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RESEARCH MEMORANDUM

TWO-DIMENSIONAL AERODYNAMIC CHARACTERISTICS OF 34 MISCELLANEOUS AIRFOIL SECTIONS

By

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NATIONAL ADVISORY COMMITTEE
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SUMMARY

The aerodynamic characteristics of 34 miscellaneous airfoils tested in the Langley two-dimensional low-turbulence tunnels are presented. The data include lift, drag, and, in some cases, pitching-moment characteristics, for Reynolds numbers between 3.0×10^6 and 9.0×10^6. The airfoils consist of modified or unconventional NACA 6-series airfoils and airfoils which were derived by various aircraft manufacturers.

INTRODUCTION

A large number of miscellaneous airfoils not included in the systematic investigations reported in reference 1 have been tested in the Langley two-dimensional low-turbulence tunnels. Virtually all these tests were requested by various agencies for the purpose of providing the detailed information necessary for the design of particular military airplanes. The results of the individual tests have previously been reported to the agency concerned but no paper covering a summary of all the data obtained has been published. In the hope that such a summary might prove of some value in problems concerning airfoil selection, the data obtained in the individual tests have been compiled and are presented in the present paper. Because of the unsystematic variations in the types of airfoil tested, no analysis of the results has been attempted.

The airfoils for which data are presented consist of 14 modified or unconventional NACA 6-series airfoils and 20 other airfoils developed by several aircraft manufacturers. Lift, drag, and, in some cases, pitching-moment data are included for each airfoil for Reynolds numbers which generally fall between 3.0×10^6 and 9.0×10^6. A table is presented which contains a brief physical description and values of the more important aerodynamic characteristics of each airfoil tested.

COEFFICIENTS AND SYMBOLS

α_o	section angle of attack
α_{l_o}	angle of attack at which lift is zero
c_d	section drag coefficient
$c_{d_{min}}$	minimum section drag coefficient
c_l	section lift coefficient
$c_{l_{max}}$	maximum section lift coefficient
c_{l_i}	design section lift coefficient
$c_{m_{ac}}$	section pitching-moment coefficient about aerodynamic center
$c_{m_{c/4}}$	section pitching-moment coefficient about quarter-chord point
R	Reynolds number
c	airfoil chord
x	horizontal distance, measured along chord from leading edge
y	vertical distance, measured above or below chord line, positive when above chord line
a	mean-line designation, fraction of chord from leading edge over which design load is uniform

APPARATUS AND TESTS

Wind tunnels.- All the tests were made in the Langley two-dimensional low-turbulence tunnels. The test section of each of these two tunnels measures 3 feet by $7\frac{1}{2}$ feet. The model, when mounted, completely spanned the 3-foot dimension with the gaps between the ends of the model and the tunnel walls sealed to prevent air leakage. All of the lift data presented were obtained by taking the difference between the pressure reaction upon the floor and ceiling of the tunnel. Drag results were

obtained by the wake-survey method, and pitching moments were determined by means of a torque balance. A more complete description of the tunnels and the methods of obtaining and reducing the data are contained in reference 2.

Models.- The models representing the airfoil sections tested were constructed of wood and all but one were of 24-inch chord. The surfaces of the models were painted and then sanded until aerodynamically smooth. Some of the models were equipped with flaps or control surfaces, most of which were constructed of metal. All plain airfoil tests were made with flap or control-surface gaps sealed, and, in many cases, faired. The ordinates of the airfoils tested are given in tables I to XXXIV.

Tests.- Because of the wide variation in specific requirements which the individual investigations were designed to satisfy, there was a lack of conformity in the scope of the data obtained for the various airfoils. For most of the airfoils, lift and drag measurements were made for several Reynolds numbers between 3.0×10^6 and 9.0×10^6 with the model in the smooth condition. The pitching-moment characteristics were determined for several of the airfoils, and, in some instances, the lift and drag characteristics were determined with the leading edge of the model in the roughened condition. The roughness employed was similar to that described in reference 1. Although some of the airfoils were equipped with high-lift devices, there was no consistency in types of devices employed. The data from tests of these latter configurations, therefore, can give no indication of the relative response of different type airfoils to high-lift devices, and for this reason, are not included.

RESULTS

The results for the 34 airfoils are presented in the form of standard coefficients representing the lift, drag, and pitching moment in figures 1 to 34. In those cases in which the pitching-moment data are available, the position of the aerodynamic center and the variation of the moment coefficient about this point have been determined and are presented. As already pointed out, all the data included herein have previously been published in individual reports. Since the publication of many of these original reports, certain refinements have been made in the methods of computing and correcting the tunnel data. All of the data presented in the present paper have been calculated according to the refined methods which are described in reference 2.

Brief descriptions of the various airfoils tested, together with their more important aerodynamic characteristics at a Reynolds number of approximately 6×10^6, are given in table XXXV. For identification

purposes the 20 airfoil sections which were company-derived are designated by letters of the alphabet. The numbers of the figures containing the complete aerodynamic characteristics obtained for each airfoil and the numbers of the tables in which the ordinates for each section are presented are also included in table XXXV. In some instances the original paper in which the data for a particular airfoil or group of airfoils were published has been reissued for general distribution. In such cases reference is made to these papers in table XXXV.

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REFERENCES

1. Abbott, Ira H., Von Doenhoff, Albert E., and Stivers, Louis S., Jr.: Summary of Airfoil Data. NACA Rep. No. 824, 1945.

2. Von Doenhoff, Albert E., and Abbott, Frank T., Jr.: The Langley Two-Dimensional Low-Turbulence Pressure Tunnel. NACA TN No. 1283, 1947.

3. Jacobs, Eastman N., Abbott, Ira H., and Davidson, Milton: Investigation of Extreme Leading-Edge Roughness on Thick Low-Drag Airfoils to Indicate Those Critical to Separation. NACA CB, June 1942.

4. Fullmer, Felicien F., Jr.: Two-Dimensional Wind-Tunnel Investigation of Six Airfoil Sections for the Wing of the Vega XP2V-1 Airplane. NACA MR No. L5I21, 1945.

5. Cahill, Jones F.: Aerodynamic Tests of an NACA 66(215)-116, a = 0.6 Airfoil with a 0.25c Slotted Flap for the Fleetwings XA-39 Airplane. NACA MR No. L4K21, 1944.

6. Loftin, Laurence K., Jr., and Rice, Fred J., Jr.: Two-Dimensional Wind-Tunnel Investigation of Two NACA Low-Drag Airfoil Sections Equipped with Slotted Flaps and a Plain NACA Low-Drag Airfoil Section for XF6U-1 Airplane. NACA MR No. L5L11, 1946.

7. Braslow, Albert L., and Loftin, Laurence K., Jr.: Two-Dimensional Wind-Tunnel Investigation of an Approximately 14-Percent-Thick NACA 66-Series-Type Airfoil Section with a Double Slotted Flap. NACA TN No. 1110, 1946.

8. Visconti, Fioravante: Investigation of an Approximately 0.178-Chord-Thick NACA 6-Series-Type Airfoil Section Equipped with Sealed Internally Balanced 0.20-Chord Ailerons and with a 0.05-Chord Tab. NACA TN No. 1590, 1948.

9. Abbott, Frank T., Jr., and Underwood, William J.: Wind-Tunnel Investigation of Profile Drag and Lift of an Intermediate Wing Section of the XP-51 Airplane with Beveled Trailing-Edge and Contour Ailerons. NACA MR, Jan. 27, 1943.

10. Braslow, Albert L.: Two-Dimensional Wind-Tunnel Investigation of Low-Drag Vertical-Tail, Horizontal-Tail, and Wing Sections Equipped with Sealed Internally Balanced Control Surfaces. NACA TN No. 1048, 1946.

11. Racisz, Stanley F.: Development of Wing Inlets. NACA ACR No. L6B18, 1946.

TABLE I

ORDINATES FOR THE

NACA 65(216)-(3.4)15 $\left\{\begin{array}{l} a = 0.5, \quad c_{l_i} = 1.794 \\ a = 0.6, \quad c_{l_i} = -1.164 \\ a = 0.7, \quad c_{l_i} = -0.291 \end{array}\right\}$ AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.221	1.244	.779	-.940
.443	1.514	1.057	-1.082
.901	1.966	1.599	-1.328
2.089	2.879	2.911	-1.749
4.531	4.255	5.469	-2.323
7.014	5.310	7.986	-2.724
9.515	6.190	10.485	-3.048
14.552	7.605	15.448	-3.531
19.618	8.658	20.382	-3.882
24.706	9.425	25.294	-4.161
29.811	9.973	30.189	-4.357
34.934	10.305	35.066	-4.493
40.077	10.387	39.923	-4.603
45.256	10.230	44.744	-4.644
50.563	9.696	49.437	-4.646
55.758	8.720	54.242	-4.664
60.605	7.535	59.395	-4.584
65.389	6.337	64.611	-4.223
70.240	5.137	69.760	-3.685
75.132	4.007	74.868	-2.997
80.073	2.915	79.927	-2.257
85.036	1.919	84.964	-1.485
90.015	1.040	89.985	-.802
95.004	.370	94.996	-.268
100.000	0	100.000	0

L.E. radius: 1.498
Slope of radius through L.E.: 0.255

TABLE II

ORDINATES FOR THE

NACA 65,3-316 (APPROX.), a = 0.8 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.330	1.250	.671	-1.079
.558	1.529	.942	-1.287
1.037	1.954	1.462	-1.583
2.254	2.733	2.746	-2.087
4.717	3.946	5.283	-2.842
7.200	4.912	7.800	-3.425
9.696	5.725	10.304	-3.900
14.704	7.029	15.296	-4.637
19.729	8.029	20.271	-5.179
24.758	8.804	25.242	-5.583
29.800	9.379	30.200	-5.862
34.842	9.767	35.158	-6.017
39.887	9.962	40.108	-6.046
44.937	9.954	45.062	-5.929
49.983	9.696	50.012	-5.621
55.029	9.204	54.971	-5.146
60.071	8.525	59.929	-4.537
65.104	7.687	64.896	-3.846
70.129	6.725	69.871	-3.104
75.146	5.658	74.850	-2.350
80.167	4.483	79.829	-1.637
85.150	3.225	84.840	-1.000
90.096	1.983	89.904	-.496
95.037	.858	94.962	-.177
100.004	.080	99.996	-.080

L.E. radius: 1.578
T.E. radius: 0.080

TABLE III

ORDINATES FOR THE

NACA 65,3-418 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.280	1.406	.720	-1.206
.504	1.720	.996	-1.440
.974	2.199	1.526	-1.771
2.184	3.082	2.816	-2.338
4.643	4.446	5.357	-3.182
7.125	5.534	7.875	-3.838
9.623	6.445	10.378	-4.377
14.638	7.904	15.362	-5.212
19.672	9.019	20.328	-5.835
24.717	9.878	25.283	-6.298
29.769	10.509	30.231	-6.621
34.825	10.926	35.175	-6.806
39.884	11.131	40.116	-6.847
44.943	11.106	45.057	-6.726
50.000	10.799	50.000	-6.387
55.051	10.235	54.949	-5.855
60.094	9.458	59.906	-5.174
65.127	8.509	64.873	-4.389
70.148	7.428	69.852	-3.540
75.156	6.243	74.844	-2.663
80.149	4.979	79.851	-1.795
85.128	3.667	84.872	-.975
90.092	2.355	89.908	-.287
95.046	1.122	94.954	.142
100.000	0	100.00	0

L.E. radius: 1.92
Slope of radius through L.E.: 0.168

TABLE IV

ORDINATES FOR THE

NACA 65(318)-419 $\left\{\begin{array}{l} a = 1.0, \quad c_{l_i} = 0.5 \\ a = 0.8, \quad c_{l_i} = -0.5 \\ a = 0.5, \quad c_{l_i} = 0.4 \end{array}\right\}$ AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.222	1.501	.778	-1.265
.441	1.835	1.059	-1.503
.903	2.351	1.597	-1.843
2.102	3.323	2.898	-2.431
4.551	4.810	5.449	-3.302
7.032	5.982	7.968	-3.966
9.532	6.971	10.468	-4.511
14.559	8.543	15.441	-5.375
19.613	9.750	20.387	-6.014
24.683	10.651	25.317	-6.499
29.765	11.303	30.235	-6.835
34.858	11.710	35.142	-7.048
39.958	11.883	40.042	-7.115
45.039	11.771	44.961	-7.019
50.220	11.346	49.780	-6.736
55.337	10.587	54.663	-6.305
60.371	9.601	59.629	-5.767
65.361	8.483	64.639	-5.173
70.319	7.314	69.681	-4.530
75.249	6.117	74.751	-3.837
80.131	4.909	79.869	-3.087
85.057	3.759	84.943	-2.239
90.054	2.691	89.946	-1.307
95.055	1.526	94.945	-.470
100.000	0	100.000	0

L.E. radius: 2.184
Slope of radius through L.E.: 0.201

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TABLE V

ORDINATES FOR THE

NACA 66(215)-114 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.456	1.060	.544	-1.010
.702	1.274	.793	-1.204
1.197	1.588	1.303	-1.480
2.439	2.172	2.561	-1.986
4.933	3.037	5.067	-2.721
7.430	3.718	7.570	-3.294
9.929	4.306	10.071	-3.788
14.932	5.242	15.068	-4.568
19.939	5.964	20.061	-5.168
24.947	6.530	25.053	-5.634
29.956	6.957	30.044	-5.985
34.967	7.263	35.033	-6.233
39.978	7.457	40.022	-6.385
44.989	7.543	45.011	-6.447
50.000	7.515	50.000	-6.411
55.011	7.406	54.989	-6.210
60.021	7.033	59.979	-5.961
65.029	6.493	64.971	-5.463
70.035	5.710	69.965	-4.738
75.038	4.790	74.962	-3.894
80.037	3.773	79.963	-2.977
85.033	2.712	84.967	-2.038
90.024	1.648	89.976	-1.130
95.012	.681	94.988	-.365
100.000	0	100.000	0

L.E. radius: 1.206
Slope of radius through L.E.: 0.042

TABLE VI

ORDINATES FOR THE

NACA 66(215)-116, a = 0.6 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.435	1.214	.565	-1.150
.678	1.462	.822	-1.370
1.170	1.823	1.330	-1.683
2.408	2.498	2.592	-2.254
4.897	3.498	5.103	-3.082
7.392	4.286	7.608	-3.726
9.890	4.969	10.110	-4.281
14.894	6.054	15.106	-5.154
19.903	6.895	20.097	-5.827
24.916	7.564	25.084	-6.346
29.931	8.052	30.069	-6.738
34.949	8.401	35.051	-7.009
39.968	8.633	40.032	-7.185
44.989	8.734	45.011	-7.260
50.011	8.694	49.989	-7.220
55.037	8.502	54.963	-7.058
60.070	8.113	59.930	-6.737
65.096	7.459	64.904	-6.203
70.099	6.519	69.901	-5.419
75.091	5.429	74.909	-4.503
80.074	4.218	79.926	-3.478
85.053	2.995	84.947	-2.451
90.030	1.763	89.970	-1.411
95.011	.679	94.989	-.514
100.000	0	100.000	0

TABLE VII

ORDINATES FOR THE

NACA 66(215)-(1.8)(15.5), a = 0.6 AIRFOIL SECTION

[Stations and ordinates are given in percent of airfoil wing reference line]

Station	Upper surface ordinate	Lower surface ordinate
0	0.560	-----
.25	1.421	-0.270
.50	1.717	-.567
.75	1.941	-.783
1.25	2.301	-1.098
2.50	2.964	-1.642
5.00	3.950	-2.430
7.50	4.722	-3.036
10	5.381	-3.576
15	6.422	-4.423
20	7.215	-5.102
25	7.818	-5.641
30	8.248	-6.068
35	8.541	-6.393
40	8.695	-6.622
45	8.722	-6.762
50	8.603	-6.813
55	8.321	-6.760
60	7.852	-6.540
65	7.102	-6.146
70	6.059	-5.529
75	4.834	-4.804
80	3.503	-3.989
85	2.108	-3.156
90	.741	-2.341
95	-.485	-1.650
100	-1.310	-----

L.E. radius: 1.40
(center: 1.40, 0.560)

TABLE VIII

ORDINATES FOR AN AIRFOIL SECTION FORMED BY A STRAIGHT-LINE FAIRING BETWEEN AN NACA 66(215)-216 AIRFOIL SECTION AND AN NACA 66,2-215 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Station	Upper Surface	Lower Surface
0	0	0
.500	1.324	-1.024
.750	1.558	-1.244
1.250	1.921	-1.563
2.500	2.602	-2.113
5.000	3.621	-2.894
7.500	4.438	-3.507
10.000	5.126	-4.022
15.000	6.244	-4.846
20.000	7.112	-5.481
25.000	7.785	-5.965
30.000	8.297	-6.337
35.000	8.668	-6.598
40.000	8.906	-6.762
45.000	9.013	-6.827
50.000	8.993	-6.785
55.000	8.817	-6.622
60.000	8.437	-6.287
65.000	7.818	-5.739
70.000	6.954	-4.982
75.000	5.898	-4.071
80.000	4.714	-3.034
85.000	3.449	-2.081
90.000	2.184	-1.126
95.000	.984	-.338
100.000	.032	-.032

L.E. radius: 1.637
Slope of radius through L.E.: 0.086

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TABLE IX

ORDINATES FOR THE

NACA 66(215)-313 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.379	1.029	.621	-.879
.617	1.249	.883	-1.039
1.102	1.578	1.398	-1.258
2.332	2.204	2.668	-1.646
4.812	3.142	5.188	-2.194
7.305	3.886	7.695	-2.614
9.803	4.530	10.197	-2.978
14.812	5.560	15.188	-3.540
19.829	6.360	20.171	-3.972
24.852	6.987	25.148	-4.303
29.878	7.466	30.122	-4.550
34.907	7.810	35.093	-4.720
39.938	8.032	40.062	-4.820
44.969	8.138	45.031	-4.854
50.000	8.119	50.000	-4.811
55.031	7.963	54.969	-4.679
60.058	7.639	59.942	-4.427
65.082	7.095	64.918	-4.005
70.098	6.308	69.902	-3.392
75.106	5.373	74.894	-2.689
80.104	4.326	79.896	-1.938
85.091	3.214	84.909	-1.194
90.068	2.064	89.932	-.512
95.034	.958	94.966	-.010
100.000	0	100.000	0

L.E. radius: 1.040
Slope of radius through L.E.: 0.126

TABLE X

ORDINATES FOR AN AIRFOIL SECTION FORMED BY A STRAIGHT-LINE FAIRING BETWEEN AN NACA $65_{(215)}$-114 AIRFOIL SECTION AND AN NACA 65_1-212, a = 0.6 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	.450	0	0.450
.533	1.571	.404	-.404
.796	1.779	.592	-.567
1.358	2.129	1.017	-.850
2.792	2.767	1.942	-1.321
5.825	3.775	3.700	-1.929
8.908	4.546	5.488	-2.433
11.988	5.167	7.304	-2.871
17.867	6.088	11.067	-3.617
23.413	6.700	14.867	-4.225
28.783	7.104	18.896	-4.742
33.792	7.329	23.313	-5.188
38.600	7.404	28.283	-5.567
43.533	7.346	33.983	-5.850
48.583	7.117	40.271	-5.963
53.783	6.700	46.700	-5.888
56.583	6.358	52.454	-5.621
59.425	5.979	57.700	-5.225
62.263	5.546	62.775	-4.746
65.079	5.067	68.296	-4.142
70.063	4.213	74.329	-3.442
75.046	3.283	77.425	-3.071
80.038	2.333	79.946	-2.767
85.025	1.358	84.963	-2.171
90.008	.421	39.967	-1.629
94.996	-.433	94.983	-1.200
99.988	-1.054	99.988	-1.054

L.E. radius: 1.193
Slope of radius through L.E.: 0.423

TABLE XI

ORDINATES FOR AN AIRFOIL SECTION FORMED BY A STRAIGHT-LINE FAIRING BETWEEN A MODIFIED NACA 66(215)-214 AIRFOIL SECTION AND A MODIFIED NACA $65_{(112)}$-213 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.171	.733	.171	-.629
.258	.854	.429	-.825
.429	1.058	.688	-1.042
.517	1.154	.863	-1.146
.688	1.300	1.033	-1.250
.863	1.438	1.308	-1.388
1.163	1.638	1.563	-1.413
1.979	2.083	1.558	-1.500
2.396	2.267	1.721	-1.558
3.446	2.704	2.617	-1.871
4.892	3.204	5.142	-2.525
7.392	3.938	7.629	-3.067
9.871	4.575	10.121	-3.504
14.875	5.563	15.133	-4.204
19.896	6.358	20.113	-4.738
24.908	6.950	25.117	-5.133
30.050	7.433	30.079	-5.425
34.863	7.750	35.083	-5.633
39.967	7.942	38.288	-5.763
45.046	8.021	44.946	-5.796
49.983	7.967	49.975	-5.746
54.367	7.763	55.425	-5.646
60.033	7.375	60.025	-5.246
65.054	6.813	64.925	-4.746
70.096	6.021	69.896	-4.050
75.092	5.083	74.883	-3.283
80.079	4.083	79.913	-2.471
90.292	2.025	84.900	-1.742
94.746	1.138	89.992	-1.042
100.000	.067	94.850	-.450
		100.000	-.067

TABLE XII

ORDINATES FOR AN AIRFOIL SECTION FORMED BY A STRAIGHT-LINE FAIRING BETWEEN AN NACA 63(420)-321 AIRFOIL SECTION AND AN NACA 65(318)-415 AIRFOIL SECTION

[Stations and ordinates given in percent of wing chord]

Station	Upper Surface	Lower Surface
0	-----	0
.5	2.267	-1.258
.75	2.629	-1.658
1.25	3.200	-2.167
2.50	4.242	-3.075
5.00	5.950	-4.283
7.50	6.900	-5.167
10	7.896	-5.875
15	9.396	-6.950
20	10.496	-7.721
25	11.246	-8.233
30	11.667	-8.462
35	11.817	-8.442
40	11.637	-8.196
45	11.358	-7.783
50	10.812	-7.225
55	10.133	-6.562
60	9.300	-5.804
65	8.300	-4.962
70	7.217	-4.050
75	6.054	-3.092
80	4.812	
83.13	3.503	-1.559
85.38	5.404	-1.179
89.88	2.370	-.517
95.50	1.001	-.041
100	0	-.017

