Installed Nacelle Drag-Improvement Tests of an M = 0.8 Turboprop Transport Configuration

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Tests were conducted on an unpowered turboprop semispan configuration that employed a supercritical wing at Mach numbers from 0.6 to 0.82, angles of attack from -3° to 5°, and Reynolds numbers from about 8- to 9.7-million. These tests were conducted in the 11-Foot Transonic Wind Tunnel at NASA Ames Research Center as part of a NASA ongoing program to develop efficient, high-speed propeller aircraft for more fuel-efficient commercial transports. The objectives were to develop a non-interfering wing/body seal for the nonmetric body and to study configuration modification effects on the installed nacelle drag.

Results indicated that the soft foam seal did not affect the balance calibration but it provided repeatable results. The jet-off nacelle installation drag can be approximately 25% of the cruise drag, but the losses could be reduced to 17% by changes to the wing leading edge and nacelle intersections. Comparison with results from a full-span test of the same wing geometry indicated that there were differences in the drag-rise characteristics between the two models. Analysis of the data at two Mach numbers and three lift coefficients suggested that the differences might be attributable to transition effects and to metric versus nonmetric body geometry. The evidence suggested that a nonmetric body configuration required a higher angle of attack to produce the same lift, with a corresponding increase in the induced drag. The test pointed out that further design, analysis, and testing are required to understand the flow about wing-mounted turboprop nacelles and to understand test results from semispan configurations that employ nonmetric body geometry.

NOMENCLATURE

The axis system and sign conventions are shown in figure 1. The longitudinal aerodynamic characteristics are presented in the stability-axis coordinate system.

\[ A_{\text{base}} \quad \text{base area, m}^2 \]
\[ C_D \quad \text{drag coefficient, drag/qS} \]
\[ C_L \quad \text{lift coefficient, lift/qS} \]
\[ C_m \quad \text{pitching-moment coefficient, pitching-moment/qS} \]
\[ C_P \quad \text{pressure coefficient} \frac{(p - p_{\infty})}{q} \]
\[ C_{P\text{base}} \quad \text{average base-pressure coefficient} \]
\[ C_X \quad \text{axial-force coefficient, axial force/qS} \]
The overall objective of the NASA turboprop activity is to develop the technology needed to implement the potential fuel-saving benefits of propfan propulsion. Since 1973, the fuel cost for transport aircraft has become a larger fraction of the total operating cost, increasing the need for fuel-efficient aircraft. One of the primary candidates is the turboprop-powered aircraft. Studies (ref. 1) have indicated that a turboprop-powered aircraft operating at $M = 0.8$ could achieve a 10 to 20% saving in fuel relative to a comparable turbofan-powered aircraft. As envisioned, turboprop aircraft will fly in the Mach number range of current turbofans and will employ an advanced technology wing. To make them practical, turboprop installations will require high solidity, highly loaded blades to reduce the propeller diameter and still maintain high efficiency. Investigations to improve the high-speed efficiency of propfans have been made and test results are presented in reference 2.

To acquire the technology base from which airframe manufacturers can reliably design this type of aircraft, several technical issues must be resolved. Among these
are the aerodynamic integration of the propeller and the nacelle with the wing. The propeller causes a swirl velocity in the slipstream, which becomes more severe as the propeller disc loading is increased. The swirl changes the local lift-coefficient of the wing because the local angle of attack is changed. Additionally, the swirl distorts the span loading, changing the downwash across the span and increasing the induced drag. Tests have been conducted using a slipstream simulator to study the effects of swirl and the results are reported in references 3 and 4. Other aspects of the wing/nacelle/propeller integration that may cause high drag in the propulsion installation are: 1) propwash incremental Mach numbers locally increasing the wing compressibility drag; 2) nacelle upwash increasing section-lift coefficients; 3) nacelle blockage of the wing 4) nacelle- and propeller-induced distortions to the span loading which increase the induced drag.

Because of the potential for high installation drags, tests of a semispan turbo-prop model were conducted in the Ames 11-Foot and 14-Foot Transonic Wind Tunnels as a part of the NASA Advanced Turboprop Program (ref. 5). The objective of the powered test (in the 14-foot tunnel) was to determine the installation aerodynamics of a turboprop mounted on a supercritical wing. For the test in the 14-foot tunnel, the model half-body was not attached to the wing (nonmetric) and required a seal at the wing/body juncture. An analysis of the data indicated that because the silicone rubber (RTV) seal was too stiff the results were affected. However, the increments due to power (relative to windmill speed) were probably correct because the data were obtained at fixed Mach number and angle of attack, but the reference values (lift and drag) for the various configurations were unreliable because the power-off data could not be repeated.

Oil-flow studies of the wing/nacelle showed poor flow characteristics which led to further testing in the 11-foot wind-tunnel. To develop a satisfactory wing/body seal, an unpowder test was conducted in the 11-foot tunnel using the same model. The objective of this test was to develop a wing/body seal that would not affect the floor balance and would remain in place under the effects of the large suction forces developed across the seal. Because a successful seal was found quickly, time permitted studying configuration modifications to reduce the jet-off installed nacelle drag. This report summarizes the results of the seal development and the jet-off, propeller-off, drag-reduction study.

MODEL DESCRIPTION

The model configuration was derived from a supercritical wing incorporating the 1975 advanced design technology for medium-range transports. The wing demonstrated good drag-rise characteristics near $M = 0.8$ and the coordinates were obtained from Douglas Aircraft Company. The turboprop nacelle was mated to the wing with little attempt to blend or shape the design for optimum aerodynamic integration. A geometric description of the wing and nacelle is shown in figure 2(a); the nacelle definition is shown in figure 2(b). The coordinates of the supercritical airfoil are given in table 1; the nacelle coordinates are given in table 2. The airfoil contours at the four semispan stations indicated in table 1 are shown in figure 3. The coordinates have been normalized by the local chord and translated so that the coordinate is at the nose of each airfoil. The wing has an aspect ratio of 7 and a maximum thickness ratio varying from 17.5% at the body juncture to 12% at the tip.

The nacelle was scaled on the basis of reference 6 for a Mach 0.8, 180-passenger transport powered by two 30,000-hp engines. The 0.12-model scale provided testing
capability up to one-third of full-scale Reynolds number at 1.5 atm. Turbine exhaust pipe at the wing midchord point. The test results reported here are for the unpowered turboprop configuration.

On the basis of oil-flow photographs, which will be described later, modifications were made at the wing/nacelle intersections. A fillet was added between the inboard side of the nacelle and the wing leading edge, and a small strake was added outboard of the nacelle. A sketch showing two versions of this fillet and the strake are shown in figure 4. Details of the fillets and strake are not given. Castings were made in the wind tunnel so that the coordinates could be obtained at a later time. The fillets and strake were shaped with a blade and file in the tunnel and therefore were not instrumented with pressure taps. Photographs of the model configurations tested are shown in figure 5.

The model half-body was nonmetric and was connected to the wing by a soft foam seal. Initial tests in the Ames 14-foot tunnel used an RTV seal which was found to be too stiff. The current test used a low-density polyurethane foam with a density of 38.5 kg/m$^3$ (2.36 lb/ft$^3$) was found to be satisfactory.

TEST PROCEDURE AND INSTRUMENTATION

The test variables for each configuration were Mach number and angle of attack. Total pressure was held constant at 1 atm throughout the test. Angle of attack was varied from $-3^\circ$ to $5^\circ$ at $M = 0.6$ to 0.82. For each test Mach number the nominal dynamic pressure and Reynolds number (based on mean aerodynamic chord) are given below.

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Lift, drag, and pitching moment were obtained for each configuration using a 5-component, force-moment floor balance. The balance capacity in the normal- and axial-force directions were 53, 400 N (12,000 lb) and 4,500 N (1,000 lb), respectively. Calibration of the balance indicated an accuracy of ±0.5% full scale. Surface pressures were measured at 239 wing locations and 104 nacelle stations. Base pressure was measured at six equally spaced stations located 1.27 cm (0.5 in.) inside the duct exit. All model static-pressure measurements were recorded using 48-port scanivalves.

The coordinates for the wing-pressure orifices are given in table 3; those for the nacelle in table 4. The reference chord length at each spanwise station where the wing pressures were measured is also noted in table 3.
DATA REDUCTION

All pressure measurements were reduced to pressure coefficients in the form

\[ C_p = \frac{p - p_\infty}{q} \]

The six base-pressure coefficients were averaged and the base axial force coefficient was obtained from

\[ C_{X_{\text{base}}} = -C_{p_{\text{base}}} \frac{A_{\text{base}}}{S} \]

(1)

The balance axial-force reading was then adjusted to free-stream static pressure on the base from

\[ C_X = C_{X_{\text{bal}}} - C_{X_{\text{base}}} \]

(2)

Lift and drag coefficients were calculated using the axial-force coefficient given by equation (2). All force and moment coefficients were referenced to the exposed wing area of 1.02 m\(^2\) (12.9 ft\(^2\)).

