[redacted]

RM No. SE7L22a

CLASSIFICATION CANCELLED 2 JAN 1948

Authority Naca Res. Abs. Date 12-14-55

RN-94

By ... 8-9-56 ... See ...

NACA

RESEARCH MEMORANDUM

for the

Bureau of Aeronautics, Navy Department

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

IV - PERFORMANCE OF MODIFIED COMPRESSOR

By H. Carl Thorman and David T. Dupree

Flight Propulsion Research Laboratory
Cleveland, Ohio

TECHNICAL EDITING WAIVED

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

[redacted]

CLASSIFIED

887

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

RESEARCH MEMORANDUM

for the

Bureau of Aeronautics, Navy Department

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

IV - PERFORMANCE OF MODIFIED COMPRESSOR

By H. Carl Thorman, and David T. Dupree

SUMMARY

The performance of the 11-stage axial-flow compressor, modified to improve the compressor-outlet velocity, in a revised X24C-4B turbojet engine is presented and compared with the performance of the compressor in the original engine. Performance data were obtained from an investigation of the revised engine in the NACA Cleveland altitude wind tunnel. Compressor performance data were obtained for engine operation with four exhaust nozzles of different outlet area at simulated altitudes from 15,000 to 45,000 feet, simulated flight Mach numbers from 0.24 to 1.07, and engine speeds from 4000 to 12,500 rpm. The data cover a range of corrected engine speeds from 4100 to 13,500 rpm, which correspond to compressor Mach numbers from 0.30 to 1.00.

Velocity distribution at the compressor outlet was more nearly uniform with the modified compressor than with the original compressor. A comparison of the performance of the modified and original compressors shows that at corrected engine speeds from 8000 to 13,000 rpm the corrected air flow was approximately 2 percent less and the compressor efficiency was approximately 2 percent greater for the modified compressor than for the original compressor. For these operating conditions, compressor pressure ratios of the two compressors were approximately the same. Operating lines for the modified compressor fell on the high air-flow side of the maximum-efficiency region. The highest compressor efficiency obtained in this investigation was 86.5 percent. At a given compressor pressure ratio and corrected engine speed, an increase in altitude reduced the corrected air flow. At a given compressor pressure ratio and

[redacted]

corrected air flow, an increase in altitude reduced the compressor efficiency. An increase in altitude caused the compressor operating line based on corrected air flow to shift to higher compressor pressure ratios. Increasing the flight Mach number caused a reduction in compressor efficiency and compressor pressure ratio at corrected air flows of less than 50 pounds per second, and reduced compressor pressure ratio at any compressor Mach number or corrected engine speed.

INTRODUCTION

Performance and operational characteristics of the X24C-4B turbojet engine and its components have been determined in an investigation conducted in the NACA Cleveland altitude wind tunnel at the request of the Bureau of Aeronautics, Navy Department. Preliminary results from an investigation of the original engine, which include pressure and temperature distributions, engine performance, and compressor performance, are presented in references 1, 2, and 3, respectively.

After the investigation of the original engine, the compressor and the combustion chamber were modified by the manufacturer. Changes in the compressor were made in order to improve the velocity distribution at the compressor outlet and changes in the combustion chamber were made in order to improve the temperature distribution at the turbine inlet. Compressor-outlet velocity profiles for the original and modified compressors, performance of the modified compressor operating as an integral part of the revised engine, and a comparison of the performance of the original and modified compressors are presented herein.

Compressor performance data were obtained for a range of flight conditions through the operable speed range of the engine with each of four exhaust nozzles. Effects of variation in flight conditions on the compressor operating line, the compressor efficiency, and the compressor performance characteristics are graphically presented. Compressor performance data are also presented in tabular form.

ENGINE INSTALLATION AND COMPRESSOR

The revised engine was mounted in a wing section in the altitude wind tunnel in the same manner as the original engine (fig. 1). A description of the original engine and installation is given in reference 1. For this part of the investigation, refrigerated air was supplied from the tunnel make-up air system through a duct to the engine. A detailed description of the original compressor is given in reference 3. Instrumentation of the engine (fig. 2) was the same as described in reference 1.

In the revised configuration the compressor was modified by reducing the load on the blades of the eleventh rotor stage. The blades were twisted 2° at the midspan and 6° at the tip in the direction of reduced angle of attack. This change was made in order to obtain a more nearly uniform velocity distribution at the compressor outlet.

The combustion chamber in the modified engine differed from the original combustion chamber in that the shape and the location of air inlet holes were changed to improve mixing in the secondary combustion zone. The total area of the air inlet holes, however, was the same as in the original combustion chamber. Improved compressor-outlet velocity distribution permitted reduction of the blocking area of the screens at the combustion-chamber inlet.

Four exhaust nozzles having outlet areas of 170.6, 188.7, 231.5, and 330.4 square inches were used. The standard configuration of the revised engine included the exhaust nozzle with an outlet area of 170.6 square inches. This outlet area was chosen in order to obtain limiting turbine-outlet temperature at maximum engine speed for static sea-level conditions.

PROCEDURE

Data were obtained at simulated altitudes from 15,000 to 45,000 feet with a simulated flight Mach number of 0.53 and at a simulated altitude of 25,000 feet with simulated flight Mach numbers from 0.24 to 1.07, which correspond to ram-pressure ratios from 1.04 to 2.05. Ram-pressure ratios were varied by regulation of the total pressure at the compressor inlet while the static pressure in the tunnel test section corresponding to the desired altitude was maintained. Flight Mach numbers were calculated on the basis of a total-pressure recovery at the compressor inlet of 100 percent.

Complete compressor performance data were obtained at each altitude and flight Mach number from operation of the engine at engine speeds from 4000 to 12,500 rpm with each of the four exhaust nozzles. The data cover a range of corrected engine speeds from approximately 4100 rpm to 13,500 rpm, which correspond to compressor Mach numbers from 0.30 to 1.00. Methods of calculating compressor performance and compressor-outlet velocity are described in reference 3.

SYMBOLS

M_c compressor Mach number

M_0 flight Mach number 887

N engine speed, rpm

P total pressure, pounds per square foot absolute

P_2/p_0 ram-pressure ratio

P_4/P_2 compressor pressure ratio

p static pressure, pounds per square foot absolute

p_3/p_2 compressor stator-stage static-pressure ratio

T_i indicated temperature, $^{\circ}R$

V velocity, feet per second

W_a air flow, pounds per second

δ ratio of compressor-inlet absolute total pressure to NACA standard sea-level absolute pressure

η_c compressor efficiency, percent

θ ratio of compressor-inlet absolute total temperature to NACA standard sea-level absolute temperature

Subscripts:

0 free-stream conditions

1 cowl inlet

2 compressor inlet

3 compressor stator stages

4 compressor outlet

Stations to which the numerical subscripts refer are shown in figure 2.

The following parameters are used to generalize the results to NACA standard atmospheric conditions at sea level:

$(W_a\sqrt{\theta})/\delta$ corrected air flow, pounds per second

$N/\sqrt{\theta}$ corrected engine speed, rpm

RESULTS AND DISCUSSION

Method of Presentation

The correction factors δ and θ used to generalize the compressor performance data account only for variations in total temperature and total pressure at the compressor inlet for a constant flight Mach number. In the development of the correction factors (reference 4), component efficiencies have been assumed constant. Variations in compressor efficiency therefore cause variations in the generalized results.

For each combination of altitude, flight Mach number, and exhaust-nozzle-outlet area, a compressor operating line was obtained. Compressor operating lines are presented in two forms: (1) the relation of compressor pressure ratio to corrected air flow, and (2) the relation of compressor pressure ratio to compressor Mach number and corrected engine speed. Compressor efficiency is presented as a function of corrected air flow. The compressor characteristics for the range of exhaust-nozzle-outlet areas investigated are presented as the relation of compressor pressure ratio to corrected air flow along lines of constant corrected engine speed and contours of constant compressor efficiency. The characteristic curves were constructed from operating lines and efficiency curves for the four exhaust nozzles at given flight conditions. The range of characteristics did not extend to the region of compressor stall. Performance data for the modified compressor are presented in table I.

Velocity Profile at Compressor Outlet

Typical velocity profiles across the compressor-outlet annulus of the modified and original compressors are compared in figure 3. The modification improved the compressor-outlet velocity distribution by increasing the velocity near the inner wall at all engine speeds and decreasing the velocity near the outer wall at engine speeds greater than 9000 rpm. The greatest improvement was obtained at an engine speed of 11,500 rpm. For both compressors the location of the peak velocity was moved toward the outer wall by increases in engine speed. At any given engine speed, however, the peak velocity was not so near the outer wall in the modified compressor as in the original compressor.

Compressor Operating Lines

Effect of altitude. - An increase in altitude so shifted the operating line based on corrected air flow that the compressor pressure ratio increased at any given corrected air flow (fig. 4(a)). This effect was very small with an increase in altitude from 15,000 to 25,000 feet. The operating line based on compressor Mach number or corrected engine speed was unaffected by changes in altitude at compressor Mach numbers less than 0.75 (fig. 4(b)). At compressor Mach numbers between 0.75 and 0.85, the operating line was shifted to higher compressor pressure ratio only by a change in altitude from 35,000 to 45,000 feet. At compressor Mach numbers greater than 0.85, the operating line was shifted to higher compressor pressure ratios by any changes in altitude above 25,000 feet. The operating line was unaffected by changes in altitude from 15,000 to 25,000 feet. The altitude effect is analyzed in a later section of this report.

Effect of flight Mach number. - An increase in flight Mach number caused the operating line based on corrected air flow to shift to lower pressure ratios at corrected air flows lower than 55 pounds per second (fig. 5(a)). At corrected air flows greater than 55 pounds per second, no shift in operating line occurred when the flight Mach number exceeded 0.53. Any increase in flight Mach number shifted the operating line based on compressor Mach number or corrected engine speed to lower pressure ratios (fig. 5(b)).

Effect of exhaust-nozzle-outlet area. - An increase in exhaust-nozzle-outlet area so shifted the operating line that at a given corrected air flow, compressor Mach number, or corrected engine speed the compressor pressure ratio was reduced (fig. 6).

Compressor Efficiency

At corrected air flows greater than 20 pounds per second, an increase in altitude at a given corrected air flow caused a decrease in compressor efficiency (fig. 7(a)); however, the effect of increasing altitude from 15,000 to 25,000 feet was very small. At an altitude of 25,000 feet and at corrected air flows lower than 50 pounds per second, an increase in flight Mach number caused a decrease in compressor efficiency (fig. 7(b)). At corrected air flows greater than 50 pounds per second, the effect of flight Mach number on efficiency was not appreciable. An increase in exhaust-nozzle-outlet area caused a decrease in compressor efficiency, except at a corrected air flow of approximately 60 pounds per second where the effect was negligible (fig. 7(c)). Maximum efficiency at each flight condition and exhaust-nozzle-outlet area was reached in a range of corrected air flow from 50 to 55 pounds per second, corresponding to a range of corrected engine speed from 11,000 to 12,000 rpm. A maximum compressor efficiency of 86.5 percent occurred with an exhaust-nozzle-outlet area of 170.6 square inches at an altitude of 25,000 feet and a flight Mach number of 0.24 (fig. 7(b)).

Characteristic Curves

Compressor performance characteristics for several altitudes and a flight Mach number of 0.53 are presented in figures 8 and 9 for the range of engine operation with the four exhaust-nozzle-outlet areas used. At high corrected engine speeds the lines of constant corrected engine speed were nearly vertical (fig. 8). When the compressor pressure ratio was decreased by enlarging the exhaust-nozzle-outlet area, the corrected air flow remained approximately constant at corrected engine speeds greater then 10,500 rpm and increased slightly at corrected engine speeds lower than 10,500 rpm. An increase in altitude so shifted all the lines of constant corrected engine speed that at a given compressor pressure ratio and a given corrected engine speed the corrected air flow decreased. An increase in altitude caused a change in the compressor characteristics, which decreased the compressor efficiency for a given corrected air flow and compressor pressure ratio (fig. 9). With an increase in altitude from 15,000 to 25,000 feet at low values of air flow, however, the effect was not easily discerned. The decrease in compressor efficiency at a given corrected air flow and compressor pressure ratio and the shift of the lines of corrected engine speed caused by an increase in altitude are attributed to the effect of a decrease in Reynolds number on the flow through the compressor.

All operating lines obtained in this investigation fell on the high air-flow side of the maximum-efficiency regions shown in figure 9. An increase in exhaust-nozzle-outlet area at a constant corrected air flow therefore resulted in a lower compressor efficiency (fig. 7(c)).

Analysis of Altitude Effect on Operating Line

The reduction in compressor efficiency as the altitude was increased (fig. 9) required that more energy per pound of gas be extracted by the turbine. In order to obtain more energy from the gas, the turbine-inlet temperature was increased. This increase in temperature caused a slight reduction in volume flow at the compressor outlet, which resulted in a higher compressor pressure ratio corresponding to the performance characteristics of the compressor. The shift in the operating line with increased altitude shown in figure 4(a) is the effect of the decrease in compressor efficiency shown in figure 7(a) and the required rise in turbine-inlet temperature. The shift may be modified by variation of turbine efficiency.

Compressor Stator-Stage Static Pressures

The static-pressure rise through the compressor stator stages at altitudes of 15,000 and 45,000 feet is shown in figure 10 in terms of the ratio of the static pressure at each stator stage to the static pressure at the compressor inlet. At a corrected engine speed of 12,500 rpm, the static pressure in the first stage, and in some cases in the second stage, was lower than the compressor-inlet static pressure. The static-pressure ratio in the first three or four stages was lower at high corrected engine speeds than at low corrected engine speeds, but increased beyond the fourth stage when the corrected engine speed was increased.

Comparison of Performance of Original and Modified Compressors

A comparison of the performance of the original and modified compressors in their standard engine configurations is given in the following table. The values for the original compressor were obtained from reference 3 and the values for the modified compressor were taken from figures 4, 5, and 7.

Corrected engine speed $N/\sqrt{\theta}$ (rpm)	Altitude (ft)	Flight Mach number M_0	Compressor pressure ratio P_4/P_2		Corrected air flow $(W_a\sqrt{\theta})/\delta$ (lb/sec)		Compressor efficiency η_c (percent)	
			Modified	Original	Modified	Original	Modified	Original
13,000	25,000	0.24	4.06	4.08	59.2	60.1	82.5	80.7
		.53	4.02	4.00	59.6	60.1	80.0	81.0
		.86	3.97	3.95	59.6	60.8	82.5	81.8
12,500	15,000	0.53	3.76	3.68	59.0	59.0	84.1	82.2
	25,000	.24	3.80	3.82	57.8	58.0	85.0	83.0
		.53	3.76	3.76	58.3	58.8	83.0	82.2
		.86	3.73	3.70	58.1	59.3	85.0	82.0
		1.07	3.68	3.70	57.8	59.3	84.6	82.0
	35,000	.53	3.82	3.84	57.5	58.2	81.8	81.0
	45,000	.53	3.94	3.98	57.1	57.0	77.0	77.5
11,500	15,000	0.53	3.26	3.22	54.8	54.8	86.2	85.0
	25,000	.24	3.32	3.30	53.6	53.6	86.5	83.0
		.53	3.26	3.27	54.3	54.8	85.8	83.9
		.86	3.20	3.16	54.0	55.0	86.2	83.8
		1.07	3.16	3.16	53.5	55.0	85.1	85.0
	35,000	.53	3.26	3.28	52.7	53.8	84.2	82.0
	45,000	.53	3.40	3.41	53.0	53.0	83.2	79.5
10,000	15,000	0.53	2.45	2.44	44.0	45.3	83.7	82.7
	25,000	.24	2.55	2.52	43.0	42.5	85.5	81.2
		.53	2.45	2.44	43.6	44.7	83.5	81.4
		.86	2.32	2.21	44.5	44.0	81.6	79.2
		1.07	2.25	2.21	44.5	45.0	80.1	79.7
	35,000	.53	2.45	2.48	42.2	43.6	81.4	80.4
	45,000	.53	2.45	2.53	41.1	43.3	77.1	78.8
8,000	15,000	0.53	1.68	1.68	31.0	32.0	75.7	-----
	25,000	.24	1.77	1.78	29.8	29.0	77.4	74.2
		.53	1.68	1.68	30.5	31.1	75.1	74.3

Examination of the data in the table shows that the compressor pressure ratio was about the same for the two compressors. The corrected air flow was about 2 percent less and the compressor efficiency was about 2 percent greater for the modified compressor.

SUMMARY OF RESULTS

The results of an investigation in the NACA Cleveland altitude wind tunnel of the performance of a modified 11-stage axial-flow compressor in a revised X24C-4B turbojet engine are summarized as follows: 887

1. Velocity distribution at the outlet of the compressor was more nearly uniform in the modified compressor than in the original compressor.

2. A comparison of the performance of the modified and the original compressors shows that the corrected air flow was approximately 2 percent less and the compressor efficiency was approximately 2 percent greater for the modified compressor. Compressor pressure ratios were approximately the same for the two compressors.

3. Compressor operating lines fell on the high air-flow side of the maximum-efficiency region.

4. Maximum compressor efficiency at each altitude was reached at corrected engine speeds between 11,000 and 12,000 rpm. A maximum compressor efficiency of 86.5 percent occurred with an exhaust-nozzle-outlet area of 170.6 square inches at an altitude of 25,000 feet and a flight Mach number of 0.24.

5. An increase in altitude so changed the compressor characteristics that at a given compressor pressure ratio and a given corrected engine speed the corrected air flow was decreased and at a given compressor pressure ratio and corrected air flow the compressor efficiency was decreased. With a change in altitude from 15,000 to 25,000 feet at lower air flows, however, the effect was not easily discerned. An increase in altitude caused the operating line based on corrected air flow to shift to higher compressor pressure ratios. The operating line based on compressor Mach number or corrected engine speed was shifted only at high altitudes and high compressor Mach numbers.

6. When the flight Mach number was increased at corrected air flows below 50 pounds per second, the compressor pressure ratio and the compressor efficiency were lowered. At corrected air flows greater than 50 pounds per second, the compressor pressure ratio did not decrease at flight Mach numbers above 0.53 and the effect of flight Mach number on compressor efficiency was negligible. At any compressor Mach number or corrected engine speed, the compressor pressure ratio decreased when the flight Mach number was increased.

7. Enlarging the exhaust-nozzle-outlet area at a given corrected air flow decreased the compressor pressure ratio and the compressor efficiency. When the exhaust-nozzle-outlet area was enlarged, the corrected air flow remained approximately constant for corrected engine speeds greater than 10,500 rpm and increased slightly for lower corrected engine speeds.

Flight Propulsion Research Laboratory,
National Advisory Committee for Aeronautics,
Cleveland, Ohio, December 22, 1947.

H. Carl Thorman
H. Carl Thorman,
Aeronautical Engineer.

David T. Dupree
David T. Dupree,
Mechanical Engineer.

Approved:

Alfred W. Young,
Mechanical Engineer.

Abe Silverstein,
Aeronautical Engineer.

rl

REFERENCES

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. Prop. NACA RM No. SE7L22, 1947.

2. Meyer, Carl L., and Bloomer, Harry E.: Preliminary Results of Altitude-Wind-Tunnel Investigation of X24C-4B Turbojet Engine. II - Engine Performance. Prop. NACA RM No. SE7L26, 1947.

3. Dupree, David T., and Thorman, H. Carl: Preliminary Results of Altitude-Wind-Tunnel Investigation of X24C-4B Turbojet Engine. III- Compressor Performance. Prop. NACA RM No. SE7L12a, 1947.

