LATERAL STABILITY INVESTIGATION OF AIR BAR AND WEB INTERACTION FOR USE IN FLOTATION OVENS

By

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NOMENCLATURE

A	crossectional area of nozzle on air bar D
C.O.L.	center of lift or pressure on a web created by an air bar
Dist	mean distance between web and air bar
g	gravity constant
g_c	gravity unit conversion factor
GPM	gallon per minute
h	height of fluid off the manometer bank
h_o	gap between plate and air bar
L	characteristic length used in calculating Reynolds' number
P	pressure
P1	pressure inside air bar pressure chamber
P2	pressure on web at the point of impingement
R_e	Reynolds' number
$(R_e)_a$	Reynolds' number in air
$(R_e)_w$	Reynolds' number in water
S.G.	specific gravity of the manometer oil
Theta	tilt angle of the web relevant to the air bar

T.L.	total lift on a web created by an air bar
V1	velocity of air inside the air bar pressure chamber
V2	velocity of air on the web at the point of impingement
VF	volume flow rate of water through air bar D
μ_a	dynamic viscosity of air
μ_w	dynamic viscosity of water
θ_s	angle of separation in degrees of the flow pattern from the round air bar model
ρ_a	density of air
ρ_{oil}	density of the manometer oil
ρ_w	density of water
#	interpolated data point

CHAPTER I

INTRODUCTION

The present paper describes an experimental investigation into the effects of air bar and web interaction for the purpose of proper web handling in flotation ovens.

In this context, a web is a thin continuous piece of material such as paper, film, or fabric. During production a web can go through many processes such as getting coated, printed on, dried, wound or unwound on a roll, transported, and many more. For a web to go through these processes, it must be moved or handled in some way. Many times this job is accomplished through automated equipment. The problem lies in the fact that while a web is being moved or handled by these automated machines, the web can become wrinkled, scratched, torn, or in some way damaged.

The process of concern in this paper is the drying of webs in flotation ovens or flotation dryers. Often when a web is coated or printed on it must be dried before the surface of the web can be touched. This process may often be done in flotation ovens. In flotation drying the heated air can be directed from both the top and bottom of the web. The impinging air acts to accelerate drying and to float the web through the oven without making contact. The object that directs this impinging air is called an air bar. Air bars come in many shapes, sizes, and

designs. The key thing to note about flotation ovens and dryers is air is not only the means to dry the web but is also the means of supporting the web.

The importance of this investigation lies in the fact that understanding the physical processes involved in air bar and web interaction is crucial if web defects and coating damage are to be avoided. Effective methods to identify undesirable characteristics of flotation ovens can be developed possibly resulting in the development of a more desirable flotation device.

Pinnamaraju (8) in previous work has utilized static web experiments. An air bar and web have been modeled as a slotted circular tube and a rigid Lucite plate respectively. It was found that a rigid web supported by a circular air bar is unstable at some gap spacing. The force on the web can become negative causing the web to be sucked onto the tube. Several other industrial air bars were tested in a similar manner with similar results. One air bar of primary concern is of an air foil design and has a trailing edge with vented slots. Total lift forces have been measured as a function of gap spacing. It is indicated that the air bar with vented slots can only be used at smaller gap spacing (less than 0.05 inch) due to the loss of lift on the web. It is also indicated that the air bar with vented slots exhibits strong stability over the range of small gap spacing.

In the following pages, the static web experiments are continued using air bars of various designs. A concentrated effort will be made on the air foil type air bar to determine if vented slots in the trailing edges provide an advantage or a disadvantage. Flow visualization techniques are applied to observe dynamic flow patterns between air bar and web. Sensitivity of the normal lifting force on the web to tilt angle is considered. The net moment on the web as a function of tilt angle is also considered. These investigations will lead to a better understanding of web out of plane dynamics in a drying oven hopefully leading to better flotation drying systems.

CHAPTER II

LITERATURE REVIEW

Web Flotation

Flotation systems are widely used in the drying of paper, film, and fabric webs. The idea is to use high-velocity fluid to strike the web at right angles breaking the boundary layer and transfer energy to the surface of the web for rapid drying and transportation of the web.

Obrzut (6) considered an air bar the primary part of a flotation system, air being the usual impinging fluid. An air bar is nothing more than a pressure chamber with continuous slotted openings that extend across the width of the web. Air is forced out the transverse nozzles to create a pressure force between the air bar and web. See figure 1. The web acts as a physical barrier to block the flow of air thus generating the pressure difference required to float the web. Past industrial experience has shown that a single lower air bar results in unstable flotation. The pressure force pushes the web away until it reaches a certain gap spacing where the weight of the web is greater than the dissipating pressure force. The web would then begin to fall until the pressure force was once again greater than the web momentum and weight. Stability can be achieved when an air bar is

placed on the opposite side of the web. The top air bar is usually staggered and not directly across from the bottom air bar.

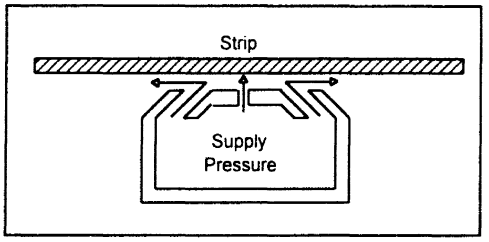

Figure 1. Air Bar Floating a Strip

It has been shown by Davies and Wood (1) that a static strip will float at a height were the weight and force due to the upper nozzle balances the force due to the lower nozzle. In actual flotation systems, the speed of the web is much less than the nozzle exit speed thus justifying the use of the stationary strip model. Symmetry of air flow (6) to the air bar is also important for proper web flotation. Unsymmetrical air supplies will create instabilities and cause the web to float to one side or the other. However, bowed, cambered or wavy webs do not present a problem for flotation systems. The bottom air bars tend to raise the low sections while the top air bars tend to lower the high sections of the web.

Web Flotation Stability

Web stability is obviously important for effective web flotation to occur. The relationship between lift force on a web and the gap between air bar and web influences web stability. Pinnamaraju (8) has plotted the effect of lift force vs. gap spacing for an air bar with round geometry such as in figure 2.

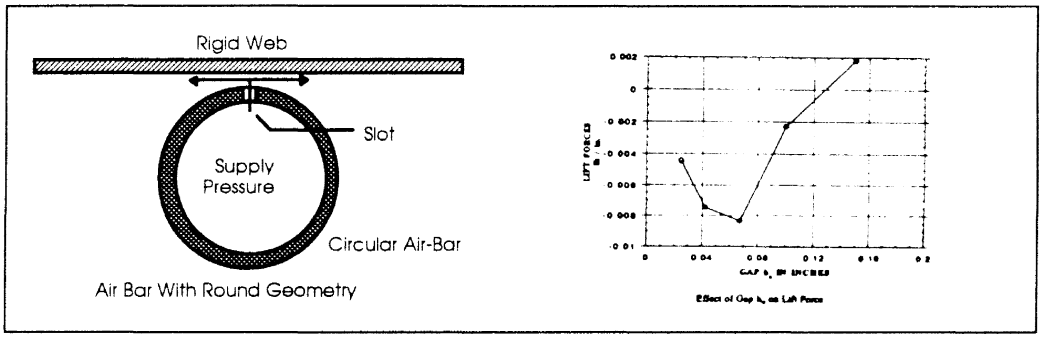

Figure 2. Air Bar Model With Round Geometry

It can be seen that for a graph of this type, a negative slope would indicate stability and a positive slope would indicate instability. For a negative slope, the lift force decreases with increasing gap spacing. As the web moves away from the air bar, the tendency for it to continue moving away diminishes. This acts to keep the web at a desired location. For a positive slope, the lift force increases with increasing gap spacing. The web will want to fly off the air bar unless some other force influences its behavior. Pinnamaraju (8) has determined that this instability occurs at gap spacing greater than 0.07 inch for the air bar model with round geometry.

Web Drying

Keep in mind that the flotation system is not only the means of transporting the web but is also the means of drying the web. Fraser (2) determined in drying a web that there are normally three overlapping phases. The first phase involves a temperature rise and heat build up in the web and coating. This phase is designed to bring the web up to proper drying temperature as efficiently and quickly as possible. The second phase is where most of the evaporation of the solvent and drying of the web occurs. This is a constant evaporation rate phase. The last phase is the falling evaporation rate phase. The last of the solvent is evaporated and the temperature of the web and coating are brought back to a normal temperature.

Dryability

Dryability is an important feature that determines how easy it is to dry out a web. The average velocity at which the air impinges on the web and the effective area over which the nozzle is working greatly influences dryability. Kataoka (4) agreed that a measure of the average velocity and effective area efficiency can be related to the heat transfer coefficient. For all practical purposes (7) , only turbulent impinging jets are used. These types of jets produce high heat and mass transfer coefficients which are obviously coupled together. Nozzle jet turbulence, large effective velocities, and large effective areas all act to increase the heat transfer coefficient.

Air Bar and Web Spacing

Kataoka (4) has shown that for a round free jet, emergence from a circular convergent nozzle impinging at right angles on a flat plate is influenced by nozzle to plate spacing. For large nozzle to plate spacing, the free jet becomes fully developed before it impinges on the plate. In this fully developed region, the jet velocity decreases inversely with the distance between nozzle exit and plate. For small nozzle to plate spacing, the free jet does not become fully developed before impingement on the flat plate resulting in no initial loss of velocity. It was also shown that if the jet is a constant temperature process except in the boundary layer of the flat plate where the heat transfer takes place, the optimal impingement spacing to maximize the heat transfer is between six and eight nozzle diameters.

Davies and Wood (1) used a nozzle with two jets directing the flow of air toward each other as in figure 3.

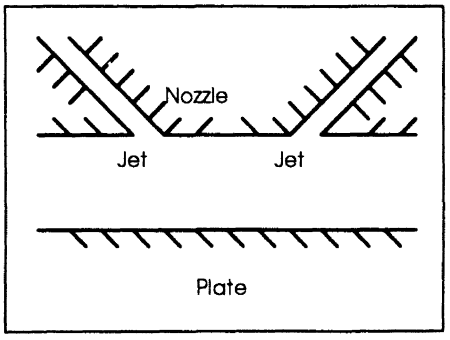

Figure 3. Model Used by Davies and Wood

The impingement of the nozzle was on a flat plate. They found that the force acting on the wall was roughly inversely proportional to the flotation height. Hwang and Liu demonstrated that for small gaps between a planar jet with a flat upper surface and a wall (3), the static pressure at the stagnation point is high. The pressures on the impinging wall next to the stagnation point are below ambient. This lower pressure on either side of the stagnation point suggests a strong acceleration in the impingement flow.

Drying Phases

Fraser (2) determined there are two distinct phases to the drying of coatings on webs. One phase deals with the heat transmitted to the web yielding a corresponding mass transfer. This mass transfer is the evaporation of the wet boundary layer on the web to the atmosphere. The second phase deals with the migration of the solvent through the resin or coating to the surface of the web which is again exposed to the atmosphere.

Different Types of Air Support Bars

Different types of air support bars (2) are the arch dryer (figure 4A), sinusoidal cushion tubes (figure 4B), and air foil tubes (figure 4C). Most of the drying systems implement one of these three types of systems.
In the arch dryer, the distance from sheet to nozzle ranges from about 1.75 to 2.5 inch. This wide spacing reduces the effective velocity and area at the web surface.

This results in wasted expended energy. This is where the sinusoidal cushion tube and air foil tube systems have an advantage. See figure 5.

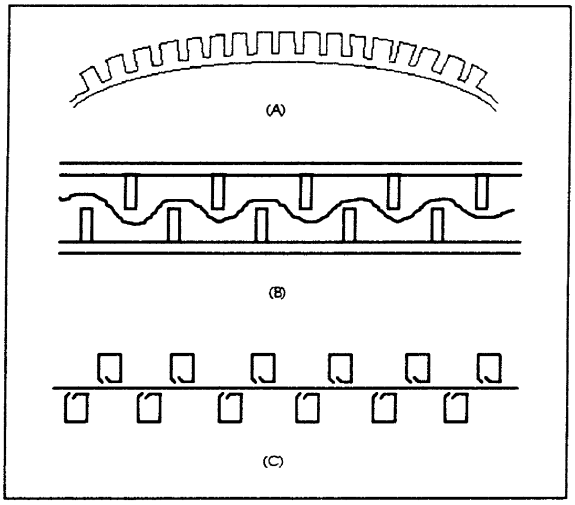

Figure 4. General Variations on Air Support Bars

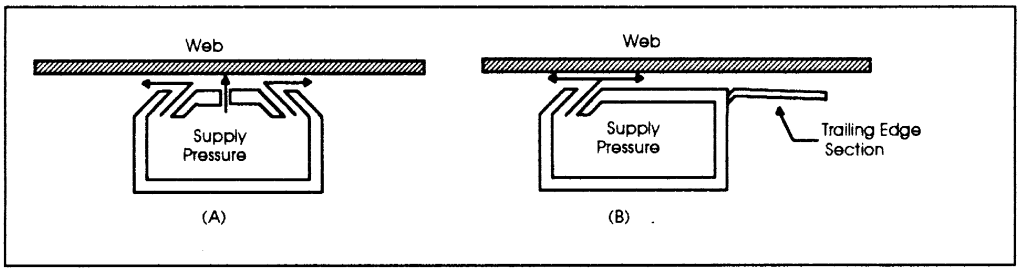

Figure 5. Example of Sinusoidal and Air Foil Type Air Bar

For these types of air bars the gap from nozzle to sheet is greatly reduced. This produces higher effective velocities and areas yielding an increase in the heat

transfer coefficient. The sinusoidal cushion tube has many slightly different designs and performance characteristics depending on the manufacturer. However, the basic design has end nozzles directing the air toward the center of the air bar. This tends to reduce and counteract high velocity air generating an overall low pressure zone (Bernoulli effect), thus keeping the web from being sucked down onto the tube. Krizek (5) states that this type of air bar is known to employ the Coanda effect. It is designed as to allow the flow of air to attach itself to the web and stay attached. For the air foil tubes, the Bernoulli effect is what governs its operations. The Bernoulli effect causes the web or sheet to be drawn closer to the surface of the tube resulting in an increase in velocity and a theoretical increase in the heat transfer coefficient. Air foil tubes tend to exhibit better directional stability. It is believed that the single directional flow of air results in a single directional force having a preference to keep the web in a straight line.

Design Features

Fraser (2) also maintains that design features to be concerned about, other than those already mentioned, are longitudinal tube spacing, spacing between top and bottom air bars, longitudinal web stability, and the characteristics of the impinging fluid.

The longitudinal spacing of the air bars affects the heat transfer coefficient. Closer tube spacing results in higher heat transfer coefficient. Care should be taken not to space the air bars too close. There is a certain amount of clearance required for the web when changes in web tension occur. In drying some types of coatings, the migration rate of the solvent to the outer surface of the web occurs at

a fixed rate. Decreasing the air bar spacing would needlessly drive up production costs. When solvent migration and operating expenses are not the limiting factors, care should be taken not to overlap the spacing of the air bars. This has been proven to be unacceptable in past oven designs.