RESULTS AND DISCUSSION

Experimental aerodynamic data confirming the development of a noninterfering seal are presented in figures 6 through 8. Figures 9 through 17 show the installed nacelle characteristics and effects of adding fillets and the strake. Oil-flow visualization studies are shown in figure 18. Test technique effects that might explain the drag-rise characteristics of the semispan wing are presented in figures 19 through 22. The test results are presented in the form of static longitudinal force and moment characteristics and pressure distributions.

Seal Effects

The development of a compliant wing/body seal requires that certain design criteria must be met. These criteria are that: 1) the seal should not affect the balance constants; 2) loads applied to the fuselage should not be transmitted to the balance; 3) the seal remain in place under high suction forces; 4) data should be repeatable; 5) integration of the span loads should agree with the balance readings; and 6) there should be no significant airflow through the seal.

To determine the effects of airflow through the gap at the wing/body juncture, data were obtained with and without the soft foam seal. The aerodynamic characteristics with and without the seal are compared in figure 6. For \( M = 0.6 \) to 0.8 the addition of the seal slightly increased the lift-curve slope, reduced the drag at all lift coefficients, and had a negligible effect on the pitching moment. It should be noted that the balance was check-loaded in the axial-force direction with and without the seal and both loadings agreed with the check loading of the bare balance.
A comparison of the pressure distributions with and without the seal are shown in figure 7. At \( M = 0.6 \), there are only small differences between the pressure distributions. At \( M = 0.8 \) the entire wing is immersed in the transonic flow field, where local disturbances propagate along the Mach lines. At \( M = 0.8 \) differences in the upper surface pressures at positive \( \alpha \) are significant, in contrast with those at \( M = 0.6 \), even at the most outboard semispan station \( (n = 0.849) \). Because the wing is mounted low on the fuselage, the wing lower surface is nearly aligned with the bottom of the fuselage and the gap is minor. On the upper surface there is a sizable gap (in comparison with that of the lower surface) and airflow through the gap alters the pressure profiles.

Although not shown, integration of the span-load distributions gave lift coefficients that agreed with the balance values. The pressure distributions at \( C_L = 0.5 \) (not at the same \( \alpha \)) agreed almost exactly with those of a previous test (ref. 3) at \( M = 0.6 \) and agreed favorably at \( M = 0.8 \). At \( M = 0.8 \) the shock wave on the wing upper surface was displaced about 5% chord forward relative to the full-span test results. The primary differences between the two tests were the test Reynolds number, fixing of the boundary-layer transition (the test reported here was conducted transition-free), and metric (attached) and nonmetric (unattached) fuselage geometry. The suspected differences because of the different tests procedures will be described later.

The final evaluation of the seal included a determination of the effects of airflow through the seal on the wing pressure distributions. This was tested by sealing the surface of the polyurethane seal with RTV and the results are shown in figure 8. The pressure distributions at the first span station outboard of the wing root \( (n = 0.250) \) were unaffected by possible airflow through the foam seal when compared to an air tight RTV seal.

Based on these results the soft foam seal successfully met the criteria stated above for maintaining a compliant wing/body seal.

### Installed Nacelle Characteristics

Configuration modifications were made at the wing-nacelle intersections in an attempt to reduce the installed nacelle drag. Sketches of these configuration modifications are shown in figure 4. The baseline wing/nacelle (WN), wing/nacelle/straight-fillet (WNF1), wing/nacelle/curved-filled (WNF2), and wing/nacelle/curved-fillet/strake (WNF2S) were tested at \( M = 0.6 \) to 0.82. The straight fillet (figure 4(b)) was unswept and extended 20 cm (8 in.) spanwise from the inboard side of the nacelle to the wing leading edge. The WNF2 configuration (fig. 4(c)) was reshaped from the WNF1 geometry by curving the leading edge to provide some sweep. All fillet and strake modifications were made in the tunnel. The fillets were made from an epoxy and filler material and shaped with a blade and file. The modifications were made on the basis of oil-flow visualization studies, but with no theoretical guidance.

Flow-visualization photographs, which will be described later, indicated a cross-flow around the nacelle with a strong inward flow. To reduce this inward flow, a strake was added at the outboard side of the nacelle. It was expected that the strake would provide some flow straightening. This strake extended about 2.5 cm (1 in.) from the wing leading edge forward along the nacelle.
Force and pressure data comparing the wing with the wing/nacelle are shown in figures 9 and 10, respectively. The addition of the nacelle reduced the lift coefficient at all angles of attack without a significant effect on the lift-curve slope, increased the drag coefficient and lift-coefficient for minimum drag, and reduced the stability at all Mach numbers. The addition of the nacelle produced significant changes in the wing pressure distributions in the vicinity of the nacelle. At $M = 0.6$ and $\alpha = 2^\circ$ just inboard of the nacelle ($\eta = 0.418$), a strong acceleration of the flow is caused by the nacelle as indicated by a decrease in the peak upper surface, $C_p$, from about $-1.0$ to $-1.8$. The lower-surface flow is also accelerated and the net effect is a substantial loss in section lift. Just outboard of the nacelle ($\eta = 0.544$) the upper-surface pressures are slightly increased while the lower surface pressures are largely unaffected.

At $M = 0.8$ just inboard of the nacelle, the effect of the nacelle is characterized by a strengthening of the upper-surface shock wave at the 20% chord station and the appearance of a new shock on the lower surface. Overall, there is a significant effect of the nacelle on the pressures inboard, with small effects outboard. Pressure distributions indicate that small separations may occur inboard because of the nacelle installation. The upper-surface pressure peaks are increased but not to the extent that would cause large flow separations.

Force data comparing the WN, WNF1, and WNF2 geometries are shown in figure 11 and pressure comparisons are shown in figure 12. The addition of the fillets has a negligible effect on the lift when compared with the wing/nacelle. The straight fillet reduced the drag about 5% at the cruise lift coefficient of 0.5. The curved fillet resulted in a further drag reduction, but only at $M > 0.7$. At all Mach numbers the addition of fillets had a minor effect on the stability.

Addition of the fillets markedly reduced the high-suction peaks previously described for the wing/nacelle configuration. The fillets covered the first 5% wing chord on the upper surface and 15% on the lower surface and were not instrumented with pressure orifices. However, sufficient pressures on the wing surface were available to indicate a reduction in the shock strength and in the pressure peaks on the upper and lower surfaces.

Comparisons between the WNF2 geometries are shown in figures 13 and 14. The addition of the strake had a negligible effect on the lift and moment characteristics at all Mach numbers tested. At $C_L = 0.5$, the addition of the strake reduced the drag about 10% at $M = 0.6$ and about 7% at $M = 0.8$. At all lift coefficients and Mach numbers the WNF2S configuration had lower drag than the WNF2 configuration. The drag improvement from this small strake was approximately equal to the increments provided by the inboard fillets. At the first station outboard of the nacelle ($\eta = 0.544$) the addition of the strake had only minor effects on the pressure distributions at all Mach numbers and angles of attack.

The drag-rise characteristics for the five configurations tested are shown in figure 15. The drag rise at constant $C_L = 0.0$ to 0.6 are presented as a function of $M$. The drag rise for five configurations are compared at $C_L = 0.5$ in figure 16. The addition of the fillets and strake to the wing/nacelle configuration, although lowering the drag level, did not have any significant effect on the drag-rise Mach number. It is suspected that the strong shocks previously discussed are primarily responsible for the large rise in nacelle drag with Mach number.
The nacelle drag increments are compared at $C_L = 0.5$ in figure 17. The nacelle drag increment, $\Delta C_{DNAC}$, is the configuration drag minus the drag of the wing alone. Compared with the wing/nacelle configuration, the WNF2S geometry reduced the installed nacelle-drag increment about 30% or more at all Mach numbers tested. It should be noted that the high level of the nacelle drag increment is a result of separated flow at the base of the nacelle, which reduces the wing lift. This is not a representative condition because there is no jet exhausting from the duct exit. Even at low exhaust-pressure ratios the effect of the jet would be to clean up the flow on the underside of the wing (ref. 5).

Flow Visualization Studies

All configurations were studied using fluorescent oil to visualize the boundary-layer flow. Photographs taken under ultraviolet light are presented in figure 18.

Figure 18(a) shows the wing-alone upper surface. The effect of adding the nacelle is shown in figure 18(b). This photograph shows the strong inward sidewash behind the nacelle and the strong normal shock adjacent to the inboard side of the nacelle. Its location agrees with that indicated on the pressure distributions. A separation bubble can be seen just downstream of this shock. Figure 18(c) is a photograph of the underside of the wing/nacelle. It shows the separation behind the nacelle exhaust pipe which is believed responsible for the lift loss with jet off described in reference 5.

The flow over the upper surface of the WNF1 configuration is shown in figure 18(d). The shock has moved inward and is no longer normal to the onset flow. The flow behind the shock has the appearance of being similar to flow around a flat plate with stationary vortices rolled up at the edges. Because of the vortices, the flow behind the shock is quickly reorganized into a uniform streamwise flow. None of the pressure distributions indicated significant loss in trailing-edge pressure recovery because of this shock wave.

The curved-fillet flow, shown in figure 18(e), has a weaker but similar flow disturbance. The sidewash has been reduced as a result of a reduced suction peak inboard of the nacelle. These results seem to suggest that further improvements might be available through modifications of the entire inboard section of the wing leading edge.

