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# WING AERODYNAMIC LOADING CAUSED BY JET-INDUCED LIFT ASSOCIATED WITH STOL-OTW CONFIGURATIONS

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# WING AERODYNAMIC LOADING CAUSED BY JET-INDUCED LIFT ASSOCIATED WITH STOL-OTW CONFIGURATIONS

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## ABSTRACT

Surface pressure distributions were obtained with model-scale STOL-OTW configurations using various nozzles designed to promote flow attachment to the wing/flap surface. The nozzle configurations included slot-types and both circular and slot nozzles with external flow deflectors. The wing aerodynamic loading caused by the jet-induced lift is presented in conventional terms of $\Delta p/q$ as a function of chordwise surface distance in the nozzle centerline plane as well as outboard of the nozzle centerline. Included in the geometric variables affecting the wing loading are nozzle roof/deflector angle, chordwise location of the nozzle, wing size, and flap deflection angle.

## INTRODUCTION

In considering the design of future STOL aircraft, one of the more commonly considered concepts is the use of engines mounted over the wing (OTW). Such engine installations (fig. 1) involve the use of slot-type nozzles or nozzles (slot or circular) with external deflectors for promoting the exhaust flow attachment to the upper surface of the wing/flap system. The attachment of the exhaust flow to the wing/flap surfaces causes a reduction in surface pressures resulting in jet-induced lift and also redirects the jet exhaust downward, as a function of the flap angle, yielding an additional lift component. The flow of the engine exhaust over the wing causes an aerodynamic loading of the wing structure that is substantially independent of that due to normal flight.

The present work is concerned with the effect of variations in nozzle/wing configurations on the jet-induced lift (surface pressure distribution downstream of the nozzle exhaust plane). Included in these configuration variations are the effects of nozzle type (fig. 1), nozzle location with respect to the wing leading edge, wing size, flap angle, nozzle roof or deflector angle and deflector size.

Most of the data presented are for the approach mode with the flaps deployed to a 60° flap deflection. In this mode, the jet exhaust flow is very susceptible to detachment from the flap surface; consequently this mode requires careful study. Furthermore, the suction pressures on the flap surface are much less (in a negative sense) due to the increased local curvature of the flap surface with a 60° flap deflection than those for the takeoff mode with a 20° flap deflection. The lower the surface suction pressures are, the greater is the wing loading. Limited data for the takeoff mode will be presented only to indicate certain data trends associated with differences in nozzle geometry and as a brief comparison with similar data for the approach mode.

In addition to their importance in lift and thrust considerations, the pressures on OTW flap surface are also important for structural reasons. This is clearly shown in figure 2, for example, wherein severe surface skin damage has resulted from pressure fluctuations caused by the jet flow over the wing/flap system tested on the QCSEE OTW configuration. Initially, the fluctuating (vibration) loads on the wing caused the 0.18 cm thick wing/flap skin to crack and rivets to fail. The suction produced by the jet-induced lift caused the panel shown in the right-hand inset in figure 2 to be lifted into the jet exhaust flow and twisted downstream by the flow.

The surface pressure distributions were obtained experimentally at model scale. The equivalent nozzle diameter for all nozzles was about 5.1 cm while wing chords (flaps retracted) of 22 cm (2/3-baseline), 33 cm (baseline), and 49.5 cm (3/2-baseline) were used. The data were obtained at nominal cold-flow jet velocities of 195 and 260 m/sec. The surface pressure measurements were made in chordwise planes at the nozzle centerline and 5.1 cm outboard from the centerline. The latter chordwise plane corresponded to the spanwise edge of the slot nozzles. The pressure distributions are presented generally in conventional terms of $\Delta p/q$ as a function of chordwise surface distance. It should be noted that while the present data were obtained at model scale, it has been shown in reference 1 that OTW pressure distribution measurements scale well for the OTW YC-14 aircraft.

## APPARATUS

The OTW surface static pressures were obtained using the aerodyanmic facility described in reference 2.

### Wings

The model wings used in the studies are shown schematically in figure 3, together with pertinent dimensions. Details of their construction are given in reference 2. The wing chords with flaps retracted were 22.0, 33.0, and 49.5 cm. Herein, these wings are referred to as 2/3-baseline, baseline, and 3/2-baseline, respectively. The wing models represent the upper surface contours of an airfoil with 20° (takeoff) and 60° (approach) deflected flaps.

The wing/flap surfaces were instrumented with chordwise static pressure taps in the nozzle centerline plane and in an outboard plane located 5.1 cm from the nozzle centerline plane. The chordwise locations of the static pressure taps are given in the table of appendix A. The pressure data were obtained from multitube manometers.

### Nozzles

Slot. - The basic slot nozzles (ref. 2) used in the program consisted of the 5:1 nozzles shown in figure 4. These nozzles had equivalent diameters of 5.1 cm. A single straight-sided nozzle was used for the tests without nozzle sidewall cutback. The roof angle, $\beta$, for this nozzle was varied by providing inserts that altered the internal angle from 10° to 40° in 10° increments. Separate nozzles were provided for the cases with sidewall cutback. The sidewall cutback angle, $\gamma$ , was the same as the roof angle for each respective nozzle.

Slot/deflector - A 5:1 slot nozzle (fig. 5) was used with various external plate-type deflectors that turned the flow in order to provide flow attachment to the flap (ref. 2). All of the nozzle sides converged at a 5° angle. The nominal dimensions of the nozzle at the exhaust plane were 2.0 cm by 10.2 cm. The dimensions of the deflectors are summarized in the table given in figure 5.

Circular/deflector - The conical nozzle (fig. 6) used in the study had a 5.2 cm exhaust diameter. Each flow deflector was held in place by two frames or "tracks" fastened to the nozzle. The deflector could be pivoted to various angles relative to the nozzle centerline. Dimensions of the deflectors (ref. 2) are given in figure 6. The bottom of the nozzle exhaust plane was located 0.1 chord (flaps retracted) above the wing/flap surface for each wing.

Airflow, through an overhead supply line to all the nozzles, was measured with a calibrated orifice. The nozzle inlet total pressure was measured with a single probe in the flow system plenum.

## DATA NORMALIZATION

In order to provide meaningful comparisons of the aerodynamic data, all configurations are compared on the basis of equal weight flow. This of course, does not imply equal lift and thrust.

In order to achieve equal weight flow, the nozzle area must be increased, which would constitute a larger external wetted surface area resulting in a cruise-drag penalty. The latter consideration is beyond the scope of this study. The measured values of the surface static pressures were normalized by compensating for the weight flow losses caused by the nozzle/deflector configurations and the presence of the wing. This procedure led to the following expression for the normalized surface static pressures: $\Delta p/q = (\Delta p/q)_{meas.} \times (W_i/W)^{0.8}$. The normalization method for the $(\Delta p/q)_{meas.}$ is analogous to the weight flow corrections to the measured lift and thrust values given in reference 2.

## ANALYSIS

The local static pressures on the wing/flap surfaces herein are expressed simply in terms of $\Delta p/q$ as a function of the ratio of the local surface length to the total wing/flap length, s/S, both lengths referenced to the wing leading edge. Measured static pressure coefficients are tabulated in Appendix A. The $\Delta p/q$ values shown are average for the two Mach numbers used in the tests.

For the purpose of illustrating data trends, the pressure distribution shown herein are initially presented holding all variables (wing size, roof/deflector angle, etc.) constant except that variable being evaluated. Finally, the pressure distributions for the several nozzle configurations are compared at approximately equal lift and thrust values. The latter were obtained using a force measuring system and are given in reference 2. Trends and comparisons generally are presented in terms of curves drawn through the data normalized for the weight flow differences and are given in Appendix A.

## RESULTS AND DISCUSSION

In this section, the loading on the flap surfaces caused by the jet-induced lift resulting from the over-the-wing nozzle installation is discussed in terms of configuration geometry variations. These variations include nozzle roof/deflector angles together with deflector size, chordwise locations of the nozzles, wing chord size, and flap deflection angle. An increase in the suction pressure on the wing/flap surface is indicated by an increase in the negative value of the surface pressure coefficient $\Delta p/q$. In some cases, due to local surface curvature effects on the jet flow attachment, positive values of the pressure coefficient are obtained. Such conditions occur near the trailing edge of the flaps and represent a genuine local lift reduction (although they may contribute a small thrust component). Near the nozzle exhaust plane, however, where the jet impinges directly on the wing surface and therefore on the static pressure taps, a positive pressure coefficient may be the result of the tap measuring total rather than static pressure and should not be interpreted as a local lift reduction.

### Effect of Nozzle Roof/Deflector Angle

The effect of the nozzle deflector angle or roof angle on the surface pressure distribution in terms of flow attachment is illustrated by the data shown in figure 7. The data were obtained with the 2/3-baseline wing and a circular/deflector nozzle positioned at 21-percent chord. With a deflector angle of 20°, no jet flow attachment to the wing/flap surface occurred in the nozzle centerline plane; however, some jet flow attachment was obtained in the outboard plane (peak $\Delta p/q$ values less than - 0.02). By increasing the deflector angle, improvements in jet flow attachment were obtained in both measurement planes as indicated by the larger negative surface pressure coefficients. The highest measured lift (ref. 4) was obtained when the suction pressures in the nozzle centerline plane were maximized (deflector angle, 40°). Also, the peak $\Delta p/q$ value in the nozzle centerline plane occurred at increasingly greater s/S locations as the jet flow attachment improved.

Although not shown, use of a longer deflector (7.90 cm) resulted in similar trends with the peak lift coefficient being obtained with a 30° deflector angle. Increasing the deflector angle to 40° for the longer deflector caused a reduction in the augmentation as evidenced by lower $\Delta$ p/q values, i.e. less negative and, in fact, an absolute lift reduction evidenced by some positive $\Delta$ p/q values (of the order of +0.15). These occurred in the nozzle centerline plane at s/S values of 0.35 to 0.45.

An increase in wing size and positioning the nozzle near the wing leading edge both resulted in a wider useful range of nozzle roof/deflector angles over which good jet flow attachment to the wing/flap surfaces was obtained. Examples of this increased useful operational range of roof/deflector angles are shown in terms of surface pressure coefficients in figure 8, together with the lift and thrust ratios. The data shown are for most of the circular/deflector nozzle configurations previously shown in figure 7 and that for the slot/cutback nozzles. Both sets of data in figure 8 are for nozzle positions at 21-percent chord.

## Effect of Nozzle Location

Approach mode. - With good jet exhaust flow attachment to the flap surface, the chordwise position of the nozzle configuration did not significantly affect the level of the static pressure distribution. In figure 9 representative pressure distributions obtained with a circular/deflector nozzle and the baseline wing are shown for nozzle chord positions of 10-, 21-, and 46- percent. Moving the nozzle from 10- to 21- percent chord caused a small decrease (less negative coefficients) in the level of the static pressure distribution for the same deflector configuration (4.14 cm deflector length, 30° deflector angle). The same nozzle/deflector positioned at 46- percent resulted in very small static pressure coefficients, indicating poor flow attachments. Increasing the deflector angle from 30° to 40° resulted in larger negative static pressure coefficients. These latter data indicate that an even greater deflector angle (beyond the range of this study) would be required in order to provide optimum flow attachment to the flap surface.

Typical static pressure distributions obtained with a slot/cutback nozzle are shown in figure 10 for nozzle chord positions of 21- and 46-percent. The data shown are for nozzle roof and sidewall cutback angles of 30°. In general, the static pressure distributions at the two nozzle chord positions are similar in magnitude. The increased erratic nature of the distribution profile at the 46-percent nozzle chord location is attributed to the manner in which the exhaust jet attaches to the local surface curvature. This type of static pressure distribution was characteristic for most of the slot-type nozzle configurations used, including those with an external deflector.

Results similar to those shown in figure 10 were also obtained with the slot/deflector nozzles, although the static pressure levels obtained with these nozzles tended to be somewhat less than those with the slot/cutback nozzles.

Limited static pressure distribution data obtained with the 2/3 - and 3/2-baseline wings indicated overall trends similar to those discussed for the preceding data obtained with the baseline wing.

Takeoff mode. - In general, the static pressure distribution trends with nozzle chordwise position discussed for the approach mode, also apply for the takeoff mode. Representative pressure distributions illustrating this are shown in figures 11 and 12 for the circular/deflector and slot/cutback nozzles, respectively. Data trends obtained with the slot/deflector nozzles were similar to those obtained with the slot/cutback nozzles. Poor flow attachment was again obtained with the circular/deflector nozzle with a 25° deflector when positioned at 46-percent chord; however, reasonable flow attachment was achieved with a 40° deflector angle (fig. 11) and the pressure distribution for this deflector angle approached that obtained with the 25° deflector angle at the 21-percent nozzle chord position. In both the approach and takeoff modes significant positive pressure coefficients were obtained near the nozzle exhaust plane with the slot/cutback nozzles positioned at 46-percent chord.

## Effect of Wing Size

The effect of wing chord size on the static pressures due to the jet flow over the flap surface was evaluated only in the approach mode and with the circular/deflector and slot/cutback nozzles. In the approach mode, the static pressure coefficients are more negative (higher suction pressure on the flap surface) than those for the takeoff mode; consequently, the approach mode is of greater importance for considerations of wing loading.

With a given nozzle configuration, fixed nozzle chord position, and good jet flow attachment to the flap surface, the static pressure coefficients became more negative (higher suction pressures) as the wing size was decreased. Typical results with the nozzle positioned at 21-percent chord are shown in figures 13 and 14 for representative circular/deflector and slot/cutback nozzles, respectively. Static pressure distributions are shown for both the nozzle centerline and outboard planes. Note that for these and similar figures the $\Delta p/q$ scale is applied normal to the local surface curvature. Positive static pressure coefficients were measured near the beginning of the flap surface curvature for some nozzle/wing combinations with increasing wing size.

The following table illustrates the peak suction pressure coefficients in the nozzle centerline plane for the two nozzle configurations shown in figures 13 and 14 for three wing sizes tested.

| Nozzle | Wing Size | | |
|---|---|---|---|
| | 2/3-baseline | baseline | 3/2-baseline |
| | | $\Delta p/q$ | |
| Circular/deflector | 0.19 | 0.10 | 0.04 |
| Slot/cutback | 0.21 | 0.14 | 0.08 |

The slot/cutback nozzle produced a higher wing loading than that produced by the circular/deflector nozzle. Both nozzle configurations produced similar lift/thrust coefficients as indicated on the figures.

In general, the peak negative (suction) static pressure coefficients were measured near s/S values of 0.70 to 0.75 corresponding generally to an angle from the flap surface of about 40° relative to the wing leading edge region. There was some tendency for the peak suction pressure to occur nearer to s/S = 0.65 with the 2/3-baseline wing (35°); however, this could be due, in part, to the relatively large spacing of the static pressure taps for this wing and the consequent inability to define the static pressure distribution shape as precisely as those for the larger wings.

The surface pressure distributions obtained with a slot/cutback nozzle (roof angle, 30°, nozzle at 21% chord) are shown in figure 15 as a function of the actual wing/flap surface dimensions, rather than s/S, for the three wing sizes used herein. The data shown are for the approach mode and at the nozzle centerline plane. The greater surface extent in true surface distance increases with increasing wing size while, as shown previously in figure 14, the $\Delta p/q$ values are decreased. However, integration of the pressures over the affected wing flap surfaces yield approximately the same thrust and lift ratios, as indicated in figure 14.

Similar trends to those shown in figures 13 to 15 were obtained when the nozzles were positioned at the 10- and 46-percent chordwise locations (figs. 16 and 17), providing good flow attachment was achieved.

## Comparison of Nozzle Configurations

In this section the static pressure distributions for a given wing/flap surface obtained with the several nozzle configurations will be compared. The comparisons will be made at closely equal lift and thrust values, where possible, as determined from force measurements (refs. 2 and 3).

Approach mode. - Representative variations of surface static pressure distributions for the circular/deflector, slot/cutback, and slot/deflector nozzles are shown in figures 18 and 19 with the nozzles positioned at 21- and 46-percent chord of the baseline wing, respectively. At both chord locations, the slot/cutback nozzle attained the highest suction pressure coefficients (greatest negative pressure coefficients) in the centerline plane, closely followed by those obtained with the slot/deflector nozzle. The low suction pressure coefficients shown with the circular/deflector nozzle for the 46-percent chord location (fig. 19) indicates relatively poor flow attachment to the flap surface. In the outboard plane (fig. 19), the circular/deflector nozzle attained somewhat higher suction pressure coefficients than either of the other nozzle configurations. In fact, the suction pressures for the circular/deflector nozzle in the outboard plane exceeded those in the nozzle centerline plane.

Additional static pressure distributions circular/deflector and slot/cutback nozzles are shown in figures 20 and 21 for the 2/3-baseline and 3/2-baseline wings. In general, the overall trends shown are similar to those just discussed.

Takeoff mode. - Comparisons of representative static pressure distributions for the various nozzle configurations positioned at 21- and 46-percent chord are shown in figures 22 and 23, respectively. In general, the trends noted for the approach mode also apply for the takeoff mode. Substantial positive coefficients are seen to occur near the nozzle exhaust plane when the nozzles are positioned at 46-percent chord (fig. 23). Of particular interest in the takeoff mode is that the wing loading in the nozzle centerline plane is significantly reduced with the circular/deflector nozzle, compared with that for the other two nozzles. The reduction with the circular/deflector nozzle is of the order of 2/3 of the wing loading obtained with the slot/cutback nozzle. Again the wing loading with the circular/deflector nozzle is approximately the same in both planes shown, whereas the loading with the slot-type nozzles is 2 to 3 times higher in the nozzle centerline plane compared to that in the outboard plane.