The gap between the top and bottom air bars also affect stability. Excessive gaps result in flutter or bounce.

The combination between the type of web, the unsupported length to web width ratio, and web tension affect the longitudinal web stability. These parameters are application dependent and common problems include wrinkling and webs steering off the air bars.

Impinging fluid characteristics vary on the application. Usually the impinging fluid is air but not always. The impinging fluid as pointed out by Page (7) can be gas or liquid. The impinging environment may be of the same fluid or different. If the environment is of a different fluid, a free jet is the result. If the environment is of the same fluid, a submerged jet is the result. Impingement fluid velocity and temperature are of such a nature as to minimize drying time. This usually means high velocity and temperature. However, Obrzut (6) points out that too high a temperature and velocity can result in bubbles, blisters, and skinning.

All of the above design features are important and affect whether or not a web can be handled in a flotation oven. However, Fraser (2) believes that if a web stretches or puffs out due to the applied action of heat or mechanical instability, the web should not be handled by a flotation system.

CHAPTER III

DELINEATION OF SPECIFIC TOPIC OF STUDY

In the following, a discussion involving several different kinds of air bar types will be given. Presented here are the different air bar geometric configurations for ease of discussion later.

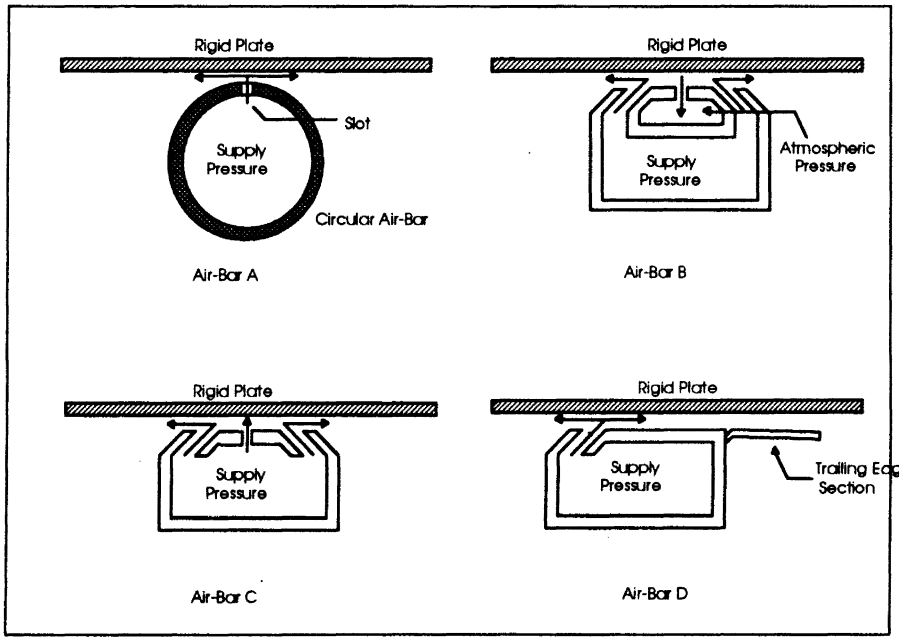

Figure 6. Air-Bar Geometric Configurations

In previous work, Pinnamaraju (8) modeled web and air bar using a flat plate and a round tube (air-bar A). The tube had a radius of 2.0 inch with a longitudinal slot of 0.10 inch wide. A series of air tests were conducted involving pressure distribution studies on the web. The pressure distributions on the plate possessed peculiar pressure fluctuations. See figure 7A. The primary results using this model implied that for certain gap spacing between plate and air bar, negative lift forces were produced. See figure 7B.

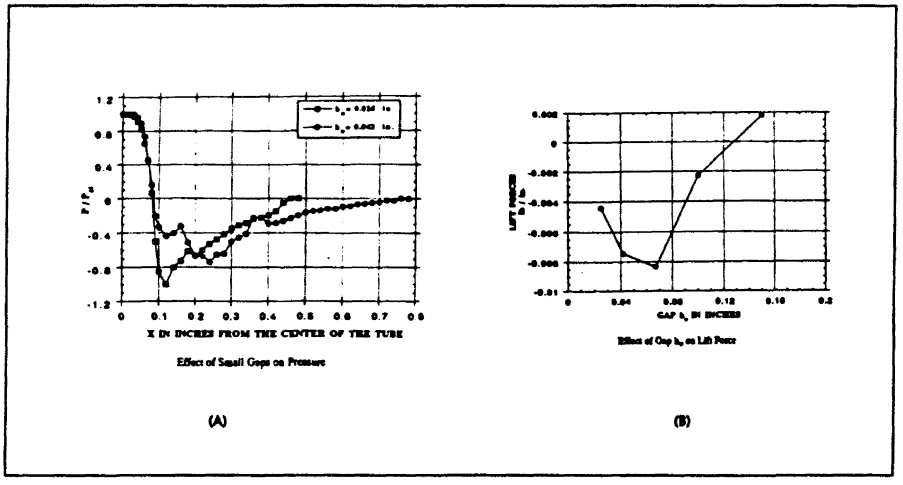

Figure 7. Pressure Distribution and Lift vs. Gap Graph Generated by Pinnamaraju

The system is considered unstable because of this suck down effect. It would be interesting and educational to visually see this unstable flow pattern.

Flow Visualization Experiment

Experimental Details

Flow visualization experiments were carried out using a water table. See figure 8. The water table was constructed from 0.5 inch Lucite glass. The dimensions of the table were 25.5 inch wide by 60 inch long by 6.5 inch high. Water height was maintained between 3 and 4 inch with the use of a water dam. Water would fill up the tank until the water height would reach the desired level, which was the height of the water dam, and begin to over flow. This overflow water would then be drained from the system. Water was supplied through a rotameter which regulated the flow of the incoming water. Dye injection was used to observe the flow patterns. A separate container holding dye was attached to the air bar being tested by a small flexible tube. The dye was allowed to flow from the container through the flexible tube and into the flow stream. It was found that better visual effects resulted if the dye was pulsed. The dye was therefore pulsed with the use of a simple circuit and a solenoid. Details of the dye injection set-up can be viewed in Appendix A. Observation of the flow patterns was usually done from the bottom of the tank to eliminate surface water irregularities, which can distort the visual observations.

A series of water table experiments were conducted using air bars A, B, and C. The objective was to observe the natural flow patterns of the simplified model and the patterns generated by industrial air bars. The volume of water pumped through the air bars ranged from 0.5 GPM to 4.5 GPM with the gap spacing between the air bar and rigid plate being adjusted between 0.025 inch and 0.100 inch. Table 1 summarizes the parameters at which this data was taken.

Approximate Reynolds' number calculations for the pressure distribution air experiments and the water table experiments for air bar A, were generated for comparative purposes.

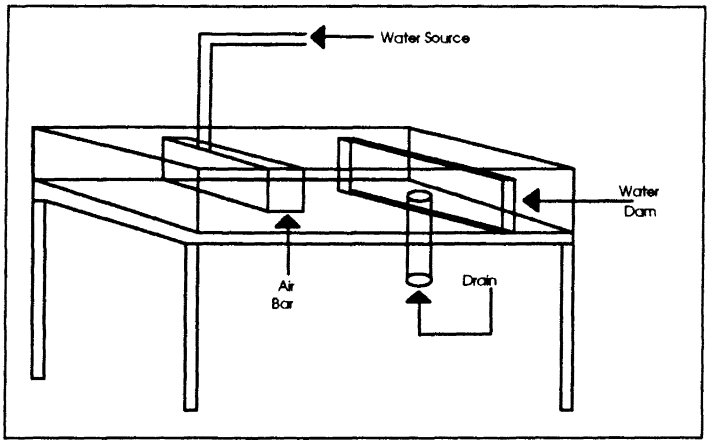

Figure 8. Water Table Setup

TABLE 1

PARAMETER VARIABLES FOR FLOW VISUALIZATION

Flow/Spacing	0.025 Inch Gap	0.063 Inch Gap	0.100 Inch Gap
0.5 GPM	----------	----------	----------
1.5 GPM	----------	----------	----------
2.5 GPM	----------	----------	----------
3.5 GPM	----------	----------	----------
4.5 GPM	----------	----------	----------

Pressure Distribution Experiment

Experimental Details

Pinnamaraju also applied static web experiments using an air bar of type D geometry. This type of geometry is of the air foil design discussed by Fraser (2). Pressure distributions (8) over the plate were recorded for different gap spacing between the Lucite plate and air bar for the plate being parallel to the air bar. From these pressure distributions, the effect of lift versus gap spacing for air bar D was generated. Further investigation of air bar D is desired and will be the primary focus point. Experiments were performed on air bar D using the apparatus described in figure 9. See Appendix B for a more detailed description of air bar D. The source of air into the thirteen inch wide air bar is constant. Pressure taps of 0.0625 inch in diameter were installed across the width of the plate. The taps were then connected to a manometer bank with a resolution of 0.05 inch of oil (0.04132 inch of H_2O). Taking pressure readings in the longitudinal direction required that the plate be moved by hand while monitoring the distance moved in the longitudinal or machine direction with a dial indicator gauge. This set-up provided a longitudinal displacement resolution of 0.001 inch. To maintain two-dimensional pressure readings, experimental data pressure recordings were done across the middle six inch of the air bar. Two-dimensionality was then checked by insuring the pressure distributions across the width of the air bar were very nearly the same for all given longitudinal displacements across the plate. For each longitudinal position, the pressure on the plate was read off the manometer bank in inches of oil. A series of "runs" were executed. For each "run", the tilt angle and average distance at which the plate is

placed above the air bar is varied. Figure 10 illustrates the orientation of the positive and negative tilt angles.

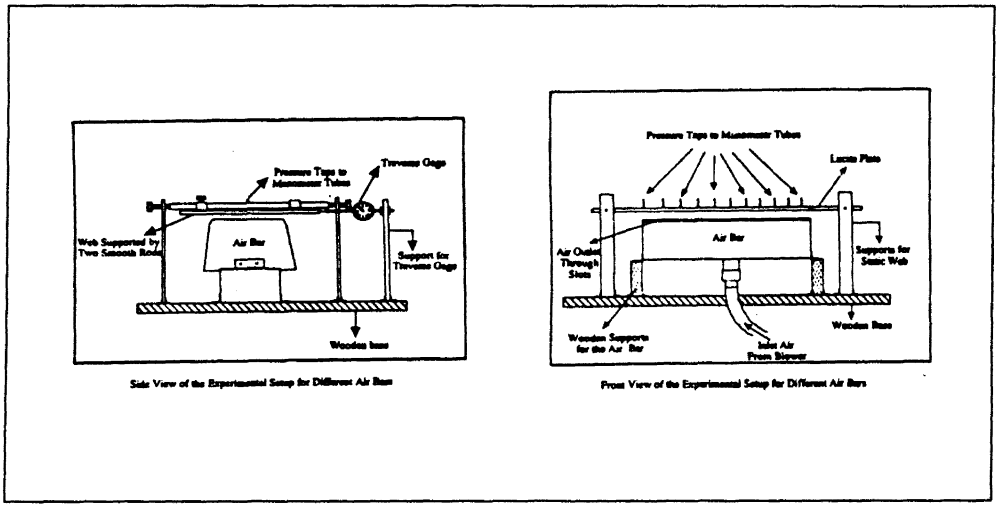

Figure 9. Experimental Setup for Air Bar D (generated by Pinnamaraju)

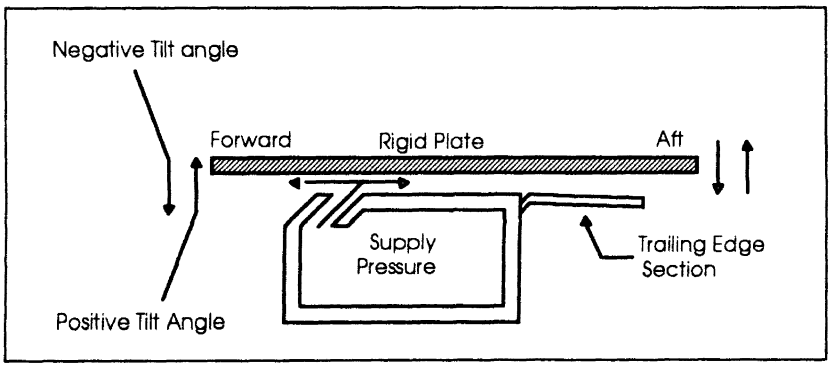

Figure 10. Tilt Angle Orientation

Table 2 summarizes the different angles and average distances at which the pressure distribution data was recorded for air bar D with the trailing slotted vent holes.

TABLE 2

DATA PARAMETERS FOR AIR BAR D
WITH VENT SLOTS

Angle/Distance	0.05"	0.06"	0.07"	0.08"	0.09"	0.10"	0.11"
0.4407°	RD	NR	RD	NR	RD	NR	NR
0.8814°	NR	RD	NR	RD	NR	RD	NR
1.322°	NR	NR	RD	NR	RD	NR	RD
-0.4407°	RD	NR	NR	NR	NR	NR	NR
-0.8814°	NR	RD	NR	NR	NR	RD	NR
-1.322°	NR	NR	RD	NR	NR	NR	RD

NR = Not Recorded, RD = Recorded Data

Table 3 summarizes the different angles and average distances at which the pressure distribution data was recorded for air bar D without trailing slotted vent holes.

A series of plots were generated from the experimental data of pressure versus longitudinal position on the plate. To summarize the information, total lift and center of pressure on the plate were calculated for air bar D with and without the slotted vent holes.

TABLE 3

DATA PARAMETERS FOR AIR BAR D WITHOUT VENT SLOTS

Angle/Distance	0.05"	0.06"	0.07"	0.08"	0.09"	0.10"	0.11"
0.4407°	RD	NR	RD	NR	RD	NR	NR
0.8814°	NR	RD	NR	RD	NR	RD	NR
1.322°	NR	RD	NR	NR	RD	NR	RD
-0.4407°	RD	NR	NR	NR	RD	NR	NR
-1.322°	NR	NR	RD	NR	NR	NR	RD

NR = Not Recorded, RD = Recorded Data

Obtaining Desired Data

Total lift on the plate is desired. To get total lift on the plate for a given pressure distribution, one needs to integrate. Say for example there is a pressure distribution as in figure 11.