4. Sanders, Newell D.: Performance Parameters for Jet-Propulsion Engines. NACA TN No. 1106, 1946.

TABLE I. - PERFORMANCE DATA FOR MODIFIED

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Run	Altitude (ft)	Exhaust-nozzle-outlet area (sq in.)	Flight Mach number, M_0	Ram-pressure ratio, P_2/p_0	Engine speed, N (rpm)	Tunnel-static pressure, p_0 (lb/sq ft abs.)	Compressor-inlet indicated temperature, $T_{i,2}$ (°R)	Compressor-inlet total pressure, P_2 (lb/sq ft abs.)	Compressor-inlet total pressure, P_2 (lb/sq ft abs.)[a]	Compressor-inlet static pressure, p_2 (lb/sq ft abs.)	Compressor stator-stage static pressure, p_3 (lb/sq ft abs.)					
											1	2	3	4	5	6
1	15,000	170.6	0.52	1.204	4,000	1190	495	1433	1427	1426	1436	1465	1486	1507	1535	1549
2	15,000	170.6	.53	1.208	5,000	1190	499	1438	1431	1427	1443	1493	1528	1556	1591	1634
3	15,000	170.6	.53	1.208	6,000	1190	499	1437	1431	1421	1443	1507	1556	1598	1655	1711
4	15,000	170.6	.52	1.206	7,000	1190	498	1435	1429	1412	1433	1528	1598	1555	1739	1817
5	15,000	170.6	.52	1.204	8,000	1190	501	1433	1426	1400	1450	1556	1655	1732	1852	1971
6	15,000	170.6	.53	1.209	9,000	1186	490	1434	1426	1383	1454	1566	1693	1827	1989	2155
7	15,000	170.6	.53	1.207	10,000	1186	491	1432	1424	1359	1411	1538	1721	1890	2094	2312
8	15,000	170.6	.53	1.212	11,000	1186	490	1437	1429	1340	1320	1446	1665	1890	2158	2425
9	15,000	170.6	.53	1.213	11,500	1186	497	1439	1432	1332	1278	1397	1615	1862	2165	2446
10	15,000	170.6	.53	1.209	12,000	1186	500	1434	1427	1317	1207	1320	1538	1791	2122	2432
11	15,000	170.6	.53	1.212	12,500	1186	500	1437	1438	1314	1151	1249	1468	1728	2080	2411
12	15,000	188.7	.52	1.204	4,000	1189	495	1432	1420	1425	1428	1457	1485	1506	1527	1548
13	15,000	188.7	.53	1.209	5,000	1189	497	1437	1425	1426	1435	1485	1520	1548	1583	1625
14	15,000	188.7	.52	1.203	6,000	1189	495	1430	1413	1414	1435	1506	1555	1597	1654	1710
15	15,000	188.7	.52	1.205	7,000	1189	495	1433	1420	1409	1442	1527	1597	1661	1745	1830
16	15,000	188.7	.52	1.204	8,000	1189	498	1431	1419	1396	1442	1555	1647	1738	1851	1977
17	15,000	188.7	.52	1.206	9,000	1189	508	1434	1422	1384	1457	1562	1589	1823	1985	2146
18	15,000	188.7	.53	1.213	10,000	1190	500	1443	1439	1371	1422	1542	1725	1894	2098	2309
19	15,000	188.7	.53	1.214	11,000	1189	499	1444	1435	1348	1330	1457	1568	1886	2153	2400
20	15,000	188.7	.53	1.212	11,500	1189	499	1441	1430	1334	1273	1386	1604	1844	2132	2407
21	15,000	188.7	.53	1.210	12,000	1189	497	1439	1429	1321	(b)	(b)	(b)	(b)	(b)	(b)
22	15,000	188.7	.53	1.212	12,500	1189	497	1441	1432	1316	1126	1224	1428	1675	2013	2301
23	15,000	231.5	.52	1.204	4,000	1190	494	1433	1421	1425	1436	1465	1486	1507	1535	1556
24	15,000	231.5	.53	1.208	5,000	1189	494	1436	1423	1424	1442	1485	1520	1548	1590	1633
25	15,000	231.5	.53	1.207	6,000	1189	494	1435	1418	1423	1442	1506	1555	1597	1654	1717
26	15,000	231.5	.52	1.204	7,000	1189	495	1432	1421	1409	1435	1527	1597	1668	1752	1837
27	15,000	231.5	.53	1.207	8,000	1189	493	1435	1424	1400	1457	1562	1661	1752	1879	2013
28	15,000	231.5	.53	1.208	9,000	1189	496	1436	1424	1384	1457	1569	1696	1830	1992	2153
29	15,000	231.5	.53	1.208	10,000	1189	490	1436	1432	1364	1407	1527	1703	1886	2090	2301
30	15,000	231.5	.53	1.211	11,000	1189	485	1440	1440	1343	1309	1421	1633	1865	2132	2386
31	15,000	231.5	.53	1.209	11,500	1189	487	1438	1437	1331	1245	1351	1569	1801	2097	2358
32	15,000	231.5	.53	1.214	12,000	1189	489	1443	1435	1324	1182	1281	1492	1731	2048	2322
33	15,000	231.5	.53	1.207	12,500	1189	491	1435	1427	1312	1139	1203	1400	1647	1970	2252
34	15,000	330.4	.53	1.210	4,000	1190	499	1440	(b)	1431	1436	1455	1486	1507	1535	1549
35	15,000	330.4	.53	1.208	5,000	1190	500	1437	(b)	1425	1436	1479	1514	1542	1584	1619
36	15,000	330.4	.52	1.203	6,000	1190	496	1431	(b)	1413	1429	1500	1549	1591	1648	1704
37	15,000	330.4	.53	1.212	7,000	1176	495	1425	(b)	1399	1422	1507	1584	1648	1732	1817
38	15,000	330.4	.52	1.206	8,000	1183	500	1427	(b)	1389	1436	1542	1634	1732	1852	1979
39	15,000	330.4	.52	1.201	9,000	1197	500	1438	(b)	1384	1457	1556	1690	1817	1978	2140
40	15,000	330.4	.52	1.203	10,000	1190	504	1431	(b)	1357	1401	1521	1697	1866	2056	2253
41	15,000	330.4	.53	1.208	11,000	1190	501	1438	(b)	1341	1310	1429	1534	1852	2112	2345
42	15,000	330.4	.53	1.210	11,500	1197	501	1448	(b)	1338	1267	1380	1598	1824	2112	2366
43	15,000	330.4	.52	1.205	12,000	1190	501	1434	(b)	1315	1197	1296	1507	1746	2049	2316
44	15,000	330.4	.52	1.205	12,500	1197	501	1442	(b)	1315	1134	1218	1422	1669	1986	2267
45	25,000	170.6	.23	1.042	4,000	778	448	811	810	808	813	827	841	855	862	884
46	25,000	170.6	.23	1.041	5,000	778	449	810	809	804	813	834	855	883	896	926
47	25,000	170.6	.23	1.041	6,000	778	447	810	809	801	813	848	884	919	947	982
48	25,000	170.6	.23	1.042	7,000	778	447	811	810	797	820	870	919	961	1010	1060
49	25,000	170.6	.25	1.046	8,000	778	446	814	812	793	827	884	947	1003	1074	1144
50	25,000	170.6	.24	1.044	9,000	778	445	812	812	779	785	862	975	1067	1165	1285
51	25,000	170.6	.25	1.049	10,000	778	442	816	816	768	(b)	(b)	(b)	(b)	(b)	(b)
52	25,000	170.6	.26	1.051	11,000	777	442	817	818	754	(b)	(b)	(b)	(b)	(b)	(b)
53	25,000	170.6	.26	1.051	11,500	781	442	821	823	752	(b)	(b)	(b)	(b)	(b)	(b)
54	25,000	170.6	.25	1.047	12,000	784	442	821	823	748	636	692	819	974	1185	1382
55	25,000	170.6	.25	1.049	12,260	781	442	819	821	745	612	668	788	950	1168	1386
56	25,000	170.6	.52	1.206	4,000	778	452	938	932	933	933	954	968	982	1003	1017
57	25,000	170.6	.53	1.207	5,000	778	452	939	932	931	940	975	1003	1024	1046	1067
58	25,000	170.6	.52	1.202	6,000	781	465	939	940	929	943	985	1027	1056	1091	1133
59	25,000	170.6	.53	1.209	7,000	781	454	944	937	927	936	999	1056	1098	1161	1225
60	25,000	170.6	.53	1.207	8,000	781	465	943	942	928	950	1027	1091	1154	1239	1330
61	25,000	170.6	.53	1.210	9,000	781	465	945	946	909	964	1034	1126	1217	1330	1457
62	25,000	170.6	.53	1.211	10,000	781	466	946	948	895	922	1007	1133	1252	1393	1541
63	25,000	170.6	.53	1.210	11,000	781	465	945	947	877	851	929	1077	1239	1422	1605
64	25,000	170.6	.54	1.220	11,500	774	465	944	945	868	809	880	1027	1196	1408	1605
65	25,000	170.6	.53	1.207	12,000	774	465	934	935	855	753	816	957	1133	1358	1570
66	25,000	170.6	.53	1.209	12,500	781	465	944	945	858	711	774	908	1098	1337	1577
67	25,000	170.6	.52	1.202	12,500	796	491	957	957	873	754	817	965	1141	1380	1599
68	25,000	170.6	.86	1.622	6,000	781	497	1267	1256	1251	1274	1330	1372	1415	1471	1527
69	25,000	170.6	.86	1.630	7,000	781	492	1273	1261	1250	1281	1358	1422	1485	1562	1640
70	25,000	170.6	.86	1.627	8,000	781	492	1271	1259	1239	1288	1372	1457	1541	1661	1760
71	25,000	170.6	.87	1.635	9,000	781	492	1277	1265	1230	1288	1379	1499	1612	1760	1907

[a]Manufacturer's instrumentation.

[b]Data not available.

NACA

COMPRESSOR IN REVISED X24C-4B TURBOJET ENGINE

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
Compressor stator-stage static pressure, p_3 (lb/sq ft abs.)					Compressor-outlet indicated temperature, $T_{1,4}$ (°R)	Compressor-outlet indicated temperature, $T_{1,4}$ (°R)[a]	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)[a]	Compressor-outlet static pressure, p_4 (lb/sq ft abs.)	Compressor pressure ratio, P_4/P_2	Corrected engine speed, $N/\sqrt{\theta}$ (rpm)	Compressor Mach number, M_c	Air flow, W_a (lb/sec)	Corrected air flow, $W\sqrt{\theta}/\delta$ (lb/sec)	Compressor efficiency, η_c (percent)	Run
7	8	9	10	11												
1563	1570	1563	1514	1345	511	512	1438	1436	1409	1.003	4,096	0.303	10.50	15.15	[illegible]	1
1669	1690	1697	1669	1479	531	534	1609	1612	1572	1.119	5,100	.377	[illegible]	18.78	51.01	2
1767	1817	1845	1831	1641	552	556	1810	1810	1760	1.260	6,120	[illegible]	[illegible]	22.83	64.31	3
1901	1978	2035	2063	1866	579	584	2086	2084	2014	1.454	7,147	.528	[illegible]	26.37	69.45	4
2084	2204	2295	2373	2176	612	617	2474	2471	2373	1.726	8,144	.602	[illegible]	31.48	[illegible]	5
2334	2510	2664	2819	2678	636	642	3045	3052	2925	2.123	9,261	.684	[illegible]	39.03	80.60	6
2524	2770	3009	3277	3277	671	679	3682	3685	3566	2.571	10,280	.760	[illegible]	46.04	84.59	7
2700	3038	3397	3840	4030	710	718	4507	4502	4368	3.136	11,319	.837	[illegible]	52.94	66.10	8
2756	3143	3558	4094	4319	738	746	4880	4882	4738	3.391	11,753	.868	38.45	55.30	86.20	9
2763	3192	3692	4333	4692	763	773	5251	5255	5101	3.662	12,226	.904	40.45	58.59	84.75	10
2777	3277	3861	4622	5065	788	795	5619	5607	5431	3.910	12,738	.941	41.13	59.45	82.10	11
1555	1569	1527	1513	1330	512	514	1431	1428	1400	.999	4,096	.303	10.49	15.14	(b)	12
1654	1575	1640	1647	1442	530	532	1578	1576	1540	1.098	5,110	.378	13.05	18.81	40.81	13
1759	1816	1787	1823	1618	550	553	1793	1794	1741	1.254	6,144	.454	15.78	22.81	60.22	14
1907	1985	1970	2055	1844	577	580	2071	2069	1731	1.445	7,168	.530	18.69	26.90	[illegible]	15
2090	2210	2210	2365	2132	607	613	2436	2428	2342	1.702	8,168	.504	22.45	32.49	75.06	16
2301	2456	2505	2738	2513	648	655	2907	2907	2790	2.027	9,099	.572	26.64	38.39	[illegible]	17
2514	3309	2844	3196	3084	676	684	3540	3541	3410	2.453	10,190	.753	32.06	46.12	83.13	18
2660	2956	3132	3653	3730	708	715	4220	4216	4072	2.922	11,220	.829	36.87	52.96	85.70	19
2689	3026	3245	3864	4033	725	732	4555	4547	4403	3.161	11,730	.867	38.58	55.52	86.07	20
(b)	(b)	3315	4026	4251	740	748	4854	4850	4694	3.373	12,264	.906	40.17	57.78	85.05	21
2618	3026	3364	4188	4512	756	765	5139	5138	4972	3.566	12,775	.944	41.41	59.48	83.46	22
1563	1570	1528	1507	1324	509	509	1427	1429	1395	.996	4,100	.303	10.51	15.14	(b)	23
1661	1689	1647	1654	1435	527	527	1581	1576	1538	1.101	5,125	.379	13.07	18.80	41.77	24
1766	1816	1787	1816	1583	546	548	1764	1776	1709	1.229	6,150	.455	15.85	22.91	57.64	25
1914	1992	1970	2055	1794	570	574	2030	2034	1958	1.418	7,168	.530	18.67	26.95	69.31	26
2118	2238	2245	2386	2090	598	603	2412	2407	2312	1.681	8,208	.606	23.25	33.42	75.16	27
2308	2470	2513	2731	2414	635	641	2843	2836	2715	1.980	9,207	.580	27.63	39.81	77.02	28
2498	2724	2696	3153	2921	660	667	3434	3435	3288	2.391	10,290	.760	32.98	47.24	81.61	29
2632	2921	2963	3590	3554	685	693	4092	4097	3940	2.942	11,374	.840	37.91	53.26	84.41	30
2625	2942	3033	3723	3808	703	710	4355	4350	4194	3.029	11,868	.878	39.54	56.36	84.08	31
2611	2956	3139	3878	4068	718	727	4641	4639	4474	[illegible]	12,360	.914	40.91	58.23	84.71	32
2548	2914	3217	3970	4209	736	746	4848	4843	4677	3.378	12,950	.950	41.50	59.55	83.45	33
1563	1563	1556	1500	1296	512	513	1404	1401	1370	.975	4,080	.302	10.51	15.14	(b)	34
1648	1669	1676	1634	1408	531	532	1546	1549	1504	1.076	5,095	.376	12.35	17.85	34.19	35
1753	1795	1817	1795	1535	548	550	1722	1725	1665	1.203	6,138	.453	15.76	22.79	51.81	36
1887	1957	2007	2007	1704	570	573	1949	1950	1875	1.368	7,168	.530	18.57	26.93	61.85	37
2091	2197	2274	2316	1971	605	608	2299	2295	2200	1.611	8,152	.602	22.95	33.40	69.57	38
2288	2436	2570	2668	2302	635	639	2723	2718	2592	1.894	9,171	.678	26.85	38.76	[illegible]	39
2450	2647	2844	3014	2668	670	677	3207	3203	3046	2.241	10,150	.750	31.49	45.89	79.87	40
2548	2844	3133	3422	3246	697	707	3823	3830	3656	2.659	11,198	.828	36.47	52.70	82.54	41
2626	2915	3239	3605	3555	712	721	4127	4133	3963	2.850	11,707	.865	38.22	54.85	82.95	42
2598	2915	3288	3746	3851	728	736	4415	4414	4254	3.079	12,216	.902	39.46	57.21	83.84	43
2556	2901	3337	3872	4112	745	753	4696	4703	4532	3.257	12,725	.940	40.72	58.68	82.14	44
898	919	912	926	905	478	478	941	940	930	1.160	4,304	.318	5.75	13.94	64.79	45
947	982	975	1010	975	495	496	1033	1038	1019	1.275	5,375	.397	7.34	17.83	70.31	46
1017	1074	1067	1123	1088	517	519	1171	1172	1149	1.446	6,462	.477	9.39	22.77	71.01	47
1116	1186	1193	1285	1250	540	544	1361	1362	1331	1.678	7,539	.556	11.34	27.47	76.69	48
1222	1313	1341	1468	1461	566	572	1593	1587	1552	1.957	8,632	.638	13.84	33.35	78.57	49
1398	1531	1581	1785	1806	597	603	1989	1996	1938	2.450	9,720	.718	16.90	40.78	85.51	50
(b)	(b)	(b)	(b)	(b)	631	637	(b)	(b)	(b)	(b)	10,840	.801	20.50	49.04	(b)	51
(b)	(b)	(b)	(b)	(b)	667	672	(b)	(b)	(b)	(b)	11,924	.881	23.17	55.36	(b)	52
(b)	(b)	(b)	(b)	(b)	688	693	(b)	(b)	(b)	(b)	12,466	.920	24.24	57.63	(b)	53
1615	1960	2199	2804	3065	712	714	3364	3354	3242	4.097	13,008	.961	24.91	59.22	81.32	54
1640	2013	2245	2907	3161	726	727	3468	3442	3325	4.234	13,290	.982	24.92	59.40	79.53	55
1024	1038	1003	1003	891	471	471	961	961	941	1.025	4,284	.317	7.71	16.24	16.90	56
1095	1123	1095	1109	996	488	487	1080	1081	1056	1.150	5,355	.396	8.94	18.81	51.26	57
1168	1210	1232	1232	1112	523	525	1222	1225	1191	1.301	6,336	.468	10.91	23.28	62.71	58
1281	1344	1337	1415	1288	536	539	1449	1450	1403	1.535	7,483	.553	13.40	28.10	72.20	59
1415	1506	1577	1633	1520	578	583	1725	1724	1666	1.829	8,448	.624	15.49	32.92	77.57	60
1569	1703	1816	1936	1865	611	618	2114	2119	2042	2.237	9,504	.702	19.06	40.41	82.45	61
1696	1878	2062	2266	2316	649	655	2580	2583	2503	2.727	10,550	.780	22.60	47.92	84.62	62
1802	2055	2316	2654	2794	688	694	3146	3153	3058	3.329	11,616	.858	25.63	54.34	85.59	63
1816	2105	2414	2830	3034	708	714	3411	3414	3315	3.613	12,144	.897	26.91	57.13	84.94	64
1809	2140	2506	2992	3252	732	737	3613	3604	3484	3.868	12,672	.936	27.37	58.73	82.27	65
1851	2259	2675	3280	3569	759	761	3913	3893	3752	4.145	13,200	.975	28.13	59.72	79.36	66
1852	2218	2619	3154	3429	782	787	3786	3795	3668	3.956	12,850	.950	27.53	59.21	80.61	67
1562	1591	1591	1534	1119	538	541	1341	1344	1279	1.058	6,132	.453	14.66	23.96	19.76	68
1703	1760	1788	1774	1351	560	565	1625	1626	1549	1.277	7,189	.532	17.71	28.66	52.39	69
1865	1957	2020	2055	1682	592	597	1990	1992	1899	1.566	8,216	.608	20.79	33.71	67.34	70
2048	2189	2309	2414	2119	628	634	2505	2499	2390	1.962	9,243	.683	24.91	40.19	76.92	71