## COMPARISON OF PRESENT DATA WHICH YC-14 DATA

The static pressure distribution obtained with a model-scale slot/ cutback nozzle are compared with that for the full-scale static engine ground tests of the YC-14 nozzle for the approach mode in figure 24. The slot/cutback nozzle curves were taken from figures 18 and 19, covering the 21- and 46-percent chord positions of the nozzle. The YC-14 data curve was taken from reference 1. The similarity between the three static pressure distributions in the sharply curved flap region is apparent. The large suction pressures shown near the beginning of the flap for the model-scale data are attributed to local surface curvature effects, as previously mentioned. It should be emphasized that the curves in figure 24 are shown only to illustrate the shapes of the curves rather than be interpreted in terms of absolute magnitude because the data of reference 1 did not provide the necessary flow parameters.

For the approach mode, both the present nozzle/wing configurations and the YC-14 configuration indicate a deficiency in suction pressure near the flap trailing edge. In reference 1 it was shown that the deployment of vortex generators on the wing surface downstream of the nozzle exhaust plane for the approach mode increased the suction pressure on the downstream portion of the flap surface.

However, the suction pressure was decreased (less $\Delta p$) on the upstream portion of the flap. The peak absolute magnitude of the suction pressure (wing loading) was only slightly decreased by the presence of the vortex generators. By using vortex generators, the jet vectored thrust component in the vertical direction is increased; however, the horizontal thrust component is decreased. Furthermore, the horizontal component of the jet-induced lift results in an additional reduction in the horizontal thrust component when vortex generators are used because of the increase in the suction pressures on the flap trailing edge region.

## CONCLUDING REMARKS

The present study indicates that the nozzle roof/deflector angle should be adjustable in order to achieve optimum lift/thrust characteristics for the approach and takeoff modes of future OTW-STOL aircraft.

On the basis of equal lift/thrust considerations, the slot-type nozzles cause generally higher suction pressures over the flap surfaces than do either the circular/ or slot/deflector-type nozzles. The circular/ deflector nozzles caused the lowest wing loading; however, with these nozzles the overall lift/thrust force measurements were equal to or exceeded those with the higher wing-loading slot-type nozzles. This was apparently due to two factors: (1) the jet exhaust flow impingement on the underside of the deflector caused additional lift to be generated that contributed significantly to the overall lift/thrust force measurements; and (2) the spanwise loading with the slot-type nozzles decreased rapidly from the nozzle centerline plane to the outboard plane (at the nozzle sidewall) whereas the spanwise loading with the circular/deflector nozzles was nearly uniform indicating a possibly greater effective spanwise distribution of the jet exhaust flow by the circular/deflector nozzle. In order to maintain the high suction pressures noted in the nozzle centerline plane over the spanwise width of a nozzle, particularly for slot-type nozzles, wing fences, such as used in studying the Coanda effect in reference 4, could be employed.

The present study was limited to static conditions; however, the expected inflight effects on the surface pressure distribution can be summarized as follows:

1. In the presence of the flight velocity field around the jet exhaust flow, the jet exhaust plume is elongated in the downstream direction (ref. 5) resulting in slightly greater suction pressures (more negative $\Delta p/q$ values) near the trailing edge region of the flap.

2. The effect of forward velocity tends to promote adverse pressure gradients and vortex flow along the outer edges of the jet exhaust plume that in turn can cause the jet flow to separate from the aft portions of the flap. This in turn, results in the reduction/disappearance of the large suction pressure peak on the flap surface. Again, wing fences (ref. 4) could be used to delay or prevent jet exhaust flow separation from the aft portions of the flap.

## NOMENCLATURE

| | |
|---|---|
| A, B, C, X, Y, y | local component dimensions |
| $L$ | measured lift |
| $L_f$ | projected surface distance from nozzle exit plane to wing leading edge (see fig. 3) |
| $L_p$ | projected surface distance (see fig. 3) |
| $L_s$ | surface distance measured from nozzle exit plane to flap trailing edge (see fig. 3) |
| $\ell$ | deflector lip chord |
| $\ell_T$ | distance from nozzle exit to deflector trailing edge (see fig. 5) |
| $M_j$ | jet exhaust Mach number |
| $\Delta p$ | surface static pressure difference referenced to atmosphere |
| $q$ | jet dynamic pressure at exhaust plane |
| $T$ | measured thrust |
| $T_i$ | ideal thrust |
| $W$ | measured weight flow |
| $W_i$ | ideal weight flow |
| $\beta$ | roof/deflector angle |
| $\gamma$ | nozzle sidewall cutback angle |

Subscript:

| | |
|---|---|
| meas. | measured |

# APPENDIX A.- DATA SUMMARY

The static pressures measured on the wing/flap surfaces are tabulated in the following tables. The data are presented in terms of $\Delta p/q$ at the various s/S measuring locations. Nominal values of q at the nominal jet Mach numbers of 0.6 and 0.8 were 2.81 and 5.35 m of waters respectively. The table also include a tabulation of $W_i/W$, $T(W_iW)/T$, and $L(W_i/W)/T_i$.

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TABLE A-1.-TAKEOFF MODE; BASELINE WING; NOZZLE AT 10% CHORD

| N ZZLE | β, deg | ℓ, cm | MEASURE-MENT PLANE | $M_j$ | s/S | | | | | | | | | | | | | | $W_i/W$ | $T(W_i/W)/T_i$ | $L(W_i/W)/T_i$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.181 | 0.241 | 0.301 | 0.378 | 0.422 | 0.482 | 0.542 | [illegible] | 0.663 | 0.723 | 0.784 | 0.844 | 0.904 | 0.957 | | | |
| Circular/ Deflector | 25° | 4.14 | Center-line | 0.6 | -.002 | -.002 | -.002 | -.003 | -.004 | -.007 | -.015 | -.024 | -.031 | -.036 | -.038 | -.045 | -.032 | -.010 | 1.02 | 0.80 | 0.42 |
| | | | | 0.8 | -.002 | -.003 | -.003 | [illegible] | -.004 | -.008 | -.014 | -.023 | -.031 | -.036 | -.038 | -.045 | -.033 | -.011 | 1.01 | 0.80 | 0.43 |
| | | | Out-board | 0.6 | -.003 | -.008 | -.012 | +.001 | -.022 | -.020 | -.025 | -.015 | -.009 | -.011 | -.016 | -.023 | -.021 | -.006 | -- | -- | -- |
| | | | | 0.8 | -.004 | -.010 | -.013 | 0 | -.021 | -.026 | -.024 | -.017 | -.012 | -.012 | -.017 | -.024 | -.022 | -.008 | -- | -- | -- |
| | 30° | 4.14 | Center-line | 0.6 | -.005 | -.005 | -.004 | -.005 | -.005 | +.002 | +.012 | -.003 | -.025 | -.041 | -.042 | -.055 | -.040 | -.014 | 1.02 | 0.74 | 0.45 |
| | | | | 0.8 | -.004 | -.003 | -.003 | -.004 | -.004 | +.005 | +.011 | -.003 | -.024 | -.037 | -.037 | -.050 | -.036 | -.012 | 1.01 | 0.75 | 0.43 |
| | | | Out-board | 0.6 | -.008 | -.011 | -.010 | 0 | -.007 | -.008 | -.007 | +.006 | -.005 | -.015 | -.021 | -.028 | -.024 | -.009 | -- | -- | -- |
| | | | | 0.8 | -.007 | -.010 | -.010 | 0 | -.006 | -.007 | 0 | +.004 | -.005 | -.014 | -.019 | -.026 | -.022 | -.009 | -- | -- | -- |
| | 20° | 7.90 | Center-line | 0.6 | -.003 | -.004 | -.005 | -.005 | -.005 | -.008 | -.012 | -.020 | -.030 | -.038 | -.041 | -.047 | -.034 | -.012 | 1.02 | 0.81 | 0.43 |
| | | | | 0.8 | -.002 | -.003 | -.003 | -.004 | -.005 | -.007 | -.011 | -.019 | -.028 | -.036 | -.038 | -.044 | -.032 | -.011 | 1.01 | 0.83 | 0.44 |
| | | | Out-board | 0.6 | -.003 | -.005 | -.008 | 0 | -.018 | -.021 | -.023 | -.022 | -.015 | -.013 | -.015 | -.022 | -.023 | -.008 | -- | -- | -- |
| | | | | 0.8 | -.002 | -.004 | -.007 | 0 | -.017 | -.020 | -.022 | -.022 | -.013 | -.013 | -.015 | -.021 | -.020 | -.008 | -- | -- | -- |
| | 25° | 7.90 | Center-line | 0.6 | -.003 | -.003 | -.003 | -.003 | -.002 | +.014 | +.033 | +.007 | -.022 | -.038 | -.038 | -.051 | -.037 | -.012 | 1.02 | 0.76 | 0.43 |
| | | | | 0.8 | -.002 | -.002 | -.002 | -.002 | -.002 | +.012 | +.029 | +.010 | -.020 | -.036 | -.036 | -.049 | -.035 | -.011 | 1.01 | 0.76 | 0.42 |
| | | | Out-board | 0.6 | -.005 | -.008 | -.011 | +.001 | -.005 | -.002 | +.007 | +.012 | -.004 | -.015 | -.021 | -.027 | -.024 | -.008 | -- | -- | -- |
| | | | | 0.8 | -.004 | -.007 | -.010 | 0 | -.006 | -.002 | +.003 | +.008 | -.003 | -.014 | -.019 | -.026 | -.023 | -.008 | -- | -- | -- |

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TABLE A-2.-TAKEOFF MODE; BASELINE WING; NOZZLE AT 21% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASUREMENT PLANE | $M_j$ | x/S 0.181 | 0.241 | 0.301 | 0.378 | 0.422 | 0.482 | 0.542 | 0.603 | 0.663 | 0.723 | 0.784 | 0.844 | 0.904 | 0.957 | $\frac{W_i}{W}$ | $\frac{I(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $\Delta p/q$ | | | | | | | | | | | | | | | | |
| Circular/ | 25° | 4.14 | Center- | 0.6 | -.002 | -.003 | -.004 | -.005 | -.005 | -.007 | -.011 | -.018 | -.026 | -.032 | -.033 | -.032 | -.023 | -.009 | 1.02 | 0.80 | 0.42 |
| Deflector | | | line | 0.8 | -.002 | -.003 | -.004 | -.005 | -.005 | -.007 | -.010 | -.017 | -.025 | -.031 | -.034 | -.034 | -.024 | -.010 | 1.01 | 0.80 | 0.43 |
| | | | Out- | 0.6 | -.002 | -.003 | -.006 | 0 | -.013 | -.027 | -.035 | -.034 | -.030 | -.020 | -.016 | -.020 | -.019 | -.007 | -- | -- | -- |
| | | | board | 0.8 | -.002 | -.003 | -.006 | 0 | -.017 | -.025 | -.033 | -.034 | -.032 | -.023 | -.019 | -.020 | -.019 | -.008 | -- | -- | -- |
| | 30° | 4.14 | Center- | 0.6 | -.003 | -.004 | -.004 | -.005 | -.005 | -.008 | -.013 | -.021 | -.028 | -.033 | -.036 | -.046 | -.035 | -.013 | 1.02 | 0.74 | 0.45 |
| | | | line | 0.8 | -.002 | -.003 | -.004 | -.004 | -.005 | -.007 | -.011 | -.018 | -.025 | -.031 | -.034 | -.045 | -.034 | -.012 | 1.01 | 0.75 | 0.43 |
| | | | Out- | 0.6 | -.003 | -.005 | -.011 | 0 | -.015 | -.017 | -.024 | -.028 | -.016 | -.008 | -.013 | -.021 | -.021 | -.008 | -- | -- | -- |
| | | | board | 0.8 | -.002 | -.005 | -.010 | 0 | -.014 | -.015 | -.021 | -.025 | -.017 | -.010 | -.013 | -.020 | -.019 | -.007 | -- | -- | -- |
| | 20° | 7.90 | Center- | 0.6 | -.002 | -.003 | -.004 | -.005 | -.007 | -.010 | -.013 | -.018 | -.023 | -.029 | -.032 | -.033 | -.024 | -.010 | 1.02 | 0.81 | 0.43 |
| | | | line | 0.8 | -.001 | -.002 | -.003 | -.005 | -.006 | -.009 | -.012 | -.017 | -.022 | -.028 | -.031 | -.032 | -.023 | -.010 | 1.01 | 0.83 | 0.44 |
| | | | Out- | 0.6 | -.001 | -.002 | -.004 | 0 | -.013 | -.023 | -.032 | -.038 | -.040 | -.029 | -.018 | -.016 | -.016 | -.005 | -- | -- | -- |
| | | | board | 0.8 | -.001 | -.001 | -.003 | 0 | -.012 | -.022 | -.029 | -.036 | -.038 | -.029 | -.019 | -.017 | -.015 | -.005 | -- | -- | -- |
| | 25° | 7.90 | Center- | 0.6 | -.002 | -.003 | -.004 | -.005 | -.005 | -.006 | -.008 | -.012 | -.017 | -.027 | -.035 | -.051 | -.040 | -.014 | 1.02 | 0.76 | 0.43 |
| | | | line | 0.8 | -.002 | -.003 | -.003 | -.004 | -.005 | -.006 | -.008 | -.010 | -.018 | -.026 | -.033 | -.048 | -.037 | -.012 | 1.01 | 0.76 | 0.42 |
| | | | Out- | 0.6 | -.002 | -.004 | -.005 | 0 | -.015 | -.015 | -.014 | -.014 | -.011 | -.006 | -.012 | -.022 | -.022 | -.008 | -- | -- | -- |
| | | | board | 0.8 | -.001 | -.003 | -.005 | 0 | -.015 | -.016 | -.014 | -.014 | -.011 | -.007 | -.010 | -.019 | -.019 | -.007 | -- | -- | -- |
| Slot/ | 20° | 0.64 | Center- | 0.6 | -- | -- | -- | -.029 | -.015 | -.046 | -.051 | -.053 | -.058 | -.077 | -.061 | -.073 | -.051 | -.023 | 1.01 | 0.76 | 0.43 |
| Deflector | | | line | 0.8 | -- | -- | -- | -.031 | -.015 | -.047 | -.052 | -.053 | -.057 | -.076 | -.059 | -.075 | -.051 | -.025 | 1.0 | 0.81 | 0.44 |
| | | | Out- | 0.6 | -- | -- | -- | +.051 | +.001 | -.008 | -.024 | -.024 | -.032 | -.030 | -.031 | -.038 | -.031 | -.007 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | +.052 | 0 | -.008 | -.025 | -.024 | -.033 | -.029 | -.032 | -.039 | -.032 | -.008 | -- | -- | -- |
| | 30° | 1.28 | Center- | 0.6 | -- | -- | -- | +.012 | -.004 | -.029 | -.028 | -.029 | -.029 | -.032 | -.025 | -.034 | -.023 | -.007 | 1.10 | 0.67 | 0.40 |
| | | | line | 0.8 | -- | -- | -- | +.012 | -.006 | -.031 | -.029 | -.029 | -.030 | -.032 | -.024 | -.035 | -.023 | -.008 | 1.03 | 0.68 | 0.42 |
| | | | Out- | 0.6 | -- | -- | -- | -.001 | +.007 | -.008 | -.005 | -.015 | -.017 | -.018 | -.017 | -.022 | -.018 | -.005 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.006 | -.009 | -.015 | -.016 | -.017 | -.018 | -.017 | -.021 | -.019 | -.005 | -- | -- | -- |
| | 40° | 0.64 | Center- | 0.6 | -- | -- | -- | +.009 | -.007 | -.036 | -.036 | -.037 | -.039 | -.042 | -.035 | -.048 | -.032 | -.011 | 1.10 | 0.72 | 0.40 |
| | | | line | 0.8 | -- | -- | -- | +.010 | -.009 | -.038 | -.037 | -.037 | -.039 | -.042 | -.034 | -.048 | -.032 | -.010 | 1.03 | 0.72 | 0.40 |
| | | | Out- | 0.6 | -- | -- | -- | 0 | +.006 | -.011 | -.018 | -.020 | -.022 | -.022 | -.021 | -.026 | -.023 | -.007 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.006 | -.011 | -.013 | -.019 | -.021 | -.021 | -.020 | -.026 | -.022 | -.007 | -- | -- | -- |
| Slot | 20 | -- | Center- | 0.6 | -- | -- | -- | +.002 | -.019 | -.060 | -.065 | -.069 | -.073 | -.076 | -.064 | -.077 | -.032 | +.003 | 1.09 | 0.85 | 0.39 |
| | | | line | 0.8 | -- | -- | -- | +.003 | -.018 | -.059 | -.062 | -.065 | -.070 | -.072 | -.059 | -.071 | -.026 | +.006 | 1.04 | 0.83 | 0.39 |
| | | | Out- | 0.6 | -- | -- | -- | 0 | +.003 | -.014 | -.020 | -.020 | -.023 | -.021 | -.020 | -.021 | -.015 | -.005 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.003 | -.013 | -.018 | -.018 | -.021 | -.018 | -.017 | -.018 | -.014 | -.004 | -- | -- | -- |
| | 30 | -- | Center- | 0.6 | -- | -- | -- | +.004 | -.017 | -.056 | -.060 | -.063 | -.069 | -.072 | -.063 | -.079 | -.041 | -.005 | 1.14 | 0.81 | 0.41 |
| | | | line | 0.8 | -- | -- | -- | +.004 | -.016 | -.057 | -.059 | -.062 | -.067 | -.069 | -.059 | -.075 | -.035 | 0 | [illegible] | 0.81 | 0.41 |
| | | | Out- | 0.6 | -- | -- | -- | 0 | +.002 | -.014 | -.020 | -.021 | -.025 | -.023 | -.022 | -.023 | -.018 | -.006 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.002 | -.013 | -.019 | -.019 | -.022 | -.020 | -.019 | -.020 | -.016 | -.005 | -- | -- | -- |
| | 40 | -- | Center- | 0.6 | -- | -- | -- | +.005 | -.014 | -.051 | -.054 | -.057 | -.062 | -.068 | -.060 | -.078 | -.048 | -.011 | 1.16 | 0.85 | 0.42 |
| | | | line | 0.8 | -- | -- | -- | +.005 | -.015 | -.053 | -.054 | -.057 | -.062 | -.066 | -.058 | -.077 | -.046 | -.008 | 1.12 | 0.81 | 0.42 |
| | | | Out- | 0.6 | -- | -- | -- | 0 | +.002 | -.016 | -.023 | -.024 | -.029 | -.027 | -.027 | -.031 | -.024 | -.009 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.002 | -.015 | -.022 | -.023 | -.028 | -.025 | -.025 | -.028 | -.023 | -.008 | -- | -- | -- |
| Slot/ | 20 | -- | Center- | 0.6 | -- | -- | -- | +.003 | -.017 | -.055 | -.058 | -.061 | -.066 | -.071 | -.064 | -.084 | -.052 | -.011 | 1.11 | 0.84 | 0.42 |
| Cutback | | | line | 0.8 | -- | -- | -- | +.003 | -.016 | -.055 | -.057 | -.059 | -.064 | -.069 | -.061 | -.082 | -.050 | -.009 | 1.06 | 0.82 | 0.41 |
| | | | Out- | 0.6 | -- | -- | -- | +.001 | +.001 | -.018 | -.025 | -.026 | -.032 | -.030 | -.030 | -.033 | -.027 | -.010 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.001 | -.017 | -.024 | -.025 | -.030 | -.028 | -.028 | -.031 | -.025 | -.009 | -- | -- | -- |
| | 30 | -- | Center- | 0.6 | -- | -- | -- | +.006 | -.012 | -.046 | -.048 | -.051 | -.055 | -.060 | -.053 | -.070 | -.047 | -.014 | 1.22 | 0.80 | 0.43 |
| | | | line | 0.8 | -- | -- | -- | +.007 | -.012 | -.047 | -.048 | -.050 | -.055 | -.059 | -.051 | -.071 | -.046 | -.011 | 1.15 | 0.79 | 0.43 |
| | | | Out- | 0.6 | -- | -- | -- | 0 | +.003 | -.014 | -.019 | -.021 | -.024 | -.023 | -.023 | -.029 | -.023 | -.009 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.003 | -.012 | -.018 | -.019 | -.023 | -.022 | -.022 | -.026 | -.021 | -.007 | -- | -- | -- |
| | 40 | -- | Center- | 0.6 | -- | -- | -- | +.006 | -.010 | -.040 | -.042 | -.044 | -.048 | -.052 | -.045 | -.061 | -.042 | -.013 | 1.27 | 0.76 | 0.42 |
| | | | line | 0.8 | -- | -- | -- | +.007 | -.010 | -.042 | -.043 | -.044 | -.048 | -.052 | -.045 | -.062 | -.040 | -.011 | 1.28 | 0.78 | 0.42 |
| | | | Out- | 0.6 | -- | -- | -- | 0 | +.002 | -.013 | -.017 | -.019 | -.022 | -.022 | -.022 | -.026 | -.022 | -.008 | -- | -- | -- |
| | | | board | 0.8 | -- | -- | -- | 0 | +.002 | -.011 | -.017 | -.018 | -.020 | -.020 | -.020 | -.024 | -.020 | -.007 | -- | -- | -- |