L.E. radius: 3.152
Slope of radius through L.E.: 0.555

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TABLE XIII

ORDINATES FOR AN AIRFOIL SECTION FORMED BY A STRAIGHT-LINE FAIRING BETWEEN AN NACA 63(420)-321 AIRFOIL SECTION AND AN NACA 65(318)-415 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Station	Upper surface ordinate	Lower surface ordinate
0	0	0
.155	1.24	-.527
.50	1.83	-1.08
1	2.36	-1.57
2.5	3.49	-2.52
5	4.85	-3.48
7.5	5.96	-4.20
10	6.87	-4.81
12.5	7.63	-5.29
15	8.29	-5.74
20	9.27	-6.39
25	9.93	-6.81
30	10.42	-7.07
35	10.67	-7.14
40	10.64	-7.05
45	10.42	-6.71
50	10.00	-6.26
55	9.42	-5.66
60	8.68	-4.97
65	7.81	-4.23
70	6.81	-3.40
75	5.71	-2.54
80	4.54	-1.71
85	3.33	-.93
90	2.12	-.28
95	.98	.15
100	0	0

L.E. radius: 2.20
Slope of radius through L.E.: 0.162

TABLE XIV

ORDINATES FOR AN AIRFOIL SECTION FORMED BY A STRAIGHT-LINE FAIRING BETWEEN AN NACA 63(420)-422 AIRFOIL SECTION AND AN NACA 63(420)-517 AIRFOIL SECTION

[Stations and ordinates given in percent of airfoil chord]

Station	Upper Surface	Lower Surface
0	0.971	----
.3125	1.86	-1.13
.625	2.39	-1.78
1.25	3.15	-2.56
2.5	4.28	-3.53
5	5.92	-4.76
10	8.26	-6.40
20	11.13	-8.26
30	12.48	-8.94
40	12.48	-8.54
50	11.56	-7.40
60	9.98	-5.81
70	7.82	-3.99
80	5.25	-2.07
90	2.50	-.42
95	1.21	.03
100	0	-.06

TABLE XV

ORDINATES FOR

AIRFOIL SECTION A

[Stations and ordinates given in percent of airfoil chord]

Station	Upper Surface	Lower Surface
0	0	0
1.25	1.84	-1.34
2.5	2.67	-1.81
5.0	3.68	-2.49
7.5	4.38	-3.04
10	5.00	-3.49
15	5.98	-4.12
20	6.64	-4.64
25	7.17	-5.06
30	7.63	-5.46
35	7.87	-5.50
40	7.93	-5.52
45	7.90	-5.45
50	7.69	-5.30
60	6.75	-4.47
70	5.20	-3.19
80	3.38	-1.68
85	2.28	-1.13
90	1.33	-.66
95	.56	-.24
99.8	.11	-.11
100	0	0

TABLE XVI

ORDINATES FOR

AIRFOIL SECTION B

[Stations and ordinates given in percent of airfoil chord]

Station	Upper ordinate	Lower ordinate
0	0.395	0
.50	1.579	-1.108
.75	1.879	-1.350
1.25	2.367	-1.754
2.50	3.233	-2.479
5.00	4.450	-3.400
7.50	5.342	-4.008
10	6.079	-4.504
15	7.217	-5.242
20	8.038	-5.729
25	8.571	-6.025
30	8.871	-6.125
35	8.979	-6.104
40	9.000	-6.033
45	8.921	-5.925
50	8.633	-5.685
55	8.125	-5.308
60	7.421	-4.817
65	6.575	-4.233
70	5.642	-3.633
75	4.700	-3.029
80	3.758	-2.425
85	2.821	-1.817
90	1.879	-1.213
95	.942	-.604
100	0	0

L.E. radius: 1.975
Slope of radius through L.E.: 0.1020
T.E. radius: 0.058 at 99.626 percent chord

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TABLE XVII

ORDINATES FOR

AIRFOIL SECTION C

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.500	1.625	.500	-1.125
.750	2.000	.750	-1.292
1.250	2.333	1.250	-1.583
2.500	3.167	2.500	-2.167
5.000	4.417	5.000	-3.042
7.500	5.333	7.500	-3.667
10	6.125	10	-4.167
15	7.417	15	-4.917
20	8.375	20	-5.625
25	9.000	25	-6.000
30	9.500	30	-6.333
35	9.917	35	-6.583
40	9.958	40	-6.625
45	10.000	45	-6.583
50	9.667	50	-6.542
55	9.208	55	-6.375
60	8.583	60	-6.333
65	7.833	65	-5.333
70	7.167	70	-4.542
75	5.917	75	-3.583
80	4.917	80	-2.542
85	3.792	85	-1.583
90	2.583	90	-.750
95	1.583	95	-.208
100	.188	100	-.188

L.E. radius: 1.625
T.E. thickness: 0.376

TABLE XVIII

ORDINATES FOR

AIRFOIL SECTION D

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.500	1.667	.500	-1.167
.750	2.000	.750	-1.375
1.250	2.417	1.250	-1.750
2.500	3.375	2.500	-2.458
5.000	4.667	5.000	-3.375
7.500	5.750	7.500	-4.125
10	6.583	10	-4.667
15	7.958	15	-5.750
20	9.000	20	-6.500
25	9.792	25	-7.000
30	10.333	30	-7.417
35	10.667	35	-7.583
40	10.750	40	-7.708
45	10.750	45	-7.750
50	10.375	50	-7.625
55	9.875	55	-7.333
60	9.125	60	-6.875
65	8.250	65	-6.167
70	7.167	70	-5.083
75	6.167	75	-4.042
80	4.958	80	-2.958
85	4.083	85	-2.125
90	2.583	90	-.833
95	1.500	95	-.208
100	.063	100	-.063

L.E. radius: 2.167
T.E. radius: 0.126

TABLE XIX

ORDINATES FOR

AIRFOIL SECTION E

[Stations and ordinates given in percent of airfoil chord]

Upper surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.500	1.500	.500	-1.042
.750	2.125	.750	-1.250
1.250	2.667	1.250	-1.583
2.500	3.708	2.500	-2.250
5.000	5.083	5.000	-3.042
7.500	6.208	7.500	-3.750
10	7.042	10	-4.292
15	8.500	15	-5.208
20	9.542	20	-5.792
25	10.375	25	-6.333
30	10.958	30	-6.708
35	11.333	35	-7.000
40	11.500	40	-7.125
45	11.375	45	-7.125
50	11.083	50	-7.042
55	10.500	55	-6.750
60	9.667	60	-6.208
65	8.792	65	-5.375
70	7.750	70	-4.500
75	6.583	75	-3.417
80	5.333	80	-2.375
85	4.042	85	-1.375
90	2.667	90	-.500
95	1.292	95	-.333
100	.188	100	-.188

L.E. radius: 1.875
T.E. radius: 0.188

TABLE XX

ORDINATES FOR

AIRFOIL SECTION F

[Stations and ordinates given in percent of airfoil reference line]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	2.852	0	2.852
.25	3.646	.25	2.028
.50	3.908	.50	1.702
1.00	4.227	1.00	1.265
1.75	4.555	1.75	.808
2.50	4.811	2.50	.436
5.00	5.454	5.00	-.539
7.50	5.926	7.50	-1.300
10	6.308	10	-1.949
15	6.884	15	-3.041
20	7.286	20	-3.927
25	7.554	25	-4.646
30	7.696	30	-5.206
35	7.716	35	-5.604
40	7.610	40	-5.835
45	7.337	45	-5.882
50	6.853	50	-5.757
55	6.205	55	-5.483
60	5.459	60	-5.097
65	4.666	65	-4.635
70	3.861	70	-4.146
75	3.053	75	-3.652
80	2.244	80	-3.157
85	1.434	85	-2.662
90	.623	90	-2.166
95	-.190	95	-1.669
100	-1.084	100	-1.084

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TABLE XXI

ORDINATES FOR

AIRFOIL SECTION G

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.004	-2.614	0.063	-2.934
.216	-1.581	.282	-3.366
.693	-.873	.701	-3.740
1.037	-.518	1.581	-4.219
2.506	.554	5.143	-5.386
6.308	2.407	7.058	-5.833
10.424	3.872	10.405	-6.468
15.370	5.254	15.651	-7.225
21.014	6.480	21.655	-7.844
24.057	7.015	24.888	-8.092
30.483	7.890	31.697	-8.433
33.828	8.212	35.227	-8.551
40.792	8.551	42.414	-8.446
44.214	8.560	47.804	-8.148
51.352	8.249	51.367	-7.723
54.956	7.946	56.918	-6.781
58.567	7.559	60.466	-6.088
65.740	6.578	64.578	-5.403
69.263	6.012	72.175	-4.151
76.064	4.801	75.817	-3.611
79.294	4.180	82.571	-2.685
85.299	2.951	85.615	-2.280
90.563	1.830	90.934	-1.548
94.890	.940	95.135	-.912
100.000	0	100.000	0

TABLE XXII

ORDINATES FOR

AIRFOIL SECTION H

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.25	.892	.25	-.892
.50	1.232	.50	-1.232
1.00	1.684	1.00	-1.684
1.75	2.148	1.75	-2.148
2.50	2.509	2.50	-2.509
5.00	3.421	5.00	-3.421
7.50	4.116	7.50	-4.116
10	4.694	10	-4.694
15	5.633	15	-5.633
20	6.367	20	-6.367
25	6.938	25	-6.938
30	7.383	30	-7.383
35	7.644	35	-7.644
40	7.773	40	-7.773
45	7.699	45	-7.699
50	7.395	50	-7.395
55	6.897	55	-6.897
60	6.258	60	-6.258
65	5.526	65	-5.526
70	4.751	70	-4.751
75	3.972	75	-3.972
80	3.195	80	-3.195
85	2.418	85	-2.418
90	1.640	90	-1.640
95	.862	95	-.862
100	0	100	0

TABLE XXIII

ORDINATES FOR

AIRFOIL SECTION I

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	-0.650	0	-0.650
.623	.537	1.078	-2.094
1.380	1.035	2.041	-2.531
2.440	1.587	3.305	-2.959
5.405	2.505	6.672	-3.773
7.282	2.981	8.746	-4.153
9.403	3.442	11.062	-4.510
14.322	4.296	16.355	-5.141
20.037	5.032	22.413	-5.640
26.403	5.618	29.084	-5.984
29.782	5.844	32.596	-6.090
36.828	6.145	39.866	-6.154
44.108	6.215	47.309	-5.992
51.438	5.989	54.771	-5.523
55.096	5.724	58.505	-5.164
62.436	4.924	65.945	-4.292
69.738	3.964	73.185	-3.370
76.735	3.034	79.964	-2.508
80.031	2.598	83.103	-2.111
86.080	1.803	88.756	-1.399
91.243	1.128	93.423	-.817
95.346	.598	96.948	-.381
98.240	.226	98.237	-.222
99.786	.028	99.189	-.105
100.000	0	100.000	-.004

TABLE XXIV

ORDINATES FOR

AIRFOIL SECTION J

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.561	1.044	.561	-1.044
1.301	1.529	1.301	-1.529
2.349	2.016	2.349	-2.016
5.295	2.987	5.295	-2.987
7.163	3.460	7.163	-3.460
9.446	3.918	9.446	-3.918
11.625	4.355	11.625	-4.355
16.952	5.146	16.952	-5.146
19.900	5.492	19.900	-5.492
26.269	6.064	26.269	-6.064
33.138	6.451	33.138	-6.451
40.335	6.622	40.335	-6.622
47.684	6.525	47.684	-6.525
51.374	6.353	51.374	-6.353
58.748	5.753	58.748	-5.753
66.062	4.876	66.062	-4.876
73.196	3.882	73.196	-3.882
79.914	2.922	79.914	-2.922
85.960	2.054	85.960	-2.054
91.134	1.303	91.134	-1.303
95.264	.697	95.264	-.697
98.196	.266	98.196	-.266
99.778	.034	99.778	-.034
100.000	.001	100.000	-.001

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TABLE XXV

ORDINATES FOR

AIRFOIL SECTION K

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.5	1.91	.5	-----
.75	2.19	.75	-----
1.25	2.62	1.25	.963
2.50	3.46	2.50	1.200
5.00	4.75	5.00	1.475
7.50	5.76	7.50	1.600
10	6.60	10	1.670
15	7.99	15	1.736
20	9.01	20	1.761
25	9.73	25	1.778
30	10.16	30	1.787
35	10.32	35	1.792
40	10.20	40	1.797
45	9.73	45	1.799
50	9.10	50	1.799
55	8.36	55	1.782
60	7.53	60	1.733
65	6.63	65	1.610
70	5.70	70	1.383
75	4.75	75	1.150
80	3.80	80	.925
85	2.85	85	.695
90	1.90	90	.460
95	.95	95	.230
100	0	100	0

L.E. radius is 0.015c on a line 22° from the chord.

TABLE XXVI

ORDINATES FOR

AIRFOIL SECTION L

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	1.63	0	0
.5	2.54	.5	-.86
.75	2.89	.75	-1.11
1.25	3.48	1.25	-1.46
2.50	4.71	2.50	-1.99
5.00	6.58	5.00	-2.67
7.50	8.00	7.50	-3.23
10	9.18	10	-3.69
15	10.94	15	-4.42
20	12.17	20	-4.99
25	13.06	25	-5.41
30	13.64	30	-5.69
35	13.97	35	-5.88
40	14.02	40	-5.98
45	13.76	45	-5.98
50	13.20	50	-5.83
55	12.40	55	-5.50
60	11.37	60	-5.02
65	10.10	65	-4.44
70	8.69	70	-3.82
75	7.24	75	-3.19
80	5.79	80	-2.54
85	4.35	85	-1.91
90	2.90	90	-1.28
95	1.45	95	-.63
100	0	100	0

L.E. radius is 0.0256c on a line 18°-40' from the chord.

TABLE XXVII

ORDINATES FOR

AIRFOIL SECTION M

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.584	1.536	.916	-1.356
1.040	1.993	1.460	-1.693
1.640	2.448	2.110	-1.998
2.244	2.842	2.756	-2.252
3.481	3.523	4.019	-2.693
4.733	4.100	5.267	-3.060
5.987	4.571	6.513	-3.361
7.270	4.984	7.730	-3.624
9.807	5.666	10.193	-4.066
12.321	6.257	12.679	-4.437
14.844	6.758	15.156	-4.778
17.351	7.188	17.649	-5.068
19.855	7.573	20.145	-5.323
24.903	8.199	25.097	-5.739
29.941	8.600	30.059	-6.030
34.996	8.800	35.004	-6.180
40.043	8.785	39.957	-6.205
45.096	8.584	44.904	-6.084
50.102	8.214	49.898	-5.834
55.102	7.664	54.898	-5.444
60.123	6.989	59.877	-4.949
65.128	6.193	64.872	-4.383
70.171	5.252	69.829	-3.802
75.138	4.237	74.862	-3.197
80.107	3.223	79.893	-2.563
85.057	2.274	84.943	-1.934
90.027	1.400	89.973	-1.320
95.007	.670	94.993	-.690
100.000	0	100.000	0

L.E. radius: 1.561
Slope of radius through L.E.: 0.115
T.E. radius: 0.0625

TABLE XXVIII

ORDINATES FOR

AIRFOIL SECTION N

[Stations and ordinates given in percent of airfoil wing reference line]

Stations	Upper surface ordinate	Lower surface ordinate
0	0.557	-----
.25	1.554	-0.307
.50	2.016	-.710
.75	2.361	-1.031
1.25	2.890	-1.529
2.5	3.850	-2.420
5.0	5.124	-3.548
7.5	5.967	-4.276
10	6.552	-4.743
15	7.494	-5.490
20	8.181	-6.064
25	8.562	-6.376
30	8.740	-6.550
35	8.795	-6.659
40	8.790	-6.689
45	8.678	-6.707
50	8.344	-6.532
55	7.770	-6.166
60	6.959	-5.634
65	5.964	-5.011
70	4.828	-4.331
75	3.627	-3.640
80	2.417	-2.956
85	1.225	-2.310
90	.144	-1.763
95	-.747	-1.407
100	-----	-1.310

L.E. radius: 1.248
(center: 1.248, 0.557)

NACA

TABLE XXIX

ORDINATES FOR

AIRFOIL SECTION O

[Stations and ordinates given in percent of airfoil chord]

Station	Upper surface	Lower surface
0	0	0
.5	.975	-.808
.75	1.192	-1.004
1.25	1.537	-1.283
2.50	2.158	-1.792
5	3.025	-2.487
7.5	3.679	-2.962
10	4.212	-3.337
15	5.021	-3.925
20	5.625	-4.346
25	6.108	-4.629
30	6.467	-4.846
35	6.712	-4.983
40	6.854	-5.062
45	6.917	-5.079
50	6.883	-5.021
55	6.737	-4.875
60	6.462	-4.633
65	6.037	-4.271
70	5.492	-3.783
75	4.796	-3.024
80	3.971	-2.542
85	3.029	-1.846
90	2.025	-1.150
95	.992	-.542
100	0	0

L.E. radius: 0.800
L.E. radius 0.054 above chord line

TABLE XXX

ORDINATES FOR

AIRFOIL SECTION P

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.50	1.408	0.50	-0.709
.75	1.667	.75	-.888
1.25	2.095	1.25	-1.175
2.50	2.924	2.50	-1.646
5.00	4.120	5.00	-2.231
7.50	5.019	7.50	-2.609
10	5.771	10	-2.869
15	6.930	15	-3.238
20	7.818	20	-3.459
25	8.467	25	-3.606
30	8.938	30	-3.654
35	9.247	35	-3.654
40	9.399	40	-3.606
45	9.399	45	-3.503
50	9.242	50	-3.346
55	8.922	55	-3.140
60	8.429	60	-2.896
65	7.736	65	-2.653
70	6.886	70	-2.398
75	5.879	75	-2.101
80	4.791	80	-1.765
85	3.638	85	-1.402
90	2.436	90	-1.002
95	1.245	95	-.563
100	.039	100	-.039

L.E. radius: 1.143
Slope of radius through L.E.: 0.21297

TABLE XXXI

ORDINATES FOR

AIRFOIL SECTION Q

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.50	1.600	0.50	-1.220
.75	1.954	.75	-1.510
1.25	2.495	1.25	-1.970
2.50	3.460	2.50	-2.810
5.00	4.770	5.00	-3.935
7.50	5.740	7.50	-4.765
10	6.520	10	-5.390
15	7.725	15	-6.325
20	8.610	20	-6.980
25	9.242	25	-7.430
30	9.692	30	-7.710
35	9.965	35	-7.885
40	10.070	40	-7.925
45	10.010	45	-7.830
50	9.805	50	-7.600
55	9.445	55	-7.245
60	8.910	60	-6.750
65	8.230	65	-6.130
70	7.395	70	-5.395
75	6.420	75	-4.580
80	5.325	80	-3.685
85	4.145	85	-2.742
90	2.880	90	-1.770
95	1.500	95	-.875
100	0	100	0

L.E. radius: 2.250
Slope of radius through L.E.: 0.07807

TABLE XXXII

ORDINATES FOR

AIRFOIL SECTION R

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.50	1.759	0.50	-1.119
.75	2.084	.75	-1.412
1.25	2.609	1.25	-1.885
2.50	3.595	2.50	-2.700
5.00	4.967	5.00	-3.768
7.50	5.993	7.50	-4.520
10	6.813	10	-5.103
15	8.089	15	-5.972
20	9.023	20	-6.569
25	9.707	25	-6.986
30	10.183	30	-7.248
35	10.482	35	-7.379
40	10.609	40	-7.396
45	10.569	45	-7.281
50	10.365	50	-7.052
55	9.991	55	-6.698
60	9.447	60	-6.220
65	8.742	65	-5.625
70	7.883	70	-4.920
75	6.869	75	-4.129
80	5.733	80	-3.286
85	4.494	85	-2.419
90	3.141	90	-1.534
95	1.663	95	-.677
100	.017	100	-.017

L.E. radius: 0.948
Slope of radius through L.E.: 0.25484

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TABLE XXXIII

ORDINATES FOR

AIRFOIL SECTION S

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.50	1.542	0.50	-0.928
.75	1.855	.75	-1.171
1.25	2.398	1.25	-1.555
2.50	3.354	2.50	-2.267
5.00	4.713	5.00	-3.170
7.50	5.772	7.50	-3.805
10	6.576	10	-4.318
15	7.850	15	-5.059
20	8.834	20	-5.574
25	9.630	25	-5.958
30	10.239	30	-6.267
35	10.679	35	-6.482
40	10.960	40	-6.633
45	11.159	45	-6.763
50	11.223	50	-6.801
55	11.139	55	-6.765
60	10.886	60	-6.539
65	10.370	65	-6.184
70	9.583	70	-5.614
75	8.495	75	-4.836
80	7.138	80	-3.822
85	5.514	85	-2.653
90	3.756	90	-1.504
95	1.906	95	-.656
100	0	100	0

L.E. radius: 1.620
Slope of radius through L.E.: 0.1689

TABLE XXXIV

ORDINATES FOR

AIRFOIL SECTION T

[Stations and ordinates given in percent of airfoil chord]

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0	0	0	0
.50	2.018	.50	-1.380
.75	2.385	.75	-1.724
1.25	2.968	1.25	-2.237
2.50	4.029	2.50	-3.117
5.00	5.498	5.00	-4.204
7.50	6.587	7.50	-4.932
10	7.472	10	-5.476
15	8.870	15	-6.262
20	9.929	20	-6.836
25	10.706	25	-7.210
30	11.212	30	-7.415
35	11.472	35	-7.498
40	11.507	40	-7.490
45	11.340	45	-7.359
50	10.987	50	-7.088
55	10.457	55	-6.673
60	9.757	60	-6.135
65	8.894	65	-5.501
70	7.884	70	-4.787
75	6.759	75	-4.006
80	5.515	80	-3.190
85	4.190	85	-2.355
90	2.808	90	-1.523
95	1.408	95	-.714
100	0	100	0

L.E. radius: 3.055

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TABLE XXXV. - AERODYNAMIC CHARACTERISTICS OF MISCELLANEOUS AIRFOILS

[All data given are for the smooth airfoil and for zero deflection and sealed gaps of flaps or control surfaces present]

