0563	0·0440
$19 \cdot 4_5$	0·939	0·117	0·068	0·0428
21·6	0·981	0·140	0·086	0·0393
23·7	1·024	0·170	0·111	0·0284
24·8	1·015	0·187	0·130	0·0213
$25 \cdot 9_5$	1·001	0·207	0·151	+0·0142
27·5	0·282	0·456	0·451	−0·0028
17·7*	0·356	0·197	0·190	+0·0097
$19 \cdot 9_5$*	0·251	0·242	0·239	+0·0042
$22 \cdot 0_5$*	0·261	0·272	0·268	−0·0038
$24 \cdot 2_5$*	0·258	0·292	0·289	−0·0068
25·3*	0·267	0·302	0·294	−0·0087
$26 \cdot 4_5$*	0·273	0·314	0·310	−0·0091

$R = 0 \cdot 67 \times 10^6$, $P = 2 \cdot 40$ atmos., $\frac{1}{2}\rho V^2 = 13 \cdot 1$, $V = 68 \cdot 8$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
−0·2	−0·013	0·0172	0·0172	−0·0016
+0·8	+0·039	0·0172	0·0171	+0·0048
1·9	0·094	0·0181	0·0176	0·0112
5·0	0·258	0·0225	0·0188	0·0281
$8 \cdot 0_5$	0·423	0·0314	0·0214	0·0410
11·1	0·584	0·0456	0·0266	0·0503
14·2	0·731	0·0648	0·0351	0·0554
$16 \cdot 2_5$	0·824	0·0836	0·0458	0·0524
18·4	0·908	0·106	0·055	0·0465
$20 \cdot 4_5$	0·978	0·132	0·079	0·0384
22·6	1·007	0·165	0·108	0·0268
23·7	0·998	0·186	0·131	0·0188
24·8	0·979	0·205	0·152	0·0125
$25 \cdot 9_5$	0·964	0·221	0·171	0·0072
27·0	0·953	0·236	0·186	0·0022

* Decreasing incidence.

$R = 1 \cdot 24 \times 10^6$, $P = 4 \cdot 30$ atmos., $\frac{1}{2}\rho V^2 = 24 \cdot 7$, $V = 70 \cdot 1$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-0 \cdot 3_5$	−0·018	0·0147	0·0147	−0·0025
$+0 \cdot 7_5$	+0·034	0·0152	0·0151	+0·0040
$1 \cdot 7_5$	0·086	0·0158	0·0154	0·0107
2·8	0·140	0·0168	0·0157	0·0171
4·9	0·247	0·0197	0·0173	0·0287
$7 \cdot 9_5$	0·415	0·0283	0·0187	0·0414
$11 \cdot 0_5$	0·587	0·0422	0·0230	0·0499
$14 \cdot 1_5$	0·729	0·0631	0·0335	0·0527
$17 \cdot 2_5$	0·857	0·0937	0·0528	0·0478
19·4	0·917	0·119	0·072	0·0409
20·4	0·945	0·134	0·085	0·0358
$21 \cdot 4_5$	0·945	0·152	0·103	0·0292
$22 \cdot 5_5$	0·929	0·172	0·124	0·0229
$24 \cdot 7_5$	0·901	0·205	0·160	0·0130
26·9	0·889	0·237	0·193	0·0035

$R = 2 \cdot 19 \times 10^6$, $P = 8 \cdot 2$ atmos., $\frac{1}{2}\rho V^2 = 41 \cdot 3$, $V = 66 \cdot 1$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
−0·4	−0·020	0·0139	0·0139	−0·0023
+0·7	+0·032	0·0141	0·0140	+0·0041
1·7	0·084	0·0143	0·0139	0·0108
3·8	0·192	0·0166	0·0146	0·0227
6·9	0·366	0·0239	0·0165	0·0359
$9 \cdot 9_5$	0·539	0·0358	0·0197	0·0444
12·0	0·653	0·0481	0·0245	0·0474
14·1	0·750	0·0648	0·0336	0·0467
$16 \cdot 1_5$	0·818	0·0905	0·0534	0·0409
18·3	0·849	0·123	0·083	0·0321
$19 \cdot 3_5$	0·861	0·139	0·098	0·0278
20·4	0·875	0·167	0·125	0·0228
$21 \cdot 4_5$	0·871	0·177	0·135	0·0171
$22 \cdot 5_5$	0·870	0·194	0·152	0·0120
$24 \cdot 7_5$	0·819	0·226	0·189	+0·0020
26·9	0·812	0·254	0·218	−0·0072

TABLE 7 (*contd.*)

$R = 4\cdot22 \times 10^6$, $P = 12\cdot6$ atmos.,
$\frac{1}{2}\rho V^2 = 103\cdot5$, $V = 85\cdot0$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-0\cdot2_5$	−0·015	0·0143	0·0143	−0·0017
$+0\cdot8$	+0·039	0·0142	0·0141	+0·0048
$1\cdot8_5$	0·091	0·0147	0·0142	0·0107
$3\cdot9_5$	0·202	0·0169	0·0146	0·0218
$7\cdot0_5$	0·377	0·0244	0·0165	0·0345
10·1	0·550	0·0370	0·0202	0·0445
$12\cdot1_5$	0·645	0·0496	0·0265	0·0494
14·3	0·701	0·0722	0·0450	0·0469
15·3	0·715	0·0872	0·0588	0·0437
$16\cdot3_5$	0·728	0·102	0·073	0·0406
$17\cdot4_5$	0·746	0·117	0·086	0·0370
18·5	0·743	0·135	0·104	0·0343
$20\cdot6_5$	0·705	0·176	0·148	0·0193
$22\cdot8_5$	0·657	0·208	0·184	0·0109

$R = 5\cdot52 \times 10^6$, $P = 18\cdot6$ atmos.,
$\frac{1}{2}\rho V^2 = 125\cdot5$, $V = 77\cdot7$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-0\cdot2_5$	−0·017	0·0145	0·0145	−0·0022
$+0\cdot8$	+0·040	0·0144	0·0143	+0·0041
$1\cdot8_5$	0·096	0·0149	0·0144	0·0100
2·9	0·152	0·0158	0·0145	0·0156
$4\cdot9_5$	0·265	0·0191	0·0149	0·0258
$8\cdot0_5$	0·441	0·0283	0·0175	0·0382
$11\cdot1_5$	0·610	0·0428	0·0222	0·0476
$12\cdot1_5$	0·659	0·0493	0·0253	0·0498
13·2	0·706	0·0579	0·0302	0·0502
$14\cdot2_5$	0·733	0·0701	0·0403	0·0482
15·3	0·721	0·0881	0·0593	0·0448
$16\cdot3_5$	0·727	0·104	0·074	0·0410
$17\cdot4_5$	0·734	0·121	0·091	0·0369
19·6	0·696	0·160	0·133	0·0252
21·8	0·625	0·195	0·173	0·0157

$R = 7\cdot07 \times 10^6$, $P = 22\cdot8$ atmos.,
$\frac{1}{2}\rho V^2 = 166\cdot0$, $V = 80\cdot5$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-0\cdot4$	−0·020	0·0143	0·0143	−0·0028
$+0\cdot6_5$	+0·040	0·0142	0·0141	+0·0033
1·7	0·094	0·0147	0·0142	0·0090
$2\;7_5$	0·152	0·0159	0·0146	0·0144
4·8	0·269	0·0188	0·0148	0·0247
7·9	0·442	0·0282	0·0174	0·0370
11·0	0·619	0·0427	0·0215	0·0457
$13\cdot0_5$	0·709	0·0565	0·0286	0·0497
14·1	0·746	0·0675	0·0366	0·0482
$15\cdot1_5$	0·749	0·0849	0·0538	0·0428
16·2	0·744	0·102	0·071	0·0400
17·3	0·743	0·120	0·089	0·0357
19·5	0·663	0·162	0·138	0·0241
$21\cdot6_5$	0·619	0·196	0·175	0·0138

TABLE 8

NACA 0030, without flap, rounded ends, on V's

$R = 0\cdot30 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6\cdot56$, $V = 75\cdot3$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·3	−0·013	0·0187	0·0187	−0·0018
+ 1·0	+0·050	0·0181	0·0180	+0·0053
2·3	0·118	0·0185	0·0178	0·0126
$4\cdot8_5$	0·253	0·0211	0·0177	0·0270
$8\cdot6_5$	0·452	0·0283	0·0176	0·0484
$12\cdot4_5$	0·637	0·0446	0·0233	0·0635
$16\cdot1_5$	0·818	0·0714	0·0363	0·0665
$18\cdot6_5$	0·925	0·0947	0·0475	0·0625
$21\cdot1_5$	0·993	0·120	0·065	0·0589
22·4	1·015	0·137	0·080	0·0533
23 7	1·027	0·157	0·099	0·0459
25·0	1 023	0·183	0·125	0·0364
$26\cdot2_5$	1·010	0·206	0·149	+0·0272
28·0	0·298	0·336	0·331	−0·0063
$19\cdot1_5$*	0·248	0·218	0·215	+0·0155
21·7*	0·243	0·262	0·260	0·0056
22·9*	0·257	0·281	0·277	+0·0019
24·2*	0·264	0·295	0·292	−0·0010
25·5*	0·271	0·309	0·305	−0·0033
$26\cdot7_5$*	0·285	0·323	0·319	−0·0058

