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RESEARCH MEMORANDUM

CANOPY LOADS INVESTIGATION FOR THE F6F-3 AIRPLANE

By

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NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

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SUMMARY

In conjunction with a general investigation of the aerodynamic forces on cockpit enclosures, surface static pressures have been measured over both the outer and inner surfaces of the cockpit canopies on the Grumman F6F-3, Curtiss SB2C-4E, and Grumman F8F-1 airplanes in the Langley full-scale tunnel. This paper presents a preliminary analysis of data obtained for the F6F-3 airplane. Plots are presented that show the distribution of pressure at four lateral stations through the canopy for a range of conditions selected to determine the effects of varying canopy position, yaw, lift coefficient, and power. The results indicate that the net aerodynamic loads on the canopy are greatest when the airplane is operating at high speed with the canopy closed. At all attitudes investigated the effect of opening the canopy is to reduce the internal-external pressure differential, therefore reducing the exploding forces. Asymmetrical loading is shown for numerous conditions due to propeller operation and airplane yaw but is most extreme at positive yaw attitudes with propeller operating.

INTRODUCTION

The occurrence of canopy failures on Navy airplanes in flight has indicated that present load requirements used in the design of canopies and their components may not be adequate. As the current load requirements are based on wind-tunnel pressure distributions obtained over a range of pitch and yaw attitudes with the canopy closed and do not include accurate measurement of internal pressure or the effects of canopy opening, it is desirable that these factors be investigated and the critical load conditions more accurately defined.

As a result, the Bureau of Aeronautics, Navy Department, has requested the Langley Laboratory of the National Advisory Committee for Aeronautics to conduct a general investigation to determine the critical load requirements by means of external and internal pressure

measurements on airplanes employing three representative types of canopies. The three types of canopies selected for the tests were the conventional single-sliding enclosure, conventional front and rear-sliding enclosures, and the bubble-type enclosures which are typified by the installation on the Grumman F6F-3, Curtiss SB2C-4E, and Grumman F8F-1 airplanes, respectively.

As the first phase of this investigation, tests have been made in the Langley full-scale tunnel to determine external and internal pressure distributions on the three types of canopies for an extensive range of simulated flight conditions with canopy position varied from closed to full open. This paper presents the results obtained with the conventional single-sliding canopy on the F6F-3 airplane.

AIRPLANE

The F6F-3 airplane is a single-place low-wing fighter airplane having a wing span of 42 feet 10 inches, a wing area of 334 square feet, and a normal gross weight of 11,441 pounds. The airplane is powered by a Pratt & Whitney R-2800 engine having an engine propeller gear ratio of 2 to 1. The engine has a military power rating of 2000 horsepower at 2700 rpm at sea level. The engine drives a 13-foot 1-inch-diameter 3-blade Hamilton Standard propeller. A three-view drawing giving the principal dimensions of the airplane is shown in figure 1. Figure 2 shows the airplane mounted in the full-scale tunnel.

The cockpit enclosure on this airplane consists of a single conventional rearward sliding canopy equipped with emergency release mechanism. The canopy has no curvature in the side panels and has approximately constant cross section from front to rear. The windshield fairing ahead of the canopy is rounded and intersects the fuselage at an angle of approximately 45°. At the rear the canopy fairs tangent to the fuselage afterbody. Figure 3 shows the general canopy arrangement.

METHODS AND TESTS

Surface static pressures over the cockpit canopy were measured by means of flush-type static orifices installed in nine longitudinal rows along the canopy (fig. 4). Internal canopy pressures were measured by means of four $\frac{1}{4}$-inch static pressure tubes installed

on the inner surface of the canopy at locations indicated in figure 4.

The external and internal pressures were measured with propeller removed and with propeller operating and with the canopy set in four positions: namely, closed, 3 inches open, $\frac{1}{2}$ open, and full open. The tests were made with the airplane set at angles of attack corresponding to lift coefficients of 0.20, 0.52, 0.91, and 1.23 which were determined from force tests with propeller removed (fig. 5). The tests with propeller removed indicated that the canopy pressures were only slightly affected by large changes in lift coefficient. It was believed, therefore, that any changes in lift coefficient due to propeller operation would have little effect on the canopy pressures. Consequently, the values of angle of attack used during the tests with propeller removed were duplicated for the tests with propeller operating. The specified values of lift coefficient are for the propeller-removed condition and hence the values given for the tests with the propeller operating are somewhat lower than those actually obtained.

With the propeller removed the tests included measurements at yawed attitudes of 0° and -7.5° for the two low lift conditions, and at yaws of -15°, -7.5°, and 0° for the high lift coefficients. Tests were not made at the positive yaw attitudes with propeller removed as the canopy is symmetrical and the pressures at positive yaw should merely be in the opposite sense from those measured at negative yaws. With the propeller operating the power-off test procedure was repeated and was expanded to include additional tests for the same series of conditions throughout the positive yaw range. Thrust coefficients used in the tests to simulate constant military power operation in flight for each of the respective lift coefficients were determined from a flight curve of T_c against C_L for sea-level military power furnished by Grumman aircraft corporation (fig. 5). Tunnel-operation conditions for obtaining the proper T_c and C_L relationships for a constant airspeed of 60 miles per hour and constant propeller blade angle of 26° (0.75 radius) were obtained from a propeller calibration.

SYMBOLS

C_L lift coefficient $\left(\dfrac{L}{q_o S}\right)$

T_c thrust coefficient $\left(\dfrac{T}{\rho V^2 D^2}\right)$

P pressure coefficient $\left(\dfrac{p - p_o}{q_o}\right)$

L lift, pounds

T thrust, pounds

q_o free-stream dynamic pressure $\left(\dfrac{1}{2}\rho_o V_o^2\right)$, pounds per square foot

ρ_o mass density of air, slugs per cubic foot

p local static pressure, pounds per square foot

p_o free-stream static pressure, pounds per square foot

S wing area, square feet

V airspeed, feet per second

D propeller diameter, feet

ψ angle of yaw, degrees

Subscripts:

   i   internal

   e   external

DISCUSSION OF RESULTS

The test results are presented in figures 6 to 13 in the form of pressure-distribution plots showing the variation of

external pressure coefficient $\left(\dfrac{p - p_0}{q_0}\right)$ at four lateral stations

through the canopy (fig. 4) for each test condition. Internal static-pressure coefficients are also shown on the respective figures for each test condition. For all cases where the internal pressure is uniform an average value is shown and for conditions where the internal pressure varied the pressure coefficients at the four points of measurement are shown individually. The variation of internal pressure coefficient with yaw is shown in figure 14 for the complete range of airplane attitudes tested with propeller operating and canopy closed.

External Pressure Distribution

Zero yaw.- The results of tests made with the airplane at zero yaw are presented in figures 6 and 7. These results show that with propeller removed (fig. 6) the lateral distribution of pressure coefficient is symmetrical and has a maximum variation of approximately 0.25 from the sides to the top of the canopy. The highest negative pressure coefficients occur with the canopy closed or 3 inches open with maximum value of approximately $0.70q_0$ reached over the top of the canopy. Neither the peak pressures nor the nature of the pressure distributions is appreciably affected by variation of lift coefficient.

With the propeller operating the test results show (fig. 7) that the magnitude of the pressure coefficient and the symmetry of distribution are appreciably affected at the higher thrust conditions due to the increased local velocity and rotation of the slipstream. For conditions with the propeller operating at low thrust coefficients (figs. 7(a) and 7(e)) the power effects are quite small. High thrust conditions, however, as shown by figures 7(b), 7(c), and 7(d), produce asymmetry of pressure distribution which results in a net side-load component to the right with maximum pressure coefficients as high as -1.8 for the condition representing take-off with military power (fig. 7(d)). As seen from the test results (fig. 7), opening the canopy decreased the peak negative external pressure coefficient for any given condition by approximately 0.40 but resulted in increased pressure asymmetry at the front of the canopy.

Considering the external-internal pressure differential $(P_e - P_i)$, which is the basic parameter in determining net

canopy exploding loads, the test results show that the greatest differential pressure exists with the canopy closed for all airplane attitudes investigated at zero yaw. Calculations indicate that the net loading for the high-speed attitude represented in figure 7(a) will be approximately double the loads encountered

in a military power take-off condition as represented by figure 7(d).
Also, the loads encountered in a high-speed pull-up are expected
to be approximately the same as those for the level-flight
high-speed condition, inasmuch as the canopy pressures are not
appreciably affected by increasing lift coefficient.

Negative yaw.- Figures 8 to 11 present the results of tests
made with the airplane at negative yaw attitudes (right wing
advanced). The results obtained with the propeller removed
(figs. 8 and 9) show that yaw produces asymmetry in the pressure
distributions with peak pressure coefficients reaching values as
high as -1.1 at a yaw angle of -15°. The asymmetry is most
pronounced at the front of the canopy although at the higher yaw
attitudes (figs. 9(a) and 9(b)) appreciable asymmetry is in evidence
at all four pressure-measurement stations. The propeller-removed
results also show that variation of lift coefficient has only slight
effects on the asymmetry of pressure distribution and magnitude of
the peak negative pressures.

With the propeller operating (figs. 10 and 11) the results show
that the lateral asymmetry of pressure is appreciably reduced
inasmuch as the slipstream rotation tends to counteract the angle
of flow over the canopy induced by negative yaw. At -7.5° yaw
attitude the slipstream effects at the higher thrust conditions
(figs. 10(c) and 10(d)) completely overcome the asymmetry due to yaw.
At -15° yaw, however, the asymmetry due to yaw is never completely
overcome although approximately symmetrical loading conditions are
indicated for the high thrust condition (fig. 11(b)). For all
negative yaw conditions the external pressure coefficients have the
greatest negative values with the canopy closed or 3 inches open but
show the greatest asymmetry of distribution with the canopy full open.
The test results indicate that the net canopy exploding force based
on external-internal pressure differential $(P_e - P_i)$ will be greatest
with canopy closed for all negative yaw attitudes.

Positive yaw.- The results of tests made at positive yaw
attitudes (right wing retarded) with propeller operating are presented
in figures 12 and 13. These results show that at positive yaw attitudes
the effects of slipstream rotation and yaw combine to cause very
pronounced asymmetry and high negative peaks in the lateral pressure
distributions. As shown for negative yaw conditions the lateral
asymmetry of pressure is most pronounced at the front sections of the
canopy and the greatest negative pressures occur on these sections.
The pressure asymmetry is similar to that shown at negative yaw
attitudes in that the location of section peak negative pressures vary
from front to rear. In general for the canopy-closed condition, the
negative pressure peaks at the front of the canopy (station 1) occur

approximately over tube number 5 on the side near the retarded
wing, and for the rear stations the peaks progressively shift
so that for station 4 the negative pressure peak is approximately
over tube number 3 on the side near the advancing wing.

The nature of the distribution of side forces on the canopy
due to the pressure asymmetry will be similar to that discussed
for zero yaw conditions except that it is more extreme. Based
on external-internal pressure differential $(P_e - P_i)$, the results
indicate that the net exploding forces will be greatest with
canopy closed throughout the positive yaw range. As noted at
zero and negative yaw attitudes, the effect of opening the canopy is
to decrease the magnitude of the external negative pressures and
increase the internal negative pressures. Calculations indicate
that although maximum negative pressures as high as $-3.0q_o$ are
encountered in the worst conditions at $15°$ positive yaw (fig. 13(b)),
the over-all net exploding force on the canopy should not exceed
that for the high-speed attitude with zero yaw.

Internal Static Pressures

Static pressures measured at the inner surface of the canopy
are shown in conjunction with the external pressure distributions
presented in figures 6 to 13 for the complete range of test
conditions. In addition, figure 14 is presented to summarize the
variation of internal pressure coefficient with yaw angle for
all the tests made with canopy closed and propeller operating.
From the test results it is seen that the internal pressure has
a negative value throughout the range of conditions investigated.
The least negative value of internal pressure coefficient measured
was -0.15 for the high-speed attitude (C_L, 0.20; T_c, 0.04) with
canopy closed (fig. 14). The effect of increasing lift coefficient
with propeller operating at thrust coefficients simulating military
power was to decrease the internal pressure coefficient as shown
by figure 14. The effect of airplane yaw also is to reduce slightly
the internal pressures at the higher angles of yaw when the thrust
coefficient is small and to a considerably greater extent when the
thrust coefficient is high. These results show that the variation
of internal pressure coefficient is a direct reflection of the
external-pressure-field variation and the cockpit leakage; therefore,
any variable which causes the external pressures to become more
negative has the same effect on the internal pressures. Likewise
partially opening the canopy increases the leakage area and allows
air to flow freely from the inside of the cockpit to the surrounding
lower pressure area, thus causing the further reduction in internal
pressure shown for canopy positions from closed to half open.

For the canopy full-open position, however, this trend is reversed
and the internal pressure becomes less negative as air is probably
flowing under the canopy for this condition. For all tests at
zero and negative yaw attitudes the internal pressure is uniform
throughout the canopy. At the positive yaw attitudes with propeller
operating (figs. 12 and 13) and canopy open the internal pressures
become quite irregular due to the influence of the asymmetrical
external pressure field and disturbed flow conditions.

CONCLUDING REMARKS

The results of the investigation of pressure distributions
on the conventional single-place canopy of the Grumman F6F-3
airplane show that:

1. The net exploding forces on the canopy will be greatest
when the airplane is operating at high speed with canopy closed.

2. For all conditions the net canopy load will be in an
exploding direction.

3. At all attitudes investigated, partially opening the
canopy reduces the external-internal pressure differential,
thus reducing the net exploding loads.

4. Yawing the airplane increases the magnitude of the peak
negative pressure coefficients and results in an asymmetrical
lateral distribution of pressure which becomes more pronounced
with increasing yaw.

5. The high axial velocities and rotation of the slipstream
at high thrust conditions also increase the magnitude of the
pressure coefficient and produce asymmetry in the distribution
of pressure. The effects of propeller operation are most pronounced
at positive yaw attitudes as the flow asymmetry due to clockwise
slipstream rotation combines with the flow asymmetry due to positive
yaw.

6. Varying the lift coefficient has little effect on either
the asymmetry or magnitude of the pressure coefficients.

Langley Memorial Aeronautical Laboratory
National Advisory Committee for Aeronautics
Langley Field, Va.

Weight _____ 11,441 lb
Wing section
    Root _____NACA 23015.6 (Modified)
    Tip _____ NACA 23009
Wing area _____ 334.0 sq ft
Twin-row two-stage-supercharged engine
1650 hp at 2700 rpm at 25,000 ft
Propeller gear ratio _____ 2:1

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9'-11.2"

42'-10"

13'-1"DIAM.

33'-10"
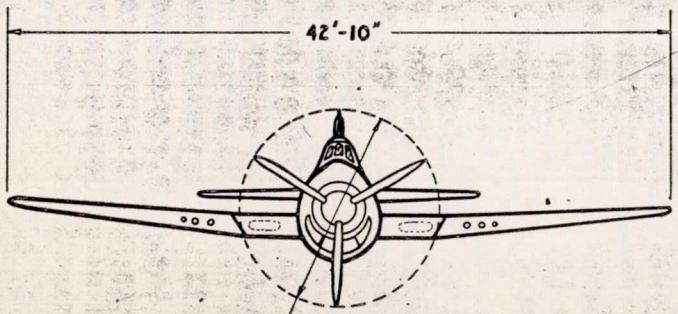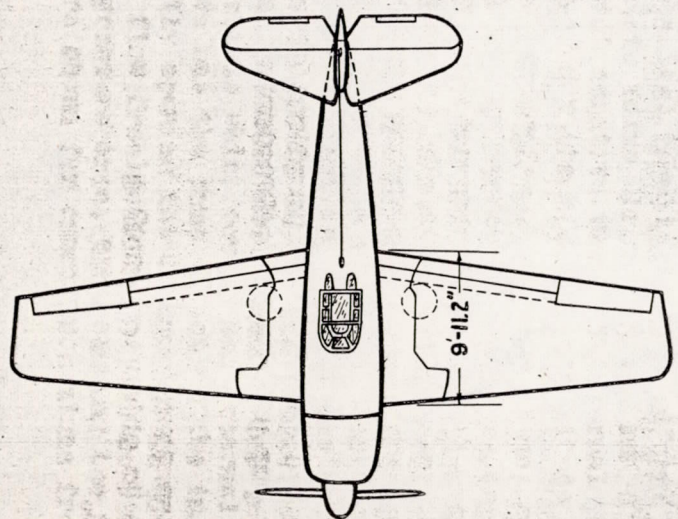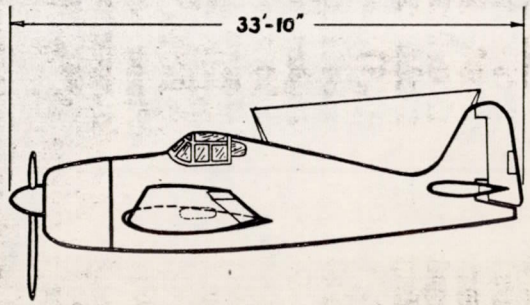
Figure 1 - Three-view drawing of the Grumman F6F-3 airplane