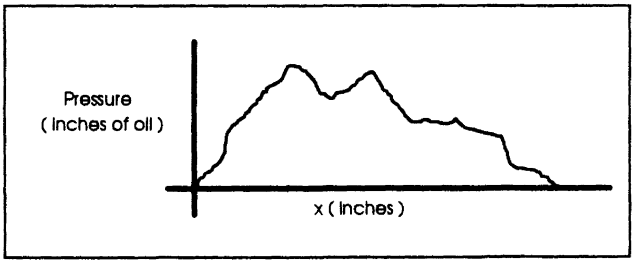

Figure 11. Example Pressure Distribution

To get the total lift one would integrate with respect to x.

$$\text{Total Lift} = \int P \times dx$$

Total Moment is required to generate the center of pressure.

$$\text{Total Moment} = \int P \times x \times dx$$

Center of pressure is calculated by taking the total moment generated by the lifting force and dividing by the total lift. To approximate the integrals, the trapezoidal rule of numerical integration will be applied to the recorded pressure data. Total lift and total moment will now be calculated by the following summations.

$$\text{Total Lift} = \sum P \times \Delta x$$

$$\text{Total Moment} = \sum P \times \Delta x \times x$$

This allows the center of pressure to be given by the following equation.

$$\text{Center of Pressure} = (\sum P \times \Delta x \times x) \div (\sum P \times \Delta x)$$

From this data, center of lift versus angle of rotation of the air bar and total lift versus gap spacing can be plotted.

Flexible Web Experiment

Modeling the web as a rigid plate is obviously a rough comparison. The flatness of a flexible web can never achieve that of a rigid plate for it has to deform to suit the aerodynamics of the particular float system. Eventually one should depart from using a rigid plate and use a flexible membrane to model the web. A paper membrane was stretched across air bar D. The web was held stationary with a prescribed amount of tension. With no air flow the web was flat on top of the air bar. With the air bar in operation, a side profile shape was generated for the web as it floats above the air bar. This gives a visible idea of the relationship between the spacing of air bar and web and the longitudinal distance across the air bar. This information was recorded on camera and visual observations noted.

CHAPTER IV

RESULTS OF THE EXPERIMENTATION

Flow Visualization

Results of the water table experiments were captured on video tape. A description of those results for air bar A are summarized in Table 4. Parameters that were recorded and observed are the separation point of the flow from the wall and bar, recirculation of the dye back into the flow pattern, and general flow pattern characteristics. Flow patterns for the other air bar geometrys were recorded visually only and will be discussed later.

Reynolds number calculations for air bar A were computed for the water table experiments and for the air pressure distribution experiments. The Reynolds' number in water was found to be 2785. The Reynolds' number in air was found to be 3787. See Appendix G for details.

TABLE 4

FLOW VISUALIZATION GENERAL OBSERVATIONS

Flow/Spacing	0.025 Inch Gap	0.063 Inch Gap	0.100 Inch Gap
0.5 GPM	• θ_c=78-82° • flow is smooth and stays attached to impinging wall and bar • no recirculation	• θ_c=82-94° • flow is smooth and stays attached equally to wall and bar • no recirculation	• θ_c=65-120° • flow is smooth and stays attached equally to wall and bar • recirculation: ?
1.5 GPM	• θ_c=78-95° • flow is smooth and attaches equally to wall and bar • no recirculation	• θ_c=79-82° • flow is smooth and attaches equally to wall and bar • recirculation: ?	• θ_c=80-103° • flow starting to attach closer to the wall • apparent recirculation
2.5 GPM	• θ_c=75-79° • flow not smooth and wants to attach more to the wall • apparent recirculation	• θ_c=75-84° • flow separates from tube earlier and attaches to plate • apparent recirculation	• θ_c=80-85° • flow is not smooth and attaches to wall • recirculation: ?
3.5 GPM	• θ_c=70-78° • flow tends to want to attach to wall • recirculation: ?	• θ_c=62-72° • flow tends to attach to wall more • apparent recirculation	• θ_c=70-80° • flow attaches to wall • apparent recirculation
4.5 GPM	• not available	• θ_c=70-75 • flow mostly attaches to wall • recirculation: ?	• $\theta_c \cong 70$ • flow attaches to wall • apparent recirculation

Pressure Distributions

Pressure distributions across the length of air bar D were recorded with and without the trailing slotted vent holes and can be viewed in Appendix B and C. Figure 12 contains a sample of the type of distribution obtained from air bar D for the two different cases of the trailing edge.

Graphs of the pressure distributions for air bar D with the trailing slotted vent holes are in Appendix D. Graphing all the pressure distributions for air bar D without trailing slotted vent holes would not provide much more insight than already obtained. The graphs are not presented but can easily be generated if needed.

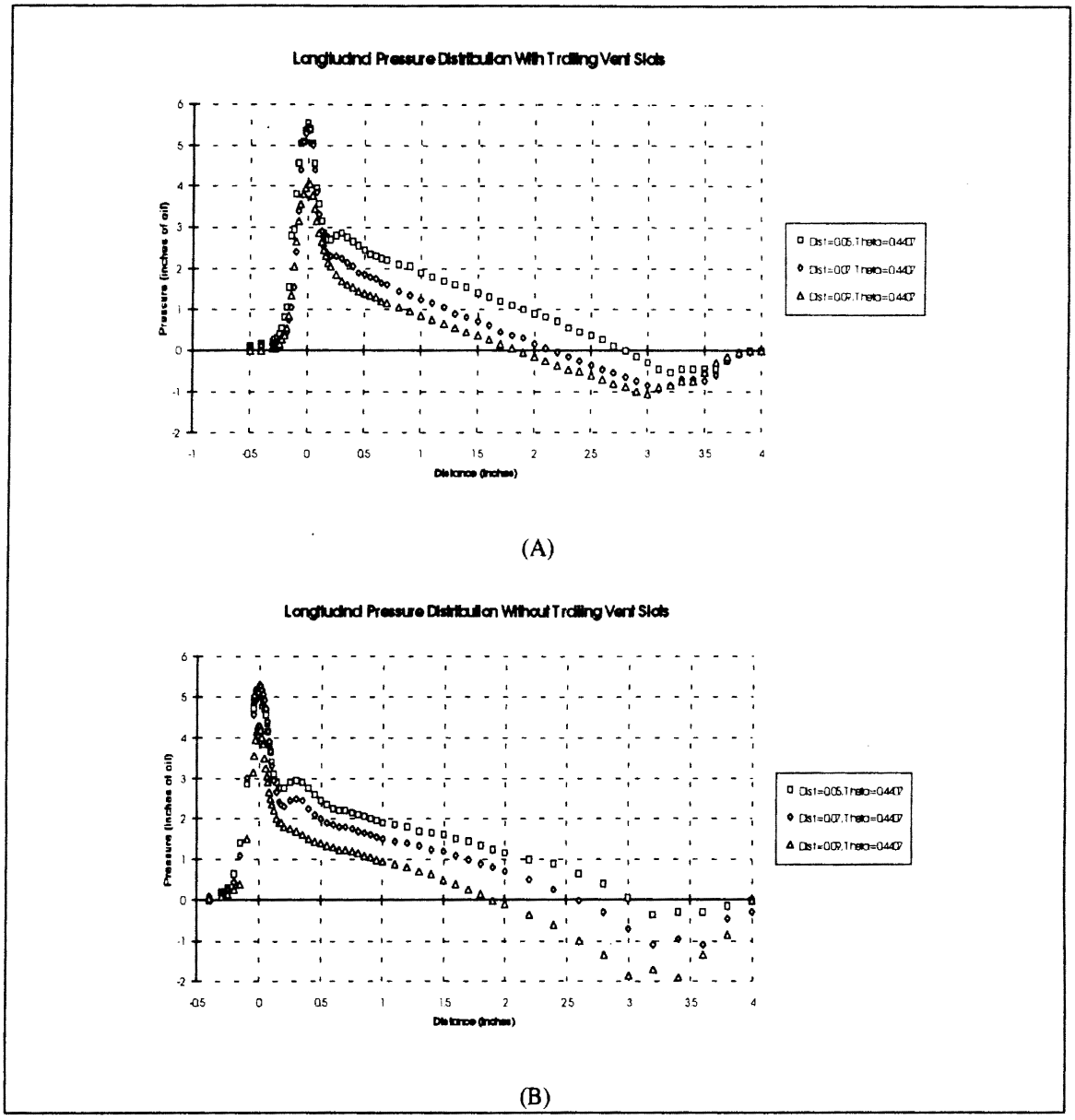

Figure 12. General Pressure Distribution for Air Bar D

Center of Lift and Total Lift Data

Table 5 contains the center of lift and total lift data for air bar D with the slotted vented holes in the trailing edge

TABLE 5

SUMMARIZED DATA FOR AIR BAR D
WITH VENT SLOTS

Angle/ Distance	0.05"	0.06"	0.07"	0.08"	0.09"	0.10"	0.11"
0.4407°	C.O.L.=0.5321 T.L.=0.1443	NR	C.O.L.=-0.4146 T.L.=0.07532	NR	C.O.L.=-1.5572 T.L.=0.04173	NR	NR
0.8814°	NR	C.O.L.=0.6336 T.L.=0.1623	NR	C.O.L.=-0.33.9 T.L.=0.0735	NR	C.O.L.=-0.1818 T.L.=0.0849	NR
1.322°	NR	NR	C.O.L.=0.5621 T.L.=0.1464	NR	C.O.L.=0.2137 T.L.=0.1142	NR	C.O.L.=-0.6055 T.L.=0.05596
-0.4407°	C.O.L.=-0.7338 T.L.=0.04828	NR	NR	NR	NR	NR	NR
-0.8814°	NR	*C.O.L.=-68.9 T.L.=0.06114	NR	NR	NR	C.O.L.=2.5461 T.L.=-0.05233	NR
-1.322°	NR	NR	C.O.L.=2.7809 T.L.=-0.03591	NR	NR	NR	C.O.L.=1.4318 T.L.=-0.1085

NR = Not Recorded, * = Division Error

Table 6 contains the center of lift and total lift data for air bar D without the slotted vented holes in the trailing edge.

TABLE 6

SUMMARIZED DATA FOR AIR BAR D
WITHOUT VENT SLOTS

Angle/ Distance	0.05"	0.06"	0.07"	0.08"	0.09"	0.10"	0.11"
0.4407°	C.O.L.=0.7741 T.L.=0.1594	NR	C.O.L.=-0.5605 T.L.=0.09927	NR	*C.O.L.=-9.8908 T.L.=0.014258	NR	NR
0.8814°	NR	C.O.L.=1.0244 T.L.=0.20167	NR	C.O.L.=-0.7111 T.L.=0.076978	NR	C.O.L.=-1.1164 T.L.=0.072638	NR
1.322°	NR	C.O.L.=1.1644 T.L.=0.22661	NR	NR	C.O.L.=-0.1140 T.L.=0.107857	NR	C.O.L.=-1.9353 T.L.=0.056926
-0.4407°	C.O.L.=-0.4102 T.L.=0.057195	NR	NR	NR	*C.O.L.=3.3946 T.L.=-0.04979	NR	NR
-1.322°	NR	NR	*C.O.L.=-78.9 T.L.=0.000947	NR	NR	NR	C.O.L.=1.8620 T.L.=-0.1591

NR = Not Recorded, * = Division Error

Center of Lift and Total Lift Graphs

Limitations in the number of successful data points recorded and in the graphics software required the interpolation of some data points in figure 13 and 14. It is the general trends of this graph that is important, not the exact value at each of the desired data points. The interpolated data points are designated with a # symbol.

Using Tables 5 and 6, graphs of total lift versus gap spacing are generated for air bar D and can be viewed in figure 13.

Again using Tables 5 and 6, graphs of center of lift versus tilt angle are generated for air bar D and can be viewed in figure 14.

