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RESEARCH MEMORANDUM

for the

Bureau of Aeronautics, Navy Department

PRELIMINARY RESULTS OF ALTITUDE-WIND-TUNNEL INVESTIGATION OF X24C-4B TURBOJET ENGINE

II - ENGINE PERFORMANCE

By Carl L. Meyer, and Harry E. Bloomer

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PRELIMINARY RESULTS OF ALTITUDE-WIND-TUNNEL INVESTIGATION OF X24C-4B TURBOJET ENGINE

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SUMMARY

An investigation was conducted in the NACA Cleveland altitude wind tunnel to evaluate the performance characteristics of the X24C-4B turbojet engine over a range of simulated altitudes from 5000 to 45,000 feet, simulated flight Mach numbers from 0 to 1.08, and engine speeds from 4000 to 12,500 rpm. Performance data are presented to show graphically the effects of altitude at a flight Mach number of 0.25 and of flight Mach number at an altitude of 25,000 feet. The performance data are generalized to show the applicability of methods used to determine performance at any altitude from data obtained at a given altitude. A complete tabulation of performance data, as well as lubrication- and fuel-system data, is presented.

Performance parameters depending upon fuel consumption that are obtained from data at one altitude cannot be used to predict these parameters at other altitudes; however, thrust and air-flow values can be predicted for a limited range of altitudes from data taken at one altitude. The exhaust-gas total temperature increased at high engine speeds as the altitude was raised and decreased at all engine speeds as the flight Mach number was increased to 0.98. A further increase in flight Mach number to 1.08 did not affect the exhaust-gas total temperature. The specific fuel consumption based on net thrust increased when the altitude was raised above 15,000 feet. The specific fuel consumption based on net thrust increased as the flight Mach number was raised from 0.25 to 0.87 but was not appreciably affected by further increases in flight Mach number to 1.08.

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INTRODUCTION

An investigation to evaluate the performance characteristics of the X24C-4B turbojet engine has been conducted in the NACA Cleveland altitude wind tunnel at the request of the Bureau of Aeronautics, Navy Department. Data have been obtained over a range of simulated altitudes and flight Mach numbers throughout the operable range of engine speeds. Extensive instrumentation was installed in the engine to obtain detailed information on the individual components of the engine, as well as the overall engine performance. Details of the instrumentation together with pressure and temperature surveys through the engine are presented in reference 1.

Data are presented herein to show the effects of altitude and flight Mach number on engine performance. The applicability of methods used to generalize the data in order to estimate the performance at various altitudes from performance data obtained at any altitude is discussed. A complete tabulation of performance data, as well as lubrication- and fuel-system data, is presented.

INSTALLATION

The X24C-4B turbojet engine used in the altitude-wind-tunnel investigation has a sea-level static thrust rating of 3000 pounds at an engine speed of 12,500 rpm. At this rating, the air flow is approximately 58.5 pounds per second and the fuel consumption is 3200 pounds per hour. The engine has an 11-stage axial-flow compressor with a pressure ratio of approximately 3.8 at rated engine speed, a double-annulus combustion chamber, and a two-stage turbine. The exhaust nozzle used in this investigation had an outlet area of 183.1 square inches.

The engine was installed in a streamlined wing nacelle in the test section of the altitude wind tunnel. For this installation, an extended inlet duct, 5 feet long, and an extended tail pipe, 3 feet long, were used. For flight Mach numbers below 0.25, a wooden lip was attached to the inlet duct and air was supplied to the engine from the tunnel air stream (fig. 1(a)). Flight at Mach numbers above 0.25 was simulated by introducing air through the make-up air duct to the compressor inlet at total pressures corresponding to the desired Mach numbers (fig. 1(b)). This air was dried and refrigerated in the tunnel make-up air system and was throttled from approximately sea-level pressure to the desired pressure at the engine inlet. The make-up air duct was connected to the engine-inlet duct by means of a labyrinth slip joint, which permitted thrust measurements to be made with the tunnel balance scales. For both inlet configurations, complete free-stream ram-pressure recovery was assumed at the compressor inlet.

The engine was extensively instrumented, as shown in figure 2. Pressure and temperature measurements were obtained at eight stations in the engine. A more complete description of the engine, the installation, and the instrumentation is given in reference 1.

PROCEDURE

Performance characteristics of the engine were obtained at pressure altitudes from 5000 to 45,000 feet, simulated flight Mach numbers from 0 to 1.08, and engine speeds from 4000 to 12,500 rpm. The inlet-air temperature was held at approximately NACA standard values corresponding to the simulated flight conditions, except for high altitudes and low flight Mach numbers. No inlet-air temperatures below -20° F were obtained. A fixed-area exhaust nozzle having an outlet area of 183.1 square inches was used. In order to conserve turbine life, the maximum temperature, as read on any thermocouple at the turbine outlet, was limited to 1250° F. The engine was not operated at an engine speed of 12,500 rpm with this exhaust nozzle at high altitudes and low flight Mach numbers because of excessive turbine-outlet temperatures.

Thrust was measured with the tunnel balance scales and was also calculated from pressure and temperature measurements obtained at the exhaust-nozzle outlet (station 8). In order to correct the scale thrust measurements for external-drag forces, power-off drag runs were made for both engine-inlet configurations. Air flow was calculated from pressure and temperature measurements made at the cowl inlet (station 1) and at the exhaust-nozzle outlet (station 8). Both values of thrust and air flow are presented in the tabulated data; calculated performance parameters and all performance curves involving thrust and air flow are based on thrust measured by the balance scales and air flow measured at the cowl inlet. The symbols and the methods of calculation used in this report are presented in the appendix.

RESULTS AND DISCUSSION

Performance data obtained at an altitude of 5000 feet and static conditions have been corrected to standard sea-level conditions and compared with corrected performance data obtained from the Navy acceptance test of the engine at sea-level static conditions (fig. 3). The two sets of data, which are compared on the basis of corrected jet thrust (fig. 3(a)), corrected air flow (fig. 3(b)), and corrected fuel consumption (fig. 3(c)) are in agreement. A corrected jet thrust of approximately 3100 pounds was obtained at a corrected engine speed of 12,500 rpm (fig. 3(a)); thus the rated thrust of the engine was obtained. At the corrected engine speed of 12,500 rpm, the corrected air flow (fig. 3(b)) was approximately 58.5 pounds per second and the corrected fuel consumption (fig. 3(c)) was approximately 3300 pounds per hour.

After the investigation at an altitude of 5000 feet and a flight Mach number of 0 had been completed, a turbine failure occurred. A new turbine assembly was then installed in the engine, and data at other altitudes and flight Mach numbers were obtained. Although no data were obtained at a flight Mach number of 0 after the installation of the new turbine, a study of the data indicated that the corrected jet thrust would have been approximately 2930 pounds at a corrected engine speed of 12,500 rpm and a flight Mach number of 0.

A summary of pertinent engine performance data is presented in table I for the range of operating conditions investigated with the new turbine assembly. A summary of lubrication- and fuel-system data is presented in table II for the same operating conditions.

Engine Performance

Effect of altitude. - Performance data obtained at a constant flight Mach number of 0.25 at altitudes from 5000 to 45,000 feet are presented to show the effect of altitude on jet thrust (fig. 4(a)), net thrust (fig. 4(b)), air flow (fig. 4(c)), fuel consumption (fig. 4(d)), specific fuel consumption based on net thrust (fig. 4(e)), fuel-air ratio (fig. 4(f)), and exhaust-gas total temperature (fig. 4(g)). As the altitude was raised, the jet thrust, net thrust, air flow, and fuel consumption decreased uniformly. Above an altitude of 15,000 feet, the maximum engine speed was limited by turbine-outlet temperature.

The specific fuel consumption based on net thrust (fig. 4(e)) was unaffected at any engine speed when the altitude was raised from 5000 to 15,000 feet, but was increased at all engine speeds when the altitude was raised above 15,000 feet. The minimum specific fuel consumption at each altitude occurred at an engine speed between 11,500 and 12,000 rpm. At an engine speed of 11,500 rpm, the specific fuel consumption based on net thrust increased from 1.13 pounds per hour per pound of thrust at altitudes of 5000 and 15,000 feet to 1.34 at an altitude of 45,000 feet. 873

The fuel-air ratio (fig. 4(f)) increased as the altitude was raised; the increase in fuel-air ratio became more pronounced at the higher altitudes. The minimum fuel-air ratio occurred at an engine speed between 9500 and 10,000 rpm for each altitude. At an engine speed of 11,500 rpm, the fuel-air ratio increased from 0.0110 at an altitude of 5000 feet to 0.0174 at an altitude of 45,000 feet.

At high engine speeds, the exhaust-gas total temperature increased as the altitude was raised. At an engine speed of 11,500 rpm, the exhaust-gas total temperature increased from 1315° R at an altitude of 5000 feet to 1540° R at an altitude of 45,000 feet. At the low engine speeds, the variation of exhaust-gas total temperature with altitude was inconsistent. By use of a variable-area exhaust nozzle, the exhaust-gas temperature could be lowered, thereby permitting operation at maximum engine speed at the higher altitudes.

Effect of flight Mach number. - Performance data obtained at an altitude of 25,000 feet at flight Mach numbers from 0.25 to 1.08 are presented to show the effect of flight Mach number on jet thrust (fig. 5(a)), net thrust (fig. 5(b)), air flow (fig. 5(c)), fuel consumption (fig. 5(d)), specific fuel consumption based on net thrust (fig. 5(e)), fuel-air ratio (fig. 5(f)), and exhaust-gas total temperature (fig. 5(g)). Throughout the entire range of engine speeds, raising the flight Mach number increased the jet thrust and air flow and reduced the fuel-air ratio.

Raising the flight Mach number from 0.25 to 0.53 decreased the net thrust (fig. 5(b)) throughout the range of engine speeds for which data were obtained. As the flight Mach number was increased beyond 0.53, the net thrust decreased at low engine speeds and increased at high engine speeds.

As the flight Mach number was raised, the fuel consumption increased at engine speeds above approximately 10,500 rpm and decreased at lower engine speeds. The specific fuel consumption based on net thrust increased at all engine speeds as the flight Mach number was raised from 0.25 to 0.87, but was not appreciably affected by further increases in flight Mach number to 1.08.

At all engine speeds, the exhaust-gas total temperature was reduced as the flight Mach number was increased to 0.98. A further increase in flight Mach number to 1.08, however, did not appreciably affect the exhaust-gas temperature. At an engine speed of 12,500 rpm, the exhaust-gas total temperature decreased from 1550° R at a flight Mach number of 0.25 to 1405° R at a flight Mach number of 1.08. In order to obtain maximum thrust at high flight Mach numbers, use of a variable-area exhaust nozzle would be desirable. By control of the exhaust-nozzle area, a limiting exhaust-gas temperature and, consequently, maximum thrust could be obtained at a given engine speed regardless of flight Mach number. The variable-area nozzle, however, should have a thrust coefficient comparable to that of a fixed-area nozzle.

Generalized Performance

Altitude performance data presented in figures 4 and 5 have been generalized to standard sea-level conditions by use of the factors δ and θ. The generalized performance data are presented in figures 6 and 7. The concept of flow similarity and the application of dimensional analysis to the performance of turbojet engines has led to the development of these factors with which data obtained at several altitudes may be generalized. In the development of this method of generalization, the efficiencies of the engine components were considered to be unaffected by changes in altitude. Any changes in component efficiencies therefore lessen the possibility of generalizing data obtained at different altitudes to a single curve.

Effect of altitude. - Data obtained at a constant flight Mach number of 0.25 at altitudes from 5000 to 45,000 feet are compared to show the effect of altitude on the corrected values of jet thrust (fig. 6(a)), net thrust (fig. 6(b)), air flow (fig. 6(c)), fuel consumption (fig. 6(d)), specific fuel consumption based on net thrust (fig. 6(e)), fuel-air ratio (fig. 6(f)), and exhaust-gas total temperature (fig. 6(g)).

Jet thrust, net thrust, and air flow were the only performance parameters that generalized to a single curve at any engine speed or altitude for which data were obtained. Jet-thrust (fig. 6(a)) and net-thrust (fig. 6(b)) data generalized to single curves at altitudes up to 25,000 feet for the range of engine speeds and at all altitudes for corrected engine speeds below 9500 rpm. At corrected engine speeds higher than 9500 rpm, however, the corrected jet thrust and corrected net thrust increased as the altitude was raised above 25,000 feet. The air-flow data (fig. 6(c))

875 generalized to a single curve at altitudes up to 15,000 feet for all engine speeds, but any increase in altitude above 15,000 feet reduced the corrected air flow for all engine speeds.

Parameters depending upon fuel consumption did not generalize to a single curve for any engine speed or altitude at which data were obtained. Corrected fuel consumption (fig. 6(d)), corrected specific fuel consumption based on net thrust (fig. 6(e)), corrected fuel-air ratio (fig. 6(f)), and corrected exhaust-gas total temperature (fig. 6(g)) increased markedly as the altitude was raised.

Failure of the various performance data to generalize to a single curve for all altitudes and corrected engine speeds is attributed to changes in component efficiencies with altitude. A study of the data has shown that the compressor efficiency for any corrected engine speed decreased as the altitude was raised above 15,000 feet.

The effect of altitude on the components was such that raising the altitude resulted in increased corrected fuel consumption and, consequently, higher corrected fuel-air ratios. This increased fuel-air ratio raised the corrected temperatures and the corrected pressures within the engine.

The increased corrected temperatures and corrected pressures in the tail pipe were of such magnitude with respect to the decreased corrected air flow that the jet thrust and net thrust generalized to single curves for all engine speeds at altitudes up to 25,000 feet but increased at high engine speeds with increases in altitude above 25,000 feet. As the altitude was raised, the corrected fuel consumption increased at a greater rate than the corrected net thrust, which resulted in a rise in corrected specific fuel consumption based on net thrust at all corrected engine speeds. Performance parameters depending upon fuel consumption that are obtained from data at one altitude cannot be used to predict these parameters at other altitudes; however, thrust and air-flow values can be predicted for a limited range of altitudes and engine speeds from data taken at one altitude.

Effect of flight Mach number. - Data obtained at an altitude of 25,000 feet and flight Mach numbers from 0.25 to 1.08 have been compared to show the effect of flight Mach number on the corrected values of jet thrust (fig. 7(a)), net thrust (fig. 7(b)), air flow (fig. 7(c)), fuel consumption (fig. 7(d)), specific fuel consumption based on net thrust (fig. 7(e)), fuel-air ratio (fig. 7(f)), 873 and exhaust-gas total temperature (fig. 7(g)). The effect of flight Mach number on the generalized performance data was similar to the effect on the engine performance data presented in figure 5. Inasmuch as the data for a constant flight Mach number and varying altitude did not generalize to single curves, the sea-level engine performance would be somewhat different from that presented in figure 7. The effect of flight Mach number on sea-level performance, however, would probably be similar to that on performance data generalized from 25,000 feet.

SUMMARY OF RESULTS

An investigation of the performance of the X24C-4B turbojet engine in the Cleveland altitude wind tunnel at altitudes from 5000 to 45,000 feet and flight Mach numbers from 0 to 1.08 gave the following results:

1. Performance parameters depending upon fuel consumption that are obtained from data at one altitude cannot be used to predict these parameters at other altitudes; however, thrust and air-flow values can be predicted for a limited range of altitudes and engine speeds from data taken at one altitude.

2. Increasing the altitude raised the exhaust-gas total temperature at high engine speeds. The exhaust-gas total temperature was lowered at all engine speeds by increases in flight Mach number to 0.98; however, a further increase in flight Mach number to 1.08 did not affect this temperature.

3. The specific fuel consumption based on net thrust was unaffected at any engine speed when the altitude was raised from 5000 to 15,000 feet, but was increased at all engine speeds when the altitude was raised above 15,000 feet.

4. The specific fuel consumption based on net thrust increased at all engine speeds as the flight Mach number was raised from 0.25 to 0.87, but was not appreciably affected by further increases in flight Mach number to 1.08.

Flight Propulsion Research Laboratory,
National Advisory Committee for Aeronautics,
Cleveland, Ohio, December 9, 1947.

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APPENDIX - CALCULATIONS

Symbols

The following symbols are used in this report:

A	cross-sectional area, sq ft
B	thrust-scale reading, lb
c_p	specific heat of gas at constant pressure, Btu/(lb)(^{o}R)
D	external drag of installation, lb
F_j	jet thrust, lb
F_n	net thrust, lb
f/a	fuel-air ratio
g	acceleration of gravity, 32.2 ft/sec^2
J	mechanical equivalent of heat, 778 ft-lb/Btu
M_0	flight Mach number
m_a	mass rate of flow of air, slugs/sec
N	engine speed, rpm
P	total pressure, lb/sq ft absolute
p	static pressure, lb/sq ft absolute
R	gas constant, 53.3 ft-lb/(lb)(^{o}R)
T	total temperature, ^{o}R
T_i	indicated temperature, ^{o}R
t	static temperature, ^{o}R
V	velocity, ft/sec
W_a	air flow, lb/sec

$\tilde{W}_f$	fuel consumption, lb/hr
W_g	gas flow, lb/sec
W_f/F_n	specific fuel consumption based on net thrust, lb/(hr)(lb thrust)
γ	ratio of specific heats
δ	ratio of absolute ambient static pressure to absolute static pressure of NACA standard atmosphere at sea level
θ	ratio of absolute ambient static temperature to absolute static temperature of NACA standard atmosphere at sea level

Subscripts:

0	free air stream
x	engine-inlet duct at slip joint
1	cowl inlet
2	compressor inlet
8	exhaust-nozzle outlet

The data are generalized to NACA standard sea-level conditions by the following parameters:

F_j/δ	corrected jet thrust, lb
F_n/δ	corrected net thrust, lb
$(f/a)/\theta$	corrected fuel-air ratio
$N/\sqrt{\theta}$	corrected engine speed, rpm
T_8/θ	corrected exhaust-gas total temperature, $^{\circ}R$
$(W_a\sqrt{\theta})/\delta$	corrected air flow, lb/sec
$W_f/(\delta\sqrt{\theta})$	corrected fuel consumption, lb/hr
$W_f/(F_n\sqrt{\theta})$	corrected specific fuel consumption based on net thrust, lb/(hr)(lb thrust)

Methods of Calculation

Thrust. - Thrust was determined from measurements on the tunnel balance scales and by calculation from temperature and pressure measurements obtained at the exhaust-nozzle outlet (station 8). Thrust values presented in the figures were obtained with the tunnel balance scales. With a wooden lip on the inlet duct and air taken from the tunnel air stream, the jet thrust was determined from the balance-scale measurements by means of the following relation:

$$F_j = B + D + m_a V_0$$

When the make-up air duct was attached to the inlet of the engine to obtain high flight Mach numbers, the jet thrust was determined from the balance-scale measurements by use of the relation

$$F_j = B + D + m_a V_x + A_x\,(p_x - p_0)$$

Jet thrust was calculated from temperature and pressure measurements obtained at the exhaust-nozzle outlet by use of the relation

$$F_j = \frac{2\gamma_8}{\gamma_8 - 1}\, p_8 A_8 \left[\left(\frac{P_8}{p_8}\right)^{\frac{\gamma_8 - 1}{\gamma_8}} - 1\right] + A_8\,(p_8 - p_0)$$

Air flow. - Engine air flow was calculated from temperature and pressure measurements at the cowl inlet (station 1) and at the exhaust-nozzle outlet (station 8). Both air-flow measurements are presented in the tabulated data, but the air flow presented in the performance curves was obtained from measurements at the cowl inlet. Air flow at the inlet was calculated from

$$W_{a,1} = \frac{p_1 A_1}{R}\sqrt{\frac{2Jgc_p}{t_1}\left[\left(\frac{P_1}{p_1}\right)^{\frac{\gamma_1 - 1}{\gamma_1}} - 1\right]}$$

Gas flow at the exhaust-nozzle outlet was calculated from the relation

$$W_{g,8} = \frac{p_8 A_8}{R}\sqrt{\frac{2Jgc_p}{t_8}\left[\left(\frac{P_8}{p_8}\right)^{\frac{\gamma_8 - 1}{\gamma_8}} - 1\right]}$$

Air flow was then determined from:

$$W_{a,8} = W_{g,8} - \frac{W_f}{3600}$$

Temperature. - The engine inlet and exhaust-nozzle-outlet static temperatures were calculated from the indicated temperature, using a thermocouple recovery factor of 0.85, and respective values of pressure, temperature, and ratio of specific heats:

$$t = \frac{T_i}{1 + 0.85\left[\left(\frac{P}{p}\right)^{\frac{\gamma-1}{\gamma}} - 1\right]}$$

Flight Mach number. - The flight Mach number was calculated from the compressor-inlet total pressure with complete ram-pressure recovery assumed.

$$M_0 = \sqrt{\frac{2}{\gamma_2 - 1}\left[\left(\frac{P_2}{p_0}\right)^{\frac{\gamma_2 - 1}{\gamma_2}} - 1\right]}$$

REFERENCE

1. Prince, William R., and Hawkins, W. Kent: Preliminary Results of Altitude-Wind-Tunnel Investigation of X24C-4B Turbojet Engine. I - Pressure and Temperature Distributions. NACA RM No. SE7L22, Bur. Aero., 1947.

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TABLE I - PERFORMANCE DATA

	1	2	3	4	5	6	7	8	9	10	11	12	13
Run	Altitude, (ft)	Ram-pressure ratio, P_2/P_0	Flight Mach number, M_0	Tunnel static pressure, P_0, (lb/sq ft abs.)	Tunnel temperature, T_0 (°R)	Engine speed, N, (rpm)	Compressor-inlet indicated temperature, $T_{1,2}$, (°R)	Calculated jet thrust, F_j, (lb)	Scale jet thrust, F_j, (lb)	Net thrust, F_n, (lb)	Cowl-inlet air flow, $W_{a,1}$, (lb/sec)	Exhaust-nozzle-outlet air flow, $W_{a,8}$, (lb/sec)	Fuel flow, W_f, (lb/hr)
1	5,000	1.037	0.23	1760	529	4,000	512	115	128	38	11.00	11.47	471
2	5,000	1.038	.23	1760	530	6,000	512	294	291	147	17.78	18.15	704
3	5,000	1.038	.23	1760	520	8,000	510	633	626	419	26.19	26.06	920
4	5,000	1.040	.24	1760	538	9,000	512	944	933	669	32.51	32.41	1075
5	5,000	1.037	.23	1753	542	10,000	510	1338	1303	1000	39.22	38.56	1323
6	5,000	1.045	.25	1753	466	11,000	509	1794	1796	1414	45.89	44.34	1725
7	5,000	1.050	.26	1753	466	11,500	509	2077	2086	1659	47.67	47.05	1840
8	5,000	1.048	.26	1767	484	12,000	510	2390	2360	1920	51.16	49.56	2223
9	5,000	1.051	.27	1760	489	12,500	495	2788	2752	2278	54.35	52.57	2631
10	15,000	1.037	.23	1190	440	4,000	460	86	85	24	8.68	8.28	415
11	15,000	1.039	.23	1190	436	6,000	465	227	218	114	13.67	13.50	568
12	15,000	1.039	.23	1190	438	8,000	470	478	476	326	19.33	19.43	729
13	15,000	1.040	.24	1190	442	9,000	476	716	703	513	24.33	24.13	829
14	15,000	1.043	.25	1190	442	10,000	473	1008	1016	782	29.45	28.82	996
15	15,000	1.048	.26	1190	444	11,000	469	1370	1371	1092	33.96	32.72	1266
16	15,000	1.051	.27	1190	447	11,500	469	1657	1631	1324	35.88	35.06	1523
17	15,000	1.052	.27	1190	445	12,000	470	1826	1792	1473	37.09	35.99	1705
18	15,000	1.046	.26	1183	462	12,500	475	2010	1992	1686	37.46	36.34	1968
19	15,000	1.210	.53	1190	523	6,000	507	227	229	-41	15.69	15.28	436
20	15,000	1.209	.53	1197	523	8,000	506	524	508	119	22.12	22.05	608
21	15,000	1.208	.53	1197	494	9,000	509	776	741	272	26.79	26.61	714
22	15,000	1.210	.53	1204	504	10,000	507	1079	1089	538	31.90	31.18	899
23	15,000	1.217	.54	1190	509	11,000	500	1653	1568	925	36.86	36.08	1236
24	15,000	1.222	.54	1197	508	11,500	493	1906	1856	1159	40.18	38.97	1518
25	15,000	1.221	.54	1197	515	12,000	497	2104	2047	1335	41.15	39.74	1740
26	15,000	1.212	.53	1190	468	12,500	494	2346	2297	1574	42.29	41.21	1985
27	15,000	1.415	.72	1190	443	8,000	498	630	623	-9	27.15	27.02	558
28	15,000	1.420	.73	1190	441	9,000	499	954	924	165	32.55	32.25	683
29	15,000	1.415	.72	1197	447	10,000	502	1312	1306	450	37.49	36.43	869
30	15,000	1.425	.73	1190	451	11,000	500	1945	1912	909	43.30	42.37	1293
31	15,000	1.423	.72	1190	467	11,500	494	2327	2262	1195	46.66	45.42	1581
32	15,000	1.424	.72	1197	452	12,000	500	2604	2547	1449	47.73	46.42	1890
33	15,000	1.421	.73	1190	482	12,500	514	2826	2739	1621	48.08	46.77	2163
34	25,000	1.037	.23	774	440	6,000	443	144	152	91	9.06	8.36	486
35	25,000	1.037	.23	788	444	8,000	445	352	358	259	13.57	13.57	603
36	25,000	1.041	.24	781	440	9,000	440	517	516	387	17.18	16.86	678
37	25,000	1.046	.26	781	441	10,000	439	722	730	569	20.65	19.93	783
38	25,000	1.046	.26	781	448	11,000	441	1028	1015	829	23.49	22.94	961
39	25,000	1.049	.25	781	451	11,500	439	1188	1164	964	24.59	24.03	1104
40	25,000	1.045	.25	781	455	12,000	439	1331	1306	1108	25.47	24.80	1261
41	25,000	1.045	.25	781	457	12,350	441	1421	1392	1192	25.60	24.92	1404
42	25,000	1.210	.53	781	445	7,000	455	263	282	61	13.70	13.21	486
43	25,000	1.202	.52	788	446	8,000	455	405	412	146	16.14	16.15	552
44	25,000	1.211	.53	774	442	9,000	446	610	604	275	20.44	19.82	633
45	25,000	1.203	.52	788	437	10,000	451	842	844	472	23.81	22.65	754
46	25,000	1.208	.53	774	440	11,000	452	1206	1186	759	26.46	25.72	966
47	25,000	1.209	.53	781	441	11,500	454	1424	1391	938	28.10	27.14	1167
48	25,000	1.213	.53	781	440	12,000	454	1562	1523	1056	28.59	27.69	1333
49	25,000	1.207	.53	781	467	12,450	451	1674	1674	1217	29.35	27.58	1571
50	25,000	1.428	.73	781	451	8,950	467	680	675	165	22.91	22.23	568
51	25,000	1.417	.73	781	442	10,000	470	955	964	398	26.55	24.86	719
52	25,000	1.428	.73	781	455	10,500	464	1266	1240	592	29.31	28.36	874
53	25,000	1.420	.73	781	441	11,000	469	1439	1412	742	30.35	29.37	996
54	25,000	1.402	.72	788	443	11,500	470	1687	1628	936	31.83	30.84	1263
55	25,000	1.428	.73	781	443	12,000	470	1883	1835	1103	32.96	31.81	1434
56	25,000	1.424	.73	781	465	12,400	460	2116	2060	1306	34.09	33.23	1670
57	25,000	1.424	.73	781	465	12,500	461	2151	2086	1334	34.14	33.11	1730
58	25,000	1.624	.86	788	480	10,000	495	1123	1109	337	29.27	28.28	693
59	25,000	1.629	.86	774	480	10,500	495	1380	1342	510	31.07	30.35	834
60	25,000	1.626	.86	781	486	11,000	496	1589	1551	679	32.65	31.87	986
61	25,000	1.625	.86	781	489	11,500	497	1891	1848	927	34.56	33.61	1242
62	25,000	1.633	.87	781	497	12,000	500	2152	2094	1131	35.85	34.90	1503
63	25,000	1.634	.87	781	482	12,500	490	2416	2350	1351	37.71	36.58	1800
64	25,000	1.850	.98	781	480	8,000	503	553	535	-159	23.16	22.58	431
65	25,000	1.841	.98	788	472	9,000	507	884	862	12	27.95	27.67	502
66	25,000	1.837	.98	781	475	10,000	502	1298	1265	303	32.41	31.50	688
67	25,000	1.846	.98	781	484	11,000	500	1920	1861	746	37.05	36.45	1084
68	25,000	1.846	.98	781	481	11,500	503	2208	2135	970	39.00	38.01	1328