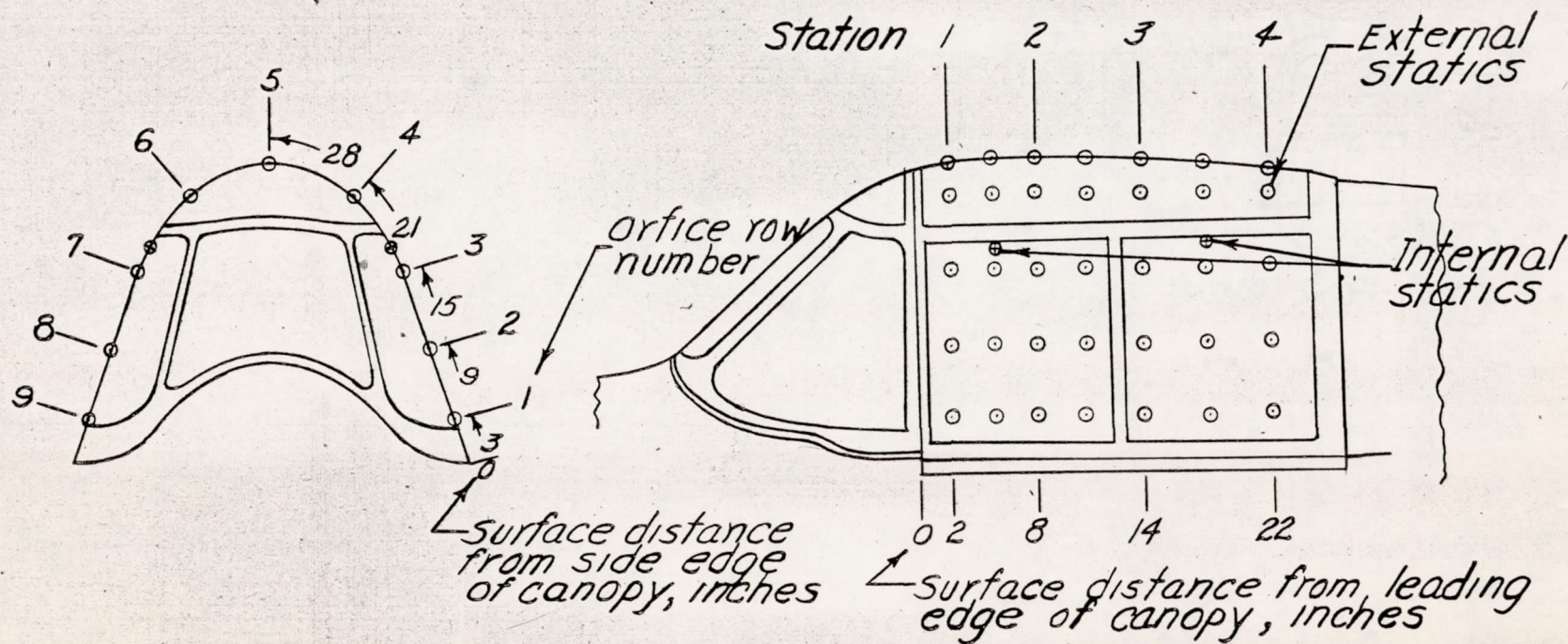Fig. 1
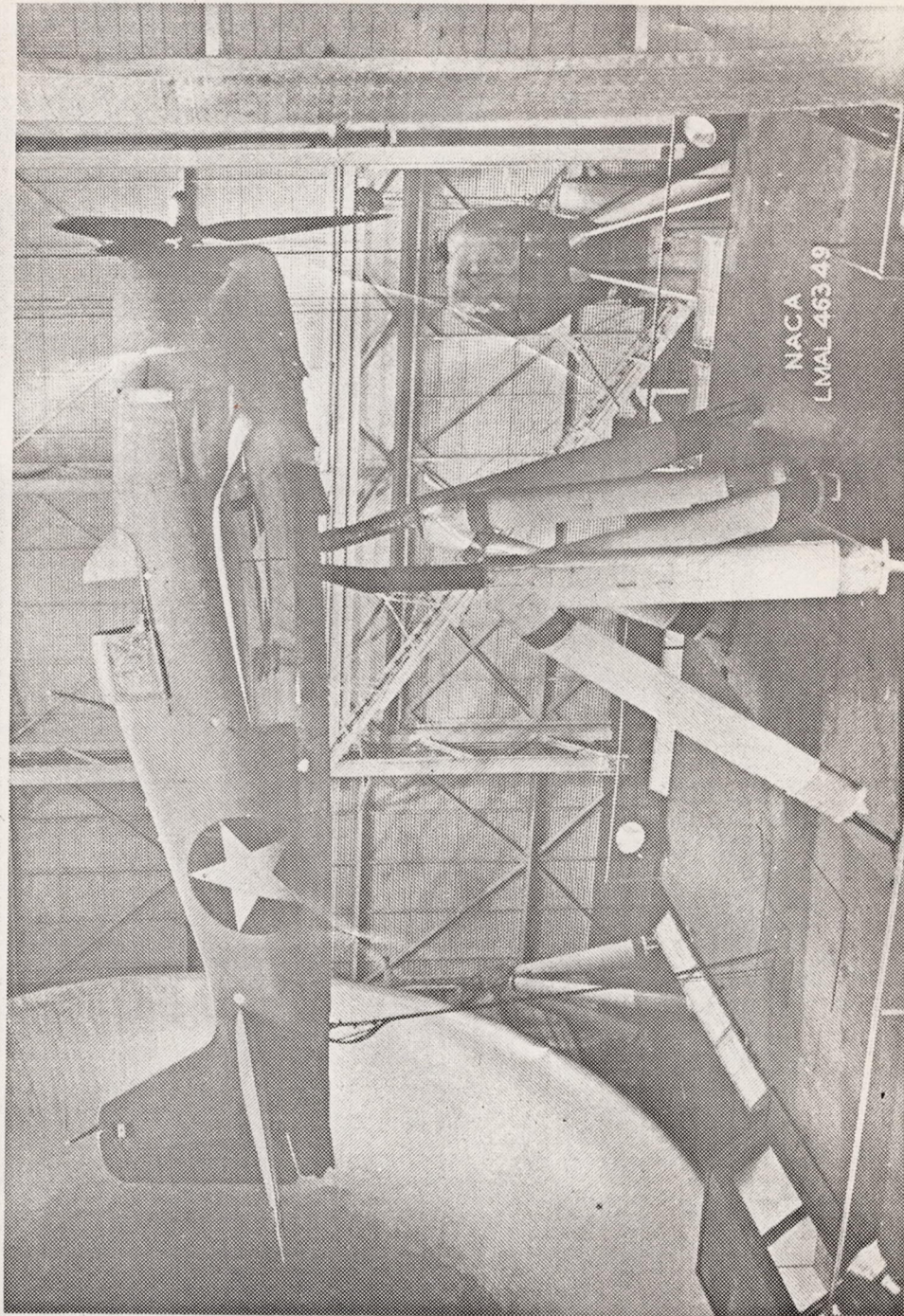
Figure 2.- The F6F-3 airplane mounted in the full-scale tunnel.
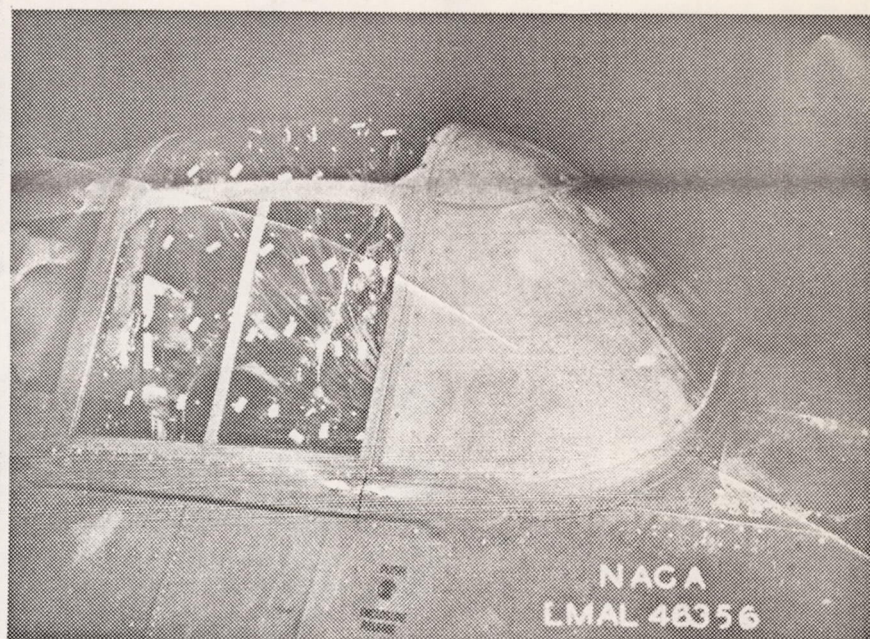
(a)   Canopy closed.
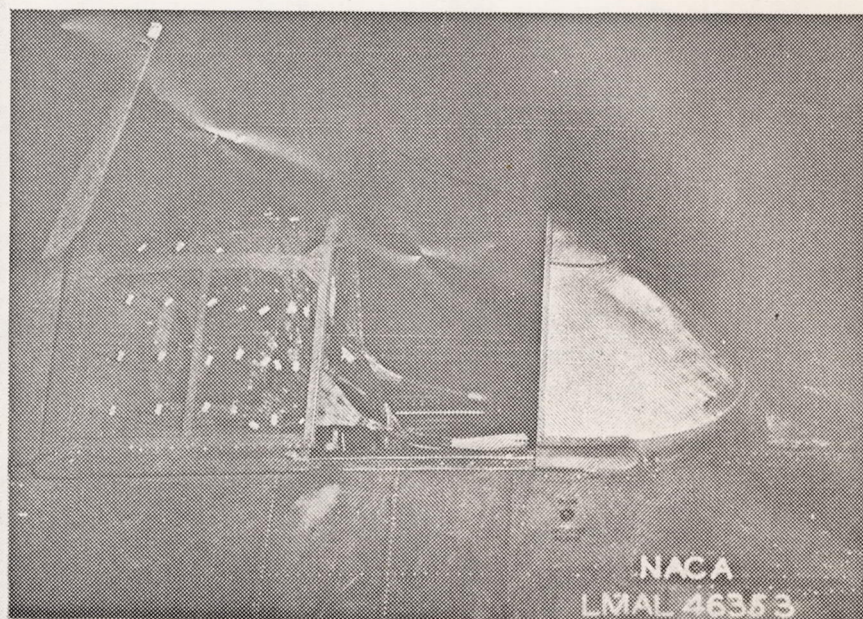
(b)   Canopy full open.

Figure 3.-   Photographs showing the general arrangement of the F6F-3 cockpit canopy.

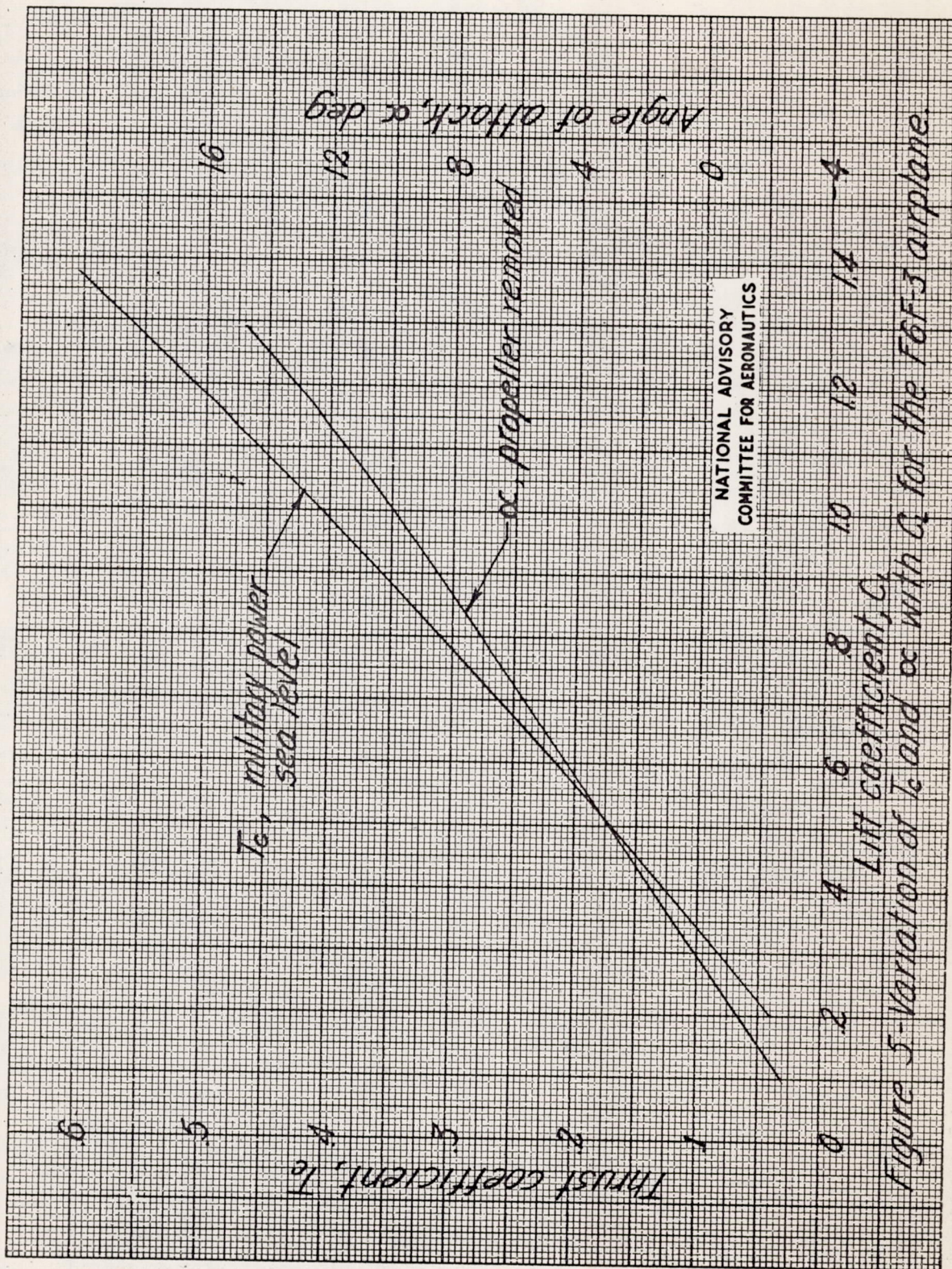Figure 4.-Static pressure orfice locations in
the F6F-3 cockpit canopy.

Fig. 4

Fig. 5   NACA RM No. L6L23a

Figure 5.- Variation of T_c and α with C_L for the F6F-3 airplane.

Stations
1
2
3
4

P_e

$P_i = -0.12$

−1.0

0

+1.0

Right side   Left side
Canopy closed

$P_i = -0.32$

Canopy 3 inches open

$P_i = -0.32$

Canopy one-half open
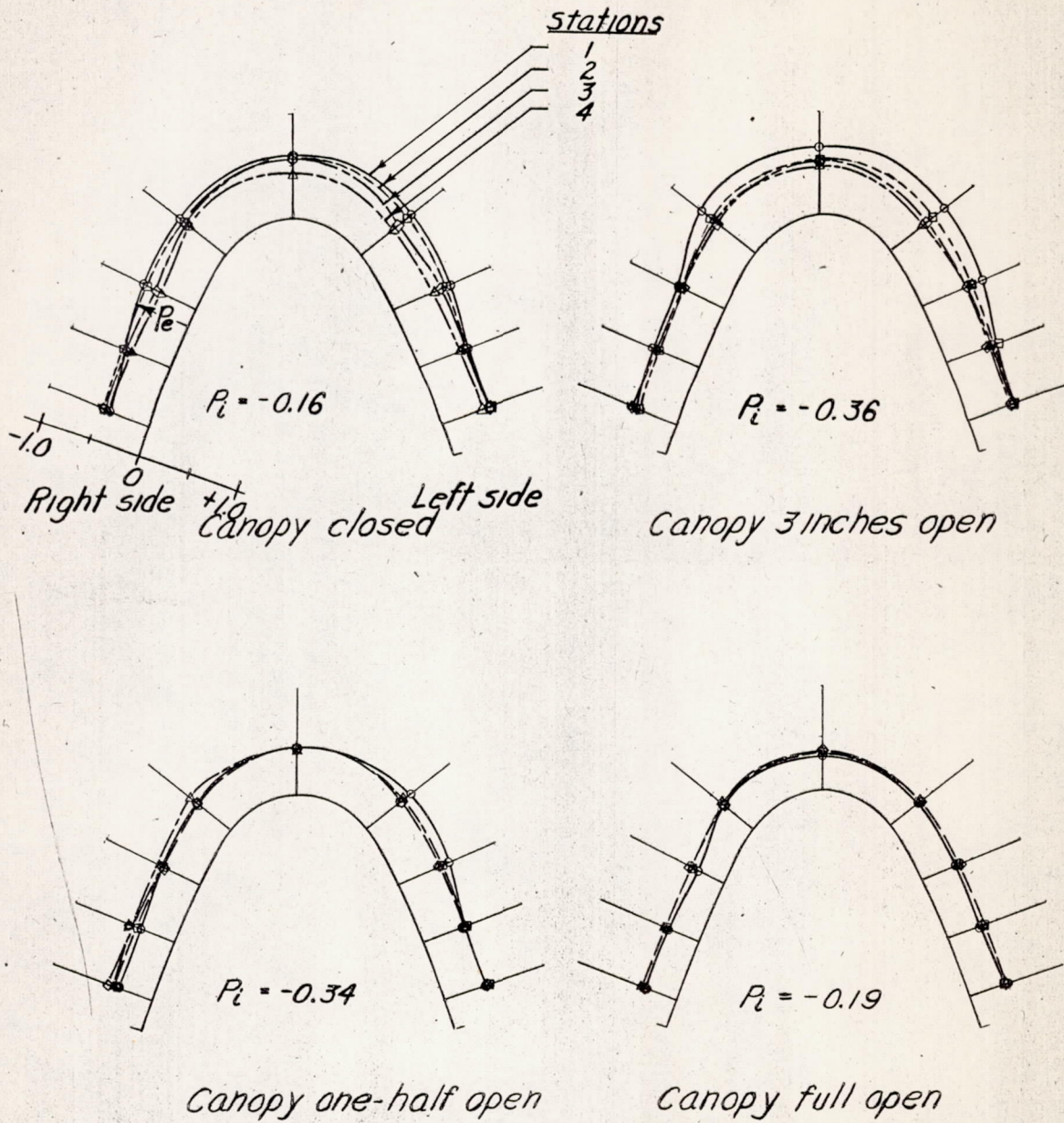
$P_i = -0.20$

Canopy full open
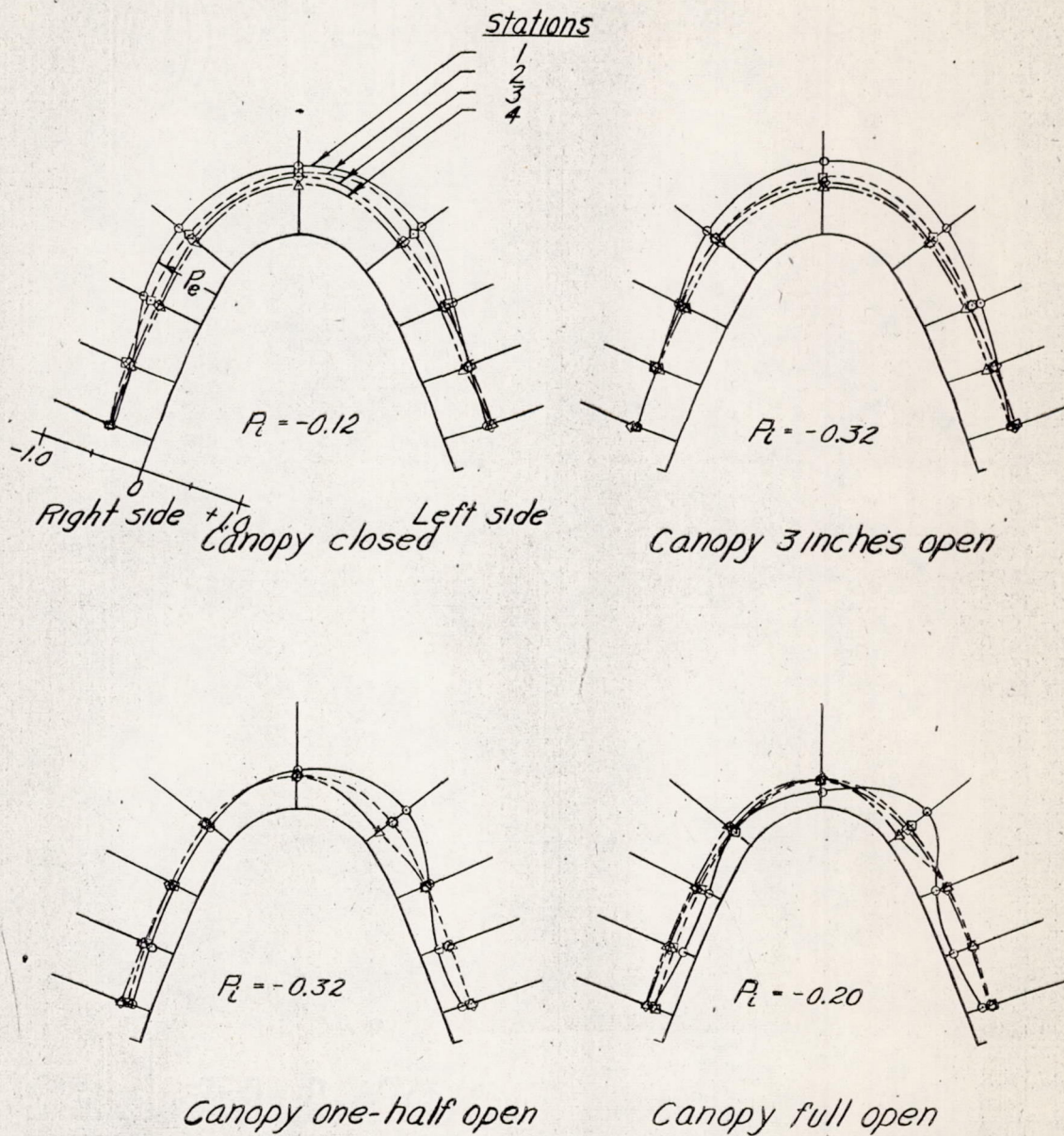
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(a) Propeller removed; C_L, 0.20