The outboard wing/nacelle juncture was modified by the addition of a small strake and the flow pattern is shown in figure 18(f). The strake appears to have provided some additional flow straightening, but the magnitude of its drag reduction is surprising.

Test Technique Effects on Wing Drag Rise

Comparisons of the drag-rise characteristics of the wing alone at $C_L = 0.3$ and 0.5 show that the semispan model has significantly higher drag rise than the full-span model (fig. 19). To show the comparison directly, the full-span data were matched with the semispan data at $M = 0.6$. All the data have been referenced to the trapezoidal wing area. The wing is designed for $M = 0.8$, but even at $C_L = 0$ the semispan model exhibited significant drag rise near $M = 0.76$. 

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In addition to scale, there were differences between the two tests. First, the full-span model was tested with a sting-mounted metric body; the semispan model with a floor-mounted non metric half-body. Second, the full-span model was tested using fine grit near the wing leading edge to produce an all-turbulent boundary-layer flow; the semispan model was tested without grit (transition-free). Third, the full-span test was conducted at constant Reynolds number based on mean aerodynamic chord of about $4.5 \times 10^6$; the semispan test was conducted at a constant pressure of 1 atm and the Reynolds number based on mean aerodynamic chord varied from about $8 \times 10^6$ at $M = 0.6$ to $9.7 \times 10^6$ at $M = 0.82$.

At $C_L = 0$, the high drag rise of the semispan model might be caused by the movement of free transition. Simplified flat-plate friction-drag estimates (ref. 8) with empirical thickness induced pressure corrections (ref. 9) were made assuming: (1) the flow was 80\% turbulent at $M = 0.7$ and below, 100\% turbulent at $M = 0.82$; (2) the extent of turbulent flow varied linearly with Mach number; and (3) the combined laminar/turbulent friction drag was the all-turbulent value times the extent of turbulent flow plus the all-laminar value times the extent of laminar flow. The results of applying the estimated increment between an all-turbulent boundary layer and a mixed laminar/turbulent boundary layer to the semispan test data are shown in figure 20.

At $C_L \neq 0$ the differences in Reynolds number and transition are not sufficient to explain the high-drag rise of the semispan model. In addition, examination of the surface-pressure distributions did not indicate the existence of a laminar bubble. Because the two tests exhibited essentially the same pressure distributions at $M = 0.6$ and a minor difference in the shock location at $M = 0.8$ ($C_L = 0.5$), there was no reason to suspect the two wings had any significant differences in section geometry and/or twist distribution.

The carryover lift on the body which is measured by the balance on metric geometries suggests that there may be differences in the angle of attack required to produce the same lift. A comparison of the lift characteristics for the two tests is shown in figure 21. At $M = 0.6$ (fig. 21(a)) the metric body configuration has higher $C_L$ at $\alpha = 0^\circ$ and lower zero-lift $\alpha$ than the nonmetric body. There is also a significant difference between the lift-curve slopes. At $M = 0.8$ (fig. 21(b)) the $C_L$ at $\alpha = 0^\circ$ and $\alpha$ at $C_L = 0$ exhibit the same characteristics as for $M = 0.6$. However, the two configurations now exhibit about the same lift curve slope. At $M = 0.8$ and $C_L = 0.5$, there is a difference of about $0.4^\circ$ in angle-of-attack. For the metric-body configuration the balance measured the total lift; for the nonmetric body the balance measured only the lift on the exposed wing surface. This might in part explain the differences in angle of attack to produce the same lift.

Calculations were made to study the effect of these angle of attack differences. The calculations were made as follows: 1) the Mach number dependent increment in skin-friction drag, described previously, was added to the axial force; 2) the angle-of-attack of the semispan test data were adjusted to correspond to the full-span test; 3) the value of the normal-force coefficient was assumed unchanged but was now at the new angle of attack; and 4) new drag polars were calculated and the drag at constant lift coefficient was determined. The results of these calculations are shown in figure 22. It can be seen that the trends are in the direction to make the drag-rise characteristics agree reasonably well at $C_L = 0.3$. However, at $C_L = 0.5$ this procedure results in almost no drag rise. Therefore, there appear to be other factors causing the differences in the drag rise.
The results of this exercise indicate the need to match all test conditions when attempting to make comparisons between full-span and semispan tests. The primary objective of the test reported in reference 5 was to obtain installation drag penalties (nacelle and slipstream interference). It was believed that a metric fuselage would only raise the drag level from which propulsion increments were to be determined, and thereby reduces overall accuracy. The above calculations suggest that carryover lift may have a significant effect on the angle of attack to produce a given lift and as a result may produce significant changes in the induced drag. This may modify the drag-rise characteristics and perhaps, raise concerns about the validity of drag increments obtained from floor-mounted semispan models.

It is known that reliable increments because of configuration modifications can be obtained from semispan models. A semispan model is generally constructed with metric fuselage. However, there is some question that semispan tests can provide data that will agree with the full-span configuration. There is an effect caused by the tunnel-floor boundary layer that produce differences in the flow around the body (affecting the upwash at the wing/body juncture) and prevents achieving a true "inviscid" reflection plane. Subsequently, it was learned from the Douglas Aircraft Company that higher drag creep was also observed on another semispan model tested in the Energy Efficient Transport Program. Because of the variations observed, further research is planned to help resolve the uncertainties of testing with floor-mounted models.

Further tests have recently been conducted on the same model, but with a metric body. Comparisons of the drag-rise characteristics for the full-span and nonmetric and metric body semispan geometries can be found in reference 7.

CONCLUSIONS

Tests were conducted in the Ames 11-Foot Transonic Wind Tunnel on a representative turboprop semispan configuration employing a supercritical wing at $M = 0.6$ to 0.82 and $\alpha = -3^\circ$ to $5^\circ$. The tests were conducted unpowered and employed a nonmetric fuselage. The Reynolds numbers varied from 8- to 9.7-million and the test was conducted transition-free. Test results indicated the following conclusions:

1. A soft polyurethane foam seal was found to provide a noninterfering wing to body seal for testing models with nonmetric bodies. Force and pressure data were repeatable; pressure distributions agreed favorably with a previous full span test; integration of the span load distributions produced the same lift as measured by the balance; the seal did not affect the balance calibration; forces applied to the fuselage did not interact with the balance; and the seal remained in place under high suction forces on the wing upper surface.

2. Addition of fillets just inboard of the nacelle reduced the strong shock wave and high suction peaks resulting from accelerated flow between the fuselage and nacelle.

3. The addition of a strake just outboard of the nacelle reduced the drag even further by reducing the nacelle crossflow.

4. A curved fillet in combination with a strake resulted in the least nacelle installation drag.
5. All geometries studied in the drag improvement program successfully lowered the installed drag. However, none of the configuration modifications had any noticeable effect on the drag rise.

6. A comparison of the present test with a previous full-span metric-body geometry test suggests that there may be an unexpected drag rise associated with semispan testing. Because the carryover lift is not being measured by the balance, there are differences in the angle of attack to produce the same lift.

7. Further design, analysis, and testing are required to reduce the nacelle installation losses, to understand the flow about wing-mounted turboprop nacelles, and to help resolve the uncertainties of testing with floor-mounted models.

REFERENCES


TABLE 1.- AIRFOIL COORDINATES

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y = 78.4575 cm (30.8888 in.)
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\( y = 156.9149 \text{ cm} \)  
(61.7775 in.)  
\( y = 224.1187 \text{ cm} \)  
(88.2537 in.)
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### TABLE 3.- WING SURFACE PRESSURE LOCATIONS

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#### Chord

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<td>Nacelle station m</td>
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NOTE:

1. POSITIVE VALUES OF FORCE AND MOMENT COEFFICIENTS AND ANGLES ARE INDICATED.

2. ORIGINS OF WIND AND STABILITY AXES HAVE BEEN DISPLACED FROM CENTER OF GRAVITY FOR CLARITY.

Figure 1.- Axis system and sign conventions.
Fuselage station 2.38

Floor balance 1.27

Seal

2° Toe-in
3.75° Droop (Relative to WRP)

35.06°

\( c = 0.702 \)

\( S_{exp} = 1.198m^2 \)

\( \Lambda c/4 = 32° \)

\( AR = 7.0 \)

Note: All dimensions are in meters

(a) Wing-nacelle.

Figure 2.- Configuration geometry.
Note: All dimensions are in centimeters

(See table 2 for R and H coordinates)

Span station 107.77

35.06°

Front view

Left side

N.S. 0
N.S. 18.34
N.S. 24.13

W.S. 91.95

Body €

N.S. 96.95

16.31

15.00

2.26

12.70 Dia.

Exhaust duct exit €
(parallel to wing ref. x-y plane)

W.S. 87.24
(Balance €)

(b) Nacelle.

Figure 2.- Concluded.
Figure 3. - Wing airfoil contours.

(a) \( \eta = 0.12 \).

(b) \( \eta = 0.35 \).
Figure 3. Concluded.
Figure 4.— Sketches of fillets and strake.
Figure 5.- Model configurations.
(b) Wing/nacelle/straight-fillet.

Figure 5.- Continued.
(c) Wing/nacelle/curved-fillet.