14	15	16	17	18	19	20	21	22	23	24	
Specific fuel consumption based on net thrust, W_f/F_n (lb/(hr)(lb thrust))	Fuel-air ratio, f/a	Exhaust-gas total temperature, T_B (°R)	Corrected engine speed, $N/\sqrt{\theta}$, (rpm)	Corrected jet thrust, F_j/δ, (lb)	Corrected net thrust, F_n/δ, (lb)	Corrected cowl-inlet air flow, $(W_{a,1}\sqrt{\theta})/\delta$ (lb/sec)	Corrected fuel consumption, $W_f/(\delta\sqrt{\theta})$, (lb/hr)	Corrected specific fuel consumption based on net thrust, $W_f/(F_n\sqrt{\theta})$ (lb/(hr)(lb thrust))	Corrected fuel-air ratio, $(f/a)/\theta$	Corrected exhaust-gas total temperature, T_B/θ (°R)	Run
12.395	0.0119	1089	4,048	154	46	13.07	573	12.457	0.0122	1122	1
4.789	.0110	1137	6,072	350	177	21.12	856	4.836	.0113	1170	2
2.196	.0098	1188	8,112	752	504	31.05	1121	2.224	.0100	1223	3
1.607	.0092	1178	9,117	1121	804	38.58	1309	1.628	.0094	1212	4
1.320	.0094	1209	10,140	1573	1209	46.68	1619	1.339	.0096	1245	5
1.220	.0104	1257	11,176	2168	1707	54.52	2115	1.239	.0108	1296	6
1.109	.0107	1314	11,696	2518	2002	56.58	2259	1.128	.0111	1361	7
1.158	.0121	1395	12,192	2827	2300	60.32	2706	1.177	.0125	1439	8
1.155	.0134	1477	12,900	3308	2738	63.30	3263	1.192	.0143	1572	9
17.29	.0133	1022	4,272	151	43	14.45	788	18.33	.0152	1165	10
4.982	.0115	1056	6,372	388	203	22.89	1073	5.286	.0130	1192	11
2.236	.0105	1102	8,448	846	580	32.55	1369	2.360	.0117	1229	12
1.616	.0095	1098	8,450	1250	912	41.20	1548	1.697	.0104	1209	13
1.274	.0094	1115	10,540	1806	1390	49.68	1867	1.343	.0104	1242	14
1.159	.0104	1214	11,649	2438	1942	57.02	2384	1.228	.0116	1363	15
1.150	.0118	1311	12,190	2900	2354	60.18	2870	1.219	.0132	1473	16
1.158	.0128	1391	12,708	3186	2619	62.27	3210	1.226	.0143	1560	17
1.167	.0146	1516	13,150	3564	3016	63.70	3703	1.228	.0162	1674	18
-----	.0077	856	6,240	407	-73	26.82	806	-----	.0084	923	19
5.109	.0076	946	8,328	898	210	37.57	1119	5.329	.0082	1023	20
2.625	.0074	995	9,342	1310	481	45.63	1310	2.723	.0080	1072	21
1.671	.0078	1057	10,400	1913	945	53.89	1642	1.738	.0084	1188	22
1.336	.0093	1160	11,517	2788	1645	62.60	2301	1.399	.0102	1270	23
1.310	.0105	1262	12,133	3281	2049	67.33	2831	1.382	.0117	1404	24
1.303	.0117	1361	12,624	3619	2360	69.16	3236	1.371	.0130	1506	25
1.261	.0130	1440	13,163	4084	2799	71.41	3716	1.328	.0144	1592	26
-----	.0057	772	8,584	1108	-16	44.99	1065	-----	.0067	890	27
4.139	.0058	854	9,657	1643	293	53.94	1303	4.447	.0068	984	28
1.931	.0064	949	10,680	2309	796	62.06	1641	2.062	.0073	1084	29
1.422	.0083	1100	11,781	3400	1616	71.88	2462	1.524	.0095	1261	30
1.323	.0094	1187	12,386	4022	2125	77.03	3028	1.425	.0109	1376	31
1.304	.0110	1310	12,852	4503	2562	78.79	3579	1.397	.0126	1502	32
1.334	.0125	1424	13,200	4870	2882	80.95	4061	1.409	.0140	1588	33
5.341	.0149	1087	6,534	416	249	22.75	1447	5.811	.0177	1290	34
2.328	.0123	1098	8,688	961	695	33.55	1758	2.529	.0146	1293	35
1.752	.0110	1067	9,828	1398	1048	42.62	2006	1.914	.0131	1270	36
1.376	.0105	1093	10,950	1978	1541	51.09	2323	1.507	.0126	1311	37
1.159	.0114	1238	12,012	2750	2246	58.27	2843	1.266	.0136	1477	38
1.145	.0125	1335	12,593	3153	2611	60.83	3275	1.254	.0149	1602	39
1.138	.0138	1427	13,140	3538	3002	63.01	3741	1.246	.0165	1710	40
1.178	.0152	1526	13,486	3771	3229	63.51	4153	1.286	.0182	1823	41
7.967	.0099	844	7,679	764	165.	33.83	1444	8.752	.0119	1014	42
3.781	.0095	907	8,768	1106	392	39.54	1624	4.143	.0114	1089	43
2.302	.0086	923	9,981	1651	752	50.39	1919	2.552	.0106	1133	44
1.597	.0088	1019	11,010	2266	1267	58.07	2229	1.759	.0107	1235	45
1.273	.0101	1184	12,111	3243	2075	65.71	2908	1.401	.0123	1437	46
1.244	.0115	1306	12,639	3768	2541	69.27	3474	1.367	.0139	1578	47
1.262	.0130	1403	13,188	4126	2861	70.47	3968	1.387	.0156	1696	48
1.291	.0149	1519	13,720	4535	3297	72.15	4689	1.422	.0181	1845	49
3.442	.0069	839	9,926	1829	447	65.96	1706	3.817	.0085	1032	50
1.807	.0075	954	11,050	2611	1078	65.09	2152	1.996	.0092	1165	51
1.476	.0083	1049	11,687	3359	1604	71.34	2635	1.643	.0103	1300	52
1.342	.0091	1137	12,166	3825	2010	74.34	2984	1.485	.0112	1392	53
1.349	.0110	1262	12,673	4371	2513	77.55	3737	1.487	.0134	1532	54
1.300	.0121	1356	13,272	4971	2988	80.73	4296	1.438	.0148	1661	55
1.279	.0136	1449	13,851	5581	3538	82.68	5052	1.428	.0170	1806	56
1.297	.0141	1484	13,950	5651	3614	82.87	5231	1.447	.0176	1848	57
2.056	.0066	923	10,970	2978	905	71.64	2041	2.255	.0079	1110	58
1.635	.0075	1014	11,519	3669	1394	77.43	2501	1.794	.0090	1220	59
1.452	.0084	1099	12,056	4202	1839	80.70	2927	1.592	.0101	1322	60
1.340	.0100	1233	12,593	5006	2511	85.50	3684	1.467	.0120	1483	61
1.329	.0116	1351	13,104	5673	3064	88.94	4446	1.451	.0139	1624	62
1.332	.0133	1438	13,800	6366	3660	92.53	5383	1.471	.0162	1753	63
-----	.0052	650	8,872	1449	-431	56.57	1295	-----	.0064	801	64
41.83	.0050	737.	9,936	2314	32	67.98	1488	46.50	.0061	899	65
2.271	.0059	881	11,090	3427	821	79.17	2067	2.818	.0073	1084	66
1.453	.0081	1076	12,232	5041	2021	90.26	3264	1.615	.0100	1331	67
1.369	.0095	1187	12,754	5784	2628	95.27	3990	1.518	.0118	1461	68

NACA

TABLE I - CONCLUDED. PERFORMANCE

	1	2	3	4	5	6	7	8	9	10	11	12	13
Run	Altitude, (ft)	Ram-pressure ratio, P_2/p_0	Flight Mach number, M_0	Tunnel static pressure, p_0, (lb/sq ft abs.)	Tunnel temperature, T_0 (°R)	Engine speed, N, (rpm)	Compressor-inlet indicated temperature, $T_{1,2}$, (°R)	Calculated jet thrust, F_j, (lb)	Scale jet thrust, F_j, (lb)	Net thrust, F_n, (lb)	Cowl-inlet air flow, $W_{a,1}$, (lb/sec)	Exhaust-nozzle-outlet air flow, $W_{a,8}$, (lb/sec)	Fuel flow, W_f, (lb/hr)
69	25,000	1.843	0.98	788	478	12,000	504	2508	2434	1219	40.57	39.63	1625
70	25,000	1.836	.98	788	477	12,500	505	2774	2703	1455	41.78	40.79	1932
71	25,000	2.063	1.07	788	520	9,500	509	1256	1240	152	33.88	32.69	588
72	25,000	2.078	1.08	781	513	10,000	505	1548	1510	332	36.29	35.37	714
73	25,000	2.074	1.08	781	497	10,500	504	1909	1854	584	38.99	38.22	925
74	25,000	2.076	1.08	788	508	11,000	505	2246	2181	826	41.53	40.71	1167
75	25,000	2.073	1.08	781	515	11,500	506	2600	2520	1114	43.39	42.23	1488
76	25,000	2.073	1.08	781	518	12,000	505	2887	2809	1355	44.90	43.74	1760
77	25,000	2.054	1.07	781	491	12,500	504	3199	3120	1617	46.51	45.53	2101
78	35,000	1.032	.22	493	441	7,000	442	156	100	100	6.61	6.85	420
79	35,000	1.041	.24	493	445	8,000	441	214	215	152	8.05	8.21	451
80	35,000	1.040	.24	500	446	9,000	438	330	343	263	11.02	10.62	502
81	35,000	1.042	.24	500	445	10,000	439	477	485	386	13.02	12.77	563
82	35,000	1.048	.26	500	446	11,000	439	679	681	560	15.02	14.65	688
83	35,000	1.050	.26	500	448	11,500	435	804	799	669	15.86	15.48	798
84	35,000	1.046	.26	500	445	12,000	431	900	890	762	16.43	15.96	910
85	35,000	1.046	.26	500	446	12,200	431	935	918	788	16.55	16.24	951
86	35,000	1.205	.52	493	434	8,000	448	267	267	97	10.31	10.46	431
87	35,000	1.197	.52	493	442	9,000	444	381	396	200	12.64	12.33	491
88	35,000	1.200	.52	500	441	10,000	451	552	554	321	14.77	14.43	573
89	35,000	1.210	.53	500	442	11,000	444	835	815	536	17.30	17.10	724
90	35,000	1.210	.53	500	445	11,500	440	977	964	672	18.16	17.94	849
91	35,000	1.205	.53	493	431	11,900	452	1013	1001	714	17.85	17.62	920
92	35,000	1.404	.72	500	448	9,000	440	469	471	146	15.18	14.93	461
93	35,000	1.404	.72	500	446	10,000	445	713	701	318	17.77	17.49	583
94	35,000	1.412	.72	500	446	10,500	446	872	842	426	19.36	18.86	678
95	35,000	1.414	.72	500	448	11,000	443	1036	1002	562	20.40	19.97	778
96	35,000	1.414	.72	500	450	11,500	443	1195	1168	708	21.12	20.88	915
97	35,000	1.418	.73	493	451	12,000	436	1354	1320	854	21.82	21.23	1104
98	35,000	1.412	.72	493	451	12,000	431	1360	1329	862	22.04	21.51	1094
99	35,000	1.410	.72	500	457	12,450	431	1498	1457	982	22.57	21.91	1302
100	35,000	1.602	.85	500	449	8,000	444	549	542	106	17.53	17.07	466
101	35,000	1.617	.86	493	434	10,000	445	886	867	345	20.50	20.26	618
102	35,000	1.615	.85	493	445	10,500	448	1039	1006	456	21.70	21.28	709
103	35,000	1.612	.85	500	449	11,000	445	1245	1211	629	23.22	22.67	839
104	35,000	1.608	.85	500	453	11,500	443	1452	1409	801	24.18	23.75	1021
105	35,000	1.615	.85	493	453	12,000	450	1559	1505	888	24.38	23.86	1158
106	35,000	1.618	.86	500	458	12,500	463	1694	1644	1011	24.81	24.07	1363
107	40,000	1.398	.71	394	453	7,000	435	188	185	4	8.16	8.42	410
108	40,000	1.406	.72	394	461	9,000	437	385	380	119	12.10	12.01	405
109	40,000	1.406	.72	387	454	10,000	441	557	566	272	13.64	13.47	502
110	40,000	1.404	.72	394	453	10,500	437	707	697	375	15.21	14.85	583
111	40,000	1.404	.72	394	455	11,000	440	827	807	466	16.05	15.69	663
112	40,000	1.411	.72	394	458	11,500	443	961	927	570	16.73	16.24	778
113	40,000	1.413	.72	387	464	12,000	436	1076	1062	700	16.88	16.57	910
114	45,000	1.036	.23	303	455	8,000	441	140	139	102	4.85	5.12	310
115	45,000	1.041	.24	317	458	9,000	444	207	200	151	6.35	6.41	350
116	45,000	1.052	.27	310	458	10,000	443	316	312	244	7.58	7.85	400
117	45,000	1.042	.24	310	458	10,500	442	395	378	310	8.31	8.73	456
118	45,000	1.042	.24	310	452	11,000	436	463	455	385	9.08	9.10	537
119	45,000	1.048	.26	310	440	11,300	426	526	512	434	9.67	9.59	588
120	45,000	1.215	.54	303	447	7,500	444	143	144	52	5.30	5.53	330
121	45,000	1.192	.51	317	442	9,000	439	265	264	140	8.08	7.83	390
122	45,000	1.210	.53	310	442	9,000	436	265	273	141	7.92	8.02	355
123	45,000	1.211	.53	303	445	10,000	437	398	398	245	9.10	9.27	431
124	45,000	1.186	.50	317	445	10,500	440	479	477	320	10.20	10.08	502
125	45,000	1.192	.51	317	445	10,500	438	490	489	325	10.13	10.36	502
126	45,000	1.201	.52	303	439	11,000	440	557	561	393	10.22	10.37	563
127	45,000	1.205	.52	303	443	11,400	437	633	641	466	10.67	10.77	633
128	45,000	1.416	.72	296	448	7,500	441	166	171	31	6.76	6.36	375
129	45,000	1.403	.72	310	452	9,000	439	308	314	116	9.32	9.14	380
130	45,000	1.406	.72	310	455	10,000	436	477	474	234	11.12	11.05	431
131	45,000	1.405	.72	296	444	10,500	434	563	555	308	11.63	11.42	486
132	45,000	1.379	.69	317	451	11,000	439	658	629	368	12.54	12.32	563
133	45,000	1.406	.72	310	453	11,500	439	787	768	488	12.97	12.85	668
134	45,000	1.397	.71	310	442	12,000	425	897	873	586	13.71	13.52	788
135	45,000	1.409	.72	303	447	12,100	429	906	874	586	13.60	13.35	813

DATA FOR X24C-4B TURBOJET ENGINE

14	15	16	17	18	19	20	21	22	23	24	
Specific fuel consumption based on net thrust, W_f/F_n (lb/(hr)(lb thrust))	Fuel-air ratio, f/a	Exhaust-gas total temperature, T_8 (°R)	Corrected engine speed, $N/\sqrt{\theta}$, (rpm)	Corrected jet thrust, F_j/δ, (lb)	Corrected net thrust, F_n/δ, (lb)	Corrected cowl-inlet air flow, $(W_{a,1}\sqrt{\theta})/\delta$ (lb/sec)	Corrected fuel consumption, $W_f/(\delta\sqrt{\theta})$, (lb/hr)	Corrected specific fuel consumption based on net thrust, $W_f/(F_n\sqrt{\theta})$ (lb/(hr)(lb thrust))	Corrected fuel-air ratio, (f/a)/θ	Corrected exhaust-gas total temperature, T_8/θ (°R)	Run
1.333	0.0111	1307	13,296	6535	3273	98.31	4836	1.478	0.0137	1605	69
1.328	.0128	1420	13,825	7258	3907	101.4	5738	1.469	.0157	1737	70
3.868	.0048	794	10,640	3329	408	81.22	1768	4.333	.0060	996	71
2.151	.0055	873	11,250	4091	899	87.39	2176	2.420	.0069	1105	72
1.584	.0066	977	11,823	5022	1582	93.78	2822	1.784	.0084	1237	73
1.413	.0078	1078	12,375	5856	2218	99.12	3525	1.589	.0101	1365	74
1.336	.0095	1208	12,926	6827	3018	104.58	4531	1.501	.0120	1529	75
1.299	.0109	1310	13,500	7610	3671	108.12	5364	1.461	.0138	1658	76
1.299	.0125	1407	14,063	8452	4380	112.0	6404	1.462	.0159	1781	77
4.200	.0177	1148	7,623	627	429	26.05	1963	4.576	.0209	1363	78
2.967	.0156	1148	8,728	923	652	31.67	2112	3.239	.0185	1363	79
1.909	.0126	1098	9,855	1452	1113	42.59	2326	2.090	.0152	1318	80
1.459	.0120	1133	10,940	2053	1634	50.37	2607	1.595	.0144	1353	81
1.229	.0127	1288	12,045	2882	2370	58.05	3188	1.345	.0152	1542	82
1.193	.0140	1406	12,650	3381	2831	61.02	3716	1.312	.0169	1701	83
1.194	.0154	1503	13,260	3766	3225	62.92	4257	1.320	.0188	1838	84
1.207	.0160	1531	13,481	3885	3335	63.38	4448	1.334	.0195	1872	85
4.443	.0116	916	8,840	1146	416	40.05	2044	4.913	.0142	1118	86
2.445	.0108	959	9,981	1700	858	48.92	2337	2.724	.0133	1180	87
1.785	.0108	1075	11,010	2345	1358	56.77	2670	1.966	.0131	1302	88
1.351	.0116	1241	12,232	3449	2268	65.84	3407	1.502	.0144	1537	89
1.263	.0130	1369	12,834	4080	2844	68.86	4010	1.410	.0162	1703	90
1.289	.0145	1464	13,090	4296	3064	69.65	4344	1.418	.0173	1768	91
3.158	.0084	821	10,269	1993	618	56.30	2226	3.602	.0118	1068	92
1.833	.0091	969	11,340	2967	1346	66.32	2798	2.079	.0117	1246	93
1.592	.0097	1059	11,907	3563	1803	72.25	3254	1.805	.0125	1362	94
1.384	.0106	1163	12,518	4240	2378	75.86	3747	1.576	.0137	1507	95
1.292	.0120	1280	13,087	4943	2996	78.54	4407	1.471	.0155	1658	96
1.293	.0141	1440	13,752	5665	3665	81.72	5430	1.482	.0185	1882	97
1.269	.0138	1411	13,824	5704	3700	82.11	5408	1.462	.0183	1873	98
1.326	.0160	1560	14,342	6166	4156	82.91	6348	1.527	.0212	2070	99
4.396	.0074	752	9,256	2294	449	64.12	2282	5.082	.0099	1009	100
1.791	.0084	935	11,570	3721	1481	76.05	3069	2.072	.0112	1252	101
1.555	.0091	1027	12,096	4318	1957	80.85	3506	1.792	.0121	1359	102
1.334	.0100	1152	12,727	5125	2662	84.93	4108	1.543	.0134	1543	103
1.275	.0117	1288	13,317	5963	3390	88.37	5004	1.476	.0157	1727	104
1.304	.0132	1394	13,812	6459	3811	90.91	5721	1.501	.0175	1847	105
1.348	.0153	1545	14,188	6957	4279	92.51	6547	1.530	.0197	1990	106
102.5	.0140	781	8,022	994	21	38.24	2524	120.2	.0184	1025	107
3.403	.0093	826	10,305	2041	639	56.76	2491	3.898	.0122	1082	108
1.846	.0102	992	11,390	3095	1487	65.48	3126	2.102	.0133	1285	109
1.555	.0106	1095	12,002	3744	2014	71.47	3579	1.777	.0139	1432	110
1.423	.0115	1194	12,551	4334	2503	75.55	4063	1.623	.0150	1553	111
1.365	.0129	1346	13,087	4979	3061	78.96	4755	1.553	.0167	1743	112
1.300	.0150	1481	13,752	5807	3828	80.54	5702	1.490	.0197	1945	113
3.039	.0178	1157	8,720	971	712	31.07	2360	3.315	.0211	1375	114
2.318	.0153	1167	9,783	1335	1008	38.99	2537	2.517	.0181	1381	115
1.639	.0147	1231	10,900	2130	1666	47.47	2976	1.786	.0174	1463	116
1.471	.0152	1302	11,445	2580	2116	52.04	3393	1.603	.0181	1546	117
1.395	.0164	1425	12,067	3106	2628	56.50	4021	1.530	.0198	1717	118
1.355	.0169	1492	12,566	3495	2962	59.36	4464	1.507	.0209	1842	119
6.346	.0173	1016	8,340	1006	363	33.28	2562	7.058	.0215	1260	120
2.786	.0134	1035	10,044	1762	935	48.33	2905	3.107	.0167	1288	121
2.518	.0124	971	10,089	1863	962	48.23	2716	2.823	.0156	1219	122
1.759	.0132	1139	11,200	2779	1711	56.74	3371	1.970	.0165	1428	123
1.569	.0137	1232	11,687	3184	2136	61.17	3729	1.746	.0170	1530	124
1.545	.0138	1203	11,718	3264	2169	60.59	3740	1.724	.0172	1499	125
1.433	.0153	1347	12,254	3917	2744	64.06	4380	1.596	.0190	1676	126
1.358	.0165	1462	12,768	4476	3254	66.53	4951	1.522	.0207	1833	127
12.10	.0154	891	8,558	1222	222	42.36	3059	13.78	.0200	1158	128
3.276	.0113	891	10,278	2143	792	55.71	2962	3.740	.0147	1161	129
1.842	.0108	1020	11,450	3236	1597	66.29	3369	2.110	.0142	1338	130
1.578	.0116	1121	12,054	3968	2202	72.42	3988	1.812	.0153	1476	131
1.530	.0125	1226	12,529	4199	2456	73.49	4280	1.743	.0162	1590	132
1.369	.0143	1399	13,133	5242	3331	77.52	5207	1.563	.0186	1821	133
1.345	.0160	1503	13,920	5959	4000	80.68	6239	1.560	.0215	2023	134
1.387	.0166	1538	13,976	6103	4092	82.22	6557	1.602	.0222	2053	135