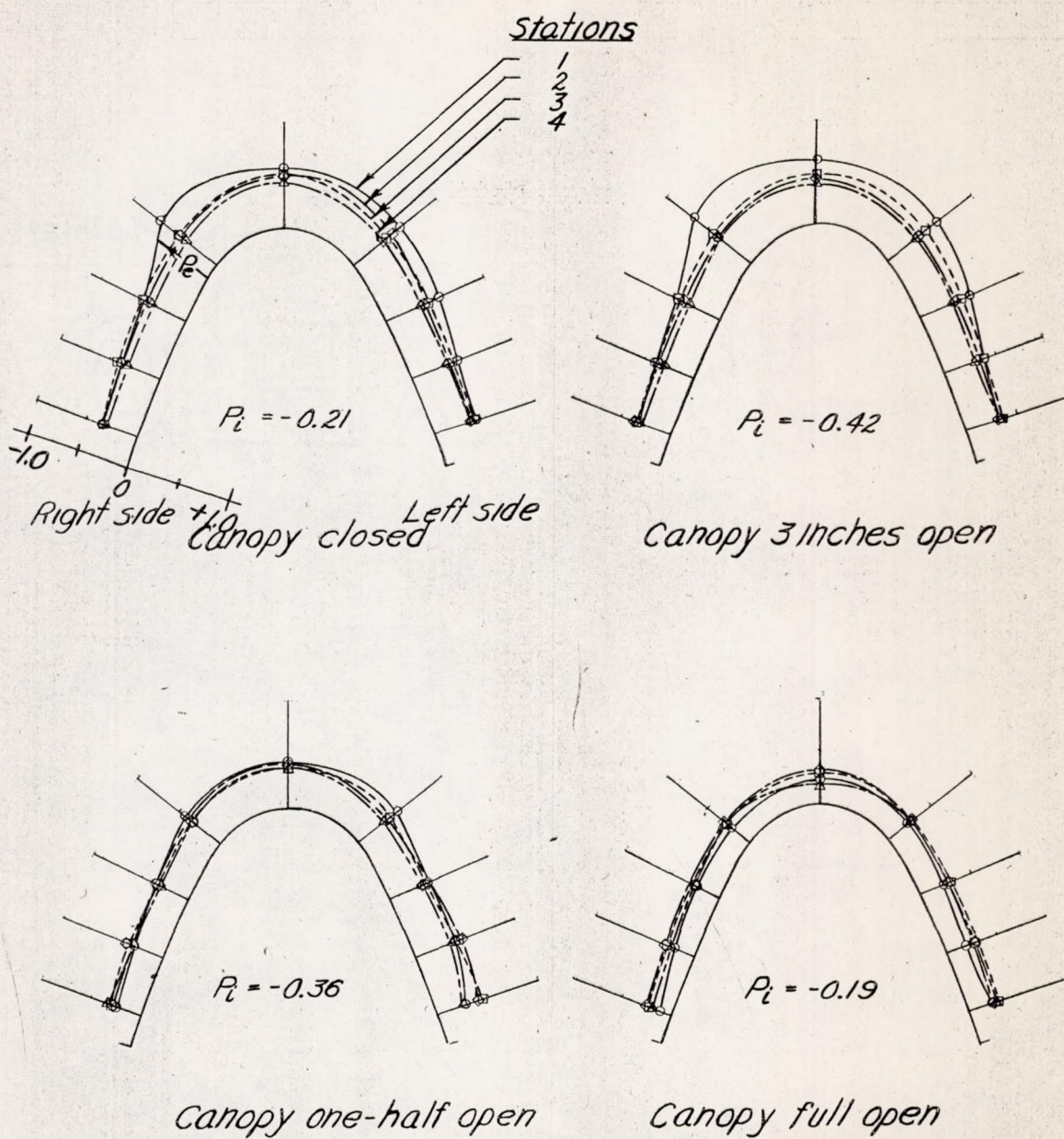Figure 6. - Pressure distributions over the
canopy of the F6F-3 airplane. ψ, 0°

stations
1
2
3
4

P_e

$P_i = -0.16$

$P_i = -0.36$

-1.0

0

+1.0

Right side   Left side

Canopy closed   Canopy 3 inches open

$P_i = -0.34$

$P_i = -0.19$

Canopy one-half open   Canopy full open

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(b) Propeller removed; C_L, 0.52

Figure 6.- continued.

Stations

$P_i = -0.21$

Right side   Left side

Canopy closed

$P_i = -0.42$

Canopy 3 inches open

$P_i = -0.36$

Canopy one-half open

$P_i = -0.19$

Canopy full open

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(c) Propeller removed; C_L, 0.91

Figure 6.- continued.

stations
1
2
3
4

$P_i = -0.20$

−1.0

Right side 0 + Left side

Canopy closed

$P_i = -0.39$

Canopy 3 inches open

$P_i = -0.41$

Canopy one-half open

$P_i = -0.20$

Canopy full open
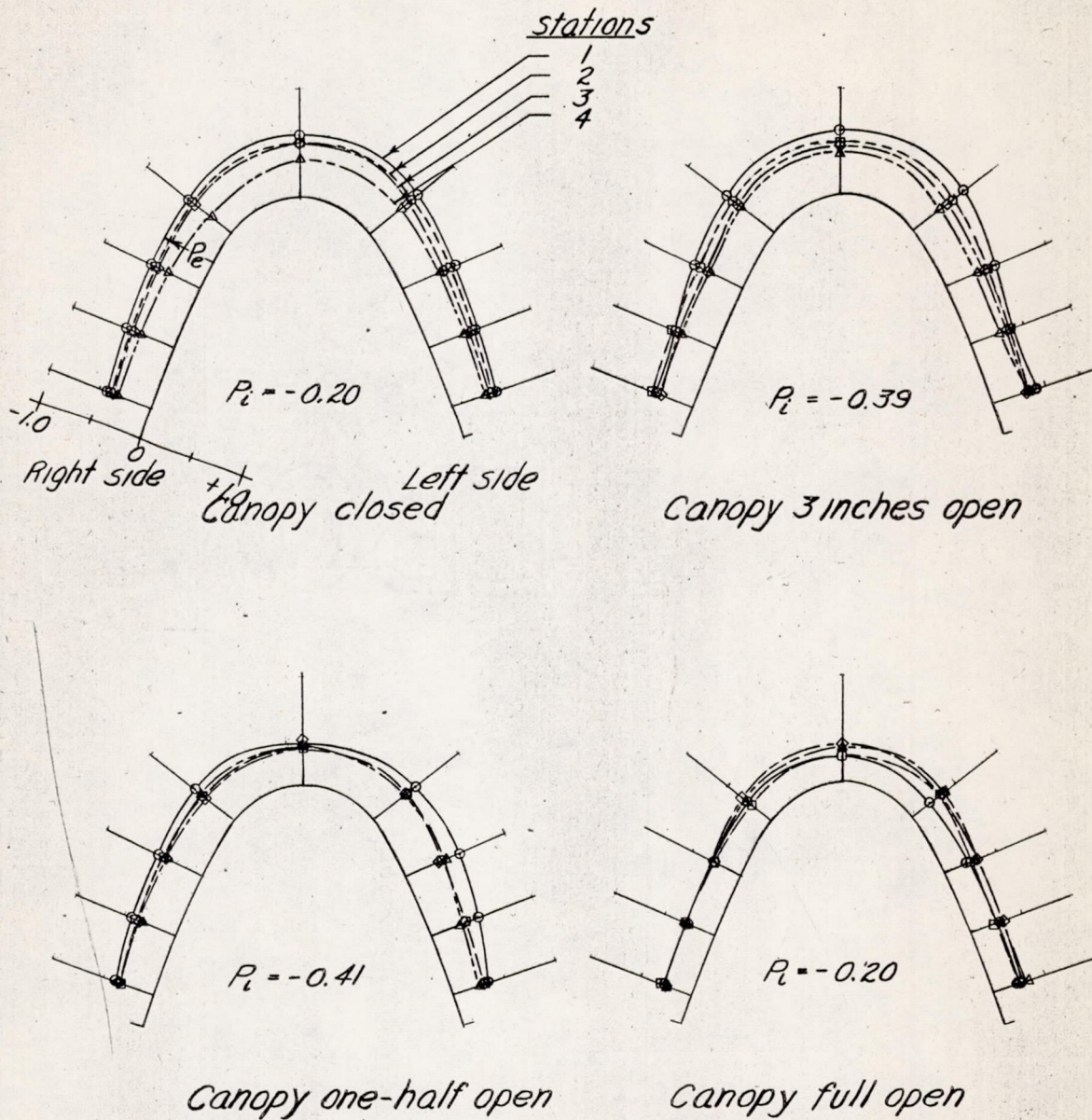
(d) Propeller removed; C_L, 1.23

Figure 6.- concluded.
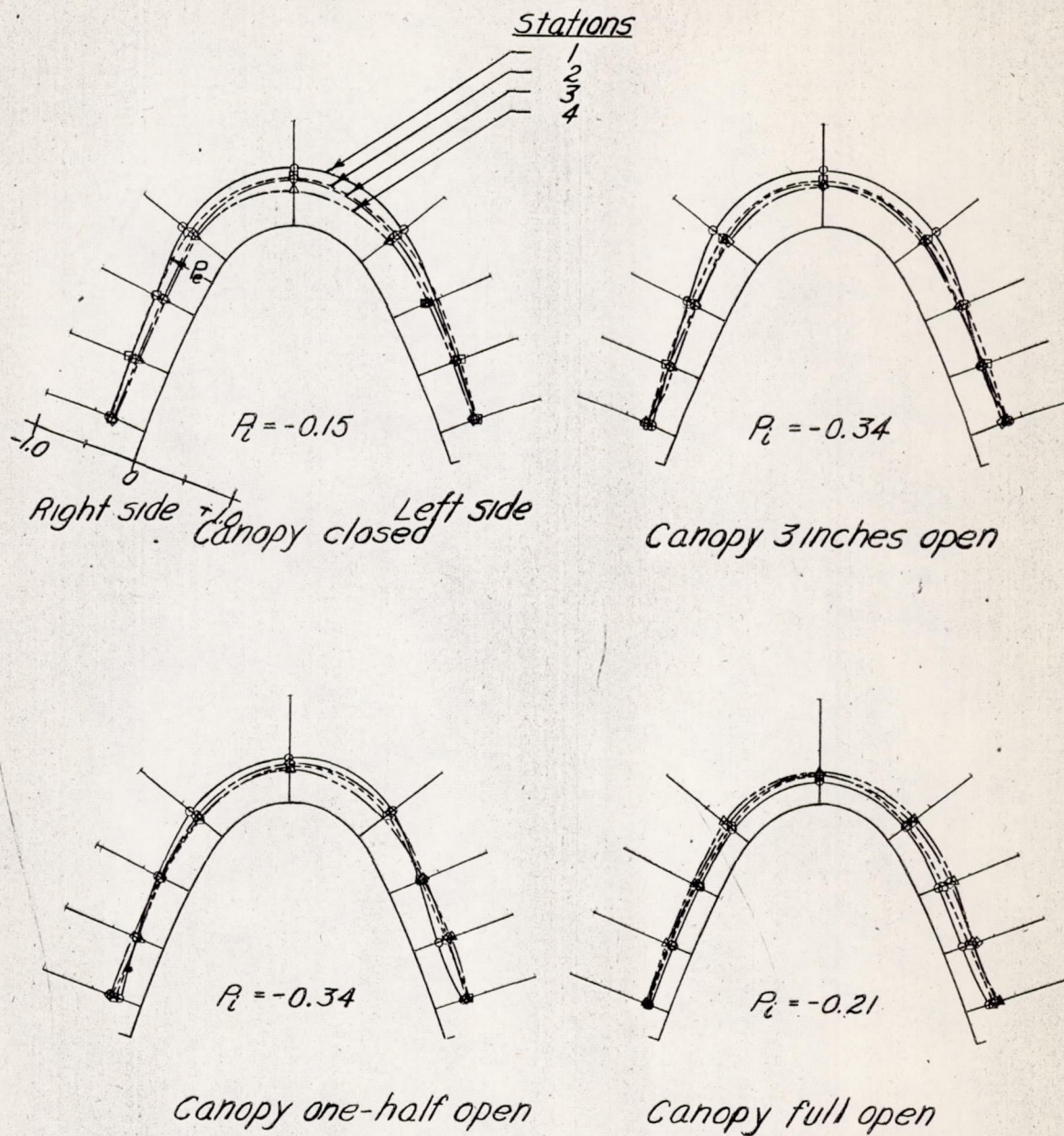
(a) Military power; T_c, 0.04; C_L, 0.20

Figure 7. - Pressure distributions over the canopy of the F6F-3 airplane. ψ, $0.°$

stations
1
2
3
4

P_e

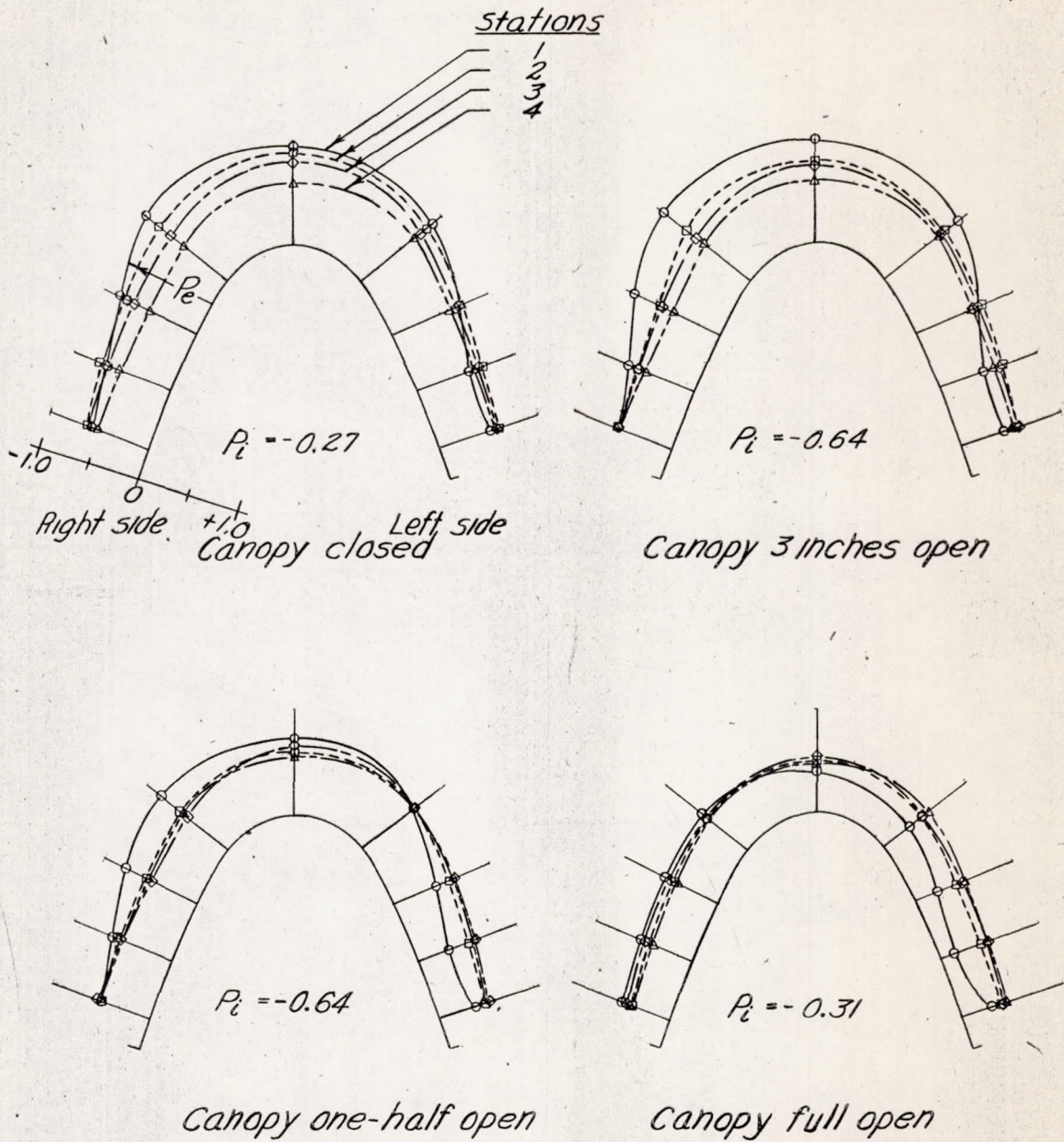$P_i = -0.19$

-1.0

Right side   0   +1.0   Left side

Canopy closed

$P_i = -0.47$

Canopy 3 inches open

$P_i = -0.47$

Canopy one-half open

$P_i = -0.24$

Canopy full open
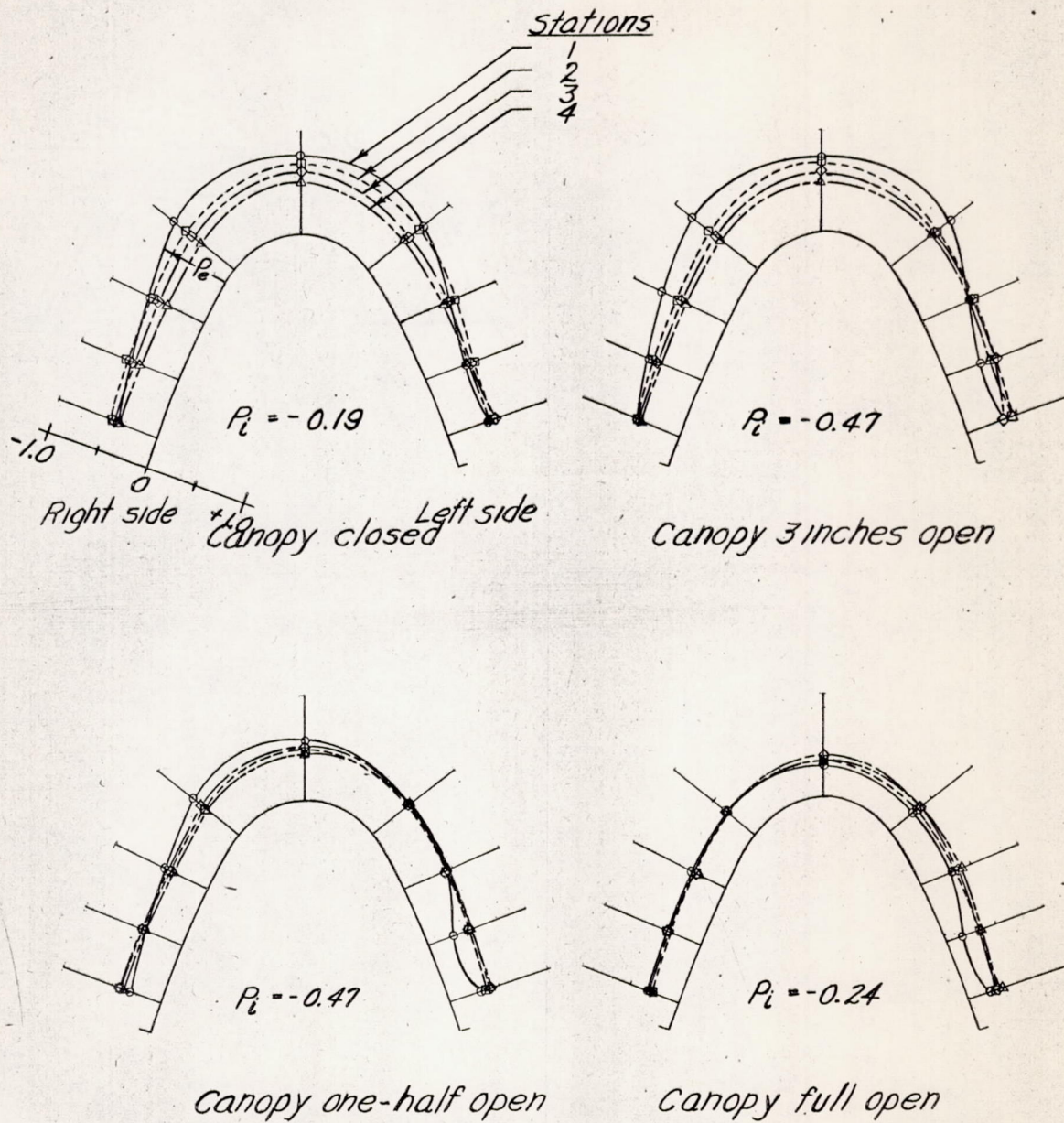
(b) Military power; T_c, 0.18; C_L, 0.52

Figure 7.— continued.

stations
1
2
3
4

P_e

$P_i = -0.27$

-1.0

Right side   0   +1.0   Left side

Canopy closed

$P_i = -0.64$

Canopy 3 inches open

$P_i = -0.64$

Canopy one-half open

$P_i = -0.31$

Canopy full open

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(c) Military power; T_c, 0.36; C_L, 0.91

Figure 7.— continued.