$R = 0\cdot65 \times 10^6$, $P = 2\cdot30$ atmos., $\frac{1}{2}\rho V^2 = 13\cdot1$, $V = 70\cdot4$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·6	−0·028	0·0138	0·0138	−0·0051
+ 0·7	+0·036	0·0129	0·0129	+0·0038
$2\cdot0_5$	0·094	0·0138	0·0133	0·0120
4·6	0·224	0·0159	0·0133	0·0285
$8\cdot3_5$	0·420	0·0245	0·0153	0·0498
12·2	0·597	0·0419	0·0232	0·0632
$15\cdot8_5$	0·763	0·0683	0·0377	0·0674
18·4	0·866	0·0951	0·0558	0·0607
20·9	0·940	0·127	0·081	0·0501
$22\cdot1_5$	0·957	0·145	0·097	0·0432
$23\cdot4_5$	0·957	0·168	0·120	0·0348
$24\cdot7_5$	0·954	0·192	0·144	0·0271
26·0	0·925	0·211	0·166	0·0204
$27\cdot2_5$	0·919	0·230	0·186	0·0140

$R = 1\cdot20 \times 10^6$, $P = 4\cdot20$ atmos., $\frac{1}{2}\rho V^2 = 24\cdot7$, $V = 71\cdot3$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·8	−0·035	0·0119	0·0119	−0·0061
+ $0\cdot5_5$	+0·025	0·0116	0·0116	+0·0023
$1\cdot8_5$	0·088	0·0119	0·0115	0·0115
4·4	0·212	0·0142	0·0118	0·0285
$8\cdot1_5$	0·411	0·0233	0·0144	0·0477
12·0	0·598	0·0409	0·0221	0·0589
$15\cdot6_5$	0·756	0·0718	0·0418	0·0588
18·2	0·827	0·106	0·070	0·0480
$19\cdot4_5$	0 856	0·128	0·089	0·0401
$20\cdot7_5$	0·862	0·152	0·113	0·0330
22·0	0·870	0·172	0·132	0·0265
23·3	0·870	0·191	0·151	0·0213
24·6	0·862	0·208	0 169	0·0165

$R = 2\cdot13 \times 10^6$, $P = 7\cdot7$ atmos., $\frac{1}{2}\rho V^2 = 41\cdot3$, $V = 68\cdot4$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
− 0·5	−0·015	0·0116	0·0116	−0·0043
+ 0·8	+0·042	0·0110	0·0109	+0·0050
$2\cdot1_5$	0·104	0·0119	0·0113	0·0142
4·7	0·226	0·0143	0·0116	0·0324
$8\cdot4_5$	0·422	0·0239	0·0145	0·0537
12·3	0·617	0·0413	0·0213	0·0631
$15\cdot9_5$	0·757	0·0730	0·0430	0·0621
$17\cdot2_5$	0·777	0·0889	0·0573	0·0578
$18\cdot5_5$	0·799	0·109	0·0755	0·0509
19·8	0·810	0·132	0·0980	0·0442
$21\cdot0_5$	0·824	0·154	0·119	0·0390
$22\cdot3_5$	0·813	0·178	0·143	0·0316
$23\cdot6_5$	0·788	0·196	0·163	0·0240
26·2	0·800	0·236	0·202	0·0140

* Decreasing incidence.

TABLE 8 (*contd.*)

$R = 4 \cdot 17 \times 10^6$, $P = 12 \cdot 4$ atmos.,
$\frac{1}{2}\rho V^2 = 103 \cdot 5$, $V = 85 \cdot 7$ ft./sec.

α deg	C_L	C_D	$C_{D,0}$	C_m
$-$ 0·7$_5$	−0·033	0·0122	0·0121	−0·0053
$+$ 0·6	+0·028	0·0120	0·0120	+0·0029
1·9	0·092	0·0122	0·0118	0·0121
4·4$_5$	0·225	0·0147	0·0121	0·0277
8·2	0·432	0·0242	0·0144	0·0436
12·0	0·615	0·0433	0·0235	0·0577
15·7$_5$	0·700	0·0864	0·0607	0·0522
17·0$_5$	0·716	0·105	0·078	0·0488
18·3$_5$	0·708	0·124	0·098	0·0428
19·6	0·683	0·148	0·123	0·0366
20·9	0·678	0·171	0·147	0·0291
22·2	0·653	0·192	0·169	0·0220
23·5	0·649	0·210	0·188	0·0167

$R = 5 \cdot 28 \times 10^6$, $P = 17 \cdot 3$ atmos.,
$\frac{1}{2}\rho V^2 = 125 \cdot 5$, $V = 80 \cdot 8$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-$ 0·7$_5$	−0·039	0·0121	0·0120	−0·0064
$+$ 0·5$_5$	+0·025	0·0117	0·0117	+0·0017
1·8$_5$	0·090	0·0120	0·0116	0·0105
4·4	0·225	0·0145	0·0119	0·0262
6·9	0·359	0·0201	0·0134	0·0387
10·7	0·567	0·0352	0·0183	0·0526
13·2	0·672	0·0521	0·0291	0·0580
14·4$_5$	0·701	0·0664	0·0406	0·0558
15·7	0·703	0·0881	0·0622	0·0506
17·0	0·705	0·107	0·081	0·0466
18·3	0·688	0·127	0·102	0·0402
19·6	0·663	0·152	0·129	0·0332
20·9	0·636	0·175	0·153	0·0265

$R = 7 \cdot 20 \times 10^6$, $P = 23 \cdot 8$ atmos.,
$\frac{1}{2}\rho V^2 = 166 \cdot 0$, $V = 79 \cdot 1$ ft./sec.

α deg	C_L	C_D	$C_{D,0}$	C_m
$-$ 0·8	−0·035	0·0131	0·0131	−0·0058
$+$ 0·5$_5$	+0·024	0·0128	0·0128	+0·0026
1·8$_5$	0·089	0·0131	0·0127	0·0112
4·4	0·222	0·0161	0·0135	0·0264
8·1$_5$	0·423	0·0259	0·0165	0·0436
10·7	0·555	0·0363	0·0202	0·0523
11·9$_5$	0·614	0·0441	0·0243	0·0559
13·2	0·661	0·0530	0·0301	0·0569
14·5	0·675	0·0683	0·0444	0·0546
15·7$_5$	0·680	0·0908	0·0666	0·0491
17·0$_5$	0·680	0·0981	0·0739	0·0463
18·3	0·682	0·128	0·104	0·0406
19·6	0·630	0·154	0·133	0·0323
22·2	0·550	0·200	0·183	0·0178

TABLE 9

NACA 0030 with 15 per cent. flap at 90 deg., square ends, on pips

$R = 0\cdot30 \times 10^6$, $P = 1$ atmos.,
$\frac{1}{2}\rho V^2 = 6\cdot57$, $V = 75\cdot4$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-5\cdot0_5$	0·715	0·174	0·145	−0·229
$-1\cdot9_5$	0·961	0·202	0·150	−0·243
$+1\cdot1_5$	1·205	0·233	0·152	−0·252
4·2	1·437	0·271	0·157	−0·260
$7\cdot2_5$	1·658	0·313	0·160	−0·265
10·3	1·866	0·357	0·164	−0·266
13·3	2·057	0·402	0·168	−0·266
14·3	2·130	0·415	0·162	−0·265
15·4	2·184	0·424	0·160	−0·260
16·4	2·135	0·431	0·177	−0·242
$17\cdot5_5$	2·037	0·436	0·206	−0·224
19·8	1·848	0·460	0·271	−0·204
$22\cdot0_5$	1·667	0·486	0·332	−0·196
23·7	0·852	0·661	0·621	−0·241
15·1*	0·993	0·515	0·460	−0·245
16·2*	0·932	0·540	0·492	−0·247
$17\cdot2_5$*	0·914	0·558	0·511	−0·249
$18\cdot3_5$*	0·909	0·582	0·535	−0·251
$20\cdot4_5$*	0·911	0·622	0·575	−0·252
22·6*	0·875	0·656	0·613	−0·243

$R = 0\cdot67 \times 10^6$, $P = 2\cdot40$ atmos.,
$\frac{1}{2}\rho V^2 = 13\cdot1$, $V = 59\cdot0$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-5\cdot0_5$	0·689	0·164	0·137	−0·221
−2·0	0·949	0·192	0·142	−0·237
+1·1	1·195	0·226	0·146	−0·249
$4\cdot1_5$	1·422	0·263	0·151	−0·256
7·2	1·657	0·302	0·150	−0·261
$10\cdot2_5$	1·867	0·349	0·155	−0·266
$13\cdot2_5$	2·060	0·395	0·159	−0·266
14·3	2·104	0·410	0·164	−0·265
$15\cdot3_5$	2·162	0·419	0·160	−0·257
16·4	2·043	0·425	0·193	−0·236
$17\cdot6_5$	1·889	0·432	0·234	−0·220
$18\cdot7_5$	1·787	0·446	0·268	−0·212
21·0	1·638	0·471	0·321	−0·207