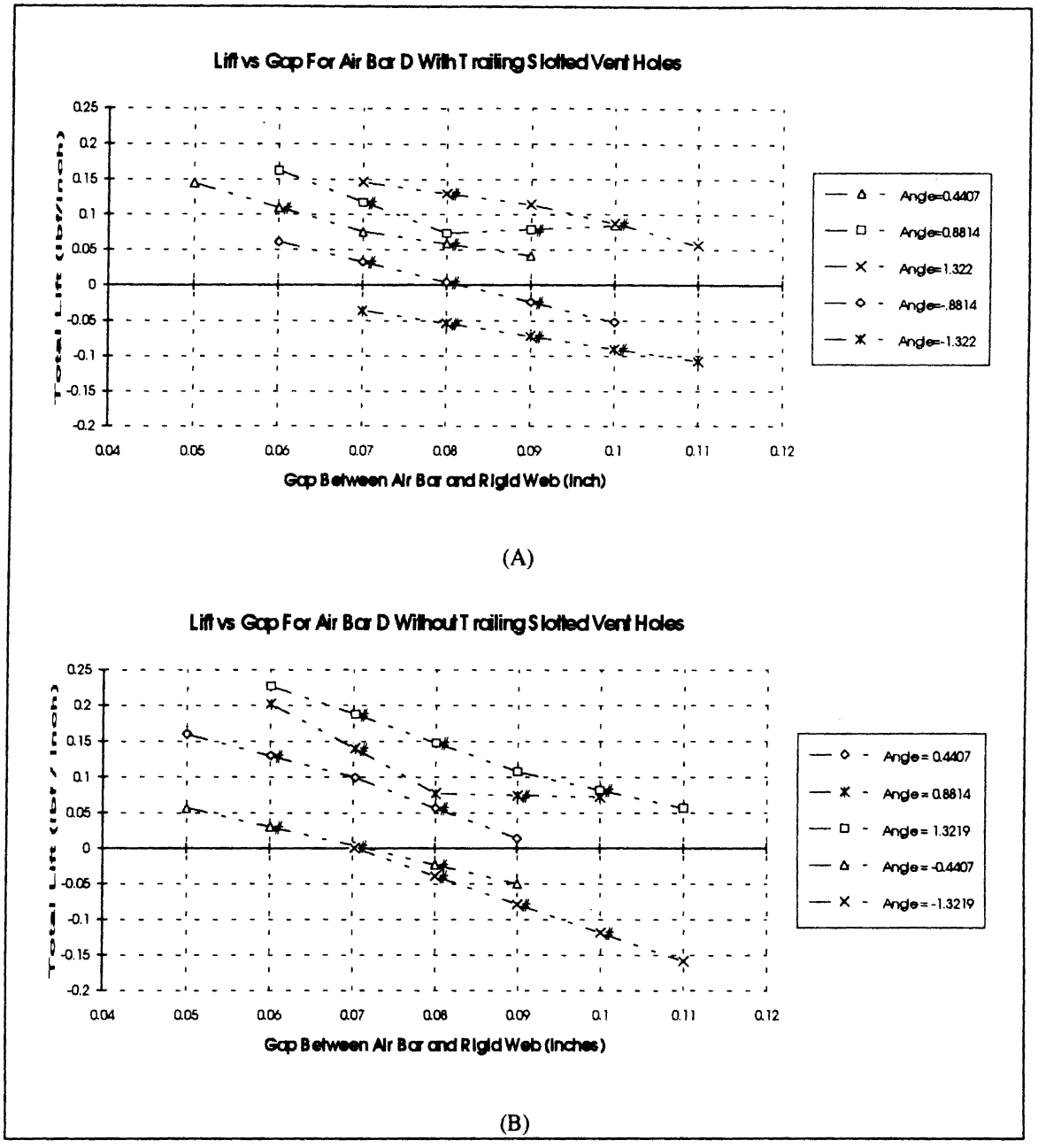

Figure 13. Total Lift Vs Gap for Air Bar D

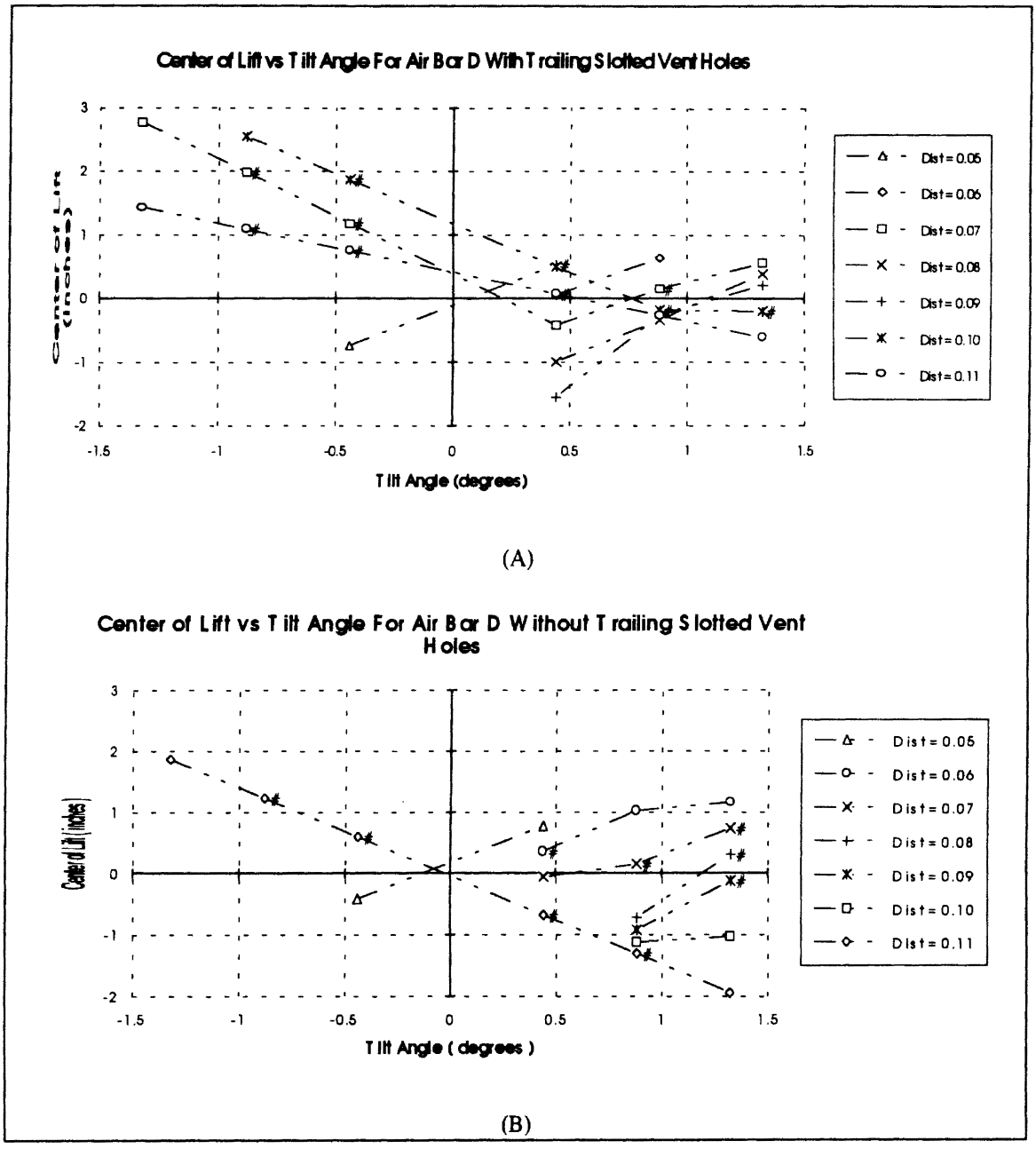

Figure 14. Center of Lift Vs Tilt Angle for Air Bar D

Flexible Web Experiment

The flexible membrane experiment was carried out using 5.124 inch H_2O in the pressure chamber of air bar D. Visual results are on 35mm film. Profiles were obtained for air bar D with and without the trailing vent holes. The chamber pressure was noted to be unaffected by the presence of the flexible web or by the modification of the trailing vent holes. The web sought a natural flotation height around 0.406 inch over the main section of the air bar. The height over the trailing section varied. The trailing section with the slotted vent holes maintained a gap of 0.263 inch (+-3/32 inch). Without the trailing vent holes, a gap was maintained at 0.175 inch (+-3/32 inch). A six inch ruler with a resolution of 1/32 inch was used to measure the flotation height of the flexible web.

The tension for the two cases also varied. The tension required to maintain steady flotation for air bar D with trailing vent slots is measured to be 0.181 pound per inch. Without trailing vent slots the tension was measured to be 0.319 pound per inch.

CHAPTER V

SUMMARY

Discussion

Flow Visualization

The purpose of flow visualization is to observe dynamic flow patterns between the web and air bar. There is a relationship among the pressure distribution between the web-air bar surface and the web flotation characteristics. Suppose there was a diffuser that displayed uniform flow dispersion as in figure 15A. Let the flow not attach to the web or the air bar but smoothly fill the space between the two. One might expect the pressure distribution to increase as the flow proceeds outwards away from the stagnation point as depicted. If there was a flow pattern that attached to the impinging wall or web and remained attached as in figure 15B, one might expect the pressure along the wall to remain constant as shown. For flow patterns that attach somewhat to the wall and partially to the web, a combination of the two pressure distributions could be expected. This combination of pressure distributions could cause instabilities and irregularities in how the web would float above the air bar. The obvious point to be made is that flow patterns and the pressure distributions between a web and air bar largely

influences web flotation. Flow visualization gives an insight to the characteristics and behavior of pressure distributions.

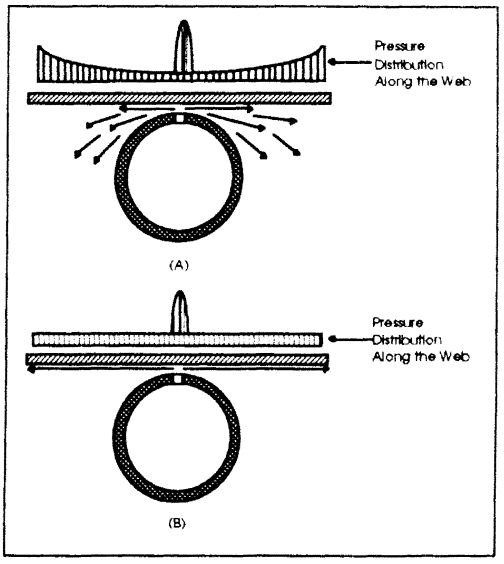

Figure 15. Hypothetical Flow Pattern

Upon observing the flow patterns for air bar A, it can be seen that for low flow rates (less than 2.5 GPM) the flow patterns attach equally to the wall and air bar. The dye that was injected into the flow stream would be dispersed evenly and flow smoothly between air bar and plate. As the velocity of the water is increased, the flow tends to attach more and more to the wall. The pressure along the wall appears to continually decrease in relation to the neighboring areas. This suggests that the flow along the impingement wall is accelerated. This also suggests that the Coanda effect has more influence at the higher velocities and Reynolds

numbers. The flow of dye between air bar and plate also became less smooth. A rough sketch of what was observed can be seen in figure 16.

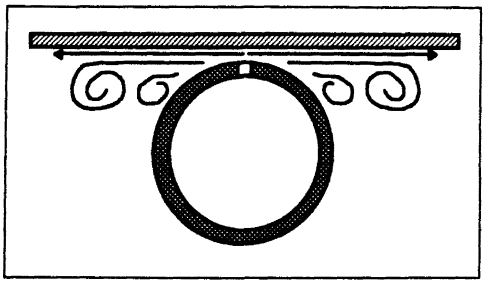

Figure 16. Observed Eddies Between Air Bar A and Rigid Web

The eddies that were observed possibly explain the kinks and irregularities in the pressure distribution generated by Pinnamaraju. See figure 7.

For the sinusoidal cushion tube of type air bar B, the attachment of flow to the wall is independent of water velocity. The Coanda effect appears to dominate in all regimes of operation. The flow exits the nozzles and impinges on the plate. Part of the flow proceeds to the center of the air bar and enters the holes in the middle which exit to atmospheric pressure. The rest of the flow impinges on the wall and proceeds outward away from the air bar. When the impingement wall is tilted, the flow patterns do proceed toward the center of the air bar to exit through the center holes but the flow is disturbed by an unequal pressure distribution. The pressure is higher on the side nearest the impingement wall. This is a positive result in the fact that the section of the air bar nearest the wall would want to lift the web more than the section further from the wall. However, this unequal pressure distribution in the middle of the air bar appears to produce ill effects.

The flow proceeding to the middle holes to exit to ambient is disturbed. This could produce unknown effects to a flexible web that is not parallel or concentric over the air bar.

Air bar C is also a sinusoidal cushion tube just as air bar B. However, the operation of air bar C is slightly different. The flow exits the nozzles and the center holes together to impinge on the web or plate. The flow for this air bar also attaches strongly to the impingement wall implying that Coanda effect is influencing the mode of operation. Smooth operation was recorded for all water velocities. The sensitivity of this air bar to slight tilt angles seemed to be less than air bar B. If the air bar was tilted, the high pressure zones over the air bar would grow or decrease depending on which side was closer to the impingement wall.

Total Lift

Total lift vs. gap spacing in figure 13 summarizes some of the pressure distribution results. It can be seen from these two graphs that as the tilt angle is increased, the total lift force increases. This is intuitive since the plate is simply increasing its angle of attack in a flow stream. The total lift force is shown to increase inversely proportional to the average gap spacing between plate and air bar. This is consistent with the results by Davies and Wood. In comparing the two graphs, the total lift force on the plate is greater when the trailing slotted vent holes are not present. It is apparent that the vent holes allow the overall pressure on the plate to drop. This also is intuitive in the fact that the holes should allow the pressure between plate and air bar to return smoothly to ambient.

Center of Pressure

In figure 14, the center of lift vs. tilt angle graphs are presented. A positive slope on these graphs implies that for an increase in tilt angle, the center of pressure increases. This would act to stabilize the plate if disturbed from the parallel position above the air bar. A negative slope implies just the opposite. As the tilt angle is increased, the center of pressure decreases. This would act as a form of divergence, hence unstable. For the two cases presented, the slopes of the graphs change from stable to unstable as the tilt angle is decreased from a positive to negative angle. As the average gap is increased, the instability tends to occur at a higher tilt angle. For instance in figure 14A, an average gap distance of 0.07 inch begins its instability trend around 0.40 degree. An average gap distance of 0.10 degree begins its instability trend at 0.8 degree or higher. Without the trailing slotted vent holes, figure 14B, the system seems to possess higher stability. The only recorded negative slope occurred at an average gap distance higher than 0.10 inch.

Flexible Web

The results of the flexible membrane experiment implied that the flotation height over the main section was largely unaffected by the modifications of the trailing section. What was affected was the tension on the web to maintain steady flotation and the flotation height over the trailing section. There was a 76% increase in tension required to keep the web from bouncing when the trailing section did not have vented slots. The tension increased while the flotation height

decreased. This is a negative response because the lack of the vented slots increases the chances of the web touching the air bar.

The natural flotation height over air bar D ranges from nearly 0.20 inch to 0.40 inch for a flexible web. This is well above the stable regime pointed out by the rigid web experiments. This is not intuitively what was expected. The errors between the flexible web experiment and the rigid plate model can be largely attributed to the fact that the rigid web largely affects the flow above air bar D. The surface of the air bar is not flat but is slightly bowed between the main section and the trailing section. See figure 17.

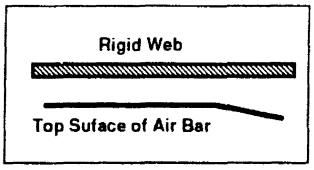

Figure 17. Rigid Web-Bowed Air Bar Illustration

Because the web is rigid, the flow of air could behave as in an expanded nozzle. This would cause the flow of air passing through the trailing vent holes to behave differently as compared with a flexible web, thus affecting flotation height and other parameters.

General Web Stability

The importance of this investigation was to develop a better understanding concerning out of plane dynamics of a web as it floats over an air bar. An understanding of web stability is vital if better flotation devices are to be developed. Pinnamaraju (8) has pointed out that a negative slope on a lift force vs. gap graph is a stable characteristic. When the gap spacing is very small, it would be desirable for this graph to possess very large negative slopes. The large negative slope would act like a very stiff spring to keep the web from touching the surface of the air bar. As the gap spacing becomes larger, the spring stiffness between web and air bar can decrease. The margin of safe travel for the web gets bigger thus requiring a negative lift vs. gap slope of less magnitude.

In using air bars of type D, this spring stiffness is very important. The natural flotation height of the web as it floats over air bar D is less than the natural flotation height of the previously mentioned air bars. It was observed in the flexible web experiment that the spring stiffness of air bar D was very high. One could put a surprisingly large amount of force on the web with a finger or hand and still not make the web touch the air bar. It was observed that the spring stiffness at the trailing edge was less with trailing vented slots. However, the gap spacing was much wider, thus following the stable force vs. gap spacing characteristics pointed out by Pinnamaraju (8).

Just as the lift force vs. gap spacing relationship influences web stability, so does the center of pressure and the moment it creates on the web. It has been shown that the tilt angle affects the center of pressure thus influencing the moment created on the web. Imagine an web-air bar configuration as in figure 18.

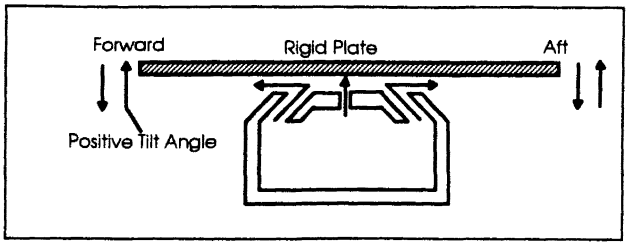

Figure 18. Moment/Tilt Angle Demonstration

If the tilt angle becomes more positive, the center of pressure should move aft to stabilize the web (assuming a positive moment is counterclockwise). Similarly, if the tilt angle becomes more negative, the center of pressure should move forward to apply a negative moment to stabilize the web. If either of these two conditions occur and the proper moment to stabilize the web is not applied, divergence occurs. Suppose moment vs. tilt angle were as in figure 19.