Airfoil	Figure	Ordinates, table	Reference	R	$c_{l_{max}}$	α_{l_0} (deg)	$c_{d_{min}}$	$c_{m_{a.c.}}$	Aerodynamic center position x/c	Aerodynamic center position y/c	c_l range for low drag	Remarks
NACA 65(216)-(3.4)15	1	I	------	6.2×10^6	1.50	-2.0	0.0041	------	------	------	0.24 to 0.72	Mean line combination: $\left\{\begin{array}{l} a = 0.5,\ c_{l_i} = 1.794 \\ a = 0.6,\ c_{l_i} = -1.164 \\ a = 0.7,\ c_{l_i} = -0.291 \end{array}\right\}$
NACA 65,3-316 (approx.), a = 0.8	2	II	------	6.1	1.54	-2.2	0.0043	-0.052	0.266	-0.053	0.05 to 0.47	Section different from standard NACA section in that leading-edge radius is reduced from 0.01704c to 0.01578c.
✓ NACA 65,3-418	3	III	3	6.0	1.56	-2.8	0.0047	------	------	------	0.04 to 0.70	
✓ NACA 65(318)-419	4	IV	4	6.0	1.35	-2.3	0.0048	-0.048	0.255	-0.022	0.02 to 0.75	Mean line combination: $\left\{\begin{array}{l} a = 1.0,\ c_{l_i} = 0.5 \\ a = 0.8,\ c_{l_i} = -0.5 \\ a = 0.5,\ c_{l_i} = 0.4 \end{array}\right\}$
NACA 66(215)-114	5	V	------	6.2	1.48	-1.7	0.0043	------	------	------	0.14 to 0.37	
NACA 66(215)-116, a = 0.6	6	VI	5	6.0	1.44	-0.9	0.0036	-0.018	0.254	-0.050	-0.05 to 0.34	0.25c slotted flap.
NACA 66(215)-(1.8)(15.5), a = 0.6	7	VII	------	5.9	1.45	-2.2	0.0038	-0.028	0.260	-0.011	0.00 to 0.38	
Intermediate section between NACA 66(215)-216 root and NACA 66,2-215 tip	8	VIII	------	6.0	1.41	-1.3	0.0035	-0.040	0.254	-0.036	-0.07 to 0.37	Section of 0.158c maximum thickness formed by straight-line fairing between root and tip, 0.25c slotted flap.
NACA 66(215)-313	9	IX	------	6.2	1.59	-2.5	0.0033	------	------	------	0.28 to 0.50	
Intermediate section between NACA 65(215)-114 root and NACA 65_1-212, a = 0.6 tip	10	X	6	6.0	1.46	-1.1	0.0041	-0.022	0.263	-0.023	-0.06 to 0.40	Section of 0.13c maximum thickness formed by straight-line fairing between root and tip; 0.336c slotted flap.
Intermediate section between NACA 66(215)-214 (mod.) root and NACA $65_{(112)}$-213 (mod.) tip	11	XI	7	6.0	1.50	-2.0	0.0039	------	------	------	0.04 to 0.44	Trailing-edge camps removed. Section of 0.138c maximum thickness formed by straight-line fairing between root and tip, 0.25c double-slotted flap.
✓ Intermediate section between NACA 63(420)-321 root and NACA 65(318)-415 tip	12	XII	------	5.9	1.39	-2.4	0.0057	-0.055	0.268	-0.054	-0.12 to 0.72	Section of 0.20c maximum thickness at 0.35c station formed by straight-line fairing between root and tip, 0.225c slotted flap.
Intermediate section between NACA 63(420)-321 root and NACA 65(318)-415 tip	13	XIII	8	5.9	1.50	-2.2	0.0056	------	------	------	-0.04 to 0.70	Section of 0.178c maximum thickness at 0.35c station formed by straight-line fairing between root and tip, 0.20c plain flap.
Intermediate section between NACA 63(420)-422 root and NACA 63(420)-517 tip	14	XIV	------	2.3	1.21	-3.0	0.0074	------	------	------	-0.20 to 0.60	Section of 0.214c maximum thickness formed by straight-line fairing between root and tip, 0.245c double-slotted flap.
A	15	XV	9	6.1	1.62	-1.2	0.0040	------	------	------	0.02 to 0.37	Section of 0.1345c maximum thickness at 0.40c station.
B	16	XVI	------	6.1	1.52	-1.5	0.0051	-0.030	0.251	-0.029	-0.06 to 0.35	Section of 0.15c maximum thickness at 0.35c station and design lift coefficient of approximately 0.2, 0.30c Fowler flap.
C	17	XVII	------	6.0	1.48	-1.5	0.0044	-0.039	0.257	-0.033	0.00 to 0.51	Section derived by modifying NACA 65,3-316 airfoil so that the quarter-chord pitching moment was reduced.

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TABLE XXXV. - AERODYNAMIC CHARACTERISTICS OF MISCELLANEOUS AIRFOILS - Concluded

[All data given are for the smooth airfoil and for zero deflection and sealed gaps of flaps or control surfaces present]

Airfoil	Figure	Ordinates, table	Reference	R	$c_{l_{max}}$	α_{l_0} (deg)	$c_{d_{min}}$	$c_{m_{a.c.}}$	Aerodynamic center position x/c	Aerodynamic center position y/c	c_l range for low drag	Remarks
D	18	XVIII	------	6.0×10^6	1.41	-1.8	0.0045	-0.040	0.257	-0.006	-0.04 to 0.45	Section derived by modifying NACA 65,3-318 airfoil so that the quarter-chord pitching moment was reduced.
E	19	XIX	------	6.0	1.45	-2.3	0.0043	-0.055	0.261	-0.027	0.02 to 0.60	Section derived by modifying NACA 65,3-418 airfoil so that the quarter-chord pitching moment was reduced.
F	20	XX	10	6.0	1.22	-1.6	0.0047	------	------	------	-0.25 to 0.07	Section of 0.134c maximum thickness at 0.40c station, 0.35c plain flap.
G	21	XXI	11	6.1	1.41	-0.3	0.0044	-0.035	0.250	-0.054	-0.09 to 0.56	Section of 0.17c maximum thickness at 0.40c station and a design lift coefficient of approximately 0.3.
H	22	XXII	10	6.0	1.32	0.1	0.0052	------	------	------	-0.23 to 0.20	Symmetrical section of 0.155c maximum thickness at 0.40c station, 0.40c plain flap.
I	23	XXIII	------	6.0	1.40	-0.5	0.0041	------	------	------	-0.05 to 0.22	Section of 0.124c maximum thickness at 0.40c station, 0.35c plain flap.
J	24	XXIV	------	6.0	1.33	-0.1	0.0044	------	------	------	-0.19 to 0.14	Symmetrical section of 0.132c maximum thickness at 0.40c station, 0.35c plain flap.
K	25	XXV	4	6.0	1.48	-2.8	0.0046	------	------	------	0.53 to 0.88	Section of 0.12c maximum thickness at 0.35c station and design lift coefficient of approximately 0.4.
L	26	XXVI	4	6.0	1.27	-3.6	0.0051	------	------	------	0.36 to 0.65	Section of 0.200c maximum thickness at 0.40c station.
M	27	XXVII	------	6.2	1.47	-0.6	0.0045	-0.009	0.258	-0.002	-0.03 to 0.41	Section of 0.15c maximum thickness at 0.40c station.
N	28	XXVIII	------	6.0	1.59	-1.9	0.0053	-0.026	0.262	-0.004	0.00 to 0.33	Section derived from NACA 66(215)-(1.8)(15.5), a = 0.6 airfoil by increasing leading-edge radius and moving maximum thickness forward to 0.40c station.
O	29	XXIX	------	6.1	1.48	-1.4	0.0034	------	------	------	0.10 to 0.24	Section of 0.12c maximum thickness at 0.45c station and design lift coefficient of 0.15, a = 0.9.
P	30	XXX	------	6.1	1.57	-2.8	0.0044	------	------	------	0.25 to 0.52	Section of 0.13c maximum thickness at 0.40c station and design lift coefficient of 0.4, a = 0.6.
Q	31	XXXI	------	6.0	1.52	-1.3	0.0047	------	------	------	0.03 to 0.30	Section of 0.18c maximum thickness at 0.40c station and design lift coefficient of 0.2, a = 1.0.
R	32	XXXII	------	6.0	1.54	-1.9	0.0048	------	------	------	0.10 to 0.32	Section of 0.18c maximum thickness at 0.40c station and design lift coefficient of 0.3, a = 1.0.
S	33	XXXIII	------	6.0	1.43	-3.1	0.0038	------	------	------	0.25 to 0.45	Section of 0.18c maximum thickness at 0.50c station and design lift coefficient of 0.4, a = 1.0.
T	34	XXXIV	4	6.0	1.36	-1.7	0.0056	-0.050	0.234	-0.052	0.16 to 0.50	Section derived from NACA 2419 airfoil by decreasing leading-edge radius and moving maximum thickness aft to 0.38c station.

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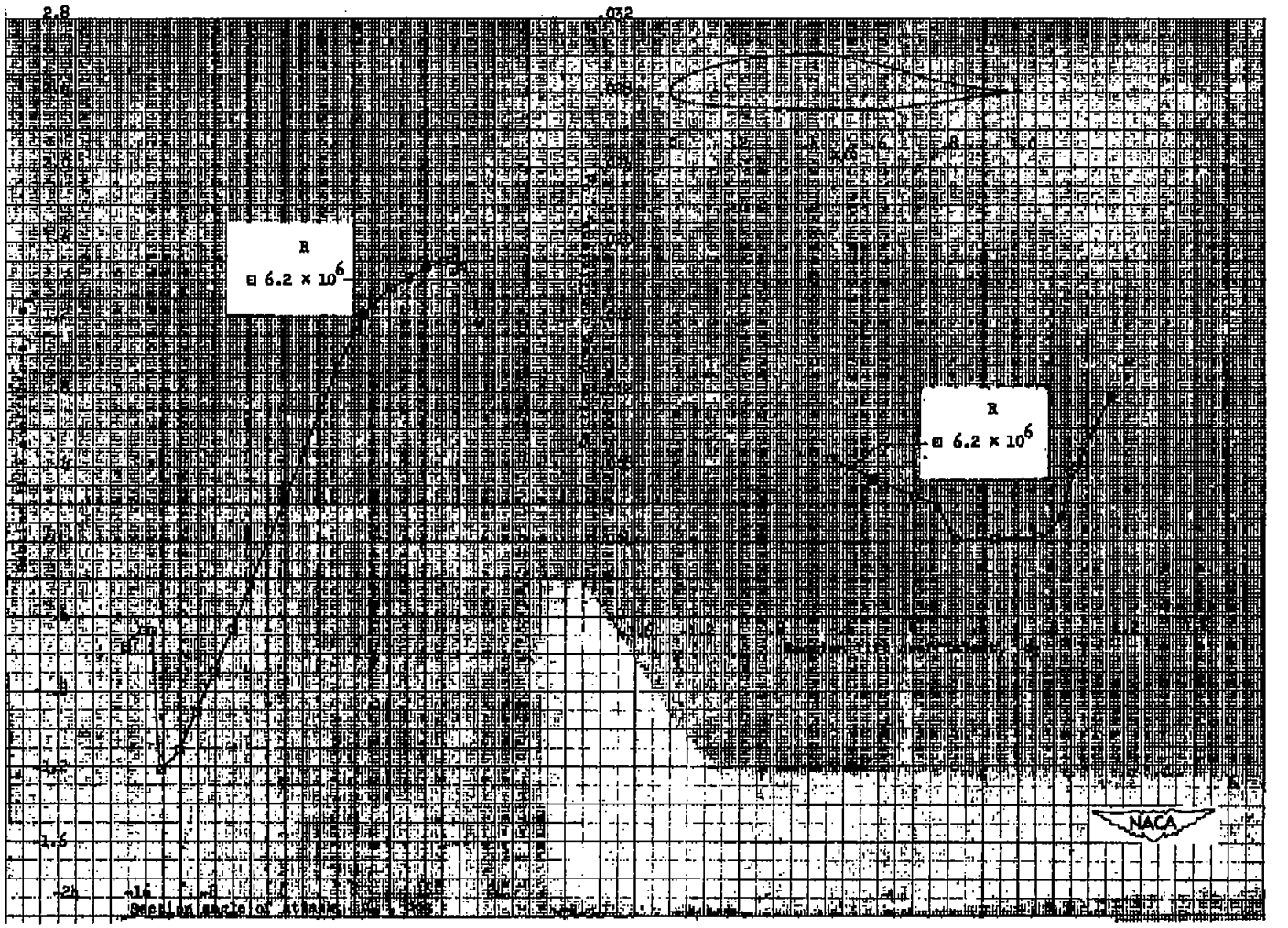

Figure 1.– Aerodynamic characteristics of the NACA 65(216)–(3.4)15 $\left\{\begin{array}{ll} a = 0.5, & c_{l_i} = 1.794 \\ a = 0.6, & c_{l_i} = -1.164 \\ a = 0.7, & c_{l_i} = -0.291 \end{array}\right\}$ airfoil section, 24-inch chord.

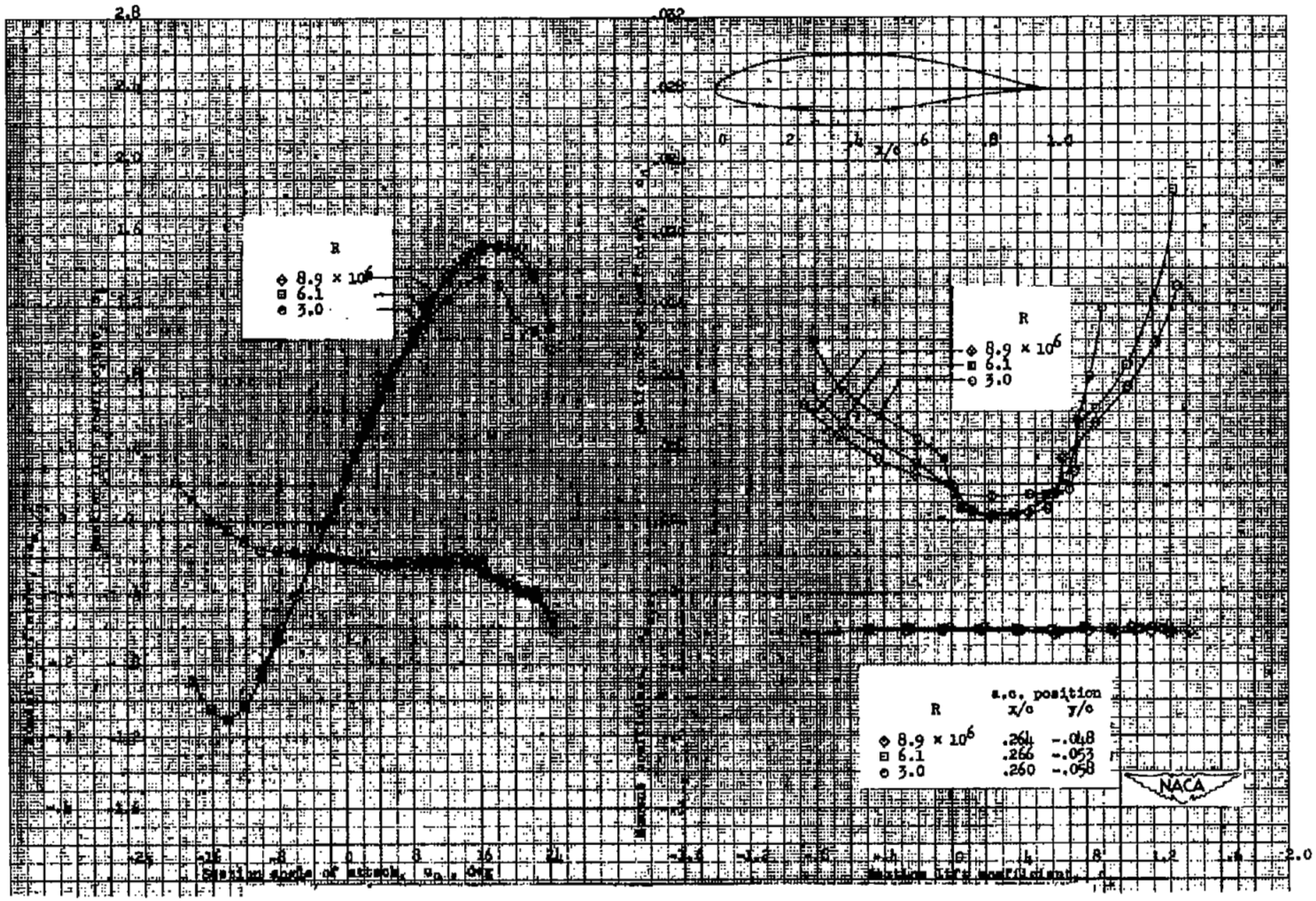

Figure 2.– Aerodynamic characteristics of the NACA 65,3-316 (approx.), a = 0.8 airfoil section, 24-inch chord.

Figure 3.– Aerodynamic characteristics of the NACA 65,3-418 airfoil section, 24-inch chord.

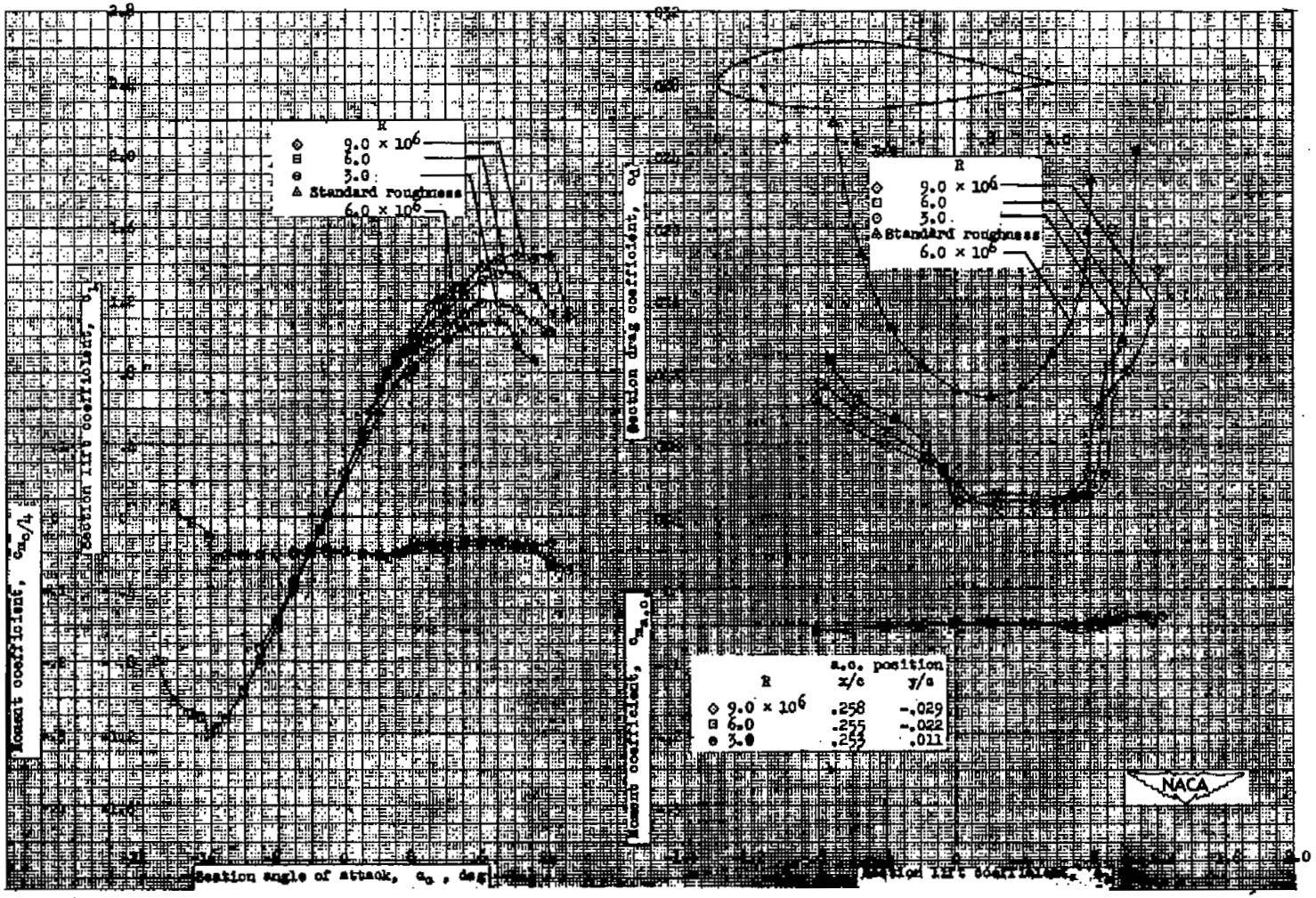

Figure 4.– Aerodynamic characteristics of the NACA $65_{(318)}$-419 $\left\{\begin{matrix} a = 1.0, & c_{l_i} = 0.5 \\ a = 0.8, & c_{l_i} = -0.5 \\ a = 0.5, & c_{l_i} = 0.4 \end{matrix}\right\}$ airfoil section, 24-inch chord.

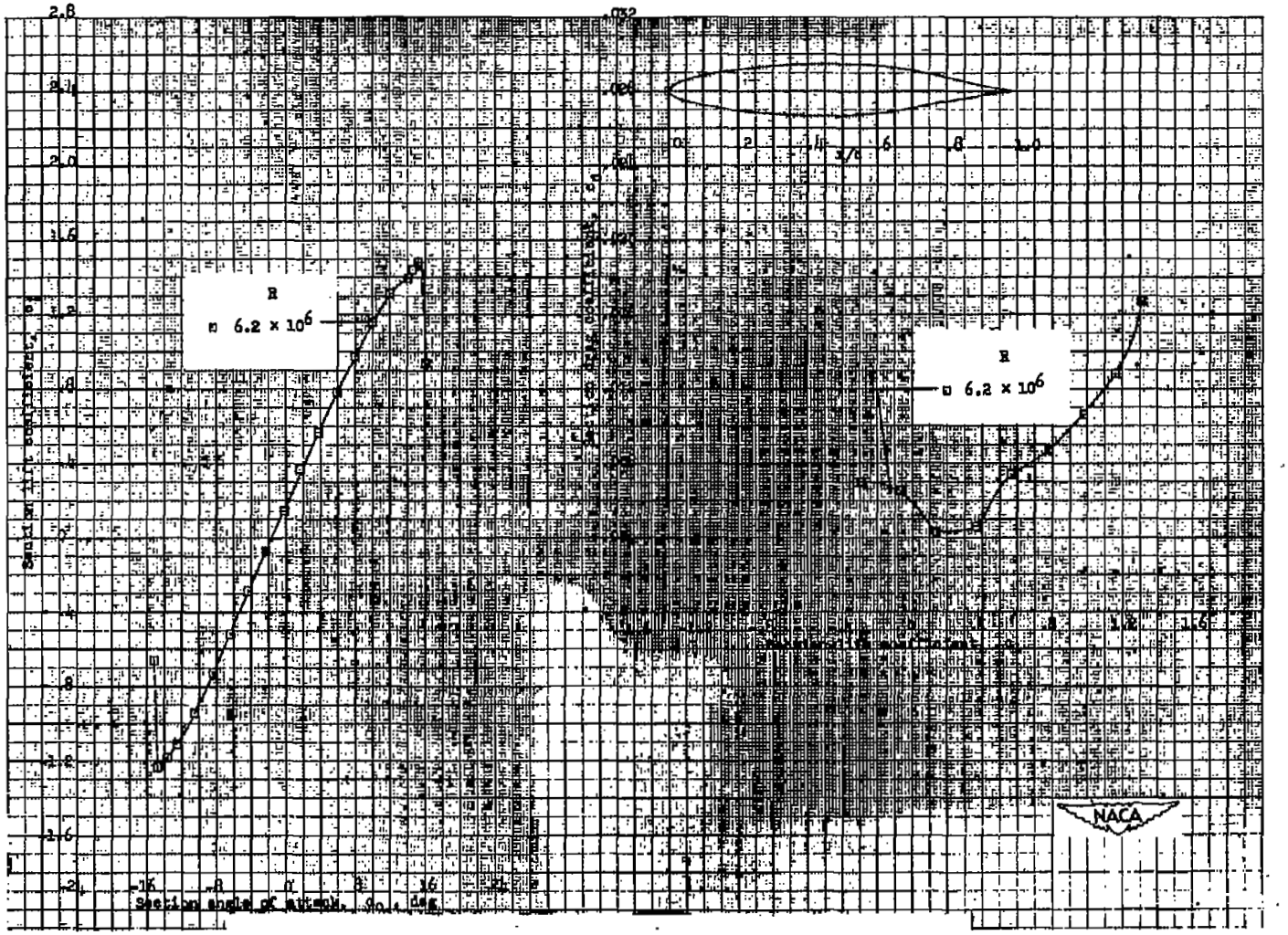

Figure 5.– Aerodynamic characteristics of the NACA 66(215)-114 airfoil section, 24-inch chord.