Figure 5.- Continued.
(d) Wing/nacelle/curved-fillet/strake.

Figure 5.- Concluded.
FIG. 6  SEAL EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .60
DATA SET SYMBOL     CONFIGURATION
RMJ001  O  W  (NO SEAL)
QMJ002  □  W  (FOAM SEAL)

FIG. 6  SEAL EFFECTS ON LONGITUDINAL CHARACTERISTICS
MACH  =  .60
FIG. 6  SEAL EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .70
<table>
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<td>QMJ002</td>
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</tbody>
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**FIG. 6 SEAL EFFECTS ON LONGITUDINAL CHARACTERISTICS**

MACH = .70
FIG. 6  SEAL EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .80
FIG. 6  SEAL EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .80
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RM.JU01) W (NO SEAL) WING UPPER SURFACE
(RM.JU02) W (FOAM SEAL) WING UPPER SURFACE
(RM.JL01) W (NO SEAL) WING LOWER SURFACE
(RM.JL02) W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .250
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH  =  .600  ETA  =  .250
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<td>RMJU02</td>
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<td>RMJL01</td>
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<td>(NO SEAL) WING LOWER SURFACE</td>
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<td>RMJL02</td>
<td>△</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
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FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.600  ETA = 0.365
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .365
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<tr>
<td>RMJU01</td>
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<td>(FOAM SEAL) WING LOWER SURFACE</td>
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FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.418
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<td>(RMJL02)</td>
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**FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS**

MACH = .600 ETA = .418
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .600  ETA = .481
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .481
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .600  ETA = .544
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .544
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU01) ○ W (NO SEAL) WING UPPER SURFACE
(RMJU02) □ W (FOAM SEAL) WING UPPER SURFACE
(RMJU01) ◇ W (NO SEAL) WING LOWER SURFACE
(RMJU02) △ W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .597
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJJ01) 〇 (NO SEAL) WING UPPER SURFACE
(RMJJ02) □ (FOAM SEAL) WING UPPER SURFACE
(RMJJ01) □ (NO SEAL) WING LOWER SURFACE
(RMJJ02) □ (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .597
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.650
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH  =  .600  ETA  =  .650
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU01) W (NO SEAL) WING UPPER SURFACE
(RMJu02) W (FOAM SEAL) WING UPPER SURFACE
(RMJL01) W (NO SEAL) WING LOWER SURFACE
(RMJL02) W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .849
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<td>RMJU04</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 7** SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.849

*Graphs showing chordwise pressure distributions for different sealing configurations,*

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<th>$C_p$</th>
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<td>-1.6</td>
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<tr>
<td>8.0</td>
<td>-1.8</td>
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*Graphs for $\alpha = 2.000$ and $\alpha = 4.000$.*
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU01) ○ W (NO SEAL) WING UPPER SURFACE
(RMJU02) ○ W (FOAM SEAL) WING UPPER SURFACE
(RMJUL01) ○ W (NO SEAL) WING LOWER SURFACE
(RMJUL02) △ W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .700  ETA = .250
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .365
**FIG. 7** SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.365
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.700  ETA = 0.418
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700  ETA = .418
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .481
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<td>(FOAM SEAL) WING UPPER SURFACE</td>
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<tr>
<td>(RMULO1)</td>
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<tr>
<td>(RMULO2)</td>
<td>△</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 7** SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

**MACH** = 0.700  **ETA** = 0.481
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<td>RMJU02</td>
<td>□</td>
<td>(Foam Seal) Wing Upper Surface</td>
</tr>
<tr>
<td>RMJL01</td>
<td>△</td>
<td>(No Seal) Wing Lower Surface</td>
</tr>
<tr>
<td>RMJL02</td>
<td>▲</td>
<td>(Foam Seal) Wing Lower Surface</td>
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</tbody>
</table>

**Figure 7** Seal Effects on Chordwise Pressure Distributions

Mach = 0.700  
Eta = 0.544
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .544
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700  ETA = .597
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .597
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<tbody>
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<td>0</td>
<td>(NO SEAL) WING UPPER SURFACE</td>
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<tr>
<td>RMJ02</td>
<td>0</td>
<td>(FOAM SEAL) WING UPPER SURFACE</td>
</tr>
<tr>
<td>RMJ01</td>
<td>0</td>
<td>(NO SEAL) WING LOWER SURFACE</td>
</tr>
<tr>
<td>RMJ02</td>
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<td>(FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS**

MACH = 0.700 ETA = 0.650
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .650
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJUO1)  O W (NO SEAL) WING UPPER SURFACE
(RMJU02)  □ W (FOAM SEAL) WING UPPER SURFACE
(RMJL01)  △ W (NO SEAL) WING LOWER SURFACE
(RMJL02)  △ W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .700 ETA = .849
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .700  ETA = .849
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .250
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = 0.800  ETA = 0.250
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .365
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800  ETA = .365
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RM1U01) O W (NO SEAL) WING UPPER SURFACE
(RM1U02) □ W (FOAM SEAL) WING UPPER SURFACE
(RM1U01) O W (NO SEAL) WING LOWER SURFACE
(RM1U02) △ W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .800 ETA = .418
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .418
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800  ETA = .481
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800  ETA = .481
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.800  ETA = 0.544
FIG. 7  SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800  ETA = .544
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU01) ○ W (NO SEAL) WING UPPER SURFACE
(RMJU02) □ W (FOAM SEAL) WING UPPER SURFACE
(RMJL01) ◯ W (NO SEAL) WING LOWER SURFACE
(RMJL02) △ W (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .800 ETA = .597
### Table: Data Set Symbol Configuration Description

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<td>W (NO SEAL) WING UPPER SURFACE</td>
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<tr>
<td>(RMJU02)</td>
<td>□</td>
<td>W (FOAM SEAL) WING UPPER SURFACE</td>
</tr>
<tr>
<td>(RMJL01)</td>
<td>△</td>
<td>W (NO SEAL) WING LOWER SURFACE</td>
</tr>
<tr>
<td>(RMJL02)</td>
<td>△</td>
<td>W (FOAM SEAL) WING LOWER SURFACE</td>
</tr>
</tbody>
</table>

---

**Fig. 7** Seal Effects on Chordwise Pressure Distributions

- **MACH** = .800  
- **ETA** = .597
DATA SET SYMBOL  CONFIGURATION DESCRIPTION
(RMJU01) □  W (NO SEAL)  WING UPPER SURFACE
(RMJU02) □  W (FOAM SEAL)  WING UPPER SURFACE
(RMJL01) ◇  W (NO SEAL)  WING LOWER SURFACE
(RMJL02) ◇  W (FOAM SEAL)  WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = .800  ETA = .650
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.650
FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .849
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJJ01)  O  (NO SEAL) WING UPPER SURFACE
(RMJJ02)  □  (FOAM SEAL) WING UPPER SURFACE
(RMJL01)  □  (NO SEAL) WING LOWER SURFACE
(RMJL02)  △  (FOAM SEAL) WING LOWER SURFACE

FIG. 7 SEAL EFFECTS ON CHORDWISE PRESSURE DISTRIBUTIONS
MACH = 0.800 ETA = 0.849
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU06) ○ WNF2S (FOAM SEAL) WING UPPER SURFACE
(RMJU07) □ WNF2S (RTV SEAL) WING UPPER SURFACE
(XMJL06) ○ WNF2S (FOAM SEAL) WING LOWER SURFACE
(RMJL07) △ WNF2S (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .600 ETA = .250
<table>
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<th>CONFIGURATION DESCRIPTION</th>
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<td>RMJJ07</td>
<td>○</td>
<td>WNF25 (RTV SEAL) WING UPPER SURFACE</td>
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<td>XMJJ06</td>
<td>△</td>
<td>WNF25 (FOAM SEAL) WING LOWER SURFACE</td>
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<td>RMJJ07</td>
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<td>WNF25 (RTV SEAL) WING LOWER SURFACE</td>
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**FIG. 8 FOAM SEAL AIRFLOW VALIDATION**

**MACH = .600 ETA = .250**
### DATA SET

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<td>□ WNF2S (RTV SEAL) WING UPPER SURFACE</td>
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<td>(XMJL06)</td>
<td>□ WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>(RMJL07)</td>
<td>△ WNF2S (RTV SEAL) WING LOWER SURFACE</td>
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</table>

![Graph](image_url)  
**FIG. 8** FOAM SEAL AIRFLOW VALIDATION

MACH =  .600   ETA =  .365
DATA SET
(XMJI06) ○ MNF25 (FOAM SEAL) WING UPPER SURFACE
(RMJU07) □ MNF25 (RTV SEAL) WING UPPER SURFACE
(XMJI06) ○ MNF25 (FOAM SEAL) WING LOWER SURFACE
(RMJU07) △ MNF25 (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .600 ETA = .365
DATA SET   SYMBOL   CONFIGURATION DESCRIPTION
(XMJU06)   ○   WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)   □   WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJU07)   △   WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJU07)   △   WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8   FOAM SEAL AIRFLOW VALIDATION
MACH = .600   ETA = .418
FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = .600 ETA = .418
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = 0.600  ETA = 0.481
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .600  ETA = .481
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<td>WNF25 (RTV SEAL) WING UPPER SURFACE</td>
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<td>(RMJL07)</td>
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**FIG. 8 FOAM SEAL AIRFLOW VALIDATION**