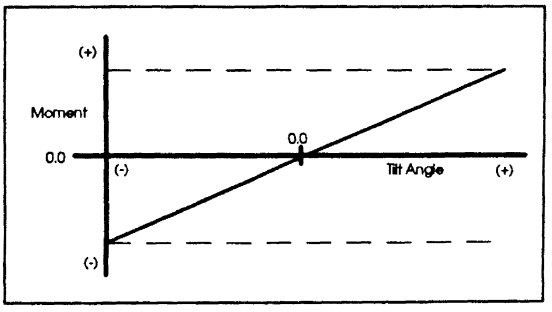

Figure 19. Moment Vs. Tilt Angle

Larger absolute values of the tilt angle would require larger restoring moment forces. Anything other than what is depicted here would be undesirable and unstable.

Conclusions

1. The sinusoidal cushion tube type air bars (air bars B and C) are designed such that the flow of the impinging fluid attaches to the web. The flow directly adjacent to the web is accelerated and is at low pressure. The neighboring area between this low pressure zone and the air bar is a relatively high pressure zone and thus generates the lift.
2. The sinusoidal cushion tube air bars operate smoothly when the web is symmetrically placed above the air bar; but if the web is tilted or not symmetrical, air bar B tends to produce irregular flow patterns and possible instabilities. Air bar D operates at smaller gap spacing and possesses larger negative slopes on the lift vs. gap graphs than other types of air bars. This leads to better drying efficiency and more control in keeping the web from touching the air bar.
3. Air bar D generates more total lift on a rigid web when there are no trailing vent slots present.
4. Total lift force increases with increasing tilt angles of a rigid web for air bar D.
5. Lift force on a rigid web increases inversely proportional to the average gap spacing.
6. Center of pressure behaves in an unstable manner as tilt angle decreases from positive to negative. This instability is enhanced as the average gap spacing

increases. This implies that the region of favorable stability using air bar D is less than 0.10 inch.

7. Trailing vent slots are required for air bar D to keep the tension to a minimum and the flotation height over the trailing edge at a safe margin. The design of the trailing vent slots are important. Their presence are required to reduce tension on the web and decrease chances for web flutter or "buzz". However, their presence also reduces the stiffness between air bar and web, thus reducing the control in keeping the web from touching the air bar.

Future Work

1. It is clear that there are discrepancies between the rigid web experiments and the flexible web experiment. The natural flotation height of a flexible web is out of the stable regime pointed out by the center of pressure stability results. Further investigation of flexible webs is required to find out why this is so. A more precise method of recording and measuring the flexible web as it floats above the air bar is needed. This will lead to a more exact web profile and thus give more insight to the forces supporting the web.
2. The effect of web speed is an important design factor that can not be overlooked. A moving web will possess non-symmetrical flotation behavior. A further study of symmetrical air bar designs and the influence of tilt angle between static and moving webs should be conducted.
3. Investigation of entry angle as the web approaches the air bar would be helpful in establishing overall stability characteristics and its role in web flotation. The entry angle being the overall angle at which the web

approaches the air bar. This would be an initial investigation into further studies involving flutter or "buzz".

4. A theoretical analysis of the out of plane and lateral motions, which are interrelated, should be further investigated.
5. Further investigation on how the restoring moment force created by center of pressure movements affects a flexible web.

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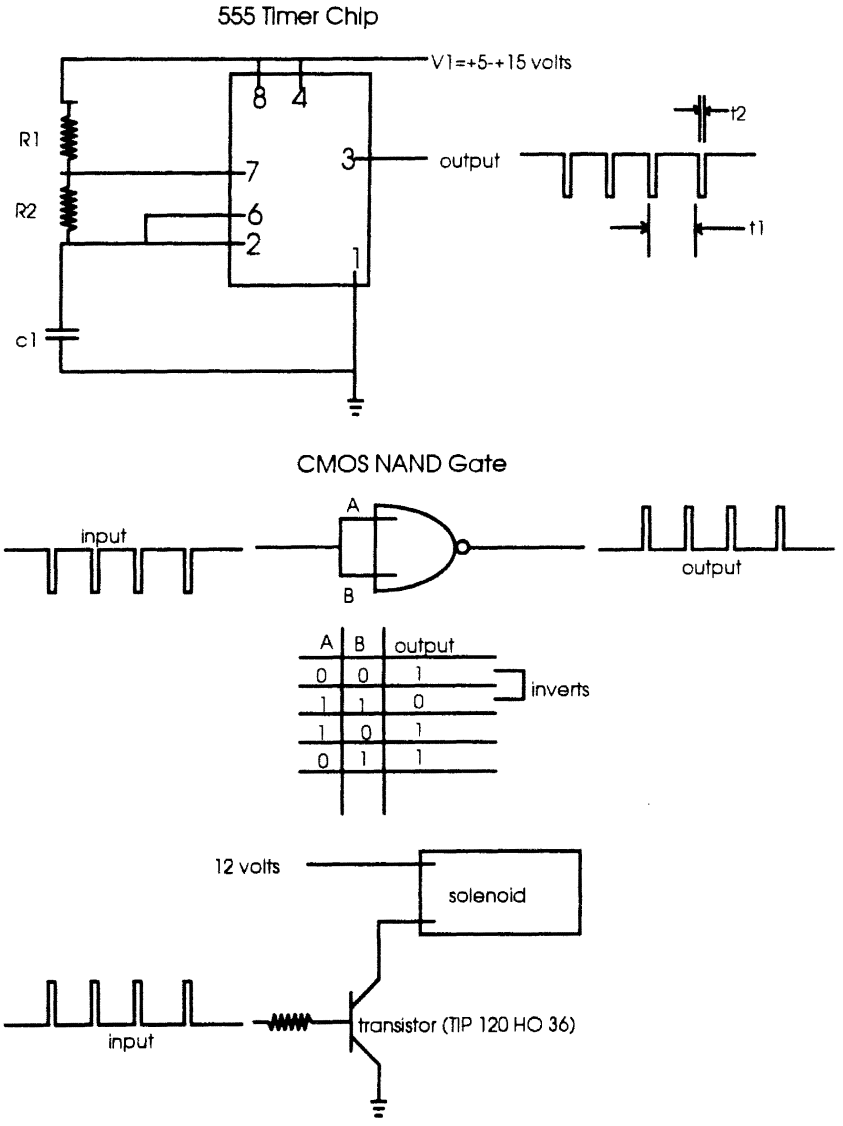
APPENDIXES

APPENDIX A

DYE INJECTION CIRCUIT DETAILS

Below are the major components of the dye pulser circuit. The output of one component is the input of the next. The setup was based on a circuit in a Radio Shack Handbook.



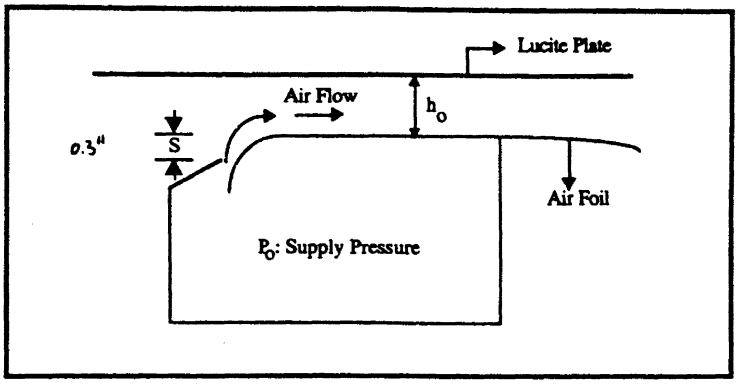
t1 = time between individual pulses = 0.693*(R1 + R2)*C1

t2 = pulse width = 0.693*R2*C1

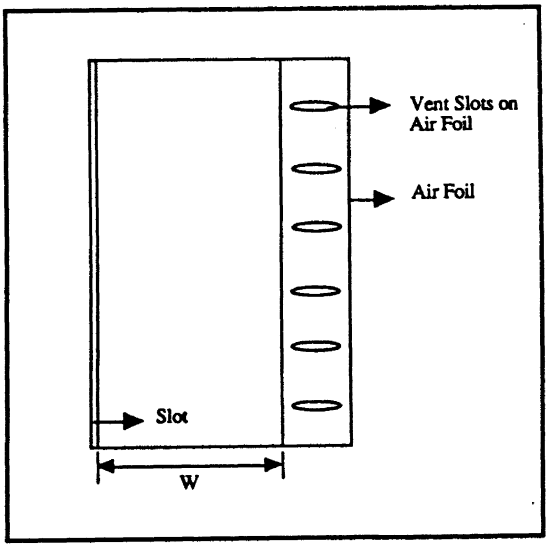
Choose C1 then determine R1 and R2 for t1 = 6 seconds and t2 = 2 seconds. For C1 = 47μF, R1 and R2 were determined to be 61 kΩ and 123 kΩ respectively.

APPENDIX B

PHYSICAL DETAILS OF AIR BAR D



Air Foil Tube



Top View of the Air Foil Bar

Diagrams supplied by Pinnamaraju

S = 0.3 inch
W = 5.5 inch
FW = 2.0 inch
TL = 1.5 inch
TW = 0.4 inch

APPENDIX C

PRESSURE DISTRIBUTION DATA FOR AIR BAR D WITH TRAILING SLOTTED VENT HOLES

Theta = 0.4407 degree
Dist = 0.05
inch

BACK 0.04 inch	FRONT 0.06 inch						
DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf/inch)
-0.5	0.1	4.45	4.55	0.0125	-0.00625	0.532102	0.144337
-0.4	0.15	4.4	4.55	0.0175	-0.007		
-0.3	0.2	4.35	4.55	0.0045	-0.00135		
-0.28	0.25	4.3	4.55	0.0055	-0.00154		
-0.26	0.3	4.25	4.55	0.007	-0.00182		
-0.24	0.4	4.15	4.55	0.0095	-0.00228		
-0.22	0.55	4	4.55	0.0135	-0.00297		
-0.2	0.8	3.75	4.55	0.0185	-0.0037		
-0.18	1.05	3.5	4.55	0.026	-0.00468		
-0.16	1.55	3	4.55	0.0435	-0.00696		
-0.14	2.8	1.75	4.55	0.0575	-0.00805		
-0.12	2.95	1.6	4.55	0.0675	-0.0081		
-0.1	3.8	0.75	4.55	0.0835	-0.00835		
-0.08	4.55	0	4.55	0.096	-0.00768		
-0.06	5.05	-0.5	4.55	0.1015	-0.00609		
-0.04	5.1	-0.55	4.55	0.1045	-0.00418		
-0.02	5.35	-0.8	4.55	0.109	-0.00218		
0	5.55	-1	4.55	0.1095	0		
0.02	5.4	-0.85	4.55	0.1045	0.00209		
0.04	5.05	-0.5	4.55	0.096	0.00384		
0.06	4.55	0	4.55	0.085	0.0051		
0.08	3.95	0.6	4.55	0.075	0.006		
0.1	3.55	1	4.55	0.067	0.0067		
0.12	3.15	1.4	4.55	0.06	0.0072		
0.14	2.85	1.7	4.55	0.056	0.00784		
0.16	2.75	1.8	4.55	0.0545	0.00872		
0.18	2.7	1.85	4.55	0.054	0.00972		
0.2	2.7	1.85	4.55	0.1375	0.0275		
0.25	2.8	1.75	4.55	0.14125	0.035313		
0.3	2.85	1.7	4.55	0.14	0.042		
0.35	2.75	1.8	4.55	0.135	0.04725		
0.4	2.65	1.9	4.55	0.13	0.052		
0.45	2.55	2	4.55	0.125	0.05625		
0.5	2.45	2.1	4.55	0.12	0.06		
0.55	2.35	2.2	4.55	0.11625	0.063937		

0.6	2.3	2.25	4.55	0.11375	0.06825
0.65	2.25	2.3	4.55	0.11125	0.072312
0.7	2.2	2.35	4.55	0.215	0.1505
0.8	2.1	2.45	4.55	0.2075	0.166
0.9	2.05	2.5	4.55	0.1975	0.17775
1	1.9	2.65	4.55	0.185	0.185
1.1	1.8	2.75	4.55	0.175	0.1925
1.2	1.7	2.85	4.55	0.165	0.198
1.3	1.6	2.95	4.55	0.1575	0.20475
1.4	1.55	3	4.55	0.1475	0.2065
1.5	1.4	3.15	4.55	0.135	0.2025
1.6	1.3	3.25	4.55	0.125	0.2
1.7	1.2	3.35	4.55	0.115	0.1955
1.8	1.1	3.45	4.55	0.105	0.189
1.9	1	3.55	4.55	0.095	0.1805
2	0.9	3.65	4.55	0.085	0.17
2.1	0.8	3.75	4.55	0.075	0.1575
2.2	0.7	3.85	4.55	0.0625	0.1375
2.3	0.55	4	4.55	0.05	0.115
2.4	0.45	4.1	4.55	0.04	0.096
2.5	0.35	4.2	4.55	0.03	0.075
2.6	0.25	4.3	4.55	0.0175	0.0455
2.7	0.1	4.45	4.55	0.005	0.0135
2.8	0	4.55	4.55	-0.0075	-0.021
2.9	-0.15	4.7	4.55	-0.0225	-0.06525
3	-0.3	4.85	4.55	-0.0375	-0.1125
3.1	-0.45	5	4.55	-0.05	-0.155
3.2	-0.55	5.1	4.55	-0.05	-0.16
3.3	-0.45	5	4.55	-0.045	-0.1485
3.4	-0.45	5	4.55	-0.045	-0.153
3.5	-0.45	5	4.55	-0.045	-0.1575
3.6	-0.45	5	4.55	-0.035	-0.126
3.7	-0.25	4.8	4.55	-0.0175	-0.06475
3.8	-0.1	4.65	4.55	-0.005	-0.019
3.9	0	4.55	4.55	0	0
4	0	4.55	4.55		