TABLE II - LUBRICATION AND FUEL SYSTEM

	1	2	3	4	5	6	7	8	9	10	11	12
Run	Altitude (ft)	Ram-pressure ratio, P_2/p_0	Engine speed (rpm)	Fuel pressures (lb/sq in. gage)			Fuel temperature (°F)	Oil pressures (lb/sq in. gage)				
				Pump inlet	Pump discharge	Manifold		Pump inlet	Pump discharge	Cooler inlet	Cooler outlet	Scavenge
1	5,000	1.037	4,000	19.3	78	4	64	18.6	29	31	29	4
2	5,000	1.038	6,000	19.1	156	10	67	18.1	50	49	40	4
3	5,000	1.038	8,000	18.8	575	11	90	17.6	76	73	57	4
4	5,000	1.040	9,000	18.5	580	27	85	17.5	90	87	67	4
5	5,000	1.037	10,000	18.0	577	40	86	17.2	102	98	73	4
6	5,000	1.045	11,000	18.5	570	63	73	17.3	113	109	79	4
7	5,000	1.050	11,500	18.5	560	75	66	17.1	122	119	83	4
8	5,000	1.048	12,000	----	---	98	51	18.0	128	123	89	4
9	5,000	1.051	12,500	----	---	127	47	17.7	200	133	94	4
10	15,000	1.037	4,000	19.7	71	3	32	18.2	48	49	33	4
11	15,000	1.039	6,000	19.5	140	7	41	17.7	72	68	47	4
12	15,000	1.039	8,000	19.7	237	13	51	17.6	83	81	60	4
13	15,000	1.040	9,000	19.0	430	18	68	17.5	87	85	68	4
14	15,000	1.043	10,000	19.0	586	26	74	17.4	104	101	77	4
15	15,000	1.048	11,000	18.5	530	39	73	17.3	118	113	84	4
16	15,000	1.051	11,500	18.5	520	51	69	17.1	124	120	87	4
17	15,000	1.052	12,000	18.0	500	57	66	17.0	134	129	92	4
18	15,000	1.046	12,500	----	---	75	50	17.8	150	129	97	4
19	15,000	1.210	6,000	19.4	113	5	65	18.1	52	52	42	4
20	15,000	1.209	8,000	19.4	193	12	70	17.7	76	73	57	4
21	15,000	1.208	9,000	19.1	270	16	84	17.7	87	84	68	4
22	15,000	1.210	10,000	18.8	588	25	96	17.5	104	101	77	4
23	15,000	1.217	11,000	18.5	540	40	85	17.2	119	114	83	4
24	15,000	1.222	11,500	18.1	548	53	78	17.1	130	124	90	4
25	15,000	1.221	12,000	17.9	547	65	78	17.0	132	126	92	4
26	15,000	1.212	12,500	----	---	81	47	17.6	152	141	98	4
27	15,000	1.415	8,000	19.5	183	13	50	17.6	94	90	66	4
28	15,000	1.420	9,000	19.5	352	18	58	17.4	105	101	72	4
29	15,000	1.415	10,000	19.5	622	27	86	17.2	113	108	76	4
30	15,000	1.425	11,000	19.0	590	44	76	17.2	124	119	84	4
31	15,000	1.423	11,500	----	---	60	50	17.8	132	126	87	4
32	15,000	1.424	12,000	18.0	560	75	67	17.0	139	133	92	4
33	15,000	1.421	12,500	----	---	94	62	18.0	122	117	88	5
34	25,000	1.037	6,000	20.1	120	5	37	17.4	88	85	52	3
35	25,000	1.037	8,000	20.0	197	9	54	17.0	118	112	72	3
36	25,000	1.041	9,000	20.1	270	12	62	16.6	149	142	86	3
37	25,000	1.046	10,000	19.8	388	17	76	16.2	168	159	98	3
38	25,000	1.046	11,000	19.1	594	24	93	16.3	169	160	101	4
39	25,000	1.049	11,500	19.0	530	30	83	16.2	171	160	101	4
40	25,000	1.045	12,000	----	---	37	53	17.4	161	154	108	4
41	25,000	1.045	12,350	----	---	42	52	17.3	160	152	104	4
42	25,000	1.210	7,000	20.0	---	--	49	----	---	---	---	-
43	25,000	1.202	8,000	20.0	---	--	52	----	---	---	---	-
44	25,000	1.211	9,000	20.0	254	13	58	17.2	111	108	76	3
45	25,000	1.203	10,000	20.0	362	18	71	17.0	123	119	83	3
46	25,000	1.208	11,000	20.0	602	26	88	16.8	132	126	87	3
47	25,000	1.209	11,500	19.5	553	34	77	16.8	138	132	91	3
48	25,000	1.213	12,000	19.0	440	39	71	16.8	147	140	100	3
49	25,000	1.207	12,450	----	204	52	50	17.6	157	142	100	4
50	25,000	1.428	8,950	20.0	232	13	65	17.6	87	70	70	3
51	25,000	1.417	10,000	20.0	340	19	75	17.2	94	73	73	3
52	25,000	1.428	10,500	19.8	593	24	89	17.2	114	86	86	3
53	25,000	1.420	11,000	19.5	596	30	82	17.2	104	78	78	3
54	25,000	1.402	11,500	19.0	527	38	80	17.1	115	82	82	3
55	25,000	1.428	12,000	19.0	500	47	77	17.0	134	96	96	3
56	25,000	1.424	12,400	----	---	60	50	17.7	140	129	93	4
57	25,000	1.424	12,500	----	---	63	50	17.7	142	136	98	4
58	25,000	1.624	10,000	19.8	347	19	84	16.8	132	125	84	3
59	25,000	1.629	10,500	19.5	468	25	91	16.7	136	128	88	3
60	25,000	1.626	11,000	19.3	586	31	95	16.6	140	132	90	3
61	25,000	1.625	11,500	19.1	562	41	85	16.4	145	137	93	3
62	25,000	1.633	12,000	18.9	538	54	81	----	---	---	--	-
63	25,000	1.634	12,500	----	---	68	54	17.3	170	141	99	4
64	25,000	1.850	8,000	----	---	9	67	18.4	83	81	62	4
65	25,000	1.841	9,000	----	---	14	64	18.2	90	89	66	4
66	25,000	1.837	10,000	----	---	22	63	18.0	114	109	77	4
67	25,000	1.846	11,000	----	---	37	59	17.7	127	120	85	4
68	25,000	1.846	11,500	----	---	47	56	17.7	133	126	88	4

NACA

DATA FOR X24C-4B TURBOJET ENGINE

13	14	15	16	17	18	19	20	21	22	23	24	25	
Oil temperatures (°F)									Total oil flow (gal/hr)	Bearing temperatures (°F)			Run
Pump inlet	Cooler inlet	Cooler outlet	Gear case scavenge	Bearing 2 (fore) scavenge	Bearing 2 (aft) scavenge	Bearing 3 (fore) scavenge	Bearing 3 (aft) scavenge	Scavenge pump discharge		1	2	3	
93	85	80	79	103	101	104	112	85	66	82	110	124	1
94	94	85	84	115	110	110	119	94	100	87	119	140	2
95	95	84	83	127	120	120	132	105	133	94	128	160	3
93	94	87	87	130	122	122	133	108	100	86	130	175	4
94	95	90	90	139	129	129	144	115	165	102	138	150	5
106	103	89	73	133	121	121	134	96	182	98	140	144	6
100	99	84	71	131	123	127	143	101	190	102	140	153	7
102	98	85	75	140	128	138	147	109	198	115	133	158	8
96	92	81	72	142	130	141	154	110	208	114	138	159	9
80	66	40	34	64	60	64	70	42	67	48	83	86	10
81	75	57	44	77	75	75	83	55	103	58	90	105	11
96	87	73	60	105	99	99	117	77	134	73	134	134	12
124	112	93	70	121	115	116	123	89	150	89	132	155	13
118	108	90	69	126	118	118	129	94	166	91	140	147	14
114	103	89	73	133	121	121	134	96	184	98	140	144	15
110	101	86	73	133	124	124	135	101	192	102	140	153	16
105	99	84	71	131	123	127	143	101	198	102	140	157	17
115	108	94	75	140	130	137	146	107	210	108	128	162	18
97	94	85	85	116	112	112	122	95	99	96	116	130	19
100	98	90	87	127	123	123	137	105	134	104	124	143	20
103	100	93	92	129	122	122	134	110	149	108	132	170	21
102	100	91	90	133	124	124	137	109	165	110	165	120	22
100	98	88	85	133	124	124	135	107	181	104	140	158	23
99	97	88	84	137	127	127	138	108	190	103	140	158	24
100	99	90	89	143	134	138	150	117	197	109	144	160	25
89	87	77	70	132	120	130	149	104	210	105	128	152	26
83	75	67	57	103	95	95	113	75	134	91	112	---	27
86	80	70	63	112	105	105	123	80	150	98	124	---	28
89	87	75	67	123	115	120	133	92	166	105	135	---	29
94	91	79	71	132	122	123	139	98	182	106	145	---	30
93	87	75	68	130	120	124	140	100	190	91	129	150	31
92	88	78	73	136	126	130	148	106	198	105	146	---	32
121	119	106	95	158	146	157	164	126	210	132	145	173	33
65	54	40	35	68	62	62	71	48	100	47	85	90	34
65	60	50	45	82	74	72	84	58	133	57	95	118	35
61	59	45	45	84	75	75	86	60	149	56	98	132	36
60	60	47	47	93	81	81	102	66	165	60	106	120	37
64	65	53	52	105	94	94	111	75	177	70	110	123	38
65	67	54	54	103	93	95	117	75	182	74	108	130	39
83	80	67	60	116	105	105	125	83	200	84	105	140	40
83	80	68	61	119	107	111	130	85	210	87	111	143	41
75	65	55	48	83	75	75	83	60	119	64	96	108	42
84	74	61	53	94	86	86	93	66	135	70	92	126	43
88	78	65	57	103	97	96	112	76	150	75	101	153	44
90	80	69	61	112	105	104	120	80	166	77	125	150	45
91	87	69	68	119	110	110	127	91	182	85	130	140	46
90	88	74	69	122	113	113	128	93	192	97	133	205	47
93	89	74	69	123	115	115	128	95	198	96	132	144	48
91	89	75	68	125	115	122	141	98	210	97	120	151	49
125	115	96	75	122	117	117	125	95	150	102	126	161	50
129	119	100	82	134	130	130	140	105	166	109	142	166	51
119	109	94	76	131	123	123	130	100	178	102	140	144	52
130	120	103	84	142	135	135	145	112	180	102	151	158	53
123	113	99	82	140	133	133	143	110	188	110	151	167	54
112	106	89	76	133	125	129	139	106	200	108	140	152	55
105	103	85	75	136	125	131	118	108	204	105	127	158	56
100	97	81	71	132	120	129	145	105	207	101	125	158	57
75	75	68	68	115	105	105	121	85	166	---	---	---	58
75	76	67	68	120	108	108	125	90	174	100	128	132	59
77	77	70	69	122	112	114	130	96	181	100	128	226	60
77	77	70	70	124	115	115	132	100	190	94	130	247	61
76	78	71	74	130	120	124	139	105	198	98	137	144	62
84	84	76	75	132	120	127	139	104	126	104	111	136	63
83	84	75	70	110	103	103	118	85	135	100	104	130	64
84	85	77	75	119	112	112	129	95	150	104	111	130	65
82	85	76	74	121	112	112	126	95	165	104	112	135	66
85	85	78	76	128	117	117	130	100	185	104	113	155	67
85	86	78	77	131	122	123	139	105	190	97	119	152	68

TABLE II - CONCLUDED. LUBRICATION AND FUEL

	1	2	3	4	5	6	7	8	9	10	11	12
Run	Altitude (ft)	Ram pressure ratio, P_2/p_0	Engine speed (rpm)	Fuel pressures (lb/sq in. gage)			Fuel temperature (°F)	Oil pressures (lb/sq in. gage)				
				Pump inlet	Pump discharge	Manifold		Pump inlet	Pump discharge	Cooler inlet	Cooler outlet	Scavenge
69	25,000	1.843	12,000	----	---	60	54	17.6	146	123	93	4
70	25,000	1.836	12,500	----	---	77	51	17.5	200	138	97	4
71	25,000	2.063	9,500	20.0	257	19	89	17.2	104	100	73	4
72	25,000	2.078	10,000	20.0	330	25	86	17.1	112	108	78	4
73	25,000	2.074	10,500	19.6	610	33	95	16.8	131	123	87	3
74	25,000	2.076	11,000	19.2	594	42	93	16.8	133	127	88	3
75	25,000	2.073	11,500	18.8	575	57	83	16.8	133	128	90	4
76	25,000	2.073	12,000	18.3	568	71	80	16.8	143	136	98	4
77	25,000	2.054	12,500	----	---	91	51	17.6	183	146	106	4
78	35,000	1.032	7,000	20.0	134	4	47	17.5	87	84	57	4
79	35,000	1.041	8,000	20.1	168	6	57	17.3	103	99	68	4
80	35,000	1.040	9,000	20.0	208	8	64	17.0	120	115	77	4
81	35,000	1.042	10,000	19.9	260	10	72	16.8	140	133	90	4
82	35,000	1.048	11,000	19.7	338	15	81	16.5	151	144	96	4
83	35,000	1.050	11,500	19.6	454	18	89	16.4	161	152	101	4
84	35,000	1.046	12,000	----	---	21	57	18.0	121	116	88	4
85	35,000	1.046	12,200	----	---	22	57	17.8	125	119	89	4
86	35,000	1.205	8,000	20.3	186	6	55	16.7	131	123	73	3
87	35,000	1.197	9,000	20.4	224	8	64	16.8	122	118	77	3
88	35,000	1.200	10,000	20.4	273	11	75	16.7	139	133	86	3
89	35,000	1.210	11,000	20.5	388	16	85	16.4	161	153	102	3
90	35,000	1.210	11,500	19.8	560	20	96	16.2	167	158	104	3
91	35,000	1.205	11,900	19.6	610	22	103	16.2	168	160	107	3
92	35,000	1.404	9,000	20.1	204	9	64	17.0	121	118	78	4
93	35,000	1.404	10,000	19.9	250	13	71	16.9	142	134	90	4
94	35,000	1.412	10,500	19.8	310	16	76	16.7	152	144	98	4
95	35,000	1.414	11,000	19.6	405	19	84	16.6	157	148	99	4
96	35,000	1.414	11,500	19.4	605	23	95	16.4	163	156	103	4
97	35,000	1.418	12,000	19.2	542	30	90	16.4	169	160	108	4
98	35,000	1.412	12,000	----	---	30	55	17.7	122	118	92	4
99	35,000	1.410	12,450	----	---	38	52	17.9	120	117	90	4
100	35,000	1.602	8,000	20.0	207	10	63	17.0	124	119	78	4
101	35,000	1.617	10,000	19.9	273	15	70	16.7	151	143	94	4
102	35,000	1.615	10,500	19.8	330	18	75	16.8	153	146	100	4
103	35,000	1.612	11,000	19.6	527	22	90	16.5	162	154	102	4
104	35,000	1.608	11,500	19.4	588	28	93	16.4	167	158	106	4
105	35,000	1.615	12,000	19.2	520	34	86	16.4	169	160	107	4
106	35,000	1.618	12,500	----	---	42	57	17.2	170	155	108	4
107	40,000	1.398	7,000	20.0	132	5	50	17.5	87	84	58	4
108	40,000	1.406	9,000	20.1	203	8	71	17.0	119	113	74	4
109	40,000	1.406	10,000	20.2	250	10	77	16.6	152	144	93	4
110	40,000	1.404	10,500	20.2	280	12	79	16.5	160	151	98	4
111	40,000	1.404	11,000	19.8	325	14	84	16.4	163	156	102	4
112	40,000	1.411	11,500	19.6	430	17	90	16.4	168	159	105	4
113	40,000	1.413	12,000	19.5	612	21	104	16.3	169	160	106	4
114	45,000	1.036	8,000	20.0	166	4	70	17.4	90	87	62	4
115	45,000	1.041	9,000	20.1	200	6	84	17.1	104	100	70	4
116	45,000	1.052	10,000	20.0	240	7	87	17.0	121	115	78	4
117	45,000	1.042	10,500	20.0	260	9	90	16.8	132	124	85	4
118	45,000	1.042	11,000	19.8	287	10	87	16.6	148	139	97	4
119	45,000	1.048	11,300	----	---	11	63	18.0	121	116	86	4
120	45,000	1.215	7,500	20.3	162	4	67	17.3	90	86	60	4
121	45,000	1.192	9,000	20.3	226	4	76	17.0	122	117	77	4
122	45,000	1.210	9,000	20.3	217	5	80	17.0	120	114	77	5
123	45,000	1.211	10,000	20.4	261	8	87	16.6	139	132	86	3
124	45,000	1.186	10,500	20.4	295	9	90	16.3	150	142	92	3
125	45,000	1.192	10,500	20.5	296	9	90	16.3	150	142	90	3
126	45,000	1.201	11,000	20.2	314	10	90	16.0	167	158	100	3
127	45,000	1.205	11,400	20.3	365	13	95	16.0	167	157	102	3
128	45,000	1.416	7,500	20.0	---	--	59	----	---	---	---	-
129	45,000	1.403	9,000	20.1	---	--	71	----	---	---	---	-
130	45,000	1.406	10,000	20.1	243	9	83	16.8	132	126	84	4
131	45,000	1.405	10,500	20.0	260	10	84	16.7	147	139	94	4
132	45,000	1.379	11,000	19.8	292	11	85	16.6	152	144	97	4
133	45,000	1.406	11,500	19.6	345	14	84	16.4	160	151	102	4
134	45,000	1.397	12,000	----	---	17	62	17.7	137	131	94	4
135	45,000	1.409	12,100	----	---	18	62	17.6	141	133	96	4

NACA

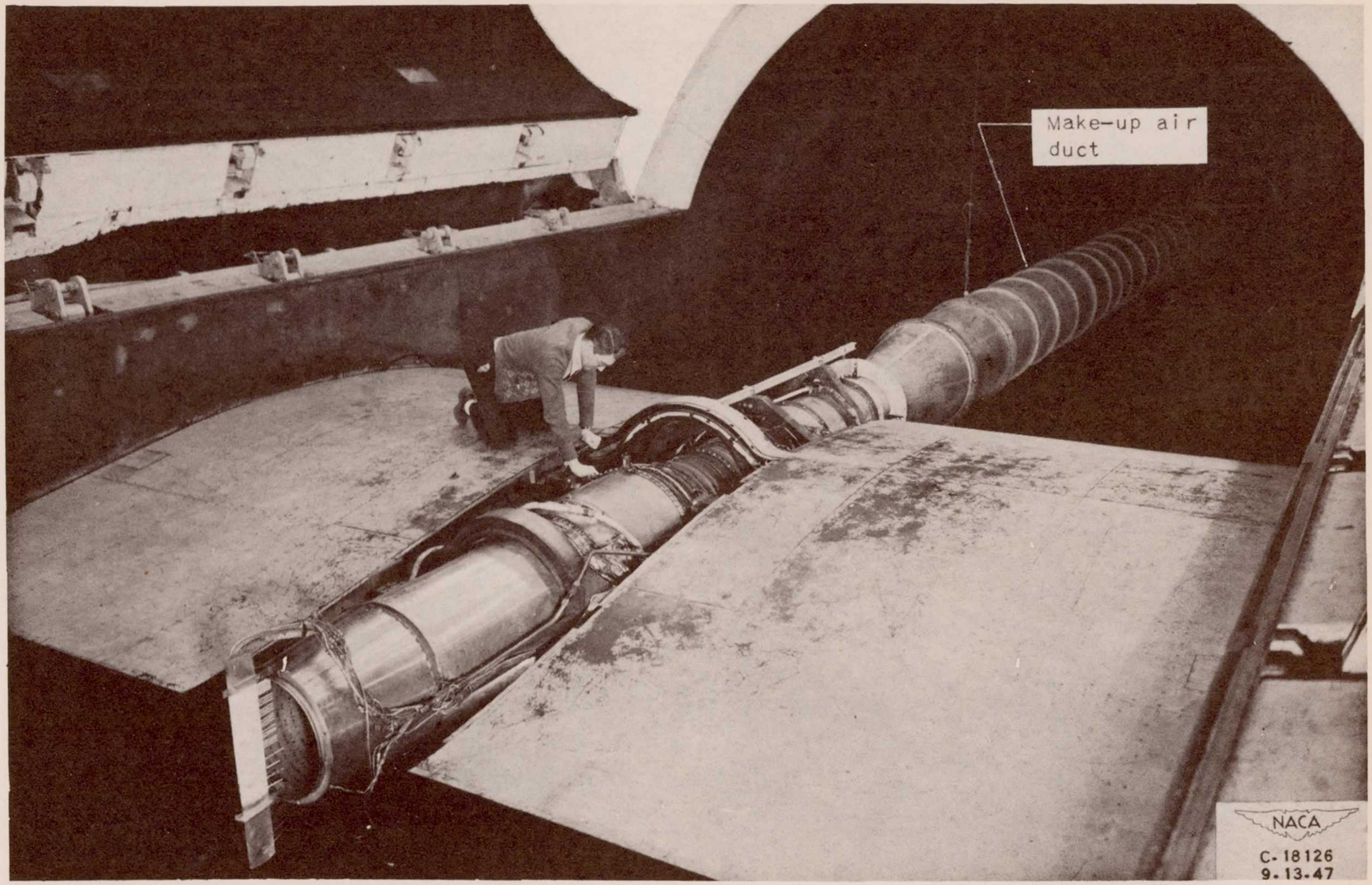
SYSTEM DATA FOR X24C-4B TURBOJET ENGINE

13	14	15	16	17	18	19	20	21	22	23	24	25	
Oil temperatures (°F)									Total oil flow (gal/hr)	Bearing temperatures (°F)			Run
Pump inlet	Cooler inlet	Cooler outlet	Gear case scavenge	Bearing 2 (fore) scavenge	Bearing 2 (aft) scavenge	Bearing 3 (fore) scavenge	Bearing 3 (aft) scavenge	Scavenge pump discharge		1	2	3	
86	87	80	80	135	124	131	147	108	200	103	120	152	69
85	86	80	80	139	128	137	151	115	210	111	129	163	70
84	90	84	84	129	123	123	138	106	158	114	132.	148	71
86	86	79	80	130	121	121	138	105	165	112	138	144	72
77	80	72	73	127	116	117	135	100	173	108	136	138	73
80	87	75	75	130	118	120	137	104	181	108	136	---	74
84	85	78	78	133	125	127	146	110	190	96	142	160	75
86	87	83	84	138	129	133	147	114	197	110	140	158	76
86	86	80	80	139	125	135	145	111	210	112	124	154	77
70	65	56	49	86	82	82	86	65	115	56	82	108	78
73	73	60	55	98	90	90	100	73	132	62	90	110	79
74	74	62	58	101	95	94	103	75	152	66	94	121	80
73	74	63	59	105	98	96	112	77	167	68	96	128	81
73	75	64	62	106	100	100	115	82	181	78	112	128	82
74	75	64	63	106	100	100	118	83	190	83	113	133	83
120	114	100	84	137	130	131	144	112	195	108	120	160	84
113	109	95	79	136	125	128	140	109	195	102	118	156	85
59	57	45	43	82	73	72	80	60	133	57	86	98	86
72	70	57	55	91	90	90	107	74	151	70	87	110	87
72	70	60	59	106	99	96	113	78	166	74	104	140	88
74	70	60	59	106	92	92	115	78	182	76	113	135	89
73	72	61	59	106	98	97	117	78	191	82	116	140	90
71	70	61	61	113	102	102	116	84	191	84	112	134	91
73	73	59	55	99	93	91	110	75	149	72	90	125	92
73	73	61	58	106	98	95	113	76	166	72	112	124	93
73	74	63	58	108	99	97	113	78	174	71	110	124	94
73	73	62	59	105	97	97	114	78	181	72	109	155	95
72	74	63	60	110	100	98	116	80	190	78	113	126	96
73	75	63	60	110	101	103	119	84	192	79	114	132	97
124	115	99	75	136	126	130	143	107	198	100	123	160	98
135	128	110	84	150	139	143	154	120	205	112	134	172	99
73	73	57	55	97	93	93	111	76	149	72	90	112	100
70	70	58	56	103	95	93	109	76	167	71	108	122	101
75	74	62	58	107	97	97	115	76	174	74	114	130	102
70	73	60	59	103	97	97	114	77	181	70	104	126	103
73	80	62	60	107	100	100	120	75	190	78	112	134	104
73	75	63	62	113	104	104	123	85	193	81	116	136	105
80	80	70	68	124	111	115	126	95	210	104	119	148	106
69	66	56	53	90	85	85	93	66	113	62	89	117	107
69	72	60	60	100	94	91	104	75	149	74	92	129	108
65	66	55	55	103	93	89	106	76	165	67	98	110	109
67	67	57	57	103	95	92	110	75	174	66	100	132	110
67	70	59	59	100	95	94	109	76	182	70	105	165	111
68	70	59	58	103	96	96	114	80	187	78	106	130	112
70	71	63	63	107	99	98	118	78	193	82	112	124	113
78	78	69	66	106	99	96	104	79	131	68	98	106	114
77	79	69	69	112	105	101	114	84	147	72	100	120	115
77	78	70	70	115	105	104	118	86	164	75	102	120	116
76	77	70	70	112	105	104	118	87	173	79	101	126	117
74	76	67	67	106	110	98	112	81	181	80	97	170	118
100	99	87	75	126	116	116	125	99	186	93	108	148	119
75	75	63	60	99	92	92	99	75	125	66	92	129	120
74	73	61	60	101	94	89	94	74	151	68	94	128	121
71	71	60	59	101	94	90	98	76	148	68	92	134	122
70	69	60	60	107	99	95	112	77	166	70	95	170	123
69	70	60	60	103	97	96	114	80	175	74	92	126	124
68	67	59	59	104	96	95	113	78	175	80	90	129	125
64	65	55	56	96	91	90	107	78	190	76	84	124	126
68	66	59	60	104	96	95	112	79	188	81	91	192	127
75	75	63	59	96	90	90	99	75	127	68	75	122	128
74	75	64	61	101	95	91	99	75	150	72	96	134	129
74	74	64	64	110	102	98	113	81	165	75	98	120	130
73	75	64	63	108	100	98	113	78	174	75	102	124	131
73	75	65	64	104	97	97	116	80	182	78	96	128	132
74	75	65	65	105	100	100	115	85	191	80	106	134	133
96	95	80	72	124	114	114	128	97	200	94	105	146	134
94	93	80	72	125	114	115	130	97	200	94	105	144	135

(a) Cowling installed.