TABLE A-3.-TAKEOFF MODE; BASELINE WING; NOZZLE AT 46% CHORD

| NOZZLE | $\beta$, deg | $\ell$, cm | MEASUREMENT PLANE | $M_j$ | s/S | | | | | | | | | | | | | | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.181 | 0.241 | 0.301 | 0.378 | 0.422 | 0.482 | 0.542 | 0.603 | 0.663 | 0.723 | 0.784 | 0.844 | 0.904 | 0.957 | | | |
| | | | | | $\Delta p/q$ | | | | | | | | | | | | | | | | |
| Circular/ Deflector | 30° | 4.14 | Center-line | 0.6 | -- | -- | -- | -.008 | -.006 | -.007 | -.009 | 0.011 | -.014 | -.017 | -.022 | -.022 | -.015 | -.008 | 1.02 | NA | NA |
| | | | | 0.8 | -- | -- | -- | -.009 | -.007 | -.007 | -.009 | -.010 | -.013 | -.017 | -.020 | -.020 | -.014 | -.008 | 1.01 | NA | NA |
| | | | Out-board | 0.6 | -- | -- | -- | -.005 | -.005 | -.010 | -.017 | -.025 | -.032 | -.043 | -.054 | -.057 | -.044 | -.023 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -.005 | -.006 | -.010 | -.018 | -.024 | -.031 | -.039 | -.050 | -.054 | -.043 | -.023 | -- | -- | -- |
| | 40° | 4.14 | Center-line | 0.6 | -- | -- | -- | -.011 | -.007 | -.005 | -.006 | -.010 | -.016 | -.025 | -.030 | -.033 | -.027 | -.013 | 1.02 | NA | NA |
| | | | | 0.8 | -- | -- | -- | -.010 | -.006 | -.005 | -.006 | -.009 | -.014 | -.023 | -.028 | -.032 | -.026 | -.012 | 1.01 | NA | NA |
| | | | Out-board | 0.6 | -- | -- | -- | -.009 | -.010 | -.011 | -.012 | -.013 | -.016 | -.025 | -.028 | -.019 | -.015 | -.005 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -.009 | -.010 | -.011 | -.012 | -.011 | -.015 | -.024 | -.029 | -.020 | -.015 | -.004 | -- | -- | -- |
| Slot/ Deflector | 20° | 0.64 | Center-line | 0.6 | -- | -- | -- | -.026 | +.221 | -.023 | -.061 | -.066 | -.069 | -.090 | -.069 | -.090 | -.062 | -.027 | 1.01 | 0.76 | 0.42 |
| | | | | 0.8 | -- | -- | -- | -.037 | -- | -.026 | -.062 | -.065 | -.069 | -.091 | -.068 | -.088 | -.062 | -.027 | 1.0 | 0.81 | 0.45 |
| | | | Out-board | 0.6 | -- | -- | -- | -.004 | +.004 | +.006 | -.020 | -.022 | -.032 | -.035 | -.040 | -.046 | -.035 | -.014 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -.005 | 0 | +.008 | -.017 | -.021 | -.034 | -.036 | -.042 | -.049 | -.039 | -.015 | -- | -- | -- |
| | 30° | 1.28 | Center-line | 0.6 | -- | -- | -- | +.267 | +.494 | +.034 | -.031 | -.041 | -.041 | -.043 | -.033 | -.049 | -.032 | -.009 | 1.10 | 0.67 | 0.47 |
| | | | | 0.8 | -- | -- | -- | +.228 | +.535 | +.030 | -.041 | -.041 | -.041 | -.044 | -.048 | -.031 | -.009 | +.001 | 1.03 | 0.68 | 0.45 |
| | | | Out-board | 0.6 | -- | -- | -- | +.001 | +.140 | +.042 | -.012 | -.017 | -.017 | -.022 | -.019 | -.025 | -.023 | -.005 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.138 | +.043 | -.014 | -.019 | -.018 | -.020 | -.019 | -.025 | -.023 | -.003 | -- | -- | -- |
| | 40° | 0.64 | Center-line | 0.6 | -- | -- | -- | +.202 | +.381 | -.006 | -.048 | -.049 | -.050 | -.052 | -.042 | -.061 | -.042 | -.013 | 1.10 | 0.72 | 0.47 |
| | | | | 0.8 | -- | -- | -- | +.162 | +.430 | -.016 | -.049 | -.049 | -.050 | -.053 | -.042 | -.061 | -.041 | -.012 | 1.03 | 0.72 | 0.44 |
| | | | Out-board | 0.6 | -- | -- | -- | +.001 | +.089 | +.028 | -.014 | -.020 | -.023 | -.025 | -.024 | -.032 | -.028 | -.006 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | 0 | +.089 | +.026 | -.015 | -.020 | -.022 | -.024 | -.023 | -.030 | -.027 | -.006 | -- | -- | -- |
| Slot | 20° | -- | Center-line | 0.6 | -- | -- | -- | +.233 | +.043 | -.063 | -.069 | -.074 | -.079 | -.085 | -.075 | -.097 | -.048 | +.004 | 1.09 | 0.85 | 0.39 |
| | | | | 0.8 | -- | -- | -- | +.184 | +.034 | -.067 | -.069 | -.072 | -.078 | -.083 | -.071 | -.094 | -.043 | +.007 | 1.04 | 0.83 | 0.39 |
| | | | Out-board | 0.6 | -- | -- | -- | +.002 | +.032 | -.003 | -.019 | -.021 | -.028 | -.024 | -.023 | -.023 | -.017 | -.003 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.025 | -.007 | -.021 | -.021 | -.027 | -.023 | -.022 | -.022 | -.017 | -.003 | -- | -- | -- |
| | 30° | -- | Center-line | 0.6 | -- | -- | -- | +.354 | +.049 | -.056 | -.064 | -.064 | -.073 | -.079 | -.070 | -.093 | -.053 | -.005 | 1.14 | 0.81 | 0.41 |
| | | | | 0.8 | -- | -- | -- | +.316 | +.037 | -.063 | -.067 | -.069 | -.074 | -.079 | -.069 | -.093 | -.050 | 0 | 1.09 | 0.81 | 0.41 |
| | | | Out-board | 0.6 | -- | -- | -- | +.002 | +.051 | -.002 | -.018 | -.021 | -.028 | -.025 | -.024 | -.026 | -.021 | -.005 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.043 | -.004 | -.019 | -.021 | -.028 | -.024 | -.024 | -.025 | -.019 | -.004 | -- | -- | -- |
| | 40° | -- | Center-line | 0.6 | -- | -- | -- | +.442 | +.051 | -.054 | -.060 | -.063 | -.068 | -.073 | -.065 | -.089 | -.060 | -.014 | 1.16 | 0.85 | 0.42 |
| | | | | 0.8 | -- | -- | -- | +.420 | +.038 | -.058 | -.061 | -.063 | -.067 | -.072 | -.063 | -.089 | -.058 | -.012 | 1.12 | 0.81 | 0.42 |
| | | | Out-board | 0.6 | -- | -- | -- | +.001 | +.058 | -.004 | -.021 | -.024 | -.032 | -.032 | -.032 | -.037 | -.030 | -.009 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.048 | -.006 | -.022 | -.023 | -.031 | -.029 | -.029 | -.034 | -.028 | -.007 | -- | -- | -- |
| Slot/ Cutback | 20° | -- | Center-line | 0.6 | -- | -- | -- | +.258 | +.070 | -.060 | -.066 | -.068 | -.073 | -.079 | -.069 | -.097 | -.065 | -.014 | 1.11 | 0.84 | 0.42 |
| | | | | 0.8 | -- | -- | -- | +.203 | +.058 | -.065 | -.066 | -.067 | -.072 | -.076 | -.067 | -.095 | -.063 | -.012 | 1.06 | 0.82 | 0.41 |
| | | | Out-board | 0.6 | -- | -- | -- | +.002 | +.057 | +.003 | -.024 | -.027 | -.035 | -.034 | -.034 | -.038 | -.031 | -.009 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.053 | +.004 | -.025 | -.027 | -.035 | -.032 | -.032 | -.034 | -.029 | -.009 | -- | -- | -- |
| | 30° | -- | Center-line | 0.6 | -- | -- | -- | +.417 | +.110 | -.050 | -.057 | -.059 | -.062 | -.068 | -.059 | -.083 | -.059 | -.017 | 1.22 | 0.80 | 0.43 |
| | | | | 0.8 | -- | -- | -- | +.400 | +.102 | -.056 | -.058 | -.059 | -.063 | -.067 | -.057 | -.084 | -.058 | -.015 | 1.15 | 0.79 | 0.43 |
| | | | Out-board | 0.6 | -- | -- | -- | +.001 | +.103 | +.003 | -.017 | -.022 | -.030 | -.030 | -.030 | -.036 | -.031 | -.009 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.098 | 0 | -.019 | -.022 | -.029 | -.028 | -.029 | -.036 | -.030 | -.009 | -- | -- | -- |
| | 40° | -- | Center-line | 0.6 | -- | -- | -- | +.684 | +.123 | -.043 | -.047 | -.049 | -.051 | -.057 | -.049 | -.071 | -.046 | -.014 | 1.37 | 0.76 | 0.42 |
| | | | | 0.8 | -- | -- | -- | +.730 | +.117 | -.050 | -.049 | -.050 | -.054 | -.058 | -.049 | -.072 | -.050 | -.015 | 1.28 | 0.78 | 0.42 |
| | | | Out-board | 0.6 | -- | -- | -- | +.001 | +.133 | +.008 | -.009 | -.015 | -.022 | -.022 | -.022 | -.028 | -.023 | -.006 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | +.001 | +.131 | +.006 | -.011 | -.016 | -.022 | -.021 | -.021 | -.027 | -.023 | -.006 | -- | -- | -- |

TABLE A-4.-APPROACH MODE; 2/3-BASELINE WING; NOZZLE AT 10% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASUREMENT PLANE | $M_j$ | s/S 0.192 | 0.274 | 0.359 | 0.444 | 0.526 | 0.610 | 0.693 | 0.777 | 0.861 | 0.945 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | |
| Circular/ Deflector | 20° | 4.14 | Center-line | 0.6 | -.001 | -.002 | -.003 | -.004 | -.004 | -.003 | +.001 | +.002 | -.001 | 0 | 1.02 | 0.89 | 0.23 |
| | | | | 0.8 | -.002 | -.002 | -.004 | -.005 | -.004 | -.003 | 0 | +.001 | 0 | -.001 | 1.01 | 0.89 | 0.22 |
| | | | Out-board | 0.6 | -.001 | -.003 | -.012 | -.021 | -.027 | -.028 | -.019 | -.005 | 0 | +.001 | -- | -- | -- |
| | | | | 0.8 | -.002 | -.003 | -.011 | -.021 | -.026 | -.026 | -.017 | -.005 | -.001 | 0 | -- | -- | -- |
| | 25° | 4.14 | Center-line | 0.6 | -.004 | -.005 | -.009 | -.021 | -.038 | -.062 | -.060 | -.033 | -.033 | -.009 | 1.02 | 0.70 | 0.49 |
| | | | | 0.8 | -.004 | -.005 | -.010 | -.021 | -.038 | -.063 | -.059 | -.035 | -.033 | -.011 | 1.01 | 0.66 | 0.52 |
| | | | Out-board | 0.6 | -.005 | -.010 | -.026 | -.041 | -.085 | -.111 | -.117 | -.086 | -.043 | -.011 | -- | -- | -- |
| | | | | 0.8 | -.005 | -.011 | -.026 | -.047 | -.080 | -.110 | -.120 | -.089 | -.047 | -.014 | -- | -- | -- |
| | 30° | 4.14 | Center-line | 0.6 | -.005 | -.006 | -.011 | -.026 | -.055 | -.118 | -.144 | -.091 | -.053 | -.032 | 1.02 | 0.50 | 0.65 |
| | | | | 0.8 | -.004 | -.005 | -.014 | -.021 | -.048 | -.112 | -.136 | -.082 | -.049 | -.031 | 1.01 | 0.50 | 0.66 |
| | | | Out-board | 0.6 | -.011 | -.014 | -.022 | -.029 | -.055 | -.107 | -.143 | -.118 | -.081 | -.026 | -- | -- | -- |
| | | | | 0.8 | -.010 | -.012 | -.020 | -.027 | -.048 | -.101 | -.138 | -.115 | -.079 | -.026 | -- | -- | -- |
| | 20° | 7.90 | Center-line | 0.6 | -.003 | -.005 | -.013 | -.027 | -.048 | -.079 | -.082 | -.055 | -.041 | -.007 | 1.02 | 0.65 | 0.56 |
| | | | | 0.8 | -.003 | -.006 | -.012 | -.025 | -.044 | -.072 | -.073 | -.048 | -.038 | -.004 | 1.01 | 0.65 | 0.57 |
| | | | Out-board | 0.6 | -.003 | -.005 | -.018 | -.048 | -.085 | -.125 | -.141 | -.101 | -.064 | -.016 | -- | -- | -- |
| | | | | 0.8 | -.003 | -.006 | -.017 | -.043 | -.077 | -.115 | -.137 | -.100 | -.060 | -.016 | -- | -- | -- |
| | 25° | 7.90 | Center-line | 0.6 | -.005 | -.005 | -.010 | -.022 | -.048 | -.111 | -.144 | -.093 | -.055 | -.033 | 1.02 | 0.50 | 0.71 |
| | | | | 0.8 | -.004 | -.006 | -.010 | -.020 | -.043 | -.103 | -.127 | -.074 | -.051 | -.035 | 1.01 | 0.48 | 0.70 |
| | | | Out-board | 0.6 | -.005 | -.010 | -.024 | -.032 | -.047 | -.088 | -.138 | -.119 | -.083 | -.028 | -- | -- | -- |
| | | | | 0.8 | -.005 | -.010 | -.024 | -.033 | -.045 | -.082 | -.133 | -.116 | -.080 | -.029 | -- | -- | -- |
| | 30° | 7.90 | Center-line | 0.6 | -.002 | -.002 | -.003 | +.029 | +.025 | -.095 | -.176 | -.151 | -.117 | -.040 | 1.02 | 0.37 | 0.69 |
| | | | | 0.8 | -.002 | -.002 | -.002 | +.026 | +.023 | -.092 | -.169 | -.143 | -.112 | -.038 | 1.01 | 0.37 | 0.71 |
| | | | Out-board | 0.6 | -.006 | -.007 | -.007 | -.004 | -.006 | -.039 | -.099 | -.100 | -.079 | -.025 | -- | -- | -- |
| | | | | 0.8 | -.007 | -.007 | -.007 | -.004 | -.008 | -.040 | -.095 | -.097 | -.077 | -.024 | -- | -- | -- |