NACA

887

TABLE I. - CONTINUED. PERFORMANCE DATA FOR

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Run	Altitude (ft)	Exhaust-nozzle-outlet area (sq in.)	Flight Mach number, M_0	Ram-pressure ratio, P_2/P_0	Engine speed, N (rpm)	Tunnel-static pressure, p_0 (lb/sq ft abs.)	Compressor-inlet indicated temperature, $T_{1,2}$ (°R)	Compressor-inlet total pressure, P_2 (lb/sq ft abs.)	Compressor-inlet total pressure, P_2 (lb/sq ft abs.)[a]	Compressor-inlet static pressure, p_2 (lb/sq ft abs.)	Compressor stator-stage static pressure, p_3 (lb/sq ft abs.)					
											1	2	3	4	5	6
72	25,000	170.6	.86	1.624	10,000	781	485	1268	1251	1202	1239	1344	1506	1561	1844	2027
73	25,000	170.6	.86	1.628	11,000	788	486	1283	1277	1195	1175	1281	1478	1682	1928	2161
74	25,000	170.6	.86	1.629	11,500	781	488	1272	1268	1175	1112	1217	1415	1633	1907	2154
75	25,000	170.6	.87	1.632	12,000	788	489	1286	1281	1179	1070	1169	1365	1591	1357	2161
76	25,000	170.6	.86	1.629	12,500	788	490	1284	1279	1171	1006	1098	1288	1527	1837	2133
77	25,000	170.6	1.07	2.065	8,000	781	511	1613	1590	1573	1633	1738	1837	1943	2076	2203
78	25,000	170.6	1.08	2.070	9,000	774	510	1602	1578	1545	1619	1731	1879	2013	2189	2365
79	25,000	170.6	1.07	2.052	10,000	781	511	1603	1581	1525	1584	1710	1907	2083	2302	2527
80	25,000	170.6	1.07	2.055	11,000	781	510	1605	1586	1502	1499	1640	1872	2105	2386	2668
81	25,000	170.6	1.07	2.064	11,500	781	511	1612	1593	1496	1450	1584	1830	2090	2414	2717
82	25,000	170.6	1.06	2.012	12,000	781	511	1571	1561	1445	1344	1464	1710	1978	2330	2654
83	25,000	170.6	1.06	2.035	12,500	774	513	1575	1570	1440	1274	1386	1626	1900	1999	2518
84	25,000	188.7	.23	1.041	4,000	778	452	810	809	806	813	827	841	848	862	877
85	25,000	188.7	.23	1.042	5,000	778	450	811	810	804	(b)	(b)	(b)	(b)	(b)	(b)
86	25,000	188.7	.23	1.041	6,000	778	448	810	810	801	820	848	891	912	947	982
87	25,000	188.7	.23	1.042	7,000	778	447	811	810	796	820	862	919	954	1010	1053
88	25,000	188.7	.24	1.044	8,000	778	448	812	812	789	813	877	940	1003	1074	1151
89	25,000	188.7	.25	1.046	9,000	778	445	814	814	780	750	813	898	982	1088	1193
90	25,000	188.7	.25	1.048	10,000	778	445	815	816	766	785	785	975	1081	1214	1348
91	25,000	188.7	.23	1.041	11,000	778	445	810	808	743	715	771	898	1038	1207	1376
92	25,000	188.7	.26	1.050	11,500	778	445	817	819	746	679	729	848	989	1172	1334
93	25,000	188.7	.27	1.056	12,000	781	445	825	826	751	633	682	795	943	1133	1309
94	25,000	188.7	.27	1.055	12,500	781	445	824	824	747	591	640	746	887	1084	1267
95	25,000	188.7	.53	1.207	4,000	778	459	939	932	933	940	961	975	989	1003	1024
96	25,000	188.7	.53	1.207	5,000	778	455	939	933	931	940	975	996	1017	1046	1074
97	25,000	188.7	.53	1.207	6,000	781	455	943	937	931	887	929	971	1006	1049	1091
98	25,000	188.7	.52	1.205	7,000	781	455	941	934	923	943	999	1056	1105	1168	1225
99	25,000	188.7	.52	1.205	8,000	781	455	941	935	914	950	1020	1084	1154	1246	1337
100	25,000	188.7	.53	1.210	9,000	781	456	945	940	906	950	1027	1126	1217	1337	1464
101	25,000	188.7	.53	1.210	10,000	781	457	945	941	891	908	985	1119	1239	1393	1541
102	25,000	188.7	.53	1.212	11,000	783	458	949	945	877	816	896	1036	1198	1388	1571
103	25,000	188.7	.53	1.214	11,500	781	460	948	945	871	788	858	999	1161	1365	1555
104	25,000	188.7	.53	1.213	12,000	783	458	950	948	867	746	804	945	1114	1325	1522
105	25,000	188.7	.53	1.209	12,500	781	458	944	942	860	697	753	873	1041	1260	1457
106	25,000	188.7	.86	1.625	6,000	781	493	1269	1247	1254	1274	1330	1372	1415	1464	1513
107	25,000	188.7	.86	1.624	7,000	781	495	1268	1246	1245	1267	1344	1415	1471	1555	1626
108	25,000	188.7	.86	1.630	8,000	778	495	1268	1246	1234	1278	1369	1454	1454	1658	1764
109	25,000	188.7	.86	1.624	9,000	781	493	1268	1246	1221	1274	1372	1485	1605	1745	1886
110	25,000	188.7	.86	1.627	10,000	781	493	1271	1250	1205	1246	1351	1506	1654	1837	2020
111	25,000	188.7	(b)	(b)	11,000	781	492	(b)	(b)	(b)	1161	1260	1450	1640	1872	2097
112	25,000	188.7	.86	1.630	11,500	781	489	1273	1253	1176	1098	1196	1386	1598	1858	2090
113	25,000	188.7	.87	1.640	12,000	778	492	1276	1257	1173	1053	1144	1334	1545	1827	2080
114	25,000	188.7	.87	1.641	12,500	778	492	1277	1257	1166	989	1074	1250	1468	1757	2017
115	25,000	188.7	1.07	2.065	9,000	781	506	1613	1599	1555	1626	1738	1893	2034	2210	2393
116	25,000	188.7	1.08	2.082	10,000	781	498	1626	1628	1544	1591	1724	1929	2126	2351	2583
117	25,000	188.7	1.07	2.044	11,000	781	499	1596	1582	1492	1478	1612	1844	2083	2365	2633
118	25,000	188.7	1.07	2.061	11,500	788	500	1624	1612	1507	1429	1555	1802	2062	2379	2675
119	25,000	188.7	1.07	2.051	12,000	785	502	1610	1597	1481	1355	1475	1714	1962	2327	2637
120	25,000	188.7	1.08	2.088	12,500	774	505	1616	1607	1479	1281	1386	1619	1893	2266	2590
121	25,000	231.5	.24	1.042	4,000	781	460	814	814	810	816	830	844	858	865	887
122	25,000	231.5	.23	1.041	5,000	781	458	813	812	806	816	837	865	880	901	922
123	25,000	231.5	.24	1.043	6,000	774	459	807	807	798	809	844	873	901	929	971
124	25,000	231.5	.23	1.041	7,000	774	458	806	806	792	809	858	908	943	985	1034
125	25,000	231.5	.25	1.048	8,000	774	458	811	810	789	816	880	936	985	1056	1133
126	25,000	231.5	.24	1.044	9,000	781	457	815	814	782	816	880	957	1041	1140	1253
127	25,000	231.5	.25	1.047	10,000	774	456	810	810	763	781	884	957	1063	1182	1316
128	25,000	231.5	.25	1.047	11,000	781	456	818	819	757	725	788	906	1041	1203	1351
129	25,000	231.5	.26	1.052	11,500	781	456	822	823	754	689	746	858	999	1175	1330
130	25,000	231.5	.27	1.054	12,000	781	455	823	824	750	640	697	809	950	1133	1295
131	25,000	231.5	.27	1.054	12,500	781	458	823	824	749	605	647	753	887	1077	1239
132	25,000	231.5	.52	1.204	4,000	781	460	940	934	935	943	964	976	992	1006	1027
133	25,000	231.5	.53	1.209	5,000	781	461	944	939	937	943	978	999	1020	1049	1077
134	25,000	231.5	.53	1.209	6,000	774	459	936	931	926	943	985	1020	1056	1098	1140
135	25,000	231.5	.52	1.202	7,000	774	461	930	926	914	936	999	1049	1091	1161	1216
136	25,000	231.5	.52	1.204	8,000	774	460	932	930	908	943	1020	1084	1147	1239	1330
137	25,000	231.5	.52	1.206	9,000	781	461	942	940	909	950	1027	1119	1210	1260	1450
138	25,000	231.5	.53	1.209	10,000	774	462	935	937	887	908	985	1112	1232	1379	1520
139	25,000	231.5	.53	1.207	11,000	788	460	951	953	874	844	915	1063	1210	1400	1569
140	25,000	231.5	.53	1.213	11,500	781	460	947	950	875	795	858	999	1161	1359	1541
141	25,000	231.5	.52	1.204	12,000	774	460	932	934	854	739	795	922	1084	1288	1478
142	25,000	231.5	.53	1.121	12,500	774	462	937	936	854	690	746	866	1020	1232	1422

[a]Manufacturer's instrumentation.

[b]Data not available.

NACA

MODIFIED COMPRESSOR IN REVISED X24C-4B TURBOJET ENGINE

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
Compressor stator-stage static pressure, p_3 (lb/sq ft abs.)					Compressor-outlet indicated temperature, $T_{1,4}$ (°R)	Compressor-outlet indicated temperature, $T_{1,4}$ (°R)a	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)a	Compressor-outlet static pressure, p_4 (lb/sq ft abs.)	Compressor pressure ratio, P_4/P_2	Corrected engine speed, $N/\sqrt{\theta}$ (rpm)	Compressor Mach number, M_c	Air flow, W_a (lb/sec)	Corrected air flow, $W_a\sqrt{\theta}/\delta$ (lb/sec)	Compressor efficiency, η_c (percent)	Run
7	8	9	10	11												
[illegible]	[illegible]	[illegible]	2351	2773	659	668	3171	3182	2299	2.501	10,340	0.764	28.01	46.66	83.56	72
2407	[illegible]	[illegible]	3428	3590	704	711	4021	4019	3896	3.134	11,363	.840	33.57	53.59	86.13	73
2428	[illegible]	3153	3646	3865	726	734	4356	4364	4233	3.425	11,968	.877	34.76	56.05	86.53	74
2464	2865	3315	3914	4252	748	758	4727	4737	4604	3.675	12,360	.914	36.31	57.99	85.16	75
2456	[illegible]	3463	4167	4561	774	780	5059	5040	4896	3.940	12,863	.951	37.24	59.64	82.14	76
2316	2407	2478	2471	1802	603	608	2241	2238	2116	1.389	8,064	.596	25.33	32.97	54.72	77
2527	2682	2816	2893	2393	640	647	2878	2872	2735	1.797	9,081	.671	29.68	38.86	71.60	78
2745	2970	3196	3407	3175	681	688	3707	3710	3554	2.313	10,080	.745	34.57	45.27	81.45	79
2949	3287	3646	4062	4188	726	733	4695	4702	4548	2.925	11,099	.820	39.33	51.37	84.84	80
3048	3442	3886	4414	4639	749	757	5232	5230	5072	3.246	11,592	.857	41.75	54.38	85.59	81
3006	3456	3970	4604	4935	770	781	5546	5561	5388	3.530	12,096	.895	42.43	56.70	85.00	82
3006	3520	4125	4885	5371	792	802	5932	5934	5767	3.766	12,575	.930	44.09	58.86	84.08	83
891	912	912	926	898	481	481	933	933	925	1.152	4,284	.316	5.73	13.97	64.33	84
(b)	(b)	(b)	(b)	(b)	495	496	(b)	(b)	(b)	(b)	5,370	.397	7.35	17.85	(b)	85
1017	1067	1067	1116	1074	516	517	1157	1158	1134	1.428	6,456	.478	8.78	21.31	70.69	86
1116	1179	1193	1271	1229	538	541	1341	1348	1308	1.654	7,539	.557	11.10	26.89	76.03	87
1229	1320	1348	1468	1419	565	570	1577	1581	1532	1.942	8,608	.636	13.79	33.40	80.02	88
1306	1426	1482	1665	1644	594	599	1841	1841	1783	2.262	9,720	.718	17.02	40.97	78.52	89
1489	1658	1750	2024	2073	626	632	2313	2313	2239	2.838	10,800	.798	20.41	49.06	85.47	90
1538	1750	1904	2291	2411	659	665	2725	2728	2646	3.364	11,980	.878	23.25	56.23	86.25	91
1517	1750	1933	2369	2538	675	679	2869	2883	2786	3.512	12,420	.918	24.07	57.72	83.63	92
1499	1767	1992	2499	2752	692	697	3065	3069	2971	3.715	12,960	.958	24.97	59.30	82.06	93
1471	1760	2020	2590	2879	714	718	3197	3189	3084	3.880	13,500	.998	25.17	59.85	78.36	94
1031	1038	1010	1003	884	475	477	949	947	929	1.011	4,252	.314	8.13	17.23	8.88	95
1095	1116	1088	1102	975	492	492	1067	1067	1039	1.136	5,340	.395	8.90	18.78	45.63	96
1126	1168	1147	1189	1049	513	513	1175	1175	1136	1.246	6,408	.474	11.41	23.97	50.90	97
1288	1351	1344	1415	1274	536	538	1436	1436	1387	1.526	7,476	.553	13.79	29.04	72.19	98
1422	1520	1534	1640	(b)	564	567	1719	1717	1651	1.827	8,544	.631	16.64	35.04	78.51	99
1577	1703	1745	1936	1823	596	602	2090	2090	2011	2.212	9,603	.710	20.02	42.01	83.03	100
1689	1865	1957	2231	2231	632	638	2522	2527	2435	2.669	10,660	.788	23.28	48.90	84.64	101
1747	1980	2135	2543	2663	667	673	2989	3001	2906	3.150	11,704	.865	26.47	55.48	85.12	102
1753	1999	2189	2661	2823	685	690	3199	3196	3102	3.374	12,213	.903	27.24	57.25	85.05	103
1733	2008	2233	2782	2987	699	705	3428	3423	3314	3.608	12,768	.944	28.38	59.40	84.26	104
1682	1978	2259	2865	3189	718	724	3542	3541	3421	3.752	13,300	.983	28.44	59.93	80.96	105
1555	1577	1527	1520	1098	534	536	1316	1316	1251	1.037	6,156	.455	14.77	24.00	12.50	106
1689	1745	1703	1745	1309	565	568	1583	1584	1506	1.248	7,168	.530	17.26	28.13	46.25	107
1862	1954	1940	2052	1623	584	589	1950	1947	1854	1.538	8,272	.611	21.18	34.19	64.18	108
2020	2154	2168	2351	1999	626	632	2383	2379	2267	1.879	9,234	.682	24.49	39.64	73.28	109
2196	2386	2457	2745	1112	661	667	2977	2977	2848	2.342	10,260	.758	28.77	46.69	80.87	110
2316	2576	2724	3175	3203	696	704	3643	3646	3513	(b)	11,297	.835	(b)	(b)	(b)	111
2344	2640	2830	3379	3527	712	719	3993	3984	3856	3.137	11,845	.876	34.62	56.19	84.62	112
2341	2665	2897	3531	3728	728	737	4249	4256	4116	3.330	12,324	.911	35.61	57.61	85.60	113
2292	2651	2946	3678	3953	751	760	4517	4523	4372	3.537	12,838	.949	36.65	59.46	82.33	114
2555	2710	2745	2928	2323	632	639	2845	2837	2692	1.764	9,117	.674	30.75	39.63	70.76	115
2801	3041	3122	3477	3083	664	671	3705	3703	3529	2.279	10,210	.755	36.61	46.65	79.72	116
2900	3210	3386	3879	3808	699	707	4397	4400	4240	2.755	11,220	.829	40.16	52.21	83.88	117
2977	3329	3569	4188	4294	720	728	4881	4878	4711	3.006	11,719	.866	43.12	55.14	84.09	118
2960	3355	3650	4368	4601	737	746	5224	5213	5047	3.245	12,204	.902	44.19	57.10	85.52	119
2935	3372	3738	4576	4878	757	766	5595	5596	5415	3.462	12,675	.937	45.86	59.20	85.13	120
894	915	908	922	887	486	486	929	929	919	1.141	4,248	.314	5.20	12.73	67.96	121
943	978	971	999	957	503	504	1015	1013	997	1.248	5,320	.393	7.32	17.91	66.53	122
1006	1042	1042	1084	1034	524	526	1117	1119	1093	1.384	6,378	.471	8.65	21.34	68.79	123
1084	1147	1154	1225	1161	545	550	1277	1281	1242	1.584	7,448	.551	10.68	26.35	74.00	124
1203	1288	1302	1408	1330	571	575	1498	1492	1445	1.847	8,512	.629	13.25	32.49	77.79	125
1351	1471	1506	1675	1591	601	606	1816	1816	1751	2.228	9,594	.709	16.76	40.82	81.69	126
1443	1591	1668	1907	1886	633	639	2141	2147	2063	2.643	10,670	.789	19.87	48.64	82.59	127
1506	1696	1774	2154	2224	660	666	2517	2520	2432	3.077	11,737	.868	22.56	54.70	84.76	128
1499	1703	1802	2238	2358	676	682	2675	2682	2593	3.254	12,271	.907	23.60	56.93	83.30	129
1471	1696	1816	2316	2471	690	696	2835	2837	2742	3.445	12,816	.946	24.57	59.15	82.19	130
1415	1654	1802	2358	2569	711	718	2927	2935	2832	3.557	13,300	.983	24.71	59.71	79.25	131
1034	1041	1006	1006	887	477	478	948	950	929	1.009	4,248	.314	6.59	13.97	7.03	132
1091	1119	1091	1098	957	495	496	1052	1049	1022	1.114	5,305	.392	9.28	19.61	42.55	133
1168	1210	1189	1225	1063	513	514	1190	1189	1153	1.271	6,378	.472	10.68	23.14	60.37	134
1274	1337	1323	1394	1225	541	542	1391	1386	1335	1.496	7,427	.549	13.50	28.95	70.37	135
1415	1499	1506	1612	1422	568	573	1648	1647	1581	1.768	8,496	.628	16.07	34.35	75.38	136
1562	1682	1710	1879	1689	597	603	1988	1985	1902	2.110	9,549	.706	19.55	41.38	80.71	137
1661	1816	1893	2147	2034	631	637	2364	2372	2268	2.529	10,600	.783	22.70	48.39	83.20	138
1745	1950	2083	2449	2485	660	667	2841	2844	2736	2.989	11,682	.863	26.20	54.80	84.50	139
1724	1950	2112	2534	2654	674	681	3016	3020	2913	3.183	12,213	.903	27.21	55.10	84.30	140
1668	1907	2098	2590	2738	690	696	3150	3146	3045	3.380	12,744	.942	28.16	60.10	83.30	141
1619	1879	2098	2654	2872	709	715	3299	3308	3189	3.520	13,250	.979	28.10	59.90	80.90	142