MACH = .600 ETA = .544
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU06)  O  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJL06)  △  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  ▲  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = 0.600  ETA = 0.544
<table>
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<td>○</td>
<td>WNFS (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>RMJL07</td>
<td>△</td>
<td>WNFS (RTV SEAL) WING LOWER SURFACE</td>
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FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = .600 ETA = .597
DATA SET | SYMBOL | CONFIGURATION DESCRIPTION
--- | --- | ---
(XMJD08) | ○ | WNF25 (FOAM SEAL) WING UPPER SURFACE
(RMJD07) | □ | WNF25 (RTV SEAL) WING UPPER SURFACE
(XMUL05) | ○ | WNF25 (FOAM SEAL) WING LOWER SURFACE
(RMUL07) | △ | WNF25 (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .500 ETA = .597
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .600  ETA = .650
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU06) O WNF2S (FOAM SEAL) WING UPPER SURFACE
(RMJu07) □ WNF2S (RTV SEAL) WING UPPER SURFACE
(XMJU06) O WNF2S (FOAM SEAL) WING LOWER SURFACE
(RMJU07) △ WNF2S (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .600 ETA = .650
### Data Set

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<td>RMJU07</td>
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<td>WNF25 (RTV Seal) Wing Upper Surface</td>
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<tr>
<td>RMJU07</td>
<td>△</td>
<td>WNF25 (RTV Seal) Wing Lower Surface</td>
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### Figure 8

**Foam Seal Airflow Validation**

- **Mach** = 0.600  
- **Eta** = 0.849
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJu05)  ○  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJu05)  ●  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJU07)  △  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .600  ETA = .849
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .700  ETA = .250
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJJ06)  ○  WNF25 (FOAM SEAL)  WING UPPER SURFACE
(RMJJ07)  ○  WNF25 (RTV SEAL)  WING UPPER SURFACE
(XMJL06)  ○  WNF25 (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  △  WNF25 (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .700  ETA = .250
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJJ06) ○ WNF25 (FOAM SEAL) WING UPPER SURFACE
(RMJJ07) ○ WNF25 (RTV SEAL) WING UPPER SURFACE
(XMJJ06) ○ WNF25 (FOAM SEAL) WING LOWER SURFACE
(RMJJ07) △ WNF25 (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .700 ETA = .365
DATA SET | SYMBOL | CONFIGURATION DESCRIPTION
--- | --- | ---
(XMJU06) | ○ | WNF2S (FOAM SEAL) WING UPPER SURFACE
(RMJU07) | □ | WNF2S (RTV SEAL) WING UPPER SURFACE
(XMJL06) | ※ | WNF2S (FOAM SEAL) WING LOWER SURFACE
(RMJL07) | △ | WNF2S (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .700 ETA = .365
FIG. B  FOAM SEAL AIRFLOW VALIDATION
MACH = .700 ETA = .418
<table>
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<td>(XMJL06)</td>
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<td>(RMJL07)</td>
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<td>WNF25 (RTV SEAL) WING LOWER SURFACE</td>
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**FIG. 8 FOAM SEAL AIRFLOW VALIDATION**

MACH = .700 ETA = .418
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<td>WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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<td>RMUL07</td>
<td>△</td>
<td>WNF2S (RTV SEAL) WING LOWER SURFACE</td>
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**FIG. 8** FOAM SEAL AIRFLOW VALIDATION

MACH = 0.700 ETA = 0.481
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .700  ETA = .481
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJJ06)  ○  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJJ07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJJ06)  ▲  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJJ07)  Δ  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH  =  .700  ETA  =  .544
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .700  ETA = .544
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU06)  ○ WNFS (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □ WNFS (RTV SEAL)  WING UPPER SURFACE
(XMUL06)  ○ WNFS (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  △ WNFS (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .700  ETA = .597
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<td>XJ07</td>
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<td>WNF2S (RTV SEAL) WING UPPER SURFACE</td>
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<td>△</td>
<td>WNF2S (RTV SEAL) WING LOWER SURFACE</td>
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**FIG. 8** FOAM SEAL AIRFLOW VALIDATION

**MACH** = **.700**  **ETA** = **.597**
### DATA SET SYMBOL CONFIGURATION DESCRIPTION

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<td>RMJU07</td>
<td>□</td>
<td>WNF2S (RTV SEAL) WING UPPER SURFACE</td>
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<td>XMJU06</td>
<td>○</td>
<td>WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>RMJU07</td>
<td>△</td>
<td>WNF2S (RTV SEAL) WING LOWER SURFACE</td>
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</table>

### FIG. 8 FOAM SEAL AIRFLOW VALIDATION

\[ \text{MACH} = .700 \quad \text{ETA} = .650 \]
DATA SET        SYMBOL    CONFIGURATION DESCRIPTION
(XMJU06)  O  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJL06)  □  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  △  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = 0.700  ETA = 0.650
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .700  ETA = .849
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJJ6)  ○  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJL6)  ◙  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XJL6)  △  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMVL7)  △  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .700  ETA = .849
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(XMJU06) ○ WNFS (FOAM SEAL) WING UPPER SURFACE
(RMUL07) ○ WNFS (RTV SEAL) WING UPPER SURFACE
(XMJU06) ○ WNFS (FOAM SEAL) WING LOWER SURFACE
(RMUL07) △ WNFS (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .800 ETA = .250
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .800  ETA = .250
<table>
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<th>DATA SET</th>
<th>SYMBOL</th>
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<tr>
<td>RMJU07</td>
<td>□</td>
<td>WNF25 (RTV SEAL) WING UPPER SURFACE</td>
</tr>
<tr>
<td>XMJL06</td>
<td>●</td>
<td>WNF25 (FOAM SEAL) WING LOWER SURFACE</td>
</tr>
<tr>
<td>RMJL07</td>
<td>△</td>
<td>WNF25 (RTV SEAL) WING LOWER SURFACE</td>
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</table>

**FIG. 8 FOAM SEAL AIRFLOW VALIDATION**

<table>
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<th>ALPHA</th>
<th>MACH</th>
<th>ETA</th>
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<td>-2.000</td>
<td>0.800</td>
<td>0.365</td>
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</table>

**FIG. 8 FOAM SEAL AIRFLOW VALIDATION**

<table>
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<tr>
<th>ALPHA</th>
<th>MACH</th>
<th>ETA</th>
</tr>
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<tbody>
<tr>
<td>0.000</td>
<td>0.800</td>
<td>0.365</td>
</tr>
</tbody>
</table>
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU06) O WNF2S (FOAM SEAL) WING UPPER SURFACE
(RMJU07) □ WNF2S (RTV SEAL) WING UPPER SURFACE
(XMJU06) ○ WNF2S (FOAM SEAL) WING LOWER SURFACE
(RMJU07) △ WNF2S (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION
MACH = .800 ETA = .365
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJO6)  ○  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJL06)  ◇  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  △  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .900  ETA = .418
FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = 0.800 ETA = 0.418
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU06)  ○  WNFS (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNFS (RTV SEAL)  WING UPPER SURFACE
(XMJU06)  ○  WNFS (FOAM SEAL)  WING LOWER SURFACE
(RMJU07)  △  WNFS (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = 0.800  ETA = 0.491
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = 0.800  ETA = 0.481
FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = .800 ETA = .544
FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = .800 ETA = .544
FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = .800 ETA = .597
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU06)  ○  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJL06)  ○  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  □  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .800  ETA = .597
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION

(XMJU06)  ○  WNF25 (FOAM SEAL)  WING UPPER SURFACE
(RMJU07)  □  WNF25 (RTV SEAL)  WING UPPER SURFACE
(XMJLO6)  ◊  WNF25 (FOAM SEAL)  WING LOWER SURFACE
(RMJLO7)  △  WNF25 (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION

MACH = 0.800  ETA = 0.650
TABLE XHJU06, RHJU07, XHJL06, RHJL07
SYMBOLS

CONFIGURATION DESCRIPTION

- WNF2S (FOAM SEAL)  WING UPPER SURFACE
- WNF2S (RTV SEAL)  WING UPPER SURFACE
- WNF2S (FOAM SEAL)  WING LOWER SURFACE
- WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = .800 ETA = .650
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU06)  O  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(RMJu07)  □  WNF2S (RTV SEAL)  WING UPPER SURFACE
(XMJL06)  ○  WNF2S (FOAM SEAL)  WING LOWER SURFACE
(RMJL07)  △  WNF2S (RTV SEAL)  WING LOWER SURFACE

FIG. 8  FOAM SEAL AIRFLOW VALIDATION
MACH = .800  ETA = .849
DATA SET | SYMBOL | CONFIGURATION DESCRIPTION
--- | --- | ---
(XMUJ06) | ○ | WNF2S (FOAM SEAL) WING UPPER SURFACE
(RMJU07) | □ | WNF2S (RTV SEAL) WING UPPER SURFACE
(XMUL06) | ○ | WNF2S (FOAM SEAL) WING LOWER SURFACE
(RMUJ07) | △ | WNF2S (RTV SEAL) WING LOWER SURFACE