TABLE A-5.-APPROACH MODE; 2/3-BASELINE WING; NOZZLE AT 21% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASUREMENT PLANE | $M_j$ | s/S 0.192 | 0.274 | 0.359 | 0.444 | 0.526 | 0.610 | 0.693 | 0.777 | 0.861 | 0.945 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | |
| Circular/ Deflector | 20° | 4.14 | Centerline | 0.6 | -.002 | -.002 | -.004 | -.004 | -.003 | -.001 | +.002 | +.002 | 0 | -.001 | 1.02 | 0.91 | 0.16 |
| | | | | 0.8 | -.001 | -.002 | -.003 | -.004 | -.002 | -.001 | +.002 | +.002 | 0 | -.001 | 1.01 | 0.90 | 0.17 |
| | | | Outboard | 0.6 | -.001 | -.002 | -.005 | -.012 | -.017 | -.014 | -.010 | -.003 | -.001 | -.001 | -- | -- | -- |
| | | | | 0.8 | -.001 | -.002 | -.005 | -.011 | -.016 | -.014 | -.009 | -.002 | -.001 | -.001 | -- | -- | -- |
| | 25° | 4.14 | Centerline | 0.6 | -.004 | -.005 | -.008 | -.013 | -.017 | -.020 | -.015 | -.012 | -.006 | -.005 | 1.02 | 0.79 | 0.34 |
| | | | | 0.8 | -.003 | -.005 | -.008 | -.012 | -.017 | -.020 | -.015 | -.011 | -.006 | -.003 | 1.01 | 0.79 | 0.33 |
| | | | Outboard | 0.6 | -.003 | -.005 | -.016 | -.033 | -.054 | -.073 | -.066 | -.034 | -.013 | -.003 | -- | -- | -- |
| | | | | 0.8 | -.003 | -.005 | -.016 | -.034 | -.055 | -.072 | -.067 | -.038 | -.014 | -.003 | -- | -- | -- |
| | 30° | 4.14 | Centerline | 0.6 | -.005 | -.006 | -.012 | -.023 | -.042 | -.076 | -.089 | -.069 | -.060 | -.024 | 1.02 | 0.53 | 0.56 |
| | | | | 0.8 | -.004 | -.006 | -.010 | -.020 | -.041 | -.075 | -.088 | -.068 | -.049 | -.030 | 1.01 | 0.53 | 0.63 |
| | | | Outboard | 0.6 | -.004 | -.010 | -.025 | -.042 | -.071 | -.139 | -.143 | -.112 | -.073 | -.022 | -- | -- | -- |
| | | | | 0.8 | -.004 | -.010 | -.025 | -.041 | -.066 | -.130 | -.157 | -.119 | -.077 | -.024 | -- | -- | -- |
| | 40° | 4.14 | Centerline | 0.6 | -.004 | -.005 | -.006 | -.013 | -.023 | -.102 | -.186 | -.163 | -.105 | -.030 | 1.02 | 0.36 | 0.70 |
| | | | | 0.8 | -.005 | -.005 | -.007 | -.009 | -.014 | -.096 | -.180 | -.157 | -.104 | -.031 | 1.01 | 0.37 | 0.68 |
| | | | Outboard | 0.6 | -.008 | -.008 | -.011 | -.013 | -.025 | -.056 | -.093 | -.097 | -.075 | -.023 | -- | -- | -- |
| | | | | 0.8 | -.009 | -.009 | -.010 | -.012 | -.022 | -.052 | -.092 | -.096 | -.075 | -.024 | -- | -- | -- |
| | 20° | 7.90 | Centerline | 0.6 | -.002 | -.004 | -.009 | -.018 | -.027 | -.037 | -.032 | -.017 | -.020 | -.001 | 1.02 | 0.78 | 0.43 |
| | | | | 0.8 | -.002 | -.003 | -.008 | -.015 | -.023 | -.030 | -.025 | -.014 | -.016 | -.003 | 1.01 | 0.78 | 0.40 |
| | | | Outboard | 0.6 | -.002 | -.003 | -.009 | -.022 | -.049 | -.085 | -.101 | -.071 | -.033 | -.009 | -- | -- | -- |
| | | | | 0.8 | -.001 | -.003 | -.008 | -.019 | -.041 | -.073 | -.085 | -.059 | -.026 | -.007 | -- | -- | -- |
| | 25° | 7.90 | Centerline | 0.6 | -.004 | -.006 | -.013 | -.025 | -.046 | -.085 | -.102 | -.079 | -.055 | -.042 | 1.02 | 0.52 | 0.69 |
| | | | | 0.8 | -.003 | -.006 | -.012 | -.023 | -.043 | -.081 | -.095 | -.073 | -.052 | -.039 | 1.01 | 0.52 | 0.68 |
| | | | Outboard | 0.6 | -.003 | -.005 | -.017 | -.043 | -.074 | -.115 | -.173 | -.154 | -.095 | -.029 | -- | -- | -- |
| | | | | 0.8 | -.002 | -.005 | -.015 | -.043 | -.069 | -.105 | -.160 | -.147 | -.091 | -.029 | -- | -- | -- |
| | 30° | 7.90 | Centerline | 0.6 | -.004 | -.005 | -.008 | -.015 | -.034 | -.097 | -.161 | -.129 | -.069 | -.029 | 1.02 | 0.43 | 0.72 |
| | | | | 0.8 | -.003 | -.005 | -.007 | -.014 | -.032 | -.090 | -.146 | -.109 | -.055 | -.027 | 1.01 | 0.42 | 0.71 |
| | | | Outboard | 0.6 | -.004 | -.008 | -.018 | -.024 | -.032 | -.059 | -.114 | -.114 | -.081 | -.027 | -- | -- | -- |
| | | | | 0.8 | -.003 | -.007 | -.017 | -.023 | -.030 | -.056 | -.106 | -.112 | -.076 | -.026 | -- | -- | -- |
| Slot/ Cutback | 30 | -- | Centerline | 0.6 | -- | -- | -.036 | -.069 | -.102 | -.154 | -.211 | -.173 | -.082 | +.007 | 1.22 | 0.48 | 0.72 |
| | | | | 0.8 | -- | -- | -.038 | -.068 | -.098 | -.153 | -.206 | -.171 | -.064 | +.011 | 1.15 | 0.46 | 0.68 |
| | | | Outboard | 0.6 | -- | -- | -.009 | -.040 | -.049 | -.074 | -.089 | -.075 | -.051 | -.010 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -.015 | -.041 | -.048 | -.071 | -.083 | -.067 | -.046 | -.009 | -- | -- | -- |

TABLE A-6.-APPROACH MODE; 2/3-BASELINE WING; NOZZLE AT 46% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASUREMENT PLANE | $M_j$ | s/S 0.359 | 0.444 | 0.526 | 0.610 | 0.693 | 0.777 | 0.861 | 0.945 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | |
| Slot/ Cutback | 30 | -- | Centerline | 0.6 | -- | -.025 | -.125 | -.168 | -.231 | -.213 | -.140 | -.005 | 1.22 | 0.48 | 0.72 |
| | | | | 0.8 | -- | -.035 | -.121 | -.161 | -.218 | -.208 | -.126 | +.002 | 1.15 | 0.46 | 0.68 |
| | | | Outboard | 0.6 | -- | +.006 | -.053 | -.089 | -.111 | -.094 | -.069 | -.012 | -- | -- | -- |
| | | | | 0.8 | -- | +.001 | -.054 | -.086 | -.103 | -.085 | -.060 | -.008 | -- | -- | -- |

TABLE A-7.-APPROACH MODE; BASELINE WING; NOZZLE AT 10% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASUREMENT PLANE | $M_j$ | s/S 0.351 | 0.407 | 0.464 | 0.520 | 0.576 | 0.632 | 0.688 | 0.744 | 0.800 | 0.856 | 0.912 | 0.968 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | | | |
| Circular/ Deflector | 25° | 4.14 | Centerline | 0.6 | -.004 | -.008 | -.019 | -.034 | -.066 | -.077 | -.083 | -.076 | -.047 | -.022 | -.003 | +.004 | 1.02 | 0.64 | 0.60 |
| | | | | 0.8 | -.004 | -.007 | -.018 | -.032 | -.065 | -.075 | -.083 | -.078 | -.050 | -.026 | -.006 | +.002 | 1.01 | 0.62 | 0.64 |
| | | | Outboard | 0.6 | -.017 | -.020 | -.035 | -.053 | -.066 | -.069 | -.076 | -.073 | -.058 | -.033 | -.013 | -.004 | -- | -- | -- |
| | | | | 0.8 | -.017 | -.018 | -.031 | -.048 | -.062 | -.076 | -.076 | -.074 | -.059 | -.035 | -.013 | -.005 | -- | -- | -- |
| | 30° | 4.14 | Centerline | 0.6 | -.005 | -.006 | -.009 | -.014 | -.077 | -.085 | -.103 | -.116 | -.081 | -.050 | -.011 | -.002 | 1.02 | 0.51 | 0.68 |
| | | | | 0.8 | -.004 | -.003 | -.005 | -.008 | -.073 | -.079 | -.095 | -.110 | -.079 | -.052 | -.012 | -.003 | 1.01 | 0.49 | 0.71 |
| | | | Outboard | 0.6 | -.011 | -.008 | -.015 | -.018 | -.031 | -.050 | -.066 | -.071 | -.064 | -.044 | -.017 | -.006 | -- | -- | -- |
| | | | | 0.8 | -.008 | -.007 | -.011 | -.016 | -.030 | -.049 | -.066 | -.070 | -.064 | -.044 | -.017 | -.007 | -- | -- | -- |
| | 40° | 4.14 | Centerline | 0.6 | +.051 | +.118 | +.031 | +.008 | -.079 | -.057 | -.067 | -.083 | -.060 | -.046 | -.012 | -.005 | 1.02 | 0.40 | 0.62 |
| | | | | 0.8 | +.057 | +.121 | +.027 | +.011 | -.071 | -.048 | -.057 | -.074 | -.052 | -.041 | -.013 | -.004 | 1.01 | 0.38 | 0.62 |
| | | | Outboard | 0.6 | -.006 | +.041 | +.044 | -.005 | -.040 | -.045 | -.051 | -.053 | -.052 | -.039 | -.014 | -.008 | -- | -- | -- |
| | | | | 0.8 | -.004 | +.040 | +.043 | -.004 | -.036 | -.040 | -.046 | -.048 | -.048 | -.035 | -.012 | -.007 | -- | -- | -- |
| | 20° | 7.90 | Centerline | 0.6 | -.005 | -.008 | -.016 | -.030 | 0.065 | -.079 | -.087 | -.078 | -.050 | -.025 | -.006 | +.002 | 1.02 | 0.61 | 0.65 |
| | | | | 0.8 | -.005 | -.009 | -.016 | -.028 | -.061 | -.074 | -.082 | -.075 | -.049 | -.027 | -.008 | +.001 | 1.01 | 0.61 | 0.67 |
| | | | Outboard | 0.6 | -.014 | -.018 | -.025 | -.042 | -.063 | -.074 | -.080 | -.078 | -.065 | -.040 | -.014 | -.003 | -- | -- | -- |
| | | | | 0.8 | -.016 | -.018 | -.025 | -.040 | -.061 | -.073 | -.080 | -.077 | -.065 | -.041 | -.014 | -.004 | -- | -- | -- |
| | 25° | 7.90 | Centerline | 0.6 | -.003 | +.002 | +.017 | +.017 | -.073 | -.079 | -.099 | -.119 | -.088 | -.065 | -.016 | -.005 | 1.02 | 0.46 | 0.63 |
| | | | | 0.8 | -.002 | +.003 | +.014 | +.015 | -.068 | -.073 | -.090 | -.110 | -.082 | -.061 | -.015 | -.005 | 1.01 | 0.46 | 0.72 |
| | | | Outboard | 0.6 | -.007 | -.004 | -.004 | -.003 | -.025 | -.050 | -.068 | -.073 | -.069 | -.050 | -.017 | -.008 | -- | -- | -- |
| | | | | 0.8 | -.008 | -.004 | -.003 | -.004 | -.024 | -.046 | -.063 | -.068 | -.065 | -.047 | -.041 | -.009 | -- | -- | -- |
| | 30° | 7.90 | Centerline | 0.6 | +.015 | +.125 | +.079 | +.024 | -.078 | -.058 | -.069 | -.086 | -.061 | -.047 | -.012 | -.005 | 1.02 | 0.40 | 0.66 |
| | | | | 0.8 | +.015 | +.108 | +.075 | +.026 | -.072 | -.051 | -.062 | -.080 | -.057 | -.045 | -.011 | -.004 | 1.01 | 0.39 | 0.67 |
| | | | Outboard | 0.6 | 0 | +.012 | +.063 | +.008 | -.035 | -.042 | -.049 | -.051 | -.051 | -.037 | -.012 | -.006 | -- | -- | -- |
| | | | | 0.8 | 0 | +.007 | +.056 | +.009 | -.033 | -.040 | -.047 | -.049 | -.049 | -.037 | -.012 | -.007 | -- | -- | -- |