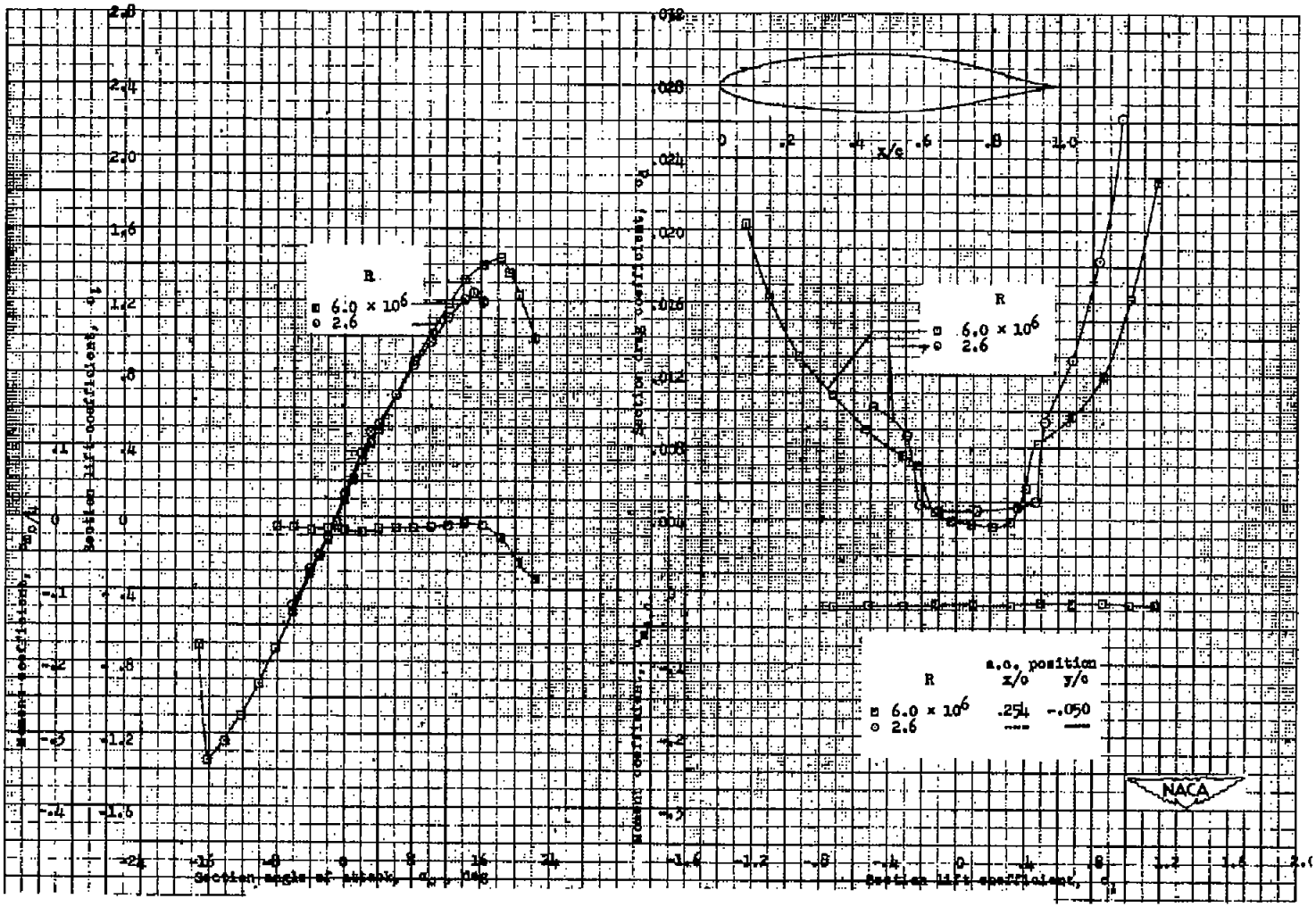

Figure 6.– Aerodynamic characteristics of the NACA 66(215)–116, a = 0.6 airfoil section, 24–inch chord.

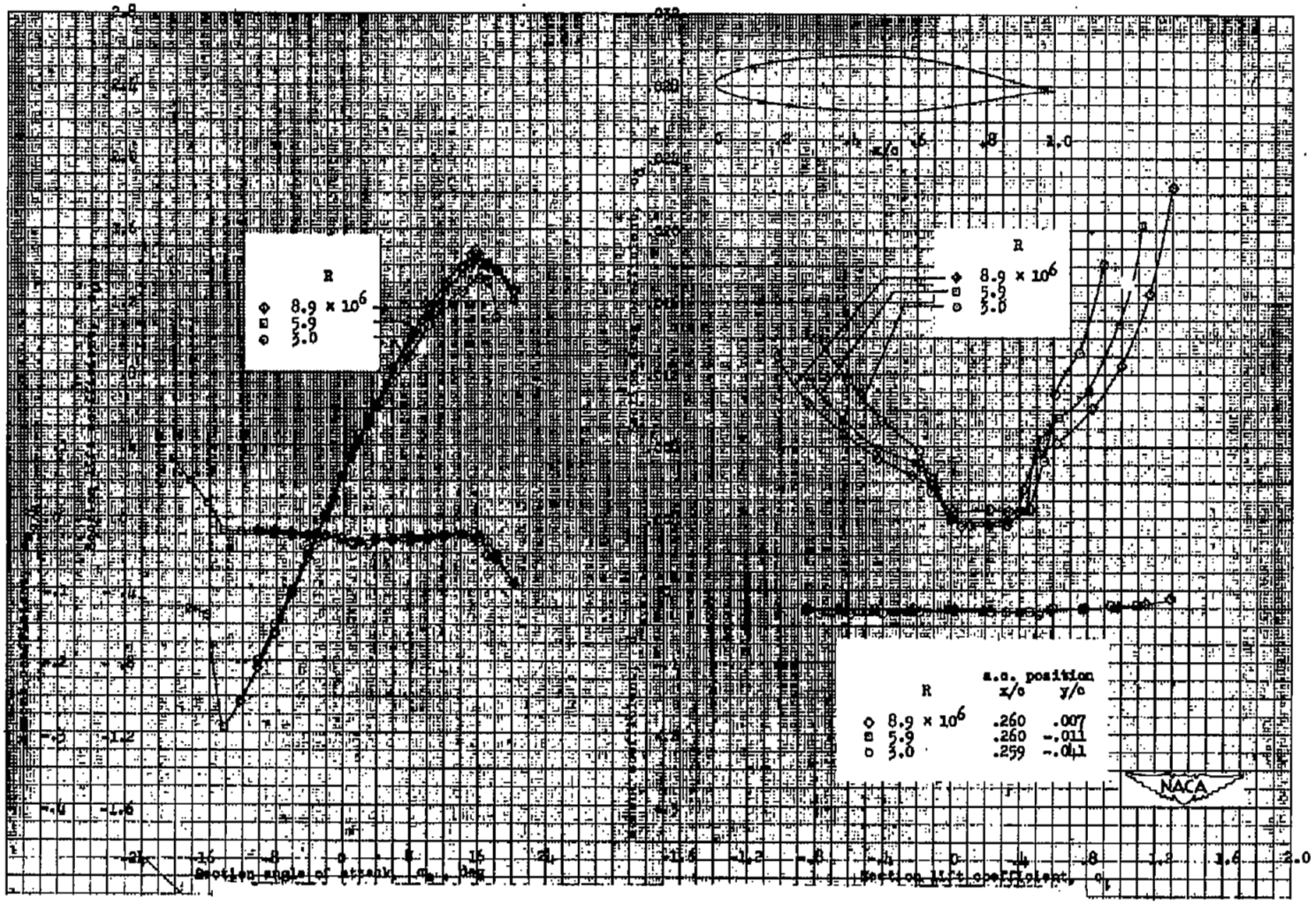

Figure 7.– Aerodynamic characteristics of the NACA 66(215)–(1.8)(15.5), a = 0.6 airfoil section, 24-inch chord.

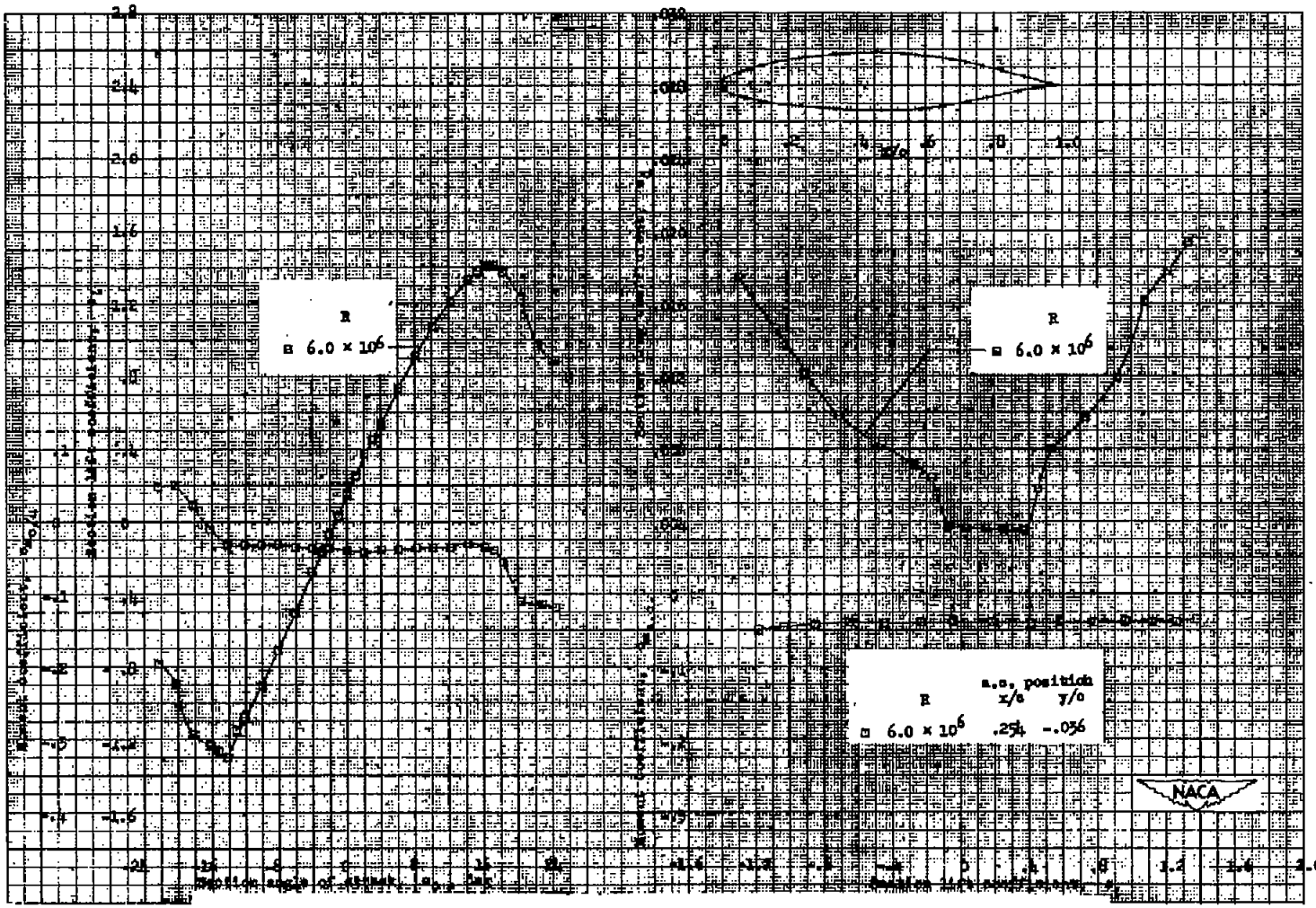

Figure 8.– Aerodynamic characteristics of an airfoil section formed by a straight-line fairing between an NACA 66(215)-216 airfoil section and an NACA 66,2-215 airfoil section, 24-inch chord.

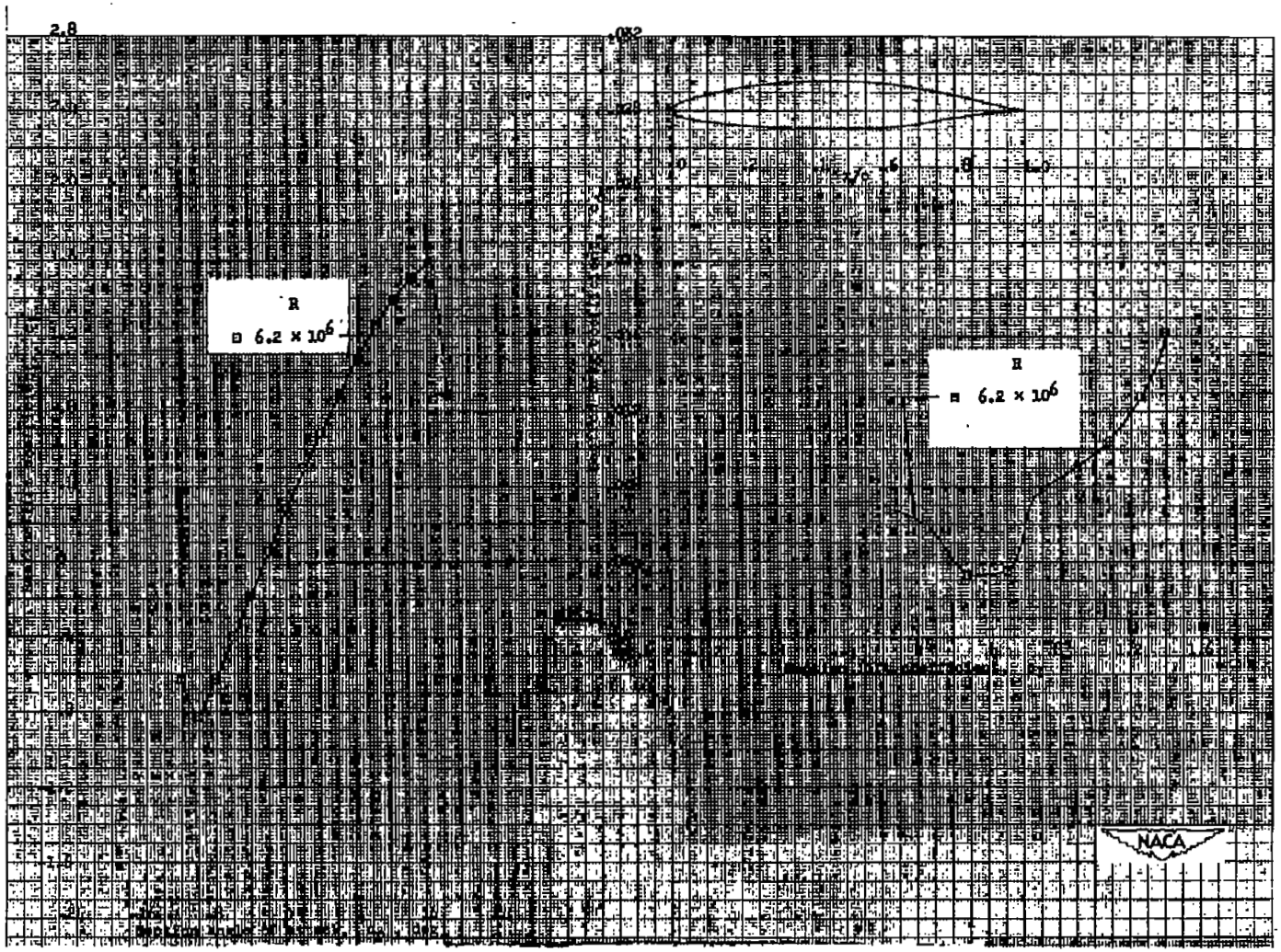

Figure 9.– Aerodynamic characteristics of the NACA 66(215)-313 airfoil section, 24-inch chord.

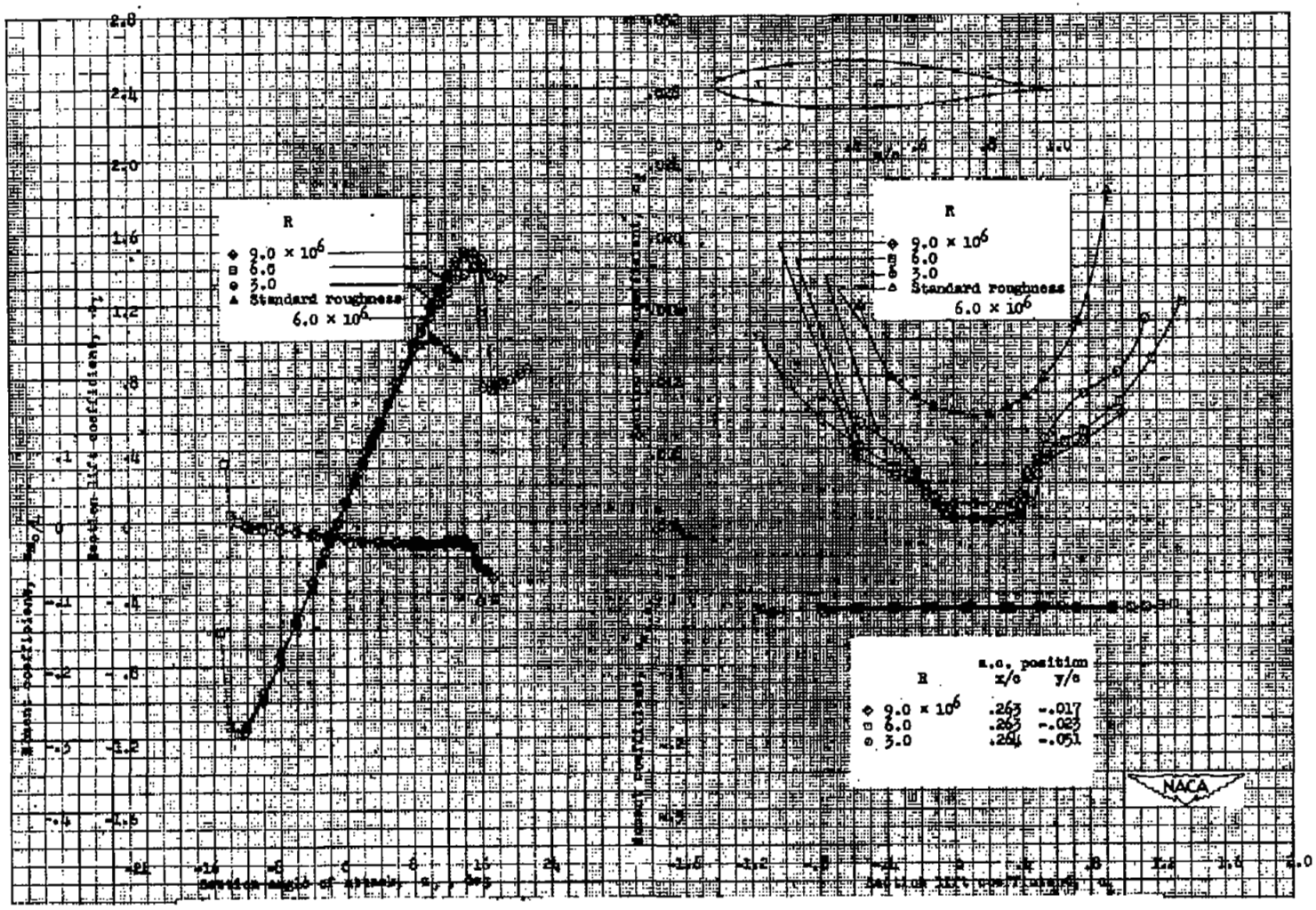

Figure 10.– Aerodynamic characteristics of an airfoil section formed by a straight-line fairing between an NACA $65_{(215)}$-114 airfoil section and an NACA 65_1-212, a = 0.6 airfoil section, 24-inch chord.

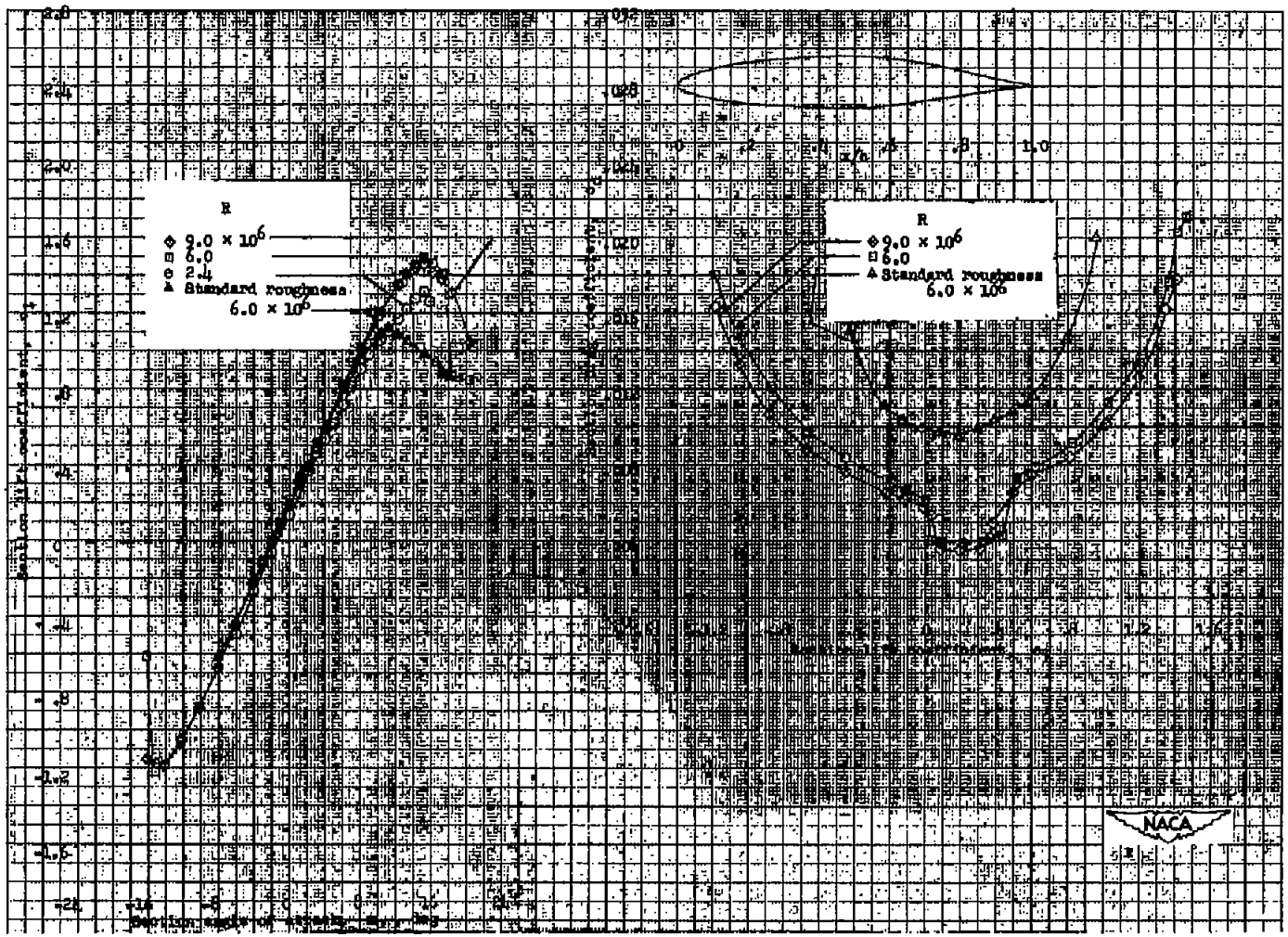

Figure 11.– Aerodynamic characteristics of an airfoil section formed by a straight-line fairing between a modified NACA 66(215)-214 airfoil section and a modified NACA $65_{(112)}$-213 airfoil section, 24-inch chord.