$R = 1\cdot28 \times 10^6$, $P = 4\cdot60$ atmos.,
$\frac{1}{2}\rho V^2 = 24\cdot7$, $V = 67\cdot8$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
$-5\cdot0_5$	0·683	0·160	0·134	−0·217
−2·0	0·943	0·187	0·138	−0·231
+1·1	1·194	0·221	0·142	−0·245
$4\cdot1_5$	1·431	0·258	0·144	−0·252
7·2	1·648	0·300	0·150	−0·259
$10\cdot2_5$	1·850	0·345	0·154	−0·262
$13\cdot2_5$	2·047	0·395	0·163	−0·265
14·3	2·112	0·414	0·166	−0·265
$15\cdot3_5$	2·180	0·429	0·165	−0·266
16·3	2·230	0·455	0·178	−0·265
$17\cdot3_5$	2·277	0·462	0·173	−0·263
18·8	1·694	0·463	0·303	−0·217
19·9	1·618	0·474	0·329	−0·214
$21\cdot0_5$	1·546	0·484	0·351	−0·211
17·7*	1·753	0·447	0·276	−0·223

$R = 2\cdot15 = 10^6$, $P = 7\cdot8$ atmos.,
$\frac{1}{2}\rho V^2 = 41\cdot3$, $V = 67\cdot5$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
−5·1	0·665	0·156	0·131	−0·120
$-2\cdot0_5$	0·936	0·185	0·136	−0·228
$+1\cdot0_5$	1·183	0·218	0·140	−0·239
4·1	1·417	0·258	0·147	−0·249
$7\cdot1_5$	1·640	0·303	0·153	−0·256
10·2	1·827	0·351	0·165	−0·260
13·2	2·025	0·400	0·173	−0·263
$14\cdot2_5$	2·080	0·417	0·177	−0·264
15·3	2·155	0·435	0·177	−0·265
$16\cdot2_5$	2·210	0·453	0·182	−0·265
$17\cdot3_5$	2·250	0·470	0·189	−0·265
$18\cdot3_5$	2·315	0·470	0·172	−0·261
19·9	1·543	0·481	0·349	−0·214
$20\cdot0_5$	1·499	0·489	0·364	−0·211
17·7*	1·711	0·457	0·295	−0·223
18·8*	1·637	0·470	0·321	−0·218

* Decreasing incidence.

(94981)

TABLE 9 (*contd.*)

$R = 4\cdot42 \times 10^6$, $P = 14\cdot0$ atmos., $\frac{1}{2}\rho V^2 = 103\cdot5$, $V = 80\cdot7$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
−4·9	0·640	0·150	0·126	−0·200
−1·8$_5$	0·907	0·179	0·133	−0·218
+1·2	1·163	0·214	0·139	−0·232
4·2$_5$	1·405	0·254	0·145	−0·244
7·3	1·631	0·297	0·150	−0·251
10·3$_5$	1·830	0·347	0·160	−0·258
13·3$_5$	2·040	0·397	0·165	−0·262
14·4	2·110	0·412	0·164	−0·262
15·4$_5$	2·175	0·430	0·168	−0·263
16·4	2·220	0·451	0·178	−0·263
17·4$_5$	2·280	0·466	0·178	−0·262
19·0	1·550	0·480	0·447	−0·231
20·1	1·478	0·495	0·374	−0·219
16·8*	1·650	0·434	0·283	−0·225
17·9*	1·615	0·463	0·318	−0·225

$R = 5\cdot39 \times 10^6$. $P = 16\cdot9$ atmos., $\frac{1}{2}\rho V^2 = 125\cdot5$, $V = 80\cdot7$ ft./sec.

α deg.	C_L	C_D	$C_{D,0}$	C_m
−4·9	0·627	0·149	0·127	−0·198
−1·8$_5$	0·887	0·177	0·133	−0·214
+1·2	1·152	0·214	0·140	−0·231
4·2$_5$	1·396	0·254	0·146	−0·242
7·3	1·617	0·298	0·152	−0·251
10·3$_5$	1·840	0·345	0·156	−0·257
13·4	2·025	0·395	0·167	−0·261
14·4	2·100	0·414	0·169	−0·262
15·4$_5$	2·162	0·430	0·170	−0·263
16·4$_5$	2·215	0·451	0·178	−0·264
18·1	1·350	0·472	0·370	−0·215
19·2	1·283	0·488	0·397	−0·215
20·2$_5$	1·237	0·503	0·418	−0·215
15·9*	1·485	0·427	0·305	−0·222
16·9$_5$*	1·418	0·455	0·344	−0·220

* Decreasing incidence.

TABLE 10A

Minimum profile drag of NACA 0030 (on balance)

P atmos.	Square ends, pips		Square ends, V's		Rounded ends, V's	
	$R \times 10^{-6}$	$C_{D,0}$	$R \times 10^{-6}$	$C_{D,0}$	$R \times 10^{-6}$	$C_{D,0}$
1	0·31	0·0208	0·31	0·0209	0·30	0·0183
2	0·36	0·0190	0·35	0·0212	0·35	0·0169
2	0·52	0·0181	0·51	0·0183	0·49	0·0154
2	0·67	0·0172	0·67	0·0164	0·65	0·0134
2	0·81	0·0161	0·81	0·0161	0·77	0·0127
4	0·69	0·0161	0·76	0·0160	0·68	0·0135
4	0·90	0·0156	0·98	0·0152	0·88	0·0123
4	1·24	0·0151	1·36	0·0143	1·21	0·0117
4	1·47	0·0151	1·61	0·0144	1·44	0·0113
8	1·26	0·0150	1·26	0·0145	1·23	0·0115
8	1·61	0·0143	1·61	0·0139	1·60	0·0111
8	2·19	0·0139	2·20	0·0134	2·13	0·0113
8	2·69	0·0141	2·72	0·0136	2·64	0·0111
12	1·90	0·0139	1·98	0·0136	1·88	0·0110
12	2·50	0·0140	2·61	0·0142	2·46	0·0109
12	3·39	0·0142	3·50	0·0161	3·31	0·0113
12	4·22	0·0141	4·15	0·0157	4·18	0·0119
18	3·45	0·0141	3·61	0·0146	3·53	0·0113
18	4·70	0·0144	4·89	0·0150	4·80	0·0116
18	5·52	0·0143	5·53	0·0149	5·28	0·0117
18	5·86	0·0145	6·12	0·0152	5·99	0·0119
23	4·47	0·0142	4·68	0·0146	4·48	0·0118
23	6·83	0·0147	6·82	0·0150	6·57	0·0119
23	7·07	0·0143	7·39	0·0164	7·20	0·0128
23	8·14	0·0158	8·18	0·0157	8·42	0·0132

TABLE 10B

Minimum profile drag of NACA 0030 (momentum method)

P atmos.	0·1c behind T.E.		0·5c behind T.E.	
	$R \times 10^{-6}$	$C_{D,0}$	$R \times 10^{-6}$	$C_{D,0}$
1	0·31	0·0152	0·30	0·0157
2	0·60	0·0134	0·61	0·0131
3	0·85	0·0124	0·86	0·0122
5	1·27	0 0124	1·26	0·0114
8	2·17	0·0121	2·07	0·0120
11	3·41	0·0126	3·24	0·0126
15	4·32	0·0128	4·22	0·0129
19	5·38	0·0127	5·24	0·0124
24	7·86	0·0126	7·89	0·0125

TABLE 11

Values of $dC_L/d\alpha$ and $dC_m/d\alpha$ (α in degrees) at $\alpha = 0$. Aspect Ratio 6

Aerofoil NACA 0012			NACA 0015			NACA 0030								
						Square Ends on Pips			Square Ends on V's			Rounded Ends on V's		
$R \times 10^{-6}$	$dC_L/d\alpha$	$dC_m/d\alpha$	$R \times 10^{-6}$	$dC_L/d\alpha$	$dC_m/d\alpha$	$R \times 10^{-6}$	$dC_L/d\alpha$	$dC_m/d\alpha$	$R \times 10^{-6}$	$dC_L/d\alpha$	$dC_m/d\alpha$	$R \times 10^{-6}$	$dC_L/d\alpha$	$dC_m/d\alpha$
0·31	0·070	0·0020	0·30	0·072	0·0027	0·31	0·054	0·0047	0·31	0·053	0·0047	0·31	0·052	0·0055
0·63	0·071	0·0019	0·67	0·070	0·0020	0·67	0·052	0·0056	0·67	0·052	0·0055	0·65	0·049	0·0060
0·98	0·071	0·0016												
1·45	$0·072_5$	0·0016	1·27	0·070	0·0018	1·24	0·052	0·0058	1·36	0·052	0·0054	1·21	0·049	0·0061
1·99	$0·072_5$	0·0015	2·20	0·072	0·0017	2·19	0·053	0·0059	2·20	0·052	0·0056	2·13	0·049	0·0066
3·02	$0·072_5$	0·0012												
3·94	$0·074_5$	0·0014	4·25	0·073	0·0014	4·22	0·054	0·0054	4·15	0·051	0·0054	4·17	0·051	0·0060
5·52	0·075	0·0013	5·55	0·074	0·0014	5·52	0·055	0·0052	5·53	0·054	0·0054	5·28	0·051	0·0057
7·20	$0·074_5$	0·0013	7·4	0·073	0·0013	7·07	0·056	0·0052	7·39	0·051	0·0055	7·20	0·051	0·0058

TABLE 12

NACA 0012 with 15 per cent. flap at 90 deg.