Stations
1
2
3
4

P_e

$P_i = -0.32$

-1.0

0

Right side +   Left side

Canopy closed

$P_i = -0.98$

Canopy 3 inches open

$P_i = -0.90$

Canopy one-half open

$P_i = -0.43$

Canopy full open
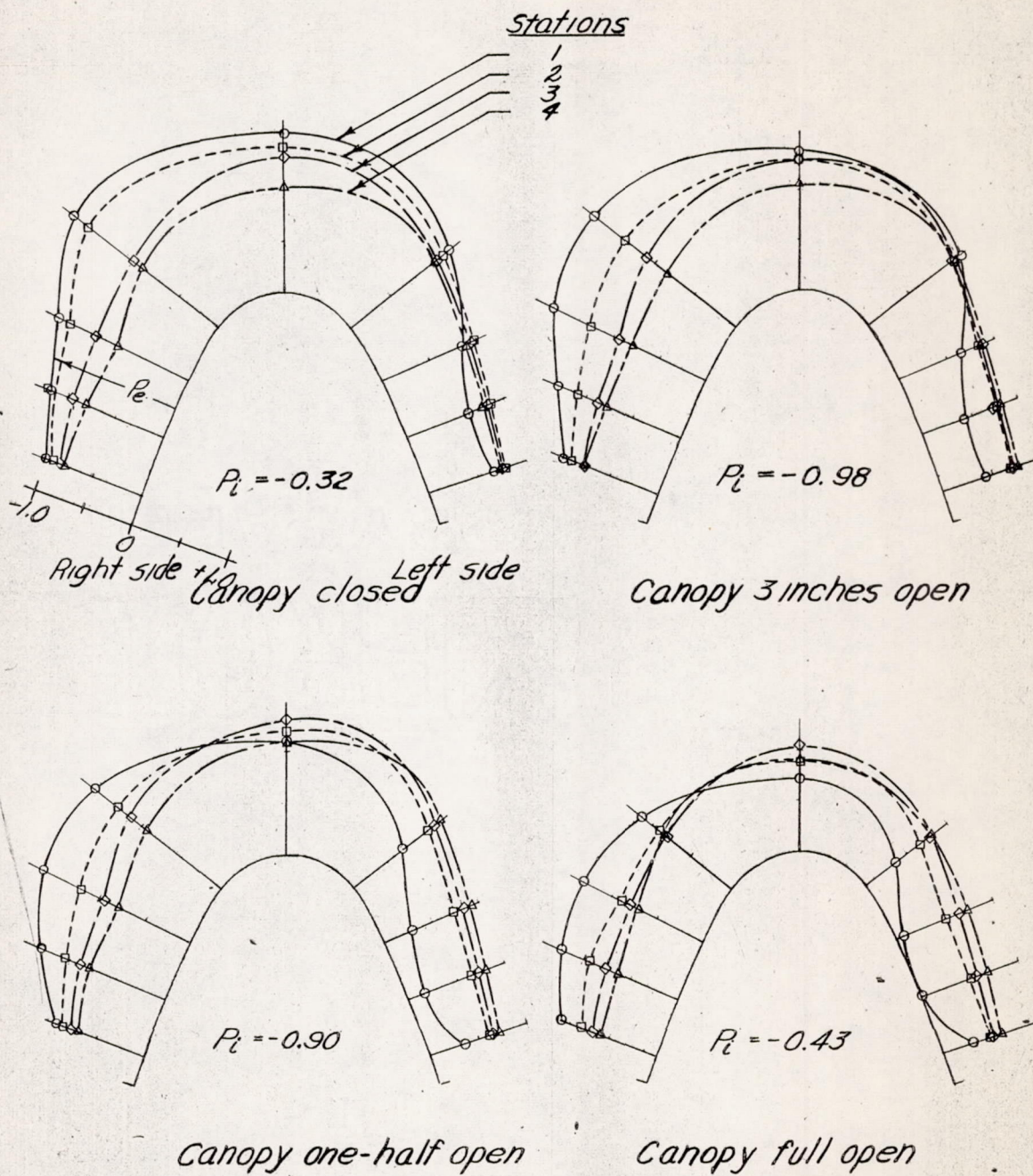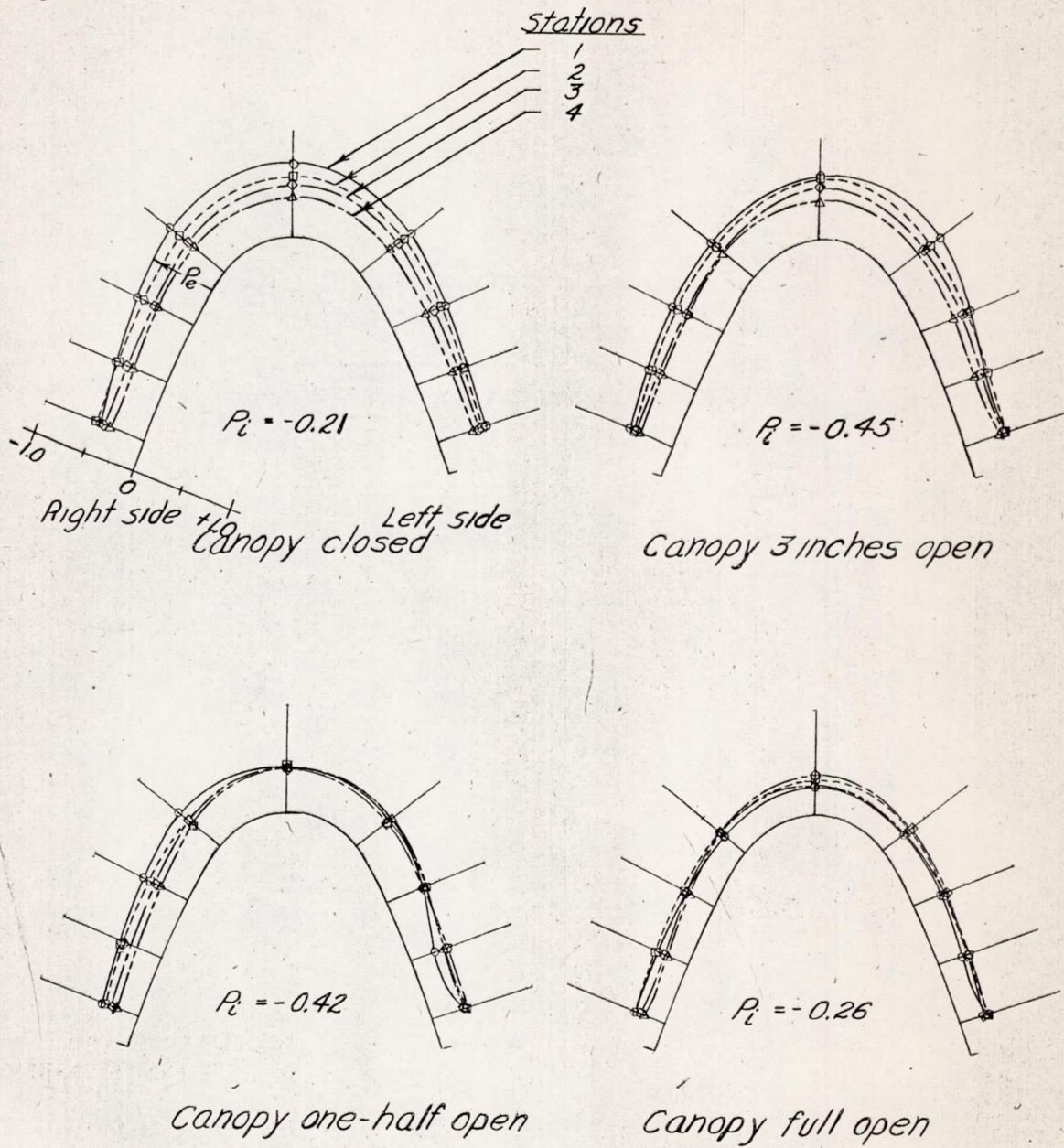
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(d) Military power; T_c, 0.53; C_L, 1.23

Figure 7. — continued.

stations
1
2
3
4

P_e

$P_i = -0.21$

-1.0
0
Right side $+$ canopy closed   Left side

Canopy closed

$P_i = -0.45$

Canopy 3 inches open

$P_i = -0.42$

Canopy one-half open

$P_i = -0.26$

Canopy full open

(e) Propeller idling; C_L, 1.23

Figure 7.- concluded.

station
1
2
3
4

$P_L = -0.12$

-1.0

0

1.0

Right side   left side

Canopy closed
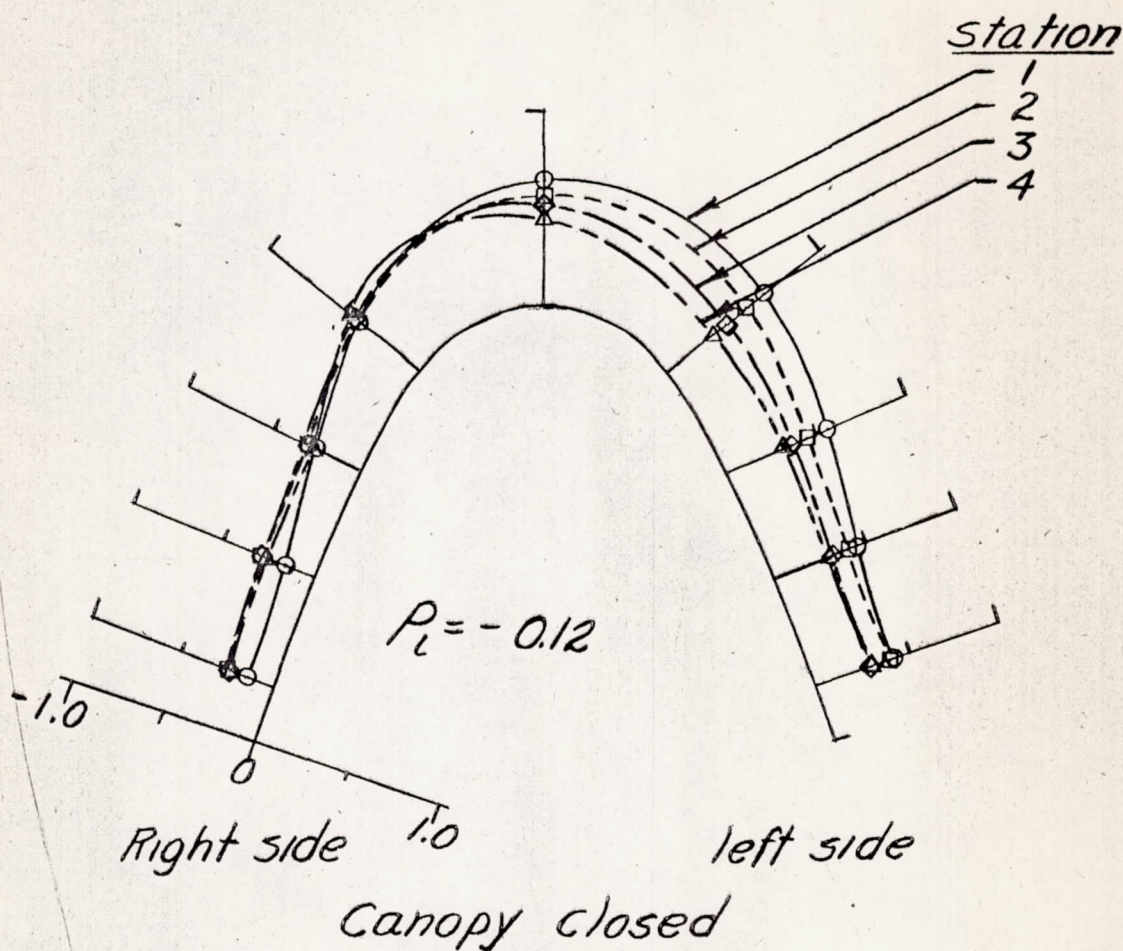
(a) Propeller removed; C_L, 0.20

Figure 8.- Pressure distributions over the canopy of the F6F-3 airplane. ψ, -7.5°

stations

$P_i = -0.14$

-1.0 0 Right side $+1.0$ Left side

Canopy closed

$P_i = -0.36$

Canopy 3 inches open

$P_i = -0.36$

Canopy one-half open

$P_i = -0.17$

Canopy full open
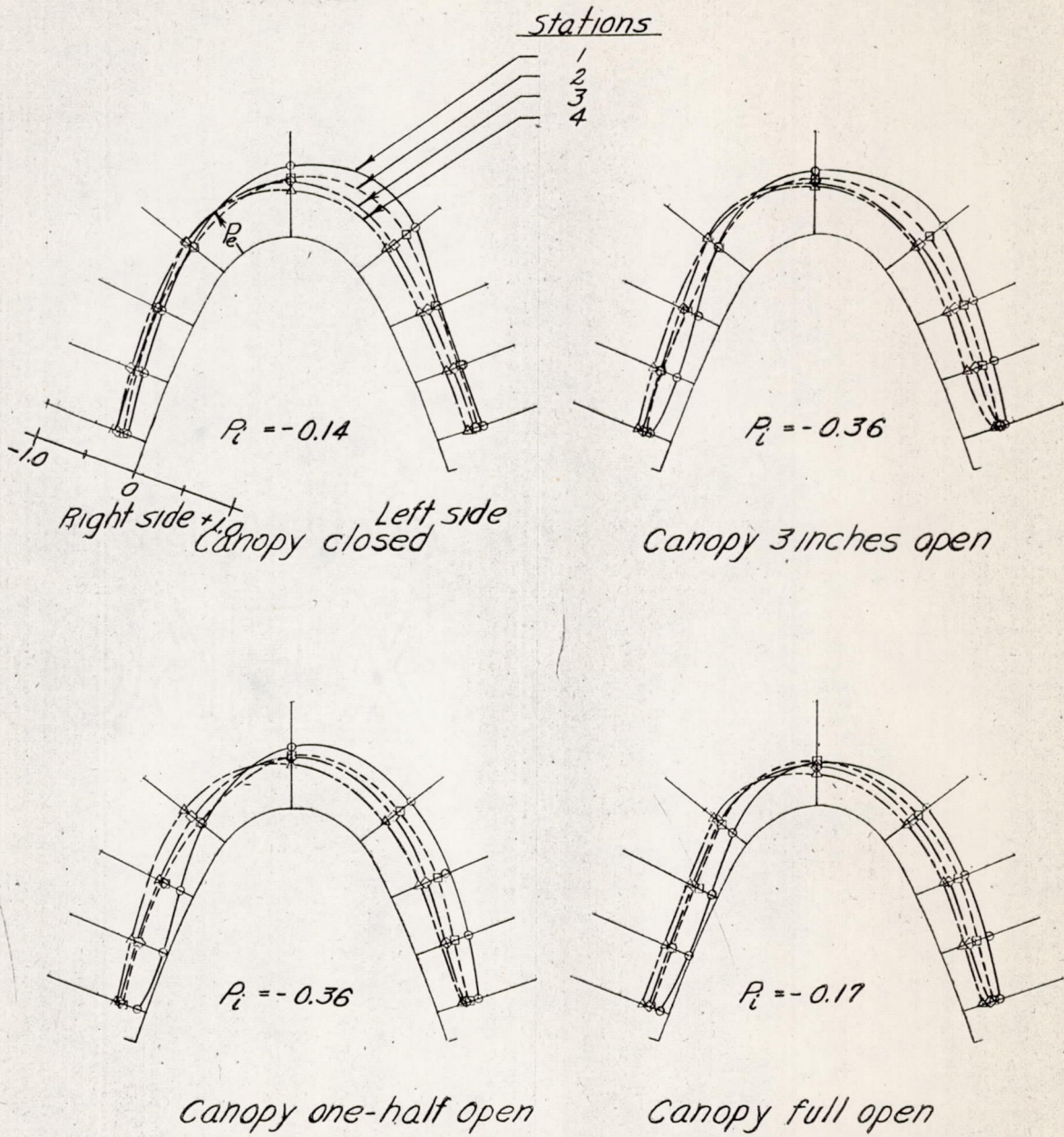
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(b) Propeller removed; C_L, 0.52

Figure 8.— continued.

Stations
1
2
3
4

P_e

$P_i = -0.16$

-1.0

0

Right side   +1.0   Left side
Canopy closed

$P_i = -0.40$

Canopy 3 inches open

$P_i = -0.38$

Canopy one-half open

$P_i = -0.20$

Canopy full open

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(c) Propeller removed; C_L, 0.91

Figure 8. - continued.
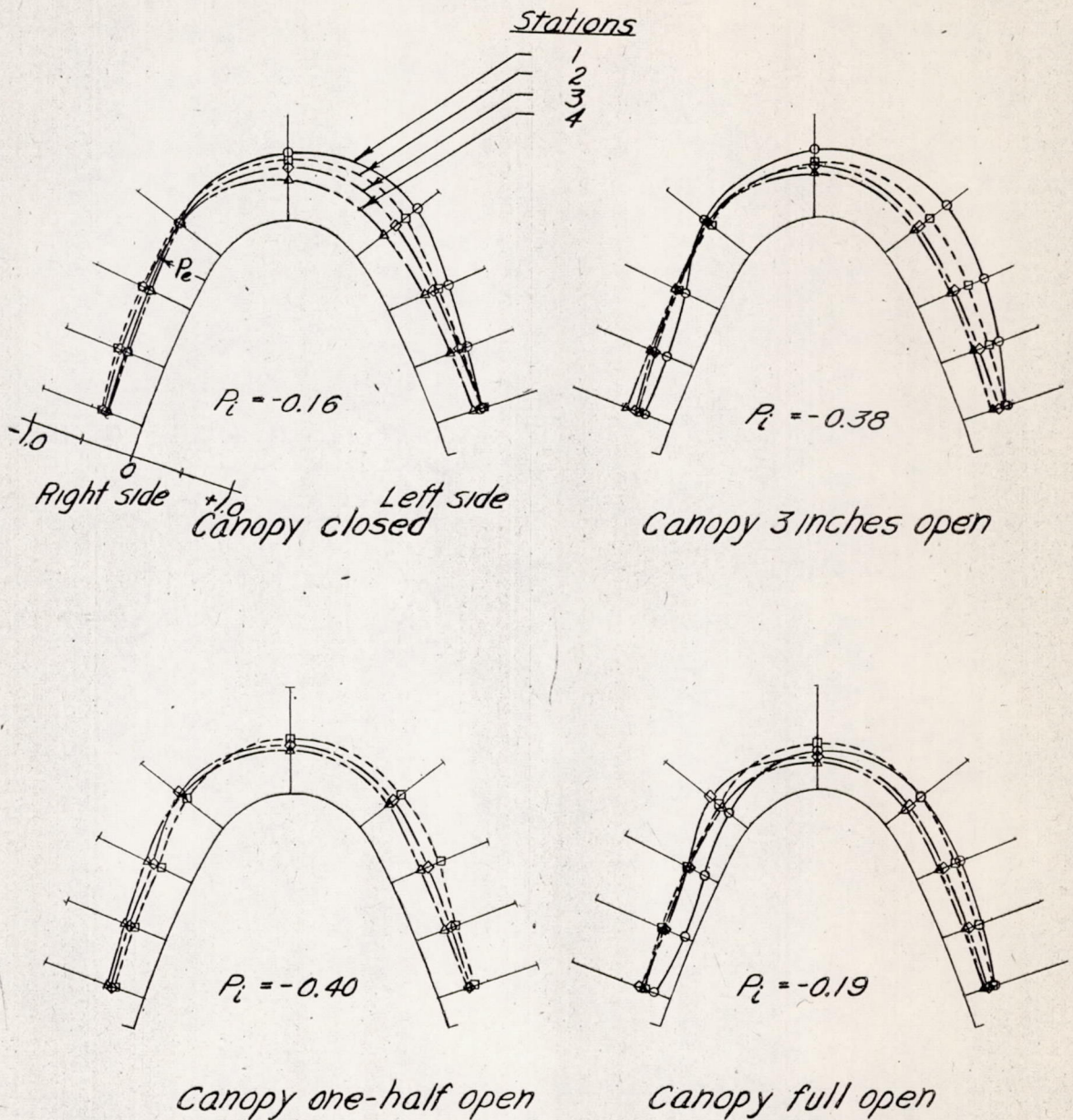
(d) Propeller removed; C_L, 1.23

Figure 8.— concluded.