TABLE A-8.-APPROACH MODE; BASELINE WING; NOZZLE AT 21% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASURE-MENT PLANE | $M_j$ | s/S 0.351 | 0.407 | 0.464 | 0.520 | 0.576 | 0.632 | 0.688 | 0.744 | 0.800 | 0.856 | 0.912 | 0.968 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | | | |
| Circular/ Deflector | 30° | 4.14 | Center-line | 0.6 | -.006 | -.009 | -.016 | -.029 | -.058 | -.074 | -.086 | -.083 | -.059 | -.035 | -.014 | -.002 | 1.02 | 0.51 | 0.68 |
| | | | | 0.8 | -.006 | -.008 | -.015 | -.026 | -.055 | -.070 | -.082 | -.082 | -.059 | -.037 | -.015 | -.003 | 1.01 | 0.49 | 0.71 |
| | | | Out-board | 0.6 | -.015 | -.015 | -.023 | -.041 | -.069 | -.083 | -.085 | -.081 | -.070 | -.047 | -.017 | -.006 | -- | -- | -- |
| | | | | 0.8 | -.014 | -.014 | -.020 | -.035 | -.061 | -.077 | -.083 | -.079 | -.069 | -.047 | -.018 | -.007 | -- | -- | -- |
| | 40° | 4.14 | Center-line | 0.6 | -.003 | -.004 | +.011 | +.042 | -.052 | -.062 | -.080 | -.102 | -.075 | -.058 | -.014 | -.004 | 1.02 | 0.40 | 0.68 |
| | | | | 0.8 | -.003 | -.004 | +.023 | +.044 | -.049 | -.055 | -.071 | -.092 | -.067 | -.053 | -.013 | -.004 | 1.01 | 0.38 | 0.67 |
| | | | Out-board | 0.6 | -.005 | -.004 | -.005 | +.012 | -.011 | -.042 | -.060 | -.065 | -.064 | -.047 | -.015 | -.008 | -- | -- | -- |
| | | | | 0.8 | -.005 | -.004 | +.004 | +.011 | -.011 | -.040 | -.056 | -.061 | -.060 | -.045 | -.015 | -.010 | -- | -- | -- |
| | 25° | 7.90 | Center-line | 0.6 | -.006 | -.009 | -.014 | -.025 | -.055 | -.076 | -.095 | -.097 | -.070 | -.043 | -.015 | -.004 | 1.02 | 0.46 | 0.63 |
| | | | | 0.8 | -.005 | -.008 | -.013 | -.022 | -.050 | -.069 | -.086 | -.089 | -.065 | -.041 | -.016 | -.004 | 1.01 | 0.46 | 0.72 |
| | | | Out-board | 0.6 | -.013 | -.016 | -.022 | -.031 | -.044 | -.069 | -.079 | -.079 | -.071 | -.051 | -.019 | -.008 | -- | -- | -- |
| | | | | 0.8 | -.010 | -.014 | -.020 | -.028 | -.044 | -.064 | -.076 | -.075 | -.067 | -.048 | -.019 | -.008 | -- | -- | -- |
| Slot/ Cutback | 20 | -- | Center-line | 0.6 | -.041 | -.016 | -.071 | -.051 | -.151 | -.115 | -.129 | -.127 | -.053 | -.011 | +.005 | +.002 | 1.11 | 0.60 | 0.63 |
| | | | | 0.8 | -.038 | -.014 | -.069 | -.047 | -.146 | -.108 | -.123 | -.117 | -.041 | -.007 | +.006 | +.002 | 1.06 | 0.60 | 0.62 |
| | | | Out-board | 0.6 | +.007 | -.007 | +.002 | -.030 | -.054 | -.051 | -.060 | -.056 | -.044 | -.025 | -.006 | -.001 | -- | -- | -- |
| | | | | 0.8 | +.006 | -.007 | +.005 | -.027 | -.050 | -.046 | -.056 | -.049 | -.038 | -.021 | -.006 | -.001 | -- | -- | -- |
| | 30 | -- | Center-line | 0.6 | -.037 | -.011 | -.063 | -.039 | -.067 | -.094 | -.108 | -.121 | -.068 | -.028 | +.004 | +.003 | 1.22 | 0.51 | 0.65 |
| | | | | 0.8 | -.035 | -.009 | -.062 | -.037 | -.129 | -.090 | -.105 | -.117 | -.061 | -.021 | +.005 | +.003 | 1.15 | 0.50 | 0.65 |
| | | | Out-board | 0.6 | +.010 | -.006 | +.003 | -.025 | -.047 | -.046 | -.055 | -.055 | -.048 | -.030 | -.009 | -.003 | -- | -- | -- |
| | | | | 0.8 | +.007 | -.005 | +.005 | -.024 | -.045 | -.042 | -.051 | -.051 | -.044 | -.028 | -.009 | -.003 | -- | -- | -- |
| | 40 | -- | Center-line | 0.6 | -.028 | -.002 | -.054 | -.023 | -.115 | -.077 | -.091 | -.107 | -.067 | -.035 | 0 | +.002 | 1.37 | 0.50 | 0.64 |
| | | | | 0.8 | -.026 | -.001 | -.054 | -.022 | -.115 | -.075 | -.090 | -.108 | -.064 | -.030 | +.004 | +.003 | 1.28 | 0.48 | 0.66 |
| | | | Out-board | 0.6 | +.008 | -.005 | +.004 | -.022 | -.042 | -.041 | -.050 | -.051 | -.046 | -.030 | -.009 | -.004 | -- | -- | -- |
| | | | | 0.8 | +.008 | -.004 | +.005 | -.021 | -.040 | -.038 | -.048 | -.048 | -.043 | -.028 | -.009 | -.003 | -- | -- | -- |
| Slot/ Deflector | 25° | 0.64 | Center-line | 0.6 | -.047 | -.010 | -.058 | -.017 | -.116 | -.079 | -.101 | -.118 | -.082 | -.055 | -.006 | +.001 | 1.03 | 0.46 | 0.67 |
| | | | | 0.8 | -.048 | -.007 | -.056 | -.012 | -.114 | -.071 | -.095 | -.114 | -.079 | -.054 | -.004 | +.004 | 1.00 | 0.44 | 0.70 |
| | | | Out-board | 0.6 | -.005 | +.011 | +.009 | -.052 | -.069 | -.074 | -.055 | -.073 | -.065 | -.040 | -.010 | -.007 | -- | -- | -- |
| | | | | 0.8 | -.009 | +.010 | +.010 | -.054 | -.071 | -.076 | -.055 | -.076 | -.067 | -.041 | -.010 | -.007 | -- | -- | -- |
| | 40° | 0.64 | Center-line | 0.6 | -.034 | 0 | -.046 | -.021 | -.092 | -.053 | -.062 | -.083 | -.060 | -.048 | -.011 | -.005 | 1.10 | 0.43 | 0.66 |
| | | | | 0.8 | -.031 | +.001 | -.045 | -.019 | -.091 | -.050 | -.059 | -.082 | -.059 | -.049 | -.010 | -.004 | 1.03 | 0.39 | 0.65 |
| | | | Out-board | 0.6 | +.012 | -.002 | +.006 | -.019 | -.040 | -.038 | -.046 | -.050 | -.050 | -.037 | -.011 | -.008 | -- | -- | -- |
| | | | | 0.8 | +.010 | -.002 | +.009 | -.017 | -.038 | -.036 | -.044 | -.048 | -.049 | -.037 | -.011 | -.008 | -- | -- | -- |
| | 30° | 1.28 | Center-line | 0.6 | -.029 | +.006 | -.039 | -.012 | -.075 | -.038 | -.044 | -.061 | -.043 | -.036 | -.009 | -.004 | 1.10 | 0.40 | 0.65 |
| | | | | 0.8 | -.026 | +.007 | -.039 | -.011 | -.076 | -.037 | -.043 | -.063 | -.038 | -.038 | -.008 | -.003 | 1.03 | 0.38 | 0.66 |
| | | | Out-board | 0.6 | +.012 | -.001 | +.007 | -.014 | -.032 | -.032 | -.037 | -.040 | -.041 | -.031 | -.009 | -.007 | -- | -- | -- |
| | | | | 0.8 | +.010 | -.001 | +.010 | -.014 | -.034 | -.031 | -.037 | -.040 | -.041 | -.031 | -.009 | -.008 | -- | -- | -- |
| | 40° | 1.28 | Center-line | 0.6 | -.025 | +.008 | -.036 | -.009 | -.065 | -.032 | -.039 | -.052 | -.037 | -.031 | -.007 | -.003 | 1.18 | 0.40 | 0.56 |
| | | | | 0.8 | -.023 | +.009 | -.036 | -.008 | -.066 | -.030 | -.037 | -.053 | -.037 | -.031 | -.007 | -.003 | 1.09 | 0.37 | 0.59 |
| | | | Out-board | 0.6 | +.004 | 0 | +.008 | -.011 | -.026 | -.026 | -.031 | -.033 | -.034 | -.025 | -.007 | -.005 | -- | -- | -- |
| | | | | 0.8 | +.011 | 0 | +.009 | -.011 | -.026 | -.025 | -.030 | -.033 | -.034 | -.025 | -.007 | -.006 | -- | -- | -- |

TABLE A-9.-APPROACH MODE; BASELINE WING; NOZZLE AT 46% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASURE-MENT PLANE | $M_j$ | s/S 0.351 | 0.407 | 0.464 | 0.520 | 0.576 | 0.632 | 0.688 | 0.744 | 0.800 | 0.856 | 0.912 | 0.968 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | | | |
| Circular/ Deflector | 30° | 4.14 | Center-line | 0.6 | -.009 | -.008 | -.010 | -.013 | -.015 | -.014 | -.011 | -.008 | -.005 | 0 | +.001 | 0 | 1.02 | NA | NA |
| | | | | 0.8 | -.009 | -.007 | -.009 | -.011 | -.014 | -.013 | -.010 | -.008 | -.005 | 0 | 0 | -.001 | 1.01 | NA | NA |
| | | | Out-board | 0.6 | -.004 | 0 | -.012 | -.023 | -.039 | -.050 | -.048 | -.041 | -.024 | -.008 | -.002 | -.001 | -- | -- | -- |
| | | | | 0.8 | -.004 | 0 | -.011 | -.022 | -.039 | -.048 | -.046 | -.040 | -.023 | -.008 | -.001 | -.001 | -- | -- | -- |
| | 40° | 4.14 | Center-line | 0.6 | -.011 | -.008 | -.011 | -.015 | -.027 | -.037 | -.050 | -.051 | -.042 | -.032 | -.020 | -.003 | 1.02 | NA | NA |
| | | | | 0.8 | -.011 | -.008 | -.011 | -.016 | -.027 | -.037 | -.048 | -.052 | -.042 | -.035 | -.022 | -.005 | 1.01 | NA | NA |
| | | | Out-board | 0.6 | -.005 | -.009 | -.017 | -.026 | -.037 | -.054 | -.087 | -.111 | -.083 | -.050 | -.019 | -.009 | -- | -- | -- |
| | | | | 0.8 | -.006 | -.010 | -.019 | -.029 | -.039 | -.058 | -.094 | -.112 | -.082 | -.050 | -.020 | -.010 | -- | -- | -- |
| Slot/ Cutback | 30° | -- | Center-line | 0.6 | -- | +.050 | -.082 | -.013 | -.142 | -.095 | -.125 | -.146 | -.099 | -.049 | +.016 | +.013 | 1.22 | 0.51 | 0.65 |
| | | | | 0.8 | -- | +.042 | -.084 | -.009 | -.140 | -.089 | -.120 | -.141 | -.093 | -.037 | +.020 | +.014 | 1.15 | 0.50 | 0.69 |
| | | | Out-board | 0.6 | -- | -.049 | -.008 | -.076 | -.096 | -.079 | -.061 | -.085 | -.069 | -.039 | -.010 | -.005 | -- | -- | -- |
| | | | | 0.8 | -- | -.010 | -.004 | -.076 | -.094 | -.075 | -.055 | -.078 | -.061 | -.034 | -.008 | -.004 | -- | -- | -- |
| Slot/ Deflector | 40° | 0.64 | Center-line | 0.6 | >+.115 | >+.272 | -.046 | -.005 | -.128 | -.075 | -.099 | -.125 | -.090 | -.073 | -.005 | +.005 | 1.10 | 0.38 | 0.73 |
| | | | | 0.8 | +.115 | +.272 | -.057 | -.002 | -.129 | -.070 | -.096 | -.124 | -.089 | -.073 | -.003 | +.007 | 1.03 | 0.37 | 0.75 |
| | | | Out-board | 0.6 | -.003 | +.058 | +.039 | -.045 | -.007 | -.083 | -.053 | -.083 | -.076 | -.047 | -.006 | -.009 | -- | -- | -- |
| | | | | 0.8 | -.003 | +.053 | +.038 | -.049 | -.080 | -.085 | -.052 | -.086 | -.078 | -.048 | -.008 | -.010 | -- | -- | -- |

TABLE A-10.-APPROACH MODE; 3/2-BASELINE WING; NOZZLE AT 10% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASURE-MENT PLANE | $M_j$ | s/S 0.375 | 0.413 | 0.449 | 0.486 | 0.524 | 0.562 | 0.600 | 0.636 | 0.674 | 0.711 | 0.750 | 0.787 | 0.824 | 0.862 | 0.900 | 0.937 | 0.975 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | | | | | | | | |
| Circular/ Deflector | 25° | 4.14 | Center-line | 0.6 | -.002 | -.005 | -.006 | -.008 | -.018 | -.030 | -.042 | -.050 | -.050 | -.062 | -.061 | -.045 | -.035 | -.017 | -.003 | +.003 | +.001 | 1.02 | 0.63 | 0.63 |
| | | | | 0.8 | -.001 | -.003 | -.004 | -.007 | -.016 | -.028 | -.039 | -.047 | -.047 | -.060 | -.060 | -.047 | -.038 | -.021 | -.005 | +.001 | 0 | 1.01 | 0.58 | 0.63 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.020 | -.031 | -.033 | -.035 | -.048 | -.051 | -.041 | -.030 | -.021 | -.006 | -.004 | -.002 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.019 | -.029 | -.032 | -.034 | -.047 | -.051 | -.042 | -.032 | -.024 | -.009 | -.004 | -.002 | -- | -- | -- |
| | 30° | 4.14 | Center-line | 0.6 | +.005 | +.034 | +.032 | +.001 | -.020 | -.032 | -.041 | -.046 | -.043 | -.059 | -.061 | -.051 | -.049 | -.033 | -.015 | -.004 | -.004 | 1.02 | 0.47 | 0.69 |
| | | | | 0.8 | +.007 | +.037 | +.033 | +.001 | -.018 | -.029 | -.037 | -.042 | -.038 | -.053 | -.056 | -.045 | -.045 | -.033 | -.016 | -.005 | -.005 | 1.01 | 0.44 | 0.71 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.020 | -.033 | -.032 | -.031 | -.048 | -.056 | -.047 | -.040 | -.033 | -.013 | -.005 | -.004 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.019 | -.031 | -.029 | -.028 | -.043 | -.051 | -.043 | -.036 | -.031 | -.012 | -.005 | -.004 | -- | -- | -- |
| | 40° | 4.14 | Center-line | 0.6 | +.111 | +.049 | -.005 | -.022 | -.020 | -.023 | -.027 | -.021 | -.027 | -.038 | -.040 | -.032 | -.032 | -.023 | -.011 | -.004 | -.003 | 1.02 | 0.34 | 0.61 |
| | | | | 0.8 | +.111 | +.047 | -.005 | -.020 | -.018 | -.020 | -.024 | -.028 | -.023 | -.034 | -.036 | -.029 | -.029 | -.021 | -.011 | -.003 | -.003 | 1.01 | 0.33 | 0.61 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.014 | -.024 | -.021 | -.018 | -.032 | -.039 | -.032 | -.027 | -.024 | -.009 | -.004 | -.003 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.012 | -.022 | -.019 | -.016 | -.028 | -.034 | -.028 | -.023 | -.022 | -.008 | -.003 | -.003 | -- | -- | -- |
| | 20° | 7.90 | Center-line | 0.6 | -.002 | 0 | -.001 | -.005 | -.016 | -.030 | -.042 | -.051 | -.051 | -.064 | -.063 | -.047 | -.037 | -.019 | -.004 | +.001 | 0 | 1.02 | 0.55 | 0.68 |
| | | | | 0.8 | -.002 | -.001 | -.002 | -.006 | -.016 | -.029 | -.042 | -.051 | -.050 | -.064 | -.065 | -.048 | -.039 | -.021 | -.005 | +.001 | 0 | 1.01 | 0.59 | 0.69 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.016 | -.028 | -.031 | -.032 | -.046 | -.050 | -.042 | -.032 | -.024 | -.009 | -.004 | -.002 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.016 | [illegible] | -.031 | -.032 | -.046 | -.050 | -.042 | -.032 | -.024 | -.009 | -.004 | -.002 | -- | -- | -- |
| | 25° | 7.90 | Center-line | 0.6 | +.025 | +.076 | +.048 | -.004 | -.022 | -.031 | -.039 | -.043 | -.039 | -.054 | -.057 | -.045 | -.045 | -.033 | -.015 | -.005 | -.005 | 1.02 | 0.41 | 0.70 |
| | | | | 0.8 | +.020 | +.070 | +.048 | -.001 | -.019 | -.028 | -.035 | -.040 | -.036 | -.050 | -.054 | -.042 | -.043 | -.031 | -.015 | -.003 | -.005 | 1.01 | 0.42 | 0.71 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.002 | -.031 | -.037 | -.024 | -.041 | -.049 | -.041 | [illegible] | -.032 | -.012 | -.005 | -.005 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.002 | -.031 | -.027 | -.024 | -.041 | -.049 | -.041 | [illegible] | -.032 | -.012 | -.005 | -.005 | -- | -- | -- |
| | 30° | 7.90 | Center-line | 0.6 | +.155 | +.069 | -.001 | -.021 | -.020 | -.023 | -.028 | -.031 | -.027 | -.039 | -.041 | -.032 | -.032 | -.023 | -.012 | -.004 | -.004 | 1.02 | 0.38 | 0.62 |
| | | | | 0.8 | +.154 | +.070 | 0 | -.019 | -.019 | -.022 | -.027 | -.030 | -.026 | -.038 | -.040 | -.032 | -.032 | -.023 | -.016 | -.003 | -.003 | [illegible] | 0.39 | 0.63 |
| | | | Out-board | [illegible] | -- | -- | -- | -- | -- | -.013 | -.023 | -.019 | -.016 | -.030 | -.036 | -.030 | -.025 | -.023 | -.008 | -.004 | -.00 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.012 | -.022 | -.019 | -.016 | -.029 | -.035 | -.029 | -.025 | -.023 | -.008 | -.003 | -.003 | -- | -- | -- |
| | 40° | 7.90 | Center-line | 0.6 | +.042 | +.023 | -.010 | -.016 | -.014 | -.015 | -.018 | -.020 | -.017 | -.024 | -.025 | -.021 | -.021 | -.014 | -.007 | -.002 | -.002 | 1.02 | 0.34 | 0.45 |
| | | | | 0.8 | +.046 | +.025 | -.009 | -.016 | -.013 | -.014 | -.017 | -.019 | -.016 | -.023 | -.024 | -.019 | -.019 | -.014 | -.007 | -.002 | -.002 | 1.01 | 0.36 | 0.47 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.010 | -.017 | -.014 | -.013 | -.022 | -.025 | -.022 | -.017 | -.015 | -.005 | -.002 | -.001 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.009 | -.016 | -.013 | -.012 | -.019 | -.024 | -.019 | -.017 | -.015 | -.006 | -.002 | -.002 | -- | -- | -- |