$R = 0{\cdot}31 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6{\cdot}62$, $V = 74{\cdot}4$ ft./sec.

α deg.	C_L	C_D	C_m
$-6{\cdot}2_5$	0·466	0·174	−0·180
$-4{\cdot}3$	0·632	0·188	−0·186
$-2{\cdot}1_5$	0·785	0·203	−0·187
$+1{\cdot}0_5$	0·996	0·226	−0·186
4·2	1·190	0·252	−0·180
7·3	1·377	0·281	−0·175
8·3	1·450	0·293	−0·176
$9{\cdot}3_5$	1·507	0·304	−0·174
10·4	1·568	0·317	−0·175
11·7	1·174	0·438	−0·247
$12{\cdot}8_5$	1·100	0·463	−0·244
15·0	1·040	0·504	−0·240
$9{\cdot}3_5$*	1·445	0·355	−0·219
$10{\cdot}5_5$*	1·316	0·403	−0·242

$R = 0{\cdot}70 \times 10^6$, $P = 2{\cdot}54$ atmos., $\frac{1}{2}\rho V^2 = 13{\cdot}1$, $V = 66{\cdot}1$ ft./sec.

α deg.	C_L	C_D	C_m
$-6{\cdot}2$	0·379	0·175	−0·177
$-4{\cdot}2_5$	0·623	0·187	−0·182
$-2{\cdot}1$	0·783	0·201	−0·184
$+1{\cdot}0$	1·005	0·224	−0·186
4·2	1·209	0·251	−0·184
$7{\cdot}3_5$	1·405	0·282	−0·181
$9{\cdot}3_5$	1·530	0·303	−0·176
$10{\cdot}4_5$	1·586	0·321	−0·178
11·4	1·669	0·328	−0·177
12·5	1·727	0·342	−0·177
$13{\cdot}5_5$	1·775	0·353	−0·175
14·5	1·870	0·362	−0·174
15·5	1·900	0·378	−0·176
$16{\cdot}5_5$	1·957	0·388	−0·175
18·1	1·085	0·603	−0·259
19·1	1·095	0·640	−0·261
$21{\cdot}2_5$	1·102	0·703	−0·271
$10{\cdot}4_5$*	1·473	0·378	−0·222
11·6*	1·298	0·430	−0·243
$12{\cdot}7_5$*	1·233	0·461	−0·247
13·9*	1·165	0·485	−0·246
$14{\cdot}9_5$*	1·090	0·512	−0·246
16·0*	1·089	0·539	−0·249
$17{\cdot}0_5$*	1·106	0·580	−0·268

$R = 1{\cdot}23 \times 10^6$, $P = 4{\cdot}27$ atmos., $\frac{1}{2}\rho V^2 = 24{\cdot}7$, $V = 70{\cdot}0$ ft. sec.

α deg.	C_L	C_D	C_m
$-6{\cdot}3$	0·453	0·173	−0·175
$-4{\cdot}2_5$	0·616	0·185	−0·179
$-2{\cdot}1$	0·774	0·200	−0·182
$+1{\cdot}0_5$	1·001	0·223	−0·184
$4{\cdot}2_5$	1·210	0·249	−0·182
$7{\cdot}3_5$	1·404	0·282	−0·179
10·4	1·594	0·314	−0·176
$12{\cdot}3_5$	1·720	0·341	−0·174
$14{\cdot}5_5$	1·834	0·369	−0·172
$15{\cdot}5_5$	1·900	0·381	−0·172
16·6	1·960	0·397	−0·171
17·6	2·010	0·409	−0·171
$18{\cdot}5_5$	2·070	0·421	−0·172
20·2	1·130	0·672	−0·269
$22{\cdot}2_5$	1·252	0·715	−0·273
$12{\cdot}6_5$*	1·500	0·422	−0·226
$14{\cdot}8_5$*	1·288	0·488	−0·231
$15{\cdot}9_5$*	1·206	0·510	−0·243
18·1*	1·124	0·598	−0·258
19·1*	1·131	0·634	−0·267

$R = 2{\cdot}07 \times 10^6$, $P = 7{\cdot}7$ atmos., $\frac{1}{2}\rho V^2 = 41{\cdot}3$, $V = 68{\cdot}4$ ft./sec.

α deg.	C_L	C_D	C_m
$-6{\cdot}3$	0·436	0·171	−0·171
$-4{\cdot}3$	0·599	0·182	−0·174
$-2{\cdot}1$	0·744	0·196	−0·177
$+1{\cdot}1$	0·980	0·221	−0·179
$4{\cdot}2_5$	1·192	0·252	−0·179
7·4	1·412	0·283	−0·178
10·5	1·587	0·316	−0·176
12·6	1·708	0·343	−0·174
14·6	1·847	0·370	−0·172
15·8	1·532	0·395	−0·166
$16{\cdot}6_5$	1·957	0·397	−0·170
$17{\cdot}6_5$	2·013	0·409	−0·171
$18{\cdot}6_5$	2·053	0·425	−0·169
$19{\cdot}7_5$	2·110	0·476	−0·167
21·2	1·172	0·600	−0·246
22·3	1·162	0·640	−0·250
$24{\cdot}5_5$	1·093	0·698	−0·249
$16{\cdot}8_5$*	1·510	0·469	−0·226
$17{\cdot}9_5$*	1·389	0·504	−0·239
$18{\cdot}9_5$*	1·324	0·554	−0·245
$20{\cdot}1_5$*	1·221	0·583	−0·237

* Decreasing incidence.

TABLE 12 (*contd.*)

$R = 4\cdot14 \times 10^6$, $P = 12\cdot3$ atmos., $\frac{1}{2}\rho V^2 = 103\cdot5$, $V = 85\cdot7$ ft./sec.

α deg.	C_L	C_D	C_m
$-6\cdot3_5$	0·434	0·168	−0·170
$-4\cdot3_5$	0·597	0·180	−0·174
$-2\cdot1$	0·757	0·195	−0·176
$+1\cdot1$	0·980	0·218	−0·177
$4\cdot3_5$	1·196	0·247	−0·177
7·5	1·400	0·277	−0·175
$10\cdot6_5$	1·600	0·313	−0·173
12·8	1·720	0·335	−0·172
$14\cdot8_5$	1·850	0·366	−0·169
$15\cdot8_5$	1·905	0·380	−0·169
$16\cdot8_5$	1·970	0·394	−0·169
$17\cdot9_5$	2·015	0·409	−0·168
18·9	2·060	0·423	−0·169
20·1	1·158	0·575	−0·245
22·2	1·162	0·646	−0·265
$14\cdot8_5$*	1·593	0·403	−0·203
15·9*	1·517	0·443	−0·213
16·9*	1·383	0·493	−0·242
19·0*	1·183	0·547	−0·243

$R = 5\cdot60 \times 10^6$, $P = 18\cdot4$ atmos., $\frac{1}{2}\rho V^2 = 125\cdot5$, $V = 76\cdot9$ ft./sec.

α deg.	C_L	C_D	C_m
$-6\cdot4$	0·438	0·170	−0·172
$-4\cdot3_5$	0·602	0·181	−0·177
$-2\cdot1$	0·759	0·195	−0·177
$+1\cdot2$	0·989	0·220	−0·178
$4\cdot3_5$	1·204	0·250	−0·179
$7\cdot5_5$	1·420	0·281	−0·177
10·7	1·607	0·316	−0·175
$12\cdot8_5$	1·720	0·343	−0·174
$13\cdot9_5$	1·801	0·356	−0·172
$15\cdot9_5$	1·910	0·385	−0·170
$16\cdot9_5$	1·970	0·396	−0·170
18·0	2·040	0·414	−0·171
$19\cdot0_5$	2·085	0·431	−0·172
$20\cdot1_5$	1·140	0·585	−0·249
22·2	1·160	0·664	−0·265
$15\cdot9_5$*	1·495	0·455	−0·218
18·0*	1·273	0·539	−0·251
19·0*	1·165	0·557	−0·245

TABLE 13

NACA 23012 *with* 15 *per cent. flap at* 90 *deg.*

$R = 0\cdot31 \times 10^6$, $P = 1$ atmos., $\frac{1}{2}\rho V^2 = 6\cdot77$, $V = 76\cdot1$ ft./sec.