Theta = 0.4407 degree
Dist = 0.07
inch

BACK	FRONT
0.06 inch	0.08 inch

CENTER TOTAL

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	of LIFT (inch)	LIFT (lbf / inch)
-0.5	0.05	4.5	4.55	0.0075	-0.00375	-0.41466	0.075315
-0.4	0.1	4.45	4.55	0.0125	-0.005		
-0.3	0.15	4.4	4.55	0.003	-0.0009		
-0.28	0.15	4.4	4.55	0.0035	-0.00098		
-0.26	0.2	4.35	4.55	0.004	-0.00104		
-0.24	0.2	4.35	4.55	0.005	-0.0012		
-0.22	0.3	4.25	4.55	0.0065	-0.00143		
-0.2	0.35	4.2	4.55	0.008	-0.0016		
-0.18	0.45	4.1	4.55	0.012	-0.00216		
-0.16	0.75	3.8	4.55	0.018	-0.00288		
-0.14	1.05	3.5	4.55	0.026	-0.00364		
-0.12	1.55	3	4.55	0.0395	-0.00474		
-0.1	2.4	2.15	4.55	0.058	-0.0058		
-0.08	3.4	1.15	4.55	0.078	-0.00624		
-0.06	4.4	0.15	4.55	0.095	-0.0057		
-0.04	5.1	-0.55	4.55	0.104	-0.00416		
-0.02	5.3	-0.75	4.55	0.1075	-0.00215		
0	5.45	-0.9	4.55	0.1085	0		
0.02	5.4	-0.85	4.55	0.104	0.00208		
0.04	5	-0.45	4.55	0.094	0.00376		
0.06	4.4	0.15	4.55	0.0825	0.00495		
0.08	3.85	0.7	4.55	0.0715	0.00572		
0.1	3.3	1.25	4.55	0.062	0.0062		
0.12	2.9	1.65	4.55	0.0545	0.00654		
0.14	2.55	2	4.55	0.0495	0.00693		
0.16	2.4	2.15	4.55	0.047	0.00752		
0.18	2.3	2.25	4.55	0.046	0.00828		
0.2	2.3	2.25	4.55	0.115	0.023		
0.25	2.3	2.25	4.55	0.11375	0.028438		
0.3	2.25	2.3	4.55	0.11	0.033		
0.35	2.15	2.4	4.55	0.105	0.03675		
0.4	2.05	2.5	4.55	0.09875	0.0395		
0.45	1.9	2.65	4.55	0.09375	0.042188		
0.5	1.85	2.7	4.55	0.09125	0.045625		
0.55	1.8	2.75	4.55	0.08875	0.048812		
0.6	1.75	2.8	4.55	0.085	0.051		
0.65	1.65	2.9	4.55	0.08125	0.052812		
0.7	1.6	2.95	4.55	0.1525	0.10675		
0.8	1.45	3.1	4.55	0.14	0.112		
0.9	1.35	3.2	4.55	0.13	0.117		
1	1.25	3.3	4.55	0.12	0.12		
1.1	1.15	3.4	4.55	0.11	0.121		
1.2	1.05	3.5	4.55	0.0975	0.117		

1.3	0.9	3.65	4.55	0.085	0.1105
1.4	0.8	3.75	4.55	0.075	0.105
1.5	0.7	3.85	4.55	0.065	0.0975
1.6	0.6	3.95	4.55	0.0525	0.084
1.7	0.45	4.1	4.55	0.04	0.068
1.8	0.35	4.2	4.55	0.0325	0.0585
1.9	0.3	4.25	4.55	0.0225	0.04275
2	0.15	4.4	4.55	0.01	0.02
2.1	0.05	4.5	4.55	0	0
2.2	-0.05	4.6	4.55	-0.01	-0.022
2.3	-0.15	4.7	4.55	-0.02	-0.046
2.4	-0.25	4.8	4.55	-0.03	-0.072
2.5	-0.35	4.9	4.55	-0.04	-0.1
2.6	-0.45	5	4.55	-0.05	-0.13
2.7	-0.55	5.1	4.55	-0.06	-0.162
2.8	-0.65	5.2	4.55	-0.07	-0.196
2.9	-0.75	5.3	4.55	-0.08	-0.232
3	-0.85	5.4	4.55	-0.09	-0.27
3.1	-0.95	5.5	4.55	-0.09	-0.279
3.2	-0.85	5.4	4.55	-0.0775	-0.248
3.3	-0.7	5.25	4.55	-0.07	-0.231
3.4	-0.7	5.25	4.55	-0.0725	-0.2465
3.5	-0.75	5.3	4.55	-0.0675	-0.23625
3.6	-0.6	5.15	4.55	-0.0425	-0.153
3.7	-0.25	4.8	4.55	-0.0175	-0.06475
3.8	-0.1	4.65	4.55	-0.0075	-0.0285
3.9	-0.05	4.6	4.55	-0.0025	-0.00975
4	0	4.55	4.55	0	0

Theta = 0.4407
degree
Dist = 0.09
inch

BACK 0.08 inch FRONT 0.1 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0	4.55	4.55	0	0	-1.55715	0.041729
-0.4	0	4.55	4.55	0.0025	-0.001		
-0.3	0.05	4.5	4.55	0.001	-0.0003		
-0.28	0.05	4.5	4.55	0.0015	-0.00042		
-0.26	0.1	4.45	4.55	0.0025	-0.00065		

-0.24	0.15	4.4	4.55	0.004	-0.00096
-0.22	0.25	4.3	4.55	0.006	-0.00132
-0.2	0.35	4.2	4.55	0.009	-0.0018
-0.18	0.55	4	4.55	0.014	-0.00252
-0.16	0.85	3.7	4.55	0.022	-0.00352
-0.14	1.35	3.2	4.55	0.034	-0.00476
-0.12	2.05	2.5	4.55	0.047	-0.00564
-0.1	2.65	1.9	4.55	0.058	-0.0058
-0.08	3.15	1.4	4.55	0.067	-0.00536
-0.06	3.55	1	4.55	0.0735	-0.00441
-0.04	3.8	0.75	4.55	0.0775	-0.0031
-0.02	3.95	0.6	4.55	0.08	-0.0016
0	4.05	0.5	4.55	0.081	0
0.02	4.05	0.5	4.55	0.078	0.00156
0.04	3.75	0.8	4.55	0.072	0.00288
0.06	3.45	1.1	4.55	0.066	0.00396
0.08	3.15	1.4	4.55	0.06	0.0048
0.1	2.85	1.7	4.55	0.055	0.0055
0.12	2.65	1.9	4.55	0.051	0.00612
0.14	2.45	2.1	4.55	0.0475	0.00665
0.16	2.3	2.25	4.55	0.0445	0.00712
0.18	2.15	2.4	4.55	0.042	0.00756
0.2	2.05	2.5	4.55	0.0975	0.0195
0.25	1.85	2.7	4.55	0.08875	0.022188
0.3	1.7	2.85	4.55	0.0825	0.02475
0.35	1.6	2.95	4.55	0.07875	0.027563
0.4	1.55	3	4.55	0.075	0.03
0.45	1.45	3.1	4.55	0.07125	0.032063
0.5	1.4	3.15	4.55	0.06875	0.034375
0.55	1.35	3.2	4.55	0.06625	0.036437
0.6	1.3	3.25	4.55	0.0625	0.0375
0.65	1.2	3.35	4.55	0.05875	0.038187
0.7	1.15	3.4	4.55	0.11	0.077
0.8	1.05	3.5	4.55	0.1	0.08
0.9	0.95	3.6	4.55	0.09	0.081
1	0.85	3.7	4.55	0.08	0.08
1.1	0.75	3.8	4.55	0.07	0.077
1.2	0.65	3.9	4.55	0.06	0.072
1.3	0.55	4	4.55	0.05	0.065
1.4	0.45	4.1	4.55	0.04	0.056
1.5	0.35	4.2	4.55	0.03	0.045
1.6	0.25	4.3	4.55	0.02	0.032
1.7	0.15	4.4	4.55	0.01	0.017
1.8	0.05	4.5	4.55	0	0
1.9	-0.05	4.6	4.55	-0.01	-0.019
2	-0.15	4.7	4.55	-0.02	-0.04
2.1	-0.25	4.8	4.55	-0.03	-0.063
2.2	-0.35	4.9	4.55	-0.04	-0.088

2.3	-0.45	5	4.55	-0.0475	-0.10925
2.4	-0.5	5.05	4.55	-0.055	-0.132
2.5	-0.6	5.15	4.55	-0.065	-0.1625
2.6	-0.7	5.25	4.55	-0.075	-0.195
2.7	-0.8	5.35	4.55	-0.085	-0.2295
2.8	-0.9	5.45	4.55	-0.095	-0.266
2.9	-1	5.55	4.55	-0.1025	-0.29725
3	-1.05	5.6	4.55	-0.0975	-0.2925
3.1	-0.9	5.45	4.55	-0.0875	-0.27125
3.2	-0.85	5.4	4.55	-0.08	-0.256
3.3	-0.75	5.3	4.55	-0.075	-0.2475
3.4	-0.75	5.3	4.55	-0.065	-0.221
3.5	-0.55	5.1	4.55	-0.0425	-0.14875
3.6	-0.3	4.85	4.55	-0.0225	-0.081
3.7	-0.15	4.7	4.55	-0.01	-0.037
3.8	-0.05	4.6	4.55	-0.0025	-0.0095
3.9	0	4.55	4.55	0	0
4	0	4.55	4.55	0	0

Theta = 0.8814 degree
Dist = 0.06 inch

BACK 0.04 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0.1	4.45	4.55	0.0125	-0.00625	0.633608	0.162263
-0.4	0.15	4.4	4.55	0.0175	-0.007		
-0.3	0.2	4.35	4.55	0.005	-0.0015		
-0.28	0.3	4.25	4.55	0.0065	-0.00182		
-0.26	0.35	4.2	4.55	0.008	-0.00208		
-0.24	0.45	4.1	4.55	0.011	-0.00264		
-0.22	0.65	3.9	4.55	0.015	-0.0033		
-0.2	0.85	3.7	4.55	0.021	-0.0042		
-0.18	1.25	3.3	4.55	0.0305	-0.00549		
-0.16	1.8	2.75	4.55	0.0435	-0.00696		
-0.14	2.55	2	4.55	0.059	-0.00826		
-0.12	3.35	1.2	4.55	0.075	-0.009		
-0.1	4.15	0.4	4.55	0.0895	-0.00895		
-0.08	4.8	-0.25	4.55	0.0995	-0.00796		
-0.06	5.15	-0.6	4.55	0.104	-0.00624		

-0.04	5.25	-0.7	4.55	0.1055	-0.00422
-0.02	5.3	-0.75	4.55	0.1055	-0.00211
0	5.25	-0.7	4.55	0.1035	0
0.02	5.1	-0.55	4.55	0.0985	0.00197
0.04	4.75	-0.2	4.55	0.089	0.00356
0.06	4.15	0.4	4.55	0.078	0.00468
0.08	3.65	0.9	4.55	0.068	0.00544
0.1	3.15	1.4	4.55	0.06	0.006
0.12	2.85	1.7	4.55	0.056	0.00672
0.14	2.75	1.8	4.55	0.053	0.00742
0.16	2.55	2	4.55	0.0505	0.00808
0.18	2.5	2.05	4.55	0.05	0.009
0.2	2.5	2.05	4.55	0.1275	0.0255
0.25	2.6	1.95	4.55	0.13125	0.032813
0.3	2.65	1.9	4.55	0.13375	0.040125
0.35	2.7	1.85	4.55	0.13375	0.046813
0.4	2.65	1.9	4.55	0.13125	0.0525
0.45	2.6	1.95	4.55	0.12875	0.057938
0.5	2.55	2	4.55	0.1275	0.06375
0.55	2.55	2	4.55	0.12625	0.069437
0.6	2.5	2.05	4.55	0.12375	0.07425
0.65	2.45	2.1	4.55	0.12125	0.078812
0.7	2.4	2.15	4.55	0.24	0.168
0.8	2.4	2.15	4.55	0.235	0.188
0.9	2.3	2.25	4.55	0.2275	0.20475
1	2.25	2.3	4.55	0.22	0.22
1.1	2.15	2.4	4.55	0.2125	0.23375
1.2	2.1	2.45	4.55	0.205	0.246
1.3	2	2.55	4.55	0.195	0.2535
1.4	1.9	2.65	4.55	0.185	0.259
1.5	1.8	2.75	4.55	0.175	0.2625
1.6	1.7	2.85	4.55	0.165	0.264
1.7	1.6	2.95	4.55	0.155	0.2635
1.8	1.5	3.05	4.55	0.145	0.261
1.9	1.4	3.15	4.55	0.135	0.2565
2	1.3	3.25	4.55	0.125	0.25
2.1	1.2	3.35	4.55	0.1125	0.23625
2.2	1.05	3.5	4.55	0.0975	0.2145
2.3	0.9	3.65	4.55	0.0825	0.18975
2.4	0.75	3.8	4.55	0.0675	0.162
2.5	0.6	3.95	4.55	0.0525	0.13125
2.6	0.45	4.1	4.55	0.0375	0.0975
2.7	0.3	4.25	4.55	0.0175	0.04725
2.8	0.05	4.5	4.55	-0.005	-0.014
2.9	-0.15	4.7	4.55	-0.025	-0.0725
3	-0.35	4.9	4.55	-0.0475	-0.1425
3.1	-0.6	5.15	4.55	-0.0625	-0.19375
3.2	-0.65	5.2	4.55	-0.065	-0.208

3.3	-0.65	5.2	4.55	-0.065	-0.2145
3.4	-0.65	5.2	4.55	-0.0625	-0.2125
3.5	-0.6	5.15	4.55	-0.055	-0.1925
3.6	-0.5	5.05	4.55	-0.0375	-0.135
3.7	-0.25	4.8	4.55	-0.0175	-0.06475
3.8	-0.1	4.65	4.55	-0.005	-0.019
3.9	0	4.55	4.55	0	0
4	0	4.55	4.55	0	0

Theta = 0.8814 degree
Dist = 0.08 inch

BACK 0.06 inch FRONT 0.1 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0.05	4.5	4.55	0.005	-0.0025	-0.33186	0.073518
-0.4	0.05	4.5	4.55	0.0075	-0.003		
-0.3	0.1	4.45	4.55	0.0025	-0.00075		
-0.28	0.15	4.4	4.55	0.003	-0.00084		
-0.26	0.15	4.4	4.55	0.003	-0.00078		
-0.24	0.15	4.4	4.55	0.0035	-0.00084		
-0.22	0.2	4.35	4.55	0.0045	-0.00099		
-0.2	0.25	4.3	4.55	0.0055	-0.0011		
-0.18	0.3	4.25	4.55	0.007	-0.00126		
-0.16	0.4	4.15	4.55	0.01	-0.0016		
-0.14	0.6	3.95	4.55	0.0155	-0.00217		
-0.12	0.95	3.6	4.55	0.025	-0.003		
-0.1	1.55	3	4.55	0.038	-0.0038		
-0.08	2.25	2.3	4.55	0.054	-0.00432		
-0.06	3.15	1.4	4.55	0.072	-0.00432		
-0.04	4.05	0.5	4.55	0.0885	-0.00354		
-0.02	4.8	-0.25	4.55	0.096	-0.00192		
0	4.8	-0.25	4.55	0.0945	0		
0.02	4.65	-0.1	4.55	0.089	0.00178		
0.04	4.25	0.3	4.55	0.0795	0.00318		
0.06	3.7	0.85	4.55	0.071	0.00426		
0.08	3.4	1.15	4.55	0.062	0.00496		
0.1	2.8	1.75	4.55	0.053	0.0053		
0.12	2.5	2.05	4.55	0.048	0.00576		
0.14	2.3	2.25	4.55	0.045	0.0063		