Figure 1. - Installation of X24C-4B turbojet engine in altitude wind tunnel.

CONFIDENTIAL



(b) Make-up air duct installed.

Figure 1. - Concluded. Installation of X24C-4B turbojet engine in altitude wind tunnel.

CONFIDENTIAL

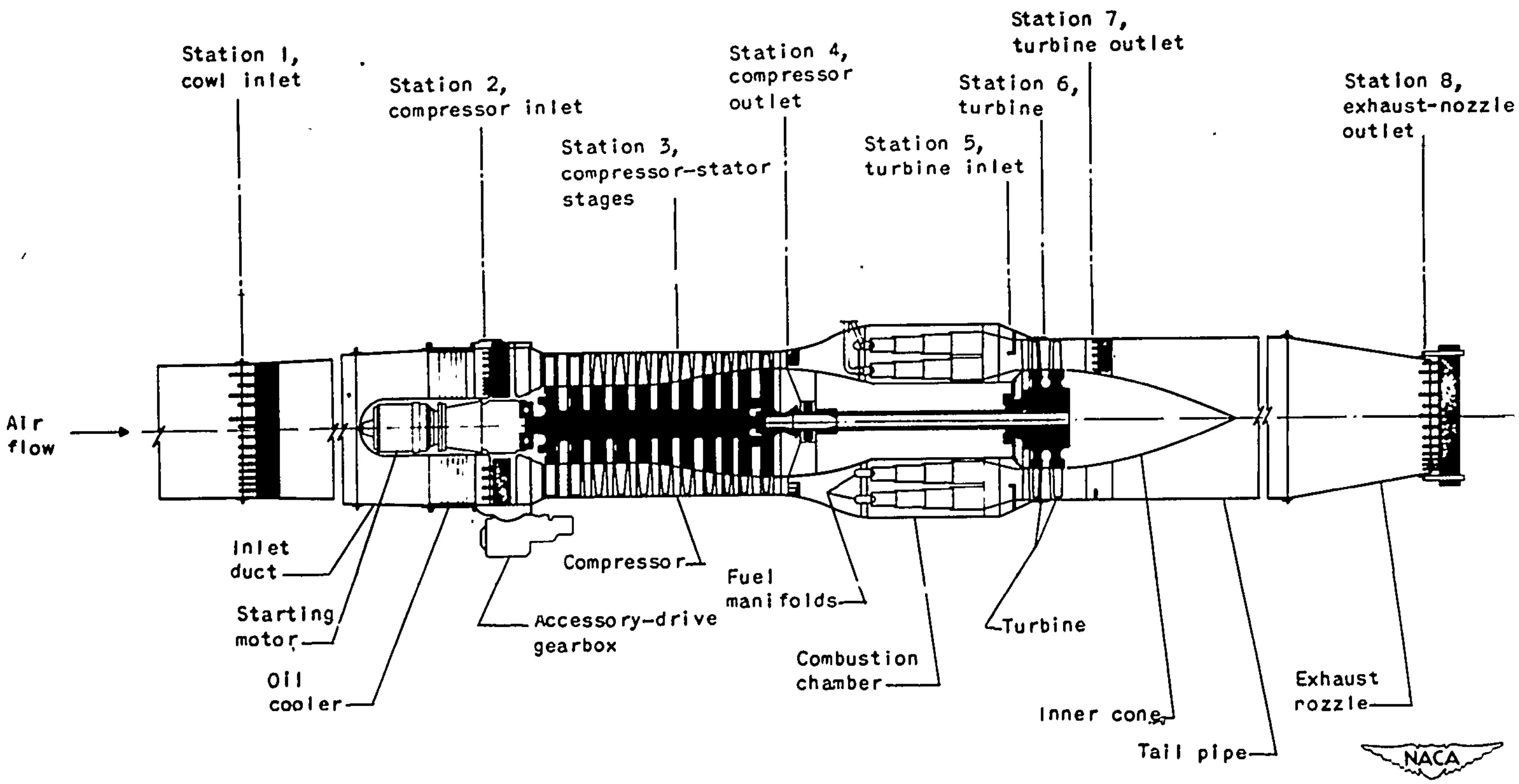
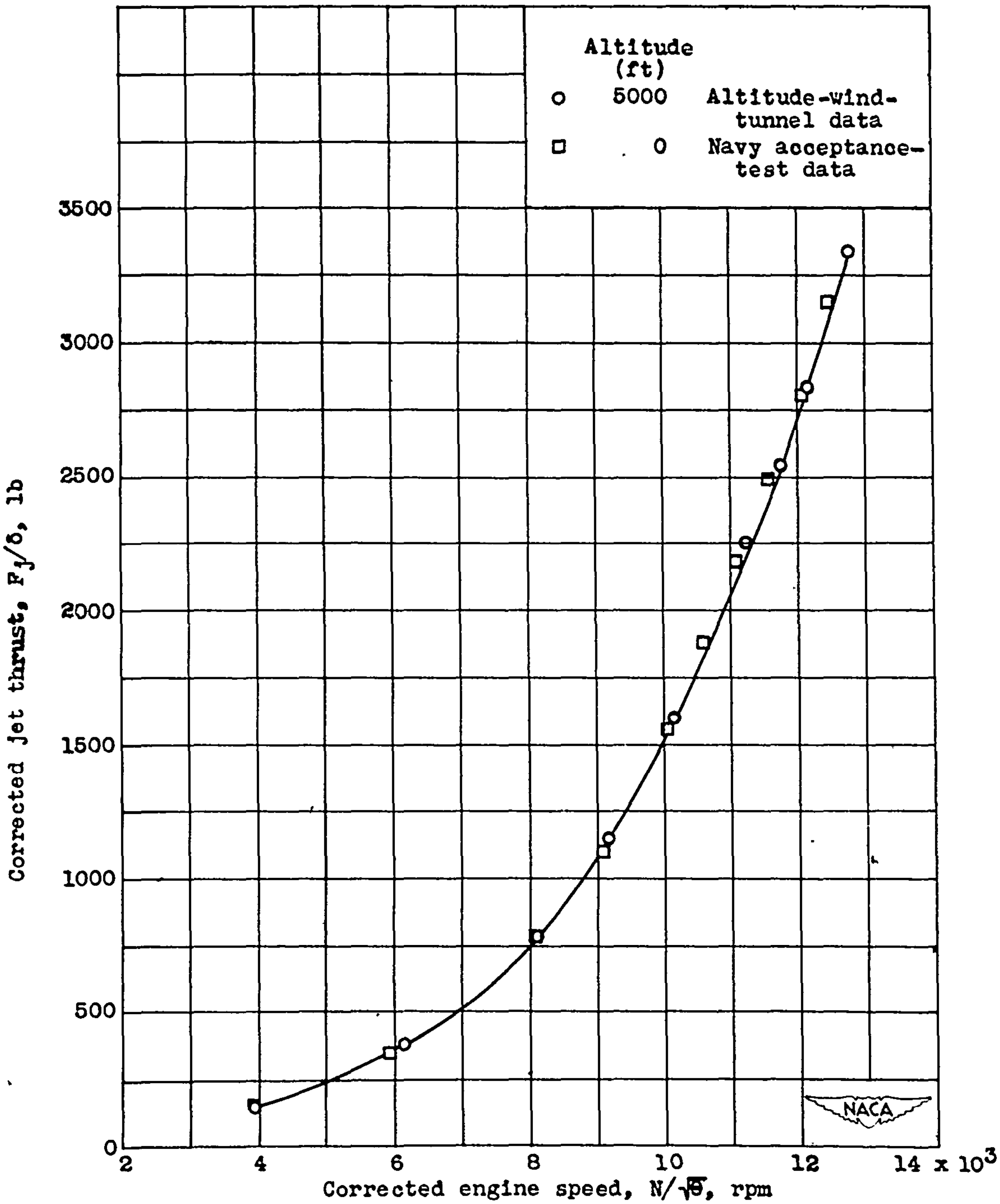
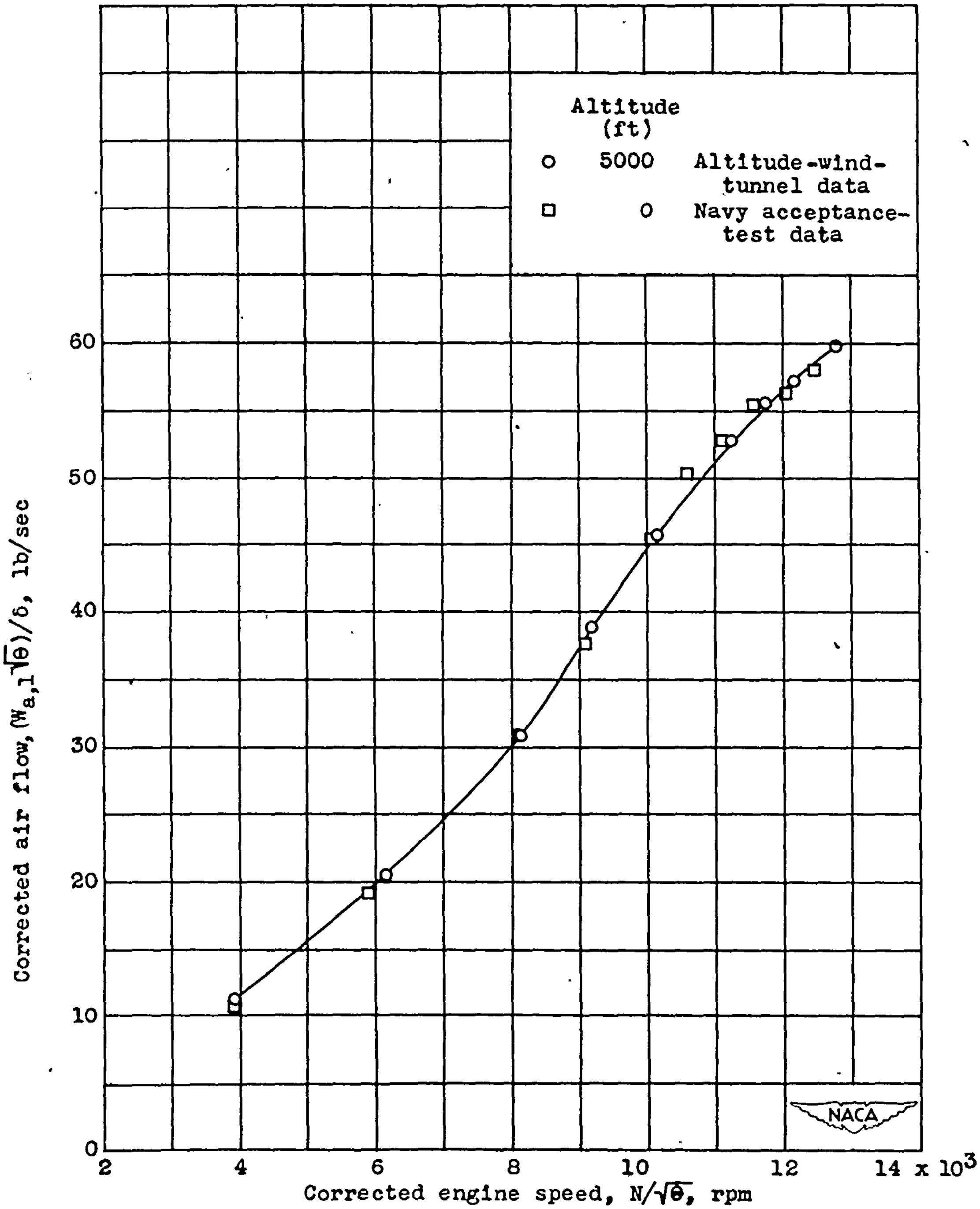


Figure 2. - Sectional side view of X24C-4B turbojet engine showing stations at which instrumentation was installed.



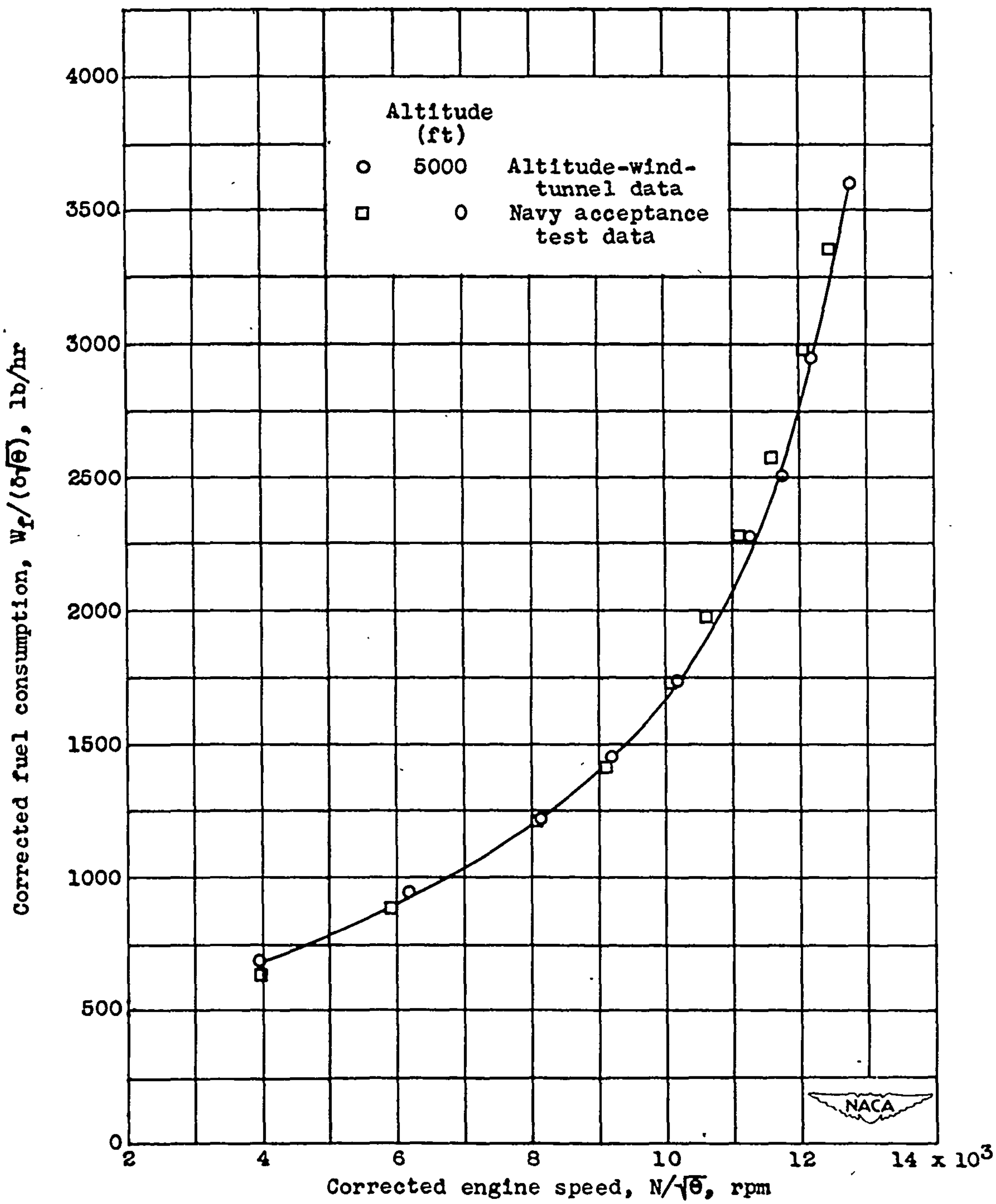
(a) Corrected jet thrust.

Figure 3. - Comparison of altitude-wind-tunnel data with Navy acceptance-test data on basis of variation of turbojet engine performance with corrected engine speed at flight Mach number of 0.



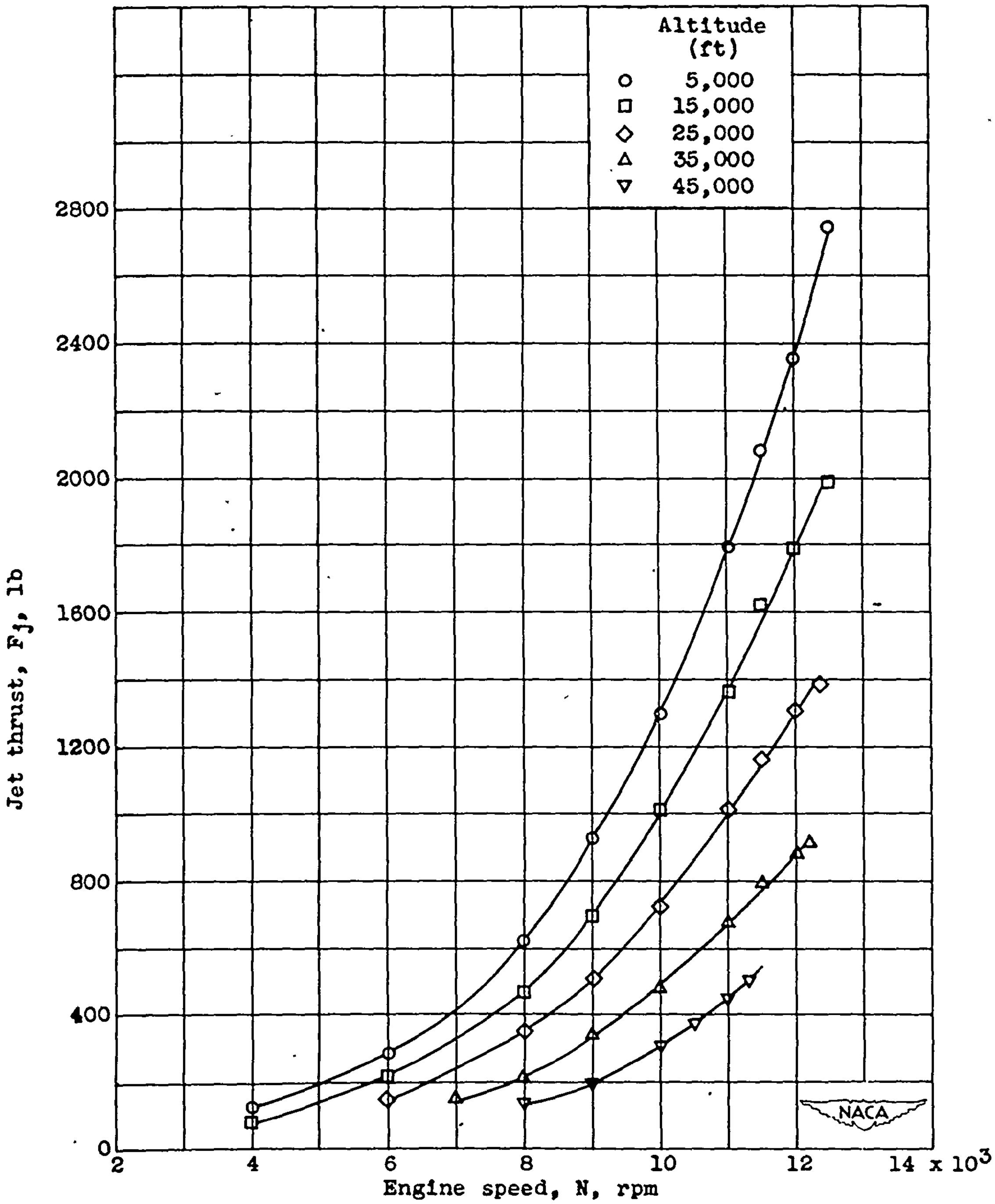
(b) Corrected air flow.

Figure 3. - Continued. Comparison of altitude-wind-tunnel data with Navy acceptance-test data on basis of variation of turbojet engine performance with corrected engine speed at flight Mach number of 0.



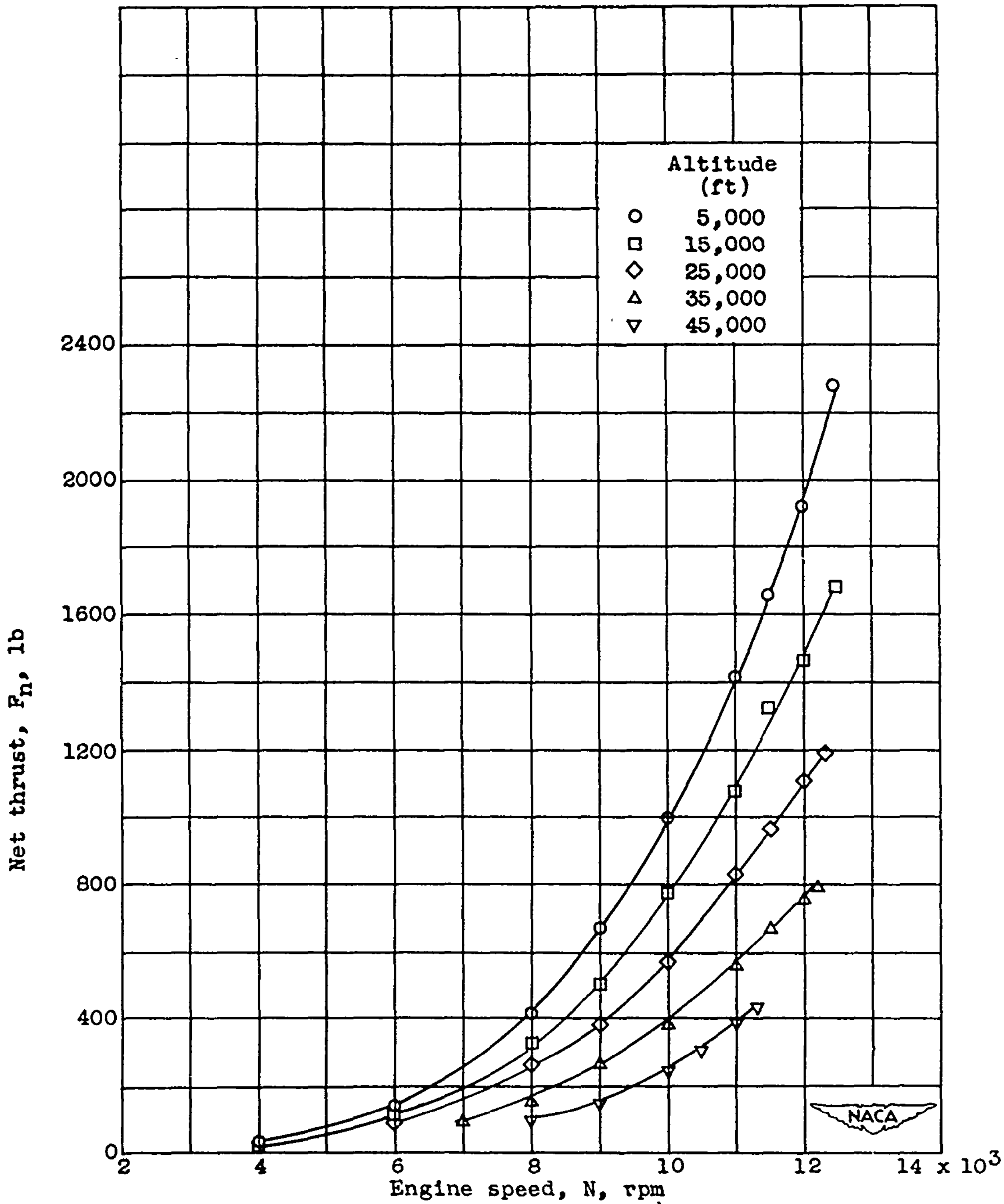
(c) Corrected fuel consumption.