TABLE A-11.-APPROACH MODE; 3/2-BASELINE WING, NOZZLE AT 21% CHORD

| NOZZLE | β, deg | ℓ, cm | MEASUREMENT PLANE | $M_j$ | s/S 0.375 | 0.413 | 0.449 | 0.486 | 0.524 | 0.562 | 0.600 | 0.636 | 0.674 | 0.711 | 0.750 | 0.787 | 0.824 | 0.862 | 0.900 | 0.937 | 0.975 | $\frac{W_i}{W}$ | $\frac{T(W_i/W)}{T_i}$ | $\frac{L(W_i/W)}{T_i}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Δp/q | | | | | | | | | | | | | | | | | | | |
| Circular/ Deflector | 25° | 4.14 | Center-line | 0.6 | -.003 | -.004 | -.007 | -.014 | -.021 | -.027 | -.033 | -.039 | -.041 | -.047 | - 044 | -.032 | -.021 | -.008 | +.001 | +.003 | +.001 | 1.02 | 0.63 | 0.63 |
| | | | | 0.8 | -.003 | -.004 | -.008 | -.014 | -.021 | -.027 | -.033 | -.038 | -.040 | -.048 | - 046 | -.034 | -.025 | -.010 | -.001 | +.002 | +.001 | 1.01 | 0.58 | 0.68 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.032 | -.033 | -.034 | -.036 | -.048 | -.050 | -.037 | -.025 | -.016 | -.005 | -.002 | -.001 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.031 | -.033 | -.034 | -.035 | -.046 | -.048 | -.037 | -.027 | -.018 | -.007 | -.003 | -.002 | -- | -- | -- |
| | 30° | 4.14 | Center-line | 0.6 | -.003 | -.004 | -.007 | -.009 | -.011 | -.022 | -.036 | -.047 | -.047 | -.064 | -.066 | -.052 | -.045 | -.026 | -.008 | 0 | -.001 | 1.02 | 0.47 | 0.69 |
| | | | | 0.8 | -.003 | -.003 | -.007 | -.007 | -.009 | -.020 | -.034 | -.044 | -.045 | -.061 | -.064 | -.051 | -.046 | -.029 | -.010 | -.001 | -.001 | 1.01 | 0.44 | 0.71 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.012 | -.024 | -.029 | -.032 | -.047 | -.054 | -.046 | -.038 | -.030 | -.012 | -.005 | -.003 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.011 | -.023 | -.028 | -.030 | -.045 | -.052 | -.045 | -.037 | -.030 | -.012 | -.005 | -.003 | -- | -- | -- |
| | 40° | 4.14 | Center-line | 0.6 | +.004 | +.085 | +.079 | +.010 | -.014 | -.024 | -.032 | -.037 | -.031 | -.044 | -.048 | -.038 | -.039 | -.028 | -.014 | -.005 | -.005 | 1.02 | 0.34 | 0.61 |
| | | | | 0.8 | +.003 | +.083 | +.080 | +.010 | -.012 | -.021 | -.028 | -.031 | -.026 | -.038 | -.041 | -.032 | -.033 | -.025 | -.012 | -.003 | -.004 | 1.01 | 0.33 | 0.61 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.014 | -.027 | -.023 | -.017 | -.035 | -.042 | -.035 | -.030 | -.028 | -.010 | -.005 | -.004 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.012 | -.025 | -.020 | -.017 | -.032 | -.039 | -.032 | -.027 | -.025 | -.009 | -.003 | -.003 | -- | -- | -- |
| Slot/ Cutback | 30° | -- | Center-line | 0.6 | +.005 | +.027 | -.019 | -.043 | -.041 | -.044 | -.053 | -.060 | -.051 | -.070 | -.068 | -.043 | -.034 | -.019 | -.006 | -.002 | -.002 | 1.22 | 0.56 | 0.66 |
| | | | | 0.8 | +.007 | +.030 | -.016 | -.041 | -.038 | -.042 | -.052 | -.059 | -.048 | -.069 | -.066 | -.040 | -.031 | -.017 | -.005 | -.001 | -.002 | 1.15 | 0.50 | 0.66 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.018 | -.032 | -.027 | -.025 | -.041 | -.044 | -.034 | -.027 | -.020 | -.007 | -.003 | -.001 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.017 | -.029 | -.025 | -.023 | -.038 | -.041 | -.032 | -.025 | -.019 | -.006 | -.002 | -.001 | -- | -- | -- |
| | 40° | -- | Center-line | 0.6 | -.015 | +.029 | -.014 | -.033 | -.032 | -.035 | -.044 | -.051 | -.042 | -.061 | -.061 | -.042 | -.035 | -.020 | -.006 | -.001 | -.002 | 1.37 | 0.50 | 0.68 |
| | | | | 0.8 | -.015 | +.032 | -.013 | -.031 | -.030 | -.034 | -.043 | -.050 | -.041 | -.060 | -.061 | -.041 | -.034 | -.019 | -.006 | -.001 | -.002 | 1.28 | 0.48 | 0.65 |
| | | | Out-board | 0.6 | -- | -- | -- | -- | -- | -.015 | -.027 | -.023 | -.022 | -.036 | -.040 | -.032 | -.025 | -.020 | -.007 | -.003 | -.001 | -- | -- | -- |
| | | | | 0.8 | -- | -- | -- | -- | -- | -.014 | -.026 | -.022 | -.020 | -.035 | -.038 | -.030 | -.024 | -.019 | -.007 | -.003 | -.001 | -- | -- | -- |

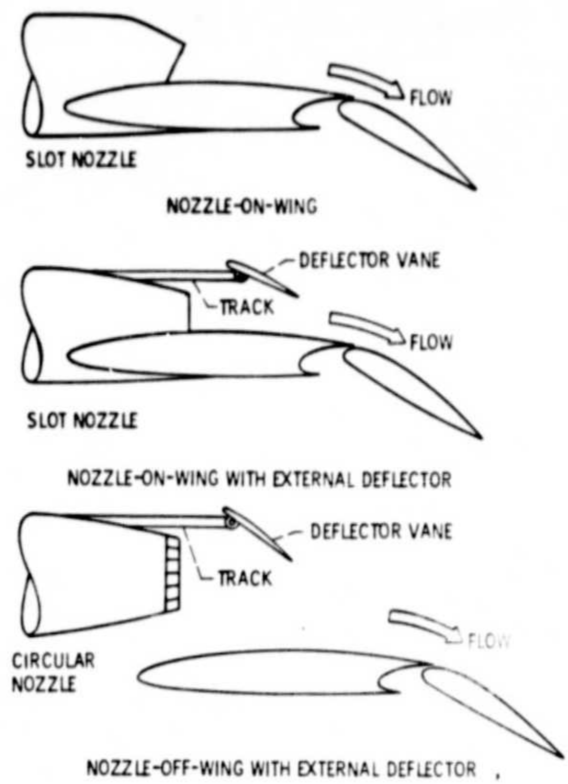



Figure 1. - Conceptual OTW nozzle/wing configurations.

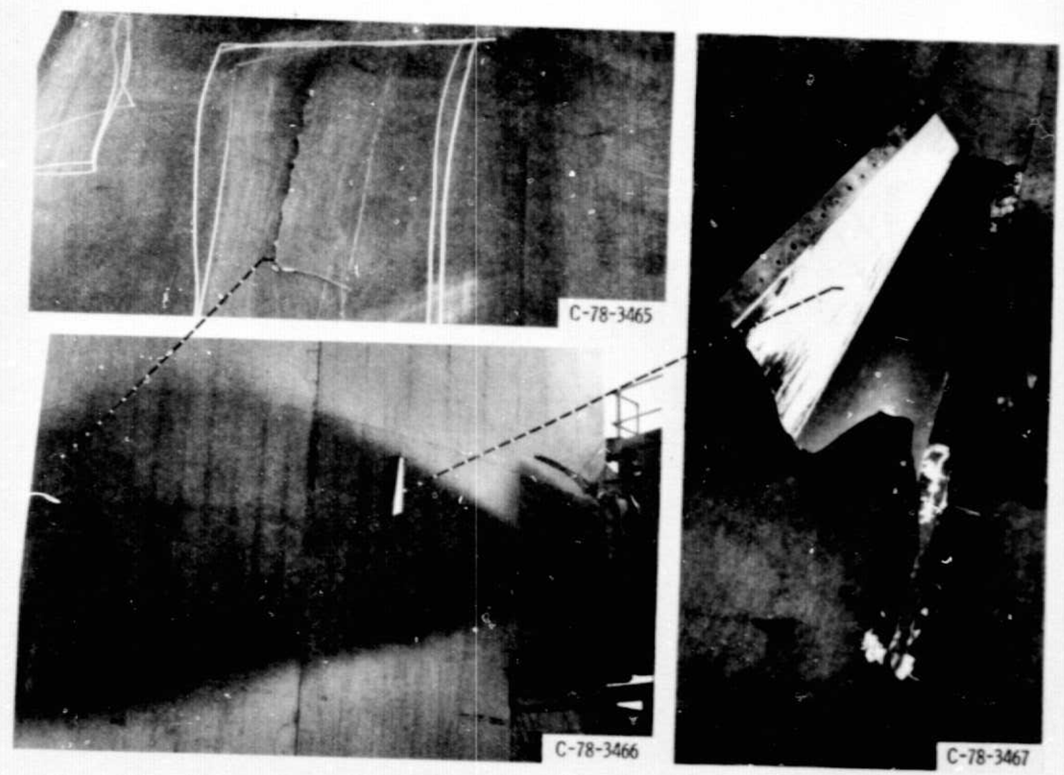
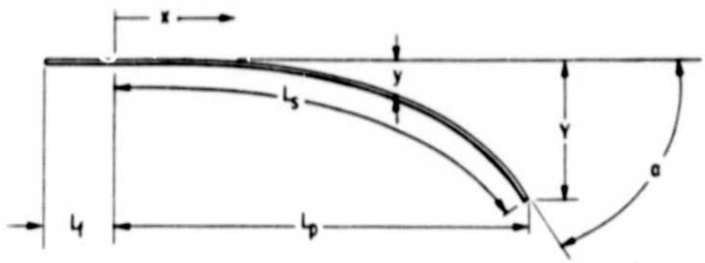



Figure 2. - Damage to QCSEE OTW skin due to wing loading, resulting from jet exhaust flow over wing surface.




WING COORDINATES

| FLAP ANGLE, α, DEG | WING CONFIGURATION | y/Y \ $x/L_p$ | 0-0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 0.95 | 0.975 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | BASELINE | | 0 | 0.04 | 0.13 | 0.26 | 0.44 | 0.70 | 0.85 | ----- | 1.0 |
| 60 | ALL | | 0 | 0.02 | 0.055 | 0.125 | 0.24 | 0.44 | 0.61 | 0.76 | 1.0 |

WING DIMENSIONS

| FLAP ANGLE, α, DEG | WING SIZE | NOZZLE LOCATION, % CHORD | Y, cm | $L_f$, cm | $L_p$, cm | $L_s$, cm |
|---|---|---|---|---|---|---|
| 20 | BASELINE | 10 | 6.6 | 3.3 | 37.4 | 39.0 |
| | | 21 | | 6.9 | 33.8 | 35.4 |
| | | 46 | | 15.2 | 25.4 | 27.0 |
| 60 | 2/3-BASELINE | 21 | 9.6 | 4.6 | 20.3 | 25.7 |
| | | 46 | | 10.2 | 14.7 | 20.3 |
| | BASELINE | 10 | 14.3 | 3.3 | 34.1 | 42.3 |
| | | 21 | | 6.9 | 30.5 | 38.7 |
| | | 46 | | 15.2 | 22.1 | 30.2 |
| | 3/2-BASELINE | 10 | 21.5 | 5.0 | 50.9 | 62.8 |
| | | 21 | | 10.2 | 45.7 | 57.6 |
| | | 46 | | 22.9 | 33.1 | 45.1 |

Figure 3. - Model-scale wing dimensions and coordinates. Dimensions in centimeters.

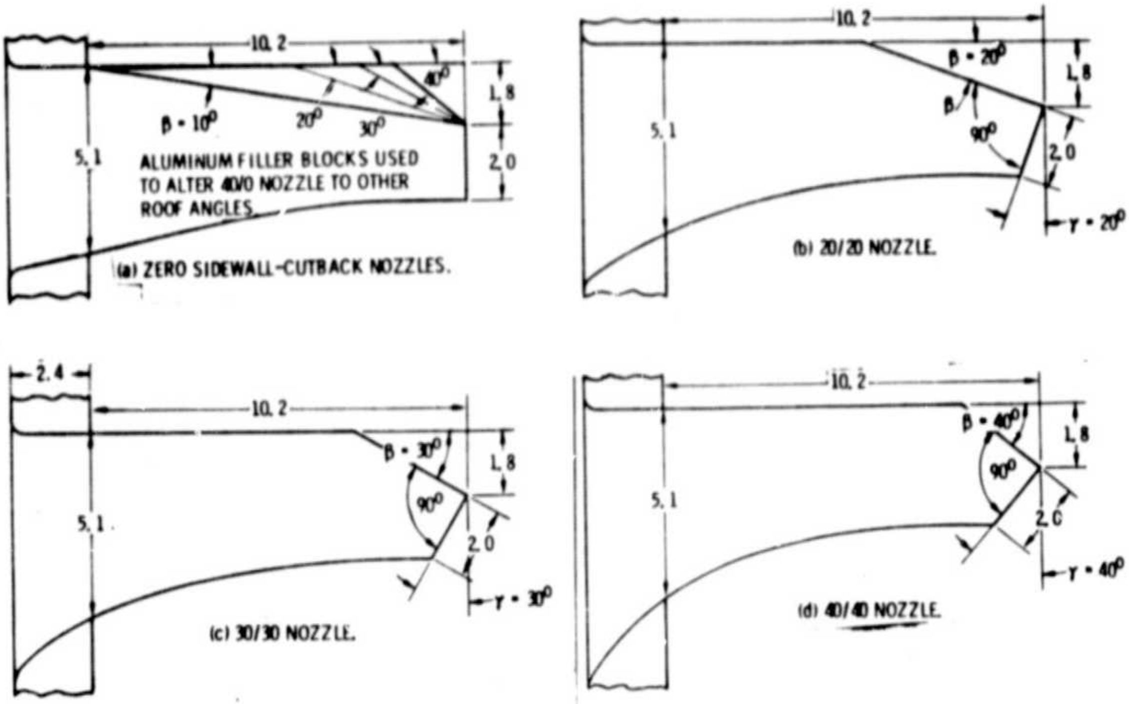
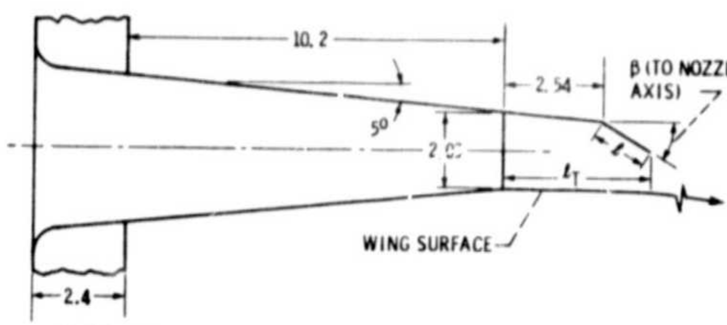
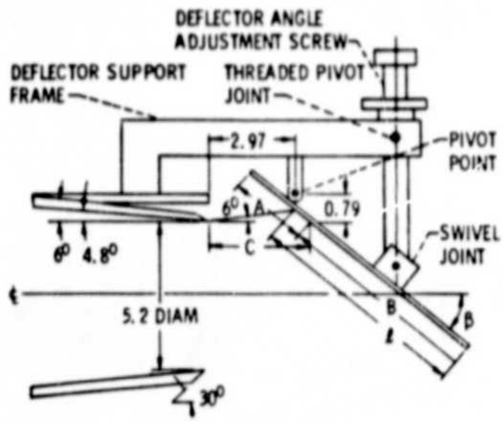



Figure 4. - Sketches of slot nozzles, with and without sidewall cutback. Dimensions in centimeters.




| DEFLECTOR ANGLE, β, deg | DEFLECTOR LIP, $\ell$, cm | TOTAL DEFLECTOR LENGTH, $\ell_T$, cm |
|---|---|---|
| 40 | 1.27 | 3.61 |
| 30 | 1.59 | 4.06 |
| 40 | .64 | 3.25 |
| 20 | .64 | 3.35 |

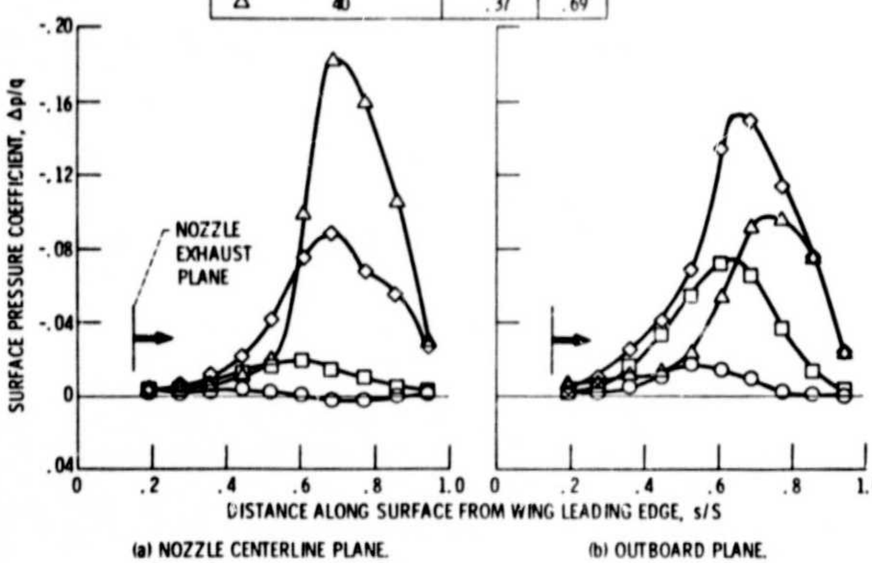
Figure 5. - Sketch of 5:1 slot/deflector nozzle. Dimensions in centimeters. All deflectors were 15.2 cm wide. Reference 2.




| ℓ | A | B | C | β |
|---|---|---|---|---|
| 4.14 | 2.51 | 3.18 | 3.91 | 20° |
| | 2.29 | 3.40 | 3.66 | 25° |
| | 2.18 | 3.51 | 3.51 | 30° |
| | 2.C6 | 3.63 | 3.25 | 40° |
| 7.90 | 2.54 | 6.91 | 4.01 | 20° |
| | 2.31 | 7.14 | 3.66 | 25° |
| | 2.11 | 7.[illegible]4 | 3.40 | 30° |
| | 2.03 | 7.42 | 3.18 | 40° |

Figure 6. - Schematic sketch of circular/deflector nozzle. Dimensions in centimeters.

| | NOZZLE DEFLECTOR ANGLE, DEG | RATIO | |
|---|---|---|---|
| | | THRUST | LIFT |
| ○ | 20 | 0.90 | 0.17 |
| □ | 25 | .79 | .33 |
| ◇ | 30 | .53 | .60 |
| △ | 40 | .37 | .69 |




(a) NOZZLE CENTERLINE PLANE.

(b) OUTBOARD PLANE.

Figure 7. - Effect of deflector angle with circular nozzle on pressure distribution and jet flow attachment to flap surface. 2/3-baseline approach wing; nozzle at 21 percent chord; deflector length, 4.14 cm.