stations
1
2
3
4

P_e

$P_i = -0.20$

1.0
Right side   0   Left side

Canopy closed

$P_i = -0.47$

Canopy 3 inches open

$P_i = -0.45$

Canopy one-half open

$P_i = -0.32$

Canopy full open
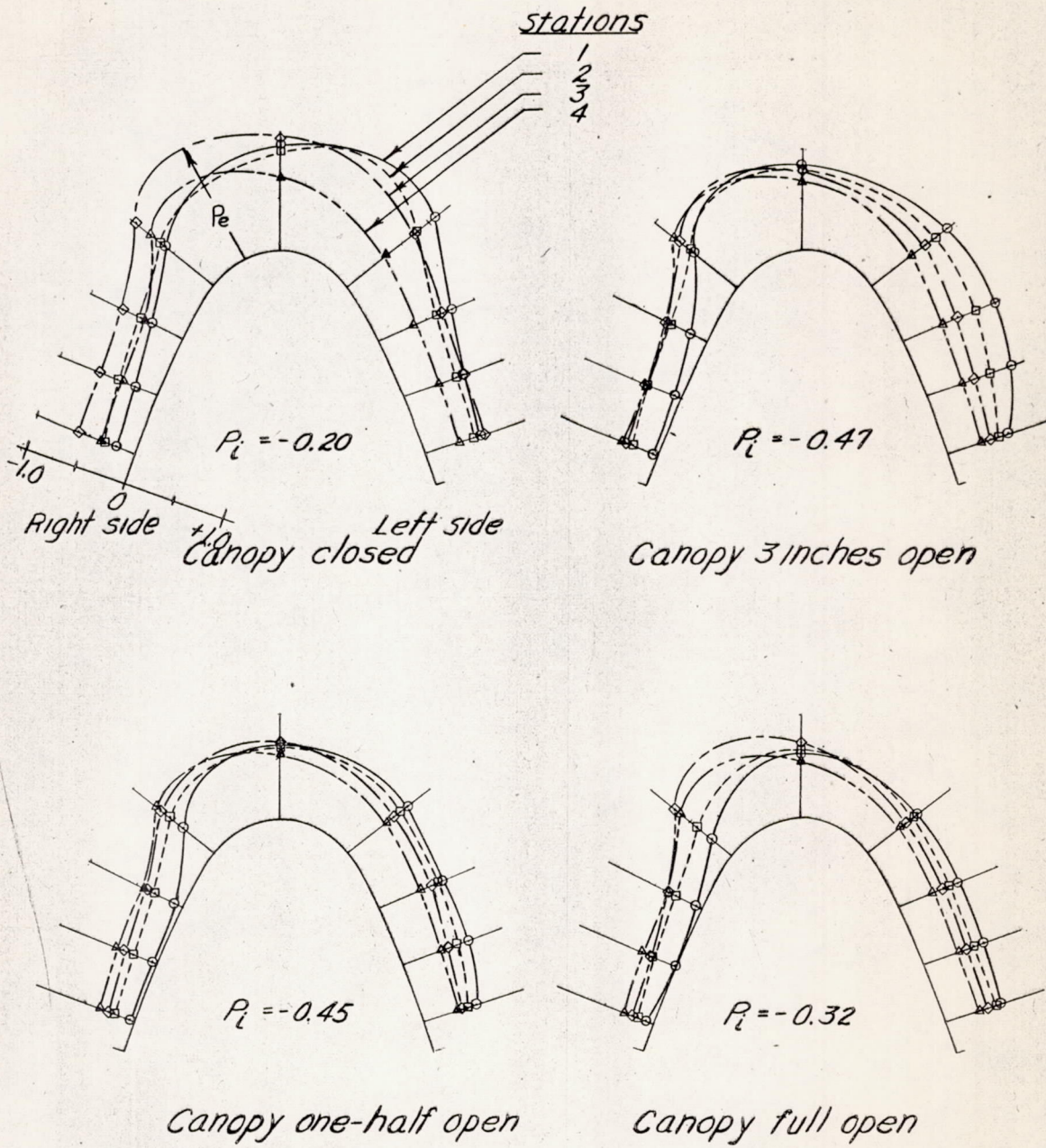
(a) Propeller removed; C_L, 0.91

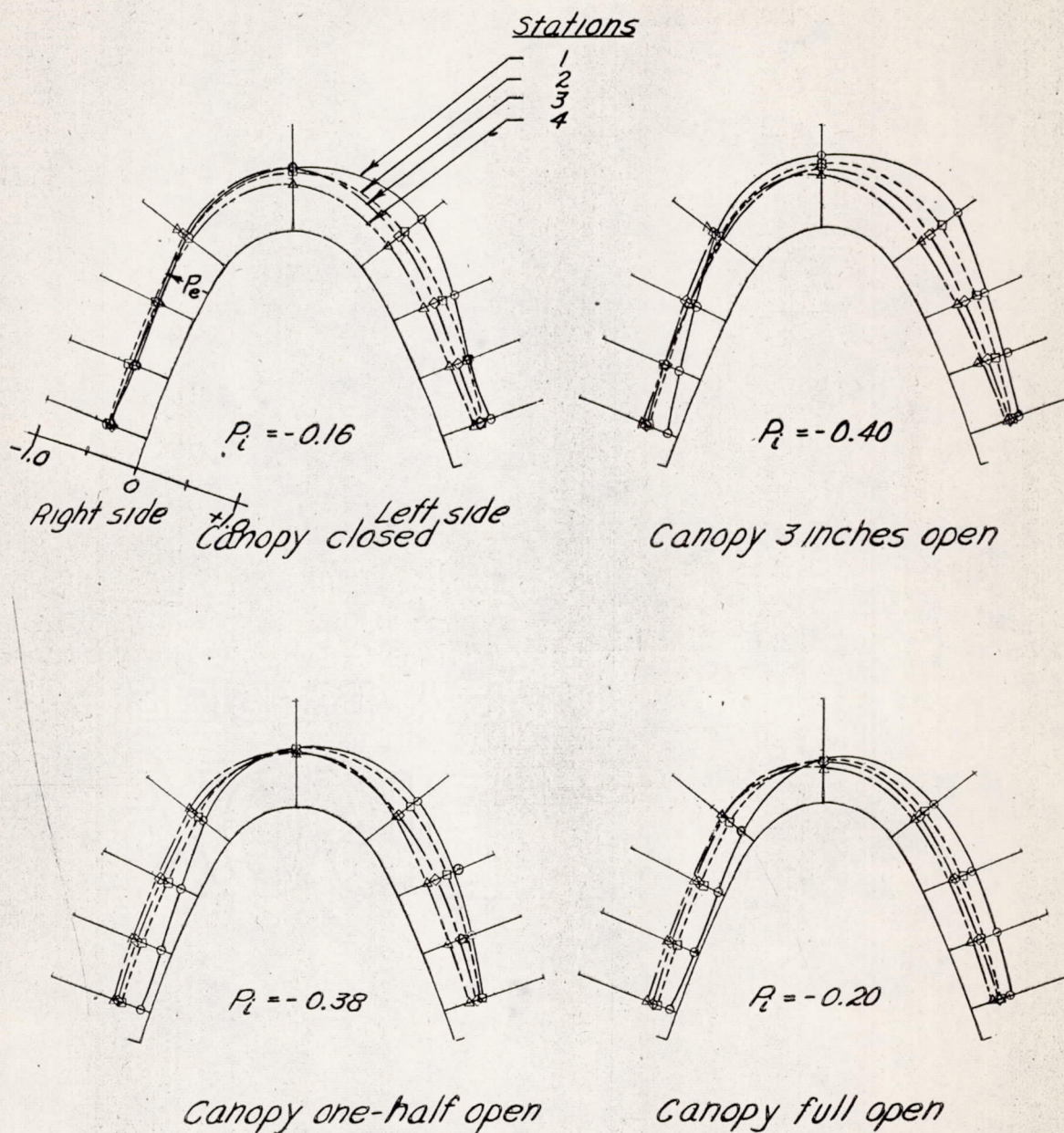Figure 9 - Pressure distributions over the canopy of the F6F-3 airplane. ψ, -15°

stations
1
2
3
4

P_e

$P_i = -0.24$

-1.0

0

+1.0

Right side   Left side

Canopy closed

$P_i = -0.46$

Canopy 3 inches open

$P_i = -0.41$

Canopy one-half open

$P_i = -0.29$

Canopy full open
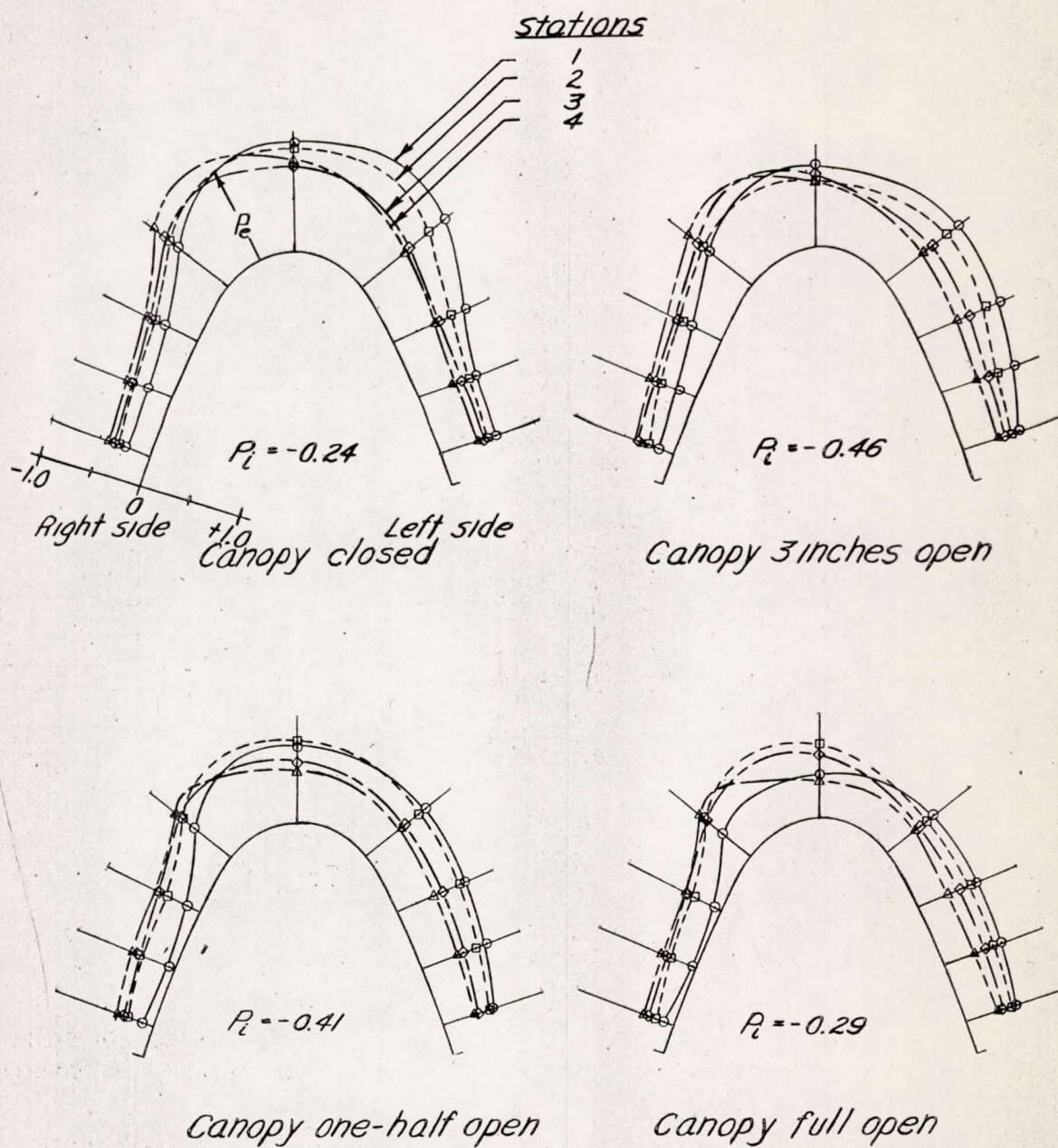
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(b) Propeller removed; C_L, 1.23

Figure 9.- concluded.

$P_i = -0.15$

Right side   left side

Canopy closed
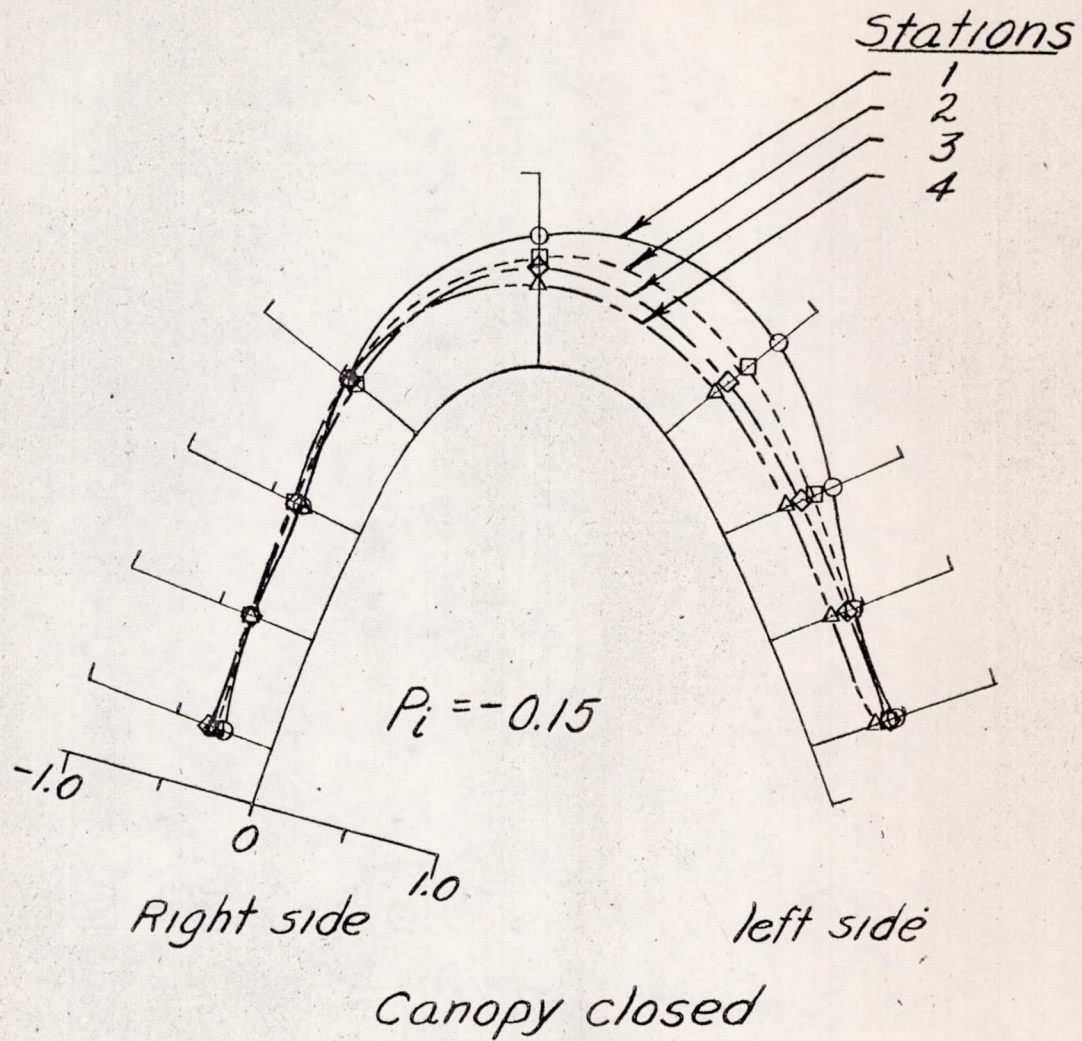
**NATIONAL ADVISORY
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(a) Military power; T_c, 0.04; C_L, 0.20

Figure 10.- Pressure distributions over
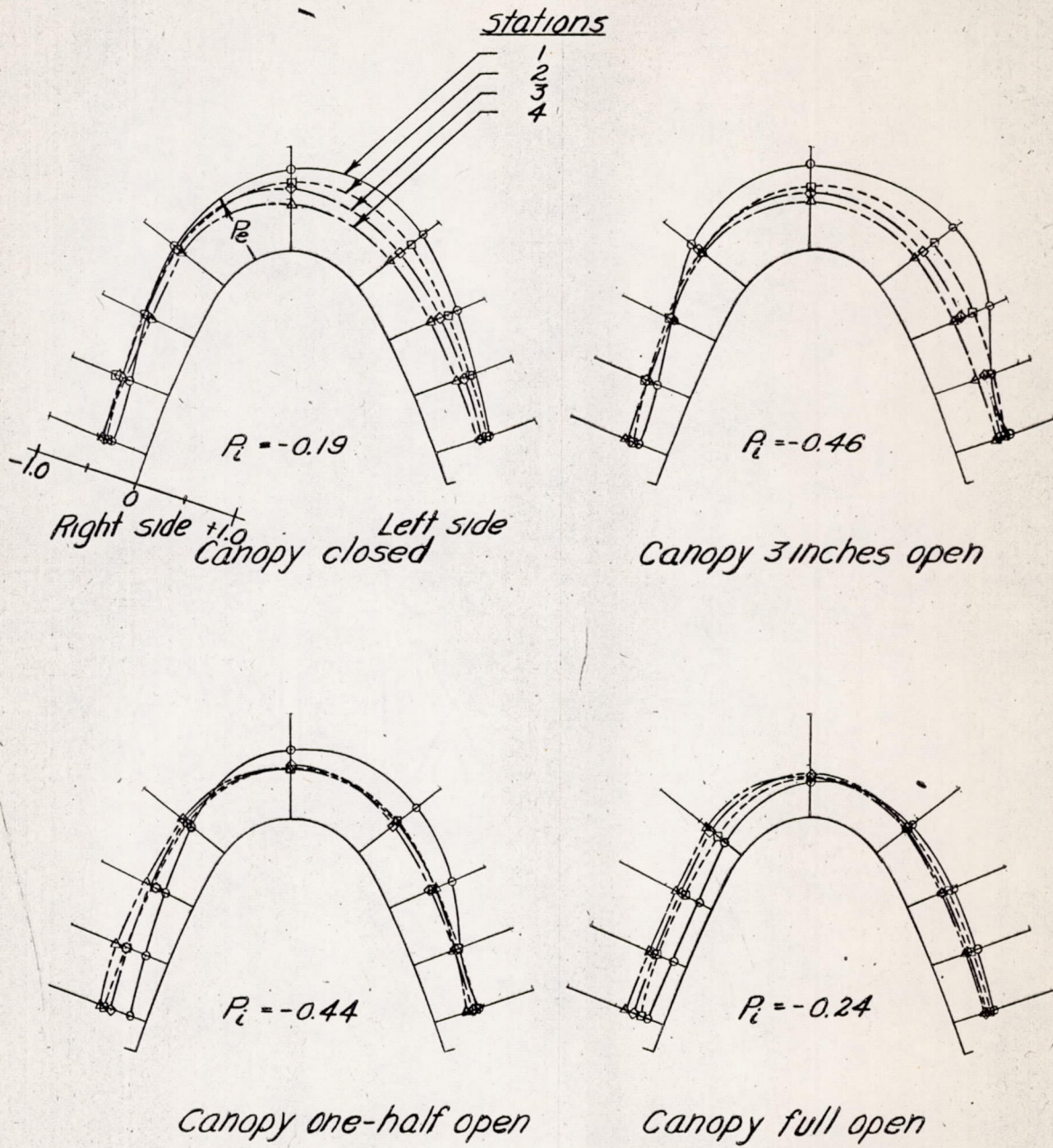the canopy of the F6F-3
airplane. ψ, -7.5°

stations
1
2
3
4

P_e

$P_i = -0.19$

-1.0

Right side   0   +1.0   Left side

Canopy closed

$P_i = -0.46$

Canopy 3 inches open

$P_i = -0.44$

Canopy one-half open

$P_i = -0.24$

Canopy full open

(b) Military power; T_c, 0.18; C_L, 0.52

Figure 10.- continued.