NACA

TABLE I. - CONTINUED. PERFORMANCE DATA FOR

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Run	Altitude (ft)	Exhaust-nozzle-outlet area (sq in.)	Flight Mach number, M_0	Ram-pressure ratio, P_2/p_0	Engine speed, N (rpm)	Tunnel-static pressure, p_0 (lb/sq ft abs.)	Compressor-inlet indicated temperature, $T_{1,2}$ (°R)	Compressor-inlet total pressure, P_2 (lb/sq ft abs.)	Compressor-inlet total pressure, P_2 (lb/sq ft abs.)[a]	Compressor-inlet static pressure, p_2 (lb/sq ft abs.)	Compressor stator-stage static pressure, p_3 (lb/sq ft abs.) 1	2	3	4	5	6
143	25,000	231.5	.86	1.629	6,000	781	490	1272	1251	1255	1274	1337	1386	1429	1485	1541
144	25,000	231.5	.85	1.603	7,000	781	490	1252	1233	1230	1239	1316	1386	1443	1527	1598
145	25,000	231.5	.86	1.626	8,000	781	490	1270	1249	1236	1288	1372	1457	1548	1661	1767
146	25,000	231.5	.86	1.611	9,000	781	490	1258	1238	1211	1267	1358	1478	1598	1738	1886
147	25,000	231.5	.87	1.635	10,000	781	490	1277	1256	1211	1239	1344	1506	1661	1837	2020
148	25,000	231.5	.86	1.629	11,000	774	489	1261	1242	1175	1140	1246	1422	1619	1844	2055
149	25,000	231.5	.86	1.628	11,500	774	489	1260	1242	1165	1154	1182	1365	1570	1816	2048
150	25,000	231.5	.86	1.624	12,000	781	490	1268	1250	1164	1041	1126	1309	1520	1795	2034
151	25,000	231.5	.87	1.631	12,500	781	490	1274	1256	1163	985	1070	1239	1457	1738	1992
152	25,000	231.5	1.08	2.085	8,000	781	519	1628	1596	1590	1647	1753	1851	1957	2083	2210
153	25,000	231.5	1.08	2.077	9,000	781	515	1622	1589	1565	1633	1753	1893	2034	2210	2386
154	25,000	231.5	1.08	2.072	10,000	781	502	1618	1612	1540	1591	1717	1921	2105	2330	2541
155	25,000	231.5	1.08	2.078	11,000	774	504	1608	1610	1503	1478	1612	1837	2076	2356	2618
156	25,000	231.5	1.08	2.073	11,500	781	505	1619	1606	1502	1422	1548	1761	2041	2378	2640
157	25,000	231.5	1.08	2.073	12,000	781	508	1619	1608	1492	1365	1478	1717	1978	2316	2618
158	25,000	231.5	1.08	2.085	12,500	781	510	1628	1614	1492	1295	1401	1633	1893	2252	2562
159	25,000	330.4	(b)	(b)	4,000	781	463	(b)	(b)	(b)	816	830	844	851	865	873
160	25,000	330.4	.23	1.041	5,000	781	463	813	(b)	805	816	915	865	887	901	929
161	25,000	330.4	.23	1.042	6,000	781	463	814	(b)	804	816	851	887	915	936	971
162	25,000	330.4	.23	1.041	7,000	781	463	813	(b)	798	816	865	914	950	992	1049
163	25,000	330.4	.24	1.044	8,000	774	465	808	(b)	785	809	873	929	985	1056	1133
164	25,000	330.4	.25	1.046	9,000	781	463	817	(b)	783	809	873	957	1034	1140	1239
165	25,000	330.4	.25	1.047	10,000	781	464	818	(b)	771	788	858	964	1063	1189	1309
166	25,000	330.4	.26	1.051	11,000	788	464	828	(b)	764	732	795	915	1048	1210	1355
167	25,000	330.4	.26	1.053	11,500	774	463	815	(b)	747	682	739	856	992	1161	1309
168	25,000	330.4	.25	1.048	12,000	774	462	811	(b)	741	640	697	802	943	1119	1274
169	25,000	330.4	.25	1.048	12,500	788	463	826	(b)	750	612	661	767	901	1084	1246
170	25,000	330.4	.53	1.209	4,000	781	464	944	(b)	939	936	964	971	992	1006	1027
171	25,000	330.4	.53	1.211	5,000	781	465	946	(b)	937	943	971	999	1013	1049	1070
172	25,000	330.4	.53	1.209	6,000	774	464	936	(b)	923	936	978	1013	1049	1064	1126
173	25,000	330.4	.53	1.216	7,000	781	465	950	(b)	932	943	1013	1056	1105	1168	1232
174	25,000	330.4	.52	1.202	8,000	781	464	939	(b)	911	950	1020	1083	1154	1239	1330
175	25,000	330.4	.53	1.210	9,000	781	464	945	(b)	905	936	1013	1112	1196	1316	1436
176	25,000	330.4	.52	1.197	10,000	781	463	935	(b)	888	901	985	1112	1232	1372	1520
177	25,000	330.4	.53	1.216	11,000	781	463	950	(b)	877	(b)	(b)	(b)	(b)	(b)	(b)
178	25,000	330.4	.54	1.219	11,500	781	463	952	(b)	873	788	858	992	1154	1351	1534
179	25,000	330.4	.53	1.214	12,000	781	464	948	(b)	864	746	802	936	1098	1302	1485
180	25,000	330.4	.53	1.209	12,500	781	463	944	(b)	857	697	753	873	1034	1239	1429
181	25,000	330.4	.85	1.607	8,000	796	501	1279	(b)	1246	1282	1373	1459	1542	1555	1753
182	25,000	330.4	(b)	(b)	9,000	781	495	(b)	(b)	(b)	1288	1372	1499	1612	1753	1893
183	25,000	330.4	.86	1.630	10,000	781	498	1273	(b)	1205	1239	1351	1506	1654	1830	2006
184	25,000	330.4	.87	1.632	11,000	774	495	1263	(b)	1176	1140	1246	1422	1619	1837	2048
185	25,000	330.4	(b)	(b)	11,500	803	486	(b)	(b)	(b)	1127	1225	1415	1627	1380	2112
186	25,000	330.4	.87	1.636	12,000	774	491	1266	(b)	1161	1034	1126	1302	1506	1774	2013
187	25,000	330.4	.87	1.632	12,500	774	485	1263	(b)	1151	964	1042	1210	1422	1703	1950
188	25,000	330.4	.78	1.502	13,000	781	493	1173	(b)	1157	929	999	1154	1365	1647	1907
189	25,000	330.4	1.08	2.072	9,000	774	525	1604	(b)	1549	1612	1724	1865	1999	2175	2337
190	25,000	330.4	1.07	2.045	10,000	791	520	1597	(b)	1519	1569	1696	1893	2062	2273	2485
191	25,000	330.4	1.09	2.094	11,000	774	515	1621	(b)	1515	1492	1626	1851	2090	2365	2626
192	25,000	330.4	1.08	2.067	11,500	774	525	1600	(b)	1486	1422	1548	1781	2027	2330	2604
193	25,000	330.4	1.08	2.081	12,000	774	531	1611	(b)	1577	1386	1506	1738	1999	2323	2611
194	25,000	330.4	1.08	2.085	12,500	774	523	1614	(b)	1477	1302	1408	1640	1907	2252	2562
195	35,000	170.6	.53	1.212	4,000	500	453	606	604	603	599	620	627	634	648	655
196	35,000	170.6	.52	1.201	5,000	493	452	592	590	588	599	620	634	641	662	676
197	35,000	170.6	.50	1.185	6,000	493	452	584	582	577	585	606	634	648	669	697
198	35,000	170.6	.53	1.209	7,000	493	453	596	594	586	606	634	669	697	739	775
199	35,000	170.6	.52	1.205	8,000	493	446	594	592	579	599	641	683	725	782	838
200	35,000	170.6	.52	1.201	9,000	493	446	592	590	568	599	648	704	761	838	915
201	35,000	170.6	.53	1.209	10,000	493	447	596	594	563	577	627	711	789	880	979
202	35,000	170.6	.53	1.207	11,000	493	447	595	593	551	521	570	669	775	894	1014
203	35,000	170.6	.53	1.207	11,500	493	449	595	592	546	500	549	641	753	887	1021
204	35,000	170.6	.53	1.211	12,000	493	449	597	597	545	472	521	613	732	880	1028
205	35,000	170.6	.52	1.206	12,159	500	450	603	602	550	472	514	613	732	887	1049
206	35,000	188.7	.52	1.201	4,000	493	447	592	590	588	592	606	613	620	634	641
207	35,000	188.7	.52	1.195	5,000	493	447	589	587	584	592	606	627	634	655	669
208	35,000	188.7	.51	1.193	6,000	493	446	588	586	581	592	620	641	662	690	718
209	35,000	188.7	.52	1.197	6,000	493	445	590	587	583	599	620	648	662	690	711
210	35,000	188.7	.52	1.206	7,000	500	448	603	601	591	606	641	676	711	746	789
211	35,000	188.7	.52	1.203	7,000	498	448	599	598	589	597	632	667	702	737	773
212	35,000	188.7	.52	1.199	8,000	498	447	597	595	580	604	653	688	737	794	850
213	35,000	188.7	.52	1.205	9,000	498	447	600	598	574	597	646	709	766	843	920

[a]Manufacturer's instrumentation.

[b]Data not available.

NACA

MODIFIED COMPRESSOR IN REVISED X24C-4B TURBOJET ENGINE

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
Compressor stator-stage static pressure, p_3 (lb/sq ft abs.)					Compressor-outlet indicated temperature, $T_{1,4}$ (°R)	Compressor-outlet indicated temperature, $T_{1,4}$ (°R)a	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)a	Compressor-outlet static pressure, p_4 (lb/sq ft abs.)	Compressor pressure ratio, P_4/P_2	Corrected engine speed, $N/\sqrt{\theta}$ (rpm)	Compressor Mach number, M_c	Air flow, W_a (lb/sec)	Corrected air flow, $(W_a\sqrt{\theta})/\delta$ (lb/sec)	Compressor efficiency, η_c (percent)	Run
7	8	9	10	11												
1577	1605	1548	1548	1084	536	539	1326	1323	1255	1.042	6,174	0.456	14.84	24.00	12.57	143
1668	1717	1682	1724	1267	556	560	1545	1548	1468	1.234	7,203	.532	17.12	28.12	46.03	144
1865	1950	1936	2034	1541	587	593	1890	1886	1792	1.488	8,232	.608	21.09	34.15	60.81	145
2020	2154	2168	2337	1900	616	623	2302	2295	2182	1.830	9,261	.685	24.72	40.41	73.40	146
2189	2372	2442	2703	2351	654	661	2855	2851	2713	2.236	10,290	.760	29.10	46.86	77.32	147
2266	2506	2640	3048	2935	685	594	3433	3435	3292	2.722	11,330	.637	32.92	53.63	82.73	148
2274	2541	2717	3189	3217	701	709	3698	3696	3559	2.935	11,845	.876	34.26	55.65	83.18	149
2281	2569	2787	3358	3491	718	726	3992	3991	3846	3.148	12,348	.913	35.78	58.03	83.43	150
2252	2569	2830	3484	3703	734	742	4247	4245	4098	3.334	12,863	.950	37.04	59.79	82.55	151
2316	2400	2358	2435	1591	601	607	2082	2076	1940	1.279	8,000	.591	24.97	32.46	46.14	152
2541	2555	2541	2879	2119	640	646	2676	2675	2518	1.650	9,036	.668	29.83	38.77	63.45	153
2752	2963	2421	3344	2780	661	670	3420	3414	3235	2.114	10,170	.752	35.75	45.98	75.40	154
2879	3161	837	3766	3498	698	707	4169	4174	3979	2.593	11,165	.625	40.10	51.99	81.37	155
2921	3245	3421	3991	3900	716	726	4552	4554	4363	2.812	11,661	.662	42.63	54.95	82.36	156
2921	3280	3498	4174	4259	735	744	4899	4899	4714	3.026	12,132	.696	44.13	57.05	83.02	157
2886	3266	3555	4322	4540	752	760	5202	5202	5015	3.195	12,613	.933	45.56	58.70	82.36	158
887	908	915	1774	873	489	489	916	915	903	(b)	4,236	.313	(b)	(b)	(b)	159
950	978	992	2837	950	507	508	1012	1013	991	1.245	5,295	.391	7.28	17.69	68.11	160
1006	1056	1077	3259	1020	525	527	1112	1105	1082	1.366	6,354	.470	9.00	22.10	69.68	161
1091	1154	1196	3400	1140	549	553	1270	1267	1228	1.562	7,413	.548	10.97	26.96	73.24	162
1203	1281	1337	3484	1281	576	581	1457	1457	1402	1.803	8,448	.624	13.46	33.38	76.92	163
1337	1443	1548	1569	1506	604	610	1747	1753	1675	2.138	9,531	.704	16.63	41.16	79.70	164
1436	1577	1710	1668	1774	634	641	2049	2055	1968	2.505	10,580	.782	19.62	48.46	81.96	165
1506	1689	1872	1907	2126	664	673	2427	2428	2341	2.931	11,638	.660	22.62	54.65	83.55	166
1471	1654	1872	2076	2217	678	685	2523	2527	2434	3.096	12,179	.900	23.22	56.92	82.15	167
1436	1647	1879	2154	2330	691	700	2662	2661	2575	3.282	12,720	.940	23.68	58.28	81.66	168
1415	1640	1907	2203	2449	709	714	2836	2844	2742	3.433	13,238	.978	24.54	59.37	79.62	169
1027	1041	1034	999	865	481	481	941	936	919	.997	4,232	.313	6.58	13.94	(b)	170
1091	1112	1112	1084	936	496	497	1031	1034	1001	1.090	5,280	.390	9.29	19.78	37.48	171
1154	1189	1210	1196	1027	516	515	1153	1154	1113	1.232	6,348	.469	10.31	22.03	54.86	172
1281	1337	1372	1379	1175	540	543	1347	1351	1294	1.418	7,392	.546	13.33	28.11	65.10	173
1408	1492	1555	1591	1379	568	573	1529	1598	1603	1.628	8,464	.626	16.00	34.07	66.71	174
1541	1654	1760	1844	1612	597	601	1913	1907	1821	2.024	9,522	.704	19.57	41.42	77.91	175
1591	1809	1957	2112	1943	628	635	2299	2302	2196	2.459	10,590	.782	22.92	48.98	82.35	176
(b)	(b)	(b)	(b)	(b)	657	665	(b)	(b)	(b)	(b)	11,649	.661	25.93	54.53	(b)	177
1710	1921	2175	2485	2569	674	683	2934	2935	2831	3.082	12,179	.900	27.16	57.01	83.41	178
1675	1900	2189	2548	2703	690	698	3085	3083	2980	3.254	12,696	.938	27.61	58.67	82.51	179
1626	1872	2189	2611	2794	708	714	3240	3252	3131	3.432	13,238	.978	28.16	59.62	80.06	180
1852	1929	1993	1993	1458	593	597	1813	1810	1708	1.418	8,144	.602	20.56	33.40	57.30	181
2020	2147	2252	2323	1788	620	627	2212	2203	2082	(b)	9,216	.681	(b)	(b)	(b)	182
2168	2344	2513	2654	2224	656	663	2726	2724	2575	2.141	10,210	.754	28.26	46.00	76.65	183
2252	2485	2738	2997	2837	690	697	3346	3351	3201	2.649	11,264	.832	32.33	52.88	81.54	184
2352	2626	2936	3295	3309	698	705	3802	3809	3662	(b)	11,680	.678	(b)	(b)	(b)	185
2252	2541	2886	3301	3428	720	728	3920	3928	3777	3.096	12,336	.912	35.35	57.46	81.73	186
2210	2520	2921	3428	3646	729	736	4189	4188	4046	3.317	12,925	.956	36.63	59.34	81.30	187
2161	2492	2935	3513	3069	757	763	4374	4378	4223	3.729	13,388	.986	37.05	65.14	85.06	188
2485	2626	2745	2787	1957	646	653	2518	2513	2355	1.570	8,949	.662	28.98	38.44	59.74	189
2682	2893	3083	3231	2633	678	686	3253	3245	3065	2.037	9,990	.738	33.84	44.68	74.36	190
2826	3161	3456	3745	3442	709	717	4114	4118	3925	2.538	11,044	.616	39.72	51.63	80.99	191
2879	3182	3520	3879	3745	740	749	4385	4393	4204	2.741	11,434	.645	40.56	53.97	81.03	192
2907	3238	3625	4055	4083	763	772	4700	4709	4523	2.917	11,863	.677	42.16	55.99	81.37	193
2879	3252	3703	4259	4449	769	776	5098	5104	4970	3.159	12,453	.920	44.62	58.72	82.06	194
662	669	669	648	577	446	446	619	620	607	1.021	4,284	.316	4.64	15.13	(b)	195
690	711	711	704	634	490	490	688	690	674	1.162	5,355	.396	5.36	17.69	52.20	196
725	753	768	768	704	513	515	774	775	754	1.325	6,426	.475	6.74	22.80	62.07	197
810	852	880	901	824	536	540	917	922	887	1.539	7,497	.554	7.93	26.29	71.62	198
894	951	1007	1042	979	561	565	1102	1105	1067	1.855	8,632	.638	10.23	33.77	74.98	199
1000	1091	1239	1253	1232	597	602	1376	1380	1335	2.324	9,711	.718	12.19	40.38	80.57	200
1084	1211	1338	1479	1535	634	640	1698	1697	1649	2.849	10,770	.796	14.54	47.93	83.46	201
1148	1317	1507	1739	1852	675	681	2078	2084	2025	3.492	11,847	.675	16.70	55.14	84.28	202
1162	1373	1591	1880	2014	700	705	2242	2246	2180	3.768	12,363	.914	17.20	56.90	82.54	203
1197	1450	1704	2056	2218	727	728	2435	2436	2355	4.079	12,900	.954	17.74	58.48	79.93	204
1225	1500	1760	2126	2288	735	737	2505	2492	2411	4.154	13,059	.965	17.98	58.74	79.38	205
648	662	641	634	570	467	467	611	613	600	1.032	4,308	.318	4.57	15.17	20.13	206
683	704	683	690	627	485	485	676	676	660	1.148	5,385	.398	6.68	22.29	47.41	207
739	768	753	782	704	505	505	777	775	753	1.321	6,474	.478	6.98	23.28	62.66	208
739	768	753	775	704	504	504	771	775	750	1.307	6,480	.479	7.03	23.34	60.03	209
831	866	866	915	831	532	535	933	936	900	1.547	7,532	.557	8.07	26.32	70.88	210
815	857	850	899	815	532	533	918	920	886	1.533	7,533	.557	8.42	27.65	69.33	211
906	970	977	1054	977	560	564	1106	1110	1067	1.853	8,616	.638	10.68	35.14	76.31	212
998	1082	1118	1237	1181	591	596	1343	1350	1296	2.238	9,693	.714	12.67	41.49	80.44	213

NACA

TABLE I. - CONCLUDED. PERFORMANCE DATA FOR

Run	1 Altitude (ft)	2 Exhaust-nozzle-outlet area (sq in.)	3 Flight Mach number, M_0	4 Ram-pressure ratio, P_2/p_0	5 Engine speed, N (rpm)	6 Tunnel-static pressure, p_0 (lb/sq ft abs.)	7 Compressor-inlet indicated temperature, $T_{1,2}$ (°R)	8 Compressor-inlet total pressure, P_2 (lb/sq ft abs.)	9 Compressor-inlet total pressure, P_2 (lb/sq ft abs.)[a]	10 Compressor-inlet static pressure, p_2 (lb/sq ft abs.)	11 Compressor stator-stage static pressure, p_3 (lb/sq ft abs.) 1	12 2	13 3	14 4	15 5	16 6
214	35,000	188.7	.53	1.209	10,000	493	443	596	594	561	577	627	711	782	880	972
215	35,000	188.7	.51	1.193	11,000	493	443	588	587	543	514	556	648	739	859	979
216	35,000	188.7	.53	1.213	11,000	493	443	598	597	552	(b)	(b)	(b)	(b)	(b)	(b)
217	35,000	188.7	.53	1.207	11,500	493	443	595	594	546	493	528	620	718	845	965
218	35,000	188.7	.53	1.209	12,000	493	443	596	594	543	465	500	585	690	824	951
219	35,000	188.7	.53	1.208	12,500	500	443	604	604	549	437	472	542	648	796	929
220	35,000	231.5	.52	1.200	4,000	500	453	600	598	596	599	613	620	634	641	655
221	35,000	231.5	.52	1.195	5,000	493	455	589	586	583	585	606	620	636	648	669
222	35,000	231.5	.53	1.211	6,000	493	453	597	594	590	599	627	648	669	690	718
223	35,000	231.5	.52	1.202	7,000	500	455	601	599	590	599	634	669	697	739	775
224	35,000	231.5	.52	1.198	8,000	500	455	599	596	582	606	655	697	739	796	852
225	35,000	231.5	.53	1.211	9,000	493	454	597	595	572	599	648	704	768	838	915
226	35,000	231.5	.53	1.209	10,000	493	454	596	594	562	577	620	704	782	873	958
227	35,000	231.5	.53	1.213	11,000	493	453	598	597	554	528	570	662	753	866	979
228	35,000	231.5	.53	1.211	11,500	493	453	597	597	546	500	535	620	725	852	965
229	35,000	231.5	.53	1.213	12,000	493	452	598	598	546	465	507	585	690	824	944
230	35,000	231.5	.53	1.213	12,500	493	454	598	596	545	444	479	549	655	789	908
231	35,000	330.4	.52	1.201	4,000	493	451	592	(b)	587	592	606	613	620	627	641
232	35,000	330.4	.52	1.205	5,000	493	451	594	(b)	589	592	613	627	641	655	669
233	35,000	330.4	.52	1.200	6,000	500	450	600	(b)	592	528	549	570	552	620	648
234	35,000	330.4	.53	1.211	7,000	493	450	597	(b)	585	599	634	669	704	739	775
235	35,000	330.4	.52	1.195	8,000	493	450	589	(b)	572	599	641	683	725	775	831
236	35,000	330.4	.52	1.204	9,000	486	450	585	(b)	560	578	627	683	739	817	680
237	35,000	330.4	.52	1.203	10,000	493	453	593	(b)	557	563	620	690	775	859	951
238	35,000	330.4	.53	1.209	11,000	493	452	596	(b)	549	521	563	655	746	866	979
239	35,000	330.4	.52	1.202	11,500	500	452	601	(b)	550	493	528	620	718	845	965
240	35,000	330.4	.52	1.202	12,000	500	450	601	(b)	547	465	507	584	690	817	936
241	35,000	330.4	.52	1.199	12,500	493	450	591	(b)	537	437	465	542	634	768	887
242	45,000	170.6	.53	1.208	4,000	303	453	366	364	364	373	380	380	387	395	402
243	45,000	170.6	.52	1.201	5,000	303	453	364	363	362	373	380	387	402	409	416
244	45,000	170.6	.52	1.198	6,000	303	455	363	362	359	366	387	395	409	423	437
245	45,000	170.6	.52	1.201	7,000	303	460	364	363	358	359	380	402	423	437	458
246	45,000	170.6	.51	1.190	8,000	310	453	369	367	360	366	394	423	451	479	507
247	45,000	170.6	.52	1.198	9,000	303	454	363	360	349	359	395	423	458	493	549
248	45,000	170.6	.57	1.246	10,000	289	450	360	359	342	352	381	430	472	528	585
249	45,000	170.6	.51	1.190	11,000	310	452	369	369	343	331	373	430	493	570	648
250	45,000	170.6	.54	1.221	11,500	303	450	370	368	340	324	359	423	486	571	662
251	45,000	188.7	.53	1.208	4,000	303	458	366	366	364	366	373	380	387	387	395
252	45,000	188.7	.53	1.210	5,000	310	459	375	374	372	380	387	402	409	416	430
253	45,000	188.7	.53	1.211	6,000	303	460	367	367	363	366	380	395	414	423	444
254	45,000	188.7	.52	1.198	7,000	303	454	363	361	356	359	380	402	416	437	465
255	45,000	188.7	.51	1.190	8,000	310	455	369	367	358	359	387	416	437	465	500
256	45,000	188.7	.52	1.197	9,000	310	457	371	369	355	366	402	430	465	507	563
257	45,000	188.7	.53	1.211	10,000	303	459	367	365	346	359	395	437	486	535	606
258	45,000	188.7	.52	1.197	11,000	310	450	371	373	345	338	373	423	486	563	634
259	45,000	188.7	.53	1.208	11,500	303	450	366	367	337	310	331	387	458	535	613
260	45,000	188.7	.53	1.208	12,000	303	447	366	366	334	296	324	373	437	521	606
261	45,000	188.7	.53	1.215	12,500	303	450	368	368	334	275	296	352	416	507	599
262	45,000	231.5	.52	1.205	4,000	303	456	365	364	362	373	380	387	395	395	402
263	45,000	231.5	.51	1.194	5,000	310	456	370	369	367	373	380	387	402	409	416
264	45,000	231.5	.52	1.200	6,000	310	455	372	371	366	373	394	402	416	430	451
265	45,000	231.5	.52	1.201	7,000	303	450	364	364	357	366	380	409	423	444	465
266	45,000	231.5	.52	1.201	8,000	303	450	364	363	354	359	387	416	444	472	500
267	45,000	231.5	.52	1.195	9,000	303	449	362	364	351	366	395	423	465	507	556
268	45,000	231.5	.50	1.188	10,000	303	447	360	360	339	352	380	430	479	528	585
269	45,000	231.5	.52	1.205	11,000	303	448	365	365	338	324	352	402	465	535	606
270	45,000	231.5	.55	1.234	11,000	303	446	374	370	343	324	352	409	465	542	613
271	45,000	231.5	.52	1.203	11,500	310	445	373	373	343	310	338	387	451	535	606
272	45,000	231.5	.53	1.211	12,000	303	445	367	367	336	289	317	366	430	507	585
273	45,000	231.5	.52	1.195	12,500	303	445	362	362	330	268	296	338	402	486	563
274	45,000	330.4	.53	1.211	4,000	303	452	367	(b)	365	366	373	380	387	387	395
275	45,000	330.4	.52	1.205	5,000	303	452	365	(b)	363	366	373	387	395	402	416
276	45,000	330.4	.53	1.209	6,000	296	451	358	(b)	355	359	373	388	395	409	423
277	45,000	330.4	.52	1.201	7,000	303	451	364	(b)	357	366	387	409	423	444	465
278	45,000	330.4	.52	1.198	8,000	303	451	363	(b)	354	359	387	416	437	472	500
279	45,000	330.4	.50	1.187	9,000	310	450	368	(b)	353	373	402	437	465	514	556
280	45,000	330.4	.52	1.205	10,000	303	451	365	(b)	344	352	387	430	479	535	565
281	45,000	330.4	(b)	(b)	11,000	303	450	(b)	(b)	(b)	324	352	409	465	528	599
282	45,000	330.4	(b)	(b)	11,500	303	450	(b)	(b)	(b)	310	338	387	458	528	606
283	45,000	330.4	(b)	(b)	12,000	303	450	(b)	(b)	(b)	282	310	359	430	507	565
284	45,000	330.4	(b)	(b)	12,500	303	450	(b)	(b)	(b)	268	296	345	409	486	563

[a]Manufacturer's instrumentation.