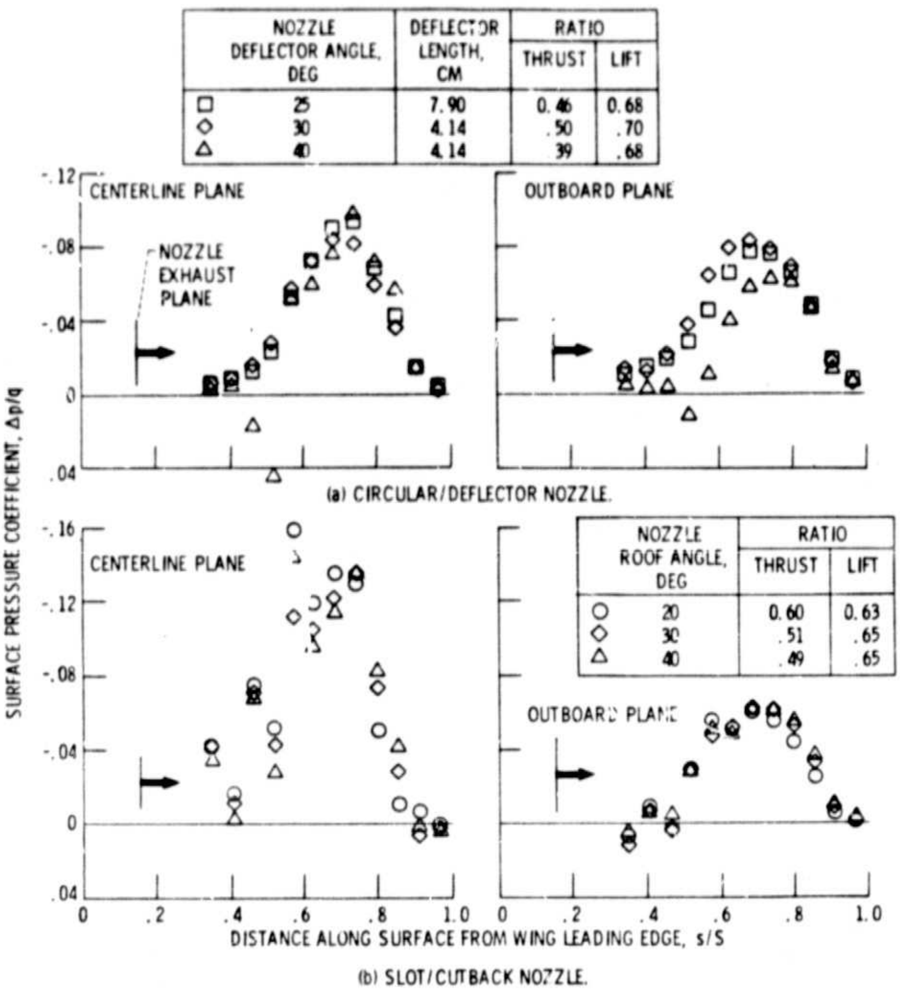
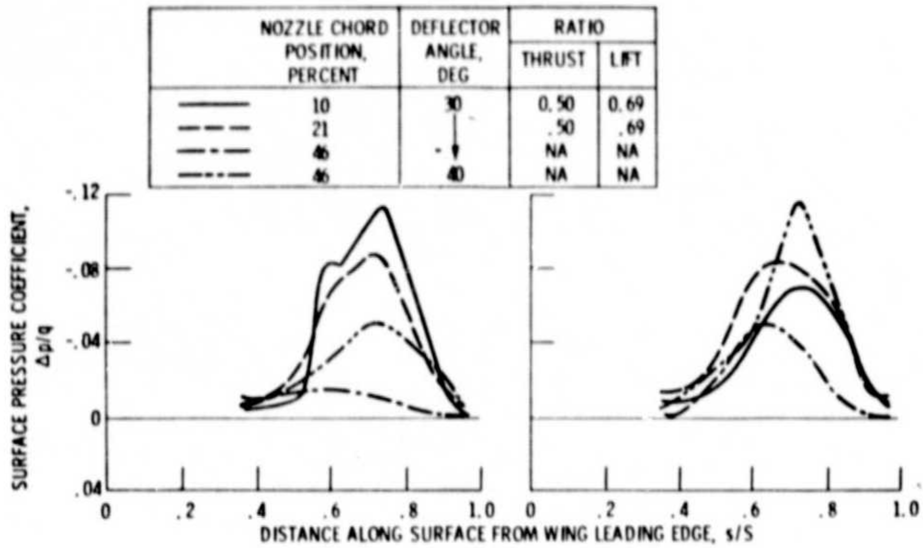
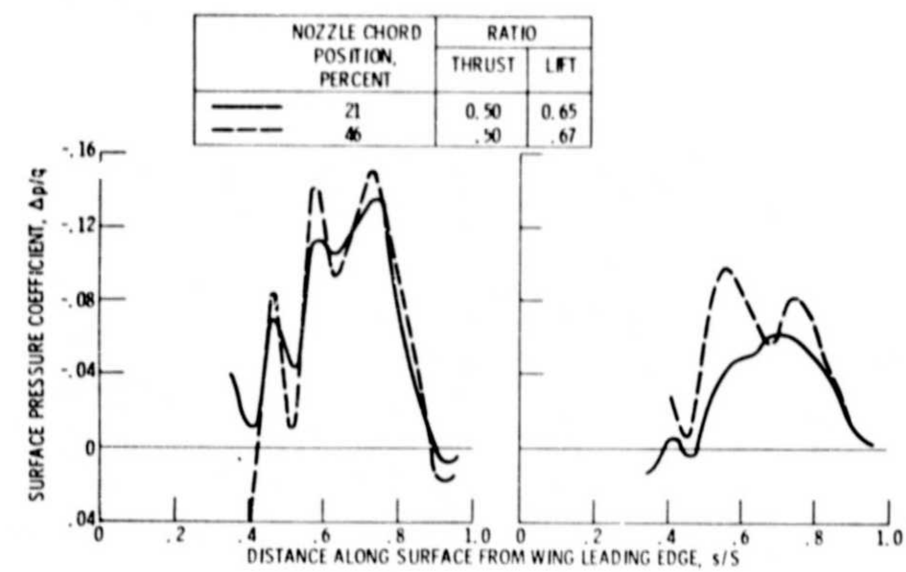



Figure 8. - Effect of roof/deflector angle on pressure distribution. Baseline approach wing; nozzle at 21 percent chord.




(a) NOZZLE CENTERLINE PLANE. (b) OUTBOARD PLANE.

Figure 9. - Effect of nozzle chord position on pressure distribution with circular/deflector nozzle. Baseline approach wing; 4.14 cm deflector length.




(a) NOZZLE CENTERLINE PLANE. (b) OUTBOARD PLANE.

Figure 10. - Effect of nozzle chord position on pressure distribution with slot/cutback nozzle. Baseline approach wing; $30^0$ roof/cutback angle.

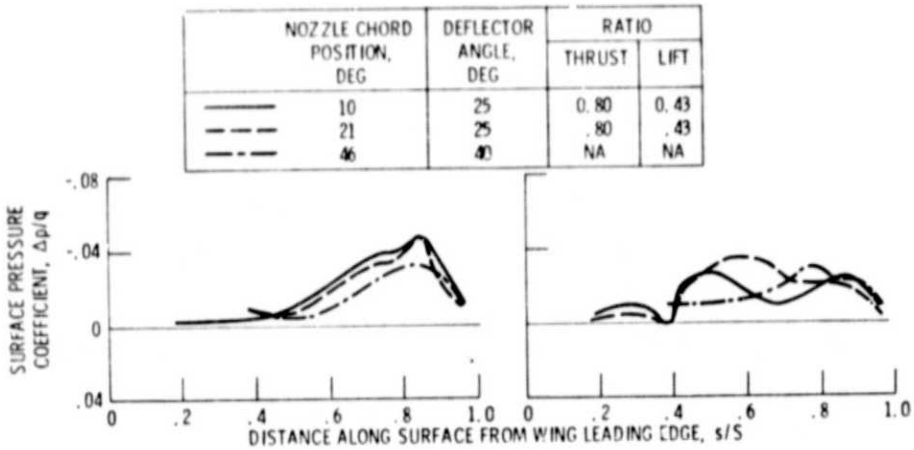



Figure 11. - Effect of nozzle chord position on pressure distribution with circular/deflector nozzle. Baseline takeoff wing; 4.14 cm deflector length.

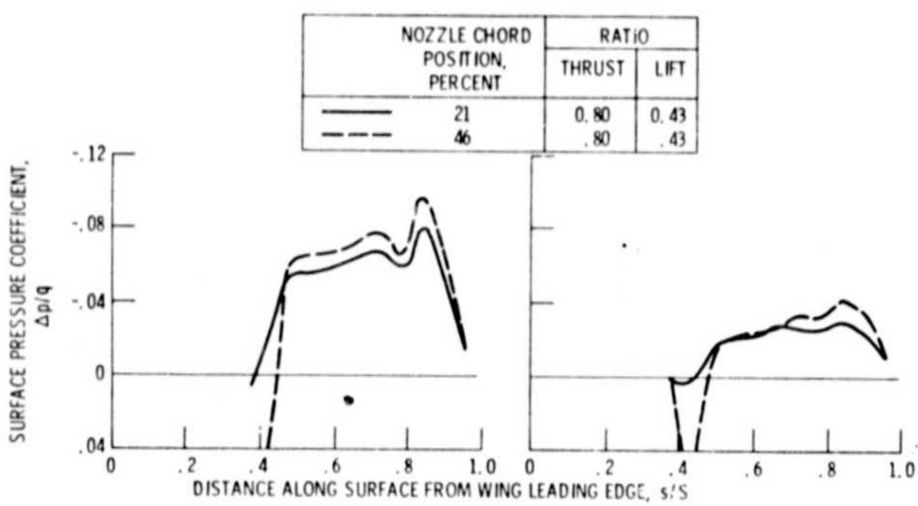



Figure 12. - Effect of nozzle chord position on pressure distribution with slot/cutback nozzle. Baseline takeoff wing; $30^{\circ}$ roof/cutback angle.

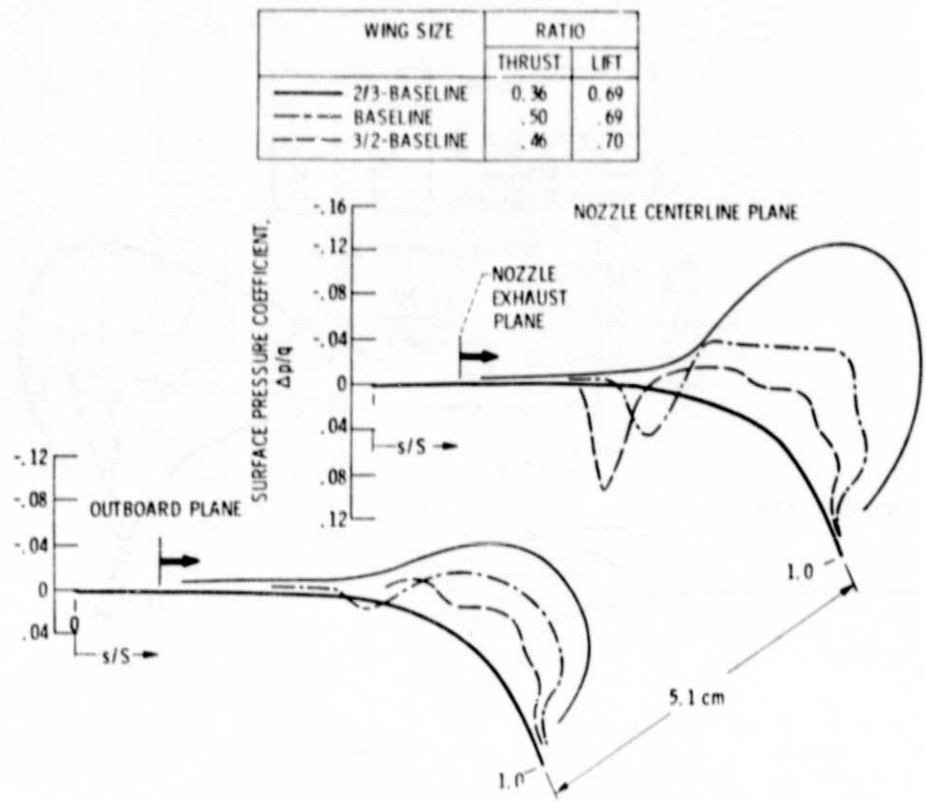



Figure 13. - Effect of wing size on pressure distribution with circular/deflector nozzle. Approach mode; $40^0$ deflector angle; 4.14 cm deflector length; nozzle at 21 percent chord.

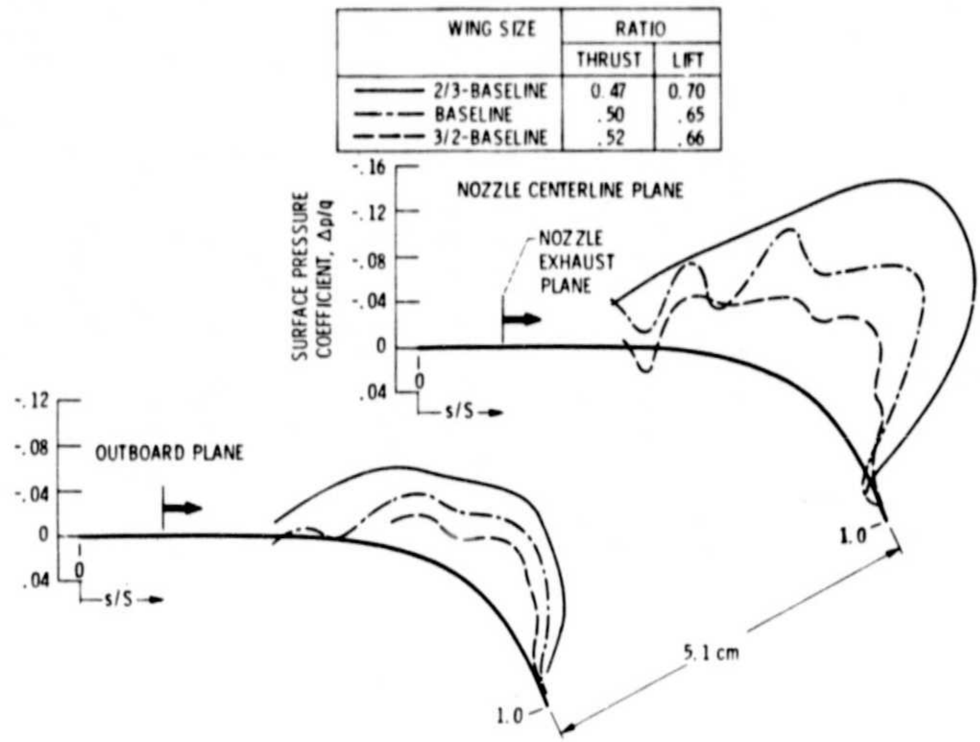



Figure 14. - Effect of wing size on pressure distribution with slot/cutback nozzle. Approach mode; $30^{\circ}$ roof/cutback angle; nozzle at 21 percent chord.

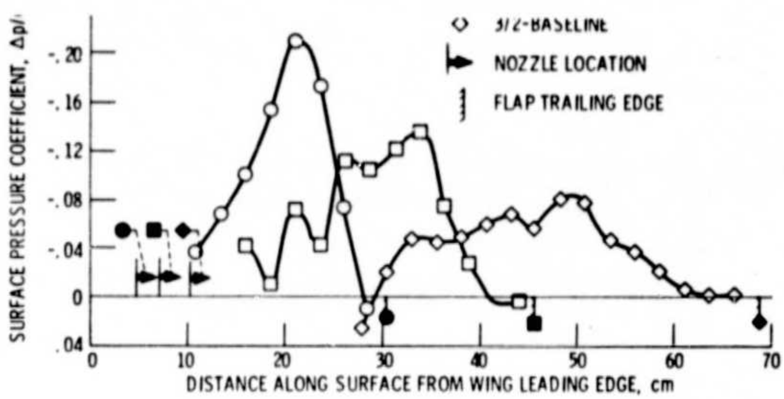
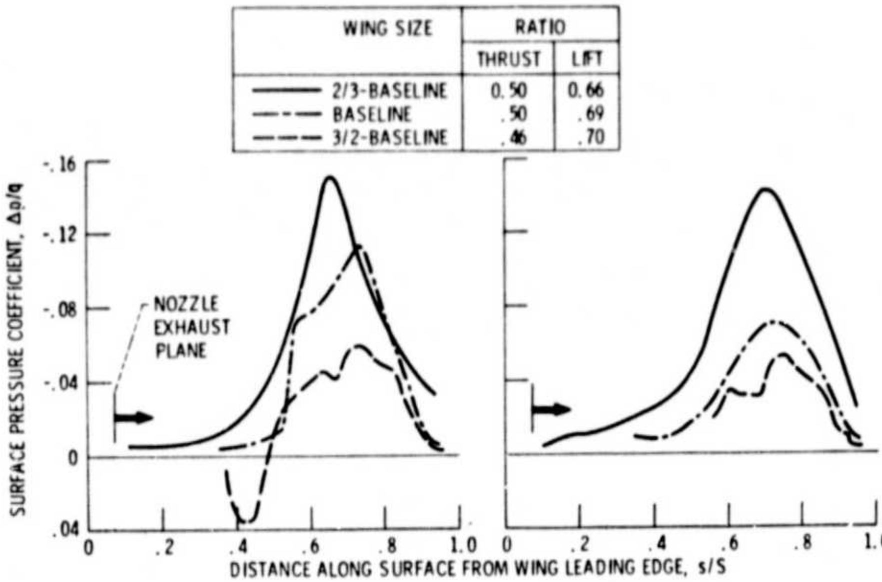
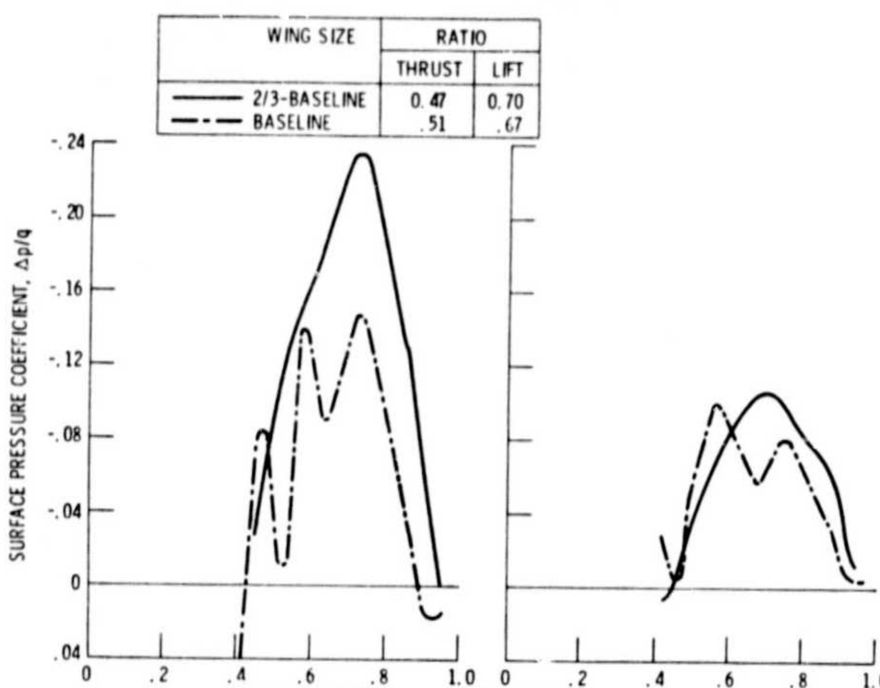



Figure 15. - Typical variation of surface pressure distribution with wing size. Approach mode; slot/cutback nozzle at 21 percent chord; 30$^0$ roof/cutback angle; nozzle centerline plane.