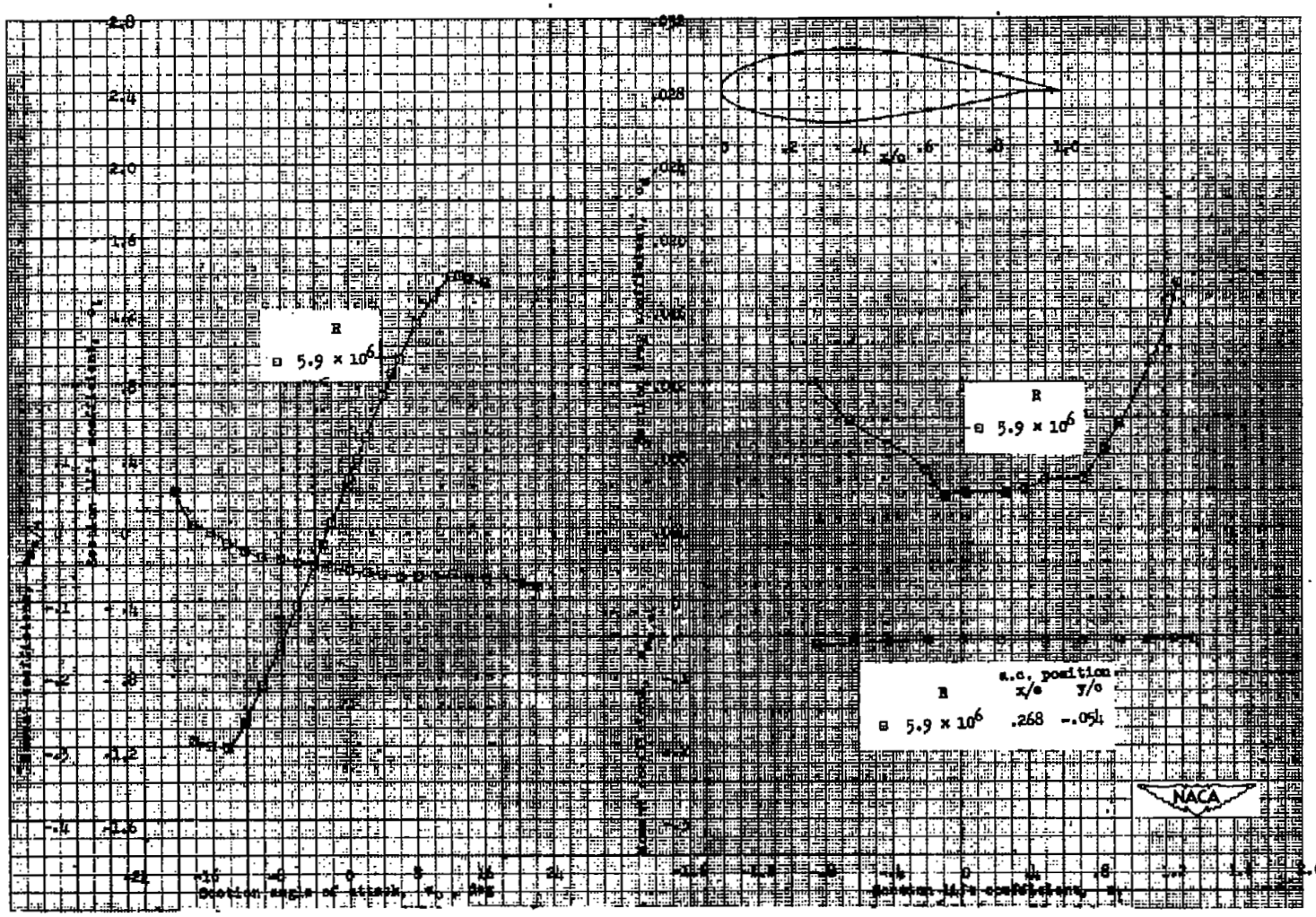

Figure 12.– Aerodynamic characteristics of an airfoil section formed by a straight-line fairing between an NACA 63(420)-321 airfoil section and an NACA 65(318)-415 airfoil section, 24-inch chord.

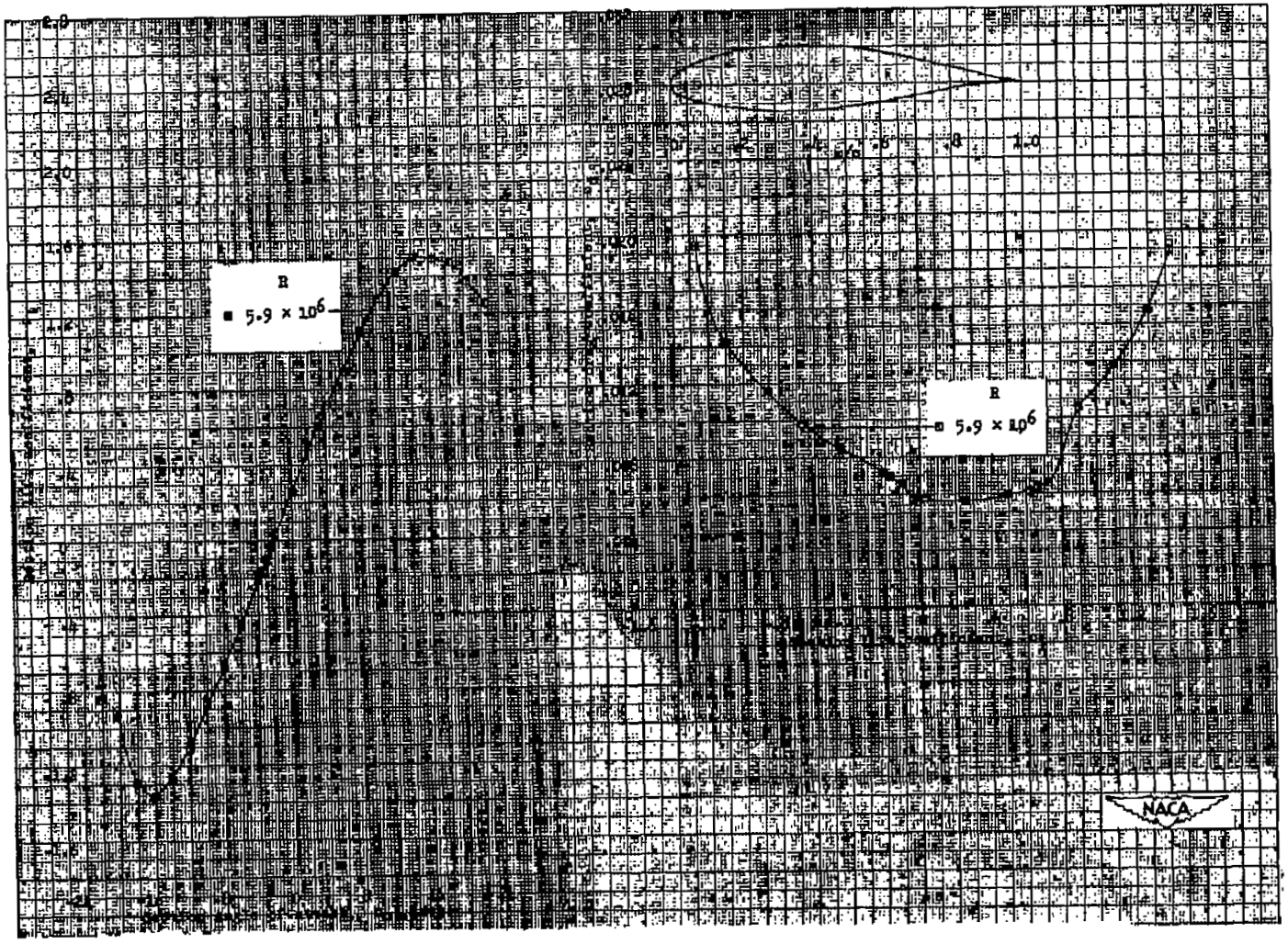

Figure 13.– Aerodynamic characteristics of an airfoil section formed by a straight-line fairing between an NACA 63(420)-321 airfoil section and an NACA 65(318)-415 airfoil section, 24-inch chord.

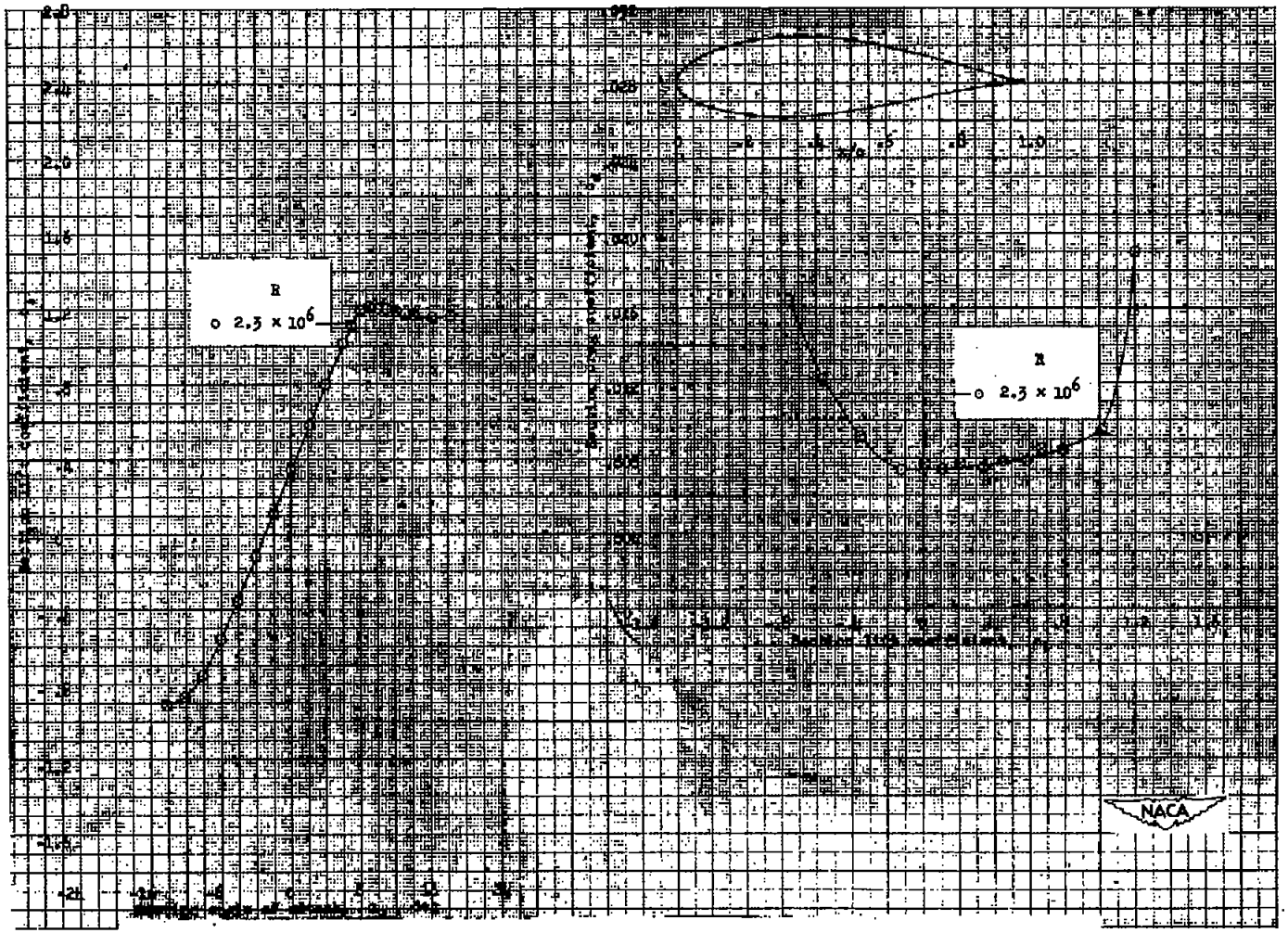

Figure 14.– Aerodynamic characteristics of an airfoil section formed by a straight-line fairing between an NACA 63(420)-422 airfoil section and an NACA 63(420)-517 airfoil section, 24-inch chord.

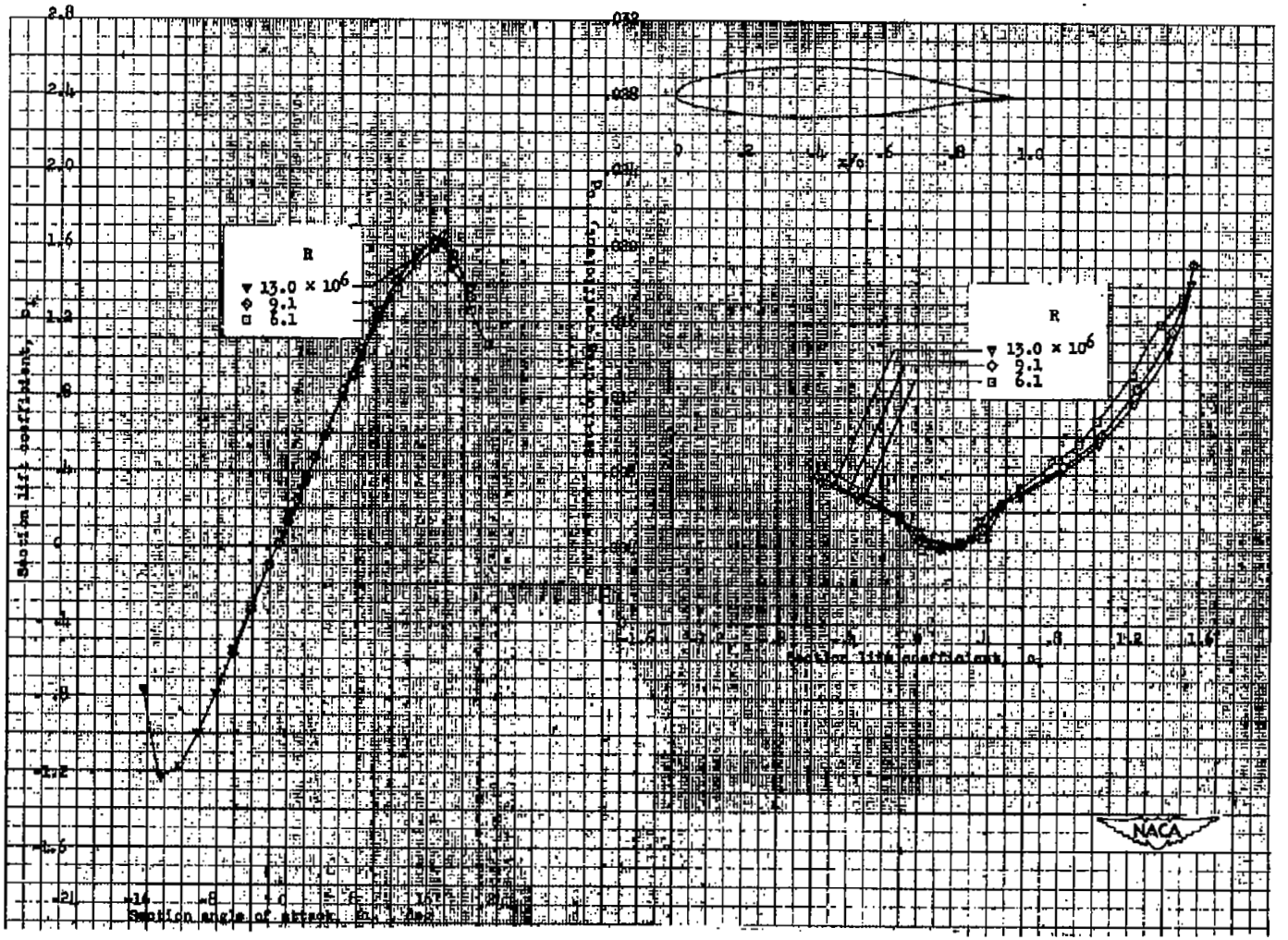

Figure 15.– Aerodynamic characteristics of airfoil section A, 36-inch chord.

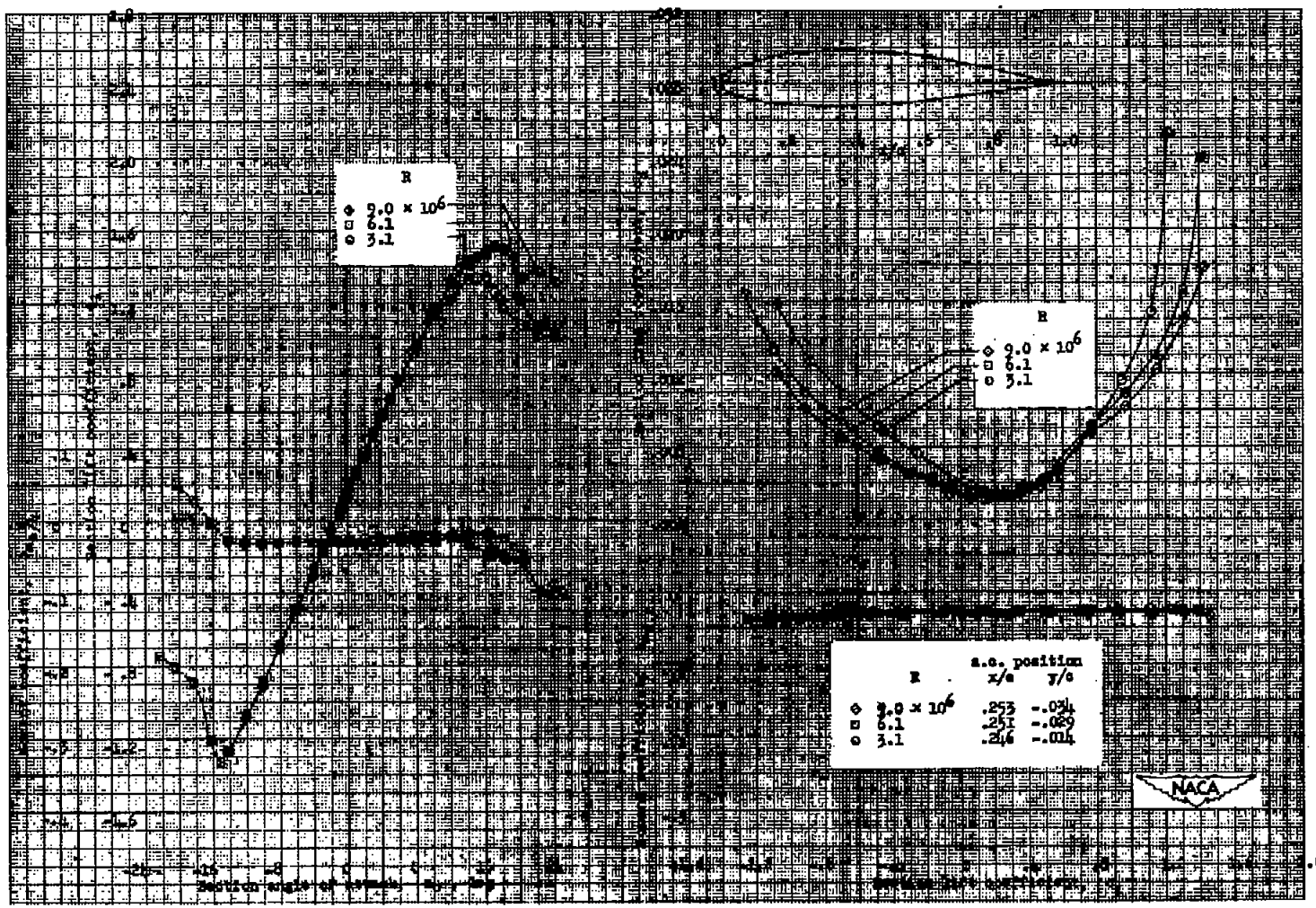

Figure 16.– Aerodynamic characteristics of airfoil section B, 24-inch chord.