0.16	2.2	2.35	4.55	0.0435	0.00696
0.18	2.15	2.4	4.55	0.0425	0.00765
0.2	2.1	2.45	4.55	0.105	0.021
0.25	2.1	2.45	4.55	0.105	0.02625
0.3	2.1	2.45	4.55	0.105	0.0315
0.35	2.1	2.45	4.55	0.10375	0.036313
0.4	2.05	2.5	4.55	0.10125	0.0405
0.45	2	2.55	4.55	0.0975	0.043875
0.5	1.9	2.65	4.55	0.09375	0.046875
0.55	1.85	2.7	4.55	0.0925	0.050875
0.6	1.85	2.7	4.55	0.09125	0.05475
0.65	1.8	2.75	4.55	0.08875	0.057687
0.7	1.75	2.8	4.55	0.17	0.119
0.8	1.65	2.9	4.55	0.16	0.128
0.9	1.55	3	4.55	0.15	0.135
1	1.45	3.1	4.55	0.14	0.14
1.1	1.35	3.2	4.55	0.13	0.143
1.2	1.25	3.3	4.55	0.1175	0.141
1.3	1.1	3.45	4.55	0.105	0.1365
1.4	1	3.55	4.55	0.0925	0.1295
1.5	0.85	3.7	4.55	0.08	0.12
1.6	0.75	3.8	4.55	0.07	0.112
1.7	0.65	3.9	4.55	0.0575	0.09775
1.8	0.5	4.05	4.55	0.0425	0.0765
1.9	0.35	4.2	4.55	0.03	0.057
2	0.25	4.3	4.55	0.02	0.04
2.1	0.15	4.4	4.55	0.005	0.0105
2.2	-0.05	4.6	4.55	-0.01	-0.022
2.3	-0.15	4.7	4.55	-0.0225	-0.05175
2.4	-0.3	4.85	4.55	-0.0375	-0.09
2.5	-0.45	5	4.55	-0.0525	-0.13125
2.6	-0.6	5.15	4.55	-0.0675	-0.1755
2.7	-0.75	5.3	4.55	-0.0825	-0.22275
2.8	-0.9	5.45	4.55	-0.1	-0.28
2.9	-1.1	5.65	4.55	-0.1075	-0.31175
3	-1.05	5.6	4.55	-0.0975	-0.2925
3.1	-0.9	5.45	4.55	-0.0875	-0.27125
3.2	-0.85	5.4	4.55	-0.0925	-0.296
3.3	-1	5.55	4.55	-0.09	-0.297
3.4	-0.8	5.35	4.55	-0.0625	-0.2125
3.5	-0.45	5	4.55	-0.03	-0.105
3.6	-0.15	4.7	4.55	-0.0125	-0.045
3.7	-0.1	4.65	4.55	-0.005	-0.0185
3.8	0	4.55	4.55	0	0
3.9	0	4.55	4.55	0	0
4	0	4.55	4.55	0	0

Theta = 0.8814 degree
Dist = 0.10 inch

BACK 0.08 inch FRONT 0.12 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0.05	4.5	4.55	0.005	-0.0025	-0.18188	0.084912
-0.4	0.05	4.5	4.55	0.0075	-0.003		
-0.3	0.1	4.45	4.55	0.002	-0.0006		
-0.28	0.1	4.45	4.55	0.0025	-0.0007		
-0.26	0.15	4.4	4.55	0.0035	-0.00091		
-0.24	0.2	4.35	4.55	0.005	-0.0012		
-0.22	0.3	4.25	4.55	0.0065	-0.00143		
-0.2	0.35	4.2	4.55	0.01	-0.002		
-0.18	0.65	3.9	4.55	0.016	-0.00288		
-0.16	0.95	3.6	4.55	0.025	-0.004		
-0.14	1.55	3	4.55	0.036	-0.00504		
-0.12	2.05	2.5	4.55	0.0495	-0.00594		
-0.1	2.9	1.65	4.55	0.0645	-0.00645		
-0.08	3.55	1	4.55	0.0755	-0.00604		
-0.06	4	0.55	4.55	0.083	-0.00498		
-0.04	4.3	0.25	4.55	0.0875	-0.0035		
-0.02	4.45	0.1	4.55	0.0855	-0.00171		
0	4.1	0.45	4.55	0.081	0		
0.02	4	0.55	4.55	0.077	0.00154		
0.04	3.7	0.85	4.55	0.07	0.0028		
0.06	3.3	1.25	4.55	0.0635	0.00381		
0.08	3.05	1.5	4.55	0.0585	0.00468		
0.1	2.8	1.75	4.55	0.054	0.0054		
0.12	2.6	1.95	4.55	0.05	0.006		
0.14	2.4	2.15	4.55	0.047	0.00658		
0.16	2.3	2.25	4.55	0.0455	0.00728		
0.18	2.25	2.3	4.55	0.0445	0.00801		
0.2	2.2	2.35	4.55	0.10875	0.02175		
0.25	2.15	2.4	4.55	0.1075	0.026875		
0.3	2.15	2.4	4.55	0.10625	0.031875		
0.35	2.1	2.45	4.55	0.105	0.03675		
0.4	2.1	2.45	4.55	0.10375	0.0415		
0.45	2.05	2.5	4.55	0.1025	0.046125		
0.5	2.05	2.5	4.55	0.10125	0.050625		

0.55	2	2.55	4.55	0.09875	0.054312
0.6	1.95	2.6	4.55	0.09625	0.05775
0.65	1.9	2.65	4.55	0.09375	0.060937
0.7	1.85	2.7	4.55	0.1825	0.12775
0.8	1.8	2.75	4.55	0.175	0.14
0.9	1.7	2.85	4.55	0.165	0.1485
1	1.6	2.95	4.55	0.155	0.155
1.1	1.5	3.05	4.55	0.145	0.1595
1.2	1.4	3.15	4.55	0.135	0.162
1.3	1.3	3.25	4.55	0.1225	0.15925
1.4	1.15	3.4	4.55	0.11	0.154
1.5	1.05	3.5	4.55	0.0975	0.14625
1.6	0.9	3.65	4.55	0.085	0.136
1.7	0.8	3.75	4.55	0.075	0.1275
1.8	0.7	3.85	4.55	0.0625	0.1125
1.9	0.55	4	4.55	0.05	0.095
2	0.45	4.1	4.55	0.0375	0.075
2.1	0.3	4.25	4.55	0.0225	0.04725
2.2	0.15	4.4	4.55	0.0075	0.0165
2.3	0	4.55	4.55	-0.0075	-0.01725
2.4	-0.15	4.7	4.55	-0.0225	-0.054
2.5	-0.3	4.85	4.55	-0.0375	-0.09375
2.6	-0.45	5	4.55	-0.055	-0.143
2.7	-0.65	5.2	4.55	-0.075	-0.2025
2.8	-0.85	5.4	4.55	-0.095	-0.266
2.9	-1.05	5.6	4.55	-0.1075	-0.31175
3	-1.1	5.65	4.55	-0.1075	-0.3225
3.1	-1.05	5.6	4.55	-0.0975	-0.30225
3.2	-0.9	5.45	4.55	-0.0975	-0.312
3.3	-1.05	5.6	4.55	-0.1025	-0.33825
3.4	-1	5.55	4.55	-0.0825	-0.2805
3.5	-0.65	5.2	4.55	-0.045	-0.1575
3.6	-0.25	4.8	4.55	-0.0175	-0.063
3.7	-0.1	4.65	4.55	-0.0075	-0.02775
3.8	-0.05	4.6	4.55	-0.0025	-0.0095
3.9	0	4.55	4.55	0	0
4	0	4.55	4.55	0	0

Theta = 1.322 degree
Dist = 0.07
inch

BACK	FRONT
0.04 inch	0.1 inch

CENTER TOTAL

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	of LIFT (inch)	LIFT (lbf / inch)
-0.5	0.05	4.4	4.45	0.0075	-0.00375	0.562081	0.146387
-0.4	0.1	4.35	4.45	0.0125	-0.005		
-0.3	0.15	4.3	4.45	0.0035	-0.00105		
-0.28	0.2	4.25	4.45	0.004	-0.00112		
-0.26	0.2	4.25	4.45	0.005	-0.0013		
-0.24	0.3	4.15	4.45	0.007	-0.00168		
-0.22	0.4	4.05	4.45	0.0095	-0.00209		
-0.2	0.55	3.9	4.45	0.013	-0.0026		
-0.18	0.75	3.7	4.45	0.019	-0.00342		
-0.16	1.15	3.3	4.45	0.0295	-0.00472		
-0.14	1.8	2.65	4.45	0.0435	-0.00609		
-0.12	2.55	1.9	4.45	0.06	-0.0072		
-0.1	3.45	1	4.45	0.0765	-0.00765		
-0.08	4.2	0.25	4.45	0.089	-0.00712		
-0.06	4.7	-0.25	4.45	0.0965	-0.00579		
-0.04	4.95	-0.5	4.45	0.0995	-0.00398		
-0.02	5	-0.55	4.45	0.1015	-0.00203		
0	5.15	-0.7	4.45	0.102	0		
0.02	5.05	-0.6	4.45	0.097	0.00194		
0.04	4.65	-0.2	4.45	0.0885	0.00354		
0.06	4.2	0.25	4.45	0.079	0.00474		
0.08	3.7	0.75	4.45	0.0685	0.00548		
0.1	3.15	1.3	4.45	0.059	0.0059		
0.12	2.75	1.7	4.45	0.052	0.00624		
0.14	2.45	2	4.45	0.0475	0.00665		
0.16	2.3	2.15	4.45	0.045	0.0072		
0.18	2.2	2.25	4.45	0.0435	0.00783		
0.2	2.15	2.3	4.45	0.10875	0.02175		
0.25	2.2	2.25	4.45	0.1125	0.028125		
0.3	2.3	2.15	4.45	0.11625	0.034875		
0.35	2.35	2.1	4.45	0.11875	0.041563		
0.4	2.4	2.05	4.45	0.12	0.048		
0.45	2.4	2.05	4.45	0.12	0.054		
0.5	2.4	2.05	4.45	0.11875	0.059375		
0.55	2.35	2.1	4.45	0.1175	0.064625		
0.6	2.35	2.1	4.45	0.1175	0.0705		
0.65	2.35	2.1	4.45	0.11625	0.075562		
0.7	2.3	2.15	4.45	0.2275	0.15925		
0.8	2.25	2.2	4.45	0.2225	0.178		
0.9	2.2	2.25	4.45	0.2175	0.19575		
1	2.15	2.3	4.45	0.21	0.21		
1.1	2.05	2.4	4.45	0.2025	0.22275		
1.2	2	2.45	4.45	0.1975	0.237		

1.3	1.95	2.5	4.45	0.19	0.247
1.4	1.85	2.6	4.45	0.18	0.252
1.5	1.75	2.7	4.45	0.1725	0.25875
1.6	1.7	2.75	4.45	0.165	0.264
1.7	1.6	2.85	4.45	0.155	0.2635
1.8	1.5	2.95	4.45	0.145	0.261
1.9	1.4	3.05	4.45	0.1325	0.25175
2	1.25	3.2	4.45	0.12	0.24
2.1	1.15	3.3	4.45	0.11	0.231
2.2	1.05	3.4	4.45	0.0975	0.2145
2.3	0.9	3.55	4.45	0.0825	0.18975
2.4	0.75	3.7	4.45	0.065	0.156
2.5	0.55	3.9	4.45	0.05	0.125
2.6	0.45	4	4.45	0.035	0.091
2.7	0.25	4.2	4.45	0.015	0.0405
2.8	0.05	4.4	4.45	-0.01	-0.028
2.9	-0.25	4.7	4.45	-0.035	-0.1015
3	-0.45	4.9	4.45	-0.0625	-0.1875
3.1	-0.8	5.25	4.45	-0.0825	-0.25575
3.2	-0.85	5.3	4.45	-0.0825	-0.264
3.3	-0.8	5.25	4.45	-0.075	-0.2475
3.4	-0.7	5.15	4.45	-0.08	-0.272
3.5	-0.9	5.35	4.45	-0.0825	-0.28875
3.6	-0.75	5.2	4.45	-0.0575	-0.207
3.7	-0.4	4.85	4.45	-0.0275	-0.10175
3.8	-0.15	4.6	4.45	-0.01	-0.038
3.9	-0.05	4.5	4.45	-0.005	-0.0195
4	-0.05	4.5	4.45	0.1	0.4

Theta = 1.322 degree
Dist = 0.09 inch

BACK 0.06 inch FRONT 0.12 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0	4.45	4.45	0.0025	-0.00125	0.213717	0.114225
-0.4	0.05	4.4	4.45	0.0075	-0.003		
-0.3	0.1	4.35	4.45	0.0025	-0.00075		
-0.28	0.15	4.3	4.45	0.0035	-0.00098		
-0.26	0.2	4.25	4.45	0.0045	-0.00117		
-0.24	0.25	4.2	4.45	0.006	-0.00144		

-0.22	0.35	4.1	4.45	0.0085	-0.00187
-0.2	0.5	3.95	4.45	0.0125	-0.0025
-0.18	0.75	3.7	4.45	0.0195	-0.00351
-0.16	1.2	3.25	4.45	0.0295	-0.00472
-0.14	1.75	2.7	4.45	0.043	-0.00602
-0.12	2.55	1.9	4.45	0.061	-0.00732
-0.1	3.55	0.9	4.45	0.0785	-0.00785
-0.08	4.3	0.15	4.45	0.09	-0.0072
-0.06	4.7	-0.25	4.45	0.0965	-0.00579
-0.04	4.95	-0.5	4.45	0.099	-0.00396
-0.02	4.95	-0.5	4.45	0.098	-0.00196
0	4.85	-0.4	4.45	0.0955	0
0.02	4.7	-0.25	4.45	0.0895	0.00179
0.04	4.25	0.2	4.45	0.081	0.00324
0.06	3.85	0.6	4.45	0.0715	0.00429
0.08	3.3	1.15	4.45	0.06	0.0048
0.1	2.7	1.75	4.45	0.0515	0.00515
0.12	2.45	2	4.45	0.0465	0.00558
0.14	2.2	2.25	4.45	0.0425	0.00595
0.16	2.05	2.4	4.45	0.04	0.0064
0.18	1.95	2.5	4.45	0.039	0.00702
0.2	1.95	2.5	4.45	0.0975	0.0195
0.25	1.95	2.5	4.45	0.1	0.025
0.3	2.05	2.4	4.45	0.105	0.0315
0.35	2.15	2.3	4.45	0.10875	0.038063
0.4	2.2	2.25	4.45	0.11	0.044
0.45	2.2	2.25	4.45	0.11	0.0495
0.5	2.2	2.25	4.45	0.11	0.055
0.55	2.2	2.25	4.45	0.11	0.0605
0.6	2.2	2.25	4.45	0.11	0.066
0.65	2.2	2.25	4.45	0.10875	0.070687
0.7	2.15	2.3	4.45	0.2125	0.14875
0.8	2.1	2.35	4.45	0.205	0.164
0.9	2	2.45	4.45	0.1975	0.17775
1	1.95	2.5	4.45	0.19	0.19
1.1	1.85	2.6	4.45	0.18	0.198
1.2	1.75	2.7	4.45	0.17	0.204
1.3	1.65	2.8	4.45	0.16	0.208
1.4	1.55	2.9	4.45	0.15	0.21
1.5	1.45	3	4.45	0.14	0.21
1.6	1.35	3.1	4.45	0.13	0.208
1.7	1.25	3.2	4.45	0.12	0.204
1.8	1.15	3.3	4.45	0.1075	0.1935
1.9	1	3.45	4.45	0.095	0.1805
2	0.9	3.55	4.45	0.0825	0.165
2.1	0.75	3.7	4.45	0.0675	0.14175
2.2	0.6	3.85	4.45	0.0525	0.1155
2.3	0.45	4	4.45	0.0375	0.08625