FIG. 8 FOAM SEAL AIRFLOW VALIDATION

MACH = .800 ETA = .849
FIG. 9 NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .60
FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH =  .60
FIG. 9 NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .70
FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .70
FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .74
FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .74
FIG. 9 NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = 0.76
FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH  =  .76
DATA SET SYMBOL  CONFIGURATION
QMJO02  □ W  (FOAM SEAL)
RMJO03  ◇ WN  (FOAM SEAL)

FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS
MACH = .78
FIG. 9 NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = 0.78
DATA SET SYMBOL CONFIGURATION
QMJ002 □ W (FOAM SEAL)
RMJ003 ◆ WN (FOAM SEAL)

FIG. 9 NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS
MACH = .80
DATA SET SYMBOL  CONFIGURATION
OMJ002  □  H  (FOAM SEAL)
RMJ003  ◇  WN  (FOAM SEAL)

FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS
MACH = .80
FIG. 9 NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .82
FIG. 9  NACELLE INSTALLATION EFFECTS ON LONGITUDINAL CHARACTERISTICS

MACH = .82
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .250
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .250
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.418
**DATA SET SYMBOL**  
(RMJU02) ○ W (FOAM SEAL) WING UPPER SURFACE  
(XMJU03) □ WN (FOAM SEAL) WING UPPER SURFACE  
(RMJL02) △ W (FOAM SEAL) WING LOWER SURFACE  
(XMJL03) △ WN (FOAM SEAL) WING LOWER SURFACE

**FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS**

MACH = .600 ETA = .481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.544
**FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS**

MACH = .600 ETA = .544
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .5y7
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .597
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .650
**Fig. 10** Nacelle installation effects on pressure distributions

Mach = 0.600  \( \eta = 0.849 \)
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = \(0.600\) ETA \(= 0.849\)
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.700  ETA = 0.365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .418
DATA SET   SYMBOL   CONFIGURATION DESCRIPTION
(AMUU02)   □   W   (FOAM SEAL)   WING UPPER SURFACE
(XMUU03)   ○   WN   (FOAM SEAL)   WING UPPER SURFACE
(AMUL02)   △   W   (FOAM SEAL)   WING LOWER SURFACE
(XMUL03)   ▲   WN   (FOAM SEAL)   WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700  ETA = .418
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.700  ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .544
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<td>(XNJU03)</td>
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<td>(XNJL03)</td>
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<td>W (FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 10** NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.544
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.597
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .597
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<td>(XMJUL03)</td>
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<td>W (FOAM SEAL) WING LOWER SURFACE</td>
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</table>

**FIG. 10** NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .849
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .849
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU02) O W (FOAM SEAL) WING UPPER SURFACE
(XMJU03) WN (FOAM SEAL) WING UPPER SURFACE
(RMJL02) W (FOAM SEAL) WING LOWER SURFACE
(XMJL03) WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .740 ETA = .250
Fig. 10  Nacelle Installation Effects on Pressure Distributions

Mach = .740  ETA = .250
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RM0U02) O W (FOAM SEAL) WING UPPER SURFACE
(XM0J03) ○ WN (FOAM SEAL) WING UPPER SURFACE
(RM0U02) △ W (FOAM SEAL) WING LOWER SURFACE
(XM0J03) △ WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .740 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .418
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU02) O W (FOAM SEAL) WING UPPER SURFACE
(XMUJ03) □ WN (FOAM SEAL) WING UPPER SURFACE
(RMJU02) O W (FOAM SEAL) WING LOWER SURFACE
(XMUJ03) △ WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .740 ETA = .481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.740 ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .544
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .544
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .597
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740  ETA = .597
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.740 ETA = 0.650
### DATA SET SYMBOL CONFIGURATION DESCRIPTION

- **(RMJU02)** ○ W (FOAM SEAL) WING UPPER SURFACE
- **(XMJU03)** □ WN (FOAM SEAL) WING UPPER SURFACE
- **(RMJU02)** ○ W (FOAM SEAL) WING LOWER SURFACE
- **(XMJU03)** △ WN (FOAM SEAL) WING LOWER SURFACE

---

**FIG. 10** NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

**MACH** = 0.740  **ETA** = 0.650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .740 ETA = .849
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.740 ETA = 0.849
<table>
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<th>SYMBOL</th>
<th>CONFIGURATION DESCRIPTION</th>
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<tr>
<td>(RMJU02)</td>
<td>W</td>
<td>WING UPPER SURFACE</td>
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<td>(XMJU02)</td>
<td>WN</td>
<td>WING UPPER SURFACE</td>
</tr>
<tr>
<td>(RMJL02)</td>
<td>W</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
</tr>
<tr>
<td>(XMJL03)</td>
<td>WN</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
</tr>
</tbody>
</table>

**FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS**

MACH = .780 ETA = .250
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU02) □ W (FOAM SEAL) WING UPPER SURFACE
(XMJU03) □ WN (FOAM SEAL) WING UPPER SURFACE
(RMJU02) ○ W (FOAM SEAL) WING LOWER SURFACE
(XMJU03) △ WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .780 ETA = .250
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.780 ETA = 0.365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.780 ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.780 ETA = 0.544
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .544
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(RMJU02)  O  W (FOAM SEAL) WING UPPER SURFACE
(XMJU03)  □  WN (FOAM SEAL) WING UPPER SURFACE
(RMJU02) ◆  W (FOAM SEAL) WING LOWER SURFACE
(XMJU03)  △  WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .780  ETA = .597
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .597
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU02) ◯ W (FOAM SEAL) WING UPPER SURFACE
(XMJU03) ◯ WN (FOAM SEAL) WING UPPER SURFACE
(RMJL02) ◯ W (FOAM SEAL) WING LOWER SURFACE
(XMJL03) Δ WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .780 ETA = .650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .650
DATA SET   SYMBOL   CONFIGURATION DESCRIPTION
(RMJU02)   ○    W   (FOAM SEAL)   WING UPPER SURFACE
(XMJU03)   □    WN  (FOAM SEAL)  WING UPPER SURFACE
(RMJL02)   ○    W   (FOAM SEAL)   WING LOWER SURFACE
(XMJL03)   △    WN  (FOAM SEAL)  WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .780  ETA = .849
<table>
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<th>DATA SET</th>
<th>SYMBOL</th>
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<td>(FOAM SEAL) WING UPPER SURFACE</td>
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<td>XMJU03</td>
<td>□</td>
<td>(FOAM SEAL) WING UPPER SURFACE</td>
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<tr>
<td>RMJL02</td>
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<tr>
<td>XMJL03</td>
<td>□</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
</tr>
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**FIG. 10** NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .780 ETA = .849
### Data Set Symbol Configuration Description

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<tr>
<th>Data Set</th>
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</thead>
<tbody>
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<td>RMJU02</td>
<td>O</td>
<td>W (foam seal) wing upper surface</td>
</tr>
<tr>
<td>RMJU03</td>
<td>DN</td>
<td>W (foam seal) wing upper surface</td>
</tr>
<tr>
<td>RMJL02</td>
<td>@</td>
<td>W (foam seal) wing lower surface</td>
</tr>
<tr>
<td>XMJL03</td>
<td>A</td>
<td>W (foam seal) wing lower surface</td>
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</table>

**FIG. 10 Nacelle Installation Effects on Pressure Distributions**

**MACH = 0.800 ETA = 0.250**
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .250
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .365
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJJU02) ○ W (FOAM SEAL) WING UPPER SURFACE
(RMJU03) □ WN (FOAM SEAL) WING UPPER SURFACE
(RMJL02) ◆ W (FOAM SEAL) WING LOWER SURFACE
(RMJL03) △ WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .800 ETA = .418
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800  ETA = .418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = 544
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .544
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH =  .800  ETA =  .597
Fig. 10 Nacelle Installation Effects on Pressure Distributions

MACH = .800 ETA = .597
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .849
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .849
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RMJU02) ○ W (FOAM SEAL) WING UPPER SURFACE
(XMJU03) □ WN (FOAM SEAL) WING UPPER SURFACE
(RMLJ02) ● W (FOAM SEAL) WING LOWER SURFACE
(XMJJ03) △ WN (FOAM SEAL) WING LOWER SURFACE

FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = 0.820 ETA = 0.250
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820 ETA = .250
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<td>RMJL02</td>
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<tr>
<td>XMJL03</td>
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**FIG. 10** NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.820  ETA = 0.365
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820 ETA = .365
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.820  ETA = 0.418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820 ETA = .418
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.820 ETA = 0.481
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.820 ETA = 0.481
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820  ETA = .544
FIGURE 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820  ETA = .544
### DATA SET SYMBOL CONFIGURATION DESCRIPTION

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<tr>
<td>XMJJ03</td>
<td>□</td>
<td>W (FOAM SEAL) WING UPPER SURFACE</td>
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<td>RMJJ02</td>
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<tr>
<td>XMJJ03</td>
<td>□</td>
<td>W (FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS**

\[
\text{MACH} = 0.820 \quad \text{ETA} = 0.597
\]
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820  ETA = .597
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = 0.820 ETA = 0.650
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS
MACH = .820 ETA = .650
FIG. 10  NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820  ETA = .849
FIG. 10 NACELLE INSTALLATION EFFECTS ON PRESSURE DISTRIBUTIONS