[b]Data not available.

NACA

887

MODIFIED COMPRESSOR IN REVISED X24C-4B TURBOJET ENGINE

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
Compressor stator-stage static pressure, P_3 (lb/sq ft abs.)					Compressor-outlet indicated temperature, $T_{1,4}$ (°R)	Compressor-outlet indicated temperature, $T_{1,4}$ (°R)[a]	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)	Compressor-outlet total pressure, P_4 (lb/sq ft abs.)[a]	Compressor-outlet static pressure, p_4 (lb/sq ft abs.)	Compressor pressure ratio, P_4/P_2	Corrected engine speed, $N/\sqrt{\theta}$ (rpm)	Compressor Mach number, M_c	Air flow, W_a (lb/sec)	Corrected air flow, $(W_a\sqrt{\theta})/\delta$ (lb/sec)	Compressor efficiency, η_c (percent)	Run
7	8	9	10	11												
1070	1190	1260	1436	1457	622	626	1634	1641	1591	2.742	10,830	0.800	14.90	48.64	82.75	214
1191	1246	1345	1619	1704	654	659	1920	1922	1863	3.205	11,913	.860	16.61	55.20	84.55	215
(b)	(b)	(b)	(b)	(b)	656	662	(b)	(b)	(b)	(b)	11,913	.880	17.19	56.16	(b)	216
1096	1127	1494	1704	1831	673	679	2067	2077	2006	3.474	12,455	.921	17.41	57.17	82.40	217
1191	1281	1436	1802	1978	692	698	2206	2211	2134	3.701	12,996	.961	18.10	59.33	80.75	218
1084	1317	1493	1922	2126	719	722	2356	2359	2274	3.901	13,538	1.000	18.40	59.52	76.40	219
655	669	641	641	577	472	473	612	613	601	1.020	4,284	.316	4.60	15.15	13.60	220
676	697	669	690	606	490	490	667	669	650	1.132	5,340	.395	5.31	17.86	46.94	221
746	768	740	775	683	511	510	759	761	736	1.271	6,426	.475	6.69	22.14	55.47	222
810	852	931	987	782	536	538	888	887	860	1.478	7,476	.553	8.37	27.59	66.40	223
901	965	951	1035	929	565	569	1072	1070	1030	1.790	8,544	.631	10.32	34.14	74.94	224
956	1070	1070	1197	1091	594	600	1276	1281	1227	2.137	9,621	.711	12.51	41.47	78.73	225
1056	1162	1183	1373	1324	626	633	1527	1535	1469	2.562	10,690	.790	14.60	48.48	81.53	226
1084	1232	1267	1542	1584	656	661	1792	1795	1731	2.997	11,781	.871	16.50	54.51	82.33	227
1084	1239	1296	1619	1704	673	679	1938	1936	1874	3.246	12,317	.911	17.07	56.49	82.52	228
1063	1232	1943	1676	1788	687	694	2049	2056	1983	3.426	12,852	.950	17.91	59.16	81.17	229
1035	1211	1310	1716	1859	707	713	2134	2140	2062	3.569	13,363	.988	18.17	60.14	78.77	230
648	655	648	690	549	469	469	600	592	584	1.014	4,292	.317	5.17	17.22	10.03	231
683	704	704	789	599	485	486	662	655	641	1.114	5,365	.397	5.39	17.89	41.64	232
676	683	760	577	676	507	509	660	662	635	1.100	6,444	.476	7.09	23.28	21.78	233
817	852	880	1000	768	528	531	876	873	842	1.467	7,518	.556	8.33	27.49	66.62	234
887	944	979	1098	880	557	560	1020	1021	973	1.732	8,592	.635	10.35	34.63	71.53	235
951	1028	1091	1274	1021	585	591	1205	1204	1149	2.060	9,666	.715	12.30	41.42	76.53	236
1035	1148	1246	1359	1260	622	628	1476	1479	1414	2.489	10,710	.792	14.74	49.11	79.87	237
1077	1218	1359	1415	1535	653	661	1755	1760	1692	2.945	11,781	.871	16.62	55.09	81.38	238
1077	1225	1387	1514	1669	666	673	1894	1901	1835	3.151	12,317	.911	17.47	57.43	82.05	239
1056	1218	1408	1584	1753	683	690	2021	2021	1952	3.363	12,888	.953	17.95	58.65	80.07	240
1007	1183	1387	1619	1609	700	706	2074	2084	2009	3.509	13,425	.993	17.67	59.57	77.74	241
402	416	402	402	366	475	475	387	387	381	1.057	4,284	.316	2.35	12.69	32.92	242
423	444	430	437	402	493	494	432	437	424	1.187	5,355	.396	2.57	13.95	56.96	243
451	479	465	486	444	520	520	484	486	473	1.333	6,408	.474	4.27	23.31	59.97	244
479	514	507	542	507	547	552	554	556	542	1.522	7,434	.550	5.14	28.13	67.48	245
578	585	592	641	620	572	577	682	683	665	1.548	8,568	.633	5.98	32.02	73.09	246
592	648	662	747	739	609	615	817	817	795	2.251	9,621	.711	7.43	40.51	76.51	247
655	733	775	901	937	649	653	1035	1035	1007	2.875	10,740	.794	8.21	44.93	79.74	248
725	852	922	1120	1190	691	696	1328	1331	1297	3.599	11,781	.870	10.03	53.70	83.64	249
761	908	986	1218	1317	722	724	1435	1436	1388	3.878	12,351	.913	10.67	56.82	78.34	250
402	409	402	395	359	481	482	380	380	374	1.038	4,256	.315	2.99	16.25	21.31	251
437	451	437	444	402	500	500	436	437	424	1.163	5,315	.393	3.06	16.24	49.50	252
451	472	465	479	437	524	525	479	479	466	1.305	6,372	.471	3.93	21.34	56.87	253
486	514	514	542	500	545	547	559	556	543	1.540	7,484	.553	4.83	26.34	65.57	254
528	570	578	620	578	571	576	653	655	633	1.770	8,544	.632	6.21	33.34	69.60	255
606	662	683	754	732	610	613	823	824	797	2.218	9,594	.709	7.49	40.08	76.43	256
662	739	775	894	901	645	649	1005	1007	976	2.738	10,630	.785	8.71	47.25	82.38	257
711	810	873	1042	1099	674	678	1232	1232	1198	3.321	11,814	.872	10.10	53.64	82.28	258
697	810	894	1084	1169	692	697	1310	1317	1275	3.579	12,351	.912	10.51	56.57	81.81	259
697	831	930	1155	1253	711	715	1389	1394	1349	3.795	12,924	.955	10.86	58.29	78.63	260
697	859	865	1218	1352	738	740	1476	1479	1422	4.016	13,425	.992	11.11	59.48	76.30	261
409	416	402	402	359	478	478	384	387	377	1.052	4,268	.316	3.00	16.30	30.29	262
423	444	423	430	394	494	495	422	423	414	1.141	5,335	.394	3.99	21.39	46.10	263
458	486	465	486	437	515	519	484	486	461	1.301	6,408	.474	4.98	26.52	59.29	264
493	521	507	542	486	537	539	549	549	531	1.508	7,518	.556	4.74	25.66	64.51	265
542	578	563	620	571	561	566	646	648	625	1.775	8,592	.635	6.00	32.47	72.27	266
634	662	655	739	690	591	597	793	796	766	2.191	9,675	.715	7.52	40.89	79.51	267
648	725	725	859	845	623	630	960	965	929	2.667	10,770	.796	8.79	47.97	82.27	268
676	768	796	972	1014	661	665	1141	1141	1103	3.126	11,836	.874	10.21	55.01	81.07	269
683	782	810	993	1028	659	664	1161	1162	1123	3.104	11,869	.878	10.38	54.43	80.11	270
676	782	824	1035	1084	672	678	1238	1239	1198	3.319	12,420	.918	10.94	57.47	80.24	271
662	775	824	1063	1141	690	697	1296	1303	1258	3.531	12,960	.958	10.93	58.35	78.91	272
648	768	838	1908	1204	713	719	1352	1352	1307	3.735	13,500	.998	10.95	59.32	76.00	273
395	409	402	444	339	470	470	364	366	360	.992	4,284	.317	(b)	(b)	(b)	274
416	430	430	479	373	490	490	408	409	397	1.118	5,355	.396	(b)	(b)	38.53	275
437	458	465	528	409	508	510	447	451	436	1.249	6,438	.476	5.75	31.68	52.06	276
486	514	528	599	472	530	533	529	535	510	1.453	7,511	.555	6.98	37.81	64.44	277
535	578	599	669	549	563	565	631	634	602	1.738	8,584	.634	7.12	38.68	68.95	278
606	655	697	754	662	590	594	764	768	733	2.076	9,666	.714	8.95	47.92	74.70	279
641	711	775	958	782	621	628	913	915	876	2.501	10,730	.792	9.15	49.43	79.60	280
662	754	838	930	965	657	664	1098	1099	1058	(b)	11,814	.873	(b)	(b)	(b)	281
676	782	880	937	1056	672	678	1198	1197	1158	(b)	12,351	.912	(b)	(b)	(b)	282
662	775	894	972	1127	690	696	1289	1289	1247	(b)	12,888	.952	(b)	(b)	(b)	283
648	761	894	1014	1183	710	715	1341	1345	1298	(b)	13,425	.992	(b)	(b)	(b)	284

NACA

[redacted]

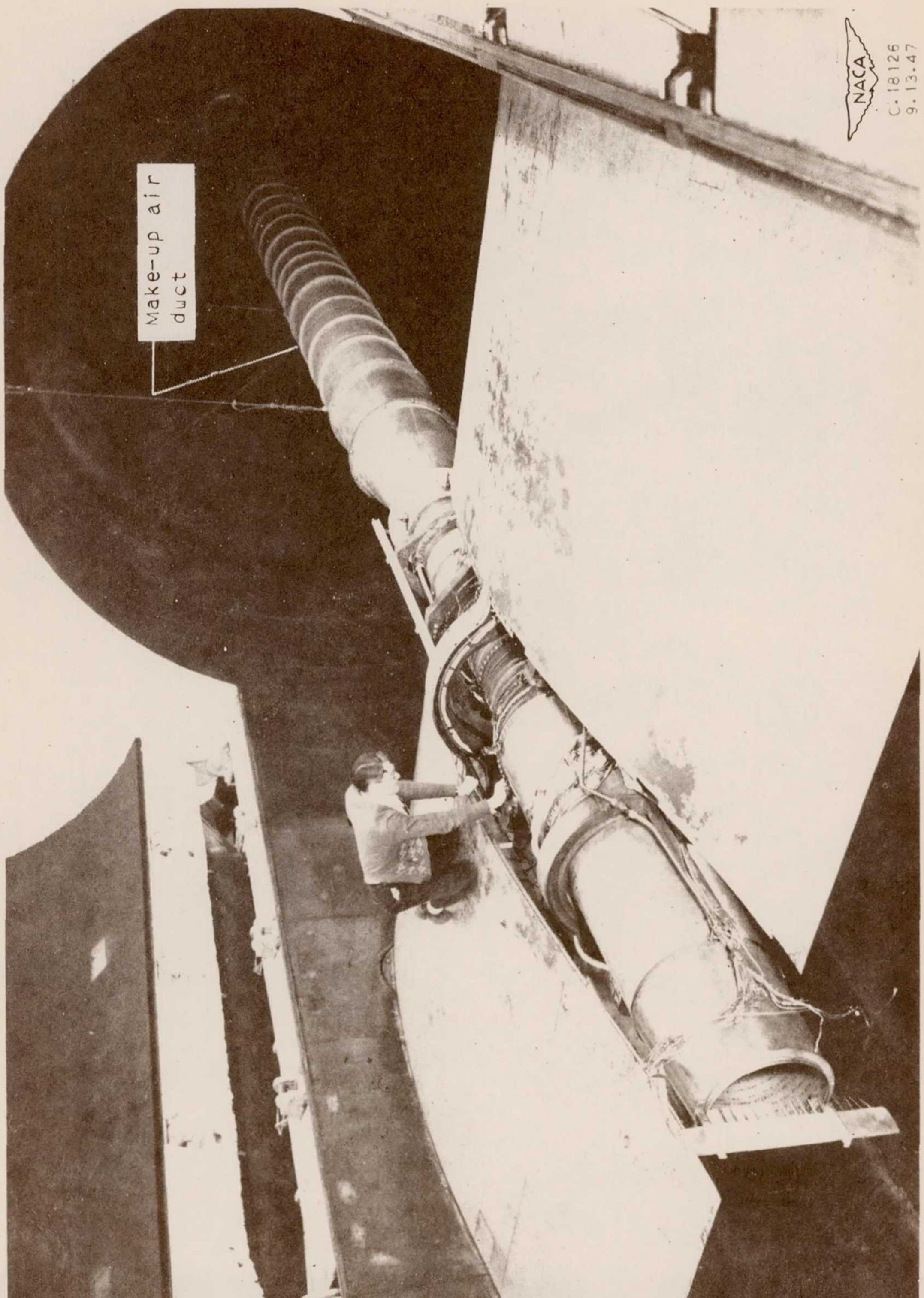


Figure 1. - Installation of X24C-4B turbojet engine in altitude wind tunnel.

[redacted]

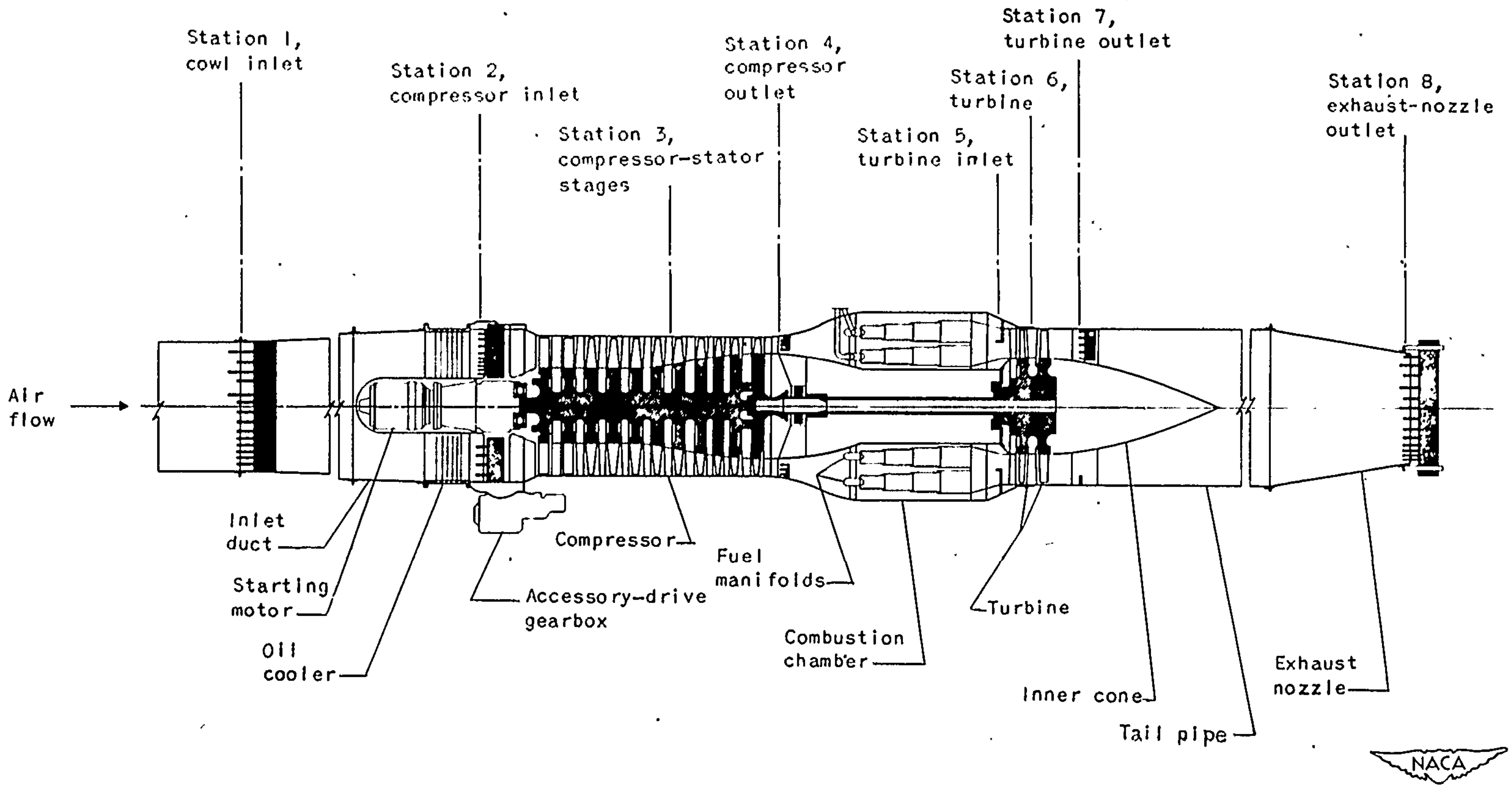
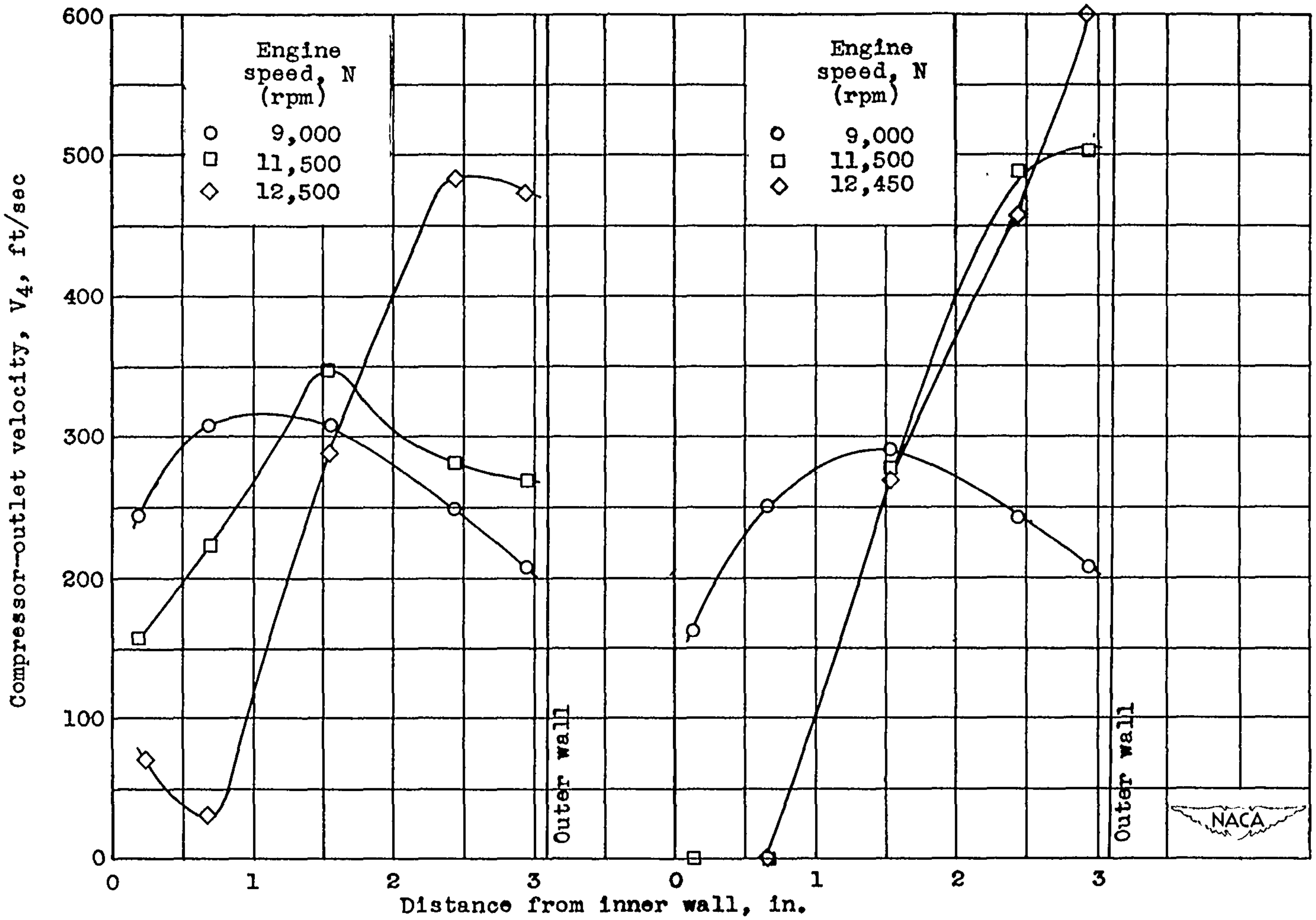


Figure 2. - Location of instrumentation installed in X24C-4B turbojet engine.