stations
1
2
3
4

P_e

$P_i = -0.26$

-1.0

Right side   +1.0   Left side
Canopy closed

$P_i = -0.63$

Canopy 3 inches open

$P_i = -0.54$

Canopy one-half open

$P_i = -0.34$

Canopy full open
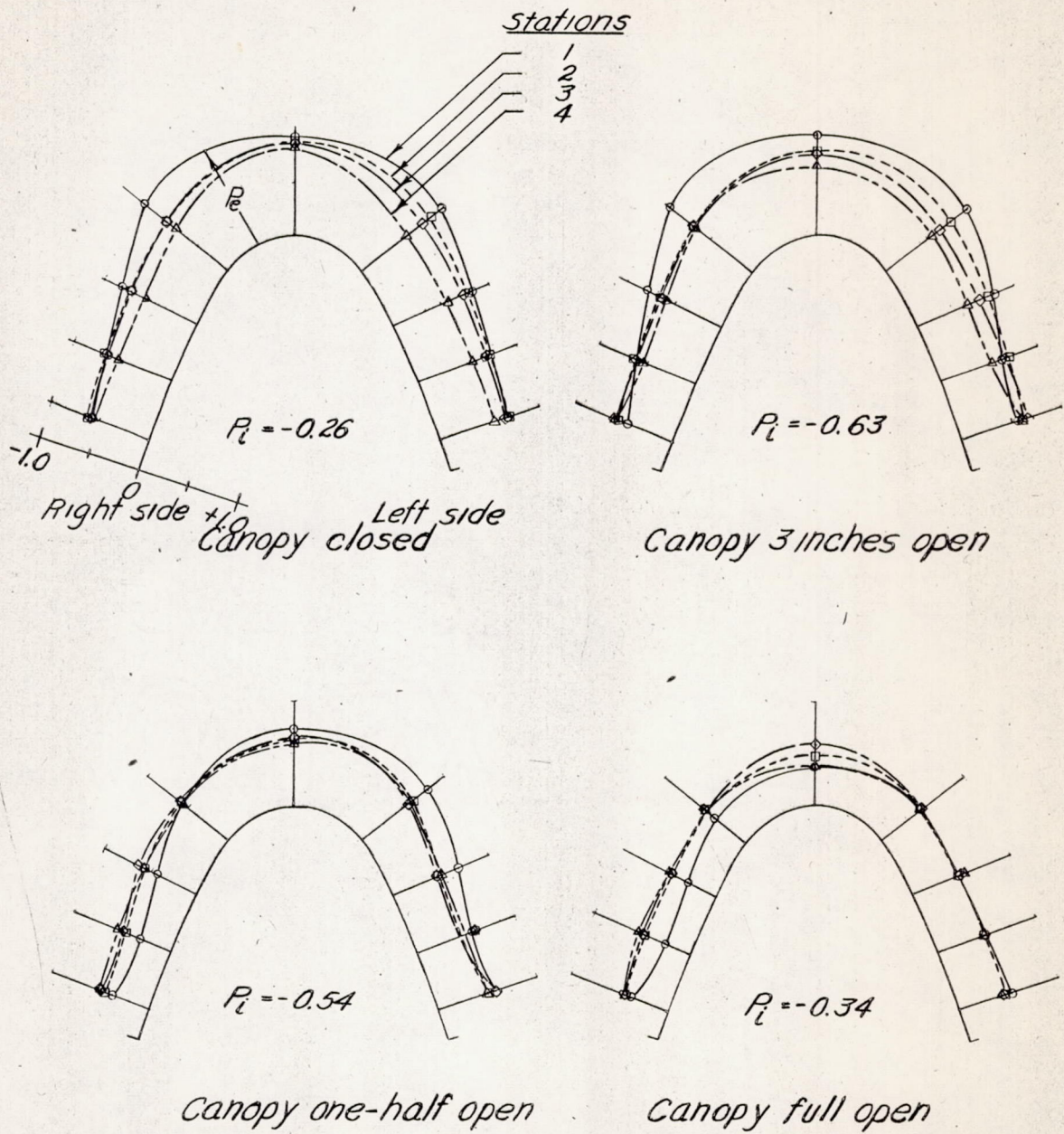
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(c) Military power; T_c, 0.36; C_L, 0.91

Figure 10.- continued.

stations
1
2
3
4

P_e

$P_i = -0.38$

-1.0

0

+1.0

Right side

Left side

Canopy closed

$P_i = -0.95$

Canopy 3 inches open

$P_i = -0.89$

Canopy one-half open

$P_i = -0.48$

Canopy full open
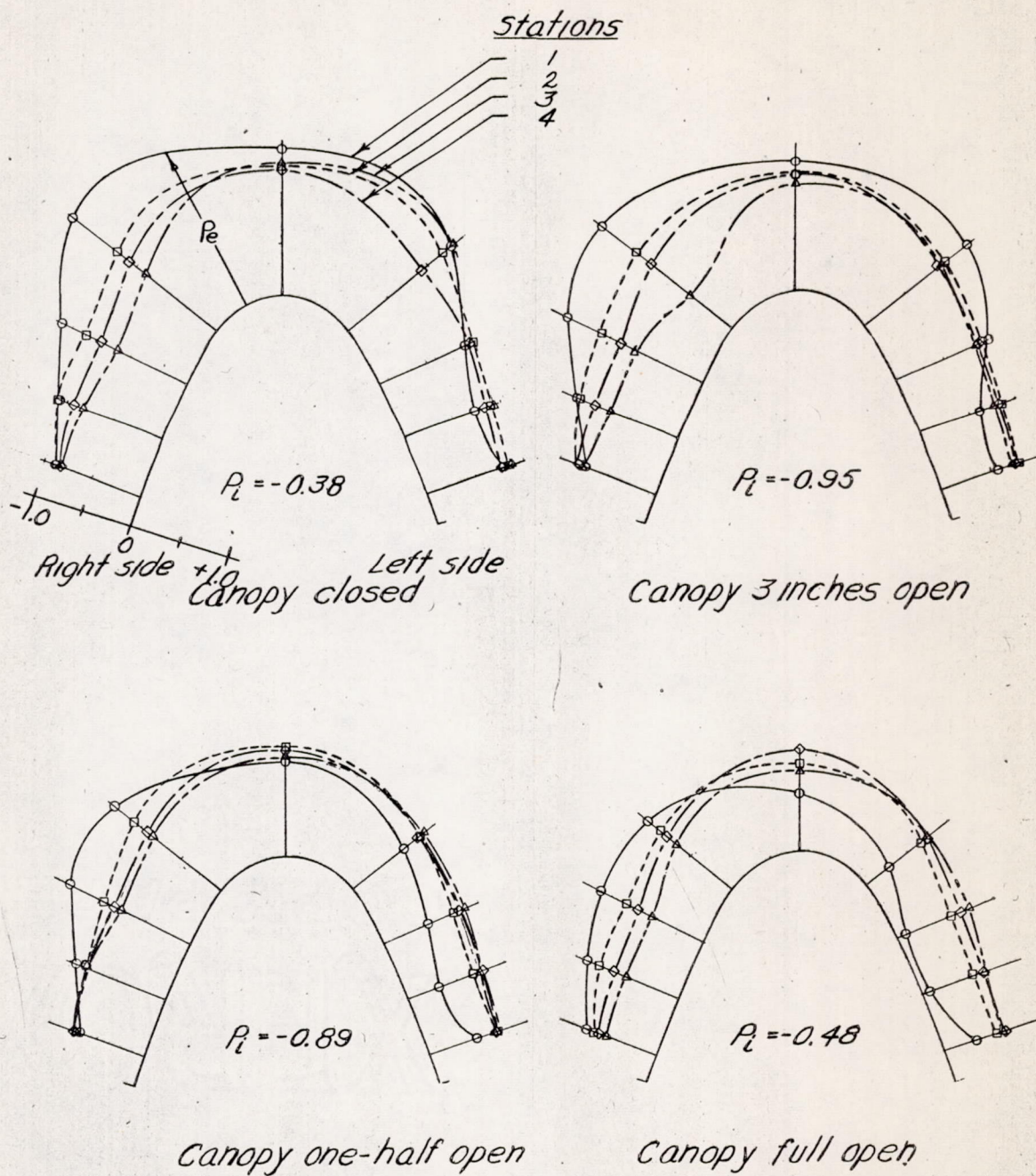
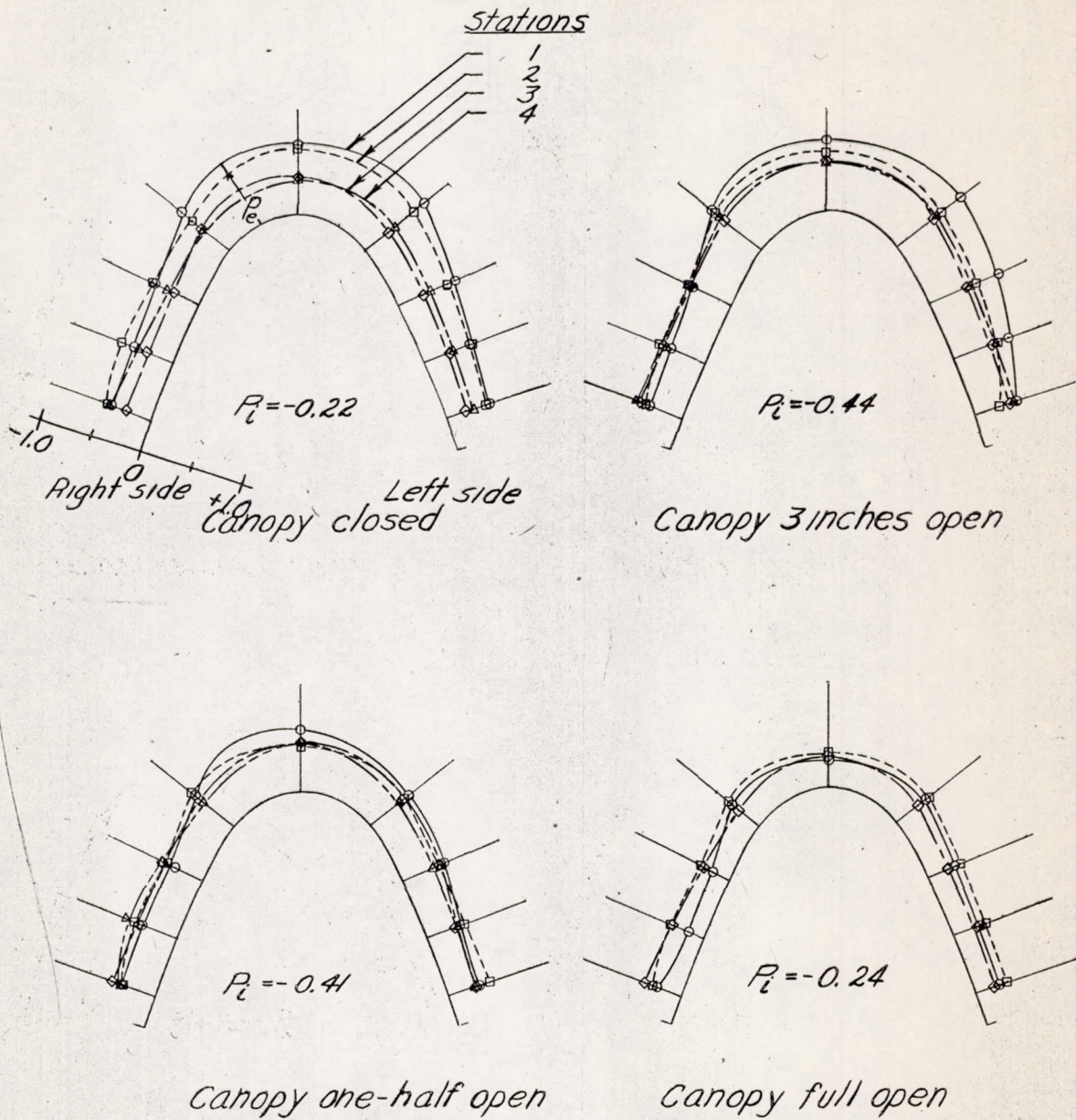NATIONAL ADVISORY
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(d) Military power; T_c, 0.53; C_L, 1.23

Figure 10.- continued.

Stations
1
2
3
4

P_e

$P_i = -0.22$

-1.0

Right side   0   +1.0   Left side

Canopy closed

$P_i = -0.44$

Canopy 3 inches open

$P_i = -0.41$

Canopy one-half open

$P_i = -0.24$

Canopy full open

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(e) Propeller idling; C_L, 1.23

Figure 10.- concluded.

stations
1
2
3
4

P_e

$P_i = -0.28$

-1.0

Right side   0 +1.0   Left side

Canopy closed

Canopy 3 inches open

$P_i = -0.72$

Canopy one-half open

$P_i = -0.34$

Canopy full open
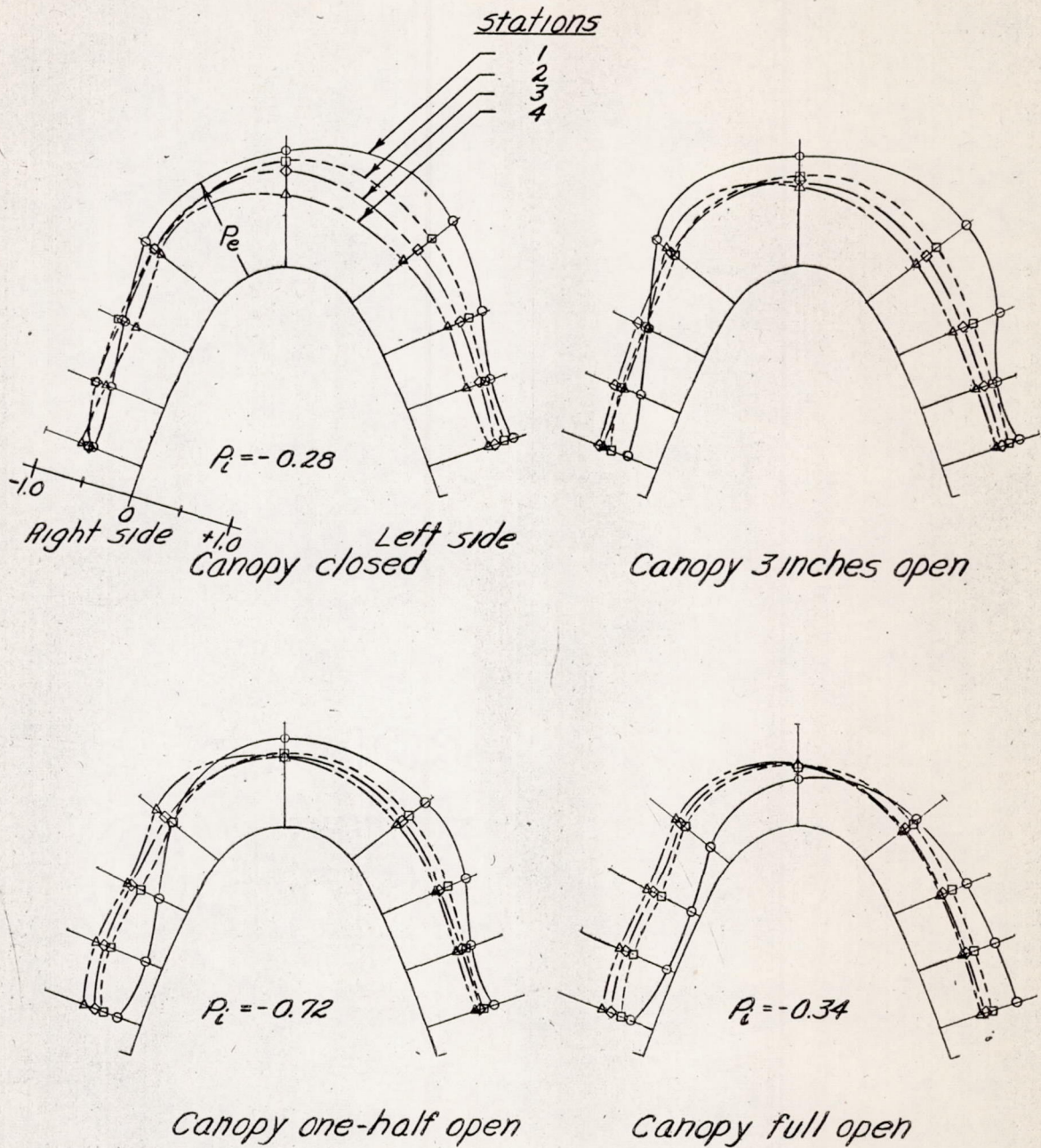
(a) Military power; T_c, 0.36; C_L, 0.91

Figure 11 - Pressure distributions over the
canopy of the F6F-3 airplane. $\psi = 15°$