Figure 3. - Concluded. Comparison of altitude-wind-tunnel data with Navy acceptance-test data on basis of variation of turbojet engine performance with corrected engine speed at flight Mach number of 0.



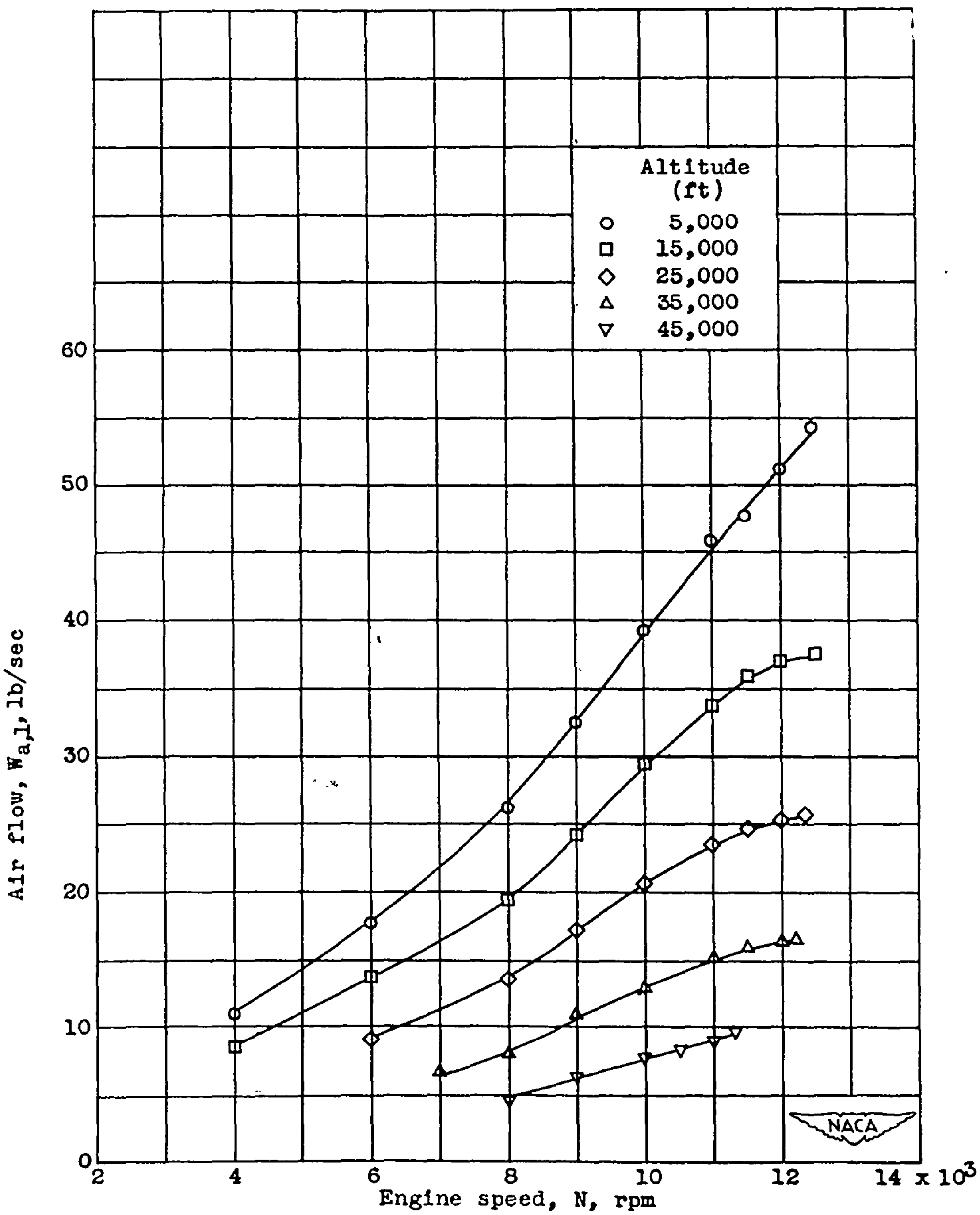
(a) Jet thrust.

Figure 4. - Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



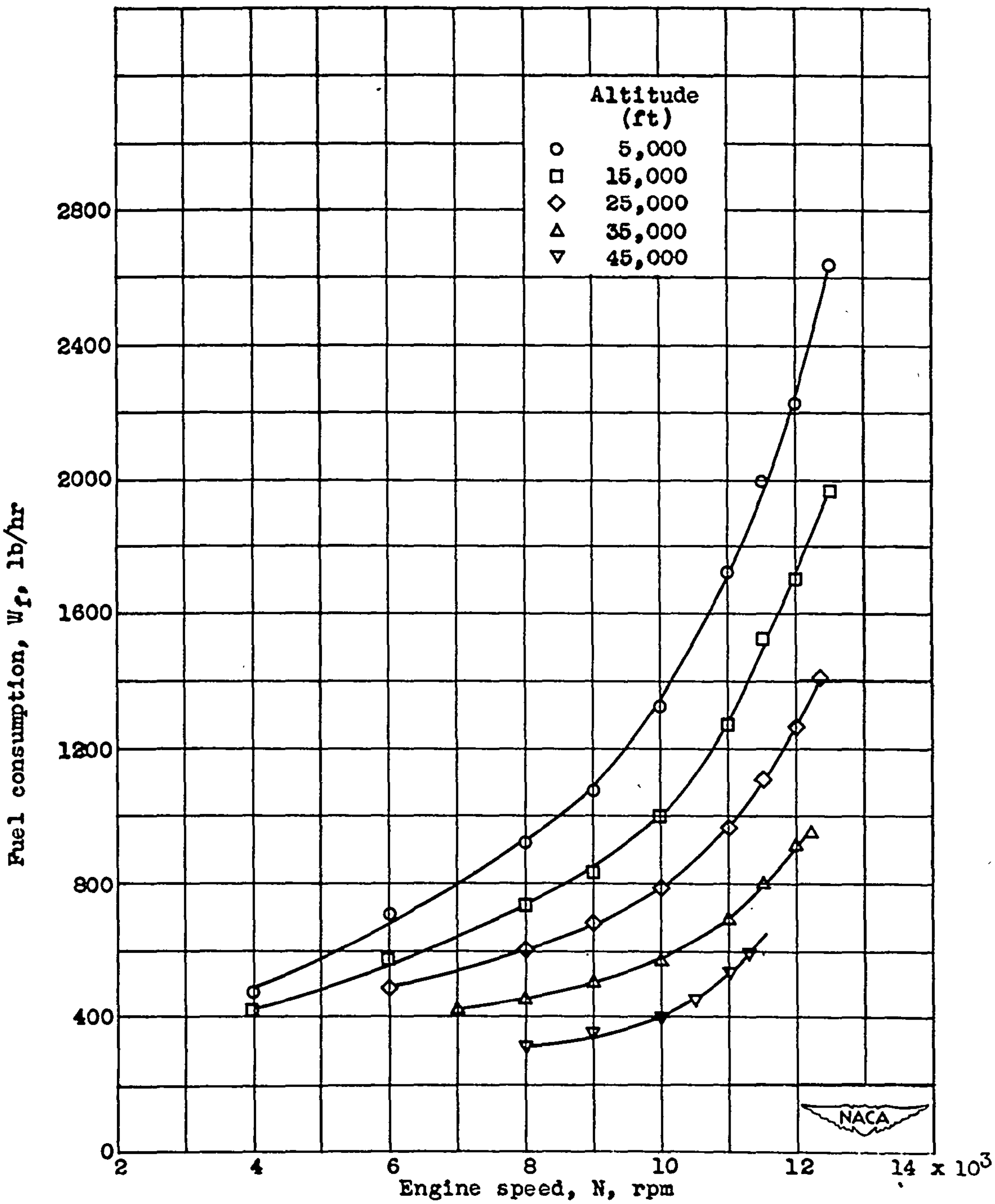
(b) Net thrust.

Figure 4. - Continued. Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



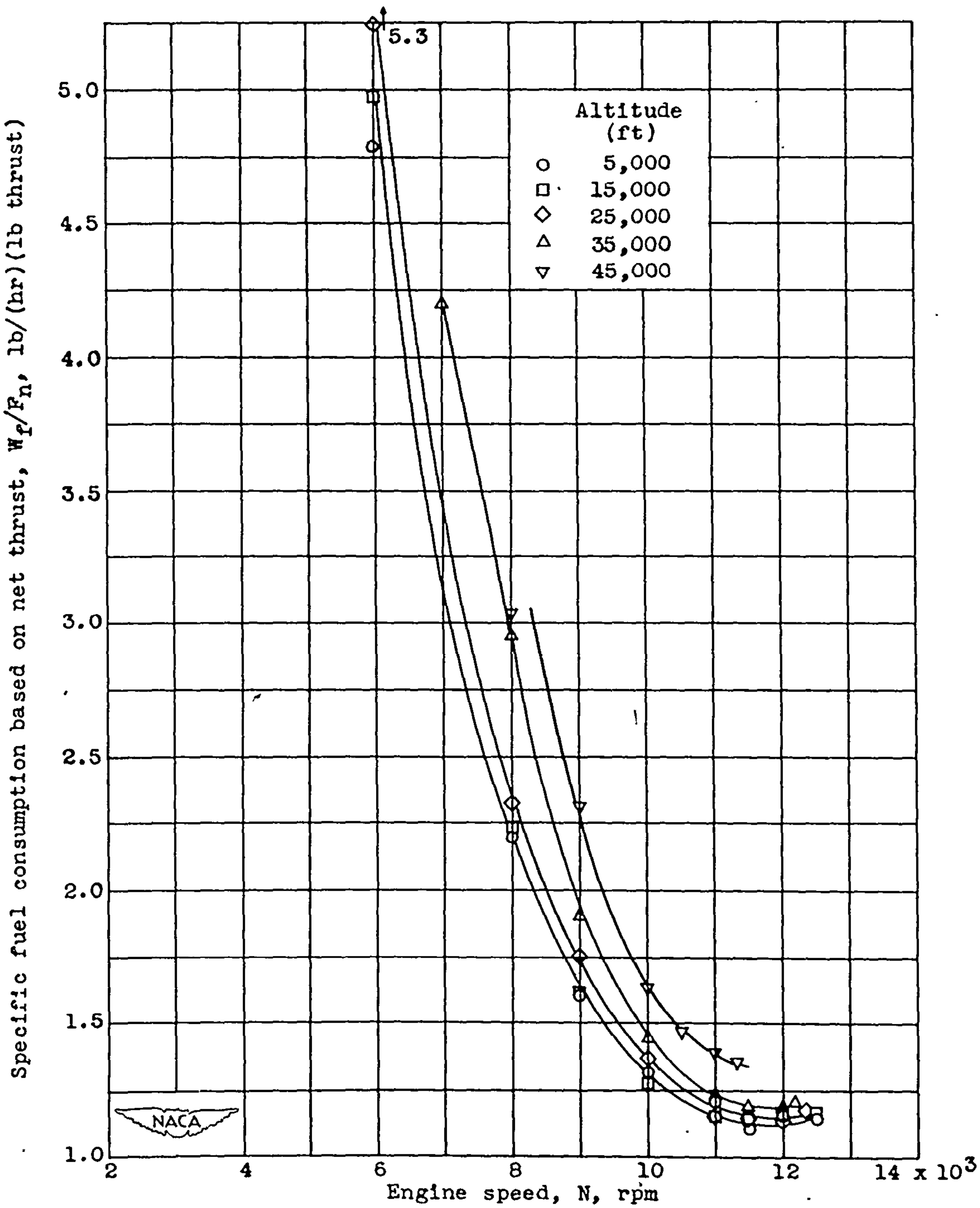
(c) Air flow.

Figure 4. - Continued. Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



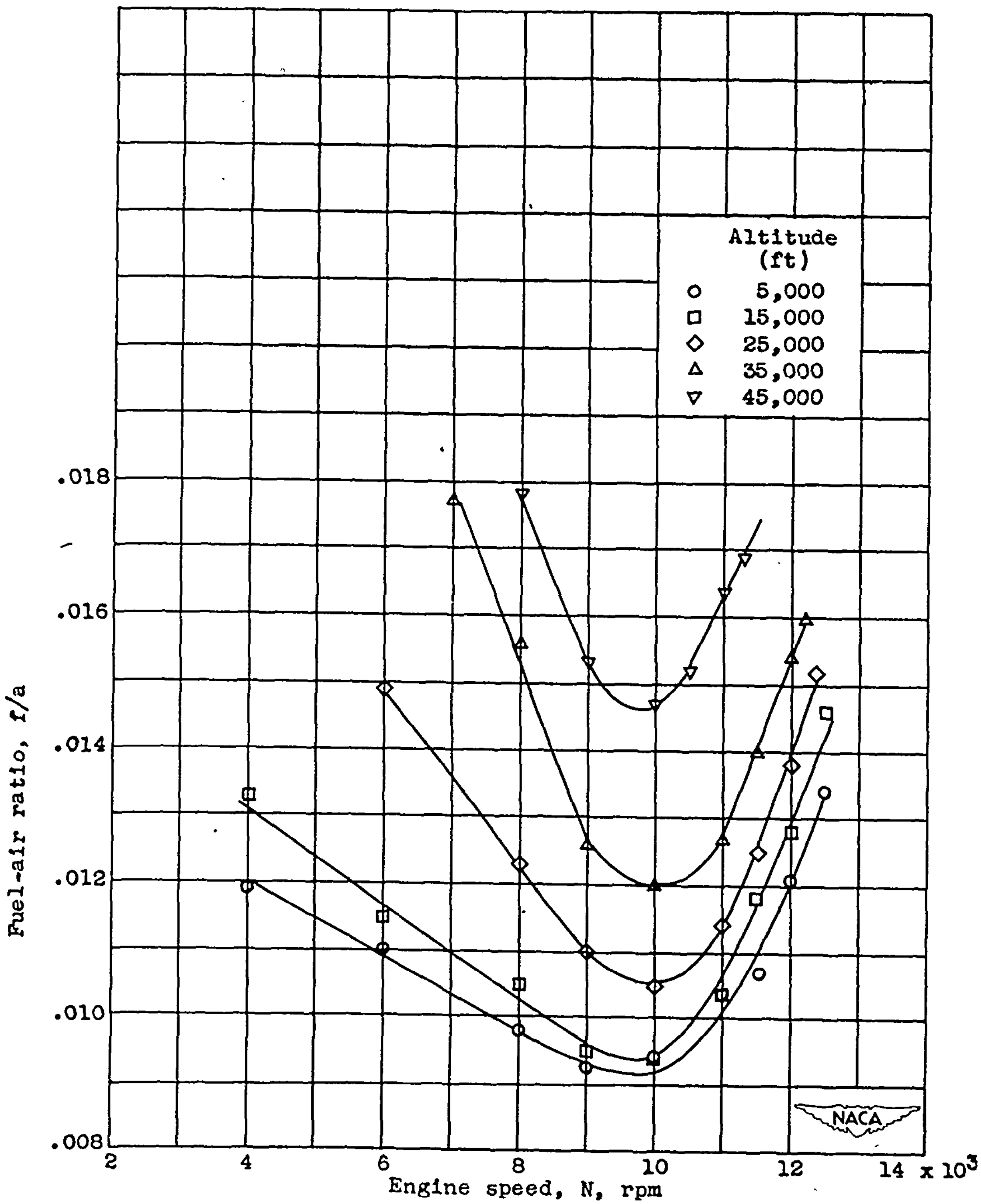
(d) Fuel consumption.

Figure 4. - Continued. Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



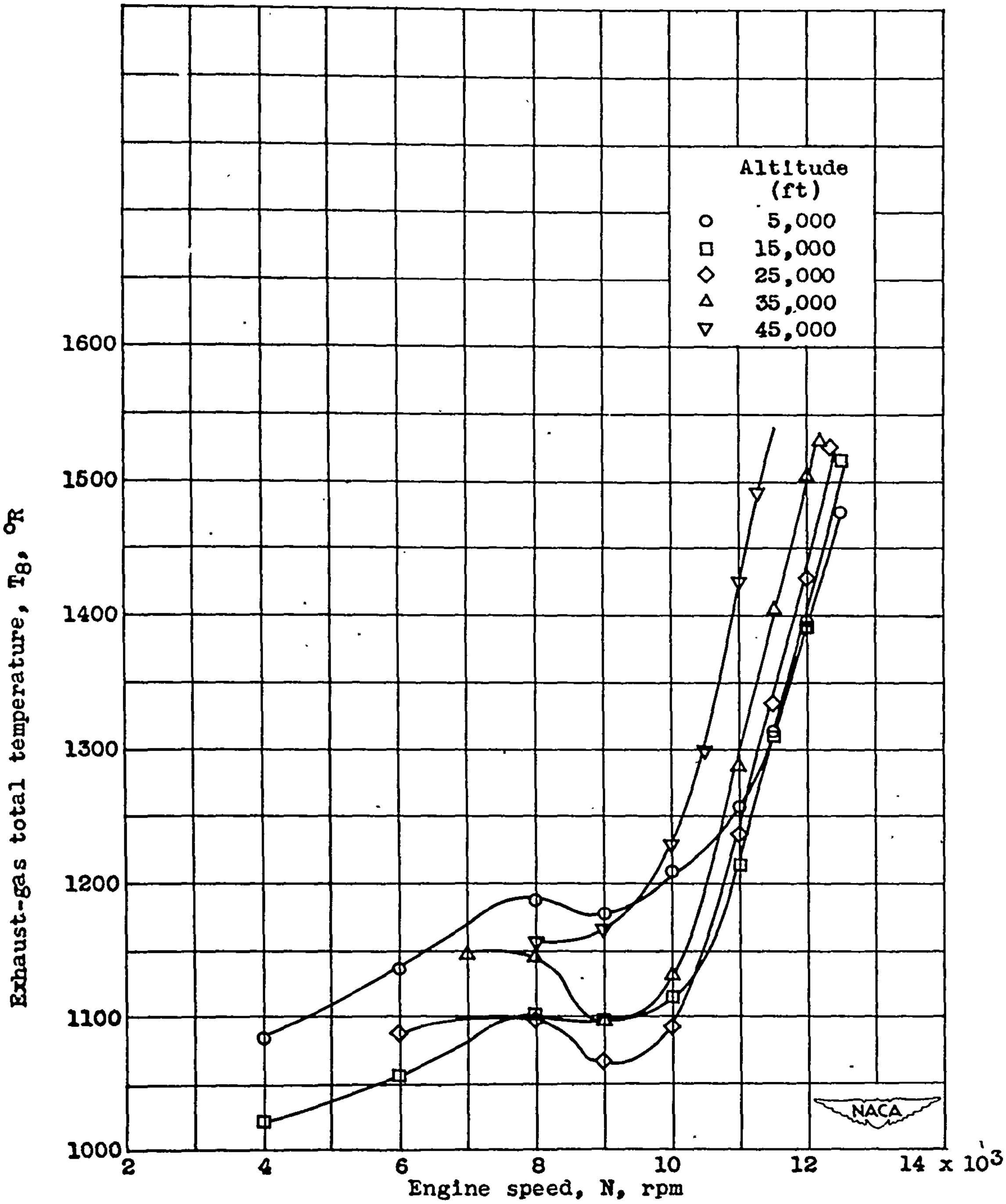
(e) Specific fuel consumption based on net thrust.

Figure 4. - Continued. Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



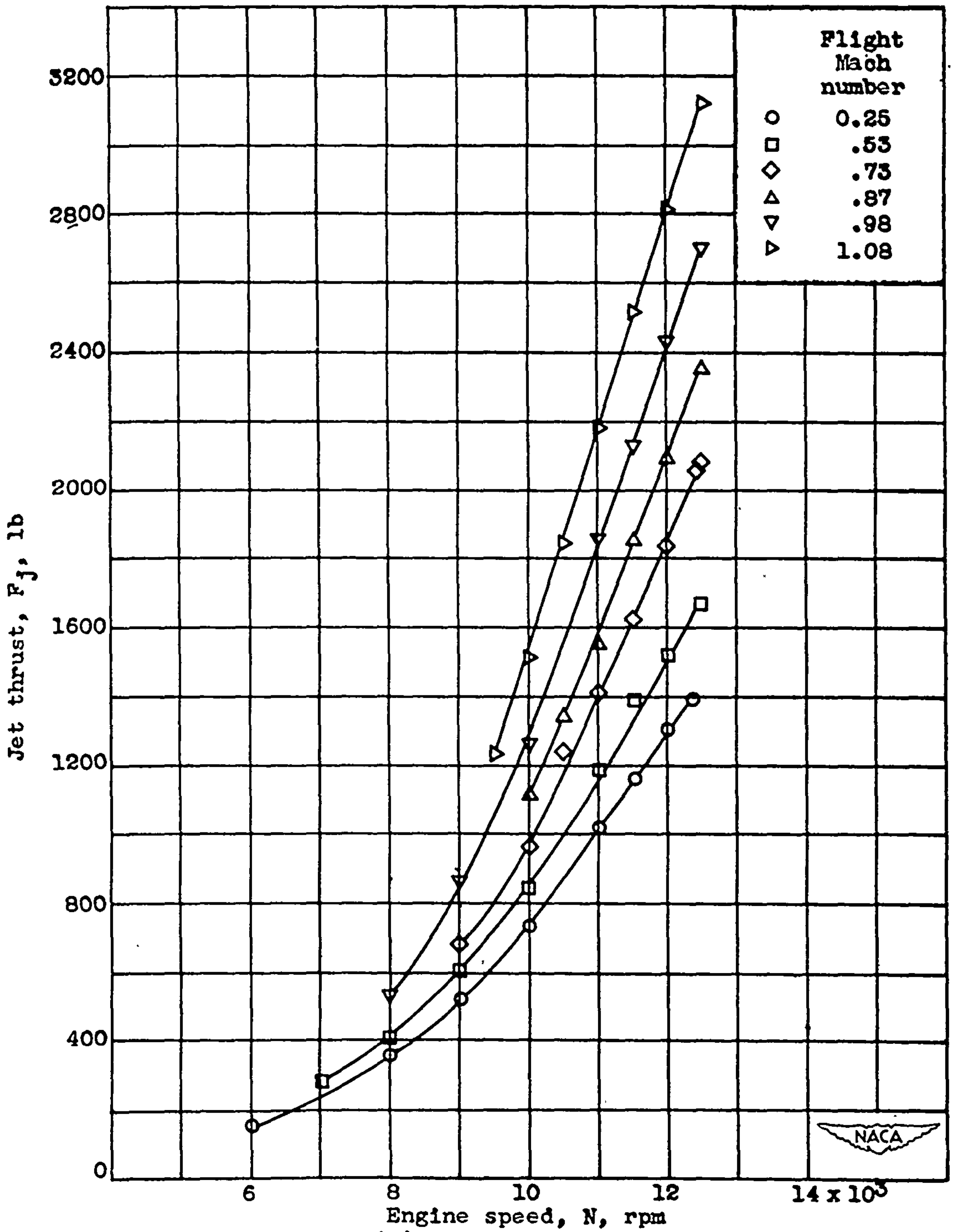
(f) Fuel-air ratio.