α deg.	C_L	C_D	C_m
$-6\cdot9_5$	0·449	0·168	−0·166
$-5\cdot1$	0·616	0·182	−0·180
$-1\cdot1_5$	0·897	0·212	−0·183
$+2\cdot9_5$	1·149	0·244	−0·180
$7\cdot1_5$	1·402	0·283	−0·174
$10\cdot1_5$	1·602	0·319	−0·174
12·2	1·713	0·344	−0·176
13·3	1·772	0·359	−0·177
14·3	1·838	0·368	−0·180
$14\cdot7_5$	1·086	0·501	−0·237
$15\cdot8_5$	1·058	0·523	−0·236
$17\cdot9_5$	1·069	0·587	−0·249
$12\cdot4_5$*	1·262	0·447	−0·235
13·7*	1·136	0·475	−0·234

$R = 0\cdot81 \times 10^6$, $P = 3\cdot02$ atmos., $\frac{1}{2}\rho V^2 = 15\cdot1$, $V = 65\cdot6$ ft./sec.

α deg.	C_L	C_D	C_m
$-7\cdot0$	0·447	0·164	−0·163
$-5\cdot1$	0·606	0·179	−0·174
$-1\cdot1_5$	0·923	0·212	−0·186
$+3\cdot0$	1·202	0·245	−0·185
$7\cdot1_5$	1·471	0·283	−0·181
10·2	1·656	0·320	−0·179
12·2	1·769	0·346	−0·178
$13\cdot3_5$	1·839	0·361	−0·179
$14\cdot3_5$	1·898	0·376	−0·181
15·4	1·957	0·388	−0·180
16·4	2·018	0·405	−0·183
17·4	2·072	0·417	−0·186
19·0	1·146	0·633	−0·256
20·0	1·156	0·666	−0·262
$22\cdot1_5$	1·152	0·722	−0·269
15·7*	1·366	0·507	−0·232
$16\cdot7_5$*	1·248	0·670	−0·229
$17\cdot8_5$*	1·162	0·592	−0·247

* Decreasing incidence.

TABLE 13 (*contd.*)

$R = 1\cdot27 \times 10^6$, $P = 4\cdot42$ atmos., $\frac{1}{2}\rho V^2 = 25\cdot3$, $V = 70\cdot1$ ft./sec.

α deg.	C_L	C_D	C_m
− 7·0	0·445	0·168	−0·166
− 5·1	0·602	0·181	−0·173
− $1\cdot1_5$	0·929	0·214	−0·187
+ $3\cdot0_5$	1·206	0·248	−0·186
7·2	1·468	0·290	−0·184
$10\cdot2_5$	1·665	0·325	−0·182
12·3	1·785	0·351	−0·181
14·4	1·910	0·378	−0·181
15·5	1·961	0·395	−0·182
16·5	2·037	0·406	−0·183
17·5	2·098	0·421	−0·184
$18\cdot5_5$	2·153	0·439	−0·187
$19\cdot9_5$	1·242	0·645	−0·251
22·1	1·235	0·705	−0·258
15·6*	1·628	0·423	−0·204
15·6*	1·585	0·403	−0·177
16·7*	1·494	0·454	−0·211
17·8*	1·360	0·580	−0·249
$18\cdot9_5$*	1·115	0·604	−0·245

$R = 2\cdot47 \times 10^6$, $P = 8\cdot0$ atmos., $\frac{1}{2}\rho V^2 = 53\cdot9$, $V = 76\cdot7$ ft./sec.

α deg.	C_L	C_D	C_m
− $7\cdot0_5$	0·438	0·167	−0·166
− $5\cdot1_5$	0·591	0·179	−0·170
− 1·1	0·909	0·212	−0·179
+ 3·1	1·203	0·248	−0·181
$7\cdot3_5$	1·479	0·291	−0·180
$10\cdot4_5$	1·675	0·327	−0·180
$12\cdot5_5$	1·797	0·352	−0·178
14·7	1·923	0·384	−0·179
15·7	1·984	0·395	−0·179
$16\cdot7_5$	2·045	0·411	−0·180
17·8	2·094	0·425	−0·179
18·9	2·175	0·440	−0·182
19·9	2·215	0·456	−0·184
$21\cdot1_5$	1·217	0·577	−0·238
22·1	1·226	0·637	−0·256
$23\cdot1_5$	1·246	0·697	−0·272
16·8*	1·552	0·458	−0·214
$17\cdot8_5$*	1·432	0·483	−0·223
$18\cdot9_5$*	1·299	0·515	−0·224
$20\cdot0_5$*	1·258	0·545	−0·235

$R = 4\cdot47 \times 10^6$, $P = 14\cdot6$ atmos., $\frac{1}{2}\rho V^2 = 101\cdot6$, $V = 78\cdot8$ ft./sec.

α deg.	C_L	C_D	C_m
− $7\cdot1_5$	0·450	0·169	−0·169
− 5·2	0·600	0·181	−0·174
− $1\cdot0_5$	0·909	0·209	−0·177
+ 3·3	1·211	0·245	−0·178
7·6	1·489	0·289	−0·177
$10\cdot7_5$	1·688	0·327	−0·177
$12\cdot9_5$	1·814	0·355	−0·177
15·1	1·933	0·383	−0·177
$17\cdot2_5$	2·067	0·414	−0·180
18·3	2·134	0·430	−0·181
19·4	2·192	0·446	−0·183
$20\cdot4_5$	2·244	0·465	−0·184
$21\cdot1_5$	1·218	0·585	−0·242
$23\cdot1_5$	1·212	0·712	−0·268
17·0*	1·536	0·471	−0·215
18·0*	1·469	0·502	−0·230
$19\cdot0_5$*	1·322	0·535	−0·235
20·1*	1·264	0·556	−0·234

$R = 5\cdot43 \times 10^6$, $P = 18\cdot1$ atmos., $\frac{1}{2}\rho V^2 = 124\cdot0$, $V = 78\cdot4$ ft./sec.

α deg.	C_L	C_D	C_m
− 7·2	0·453	0·171	−0·171
− 5·2	0·599	0·180	−0·173
− 1·0	0·917	0·210	−0·178
+ 3·4	1·221	0·245	−0·178
$7\cdot7_5$	1·501	0·290	−0·178
$10\cdot9_5$	1·705	0·329	−0·177
$13\cdot0_5$	1·834	0·358	−0·177
15·3	1·967	0·387	−0·178
$17\cdot4_5$	2·076	0·419	−0·180
18·5	2·137	0·436	−0·182
$19\cdot6_5$	2·210	0·453	−0·185
20·7	2·263	0·467	−0·185
$21\cdot1_5$	1·204	0·600	−0·245
$22\cdot1_5$	1·216	0·656	−0·259
$24\cdot0_5$	1·232	0·750	−0·284
$17\cdot0_5$*	1·522	—	—
$18\cdot0_5$*	1·477	0·511	−0·229
19·1*	1·329	0·545	−0·236
20·1*	1·258	0·563	−0·234

* Decreasing incidence.

TABLE 14

RAF 28 with 15 per cent. flap at 90 deg.

$R = 0{\cdot}31 \times 10^6$, $P = 1$ atmos.,
$\frac{1}{2}\rho V^2 = 6{\cdot}77$, $V = 76{\cdot}7$ ft./sec.

α deg.	C_L	C_D	C_m
− 6·6	0·476	0·173	−0·174
− 4·5$_5$	0·641	0·185	−0·179
− 0·3$_5$	0·931	0·215	−0·181
+ 3·9	1·187	0·251	−0·177
8·0	1·449	0·295	−0·177
9·0$_5$	1·504	0·324	−0·185
10·1	1·496	0·366	−0·202
11·2$_5$	1·438	0·411	−0·216
12·3	1·359	0·448	−0·227
13·4$_5$	1·218	0·473	−0·231
14·5$_5$	1·126	0·497	−0·228
15·6	1·101	0·522	−0·236
16·6$_5$	1·084	0·552	−0·238

$R = 0{\cdot}78 \times 10^6$, $P = 2{\cdot}88$ atmos.,
$\frac{1}{2}\rho V^2 = 15{\cdot}1$, $V = 67{\cdot}6$ ft./sec.

α deg.	C_L	C_D	C_m
− 6·6	0·471	0·175	−0·175
− 4·5$_5$	0·631	0·187	−0·179
− 0·3	0·948	0·221	−0·187
+ 4·0	1·217	0·254	−0·184
7·1	1·405	0·287	−0·182
9·1$_5$	1·547	0·315	−0·186
10·2	1·566	0·350	−0·192
11·2$_5$	1·523	0·399	−0·210
12·3$_5$	1·452	0·442	−0·223
14·5	1·280	0·510	−0·239
16·6$_5$	1·168	0·557	−0·238

$R = 1{\cdot}27 \times 10^6$, $P = 4{\cdot}52$ atmos.,
$\frac{1}{2}\rho V^2 = 25{\cdot}3$, $V = 69{\cdot}9$ ft./sec.