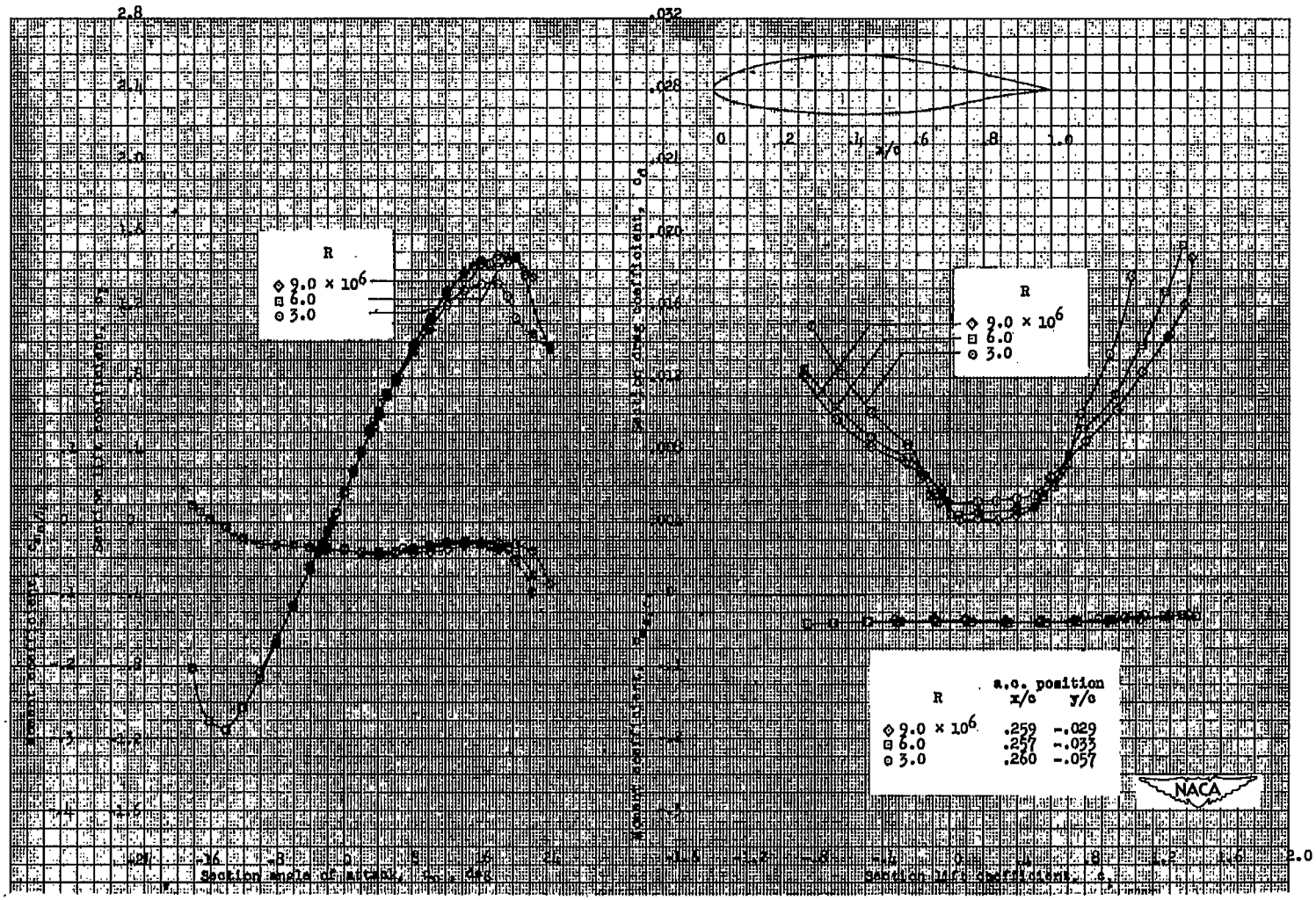

Figure 17.– Aerodynamic characteristics of airfoil section C, 24-inch chord.

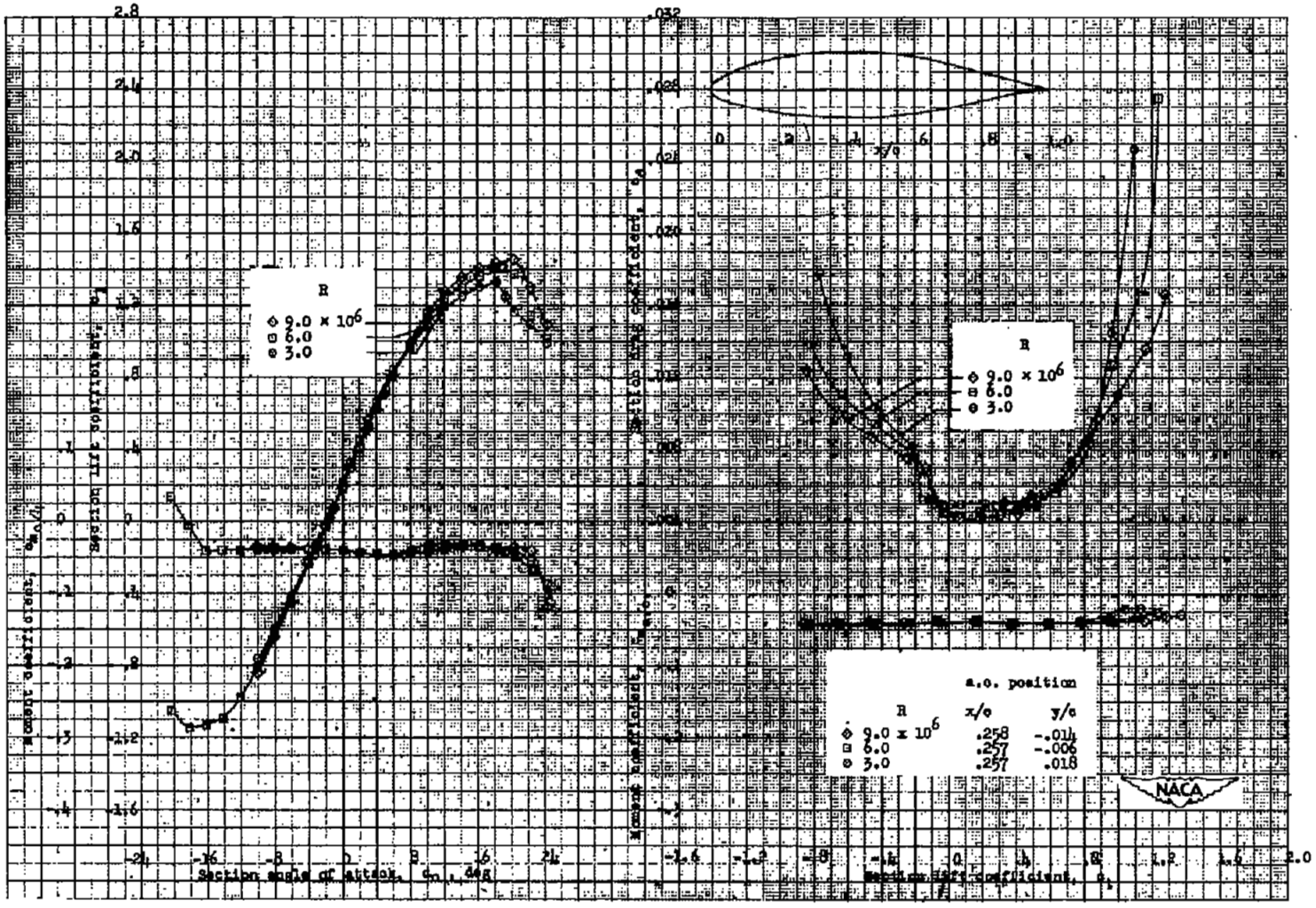

Figure 18.– Aerodynamic characteristics of airfoil section D, 24-inch chord.

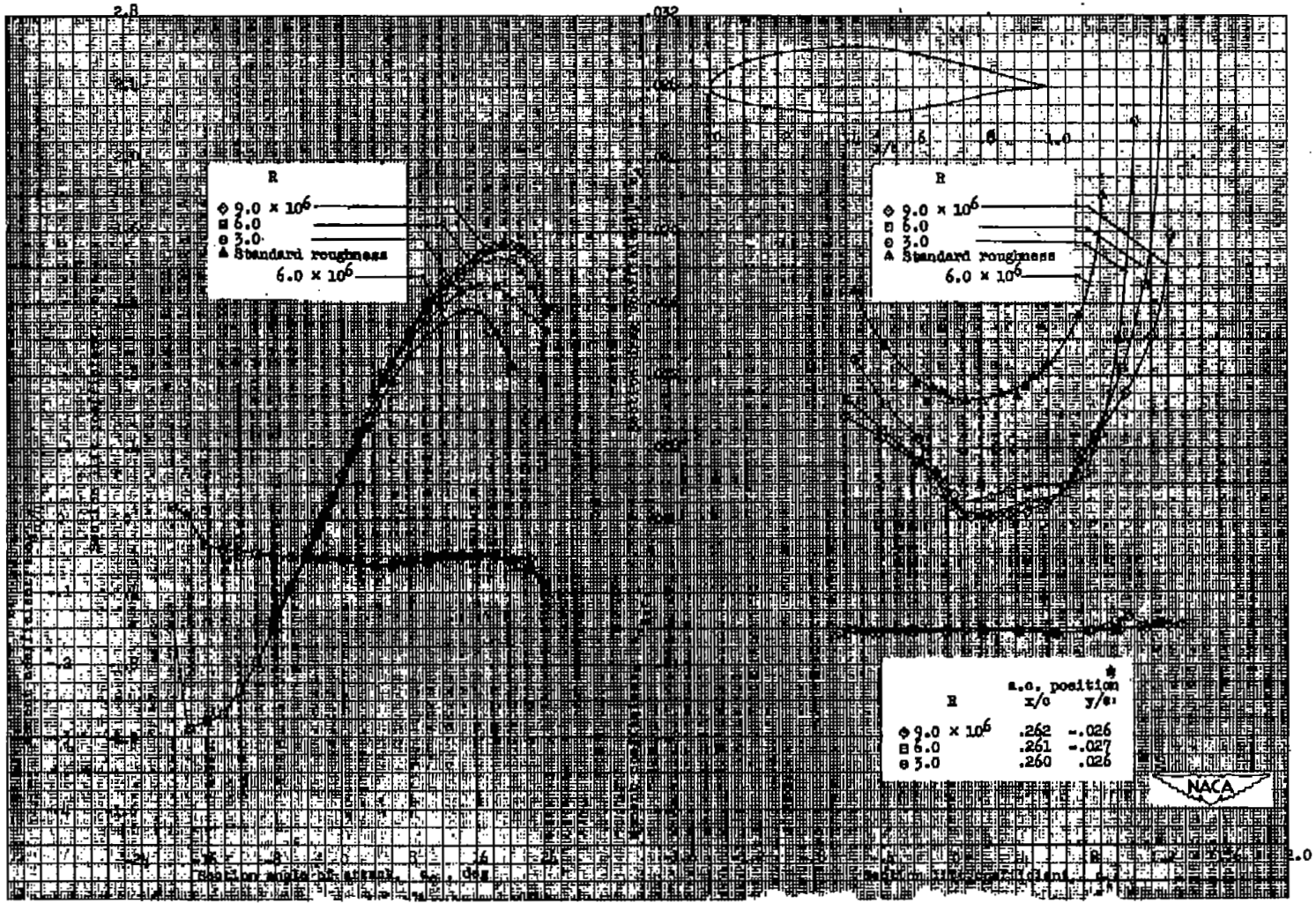

Figure 19.– Aerodynamic characteristics of airfoil section E, 24-inch chord.

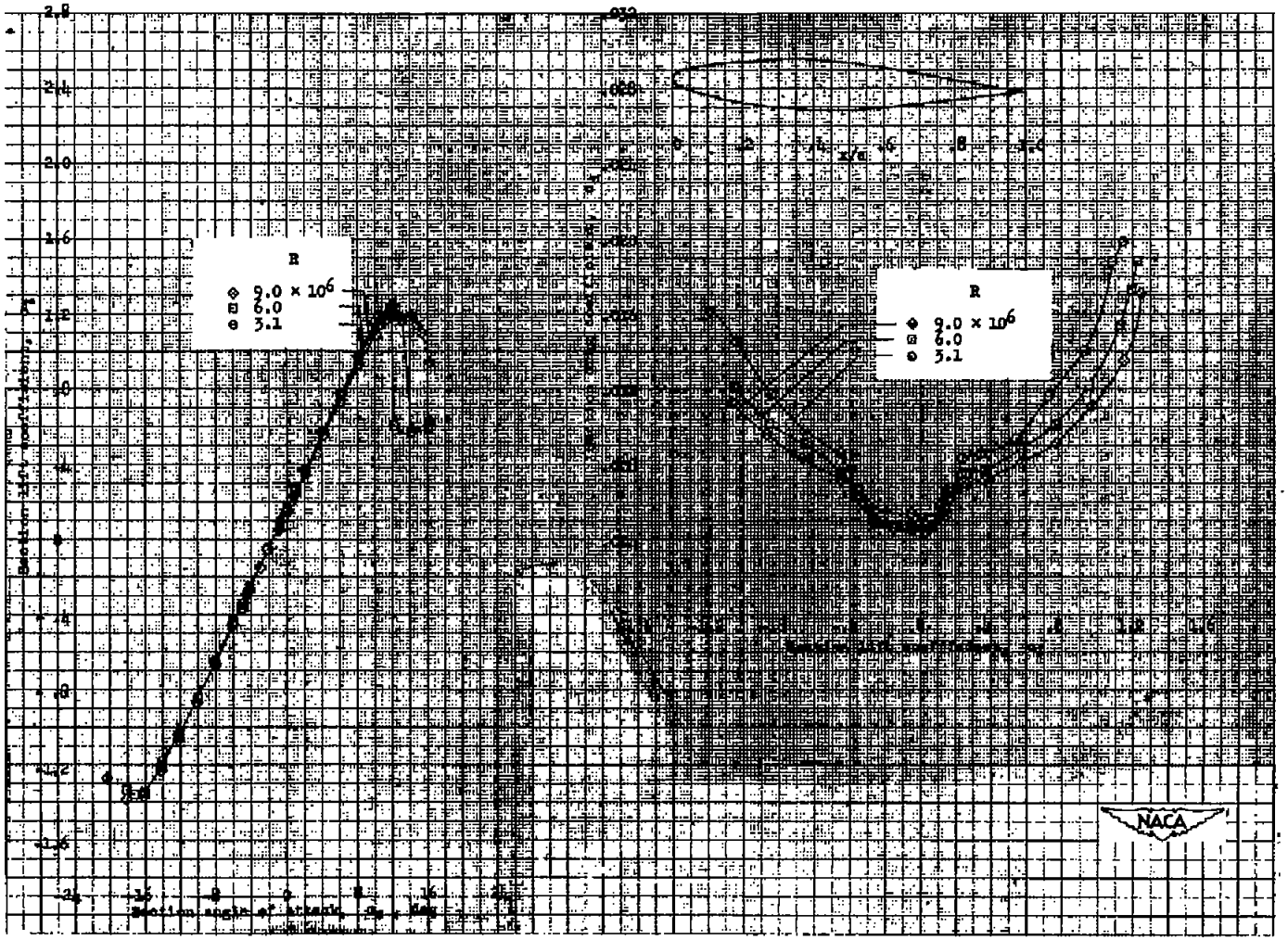

Figure 20.– Aerodynamic characteristics of airfoil section F, 24-inch chord.

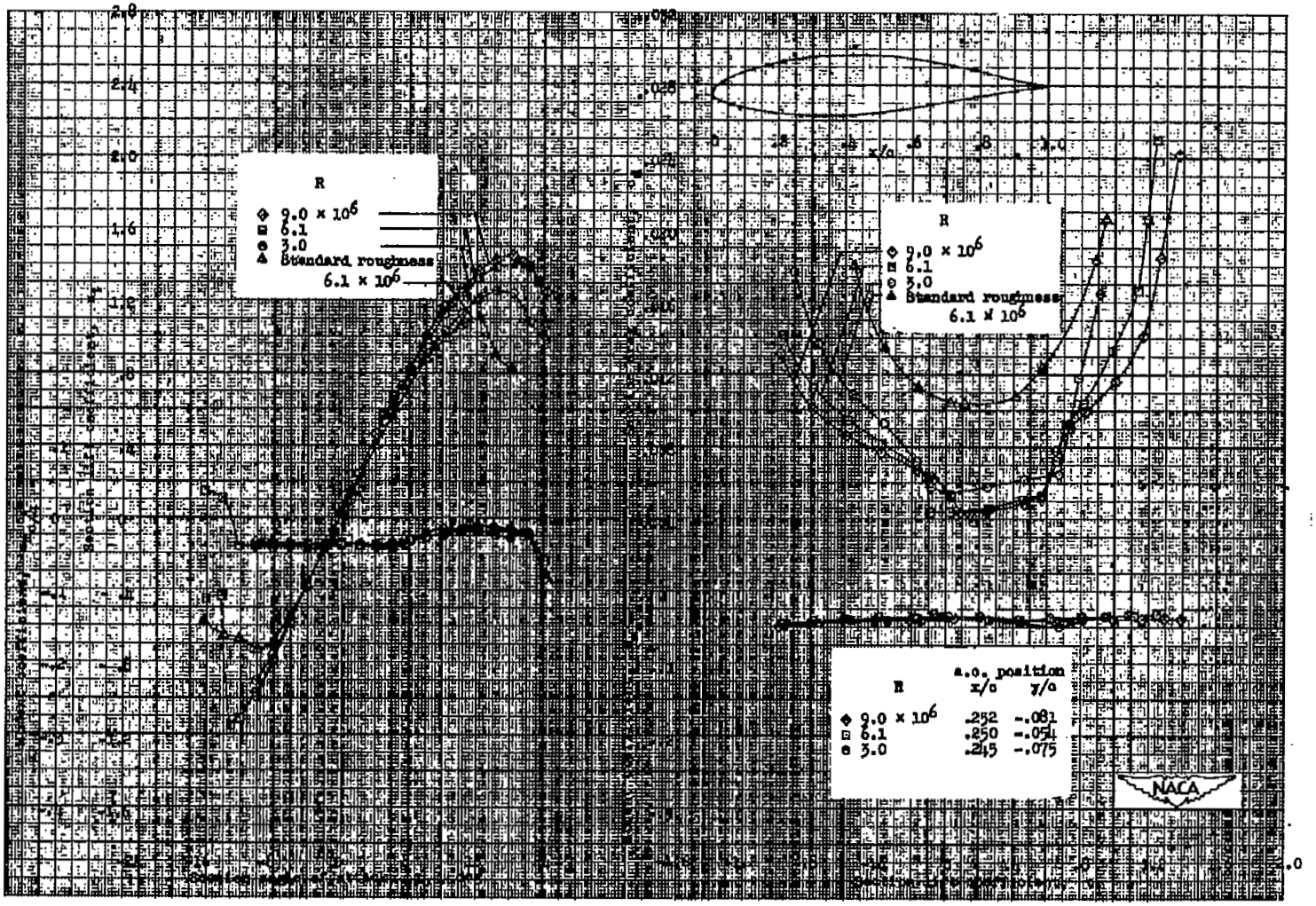

Figure 21.– Aerodynamic characteristics of airfoil section G, 24-inch chord.

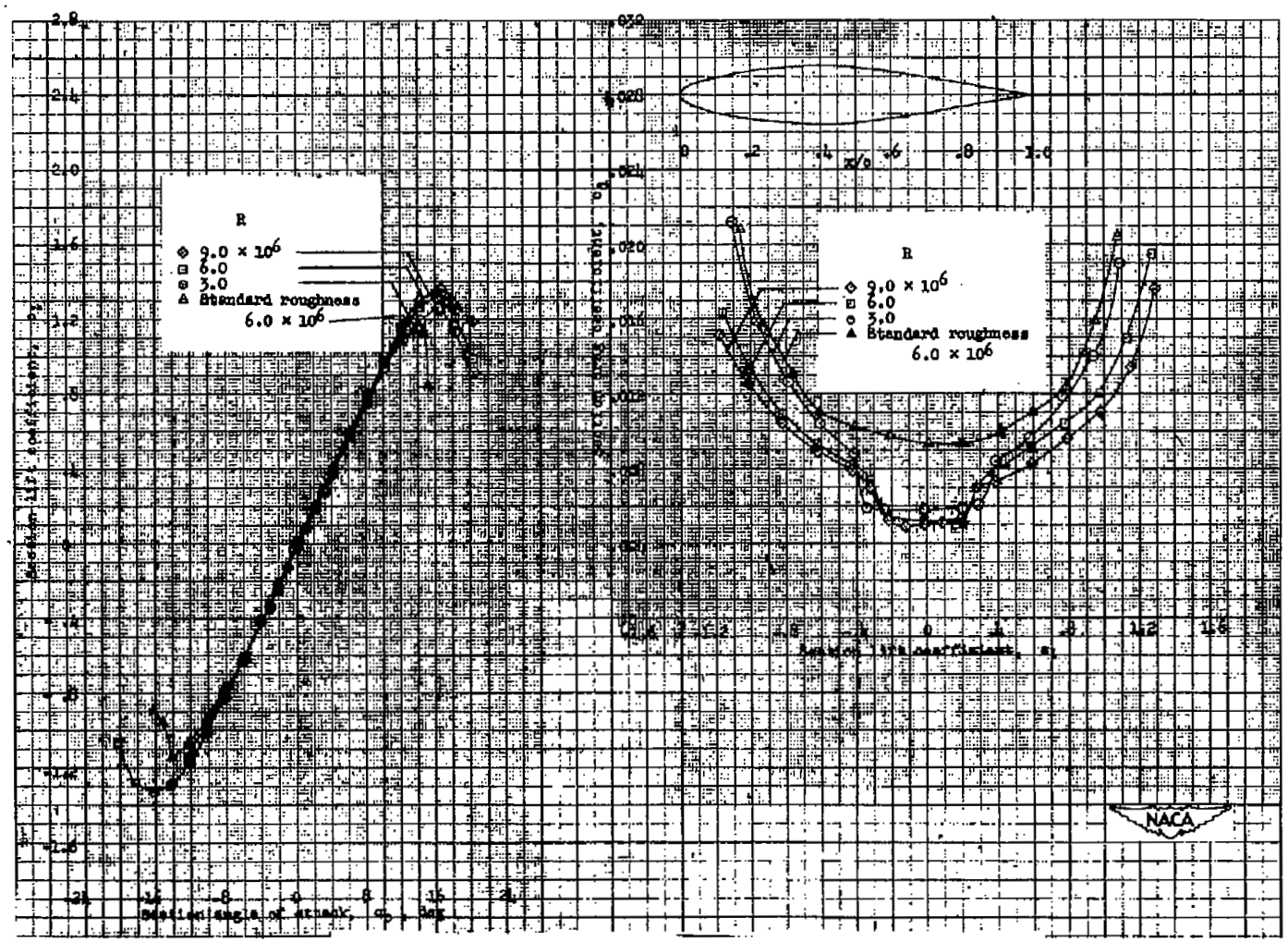

Figure 22.– Aerodynamic characteristics of airfoil section H, 24-inch chord.