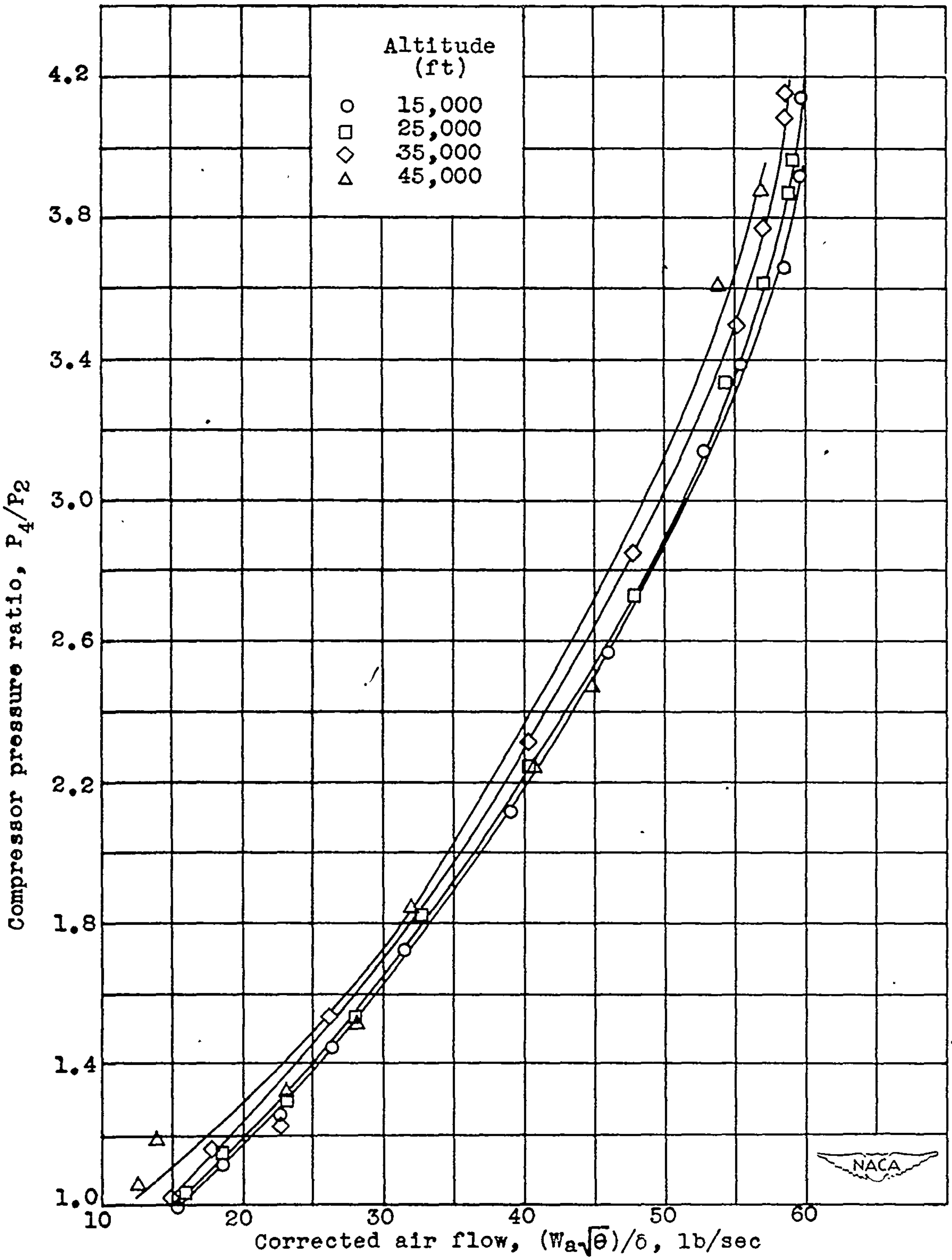
[redacted]



(a) Modified compressor; exhaust-nozzle-outlet area, 170.6 square inches.

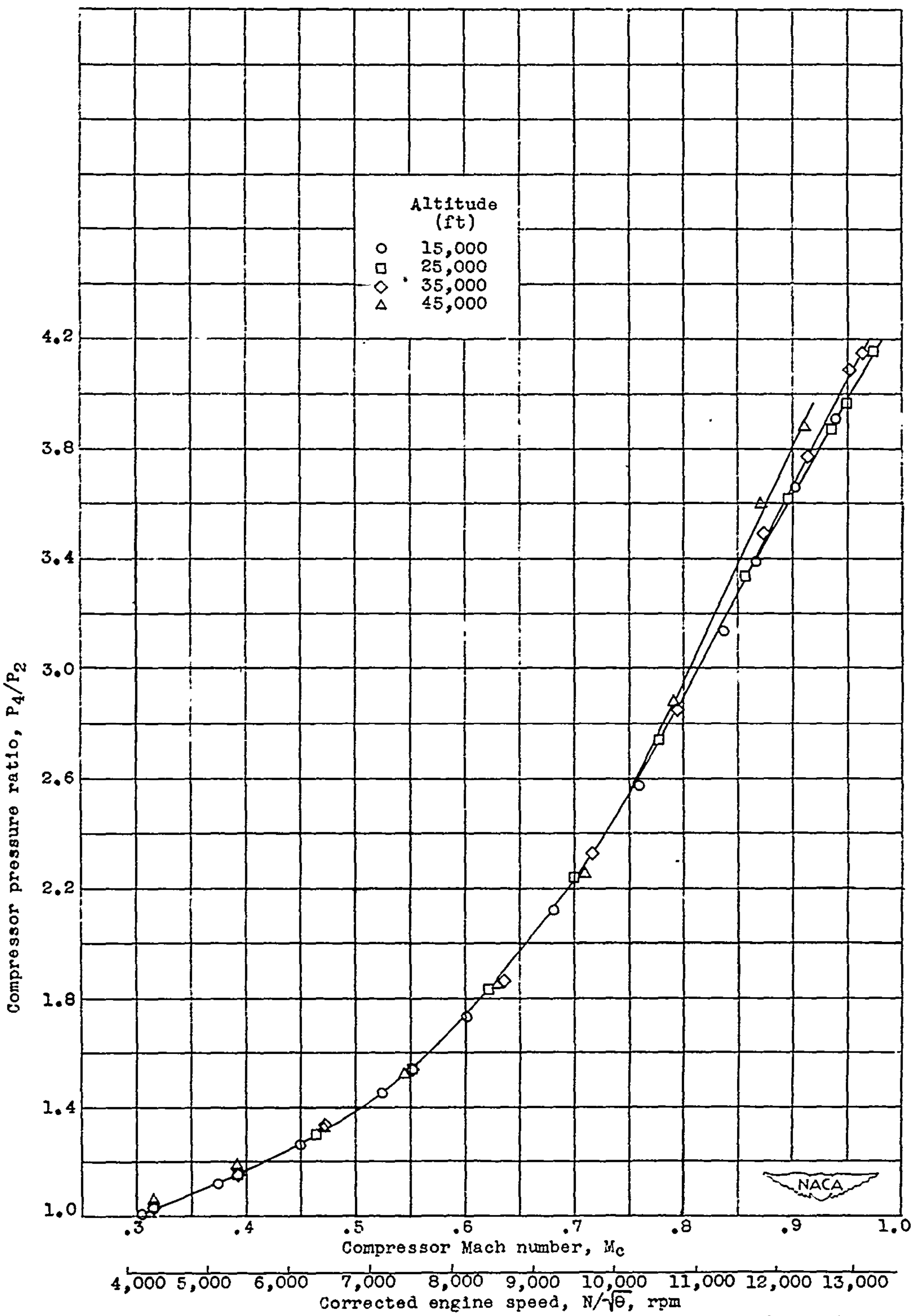
(b) Original compressor; exhaust-nozzle-outlet area, 183.1 square inches.

Figure 3. - Velocity profile at compressor outlet. Altitude, 25,000 feet; flight Mach number, 0.53.



(a) Relation of compressor pressure ratio to corrected air flow.

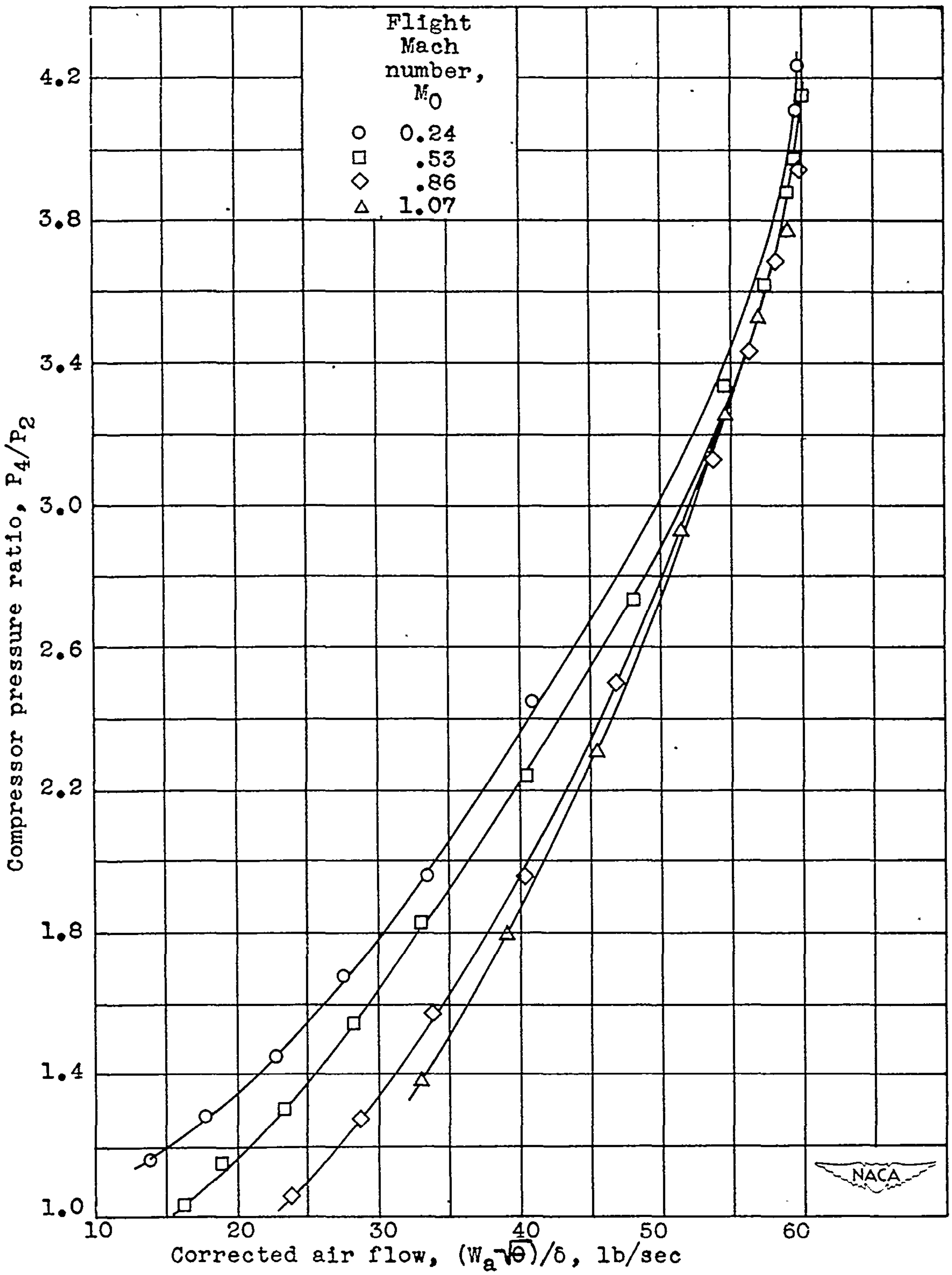
Figure 4. - Effect of altitude on compressor operating line. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 square inches.



(b) Relation of compressor pressure ratio to compressor Mach number and corrected engine speed.

Figure 4. - Concluded. Effect of altitude on compressor operating line. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 square inches.

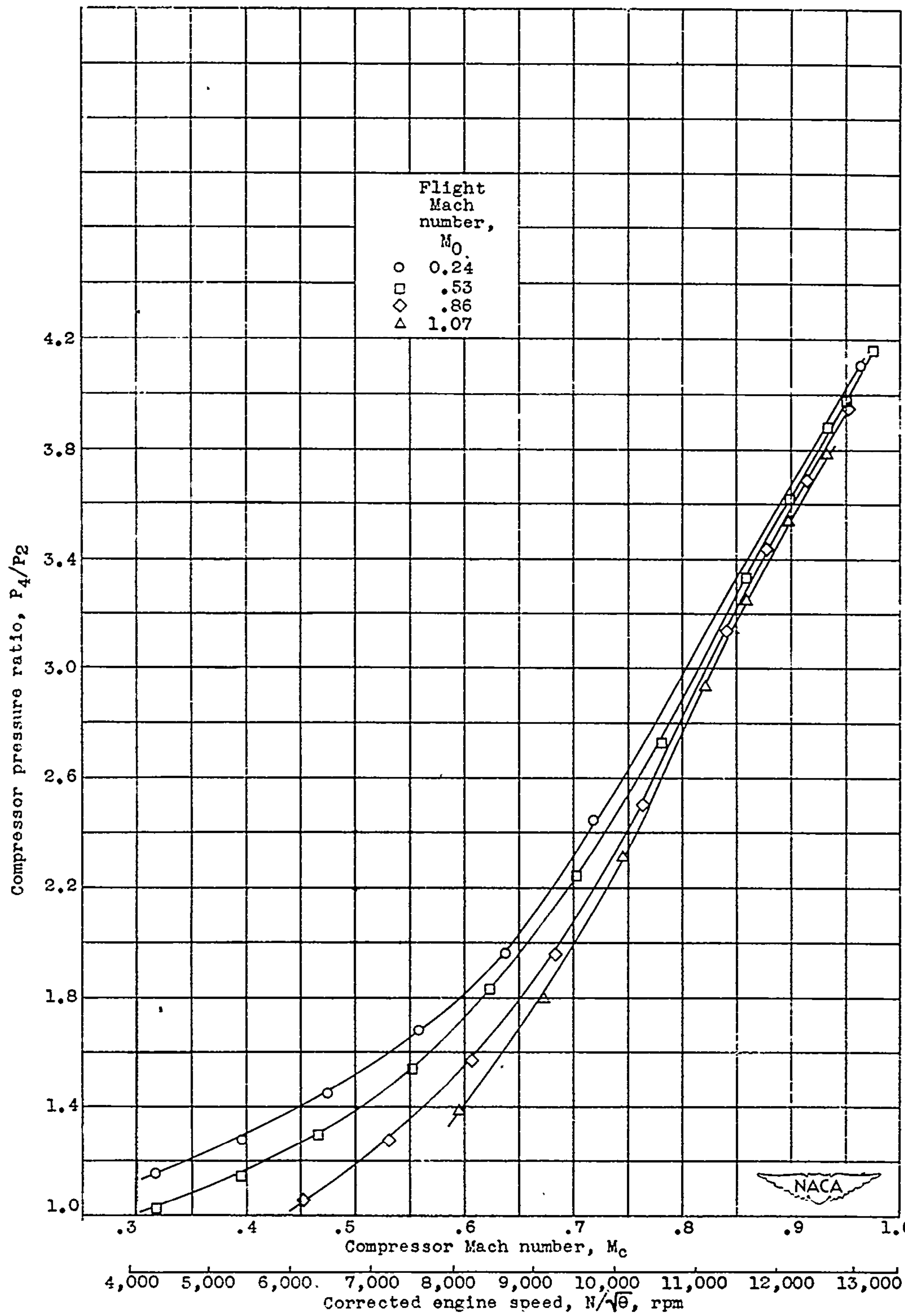
[redacted]



(a) Relation of compressor pressure ratio to corrected air flow.

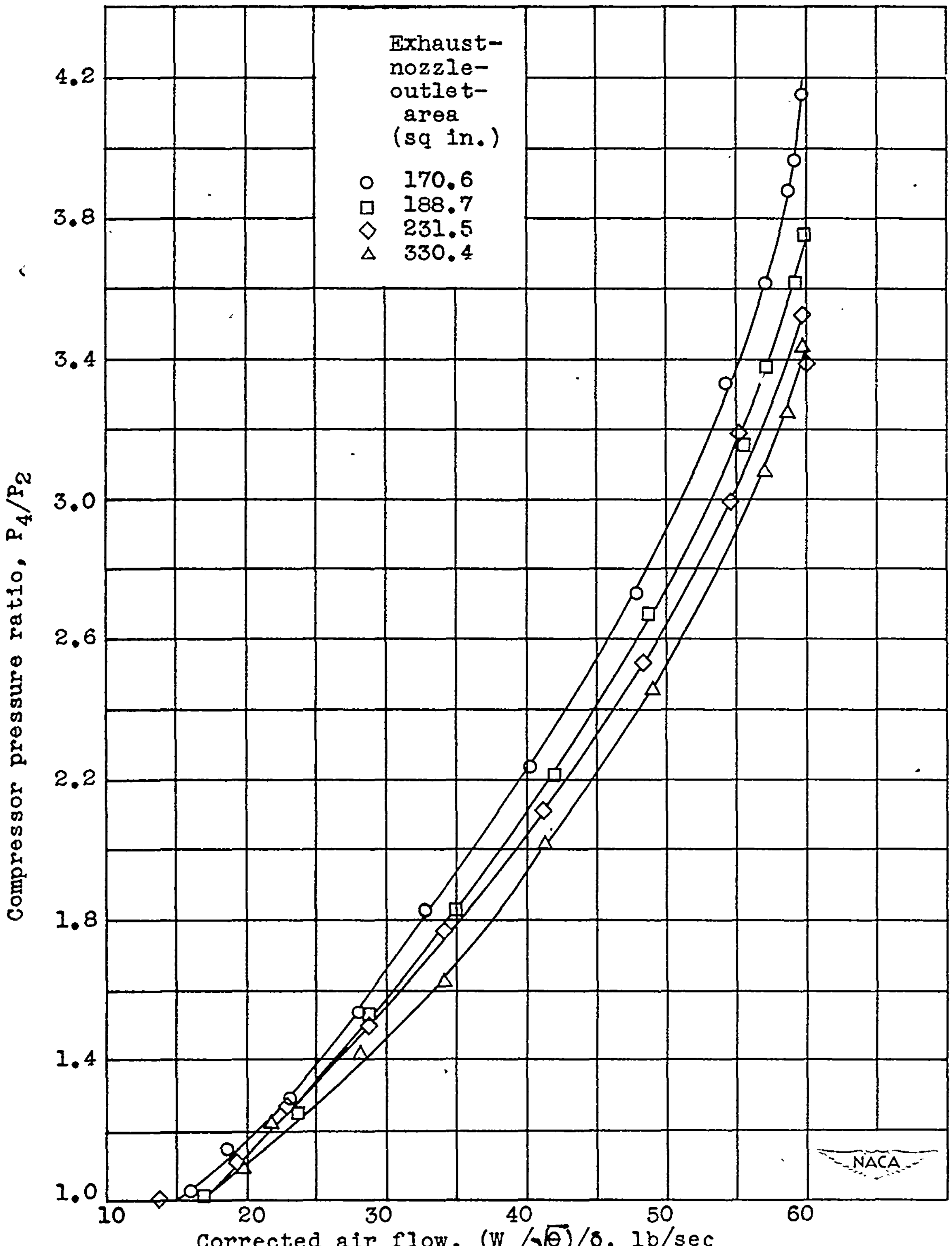
Figure 5. - Effect of flight Mach number on compressor operating line. Altitude, 25,000 feet; exhaust-nozzle-outlet area, 170.6 square inches.