α deg.	C_L	C_D	C_m
− 5·5	0·541	0·180	−0·174
− 3·4$_5$	0·707	0·193	−0·178
− 0·2$_5$	0·938	0·217	−0·181
+ 4·1$_5$	1·219	0·253	−0·181
7·2$_5$	1·424	0·286	−0·181
9·3	1·562	0·308	−0·182
10·3$_5$	1·592	0·333	−0·186
11·4	1·603	0·367	−0·199
12·5	1·482	0·426	−0·211
13·5$_5$	1·422	0·451	−0·225
15·6$_5$	1·232	0·532	−0·235

$R = 2{\cdot}43 \times 10^6$, $P = 8{\cdot}0$ atmos.,
$\frac{1}{2}\rho V^2 = 53{\cdot}9$, $V = 77{\cdot}1$ ft./sec.

α deg.	C_L	C_D	C_m
− 6·6$_5$	0·458	0·175	−0·171
− 4·4	0·621	0·188	−0·176
− 0·0$_5$	0·935	0·222	−0·180
+ 4·4$_5$	1·217	0·257	−0·177
7·6$_5$	1·424	0·288	−0·180
9·8	1·559	0·312	−0·179
10·8$_5$	1·633	0·325	−0·182
11·9	1·667	0·353	−0·185
12·9	1·609	0·394	−0·203
13·9$_5$	1·560	0·435	−0·207
15·9$_5$	1·453	0·517	−0·227

TABLE 14 (*contd.*)

$R = 4\cdot48 \times 10^6$, $P = 14\cdot6$ atmos.,
$\frac{1}{2}\rho V^2 = 101\cdot6$, $V = 78\cdot6$ ft./sec.

α deg.	C_L	C_D	C_m
− 6·7	0·461	0·175	−0·174
− $4\cdot3_5$	0·627	0·187	−0·176
+ 0·3	0·953	0·219	−0·179
5·0	1·252	0·258	−0·177
$8\cdot3_5$	1·464	0·291	−0·177
10·6	1·607	0·317	−0·178
11·7	1·670	0·330	−0·180
12·9	1·732	0·345	−0·180
13·9	1·767	0·373	−0·195
$14\cdot7_5$	1·671	0·425	−0·212
$15\cdot6_5$	1·609	0·469	−0·223
$17\cdot5_5$	1·478	0·529	−0·230

$R = 5\cdot48 \times 10^6$, $P = 17\cdot9$ atmos.,
$\frac{1}{2}\rho V^2 = 124\cdot0$, $V = 78\cdot2$ ft./sec.

α deg.	C_L	C_D	C_m
− $6\cdot7_5$	0·456	0·175	−0·175
− 4·3	0·626	0·188	−0·176
+ $0\cdot4_5$	0·953	0·221	−0·177
$5\cdot2_5$	1·268	0·260	−0·176
$8\cdot7_5$	1·477	0·294	−0·177
$11\cdot0_5$	1·627	0·320	−0·179
$12\cdot1_5$	1·695	0·334	−0·179
$13\cdot3_5$	1·752	0·349	−0·179
$14\cdot2_5$	1·723	0·391	−0·199
$15\cdot0_5$	1·651	0·438	−0·217
$16\cdot8_5$	1·542	0·514	−0·232
13·3*	1·757	0·354	−0·189

TABLE 15

RAF 48, *with* 15 *per cent. sharp-edge flap at* 90 *deg.* *Aspect ratio* 6

$R = 0\cdot31 \times 10^6$, $P = 1$ atmos.,
$\frac{1}{2}\rho V^2 = 6\cdot63$, $V = 75\cdot6$ ft./sec.

α deg.	C_L	C_D	C_m
− 3·2	0·843	0·202	−0·201
− $0\cdot1_5$	1·073	0·227	−0·203
+ 3·0	1·288	0·255	−0·204
6·1	1·477	0·286	−0·200
$9\cdot1_5$	1·668	0·322	−0·201
12·2	1·870	0·365	−0·206
13·2	1·910	0·377	−0·205
14·2	1·970	0·390	−0·206
15·4	1·760	0·409	−0·207
$16\cdot5_5$	1·650	0·413	−0·186

$R = 0\cdot68 \times 10^6$, $P = 2\cdot47$ atmos.,
$\frac{1}{2}\rho V^2 = 13\cdot3$, $V = 68\cdot4$ ft./sec.

α deg.	C_L	C_D	C_m
− $3\cdot1_5$	0·827	0·196	−0·196
− $0\cdot0_5$	1·059	0·224	−0·199
+ $3\cdot0_5$	1·262	0·248	−0·201
$6\cdot1_5$	1·466	0·279	−0·200
9·3	1·662	0·312	−0·198
12·3	1·837	0·358	−0·201
14·3	1·968	0·385	−0·205
$15\cdot3_5$	2·022	0·401	−0·205
$16\cdot6_5$	1·639	0·407	−0·185
$17\cdot7_5$	1·575	0·422	−0·183
$15\cdot5_5$*	1·720	0·395	−0·188

* Decreasing incidence.

TABLE 15 (*contd.*)

$R = 1 \cdot 27 \times 10^6$, $P = 4 \cdot 60$ atmos.,
$\frac{1}{2}\rho V^2 = 25 \cdot 0$, $V = 68 \cdot 9$ ft./sec.

α deg.	C_L	C_D	C_m
− 3·0	0·810	0·210	−0·190
+ 0·0$_5$	1·042	0·219	−0·194
3·2	1·248	0·249	−0·196
6·3	1·448	0·280	−0·198
9·4$_5$	1·654	0·318	−0·199
12·4$_5$	1·822	0·359	−0·198
14·5$_5$	1·950	0·389	−0·201
15·5$_5$	2·03	0·402	−0·202
16·5$_5$	2·075	0·418	−0·203
17·5$_5$	2·13	0·429	−0·204
19·0	1·535	0·447	−0·189
20·0$_5$	1·465	0·458	−0·192
16·7*	1·755	0·415	−0·193
17·8$_5$*	1·625	0·435	−0·191

$R = 2 \cdot 25 \times 10^6$, $P = 8 \cdot 7$ atmos.,
$\frac{1}{2}\rho V^2 = 41 \cdot 6$, $V = 64 \cdot 7$ ft./sec.

α deg	C_L	C_D	C_m
− 2·9	0·809	0·197	−0·191
+ 0·2	1·031	0·223	−0·193
3·4	1·246	0·252	−0·196
6·6	1·440	0·285	−0·197
9·7	1·652	0·322	−0·198
12·7$_5$	1·844	0·361	−0·197
14·7$_5$	1·969	0·388	−0·198
16·8$_5$	2·092	0·422	−0·201
17·8$_5$	2·148	0·435	−0·202
18·9	2·194	0·455	−0·203
20·3	1·575	0·490	−0·201
21·4	1·498	0·509	−0·205
19·2*	1·635	0·469	−0·199

$R = 3 \cdot 66 \times 10^6$, $P = 14 \cdot 5$ atmos.,
$\frac{1}{2}\rho V^2 = 66 \cdot 0$, $V = 62 \cdot 8$ ft./sec.

α deg.	C_L	C_D	C_m
− 2·7	0·811	0·197	−0·191
+ 0·5	1·037	0·223	−0·193
3·6$_5$	1·260	0·250	−0·195
6·8$_5$	1·463	0·281	−0·195
10·0	1·657	0·320	−0·195
13·1	1·850	0·360	−0·195
16·2	2·030	0·407	−0·197
18·2$_5$	2·165	0·437	−0·201
19·3$_5$	2·225	0·452	−0·204
20·3$_5$	2·280	0·474	−0·205
21·7$_5$	1·510	0·527	−0·210
22·9	1·428	0·550	−0·217
19·5*	1·682	0·484	−0·201
20·6*	1·595	0·504	−0·207

$R = 4 \cdot 63 = 10^6$, $P = 24 \cdot 0$ atmos.,
$\frac{1}{2}\rho V^2 = 66 \cdot 0$, $V = 49 \cdot 2$ ft./sec.

α deg.	C_L	C_D	C_m
− 2·6	0·802	0·198	−0·190
+ 0·4$_5$	1·028	0·221	−0·191
3·6$_5$	1·245	0·249	−0·194
6·8$_5$	1·455	0·281	−0·195
10·0	1·655	0·319	−0·195
13·1	1·850	0·358	−0·195
16·2	2·035	0·407	−0·198
18·3	2·150	0·436	−0·200
19·3$_5$	2·220	0·451	−0·204
20·3$_5$	2·270	0·471	−0·203
21·7$_5$	1·473	0·529	−0·209
22·8$_5$	1·377	0·561	−0·218
19·5$_5$*	1·650	0·481	−0·201
20·6$_5$*	1·580	0·508	−0·209

* Decreasing incidence.

TABLE 16

RAF 48, *with* 20 *per cent. flap at* 50 *deg. Aspect ratio* 6

$R = 0 \cdot 31 \times 10^6$, $P = 1$ atmos.,
$\frac{1}{2}\rho V^2 = 6 \cdot 63$, $V = 74 \cdot 8$ ft./sec.