MACH = .820 ETA = .849
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .60
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .60
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .70
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = 0.70
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .74
FIG. 1: FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .74
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .78
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .78
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = 0.80
FIG. 11  FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH =  .80
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = 0.82
FIG. 11 FILLET VARIATIONS, LONGITUDINAL CHARACTERISTICS

MACH = .82
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .250
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .250
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .365
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.365
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .418
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.418
DATA SET | SYMBOL | CONFIGURATION DESCRIPTION
---|---|---
(XMJU03) | □ | (FOAM SEAL) WING UPPER SURFACE
(RMJU04) | □ | (FOAM SEAL) WING UPPER SURFACE
(XMJU05) | □ | (FOAM SEAL) WING UPPER SURFACE
(XMJL03) | △ | (FOAM SEAL) WING LOWER SURFACE
(RMJL04) | △ | (FOAM SEAL) WING LOWER SURFACE
(XMJL05) | □ | (FOAM SEAL) WING LOWER SURFACE

**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = .600 ETA = .431
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJJU03) WN (FOAM SEAL) WING UPPER SURFACE
(RMJU04) WNF1 (FOAM SEAL) WING UPPER SURFACE
(XMJJU05) WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJL03) WN (FOAM SEAL) WING LOWER SURFACE
(RMJL04) WNF1 (FOAM SEAL) WING LOWER SURFACE
(XMJL05) WNF2 (FOAM SEAL) WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .481
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<th>Data Set</th>
<th>Symbol</th>
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<td>RMJU04</td>
<td>WN</td>
<td>(Foam Seal) Wing Upper Surface</td>
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<td>XMJU05</td>
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<td>(Foam Seal) Wing Upper Surface</td>
</tr>
<tr>
<td>XMJL03</td>
<td>WN</td>
<td>(Foam Seal) Wing Lower Surface</td>
</tr>
<tr>
<td>RMJL04</td>
<td>WN</td>
<td>(Foam Seal) Wing Lower Surface</td>
</tr>
<tr>
<td>XMJL05</td>
<td>WN</td>
<td>(Foam Seal) Wing Lower Surface</td>
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**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = 0.600 ETA = 0.544
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.544
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .597

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMUL03) W (FOAM SEAL) WING UPPER SURFACE
(RMUL04) WNF1 (FOAM SEAL) WING UPPER SURFACE
(XMUL05) WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMUL03) WNF1 (FOAM SEAL) WING LOWER SURFACE
(RMUL04) WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMUL05)
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<td>WING UPPER SURFACE</td>
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<td>XMJU05</td>
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<td>XMUL03</td>
<td>WN</td>
<td>WING LOWER SURFACE</td>
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<td>RMUL04</td>
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<td>WING LOWER SURFACE</td>
</tr>
<tr>
<td>XMUL05</td>
<td>WNF2</td>
<td>WING LOWER SURFACE</td>
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**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = 0.600 ETA = 0.597
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .650
### FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.650

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<td>WN (FOAM SEAL) WING UPPER SURFACE</td>
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<td>WNF2 (FOAM SEAL) WING UPPER SURFACE</td>
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<td>WN (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>RMJL04</td>
<td>□</td>
<td>WNF1 (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>XMJL05</td>
<td>◼</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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**ALPHA = 2.000 x/c**

**ALPHA = 4.000 x/c**
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<td>XMJU05</td>
<td>WNF2 (FOAM SEAL) WING UPPER SURFACE</td>
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<td>WN (FOAM SEAL) WING LOWER SURFACE</td>
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<td>RMJL04</td>
<td>WNF1 (FOAM SEAL) WING LOWER SURFACE</td>
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<td>XMJL05</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .849
<table>
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<th>Symbol</th>
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<th>Description</th>
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<tr>
<td>(XMJU03)</td>
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<td>Foam Seal</td>
<td>Wing Upper Surface</td>
</tr>
<tr>
<td>(RMJU04)</td>
<td>WNF1</td>
<td>Foam Seal</td>
<td>Wing Upper Surface</td>
</tr>
<tr>
<td>(XMJU05)</td>
<td>WNF2</td>
<td>Foam Seal</td>
<td>Wing Upper Surface</td>
</tr>
<tr>
<td>(XMJL03)</td>
<td>WNF2</td>
<td>Foam Seal</td>
<td>Wing Lower Surface</td>
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<tr>
<td>(RMJU04)</td>
<td>WNF1</td>
<td>Foam Seal</td>
<td>Wing Lower Surface</td>
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<td>(XMJL05)</td>
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<td>Wing Lower Surface</td>
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</table>

**FIG. 12** FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.600 ETA = 0.849
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .365
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.365
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .418
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .418
DATA SET SYMBOL  CONFIGURATION DESCRIPTION
(XMJU03)  O  NN (FOAM SEAL) WING UPPER SURFACE
(RMJU04)  (XMJU05)  O  WNF1 (FOAM SEAL) WING UPPER SURFACE
(XMJL03)  O  WNF2 (FOAM SEAL) WING UPPER SURFACE
(RHLJ04)  (XMHL05)  WNF1 (FOAM SEAL) WING LOWER SURFACE
(XMJL05)  WNF2 (FOAM SEAL) WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH = .700 ETA = .481
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU03) WN (FOAM SEAL) WING UPPER SURFACE
(RMJU04) WNF1 (FOAM SEAL) WING UPPER SURFACE
(XMJU05) WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJL03) WN (FOAM SEAL) WING LOWER SURFACE
(RMJL04) WNF1 (FOAM SEAL) WING LOWER SURFACE
(XMJL05) WNF2 (FOAM SEAL) WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .481
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .544
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.544
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.597
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .597
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU03) WN (FOAM SEAL) WING UPPER SURFACE
(RMJU04) WNF1 (FOAM SEAL) WING UPPER SURFACE
(XMJU05) WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU03) WN (FOAM SEAL) WING LOWER SURFACE
(RMJU04) WNF1 (FOAM SEAL) WING LOWER SURFACE
(XMJU05) WNF2 (FOAM SEAL) WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH = .700 ETA = .650
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .650
<table>
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<td>WN (FOAM SEAL) WING LOWER SURFACE</td>
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<td>RMJL04</td>
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</tr>
<tr>
<td>XMJL05</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
</tr>
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</table>

**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = 0.700 ETA = 0.849
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .849
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJJU03)  WN  (FOAM SEAL)  WING UPPER SURFACE
(RMJUU04)  WNFI  (FOAM SEAL)  WING UPPER SURFACE
(XMJUU05)  WNFI  (FOAM SEAL)  WING UPPER SURFACE
(XMJL03)  WN  (FOAM SEAL)  WING LOWER SURFACE
(RMJL04)  WNFI  (FOAM SEAL)  WING LOWER SURFACE
(XMJL05)  WNFI  (FOAM SEAL)  WING LOWER SURFACE

FIG. 12  FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH =  .800  ETA =  .250
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.250
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .365
Fig. 12 Fillet Variations, Pressure Distributions

Mach = .800 Eta = .365
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU03) WN (FOAM SEAL) WING UPPER SURFACE
(XMJU04) WNF1 (FOAM SEAL) WING UPPER SURFACE
(XMJU05) WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJL03) WN (FOAM SEAL) WING LOWER SURFACE
(XMJL04) WNF1 (FOAM SEAL) WING LOWER SURFACE
(XMJL05) WNF2 (FOAM SEAL) WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.418
<table>
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<td>WNF2 (FOAM SEAL) WING UPPER SURFACE</td>
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<td>XMJL03</td>
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</tr>
<tr>
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</tr>
<tr>
<td>XMJL05</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
</tr>
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</table>

**Fig. 12 Fillet Variations, Pressure Distributions**

- **MACH = 0.800 ETA = 0.418**
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJJ03) NN (FOAM SEAL) WING UPPER SURFACE
(RMJJ04) NNF1 (FOAM SEAL) WING UPPER SURFACE
(XMJJ05) NNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJJ06) NN (FOAM SEAL) WING LOWER SURFACE
(RMJJ07) NNF1 (FOAM SEAL) WING LOWER SURFACE
(RMJJ08) NNF2 (FOAM SEAL) WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH = .800 ETA = .481
<table>
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<td>□</td>
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<td>XMJU03</td>
<td>○</td>
<td>WN (FOAM SEAL) WING LOWER SURFACE</td>
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<td>RMJU04</td>
<td>△</td>
<td>WN1 (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>XMJU05</td>
<td>□</td>
<td>WN2 (FOAM SEAL) WING LOWER SURFACE</td>
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</table>

**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = 0.800 ETA = 0.481
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .544
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .597
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .597
### DATA SET SYMBOL CONFIGURATION DESCRIPTION

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<th>CONFIGURATION DESCRIPTION</th>
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<td>WN</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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<td>RMJL04</td>
<td>WNF1</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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<td>XMJL05</td>
<td>WNF2</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = 0.800 ETA = 0.650
### DATA SET SYMBOL CONFIGURATION DESCRIPTION