[redacted]



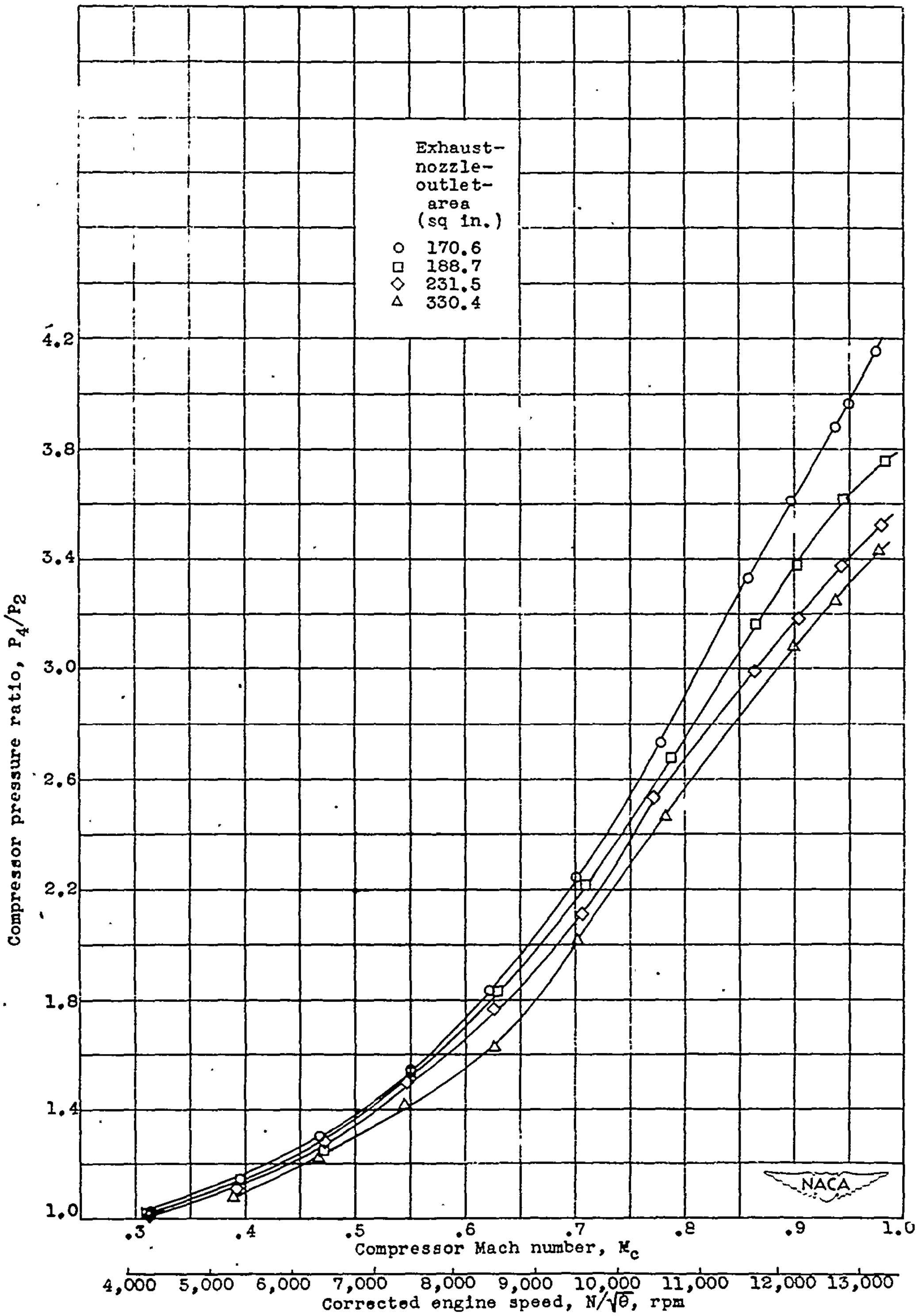
(b) Relation of compressor pressure ratio to compressor Mach number and corrected engine speed.

Figure 5. - Concluded. Effect of flight Mach number on compressor operating line. Altitude, 25,000 feet; exhaust-nozzle-outlet area, 170.6 square inches.



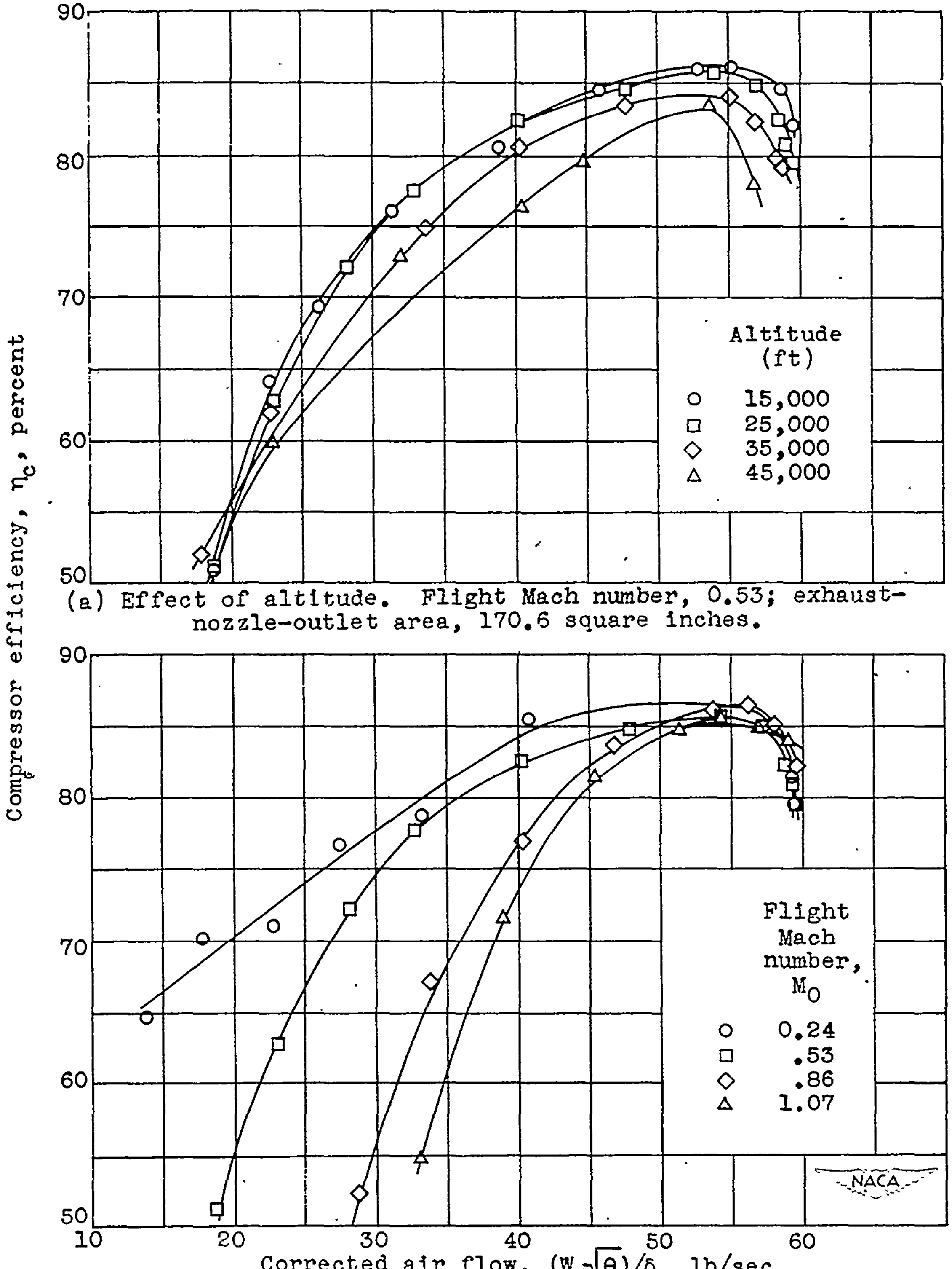
(a) Relation of compressor pressure ratio to corrected air flow.

Figure 6. - Effect of exhaust-nozzle-outlet area on compressor operating line. Flight Mach number, 0.53; altitude, 25,000 feet.



(b) Relation of compressor pressure ratio to compressor Mach number and corrected engine speed.

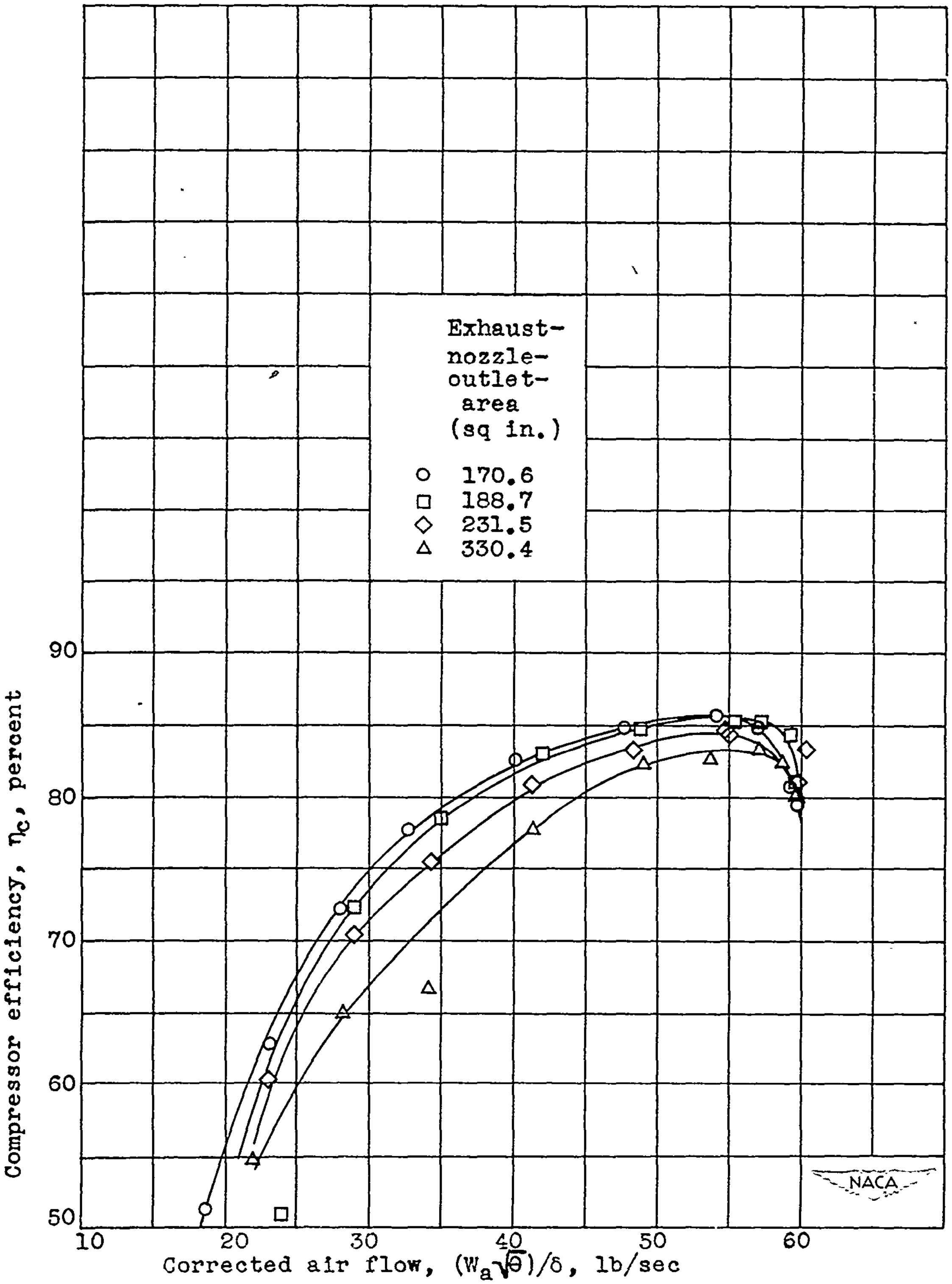
Figure 6. - Concluded. Effect of exhaust-nozzle-outlet area on compressor operating line. Flight Mach number, 0.53; altitude, 25,000 feet.



(a) Effect of altitude. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 square inches.

(b) Effect of flight Mach number. Altitude, 25,000 feet; exhaust-nozzle-outlet area, 170.6 square inches.

Figure 7. - Relation between compressor efficiency and corrected air flow.



(c) Effect of exhaust-nozzle-outlet area. Flight Mach number, 0.53; altitude, 25,000 feet.

Figure 7. - Concluded. Relation between compressor efficiency and corrected air flow.

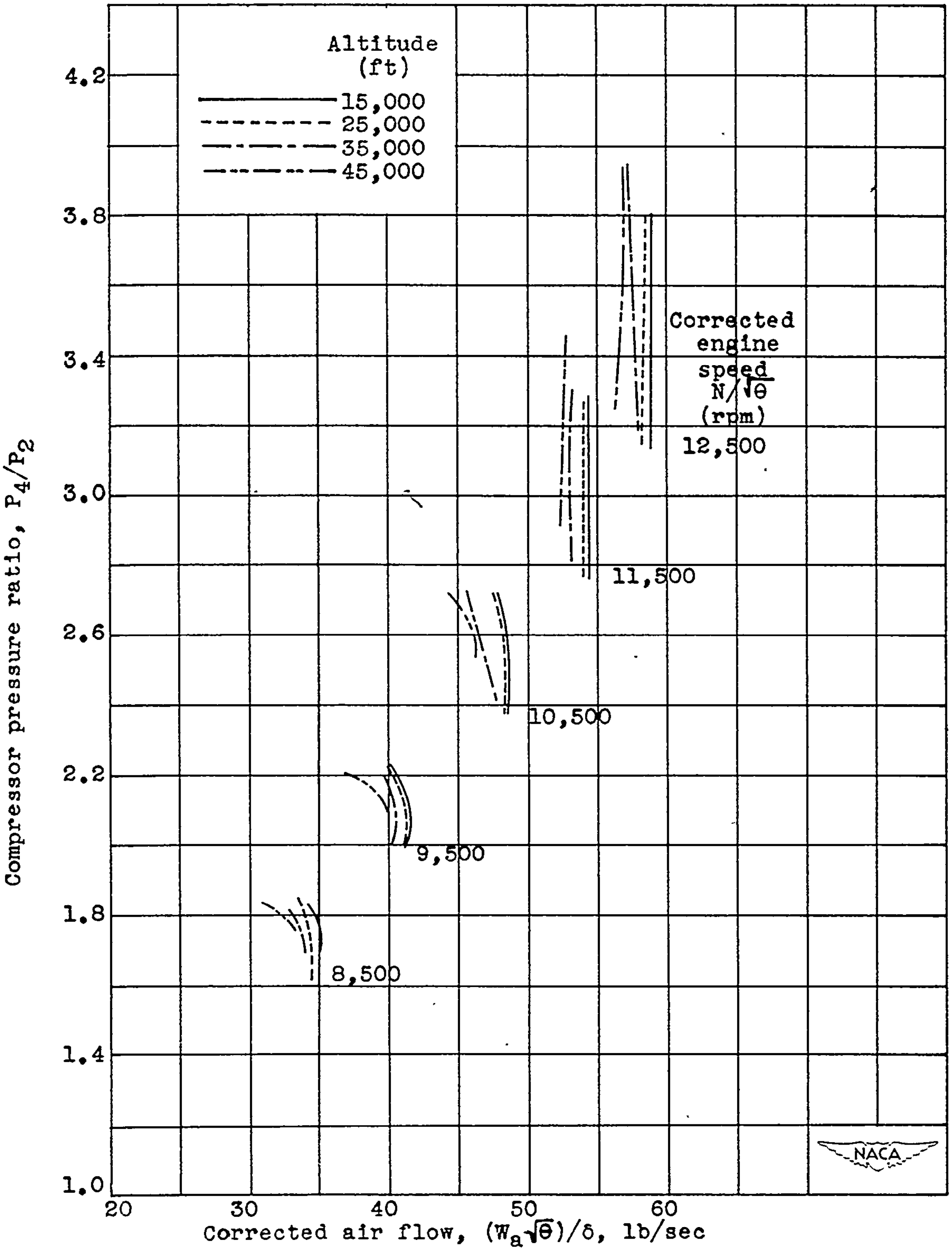
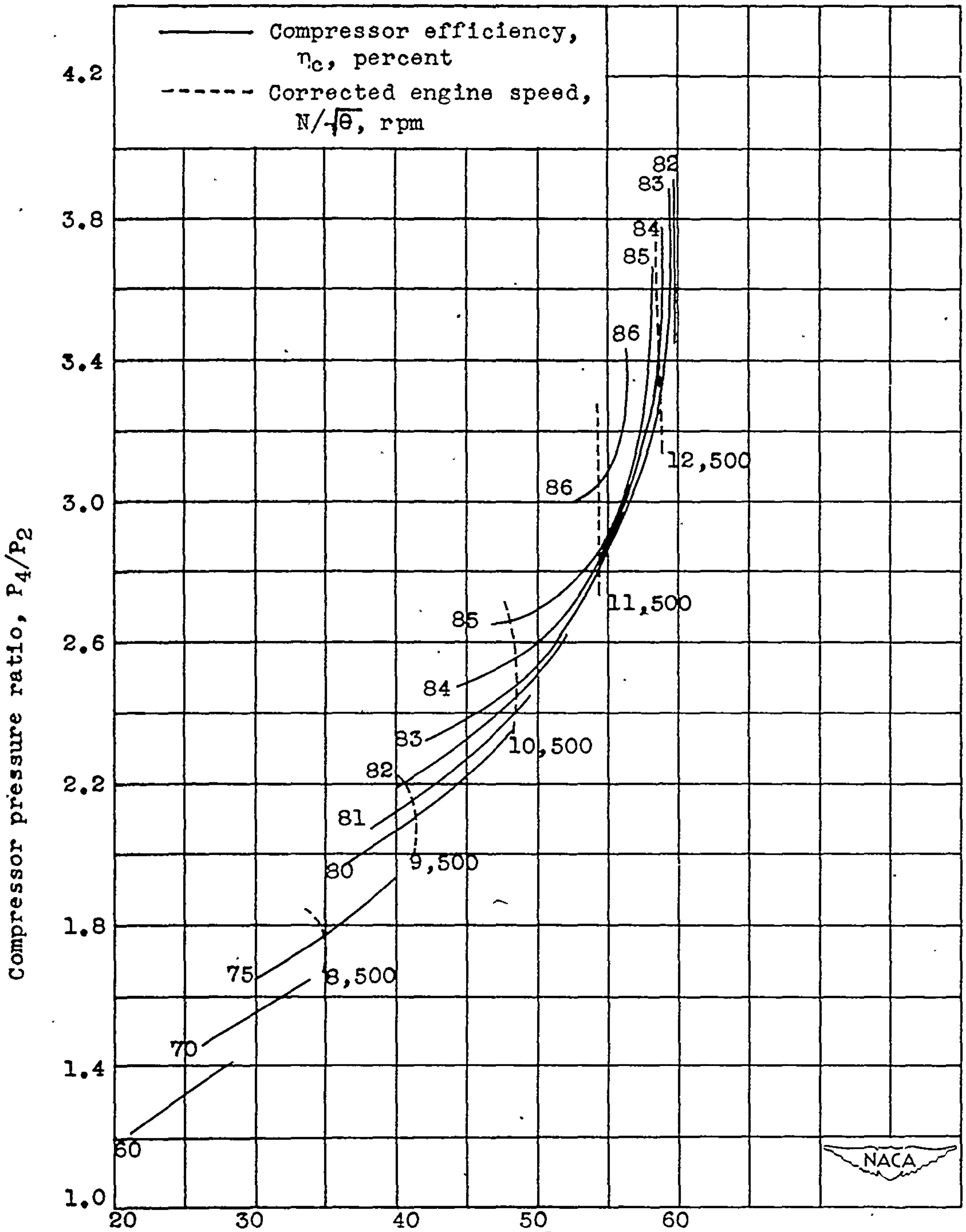
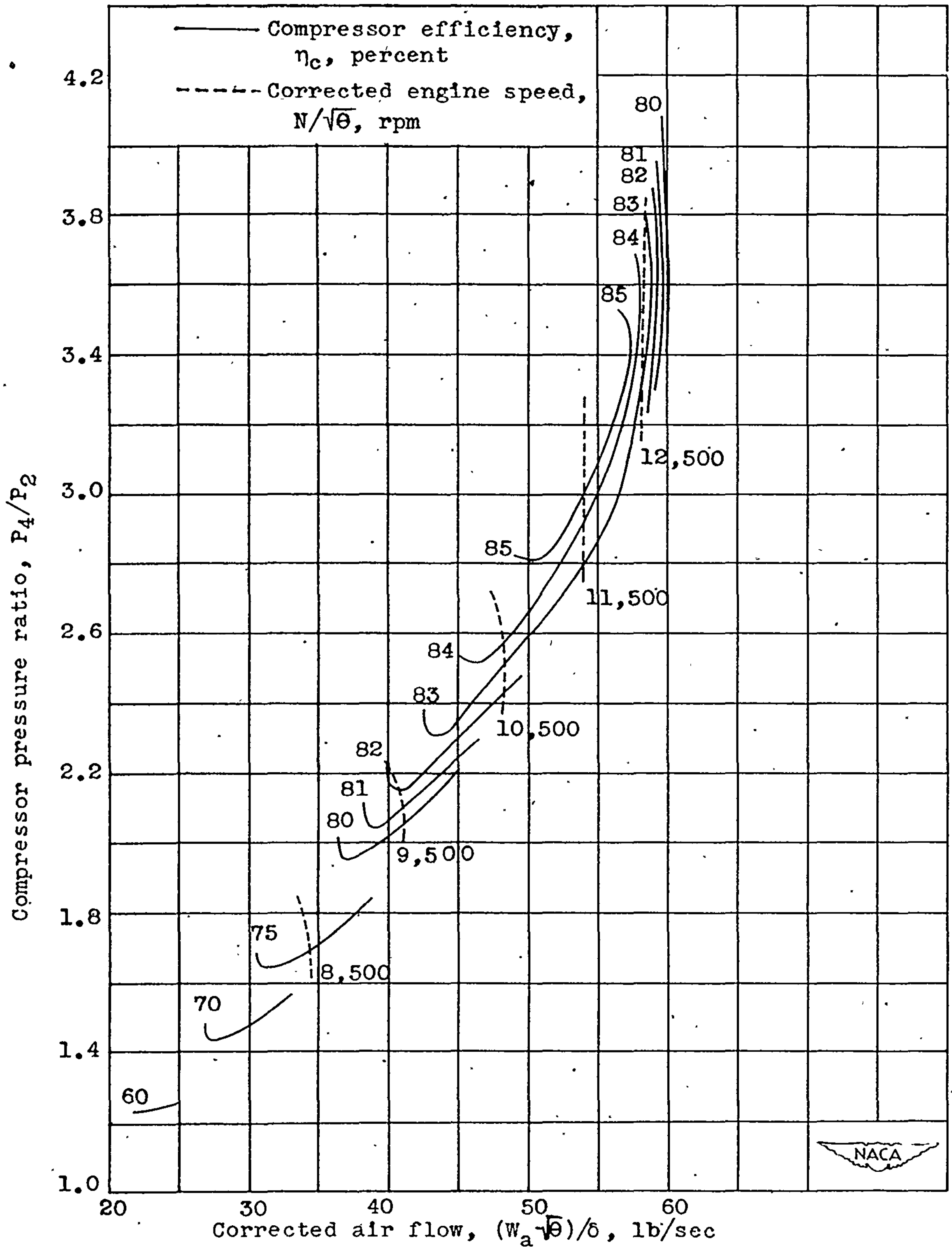