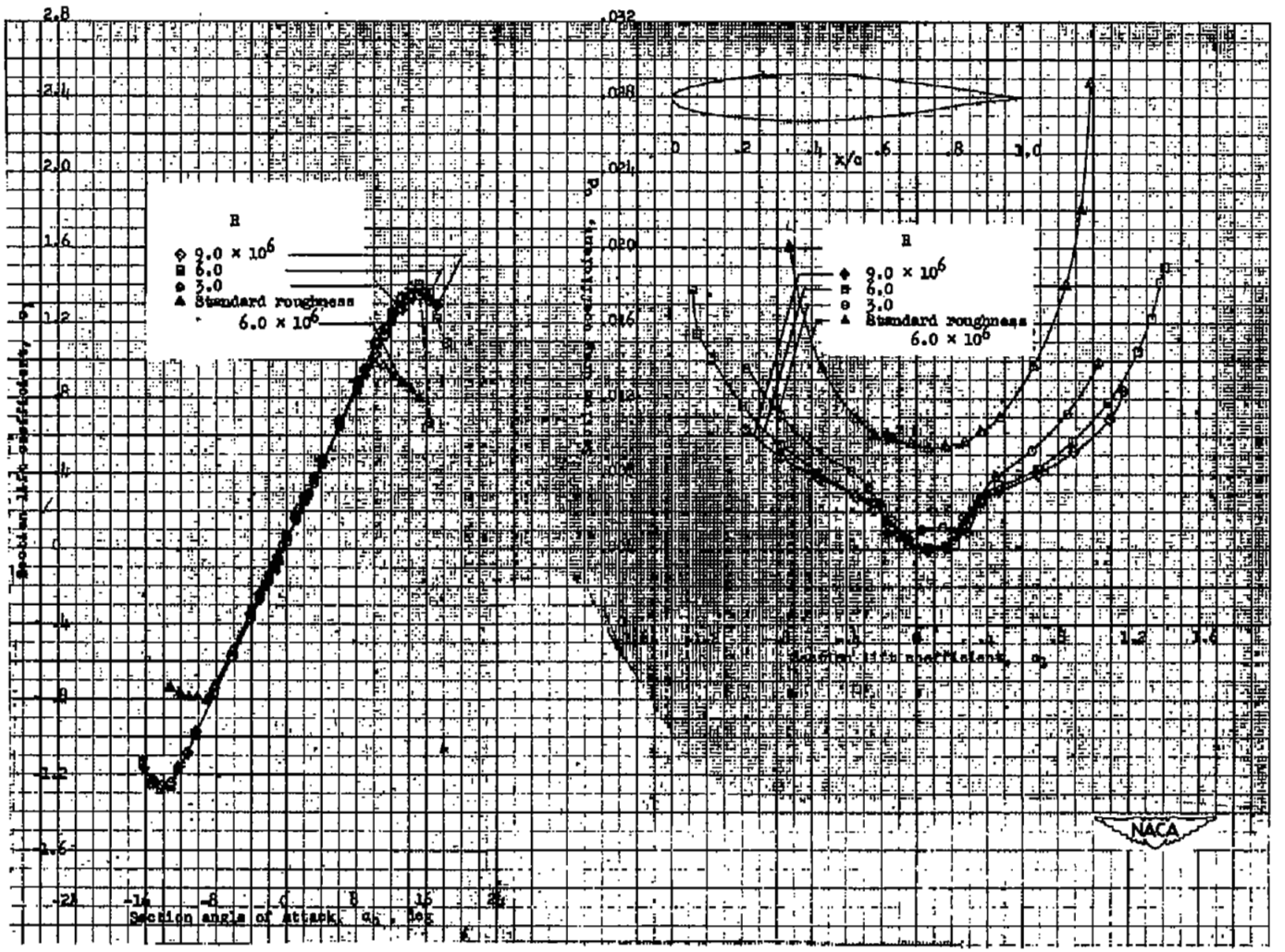

Figure 23.– Aerodynamic characteristics of airfoil section I, 24-inch chord.

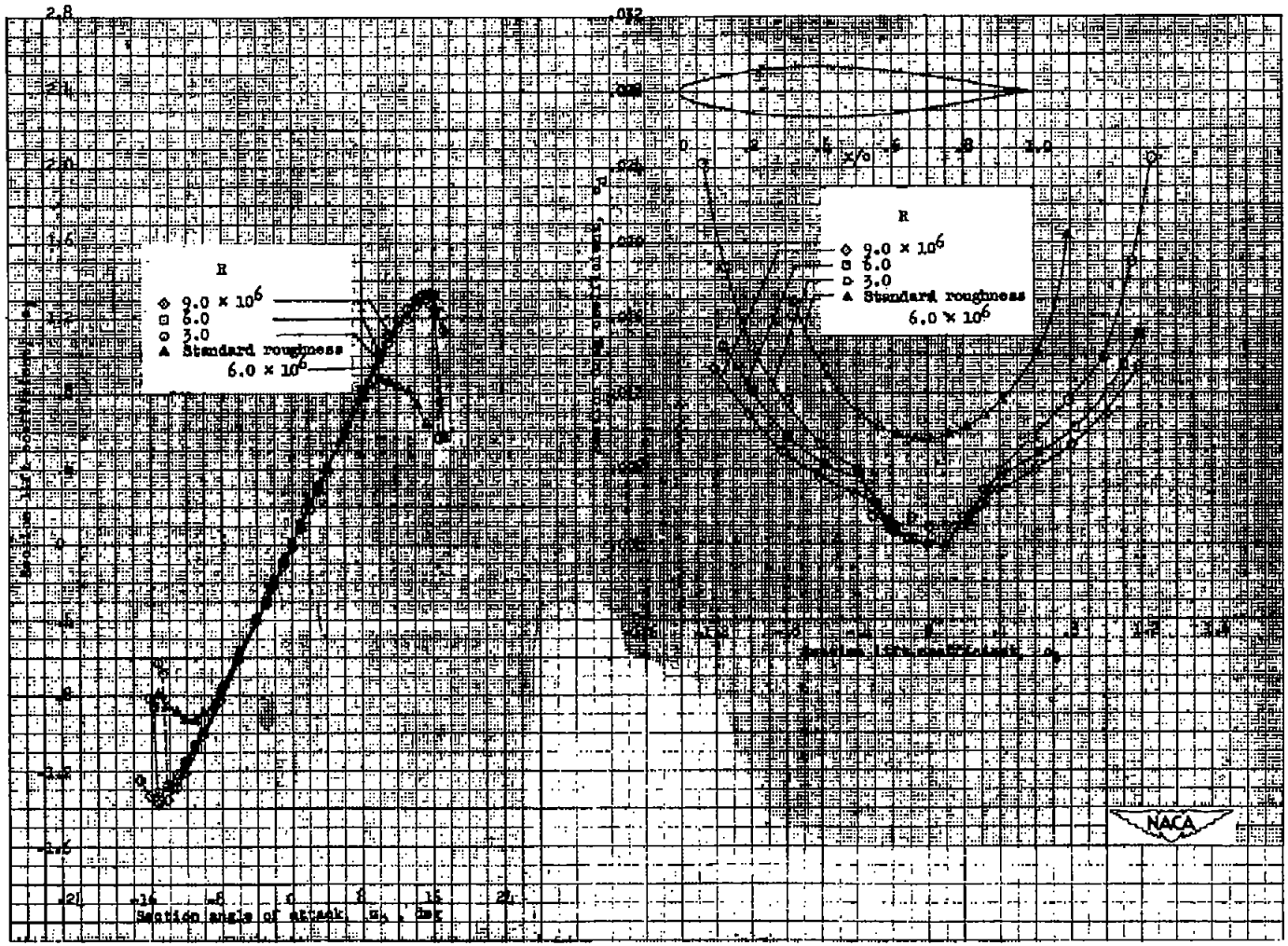

Figure 24.– Aerodynamic characteristics of airfoil section J, 24-inch chord.

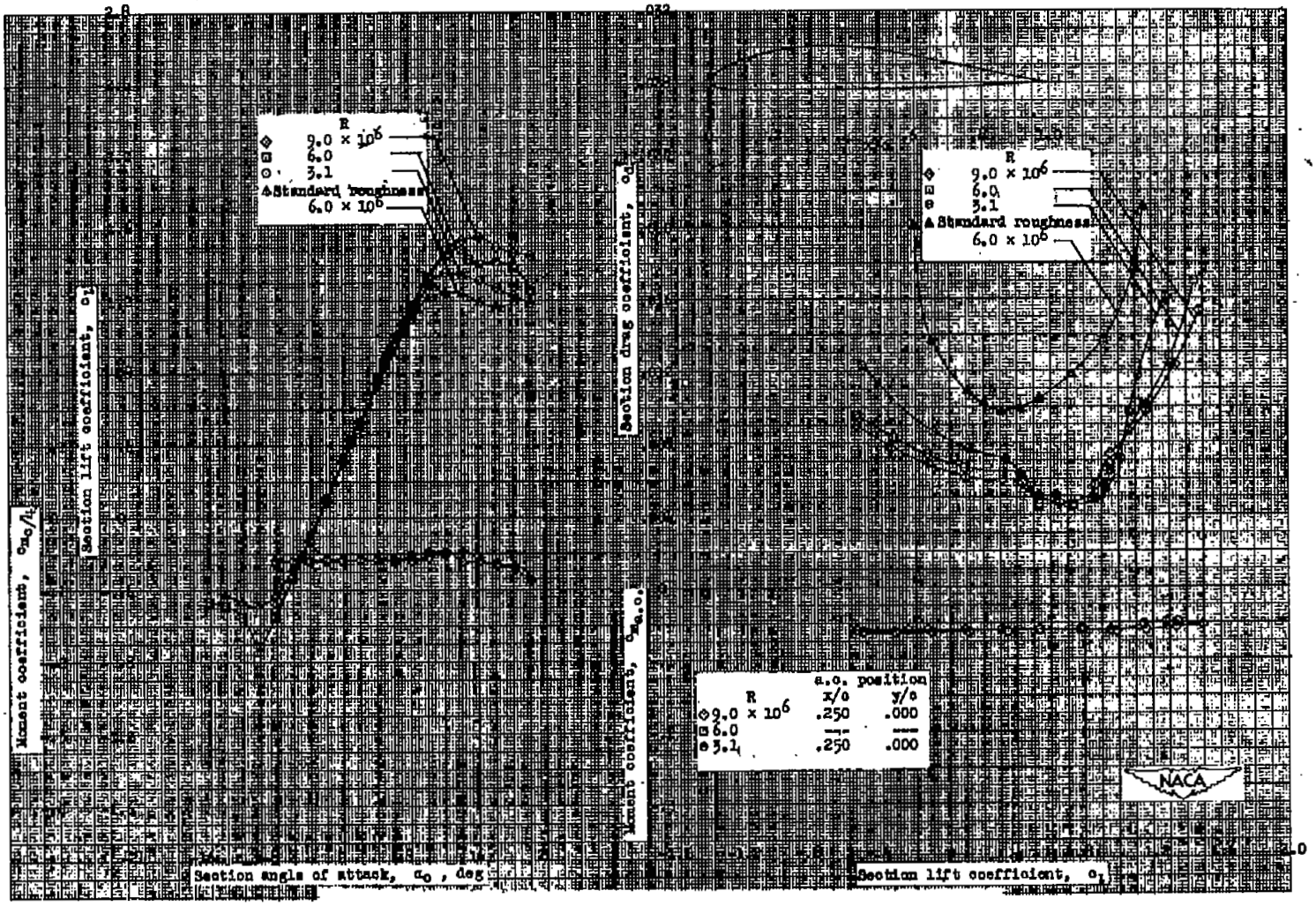

Figure 25.– Aerodynamic characteristics of airfoil section K, 24-inch chord.

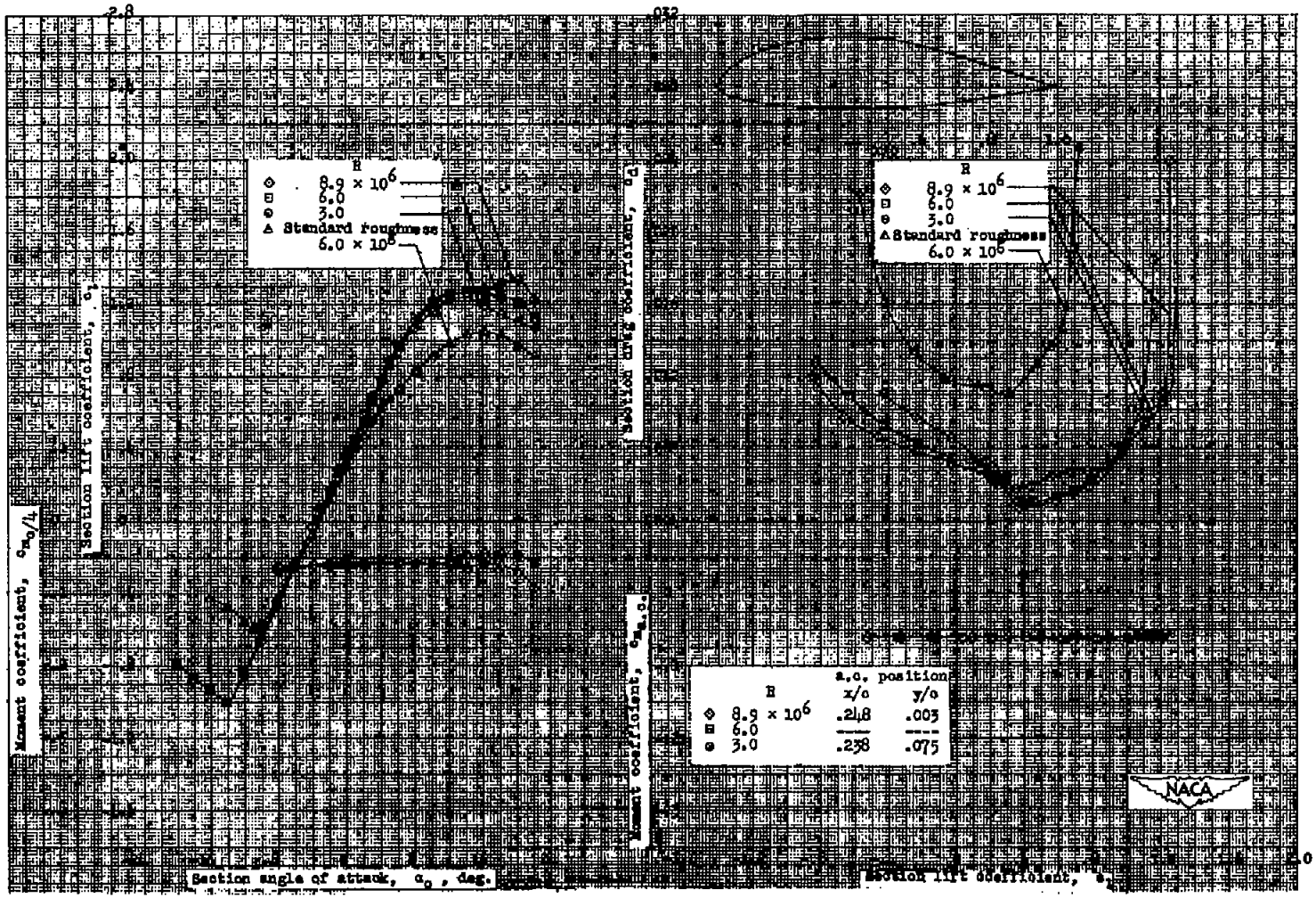

Figure 26.– Aerodynamic characteristics of airfoil section L, 24-inch chord.

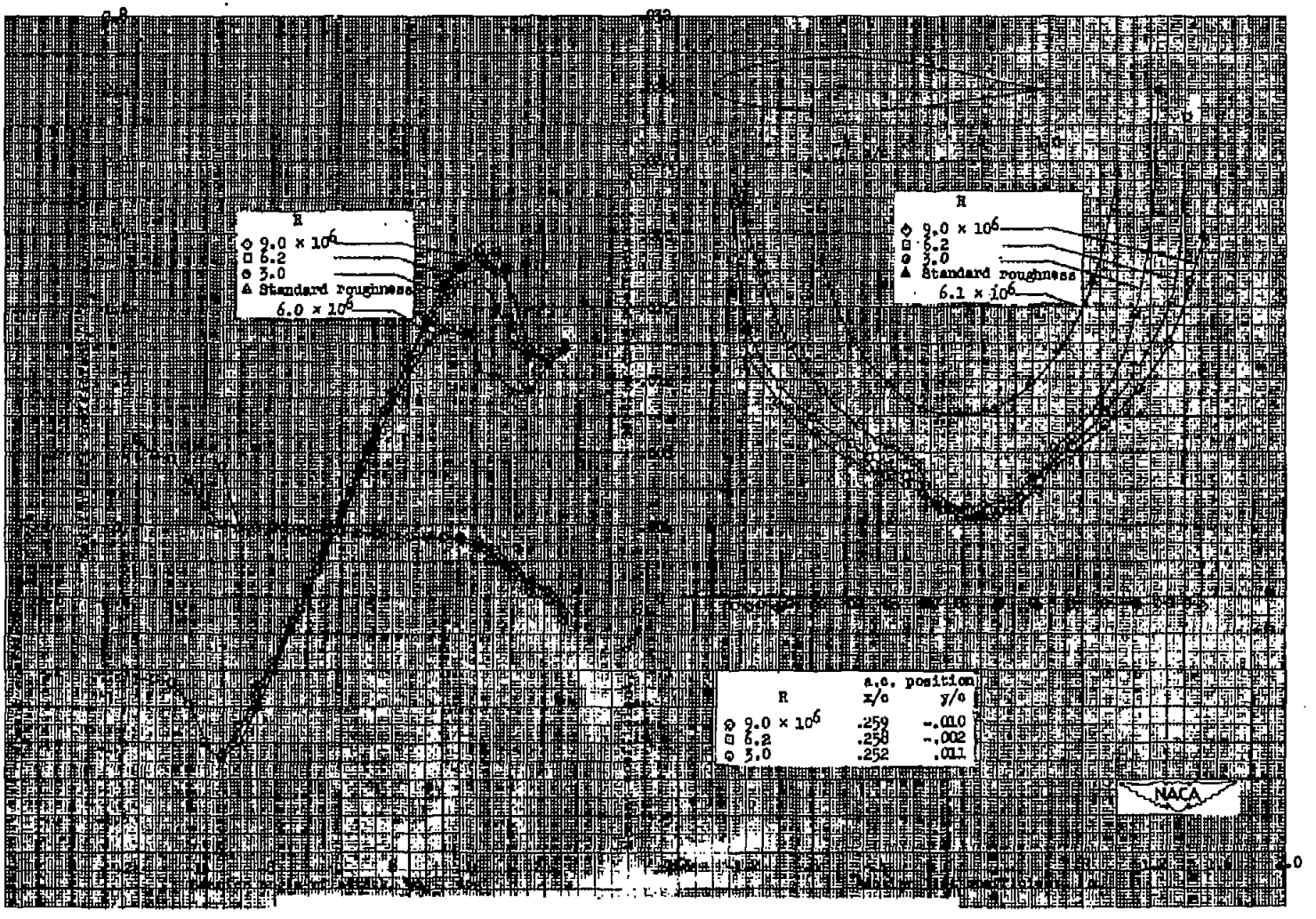

Figure 27.– Aerodynamic characteristics of airfoil section M, 24-inch chord.

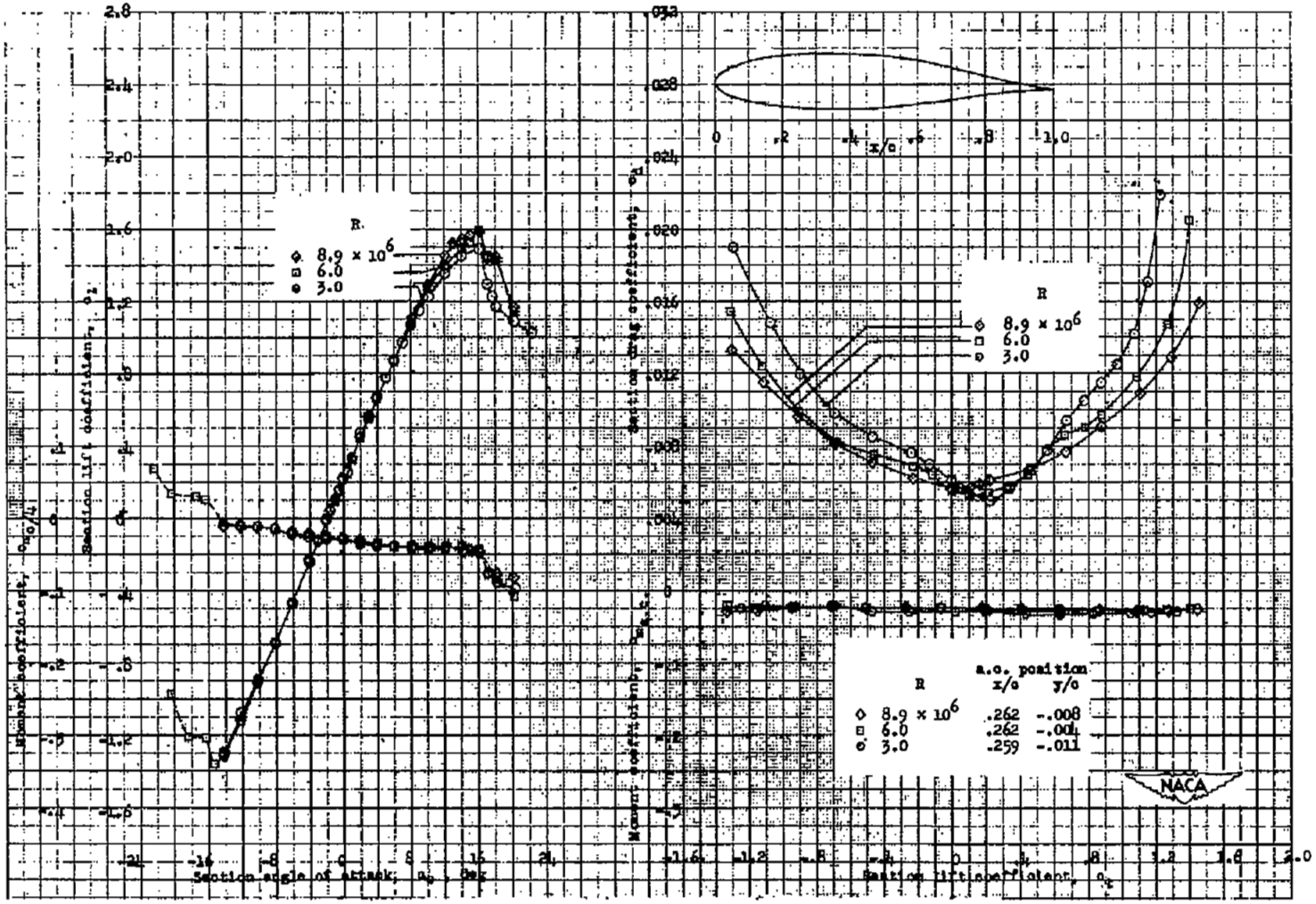

Figure 28.– Aerodynamic characteristics of airfoil section N, 24-inch chord.