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<td>WNF1</td>
<td>(FOAM SEAL) WING UPPER SURFACE</td>
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<td>(FOAM SEAL) WING UPPER SURFACE</td>
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<tr>
<td>(XMJU05)</td>
<td>WN</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>(RMJU04)</td>
<td>WNF1</td>
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<tr>
<td>(XMJU05)</td>
<td>WNF2</td>
<td>(FOAM SEAL) WING LOWER SURFACE</td>
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</table>

**FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS**

MACH = .800 ETA = .650
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU03)  WN (FOAM SEAL)  WING UPPER SURFACE
(RMJU04)  WNF1 (FOAM SEAL)  WING UPPER SURFACE
(XMJU05)  WNF2 (FOAM SEAL)  WING UPPER SURFACE
(XMJL03)  WN (FOAM SEAL)  WING LOWER SURFACE
(RMJL04)  WNF1 (FOAM SEAL)  WING LOWER SURFACE
(XMJL05)  WNF2 (FOAM SEAL)  WING LOWER SURFACE

FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS
MACH = .800  ETA = .849
FIG. 12 FILLET VARIATIONS, PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .849
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = 0.60
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = 0.60
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = .70
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = 0.70
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = .74
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = .74
FIG. 13. CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = 0.78
FIG. 13  CURVED FILLET WITH STRAKE -  LONGITUDINAL CHARACTERISTICS

MACH = .78
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH $= 0.80$
DATA SET SYMBOL CONFIGURATION
RMJ005 △ WNF2 (FOAM SEAL)
QMJ006 △ WNF2S (FOAM SEAL)

FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS
MACH = .80
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = .82
FIG. 13 CURVED FILLET WITH STRAKE - LONGITUDINAL CHARACTERISTICS

MACH = .82
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .250
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU05) O WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU06) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJL05) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJL06) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .250
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMUL05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMUL06) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMUL05) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMUL06) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .365
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .365
<table>
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<td>(XMJU06)</td>
<td>□ WNF2S (FOAM SEAL) WING UPPER SURFACE</td>
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<td>(XMJL05)</td>
<td>◊ WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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<td>(XMJL06)</td>
<td>△ WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS**

MACH = 0.600 ETA = 0.418
DATA SET SYMBOL
(XMJJQS) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJJQS) □ WNF25 (FOAM SEAL) WING UPPER SURFACE
(XMJLQ5) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJLQ5) △ WNF25 (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .418
<table>
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<tr>
<th>DATA SET</th>
<th>SYMBOL</th>
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<td>WNF2 (FOAM SEAL) WING UPPER SURFACE</td>
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<td>XMJU06</td>
<td>□</td>
<td>WNF2S (FOAM SEAL) WING UPPER SURFACE</td>
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<td>XMJL06</td>
<td>△</td>
<td>WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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</table>

**FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS**

MACH = .600 ETA = .481
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .481
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .544
<table>
<thead>
<tr>
<th>DATA SET SYMBOL</th>
<th>CONFIGURATION DESCRIPTION</th>
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<td>(XMJU06) □</td>
<td>WNF2S (FOAM SEAL) WING UPPER SURFACE</td>
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<td>(XMJU05) ○</td>
<td>WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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<td>(XMJL06) △</td>
<td>WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS**

MACH = .600 ETA = .544

**PRESSURE DISTRIBUTIONS**

- **α = 2.000**
- **α = 4.000**
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .597
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH =  .600 ETA =  .597
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .650
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .600 ETA = .650
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU06) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJU05) □ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJU06) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .849
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU06) ○ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJU05) ▲ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJU06) ▲ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .600 ETA = .849
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
### DATA SET SYMBOL CONFIGURATION DESCRIPTION

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<td>XMJU106</td>
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### FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .250
### Data Set, Symbol, Configuration Description

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<tr>
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<td>XMJL06</td>
<td>◇</td>
<td>WNF2S (FOAM SEAL) WING LOWER SURFACE</td>
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**FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS**

MACH = 0.700  ETA = 0.365
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.365
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .418
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .418
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJJ05) O WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJJ05) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJJ05) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJJ05) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .700 ETA = .481
DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMUJ05)  ○  WNF2 (FOAM SEAL)  WING UPPER SURFACE
(XMUJ06)  □  WNF2S (FOAM SEAL)  WING UPPER SURFACE
(XMUL05)  ○  WNF2 (FOAM SEAL)  WING LOWER SURFACE
(XMUL06)  △  WNF2S (FOAM SEAL)  WING LOWER SURFACE

FIG. 14  CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .700  ETA = .481
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.544
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.700 ETA = 0.544
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .597
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<tr>
<td>(XMJU06)</td>
<td>□ WNF25 (FOAM SEAL) WING UPPER SURFACE</td>
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<tr>
<td>(XMJL05)</td>
<td>△ WNF2 (FOAM SEAL) WING LOWER SURFACE</td>
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<tr>
<td>(XMJL06)</td>
<td>△ WNF25 (FOAM SEAL) WING LOWER SURFACE</td>
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FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700 ETA = .597
FIG. 14  CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH =  .700  ETA =  .650
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .700 ETA = .650
FIG. 14  CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .700  ETA = .849

DATA SET  SYMBOL  CONFIGURATION DESCRIPTION
(XMJU05)  ○ WNF2 (FOAM SEAL)  WING UPPER SURFACE
(XMJU06)  □ WNF2S (FOAM SEAL)  WING UPPER SURFACE
(XMJL05)  ○ WNF2 (FOAM SEAL)  WING LOWER SURFACE
(XMJL06)  △ WNF2S (FOAM SEAL)  WING LOWER SURFACE
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU06) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJL05) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJL06) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .700 ETA = .849
**Figure 14: Curved Fillet with Strake - Pressure Distributions**

MACH = 0.800  ETA = 0.250
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJJ05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJJ05) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJJ05) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJJ05) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .800 ETA = .250
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.365
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU06) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJU05) ○ WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJU06) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = .800 ETA = .365
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.418
FIG. 14  CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.800  ETA = 0.418
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .481
Fig. 14 Curved Fillet with Strake - Pressure Distributions

Mach = 0.800  \( \eta = 0.481 \)
**FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS**

MACH = 0.800 ETA = 0.544
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(XMJU05) ○ WNF2 (FOAM SEAL) WING UPPER SURFACE
(XMJU06) □ WNF2S (FOAM SEAL) WING UPPER SURFACE
(XMJUL05) × WNF2 (FOAM SEAL) WING LOWER SURFACE
(XMJUL06) △ WNF2S (FOAM SEAL) WING LOWER SURFACE

FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS
MACH = 0.800 ETA = 0.544
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .597
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .597
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .650
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = .800 ETA = .650
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.849
FIG. 14 CURVED FILLET WITH STRAKE - PRESSURE DISTRIBUTIONS

MACH = 0.800 ETA = 0.849
FIG. 15A CONFIGURATION W DRAG RISE CHARACTERISTICS
FIG. 15B  CONFIGURATION  WN  DRAG RISE CHARACTERISTICS
FIG. 15C CONFIGURATION WNFI DRAG RISE CHARACTERISTICS
FIG. 15D CONFIGURATION WNF2 DRAG RISE CHARACTERISTICS
FIG. 15E CONFIGURATION WNF2S DRAG RISE CHARACTERISTICS
FIG. 16 COMPARISON OF CONFIGURATION DRAG RISE

\[ \text{CL} = 0.50 \]
FIG. 17 NACELLE INSTALLATION DRAG PENALTY

\[ \Delta C_{D_{\text{NAC}}} \]

\[ M \]

\[ CL = 0.50 \]
(a) Wing alone, upper surface.

Figure 18. Oil flow visualization; $M = 0.8$, $\alpha = 1.9^\circ$. 
(d) Wing/nacelle/straight-fillet.

Figure 18.- Continued.
Figure 19.- Comparison of the drag-rise characteristics.
Figure 20.- Calculated transition effect on the drag-rise characteristics.
(a) $M = 0.6$.

Figure 21.- Full-span/semispan lift comparison.
Figure 21.- Concluded.

(b) $M = 0.8$.

*Full span wing/body*
*Semi-span wing*
Figure 22.— Calculated angle-of-attack and transition effects on the drag rise characteristics.
An unpowered semispan model of a representative turboprop configuration has been tested to determine the effect of configuration modifications on the installed nacelle interference drag and to develop a seal between the nonmetric body and wing juncture. The test was conducted in the 11-Foot Transonic Wind Tunnel at NASA Ames Research Center. Angles of attack were from -3° to 5° at Mach numbers 0.6 to 0.82 and Reynolds numbers between 8- and 9.7-million. The supercritical wing was tested transition free and instrumented at 239 pressure locations. The nacelle was instrumented at 104 pressure locations and a 5-component force-moment balance measured the aerodynamic forces on the wing/nacelle. Test results indicated that the jet-off nacelle-installation drag can be approximately 25% of the cruise drag. However, the losses can be reduced to 17% by changes to the wing leading edge and nacelle intersection. Comparison of test results from a semispan nonmetric fuselage model with those from a full-span metric fuselage showed differences in angles of attack produced the same lift. Therefore, the constant-lift drag rise of the semispan model was higher because of the increased angle of attack to achieve the same lift.