α deg.	C_L	C_D	C_m
$-3 \cdot 1_5$	0·837	0·172	−0·233
$-0 \cdot 1_5$	1·062	0·195	−0·235
$+3 \cdot 0$	1·284	0·220	−0·233
6·1	1·490	0·254	−0·234
$9 \cdot 1_5$	1·690	0·293	−0·236
$12 \cdot 1_5$	1·900	0·334	−0·240
13·2	1·970	0·347	−0·241
$14 \cdot 3_5$	1·880	0·356	−0·225
15·4	1·785	0·373	−0·220
16·5	1·702	0·388	−0·216
17·6	1·624	0·406	−0·216

$R = 0 \cdot 68 \times 10^6$, $P = 2 \cdot 40$ atmos.,
$\frac{1}{2}\rho V^2 = 13 \cdot 3$, $V = 68 \cdot 9$ ft./sec.

α deg	C_L	C_D	C_m
$-3 \cdot 0_5$	0·828	0·169	−0·231
$-0 \cdot 0_5$	1·062	0·194	−0·235
$+3 \cdot 0_5$	1·280	0·223	−0·235
6·2	1·490	0·259	−0·237
$9 \cdot 2_5$	1·692	0·297	−0·239
$12 \cdot 2_5$	1·887	0·342	−0·242
14·4	2·010	0·369	−0·240
15·5	1·743	0·379	−0·225
$17 \cdot 7_5$	1·588	0·409	−0·217

$R = 1 \cdot 25 \times 10^6$, $P = 4 \cdot 32$ atmos.,
$\frac{1}{2}\rho V^2 = 25 \cdot 0$, $V = 70 \cdot 5$ ft./sec.

α deg.	C_L	C_D	C_m
$-2 \cdot 9_5$	0·828	0·170	−0·230
$+0 \cdot 0_5$	1·054	0·194	−0·233
3·2	1·277	0·224	−0·234
$6 \cdot 3_5$	1·510	0·257	−0·237
$9 \cdot 4_5$	1·714	0·298	−0·239
$12 \cdot 4_5$	1·900	0·342	−0·241
14·6	2·025	0·373	−0·241
$15 \cdot 5_5$	2·095	0·386	−0·242
$16 \cdot 5_5$	2·155	0·353	−0·246
$17 \cdot 8_5$	1·670	0·419	−0·224
$20 \cdot 0_5$	1·540	0·458	−0·226
$16 \cdot 7_5$*	1·770	0·402	−0·228

$R = 2 \cdot 19 \times 10^6$, $P = 6 \cdot 5$ atmos.,
$\frac{1}{2}\rho V^2 = 41 \cdot 6$, $V = 66 \cdot 7$ ft./sec.

α deg.	C_L	C_D	C_m
$-2 \cdot 8_5$	0·813	0·166	−0·225
$+0 \cdot 2_5$	1·042	0·196	−0·229
3·4	1·268	0·228	−0·232
$6 \cdot 5_5$	1·471	0·264	−0·233
$9 \cdot 6_5$	1·684	0·303	−0·234
12·7	1·892	0·345	−0·235
14·8	2·003	0·380	−0·237
$16 \cdot 8_5$	2·132	0·413	−0·239
$17 \cdot 8_5$	2·193	0·427	−0·241
$19 \cdot 1_5$	1·680	0·453	−0·229
$20 \cdot 2_5$	1·618	0·478	−0·231
$18 \cdot 0_5$*	1·758	0·435	−0·230

* Decreasing incidence.

TABLE 16 (*contd.*)

$R = 3{\cdot}70 \times 10^6$, $P = 14{\cdot}6$ atmos.,
$\frac{1}{2}\rho V^2 = 65{\cdot}7$, $V = 62{\cdot}4$ ft./sec.

α deg.	C_L	C_D	C_m
$-2{\cdot}6$	0·817	0·170	−0·230
$+0{\cdot}5_5$	1·046	0·197	−0·231
3·7	1·284	0·226	−0·234
6·9	1·496	0·262	−0·234
$10{\cdot}0_5$	1·700	0·301	−0·235
$13{\cdot}1_5$	1·905	0·346	−0·237
$15{\cdot}2_5$	2·031	0·377	−0·237
17·3	2·161	0·414	−0·231
18·3	2·237	0·431	−0·243
19·4	2·284	0·447	−0·244
20·6	1·674	0·494	−0·244
$21{\cdot}7_5$	1·619	0·518	−0·246
19·5*	1·751	0·468	−0·240

$R = 4{\cdot}68 \times 10^6$, $P = 24{\cdot}0$ atmos.,
$\frac{1}{2}\rho V^2 = 66{\cdot}0$, $V = 49{\cdot}0$ ft./sec.

α deg.	C_L	C_D	C_m
$-2{\cdot}5_5$	0·820	0·169	−0·227
$+0{\cdot}5$	1·052	0·196	−0·231
3·7	1·272	0·225	−0·232
6·9	1·482	0·258	−0·230
$10{\cdot}0_5$	1·687	0·297	−0·231
$13{\cdot}1_5$	1·903	0·344	−0·234
15·3	2·030	0·371	−0·236
17·3	2·165	0·411	−0·241
18·3	2·225	0·428	−0·243
19·4	2·300	0·444	−0·246
$20{\cdot}6_5$	1·660	0·496	−0·243
$21{\cdot}7_5$	1·591	$0{\cdot}521_5$	−0·249
19·5*	1·740	0·465	−0·240

* Decreasing incidence.

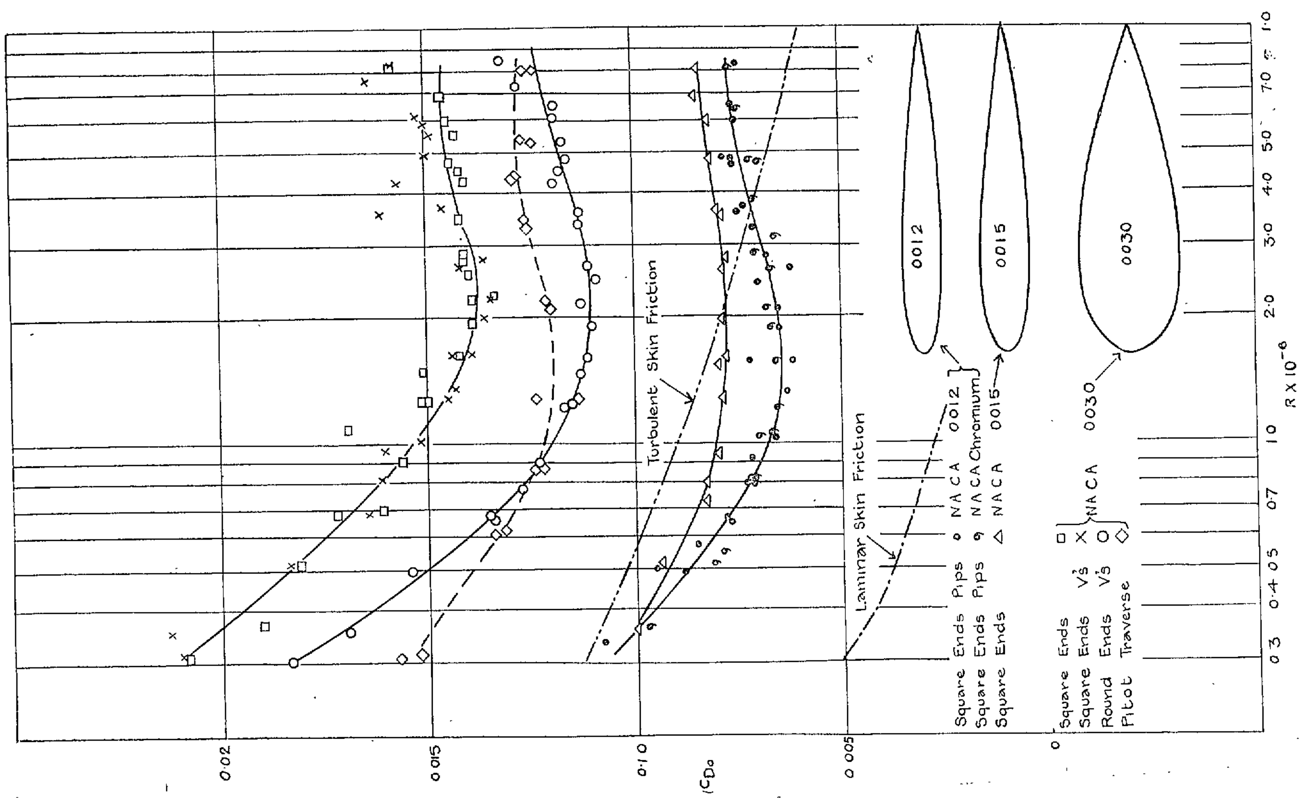

FIG. 1.