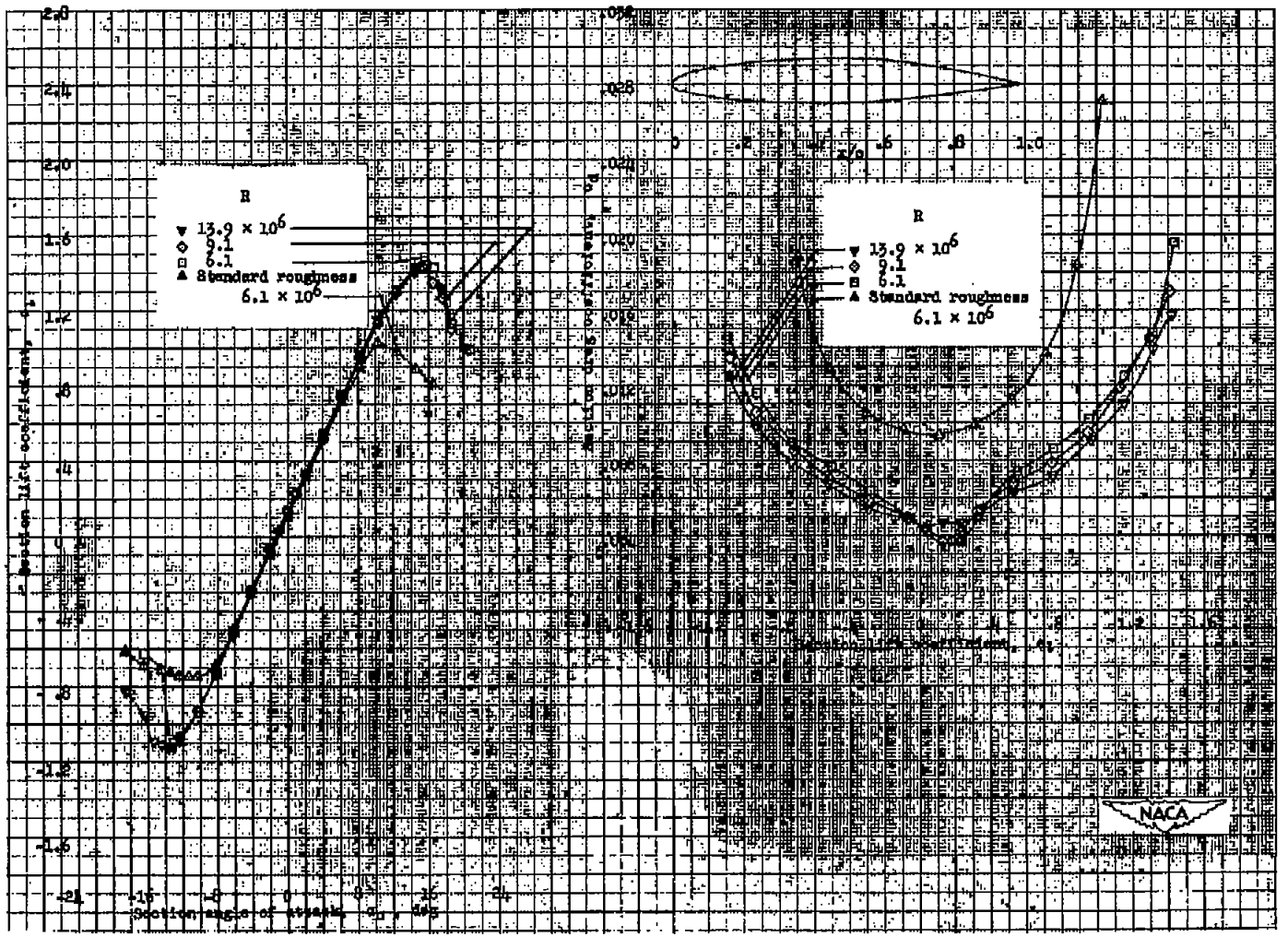

Figure 29.– Aerodynamic characteristics of airfoil section 0, 24-inch chord.

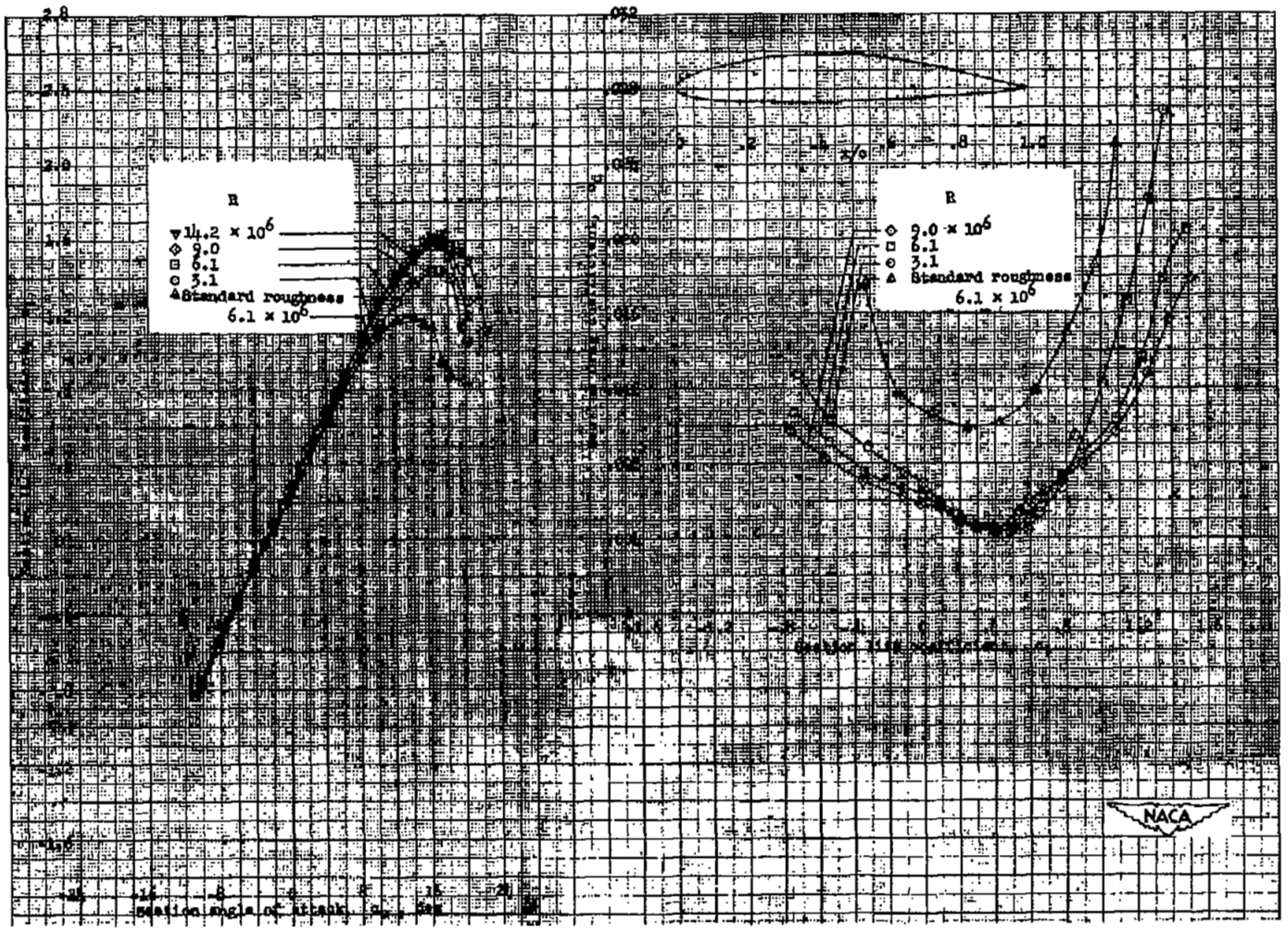

Figure 30.--Aerodynamic characteristics of airfoil section P, 24-inch chord.

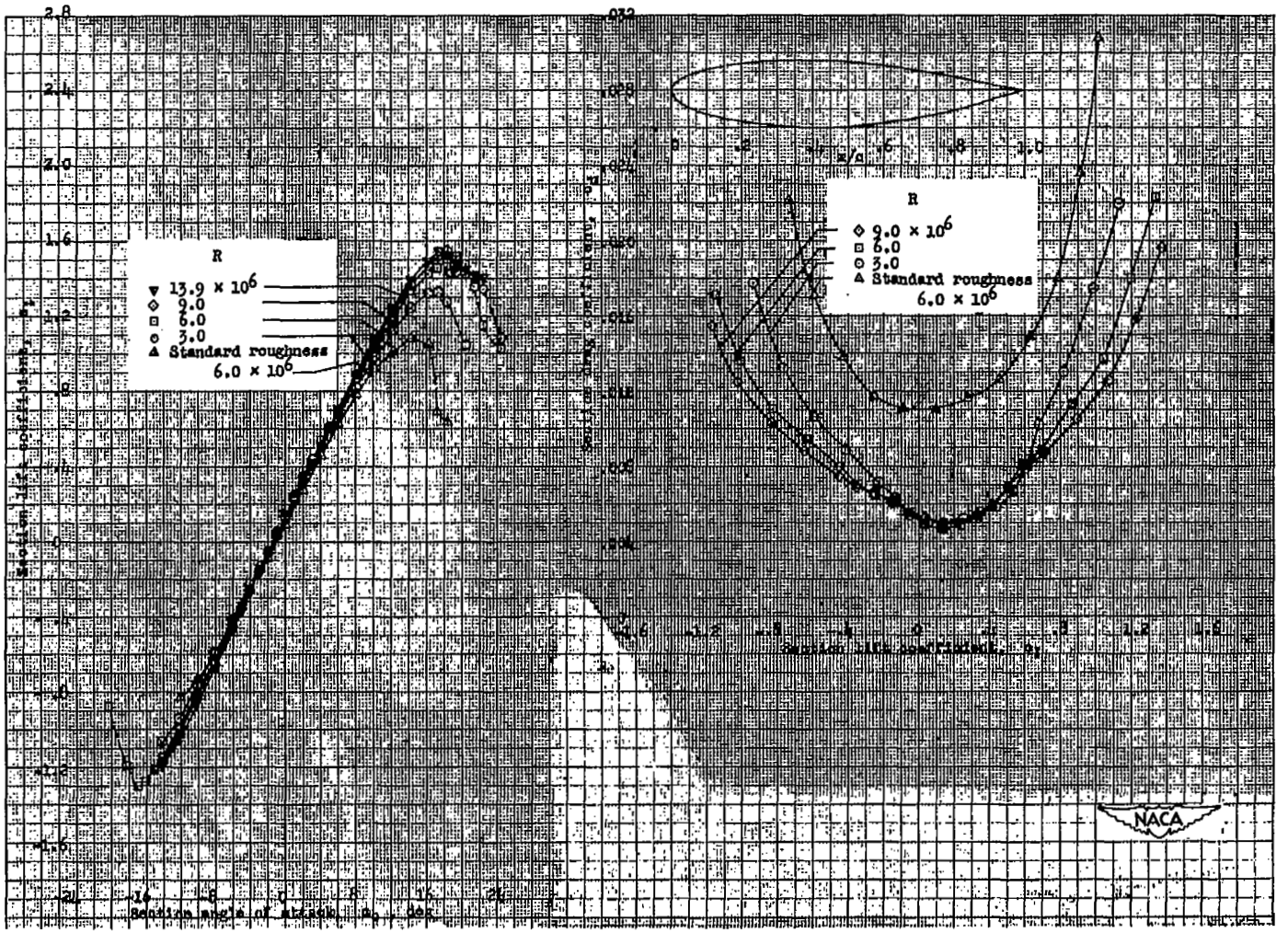

Figure 31.– Aerodynamic characteristics of airfoil section Q, 24-inch chord.

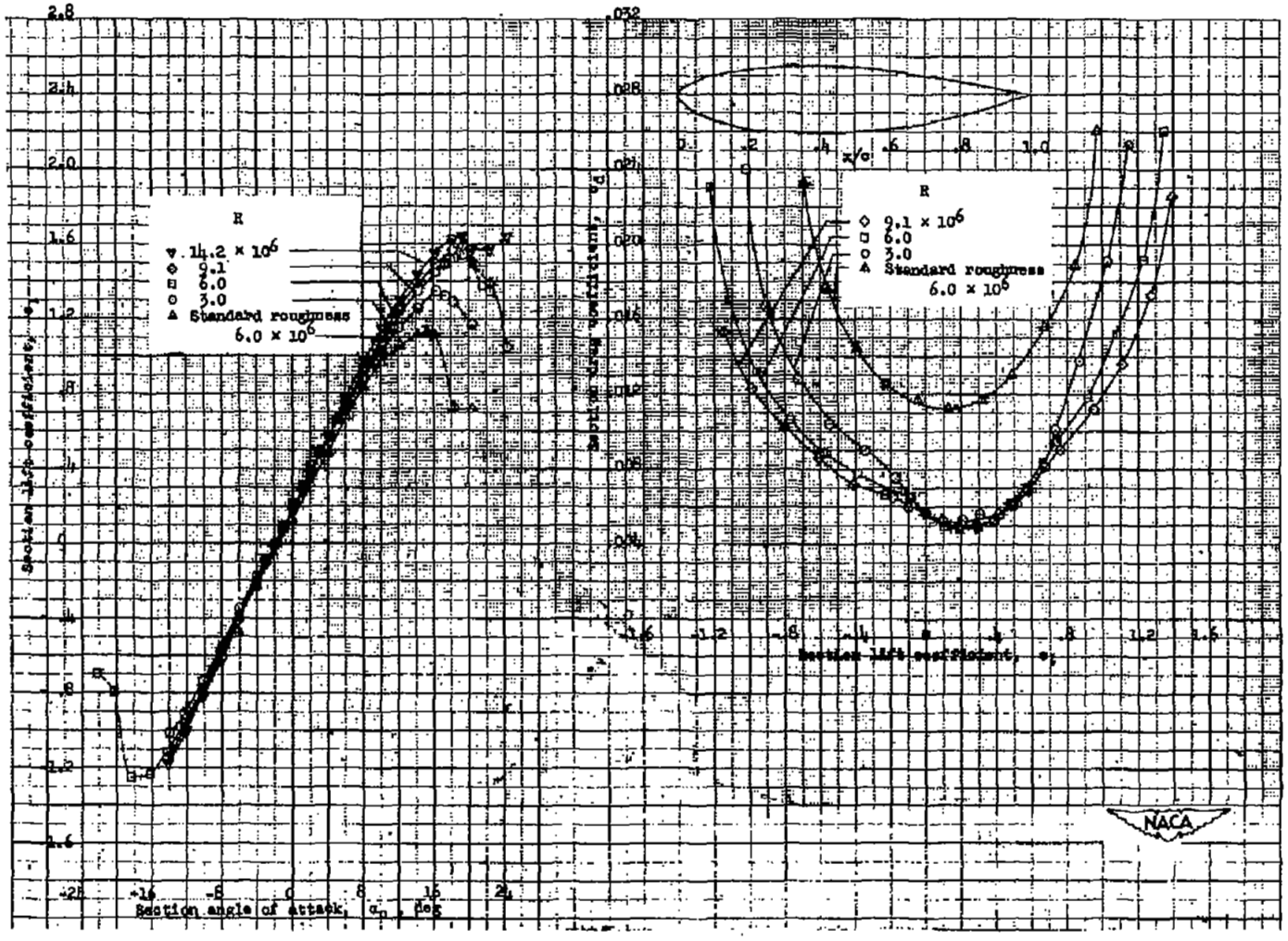

Figure 32.– Aerodynamic characteristics of airfoil section R, 24-inch chord.

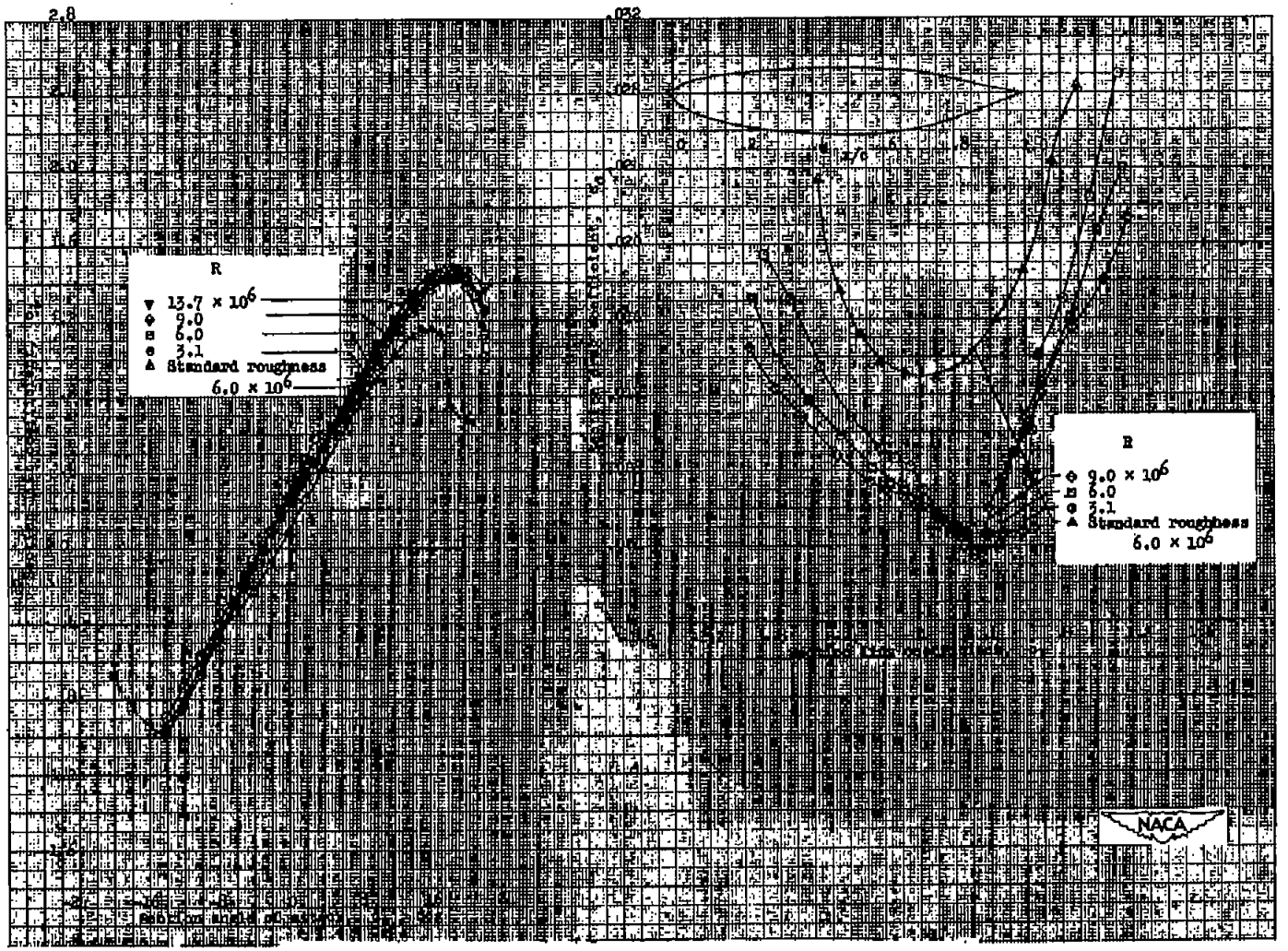

Figure 33.– Aerodynamic characteristics of airfoil section S, 24-inch chord.

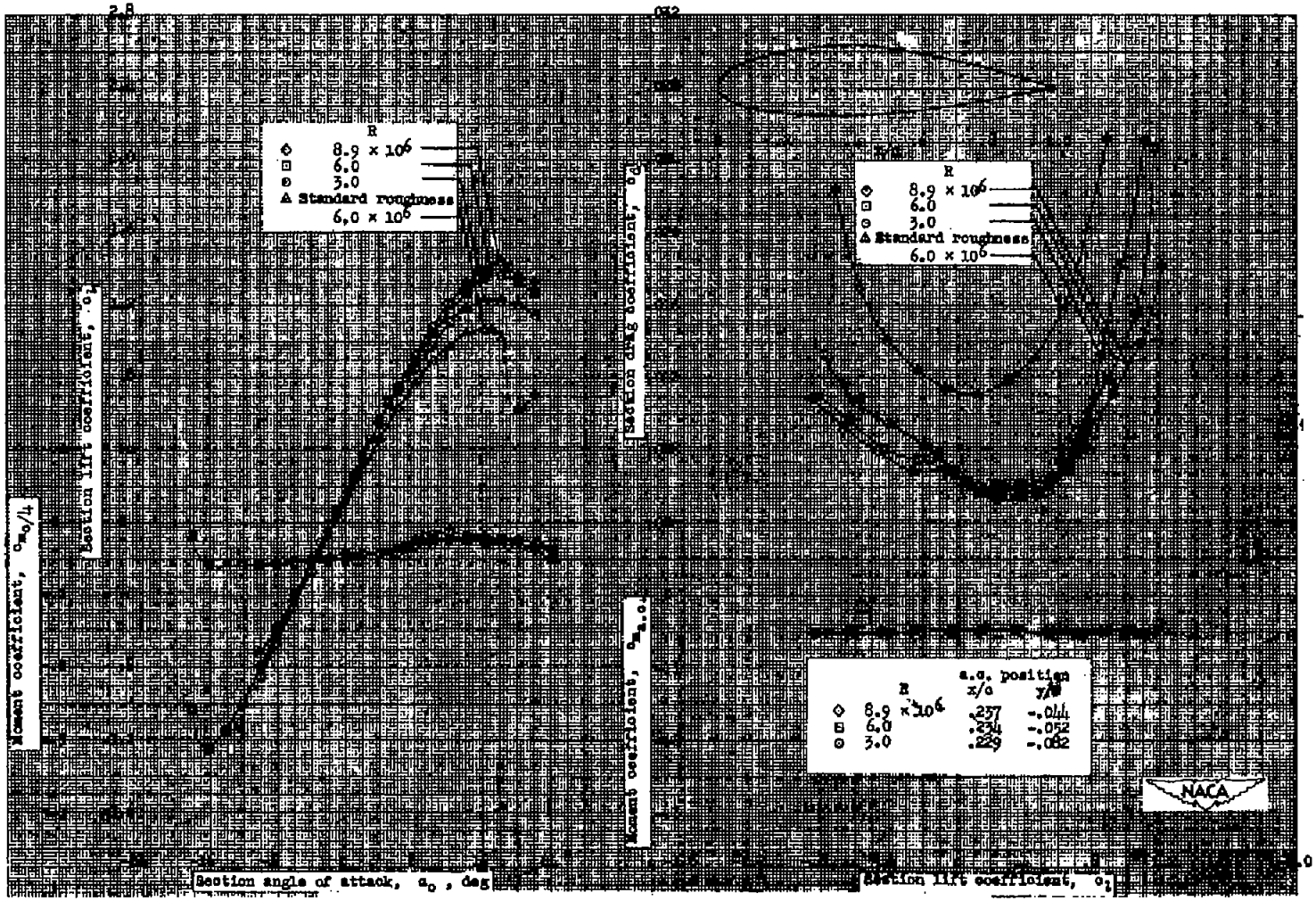

Figure 34.– Aerodynamic characteristics of airfoil section T, 24-inch chord.