Figure 4. - Continued. Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



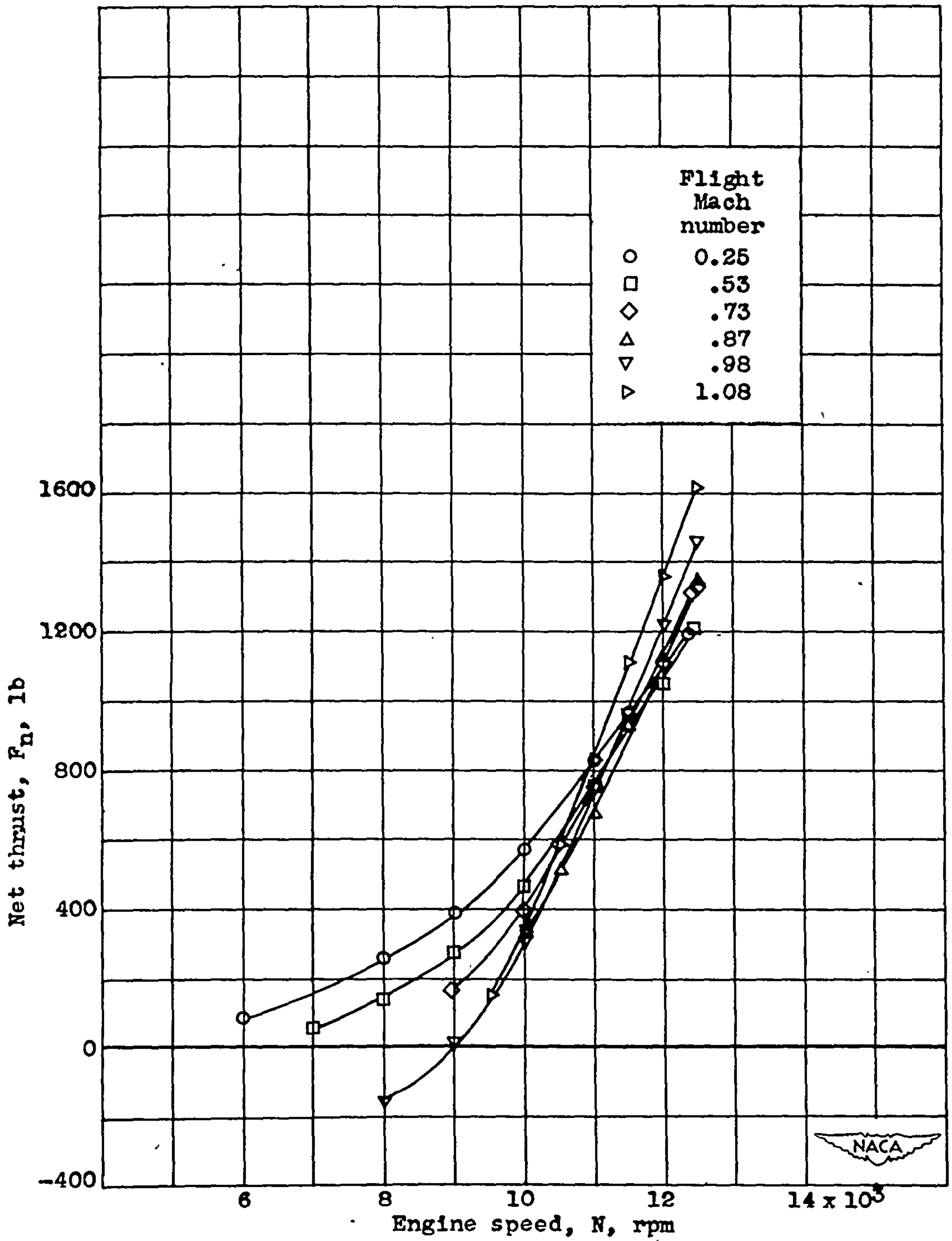
(g) Exhaust-gas total temperature.

Figure 4. - Concluded. Effect of altitude on variation of turbojet engine performance with engine speed at flight Mach number of 0.25.



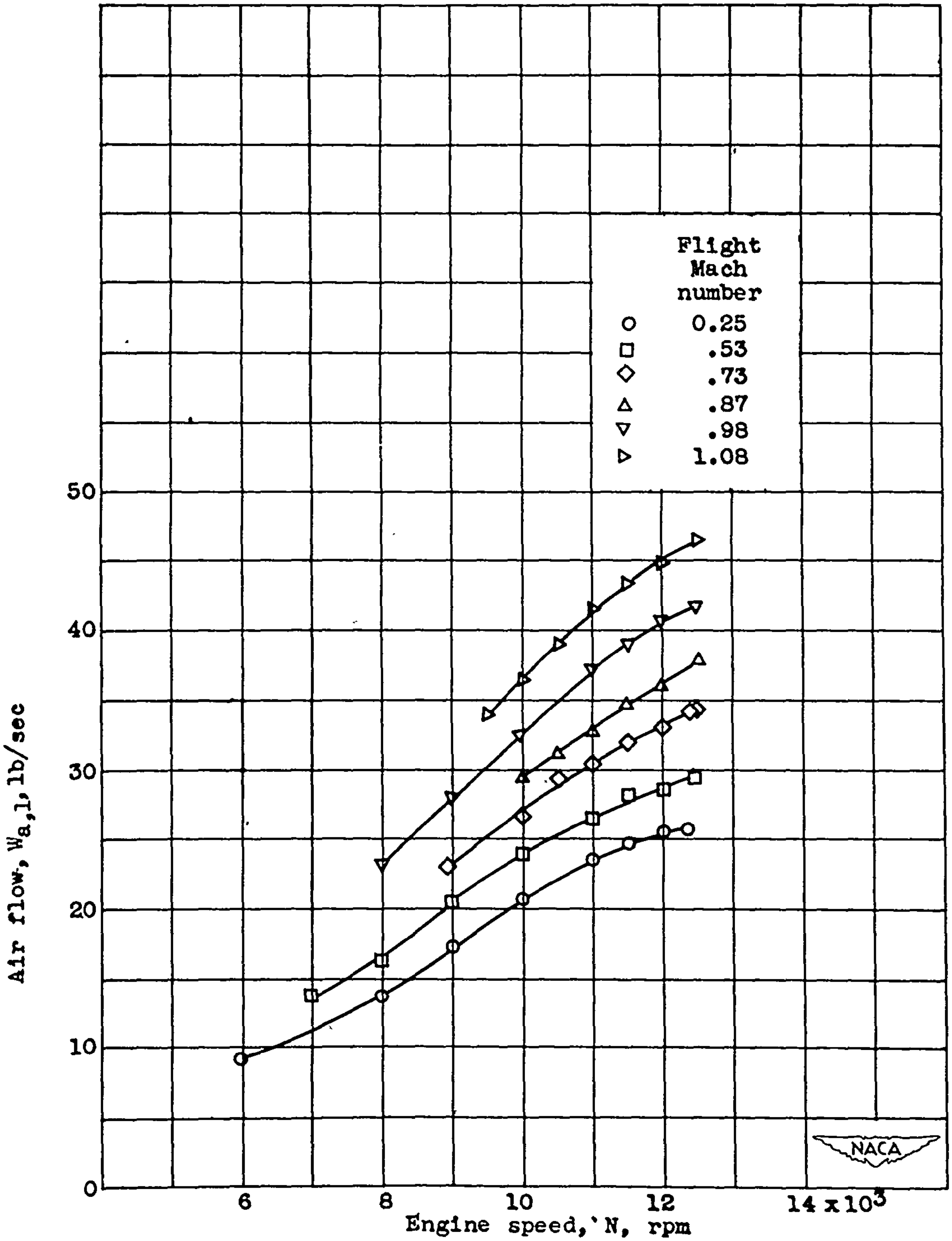
(a) Jet thrust.

Figure 5. - Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



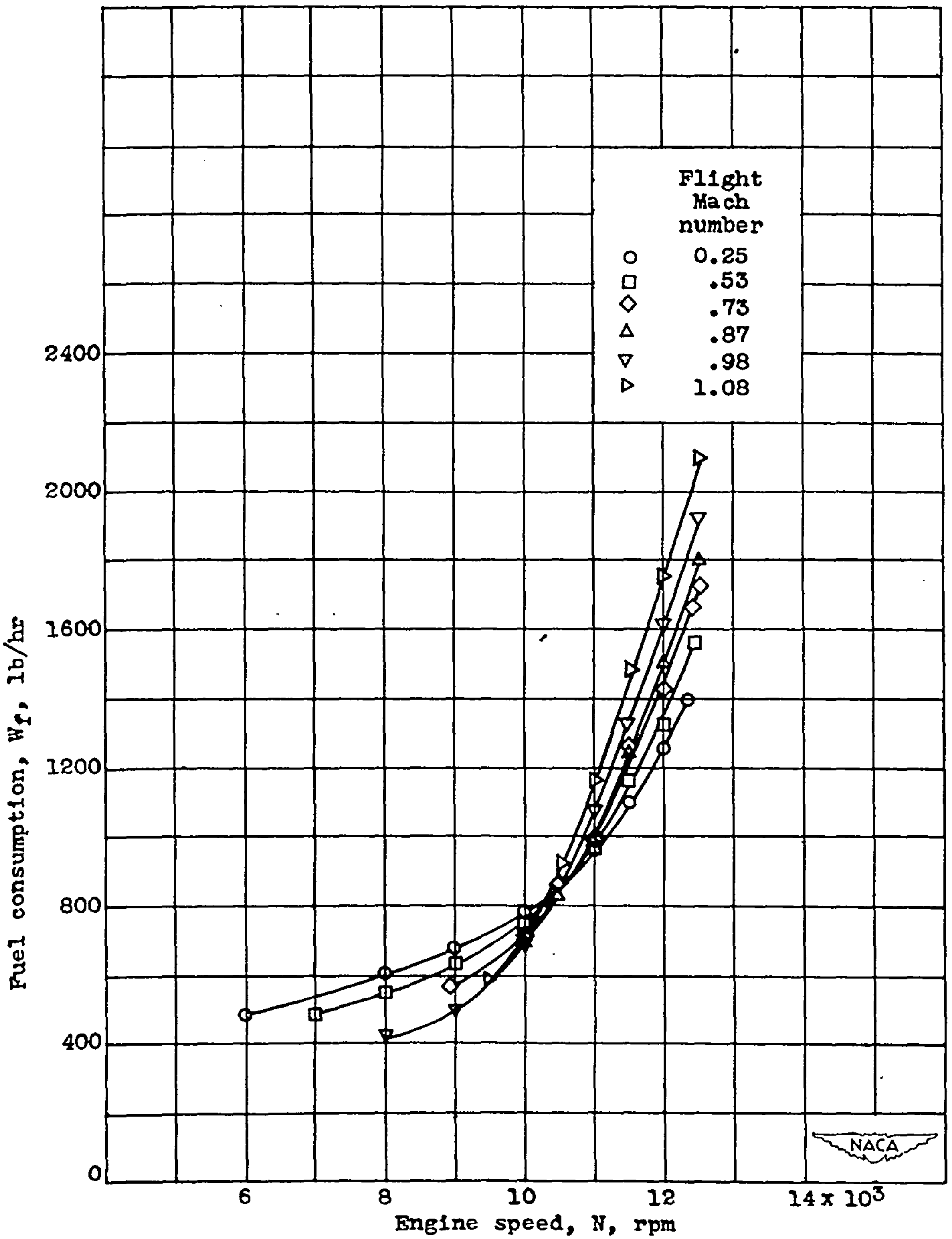
(b) Net thrust.

Figure 5. - Continued. Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



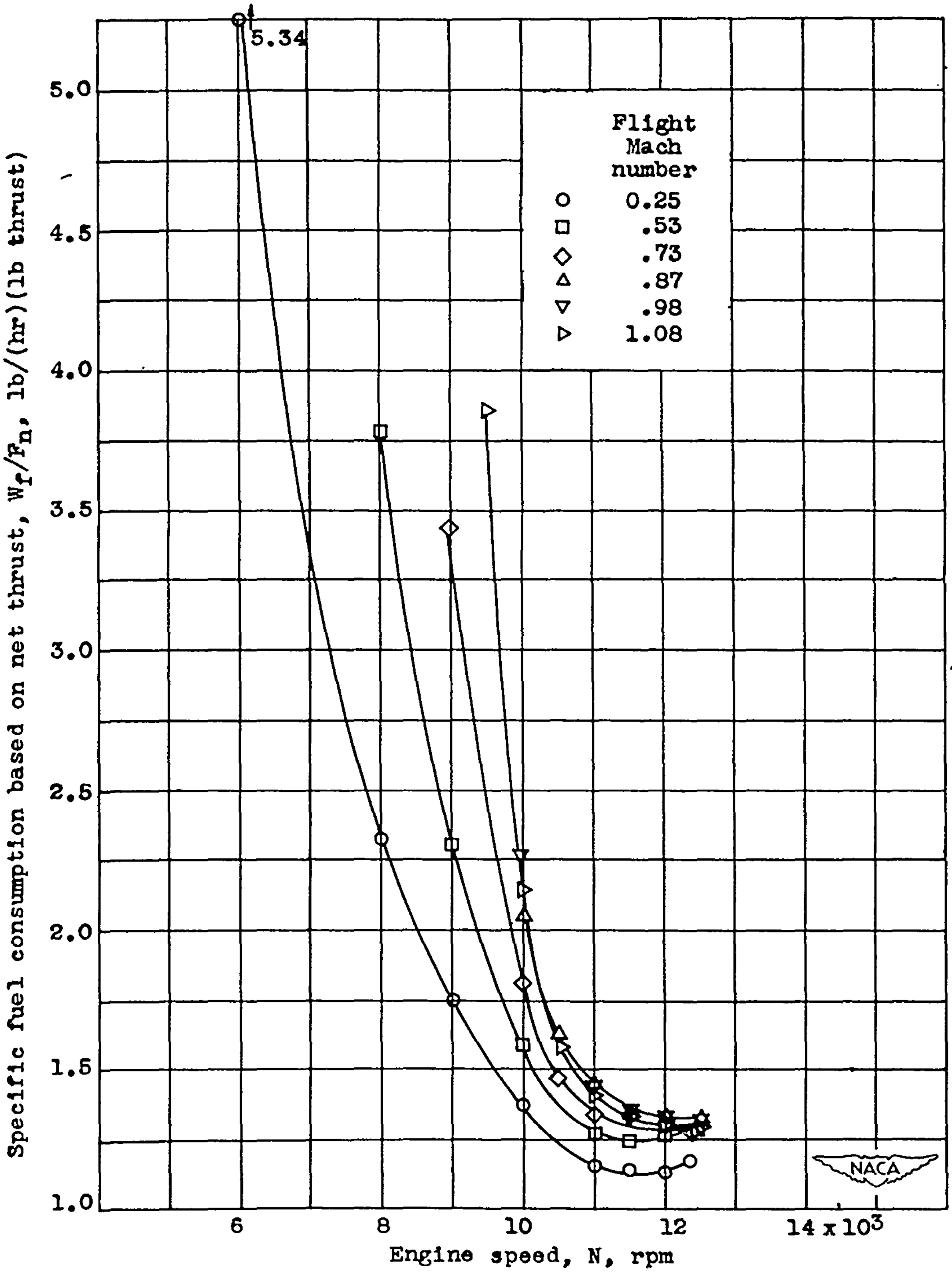
(c) Air flow.

Figure 5. - Continued. Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



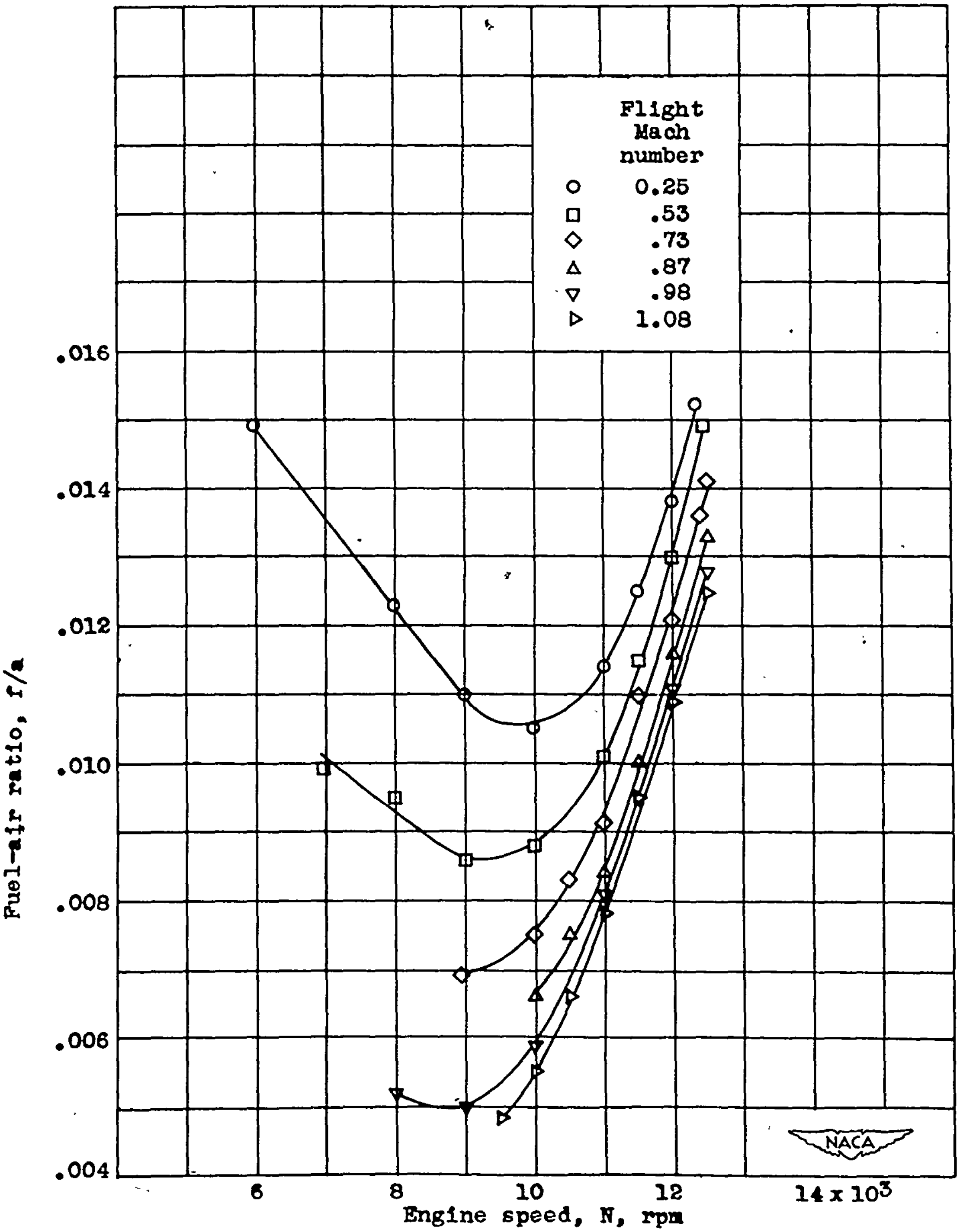
(d) Fuel consumption.

Figure 5. - Continued. Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



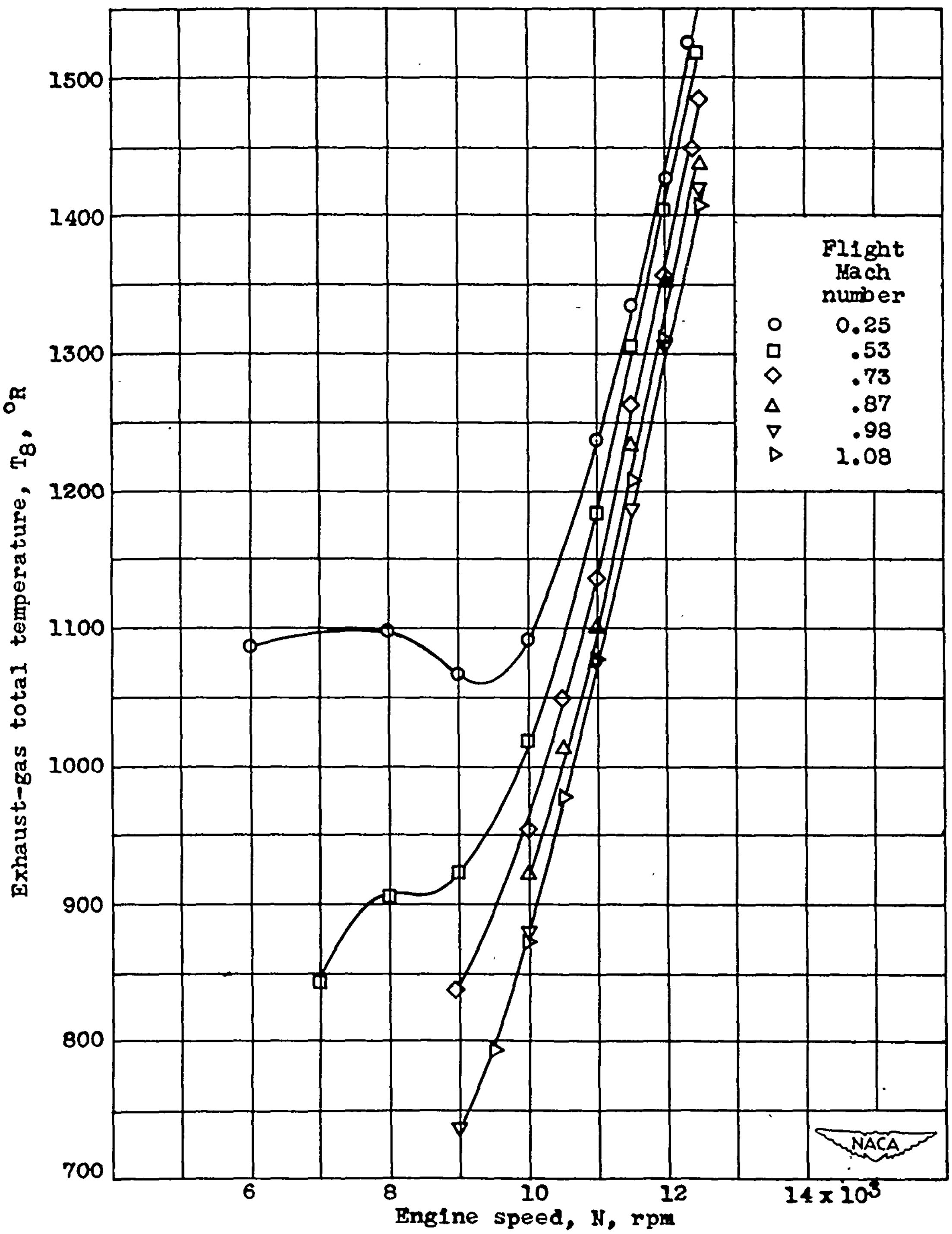
(e) Specific fuel consumption based on net thrust.

Figure 5. - Continued. Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



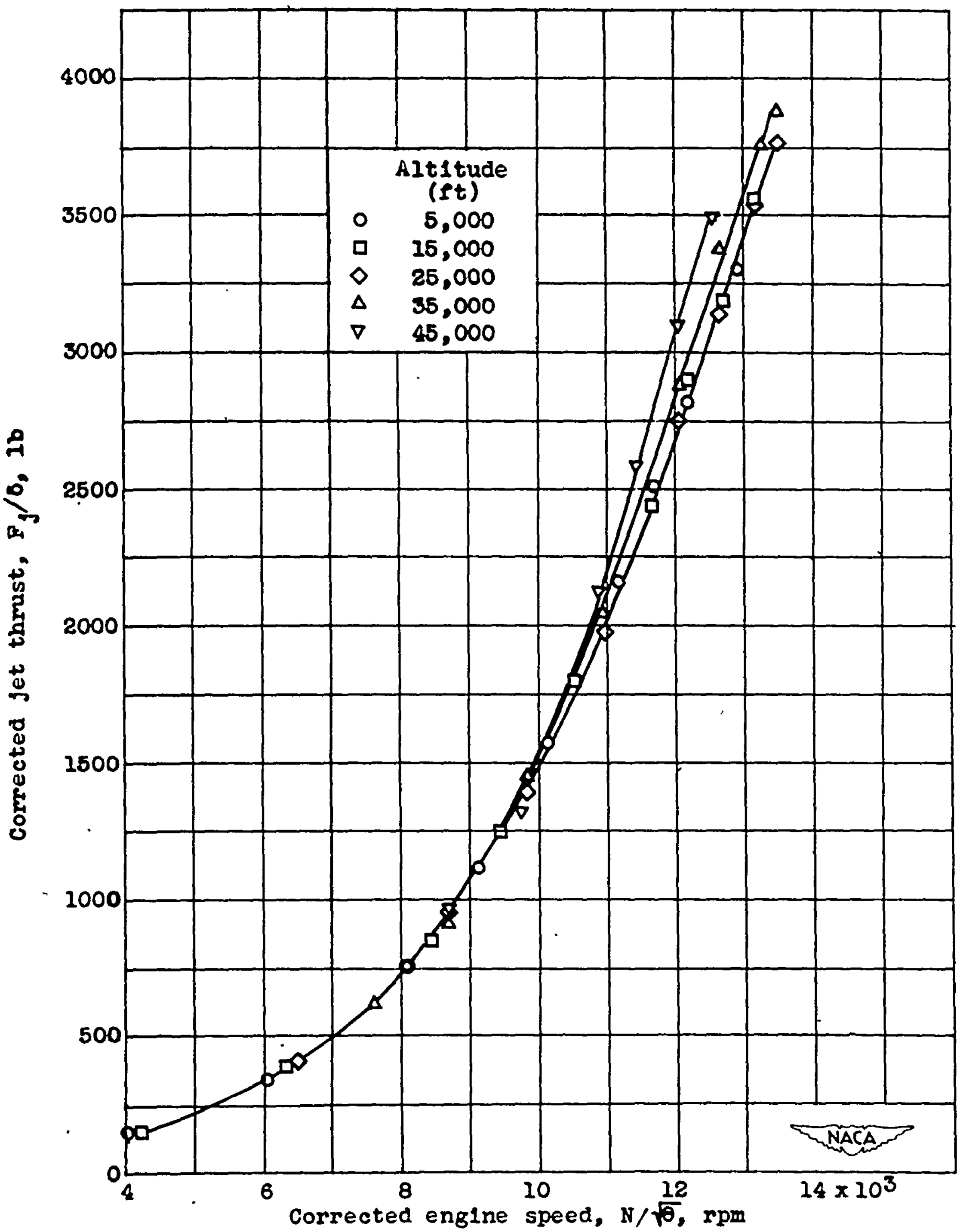
(f) Fuel-air ratio.