stations
1
2
3
4

P_e
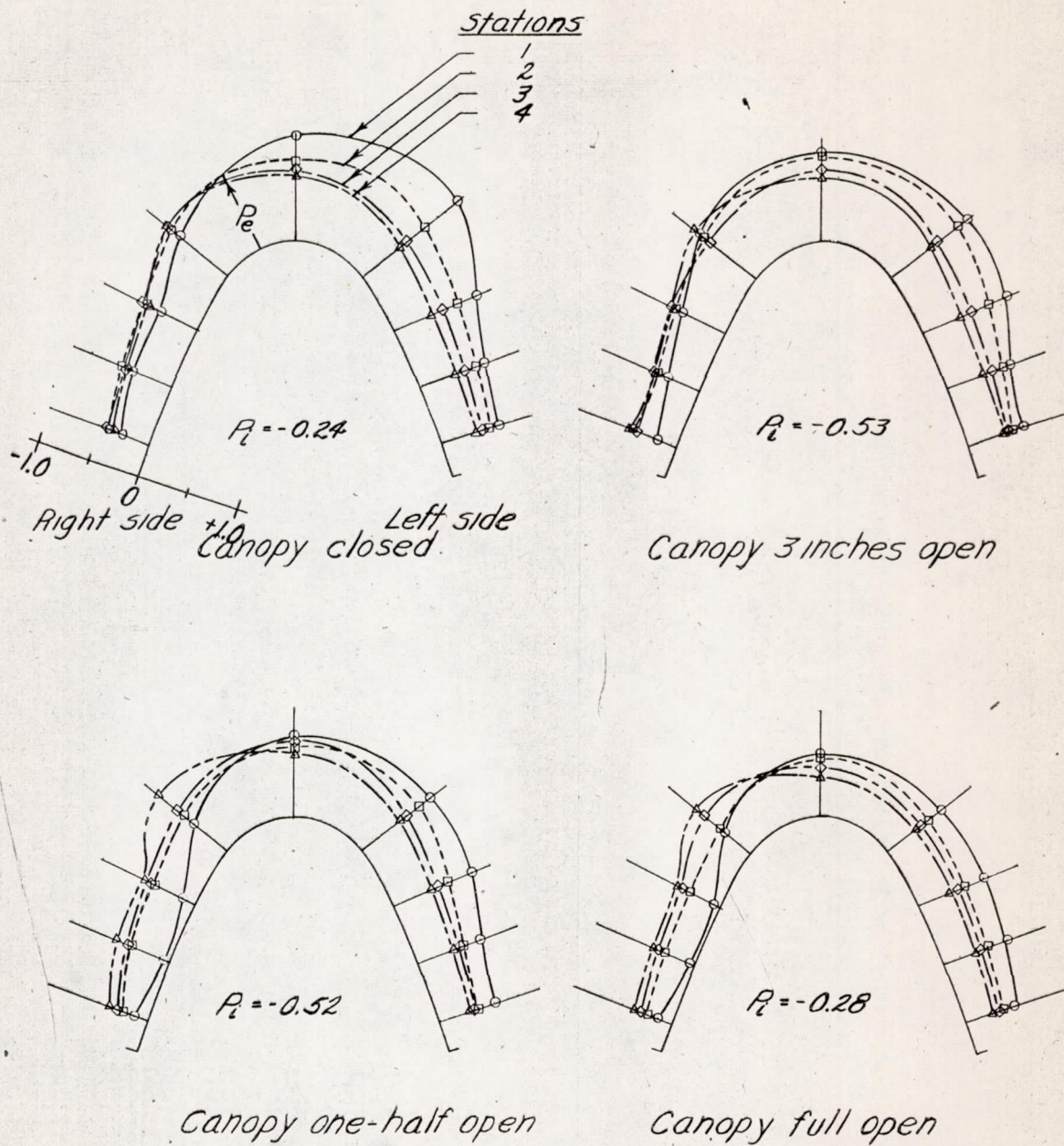
$P_i = -0.37$

-1.0

0

+1.0

Right side

Left side

Canopy closed

$P_i = -0.88$

Canopy 3 inches open

$P_i = -0.98$

Canopy one-half open

$P_i = -0.45$

Canopy full open
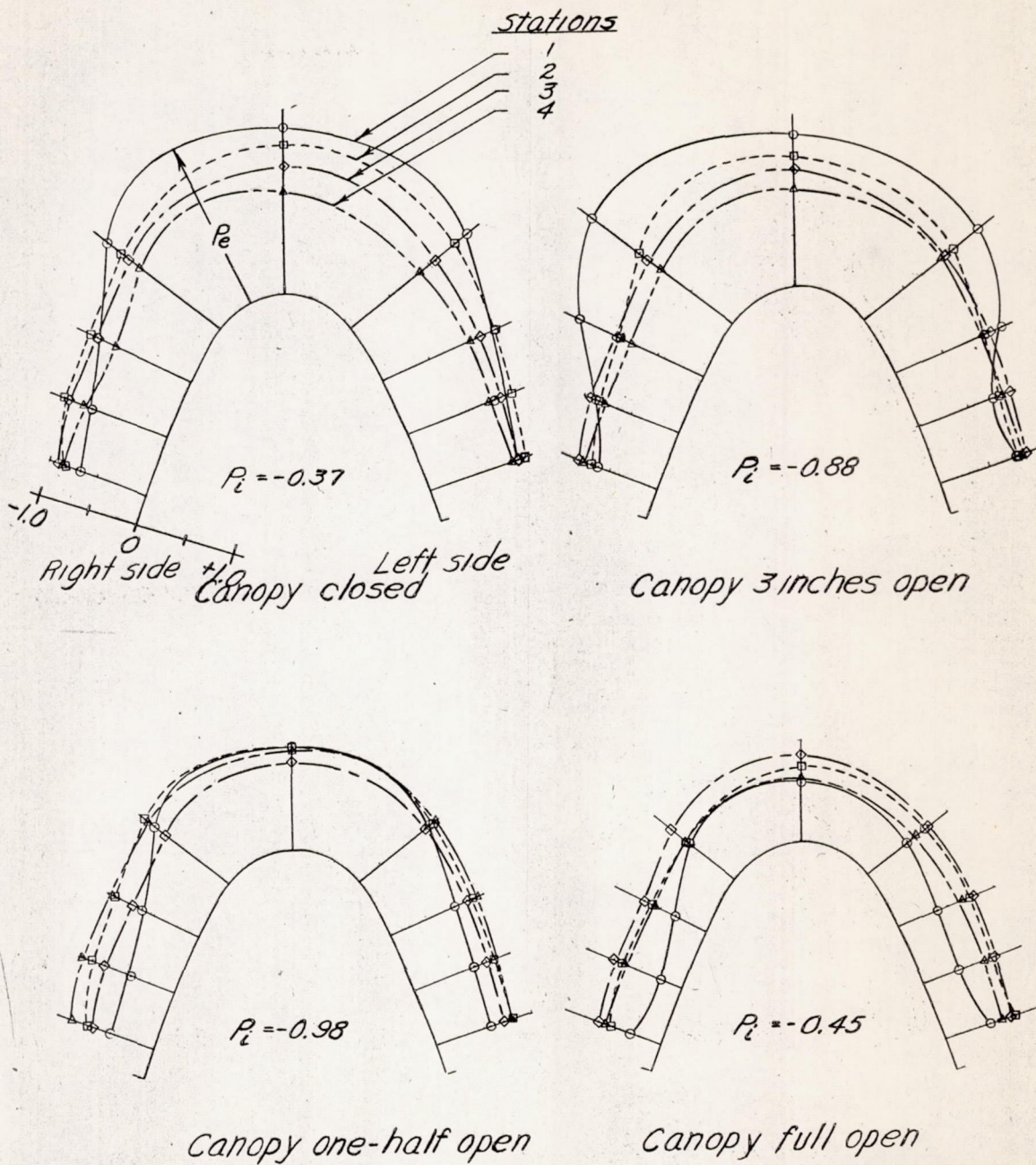
(b) Military power; T_c, 0.53; C_L, 1.23

Figure 11.- continued.

stations
1
2
3
4

P_e

$P_i = -0.24$

-1.0
0
Right side $+1.0$ Left side

Canopy closed

$P_i = -0.53$

Canopy 3 inches open

$P_i = -0.52$

Canopy one-half open

$P_i = -0.28$

Canopy full open

(c) Propeller idling; C_L, 1.23

Figure 11. — concluded.

station
1
2
3
4

$P_i = -0.16$

-1.0

0

1.0

Right side   left side

Canopy closed
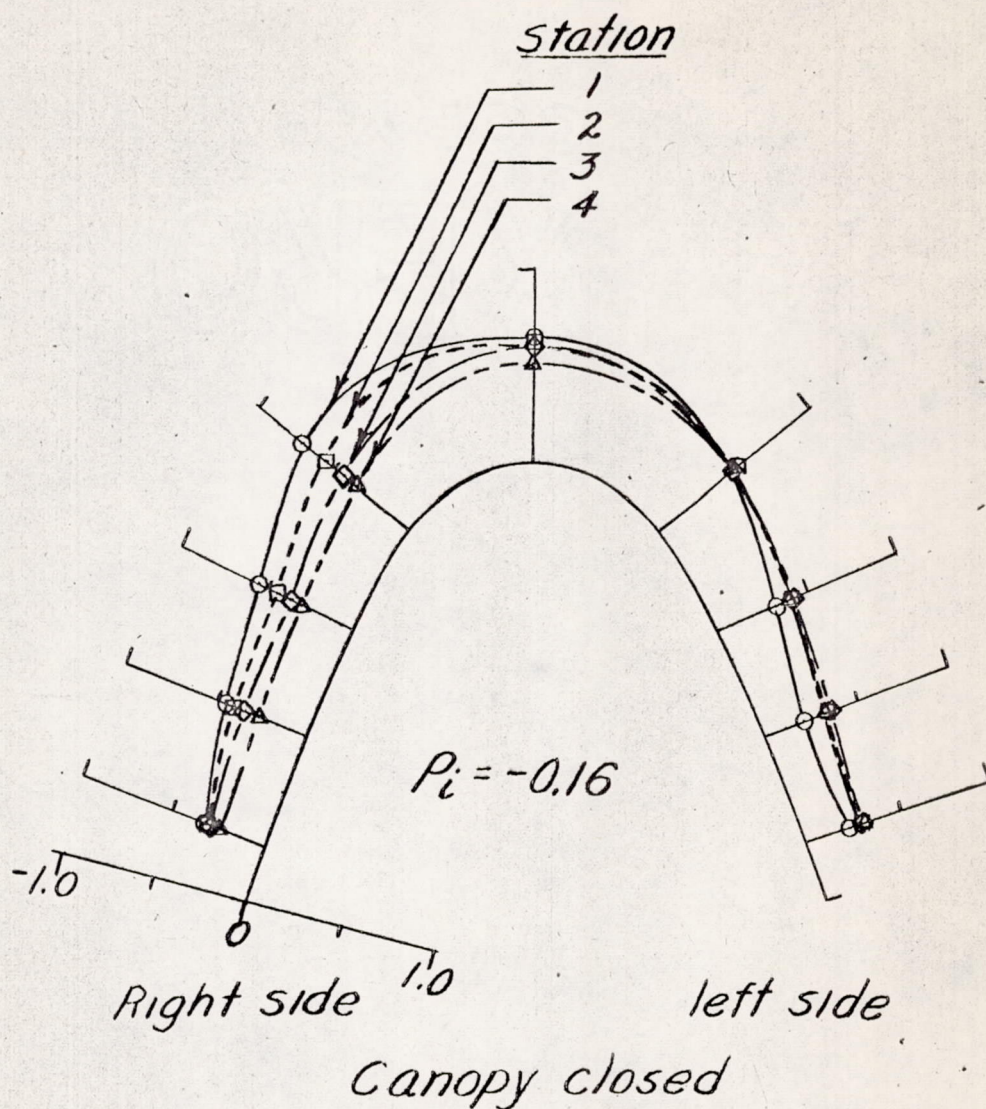
(a) Military power; T_c, 0.04; C_L, 0.20

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Figure 12.- Pressure distributions over
the canopy of the F6F-3
airplane. ψ, 7.5°
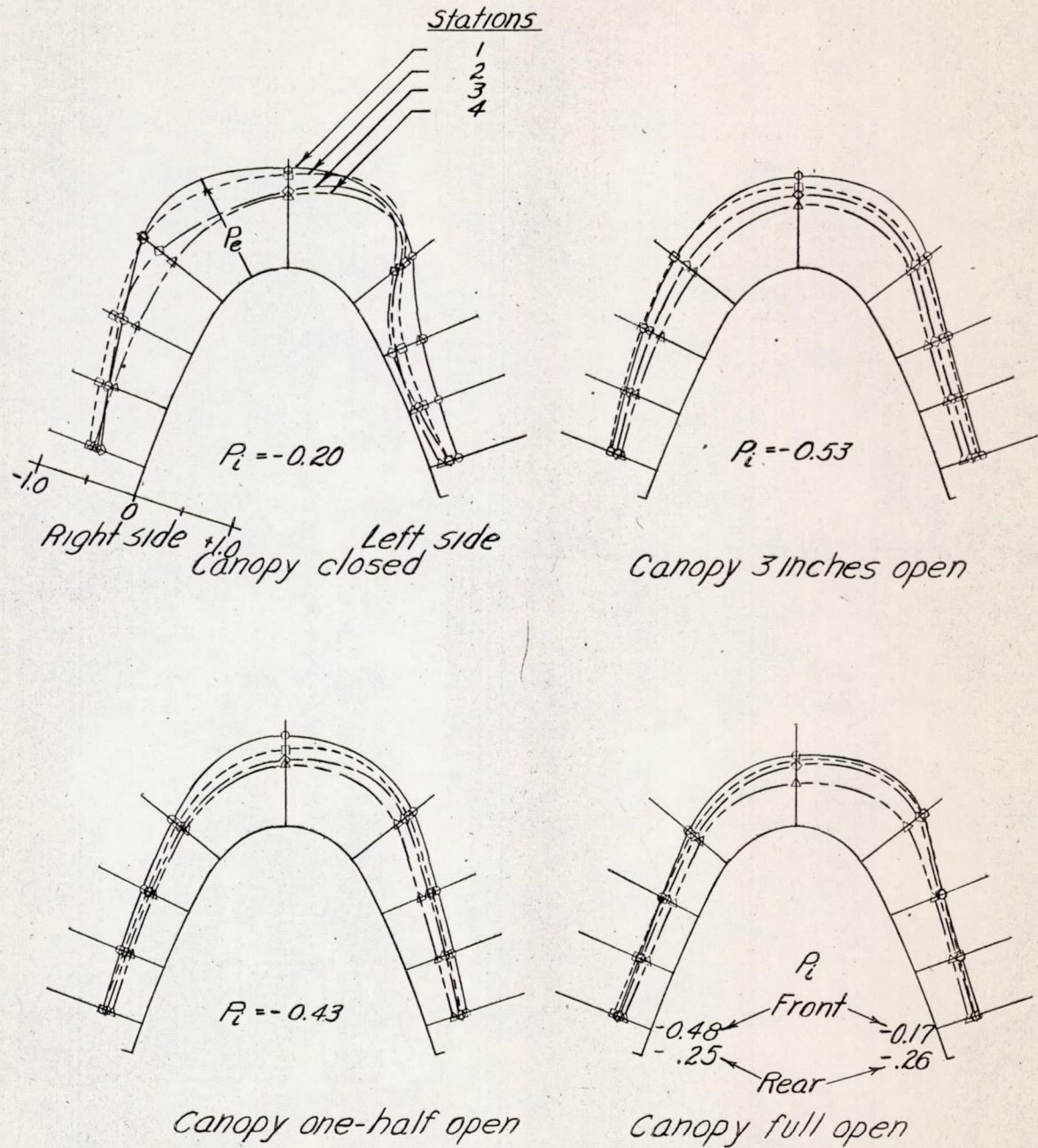
Stations
1
2
3
4

P_e

$P_i = -0.20$

-1.0
0
+1.0

Right side   Left side

Canopy closed

$P_i = -0.53$

Canopy 3 inches open

$P_i = -0.43$

Canopy one-half open

P_i
Front
-0.48 ←   → -0.17
.25 ←   → -.26
Rear

Canopy full open

(b) Military power; T_c, 0.18; C_L, 0.52

Figure 12.— continued.
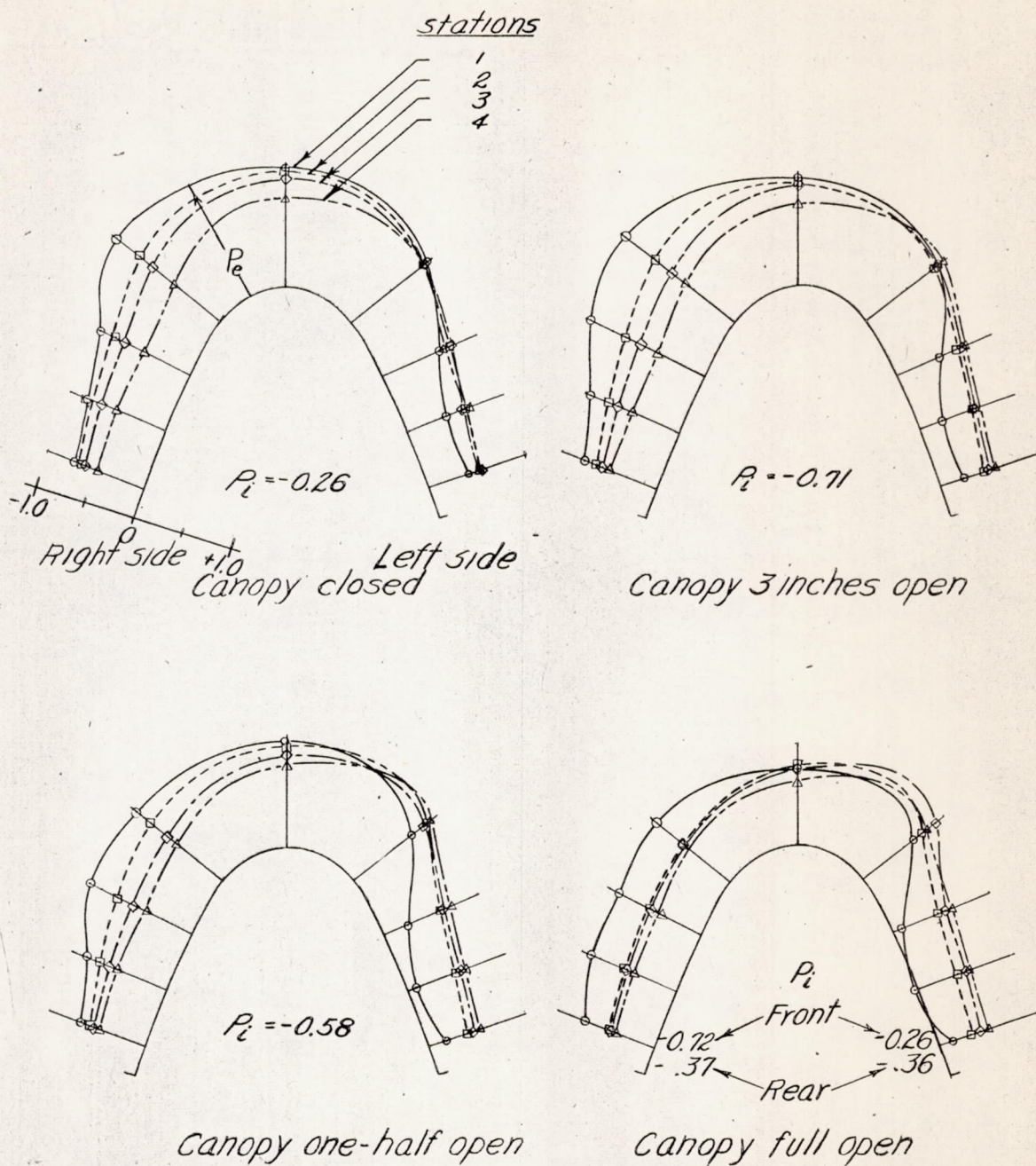
stations

$P_i = -0.26$

-1.0

Right side   +1.0   Left side
Canopy closed

$P_i = -0.71$

Canopy 3 inches open

$P_i = -0.58$

Canopy one-half open

P_i
Front
-0.72   -0.26
-.37   -.36
Rear

Canopy full open

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(c) Military power; T_c, 0.36; C_L; 0.91

Figure 12.— continued.

stations
1
2
3
4

P_e

$P_i = -0.40$

-1.0   0
Right side   +1.0   Left side

Canopy closed

$P_i = -0.77$

Canopy 3 inches open

$P_i = -0.86$

Canopy one-half open

P_i
Front   -0.38
-1.38
-.56   Rear   -.75

Canopy full open
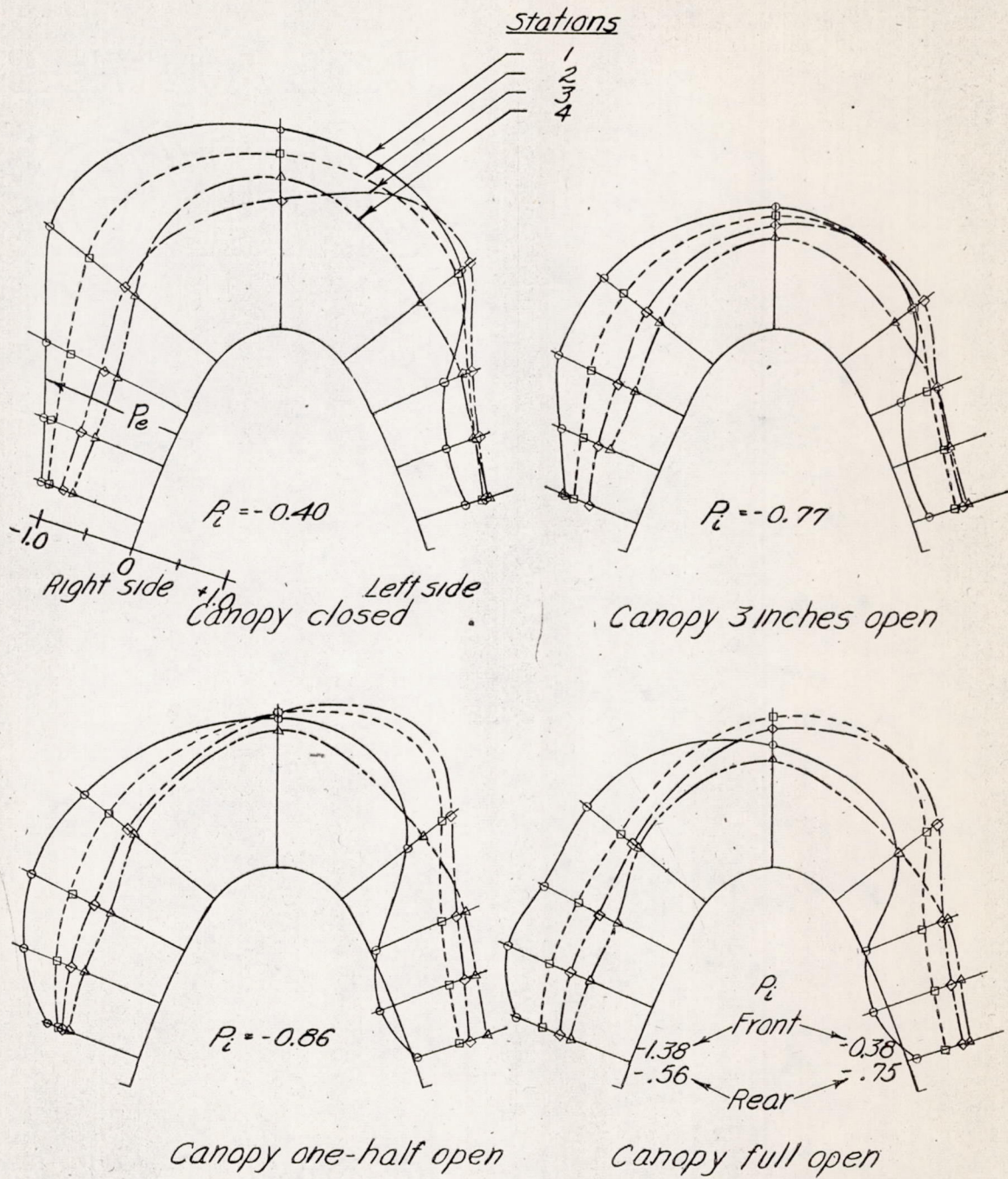
(d) Military power; T_c, 0.53; C_L, 1.23

Figure 12. – continued.