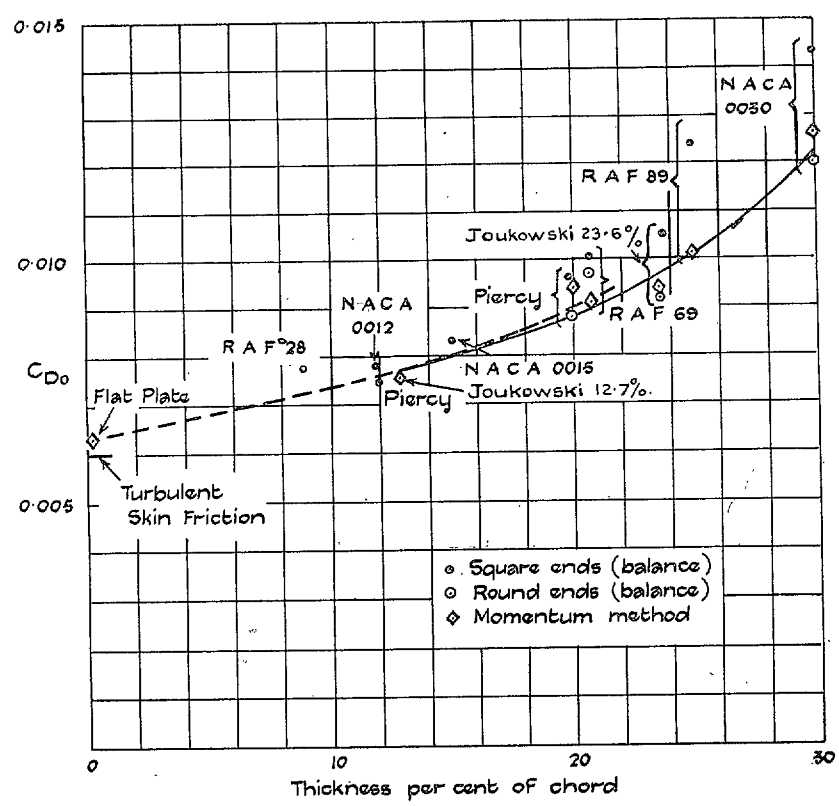

FIG. 2. Variation of minimum profile drag coefficient with thickness ratio at $R = 7 \times 10^6$.

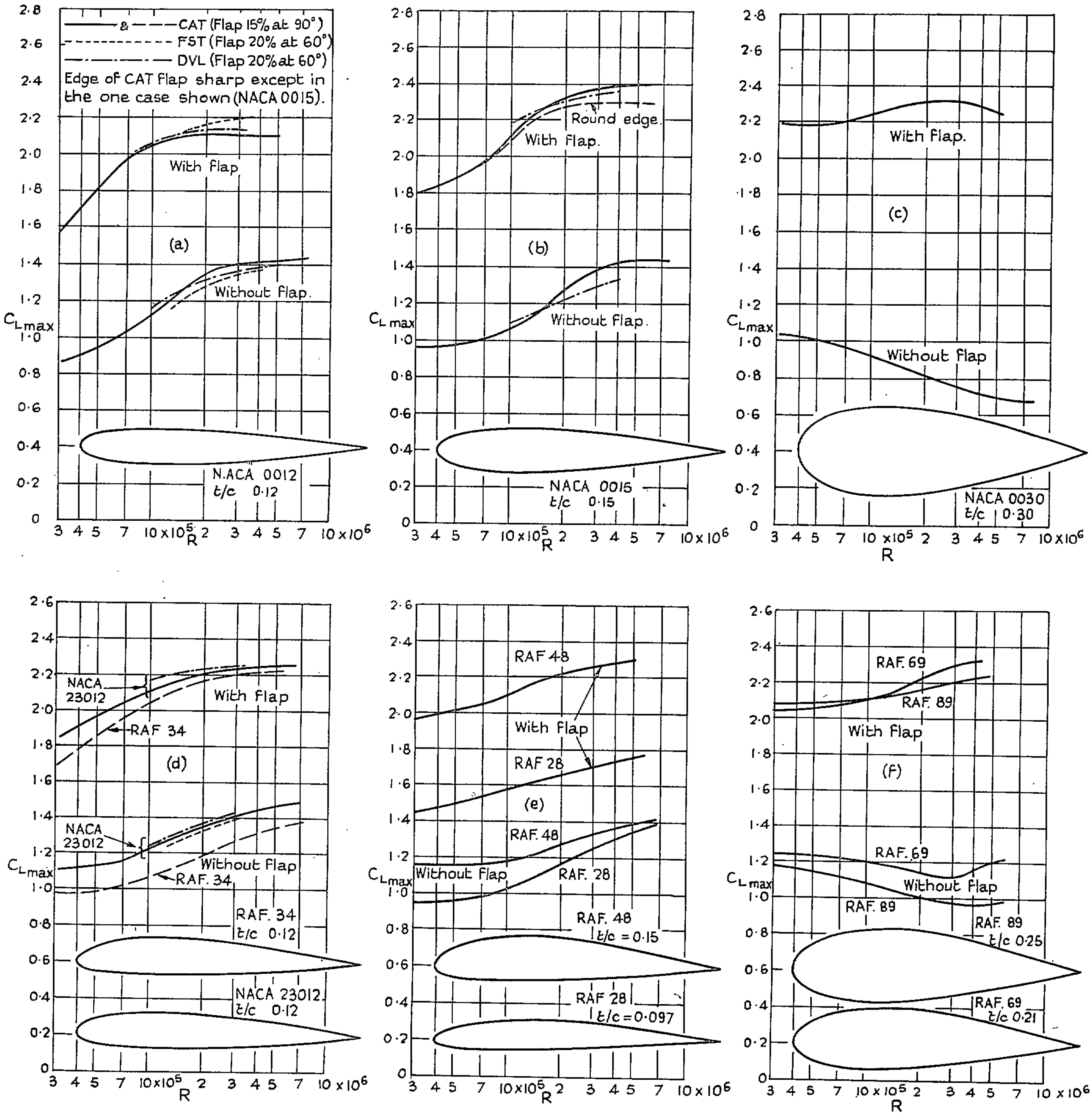

FIG. 3. Variation of $C_{L\,max}$ with R and comparison with other tunnels.

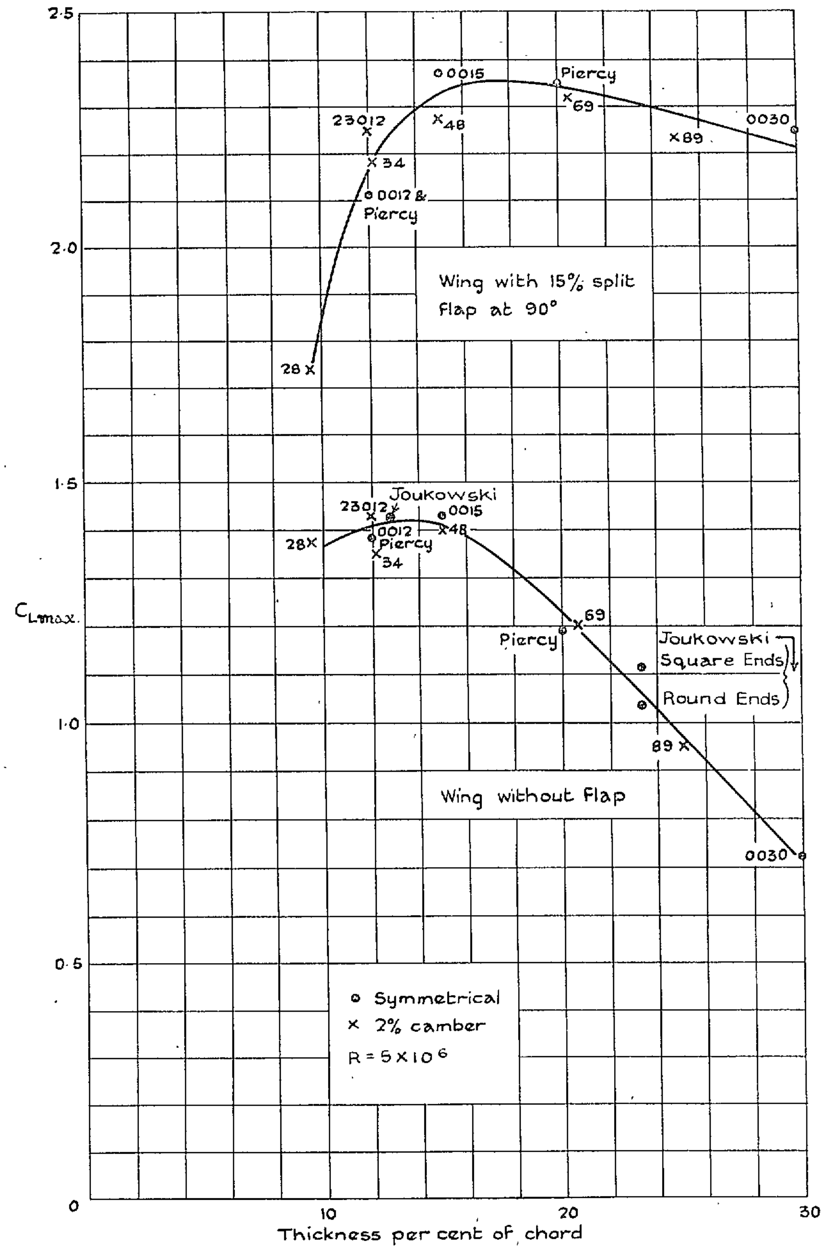

FIG. 4. Variation of maximum lift coefficient with thickness ratio.

(94981) Wt. 14/806 K.5 7/52 Hw.

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