Figure 5. - Continued. Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



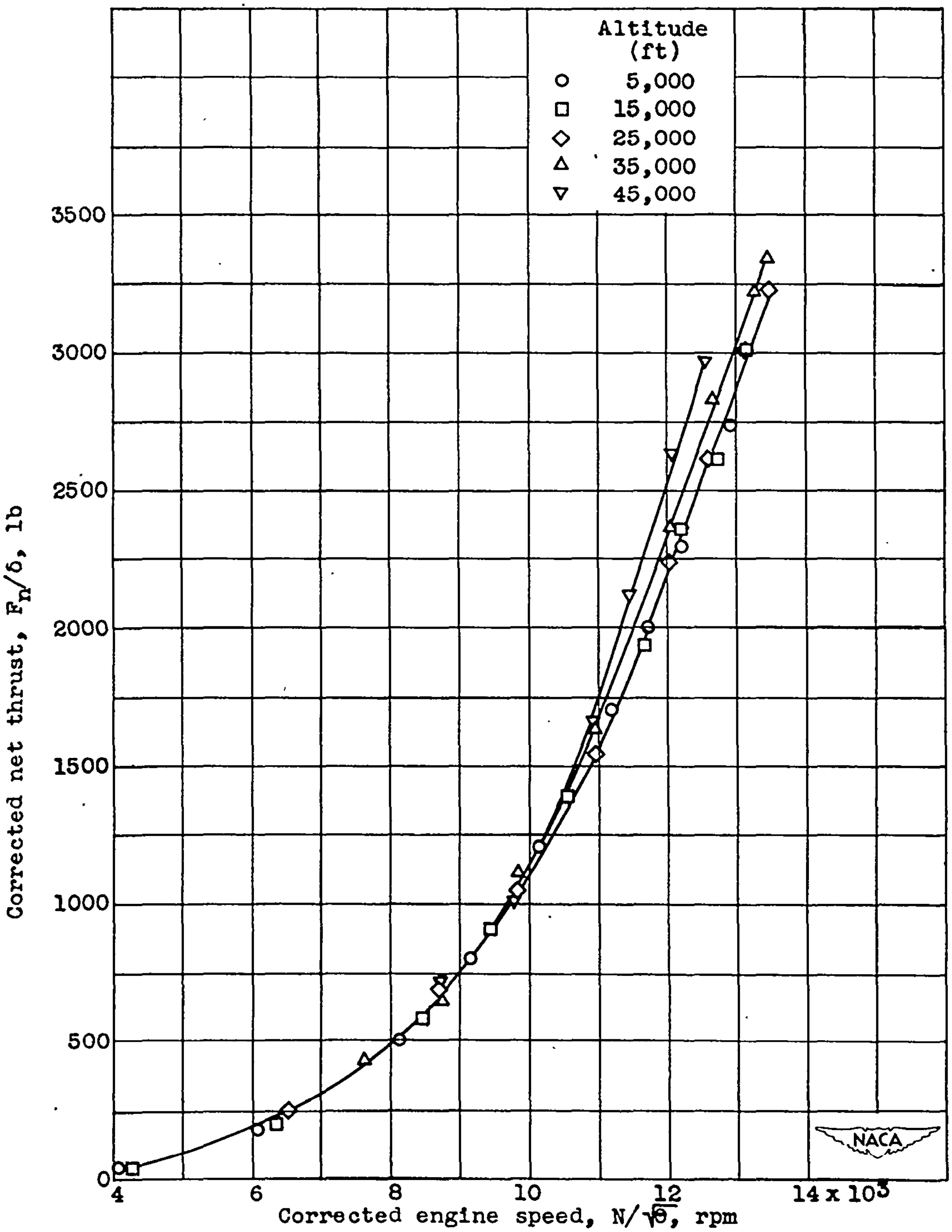
(g) Exhaust-gas total temperature.

Figure 5. - Concluded. Effect of flight Mach number on variation of turbojet engine performance with engine speed at altitude of 25,000 feet.



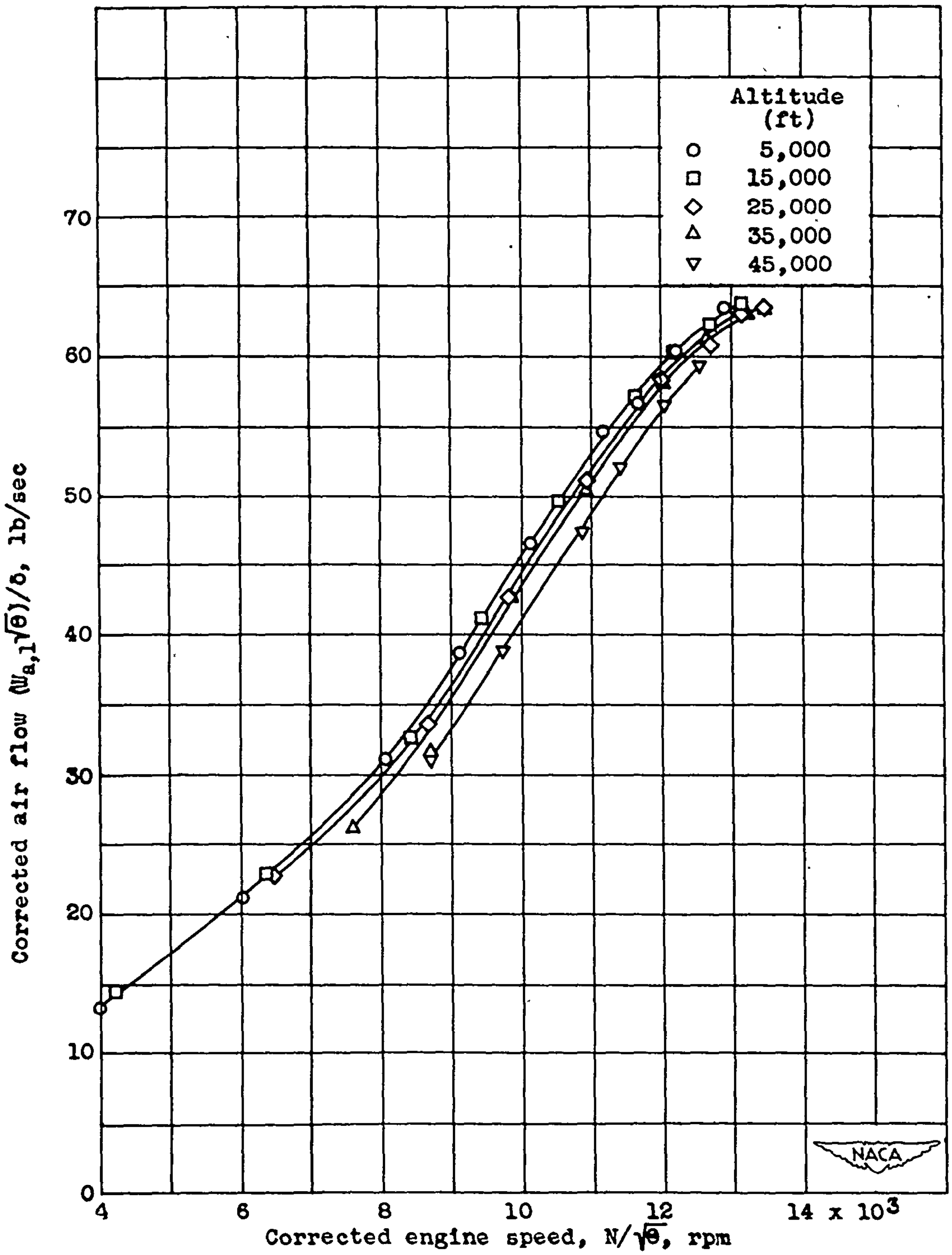
(a) Corrected jet thrust.

Figure 6. - Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



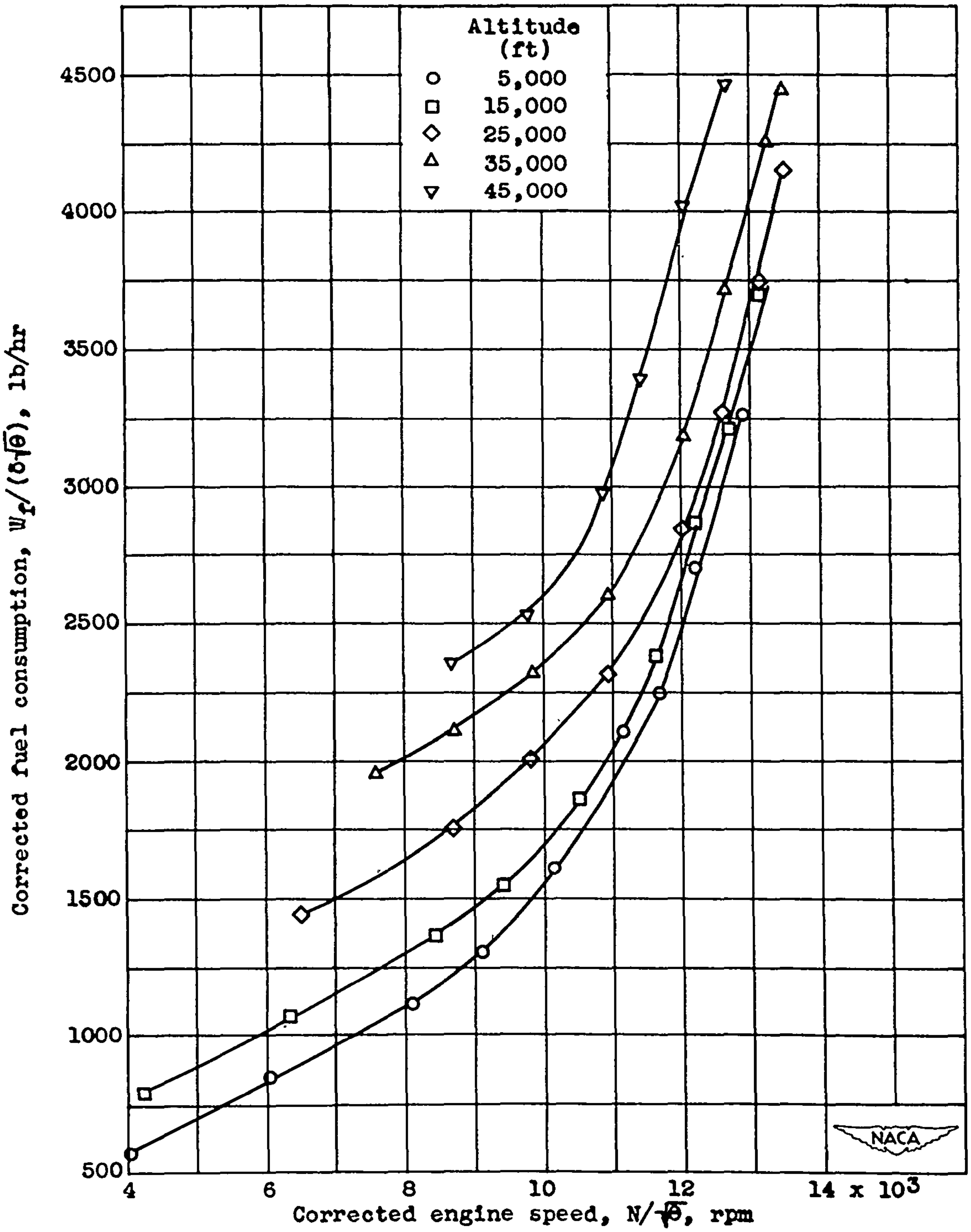
(b) Corrected net thrust.

Figure 6. - Continued. Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



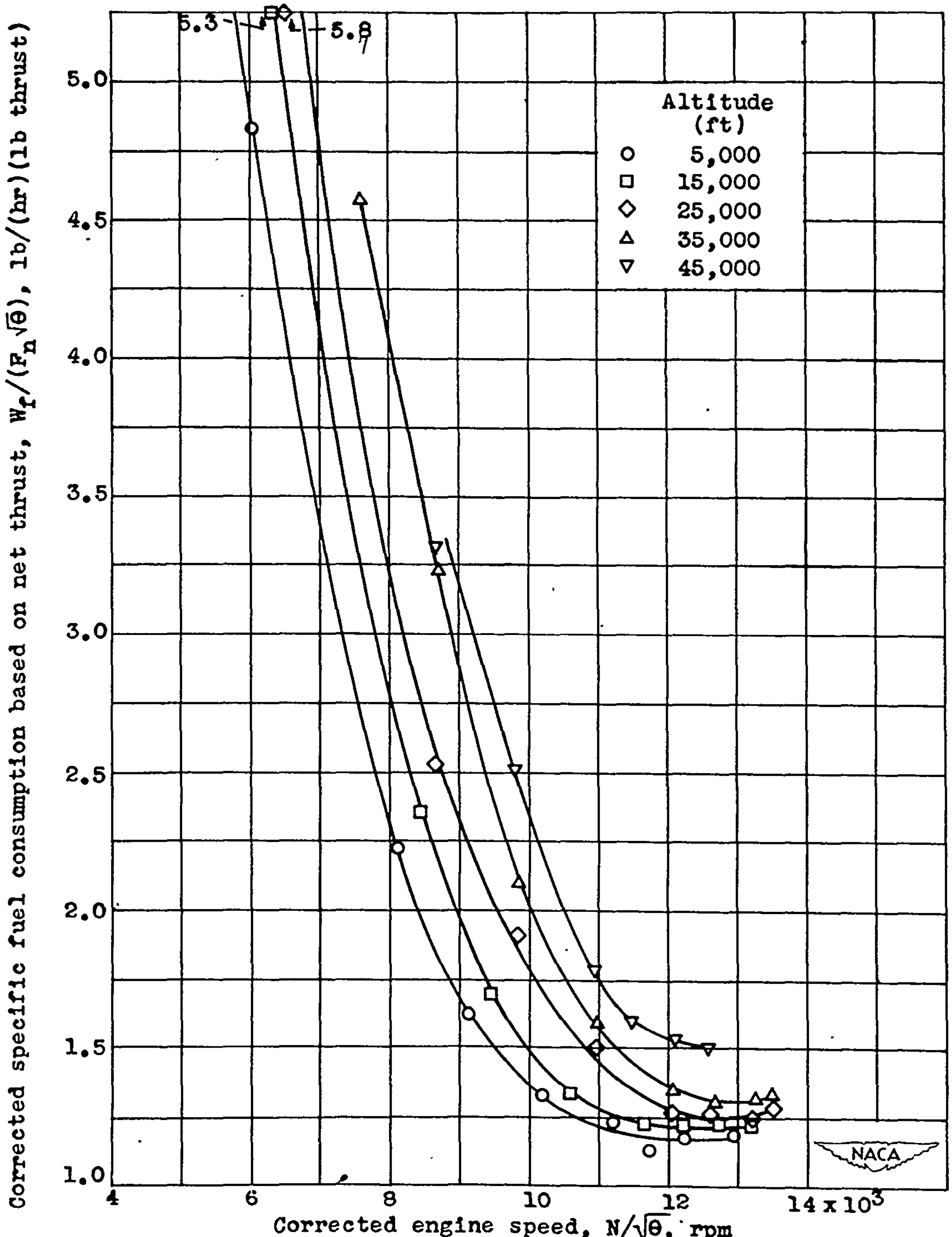
(c) Corrected air flow.

Figure 6. - Continued. Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



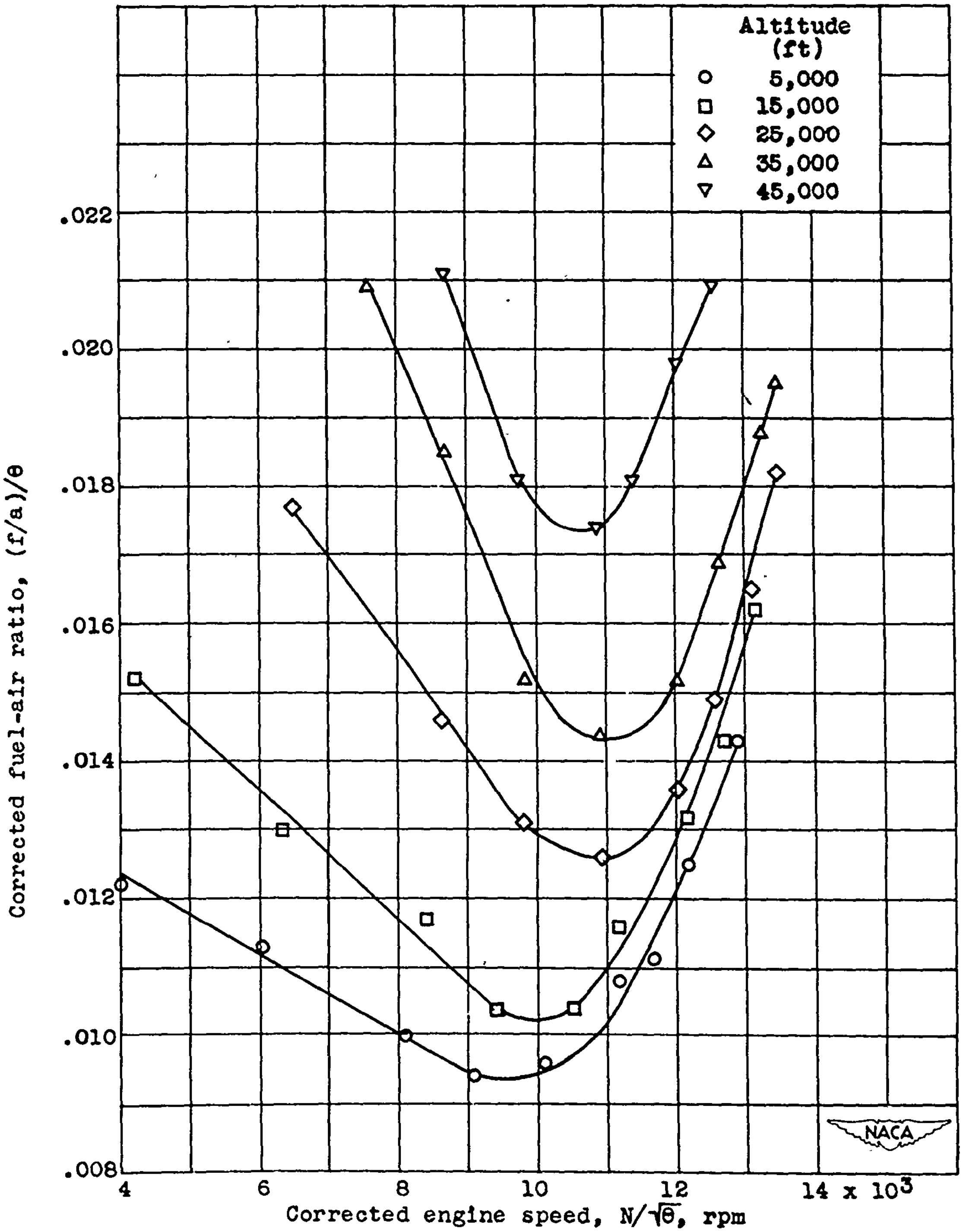
(d) Corrected fuel consumption.

Figure 6. - Continued. Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



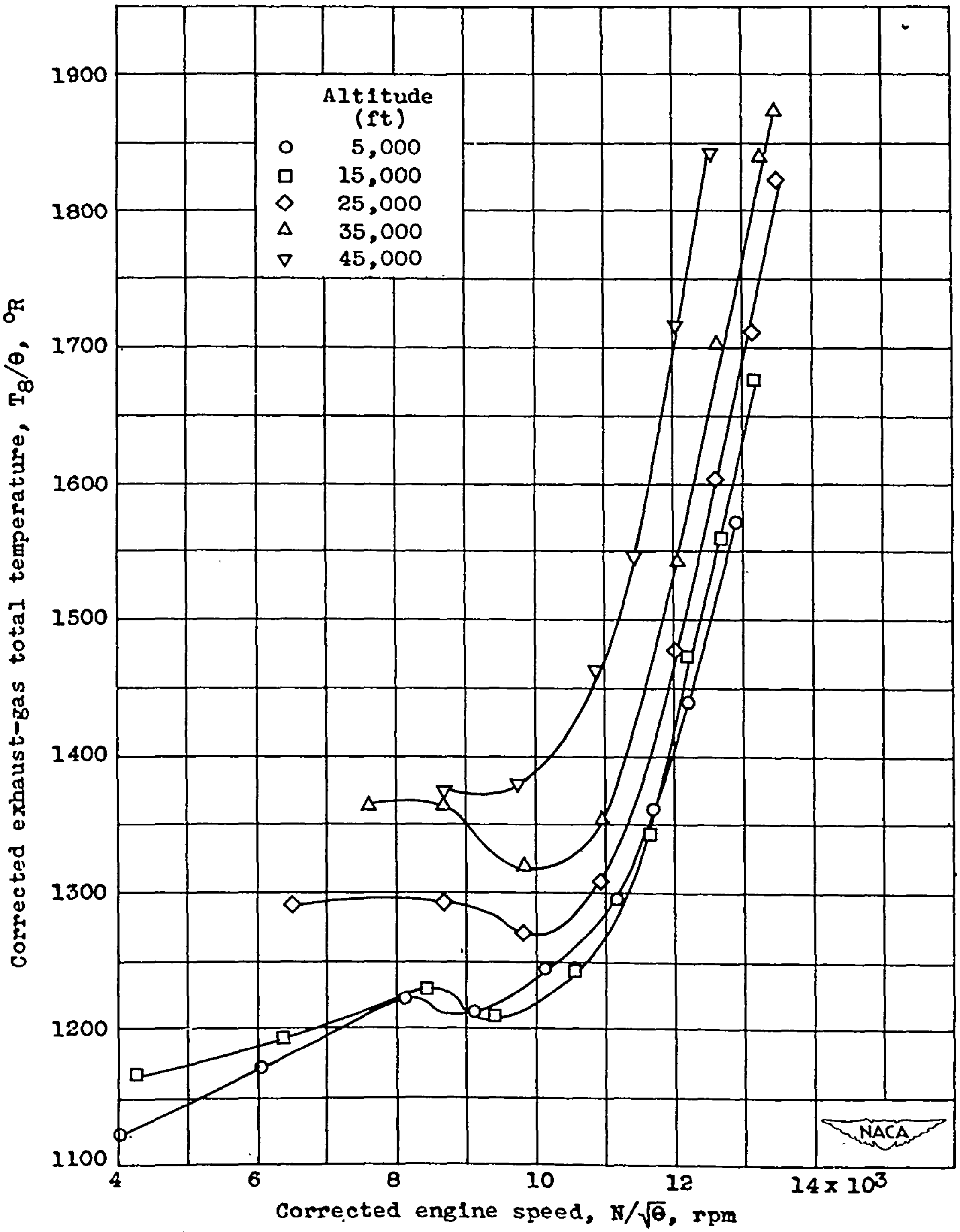
(e) Corrected specific fuel consumption based on net thrust.

Figure 6. - Continued. Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



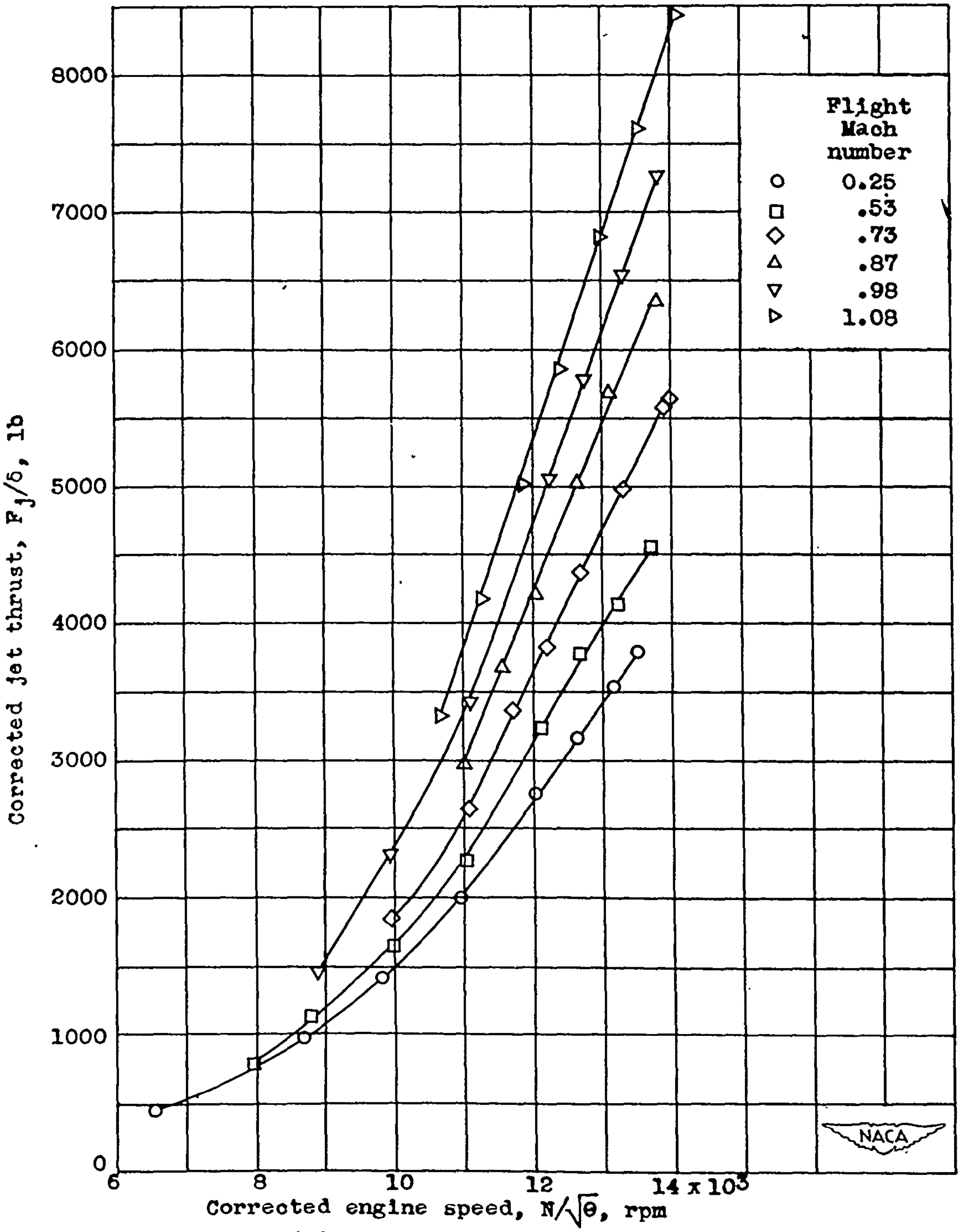
(f) Corrected fuel-air ratio.