Figure 8. - Effect of altitude on relation between compressor pressure ratio and corrected air flow at constant corrected engine speed. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 to 330.4 square inches.



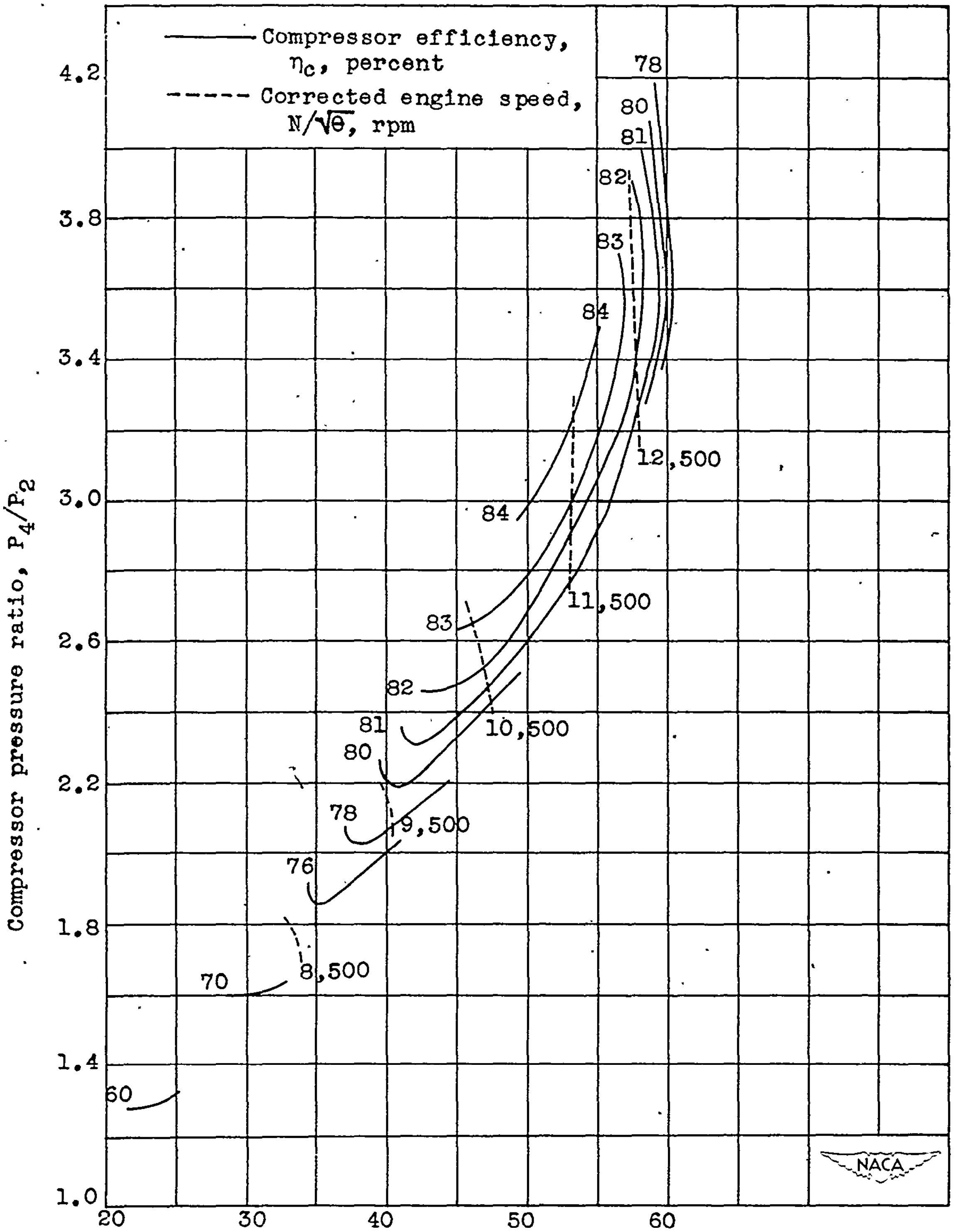
(a) Altitude, 15,000 feet.

Figure 9. - Effect of altitude on compressor performance characteristics. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 to 330.4 square inches.



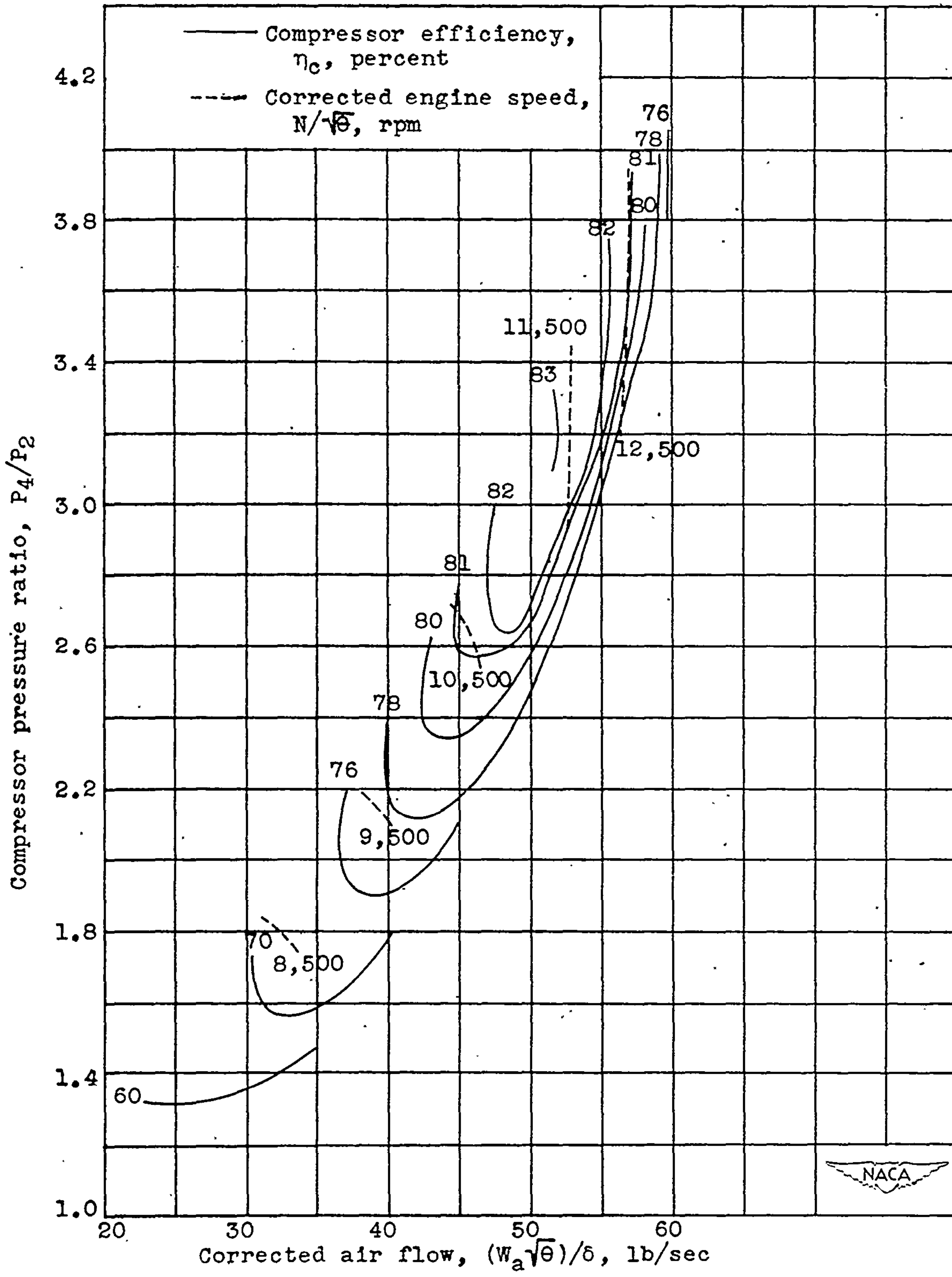
(b) Altitude, 25,000 feet.

Figure 9. - Continued. Effect of altitude on compressor performance characteristics. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 to 330.4 square inches.



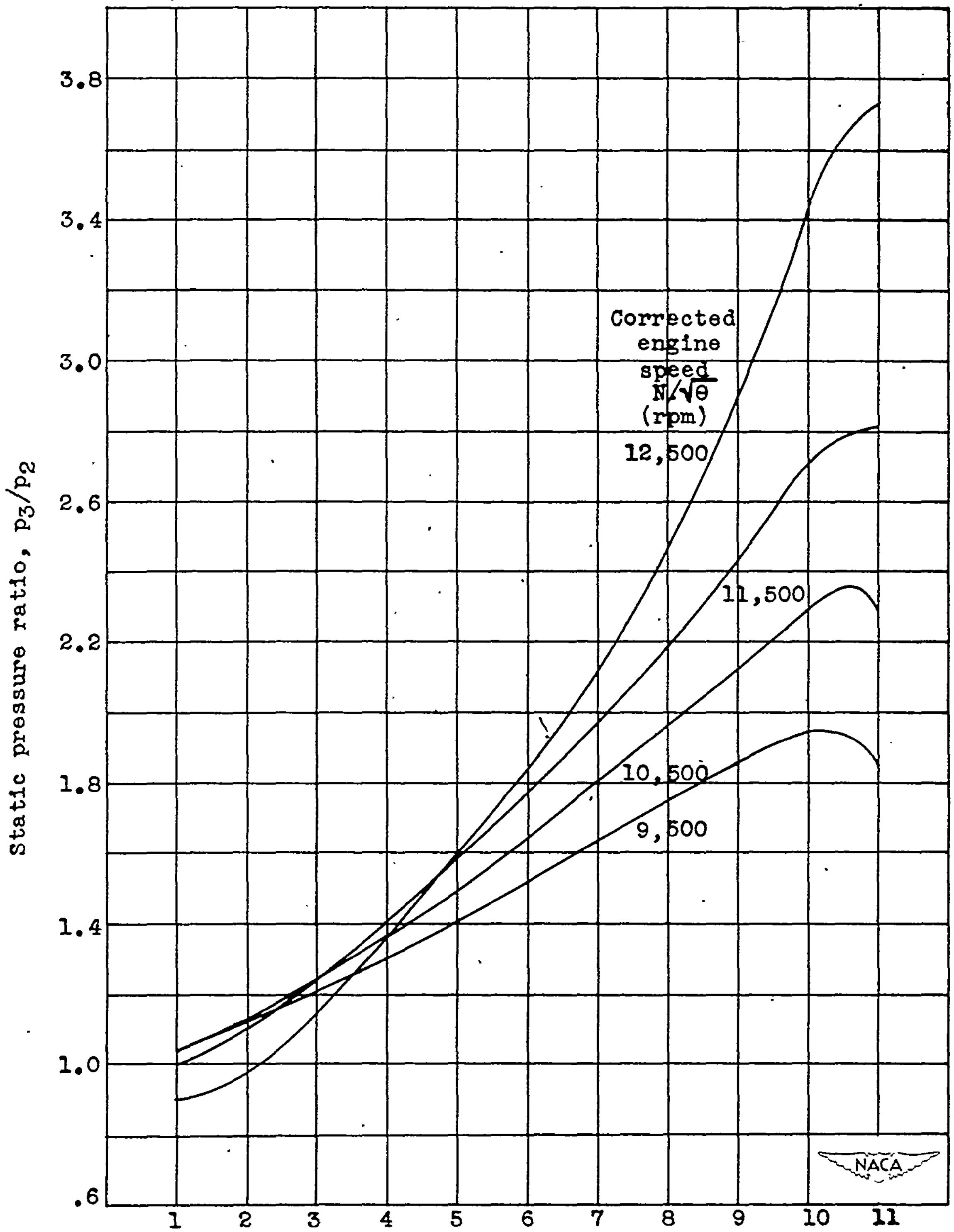
(c) Altitude, 35,000 feet.

Figure 9. - Continued. Effect of altitude on compressor performance characteristics. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 to 330.4 square inches.



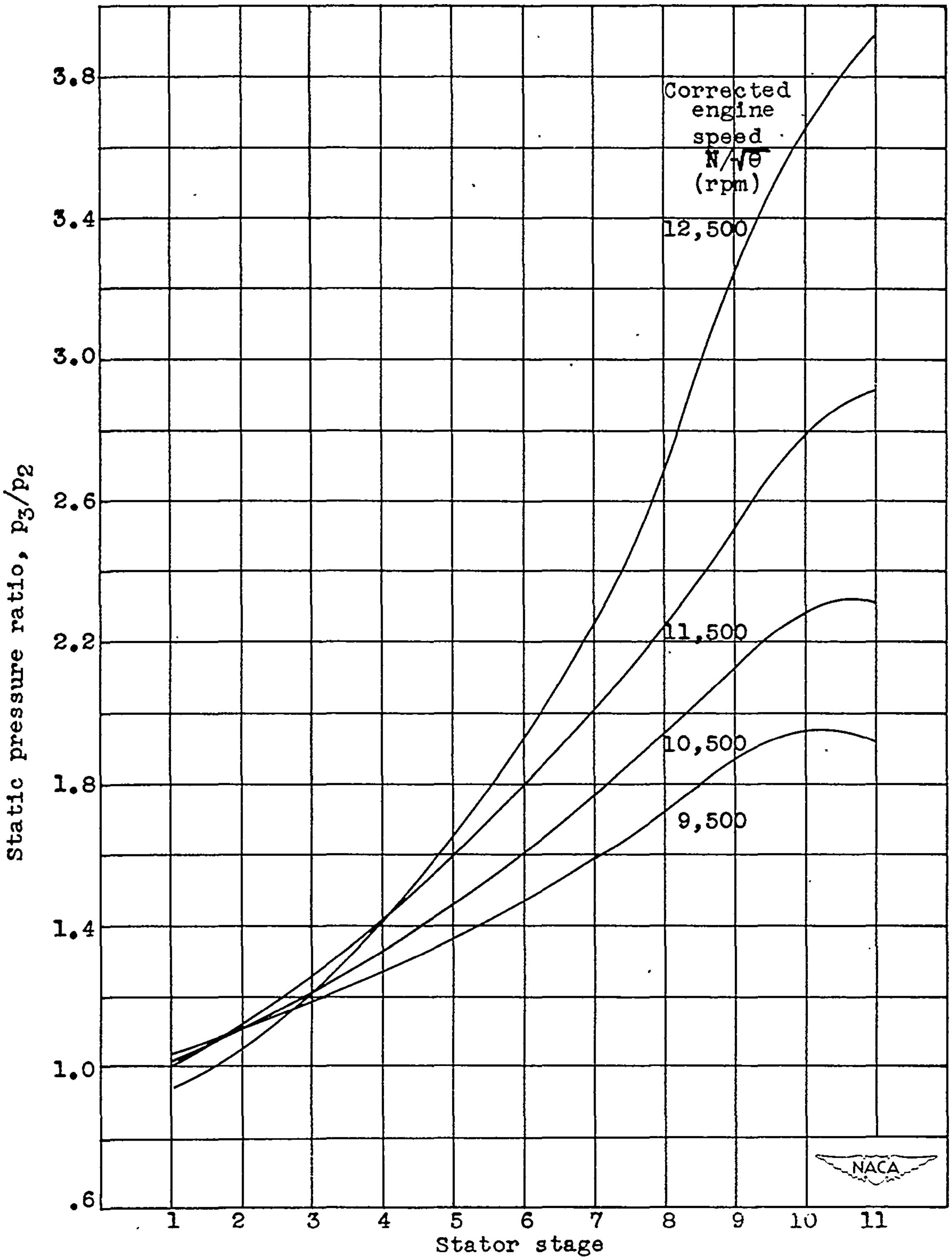
(d) Altitude, 45,000 feet.

Figure 9. - Concluded. Effect of altitude on compressor performance characteristics. Flight Mach number, 0.53; exhaust-nozzle-outlet area, 170.6 to 330.4 square inches.



(a) Altitude, 15,000 feet.

Figure 10. - Compressor stator-stage static-pressure ratios. Exhaust-nozzle-outlet area, 170.6 square inches; flight Mach number, 0.53.



(b) Altitude, 45,000 feet.

Figure 10. - Concluded. Compressor stator-stage static-pressure ratios. Exhaust-nozzle-outlet area, 170.6 square inches; flight Mach number, 0.53.