stations
1
2
3
4

P_e

$P_i = -0.23$

-1.0   0   +1.0
Right side   Left side
Canopy closed

$P_i = -0.41$

Canopy 3 inches open

$P_i = -0.43$

Canopy one-half open

P_i
Front
-0.34   -0.20
-.24   -.21
Rear

Canopy full open
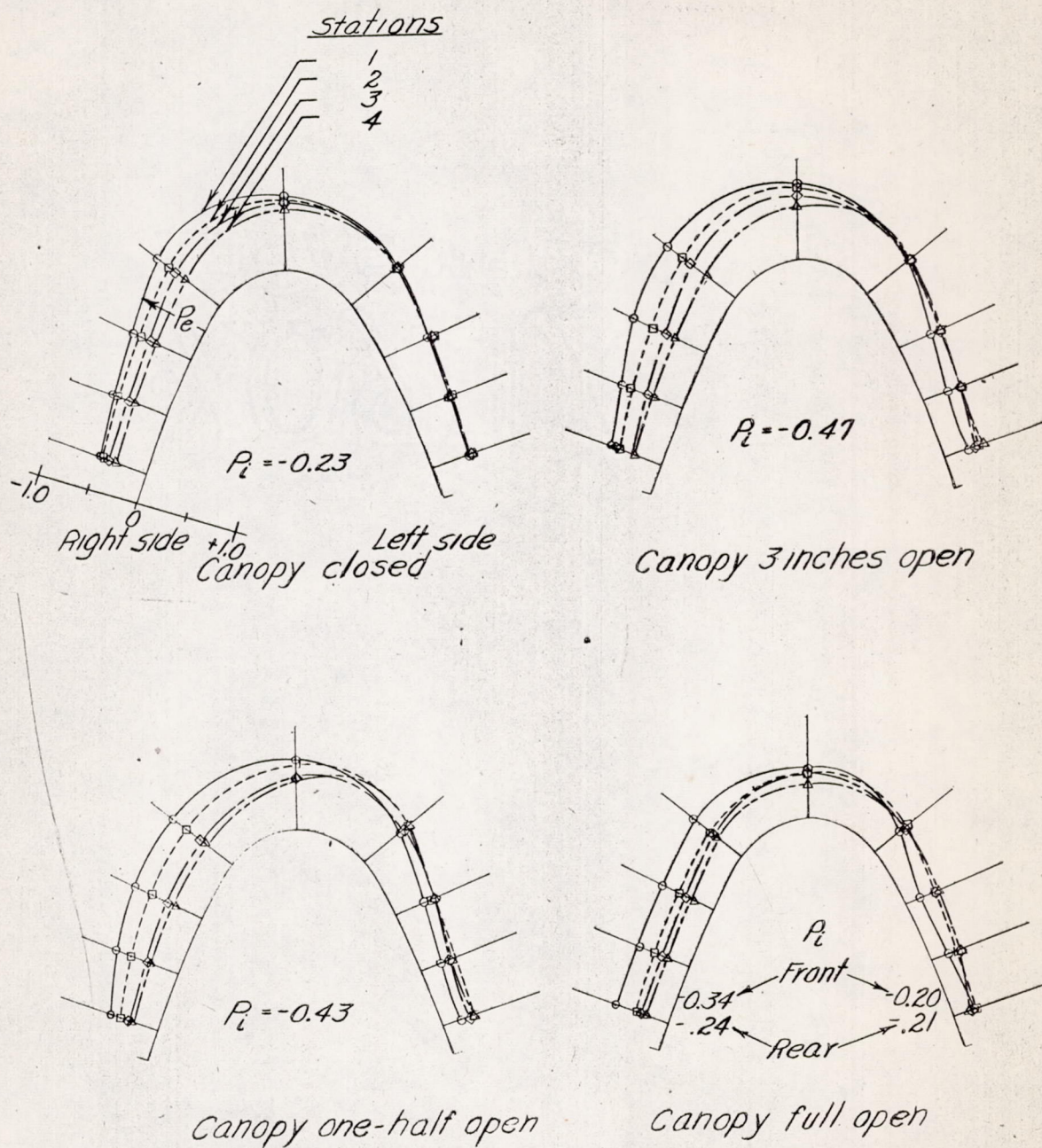
(e) Propeller idling; C_L, 1.23

Figure 12.- concluded.

stations
1
2
3
4

P_e

$P_i = -0.28$

-1.0

Right side   0   +1.0

Left side

Canopy closed

$P_i = -0.85$

Canopy 3 inches open

P_i

Front   →   -0.48

-0.78

-.74   ←   =.70

Rear

Canopy one-half open

P_i

Front   →   -0.40

-2.00

-.64   ←   =.58

Rear

Canopy full open
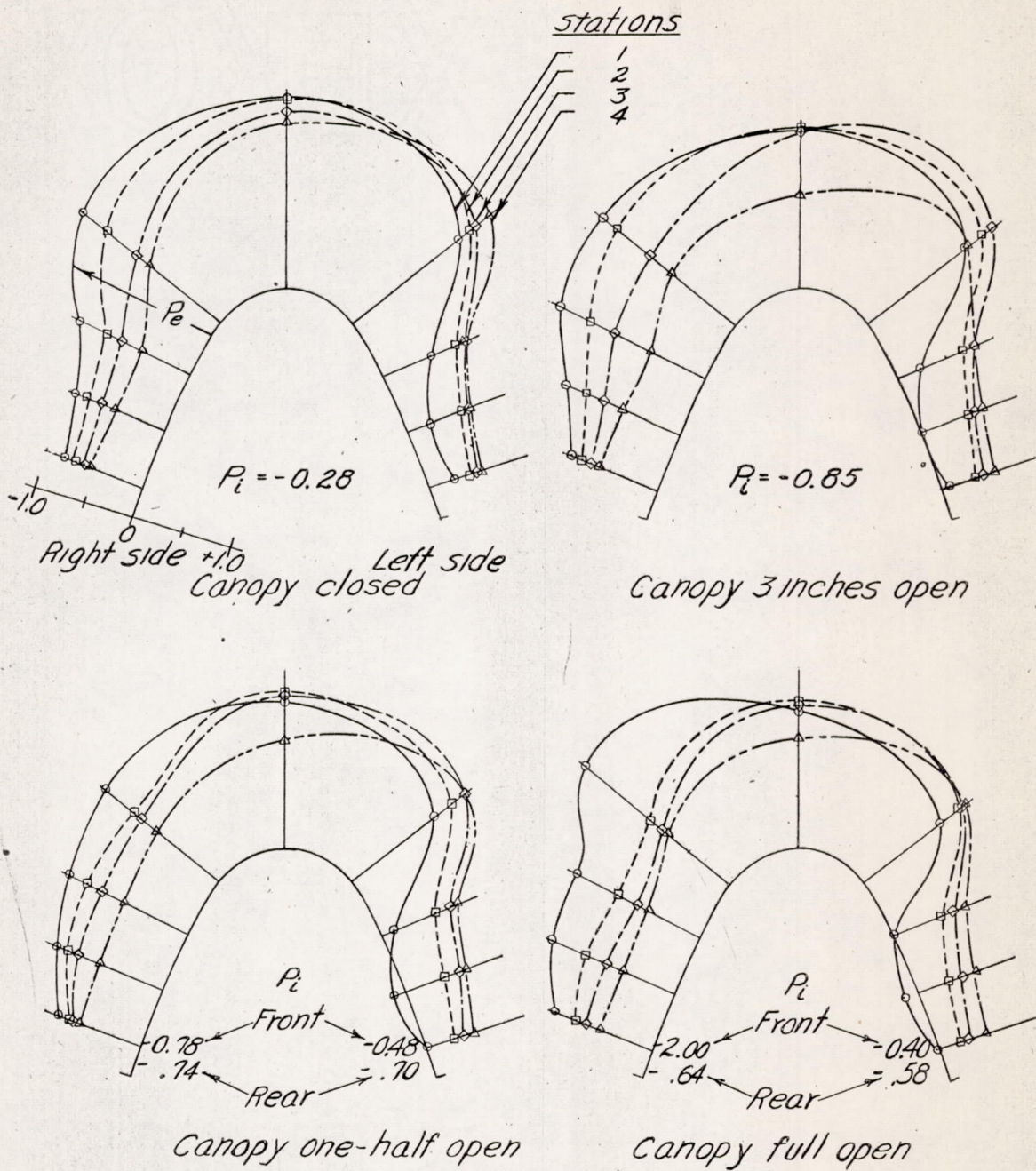
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(a) Military power; T_c, 0.36; C_L, 0.91

Figure 13 - Pressure distributions over the
canopy of the F6F-3 airplane. ψ, 15°.

stations
1
2
3
4

P_e

$P_i = -0.50$

-1.0 0 $+1.0$
Right side   Left side
Canopy closed

$P_i = -1.27$

Canopy 3 inches open

P_i
Front
-1.18 -1.00
-1.23 -1.04
Rear
Canopy one-half open

P_i
Front
-2.77 -0.60
$-.97$ $-.80$
Rear
Canopy full open

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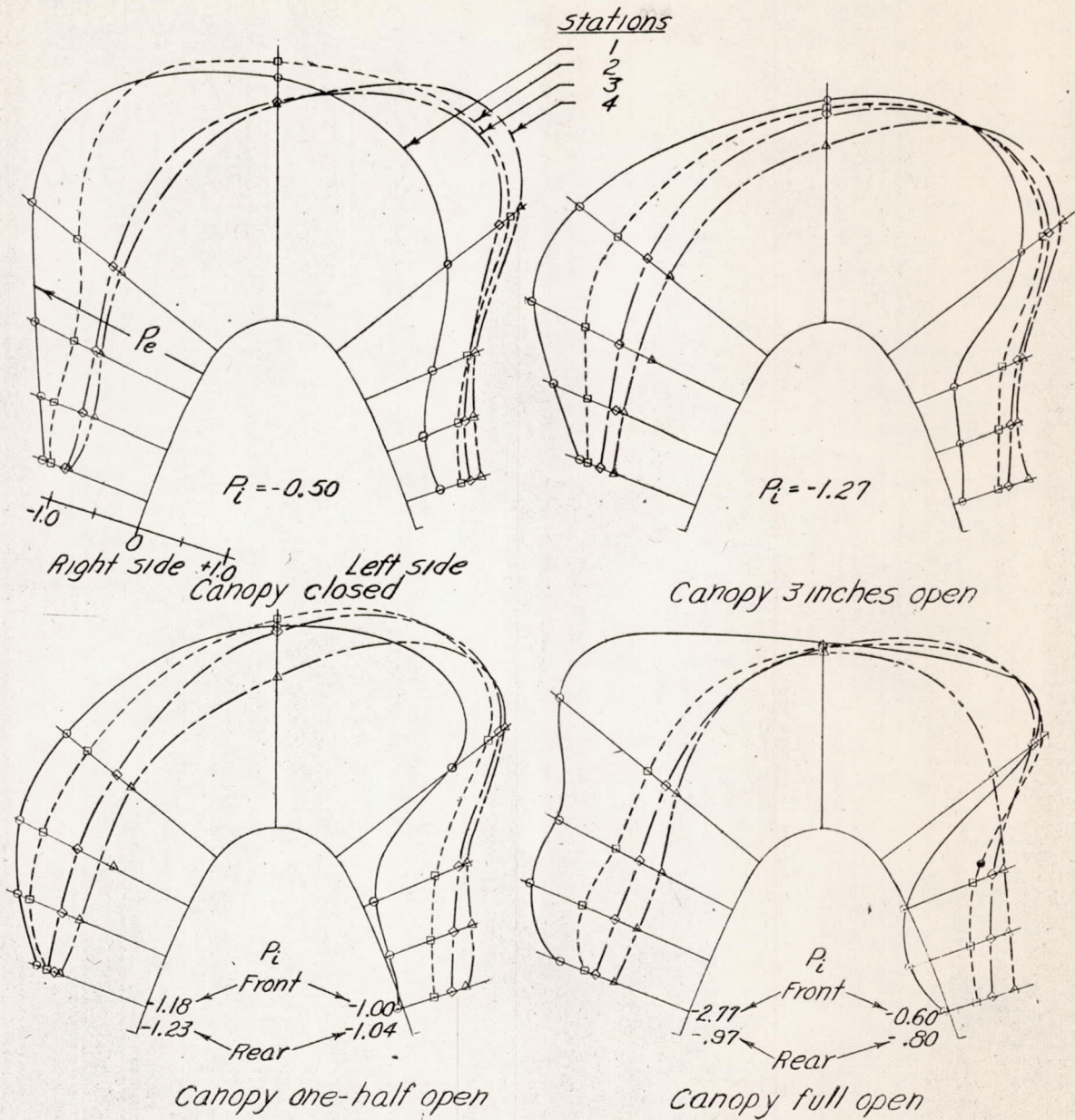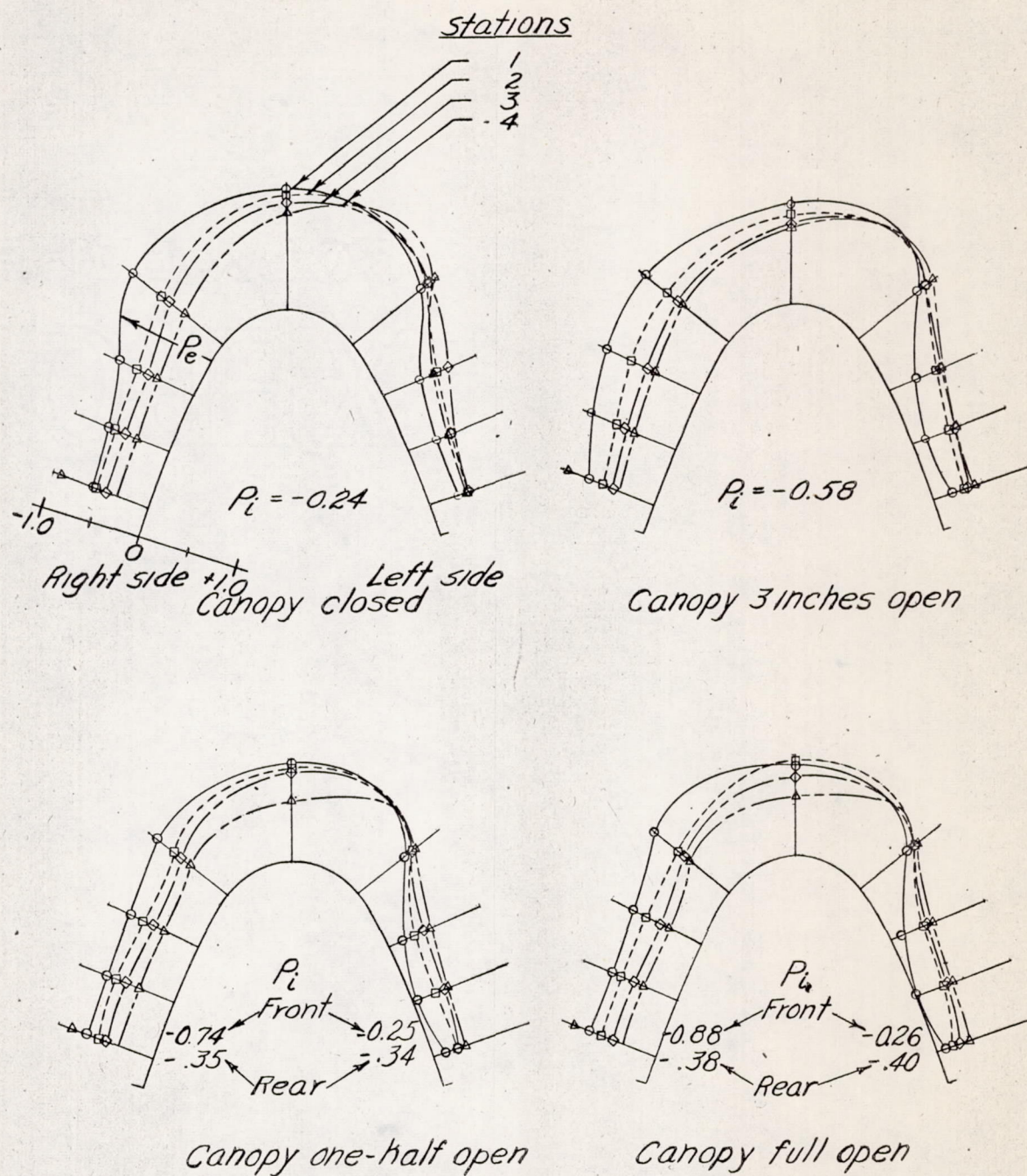(b) Military power; T_c, 0.53; C_L, 1.23

Figure 13.— continued.

stations

$P_i = -0.24$

-1.0
0
Right side +1.0

Canopy closed   Left side

$P_i = -0.58$

Canopy 3 inches open

P_i
Front
-0.74   -0.25
-.35   -.34
Rear

Canopy one-half open

P_{i_4}
Front
-0.88   -0.26
-.38   -.40
Rear

Canopy full open

(c) Propeller idling; C_L, 1.23

Figure 13.-concluded.

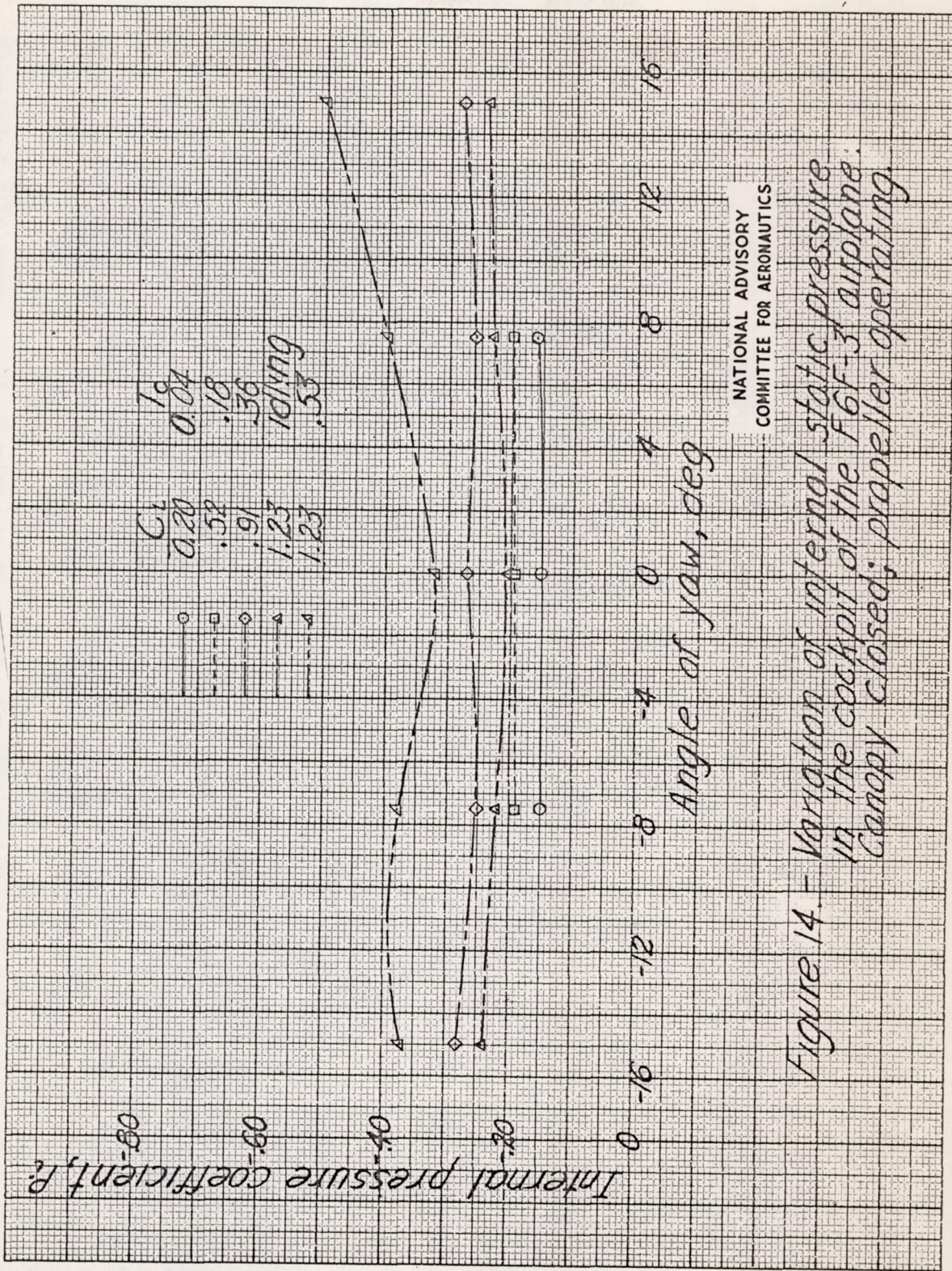Fig. 14   NACA RM No. L6L23a

Figure 14.- Variation of internal static pressure in the cockpit of the F6F-3 airplane. Canopy closed; propeller operating.