(a) NOZZLE CENTERLINE PLANE. (b) OUTBOARD PLANE.

Figure 16. - Effect of wing size on pressure distribution with circular/deflector nozzle. Approach mode; 30° deflector angle, 4.14 cm deflector length; nozzle at 10 percent chord.




(a) NOZZLE CENTERLINE PLANE. (b) OUTBOARD PLANE.

Figure 17. - Effect of wing size on pressure distribution with slot/cutback nozzle. Approach mode; 30° roof/cutback angle; nozzle at 46 percent chord.

| NOZZLE | DEFLECTOR LENGTH, cm | ROOF/DEFLECTOR ANGLE, DEG | RATIO | |
|---|---|---|---|---|
| | | | THRUST | LIFT |
| ——— CIRCULAR/DEFLECTOR | 4.14 | 30 | 0.50 | 0.69 |
| —·— SLOT/CUTBACK | ---- | 30 | .51 | .65 |
| — — SLOT/DEFLECTOR | .64 | 25 | .45 | .68 |

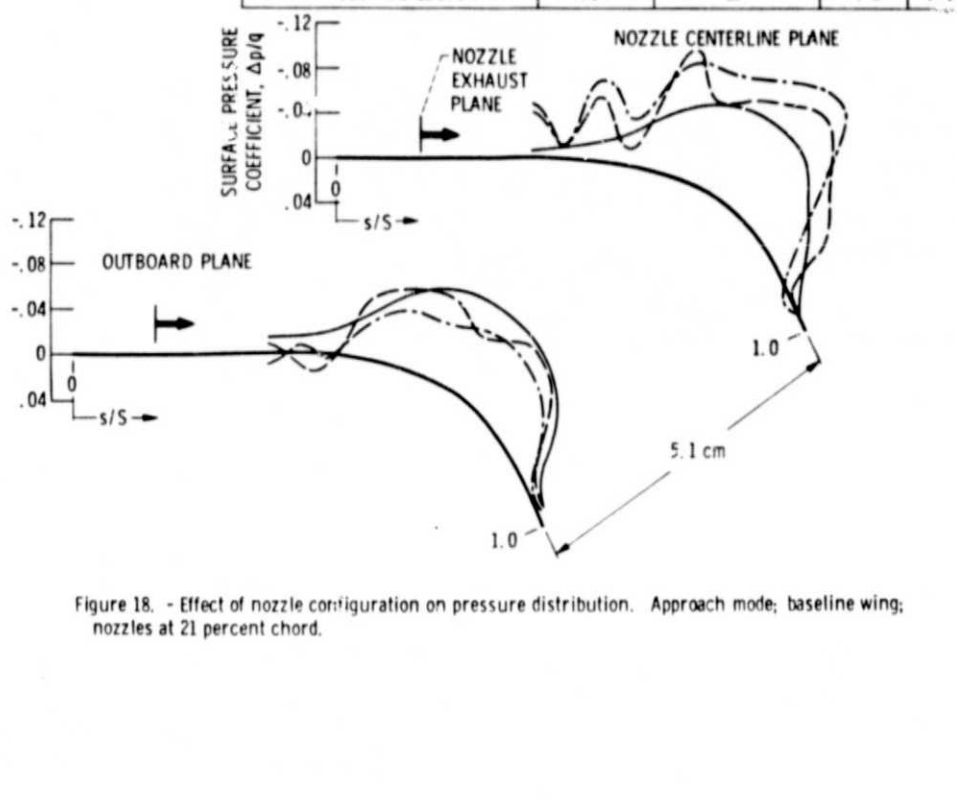



Figure 18. - Effect of nozzle configuration on pressure distribution. Approach mode; baseline wing; nozzles at 21 percent chord.

| NOZZLE | DEFLECTOR LENGTH, cm | ROOF/DEFLECTOR ANGLE, DEG | RATIO | |
|---|---|---|---|---|
| | | | THRUST | LIFT |
| CIRCULAR/DEFLECTOR | 4.14 | 40 | NA | NA |
| SLOT/CUTBACK | ---- | 30 | 0.50 | 0.67 |
| SLOT/DEFLECTOR | .64 | 40 | .38 | .74 |

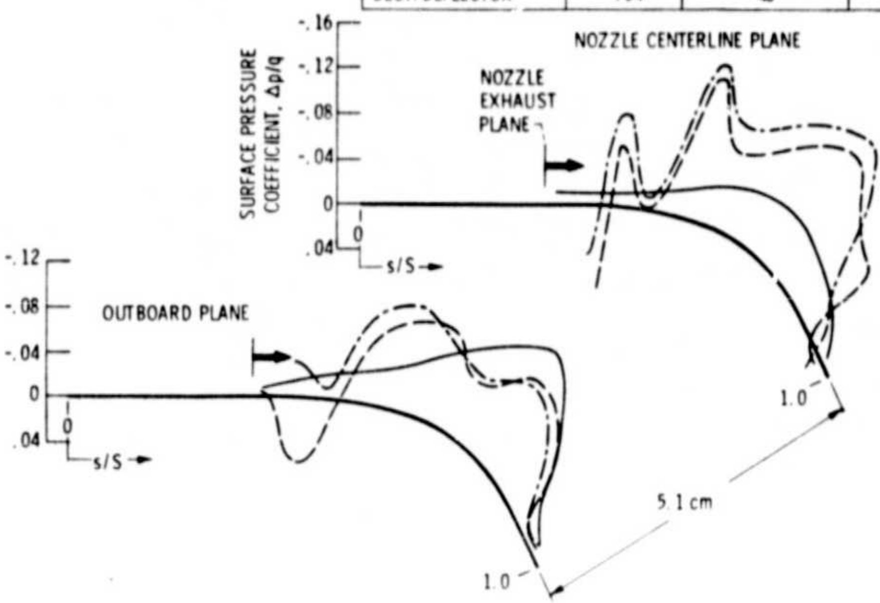



Figure 19. - Effect of nozzle configuration on pressure distribution. Baseline approach wing; nozzle at 46 percent chord.

| NOZZLE | DEFLECTOR LENGTH, cm | ROOF/ DEFLECTOR ANGLE, DEG | RATIO THRUST | RATIO LIFT |
|---|---|---|---|---|
| ——— CIRCULAR/DEFLECTOR | 4.14 | 40 | 0.37 | 0.69 |
| —·— SLOT/CUTBACK | ---- | 30 | .47 | .70 |

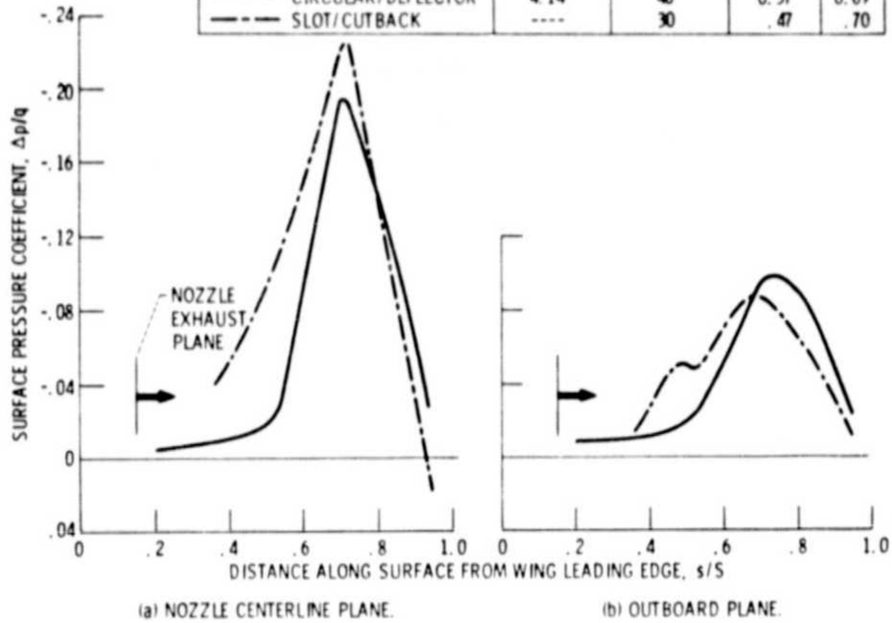



Figure 20. - Effect of nozzle configuration on pressure distribution, 2/3-baseline approach wing; nozzle at 21 percent chord.

| NOZZLE | DEFLECTOR LENGTH, cm | ROOF/ DEFLECTOR ANGLE, DEG | RATIO THRUST | RATIO LIFT |
|---|---|---|---|---|
| ——— CIRCULAR/DEFLECTOR | 4.14 | 30 | 0.46 | 0.70 |
| —·— SLOT/CUTBACK | ---- | 30 | .53 | .66 |

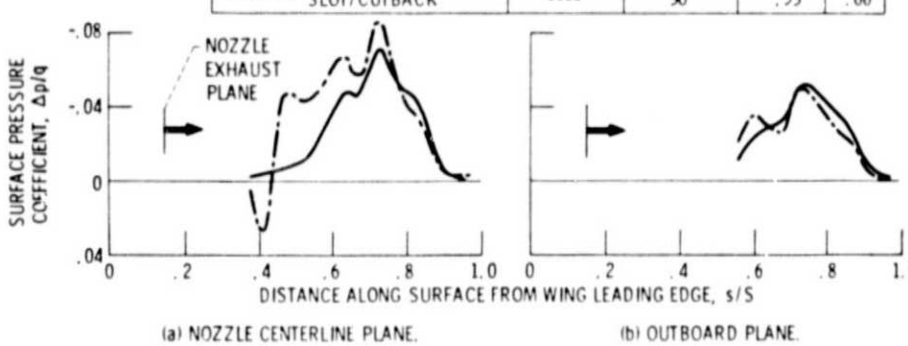



Figure 21. - Effect of nozzle configuration on pressure distribution. 3/2-baseline approach wing; nozzle at 21 percent chord.

| | DEFLECTOR LENGTH, cm | RATIO | |
|---|---|---|---|
| | | THRUST | LIFT |
| ——— CIRCULAR/DEFLECTOR | 7.90 | 0.82 | 0.44 |
| —·— SLOT/CUTBACK | ---- | .83 | .42 |
| — — SLOT/DEFLECTOR | .64 | .79 | .43 |

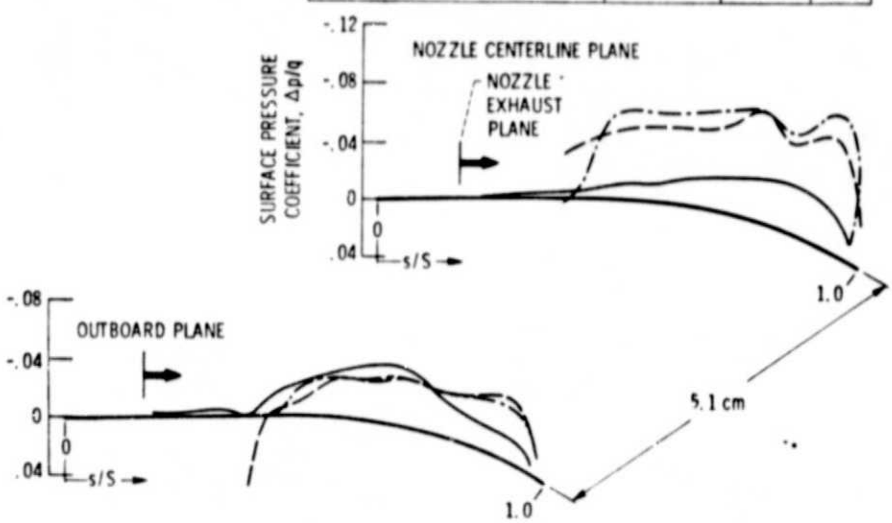



Figure 22. - Effect of nozzle configuration on pressure distribution. Baseline takeoff wing; $20^0$ roof/deflector angle; nozzles at 21 percent chord.

| NOZZLE | DEFLECTOR LENGTH, cm | ROOF/ DEFLECTOR ANGLE, DEG | RATIO | |
|---|---|---|---|---|
| | | | THRUST | LIFT |
| ——— CIRCULAR/DEFLECTOR | 4.14 | 40 | NA | NA |
| —·— SLOT/CUTBACK | ---- | 20 | 0.83 | 0.42 |
| — — SLOT/DEFLECTOR | .64 | 20 | .79 | .43 |

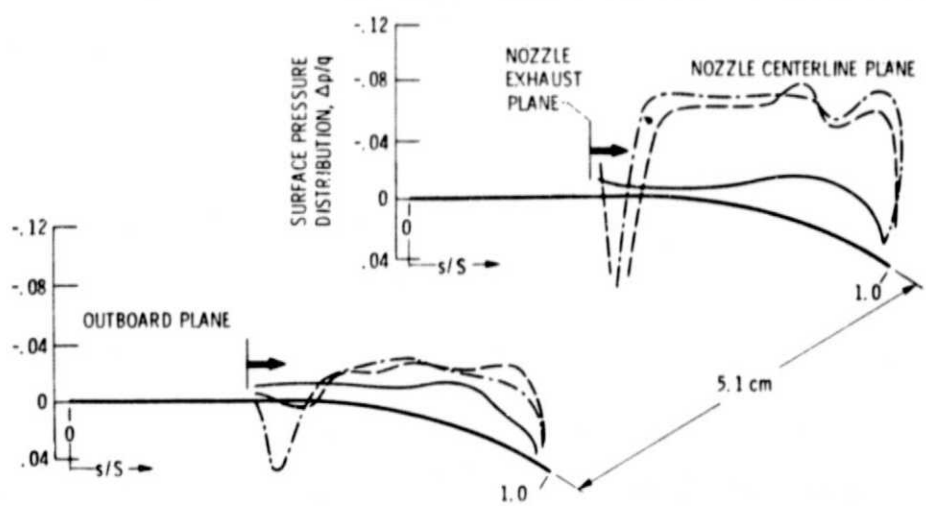



Figure 23. - Effect of nozzle configuration on pressure distribution. Baseline takeoff wing; nozzles at 46 percent chord.

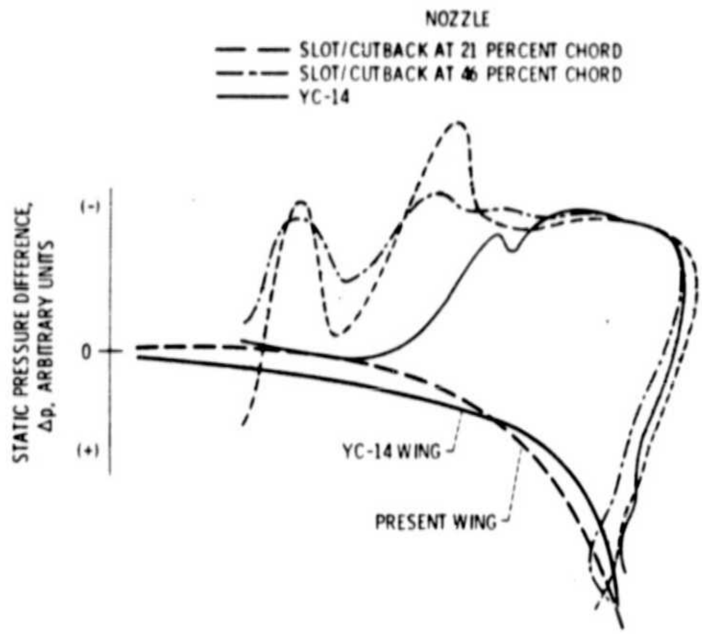



Figure 24. - Comparison of surface static pressure distribution with present slot/cutback nozzle and with YC-14 nozzle. Approach mode.