Figure 6. - Continued. Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



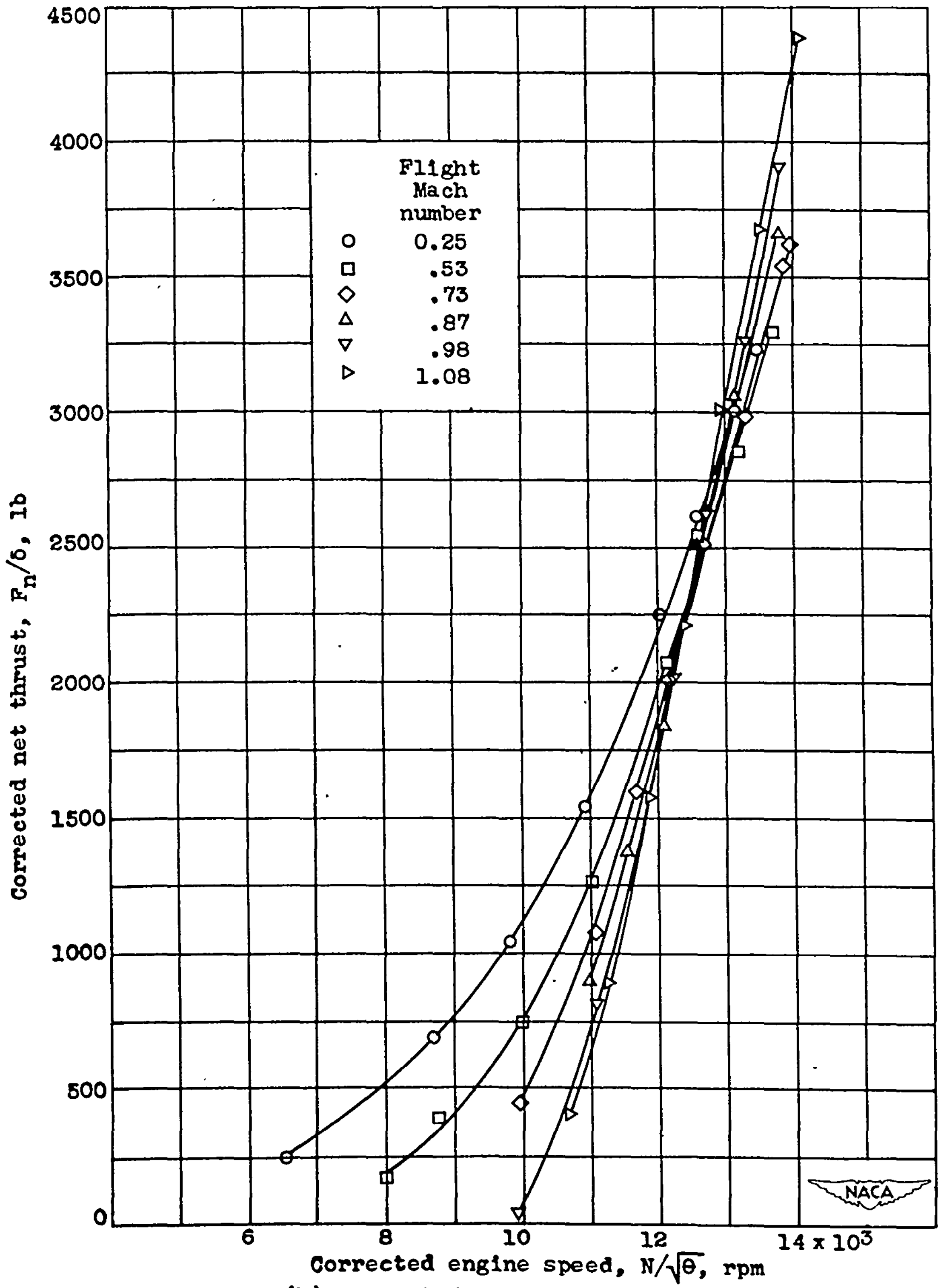
(g) Corrected exhaust-gas total temperature.

Figure 6. - Concluded. Effect of altitude on variation of generalized turbojet engine performance with corrected engine speed at flight Mach number of 0.25.



(a) Corrected jet thrust.

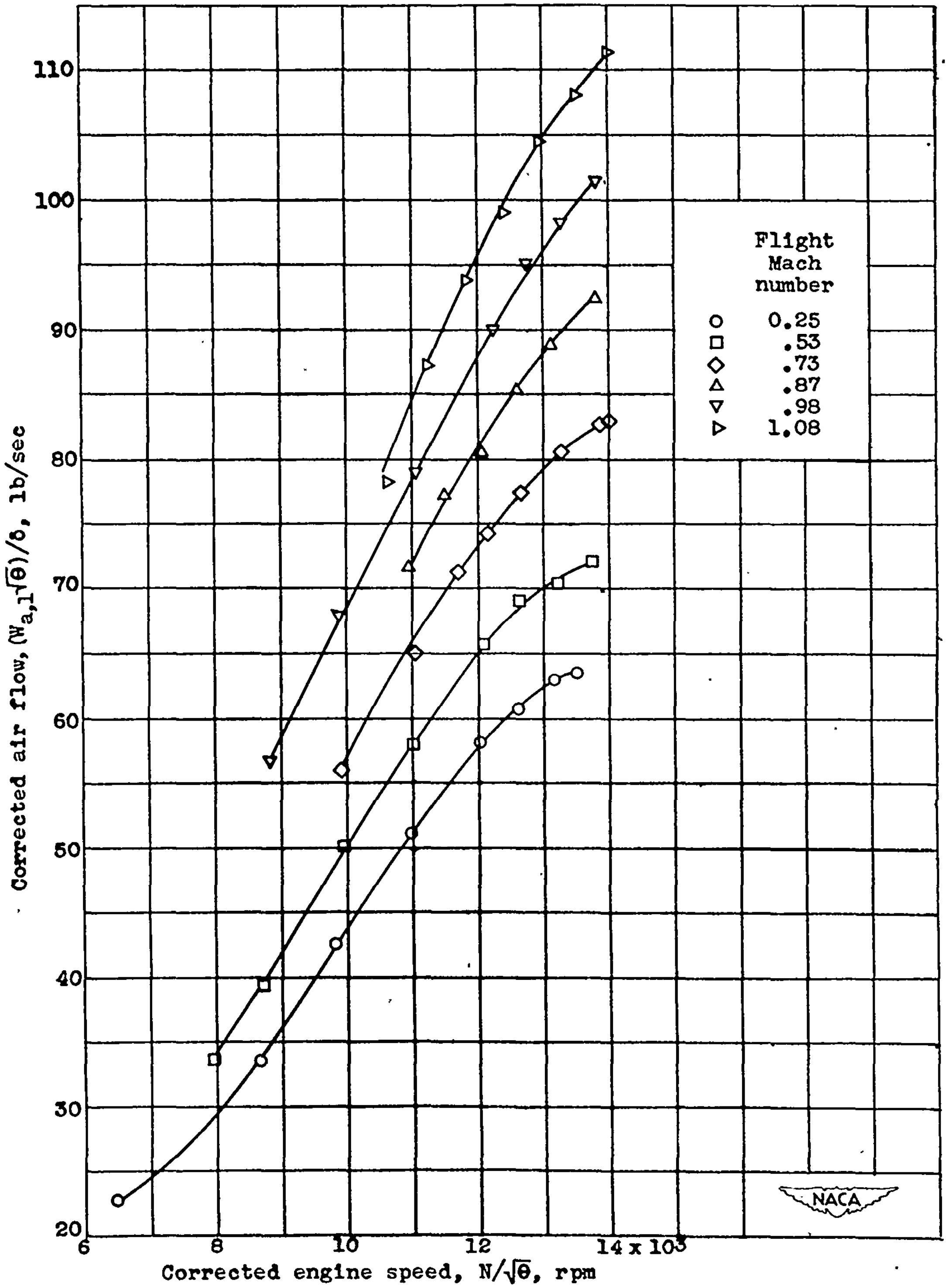
Figure 7. - Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.



(b) Corrected net thrust.

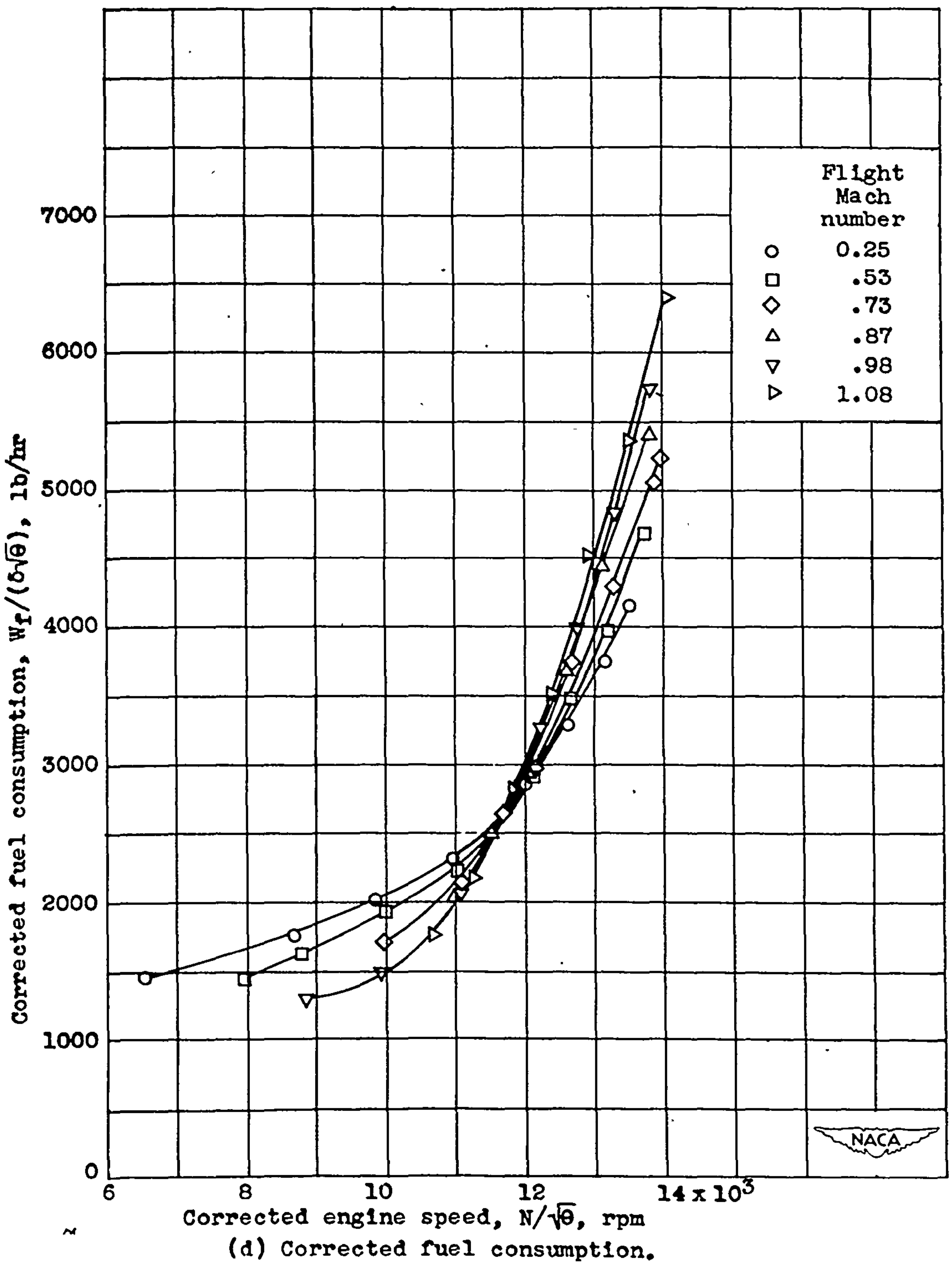
Figure 7. - Continued. Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.

[redacted]



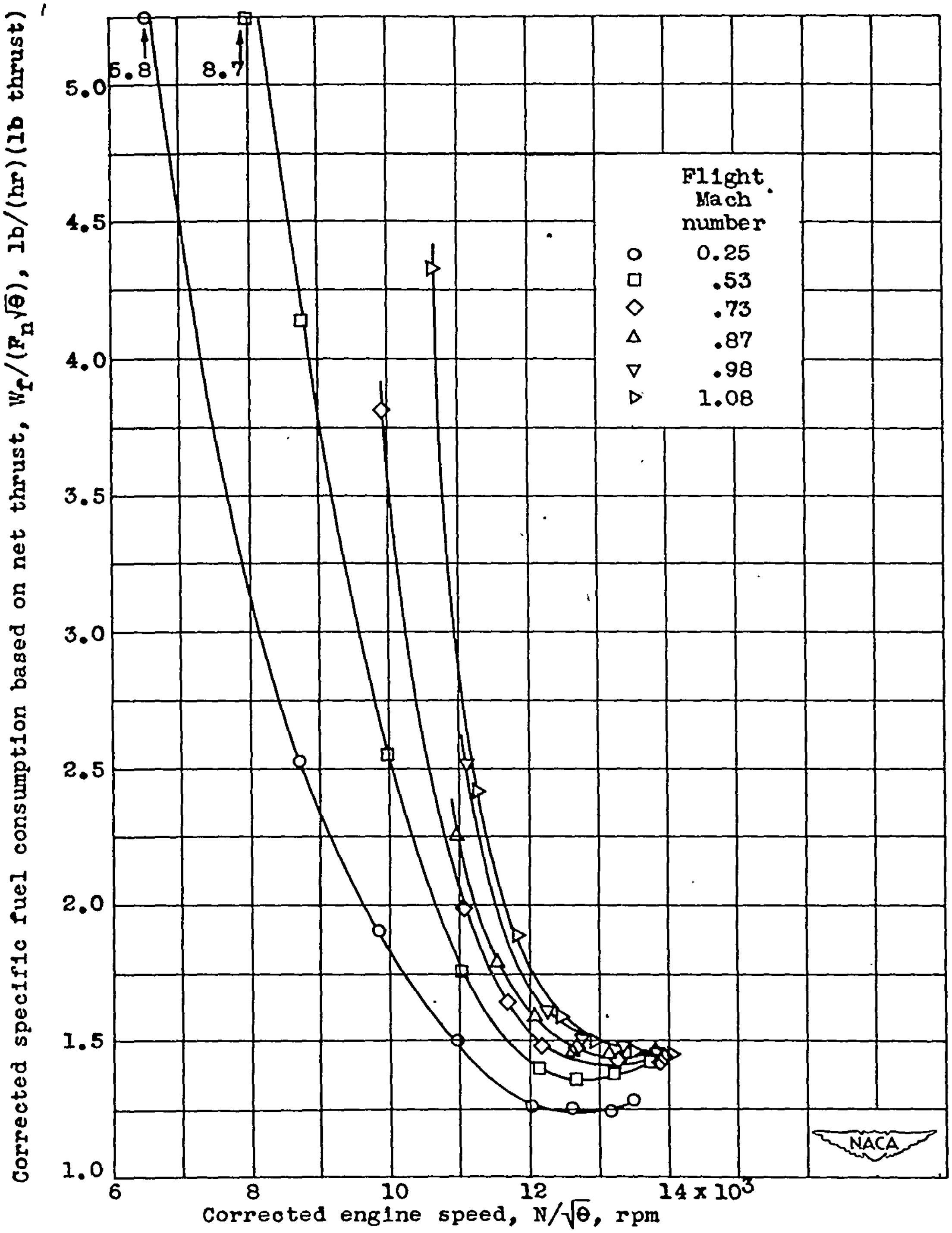
(c) Corrected air flow.

Figure 7. - Continued. Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.



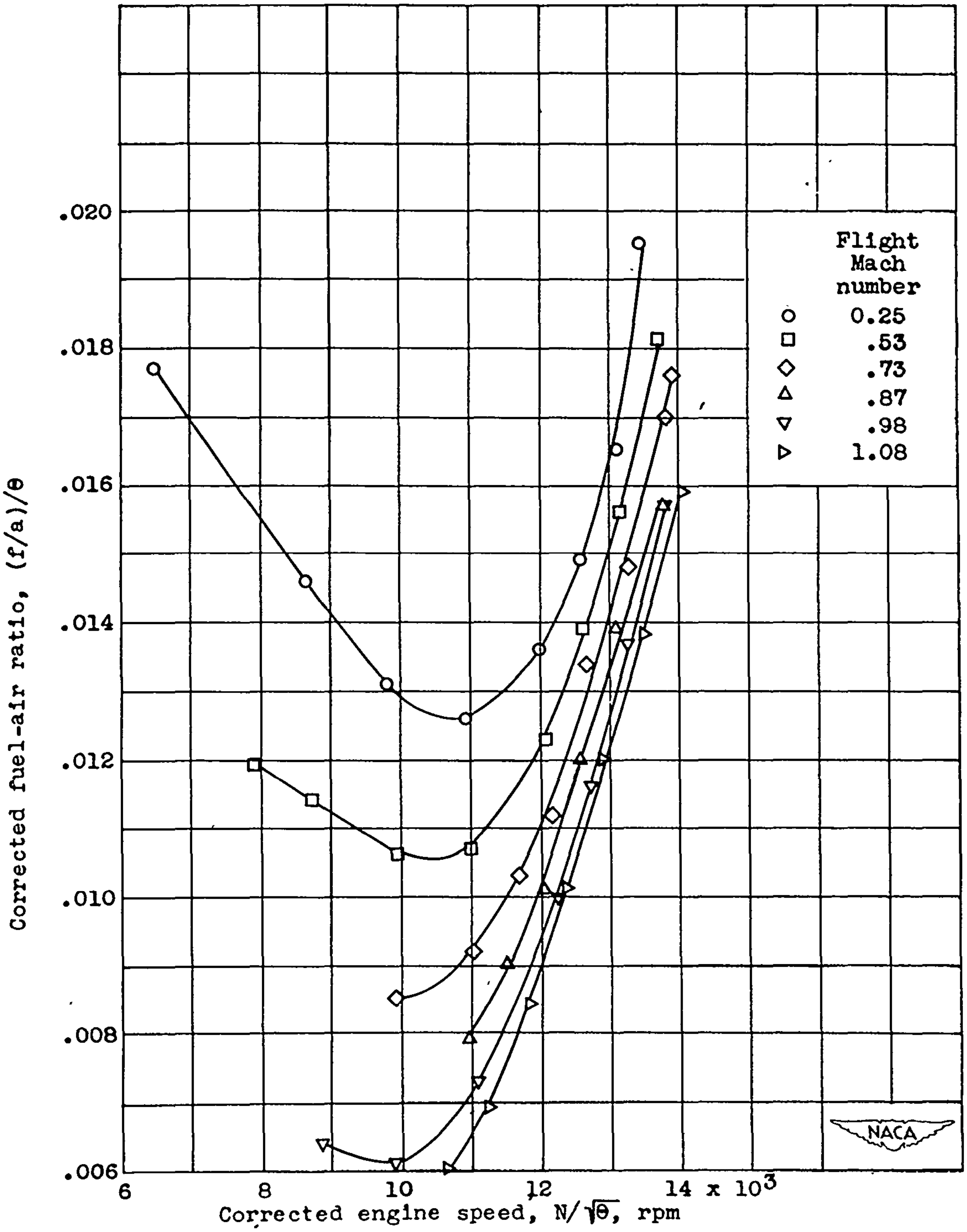
(d) Corrected fuel consumption.

Figure 7. - Continued. Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.



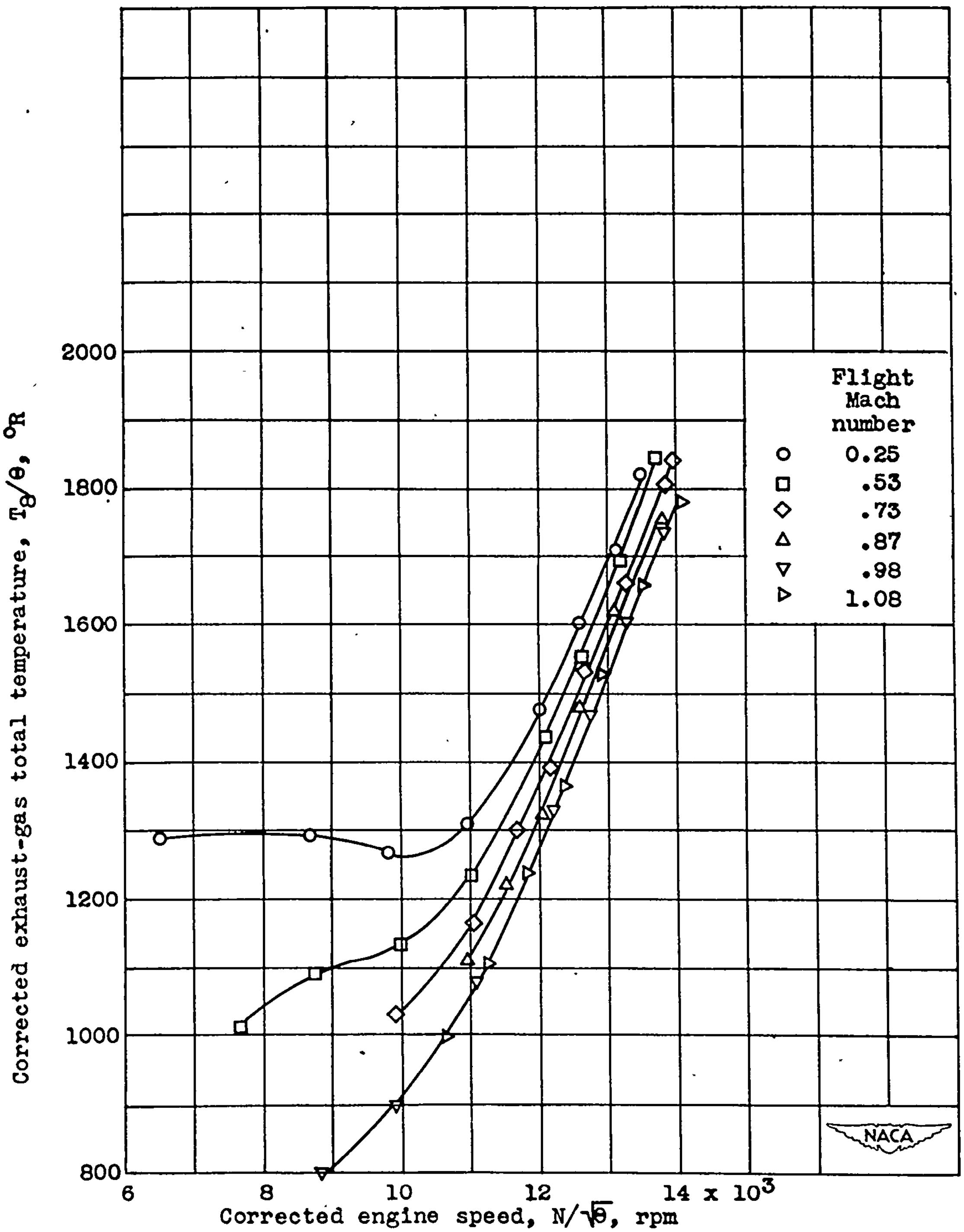
(e) Corrected specific fuel consumption based on net thrust.

Figure 7. - Continued. Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.



(f) Corrected fuel-air ratio.

Figure 7. - Continued. Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.



(g) Corrected exhaust-gas total temperature.

Figure 7. - Concluded. Effect of flight Mach number on variation of generalized turbojet engine performance with corrected engine speed at altitude of 25,000 feet.