2.4	0.3	4.15	4.45	0.0225	0.054
2.5	0.15	4.3	4.45	0.005	0.0125
2.6	-0.05	4.5	4.45	-0.015	-0.039
2.7	-0.25	4.7	4.45	-0.03	-0.081
2.8	-0.35	4.8	4.45	-0.0525	-0.147
2.9	-0.7	5.15	4.45	-0.085	-0.2465
3	-1	5.45	4.45	-0.1025	-0.3075
3.1	-1.05	5.5	4.45	-0.1025	-0.31775
3.2	-1	5.45	4.45	-0.095	-0.304
3.3	-0.9	5.35	4.45	-0.0975	-0.32175
3.4	-1.05	5.5	4.45	-0.1025	-0.3485
3.5	-1	5.45	4.45	-0.08	-0.28
3.6	-0.6	5.05	4.45	-0.045	-0.162
3.7	-0.3	4.75	4.45	-0.0225	-0.08325
3.8	-0.15	4.6	4.45	-0.01	-0.038
3.9	-0.05	4.5	4.45	-0.005	-0.0195
4	-0.05	4.5	4.45	0.1	0.4

Theta = 1.322 degree
Dist = 0.11 inch

BACK 0.08 inch FRONT 0.14 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	-0.15	4.6	4.45	-0.015	0.0075	-0.60547	0.055964
-0.4	-0.15	4.6	4.45	-0.015	0.006		
-0.3	-0.15	4.6	4.45	-0.003	0.0009		
-0.28	-0.15	4.6	4.45	-0.0025	0.0007		
-0.26	-0.1	4.55	4.45	-0.0015	0.00039		
-0.24	-0.05	4.5	4.45	-0.001	0.00024		
-0.22	-0.05	4.5	4.45	0.0005	-0.00011		
-0.2	0.1	4.35	4.45	0.0035	-0.0007		
-0.18	0.25	4.2	4.45	0.007	-0.00126		
-0.16	0.45	4	4.45	0.012	-0.00192		
-0.14	0.75	3.7	4.45	0.0195	-0.00273		
-0.12	1.2	3.25	4.45	0.0275	-0.0033		
-0.1	1.55	2.9	4.45	0.0355	-0.00355		
-0.08	2	2.45	4.45	0.0435	-0.00348		
-0.06	2.35	2.1	4.45	0.0505	-0.00303		
-0.04	2.7	1.75	4.45	0.055	-0.0022		
-0.02	2.8	1.65	4.45	0.056	-0.00112		

0	2.8	1.65	4.45	0.056	0
0.02	2.8	1.65	4.45	0.055	0.0011
0.04	2.7	1.75	4.45	0.053	0.00212
0.06	2.6	1.85	4.45	0.0515	0.00309
0.08	2.55	1.9	4.45	0.05	0.004
0.1	2.45	2	4.45	0.048	0.0048
0.12	2.35	2.1	4.45	0.046	0.00552
0.14	2.25	2.2	4.45	0.0445	0.00623
0.16	2.2	2.25	4.45	0.0435	0.00696
0.18	2.15	2.3	4.45	0.0425	0.00765
0.2	2.1	2.35	4.45	0.10375	0.02075
0.25	2.05	2.4	4.45	0.1	0.025
0.3	1.95	2.5	4.45	0.09625	0.028875
0.35	1.9	2.55	4.45	0.09375	0.032813
0.4	1.85	2.6	4.45	0.09125	0.0365
0.45	1.8	2.65	4.45	0.08875	0.039938
0.5	1.75	2.7	4.45	0.08625	0.043125
0.55	1.7	2.75	4.45	0.085	0.04675
0.6	1.7	2.75	4.45	0.0825	0.0495
0.65	1.6	2.85	4.45	0.07875	0.051187
0.7	1.55	2.9	4.45	0.1525	0.10675
0.8	1.5	2.95	4.45	0.145	0.116
0.9	1.4	3.05	4.45	0.135	0.1215
1	1.3	3.15	4.45	0.125	0.125
1.1	1.2	3.25	4.45	0.115	0.1265
1.2	1.1	3.35	4.45	0.105	0.126
1.3	1	3.45	4.45	0.095	0.1235
1.4	0.9	3.55	4.45	0.085	0.119
1.5	0.8	3.65	4.45	0.075	0.1125
1.6	0.7	3.75	4.45	0.0625	0.1
1.7	0.55	3.9	4.45	0.05	0.085
1.8	0.45	4	4.45	0.0375	0.0675
1.9	0.3	4.15	4.45	0.025	0.0475
2	0.2	4.25	4.45	0.0125	0.025
2.1	0.05	4.4	4.45	0	0
2.2	-0.05	4.5	4.45	-0.0125	-0.0275
2.3	-0.2	4.65	4.45	-0.03	-0.069
2.4	-0.4	4.85	4.45	-0.0475	-0.114
2.5	-0.55	5	4.45	-0.065	-0.1625
2.6	-0.75	5.2	4.45	-0.0825	-0.2145
2.7	-0.9	5.35	4.45	-0.0975	-0.26325
2.8	-1.05	5.5	4.45	-0.1075	-0.301
2.9	-1.1	5.55	4.45	-0.105	-0.3045
3	-1	5.45	4.45	-0.0975	-0.2925
3.1	-0.95	5.4	4.45	-0.1025	-0.31775
3.2	-1.1	5.55	4.45	-0.1025	-0.328
3.3	-0.95	5.4	4.45	-0.0775	-0.25575
3.4	-0.6	5.05	4.45	-0.045	-0.153

3.5	-0.3	4.75	4.45	-0.0225	-0.07875
3.6	-0.15	4.6	4.45	-0.01	-0.036
3.7	-0.05	4.5	4.45	-0.005	-0.0185
3.8	-0.05	4.5	4.45	-0.0025	-0.0095
3.9	0	4.45	4.45	0	0
4	0	4.45	4.45	0	0

Theta = -0.4407 degree
Dist = 0.05 inch

BACK 0.06 inch FRONT 0.04 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0.05	4.35	4.4	0.0075	-0.00375	-0.73375	0.048276
-0.4	0.1	4.3	4.4	0.0125	-0.005		
-0.3	0.15	4.25	4.4	0.0035	-0.00105		
-0.28	0.2	4.2	4.4	0.0045	-0.00126		
-0.26	0.25	4.15	4.4	0.006	-0.00156		
-0.24	0.35	4.05	4.4	0.0085	-0.00204		
-0.22	0.5	3.9	4.4	0.012	-0.00264		
-0.2	0.7	3.7	4.4	0.018	-0.0036		
-0.18	1.1	3.3	4.4	0.028	-0.00504		
-0.16	1.7	2.7	4.4	0.041	-0.00656		
-0.14	2.4	2	4.4	0.056	-0.00784		
-0.12	3.2	1.2	4.4	0.073	-0.00876		
-0.1	4.1	0.3	4.4	0.088	-0.0088		
-0.08	4.7	-0.3	4.4	0.099	-0.00792		
-0.06	5.2	-0.8	4.4	0.1065	-0.00639		
-0.04	5.45	-1.05	4.4	0.109	-0.00436		
-0.02	5.45	-1.05	4.4	0.11	-0.0022		
0	5.55	-1.15	4.4	0.11	0		
0.02	5.45	-1.05	4.4	0.106	0.00212		
0.04	5.15	-0.75	4.4	0.098	0.00392		
0.06	4.65	-0.25	4.4	0.086	0.00516		
0.08	3.95	0.45	4.4	0.074	0.00592		
0.1	3.45	0.95	4.4	0.066	0.0066		
0.12	3.15	1.25	4.4	0.061	0.00732		
0.14	2.95	1.45	4.4	0.0585	0.00819		
0.16	2.9	1.5	4.4	0.058	0.00928		
0.18	2.9	1.5	4.4	0.058	0.01044		

0.2	2.9	1.5	4.4	0.145	0.029
0.25	2.9	1.5	4.4	0.13875	0.034688
0.3	2.65	1.75	4.4	0.12125	0.036375
0.35	2.2	2.2	4.4	0.095	0.03325
0.4	1.6	2.8	4.4	0.06375	0.0255
0.45	0.95	3.45	4.4	0.0375	0.016875
0.5	0.55	3.85	4.4	0.0225	0.01125
0.55	0.35	4.05	4.4	0.015	0.00825
0.6	0.25	4.15	4.4	0.01	0.006
0.65	0.15	4.25	4.4	0.00625	0.004063
0.7	0.1	4.3	4.4	0.005	0.0035
0.8	0	4.4	4.4	-0.0025	-0.002
0.9	-0.05	4.45	4.4	-0.0075	-0.00675
1	-0.1	4.5	4.4	-0.0125	-0.0125
1.1	-0.15	4.55	4.4	-0.015	-0.0165
1.2	-0.15	4.55	4.4	-0.0175	-0.021
1.3	-0.2	4.6	4.4	-0.02	-0.026
1.4	-0.2	4.6	4.4	-0.02	-0.028
1.5	-0.2	4.6	4.4	-0.02	-0.03
1.6	-0.2	4.6	4.4	-0.0225	-0.036
1.7	-0.25	4.65	4.4	-0.025	-0.0425
1.8	-0.25	4.65	4.4	-0.025	-0.045
1.9	-0.25	4.65	4.4	-0.025	-0.0475
2	-0.25	4.65	4.4	-0.025	-0.05
2.1	-0.25	4.65	4.4	-0.025	-0.0525
2.2	-0.25	4.65	4.4	-0.025	-0.055
2.3	-0.25	4.65	4.4	-0.025	-0.0575
2.4	-0.25	4.65	4.4	-0.025	-0.06
2.5	-0.25	4.65	4.4	-0.025	-0.0625
2.6	-0.25	4.65	4.4	-0.025	-0.065
2.7	-0.25	4.65	4.4	-0.025	-0.0675
2.8	-0.25	4.65	4.4	-0.025	-0.07
2.9	-0.25	4.65	4.4	-0.025	-0.0725
3	-0.25	4.65	4.4	-0.025	-0.075
3.1	-0.25	4.65	4.4	-0.025	-0.0775
3.2	-0.25	4.65	4.4	-0.0225	-0.072
3.3	-0.2	4.6	4.4	-0.0175	-0.05775
3.4	-0.15	4.55	4.4	-0.015	-0.051
3.5	-0.15	4.55	4.4	-0.0125	-0.04375
3.6	-0.1	4.5	4.4	-0.01	-0.036
3.7	-0.1	4.5	4.4	-0.0075	-0.02775
3.8	-0.05	4.45	4.4	-0.0025	-0.0095
3.9	0	4.4	4.4	0	0
4	0	4.4	4.4	0	0

Theta = -0..2204
degree

Dist =
0.095 inch

BACK 0.1 inch	FRONT 0.09 inch						
DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	-0.05	4.45	4.4	-0.0075	0.00375	8.050393	-0.01406
-0.4	-0.1	4.5	4.4	-0.0075	0.003		
-0.3	-0.05	4.45	4.4	-0.0005	0.00015		
-0.28	0	4.4	4.4	0.001	-0.00028		
-0.26	0.1	4.3	4.4	0.003	-0.00078		
-0.24	0.2	4.2	4.4	0.007	-0.00168		
-0.22	0.5	3.9	4.4	0.013	-0.00286		
-0.2	0.8	3.6	4.4	0.022	-0.0044		
-0.18	1.4	3	4.4	0.0325	-0.00585		
-0.16	1.85	2.55	4.4	0.0425	-0.0068		
-0.14	2.4	2	4.4	0.053	-0.00742		
-0.12	2.9	1.5	4.4	0.06	-0.0072		
-0.1	3.1	1.3	4.4	0.064	-0.0064		
-0.08	3.3	1.1	4.4	0.066	-0.00528		
-0.06	3.3	1.1	4.4	0.066	-0.00396		
-0.04	3.3	1.1	4.4	0.0645	-0.00258		
-0.02	3.15	1.25	4.4	0.062	-0.00124		
0	3.05	1.35	4.4	0.0595	0		
0.02	2.9	1.5	4.4	0.056	0.00112		
0.04	2.7	1.7	4.4	0.052	0.00208		
0.06	2.5	1.9	4.4	0.047	0.00282		
0.08	2.2	2.2	4.4	0.041	0.00328		
0.1	1.9	2.5	4.4	0.036	0.0036		
0.12	1.7	2.7	4.4	0.031	0.00372		
0.14	1.4	3	4.4	0.0265	0.00371		
0.16	1.25	3.15	4.4	0.023	0.00368		
0.18	1.05	3.35	4.4	0.0195	0.00351		
0.2	0.9	3.5	4.4	0.03875	0.00775		
0.25	0.65	3.75	4.4	0.02875	0.007188		
0.3	0.5	3.9	4.4	0.0225	0.00675		
0.35	0.4	4	4.4	0.01875	0.006563		
0.4	0.35	4.05	4.4	0.01625	0.0065		
0.45	0.3	4.1	4.4	0.01375	0.006188		
0.5	0.25	4.15	4.4	0.01125	0.005625		
0.55	0.2	4.2	4.4	0.00875	0.004813		
0.6	0.15	4.25	4.4	0.00625	0.00375		
0.65	0.1	4.3	4.4	0.00375	0.002438		

0.7	0.05	4.35	4.4	0.0025	0.00175
0.8	0	4.4	4.4	-0.005	-0.004
0.9	-0.1	4.5	4.4	-0.0125	-0.01125
1	-0.15	4.55	4.4	-0.0175	-0.0175
1.1	-0.2	4.6	4.4	-0.0225	-0.02475
1.2	-0.25	4.65	4.4	-0.0275	-0.033
1.3	-0.3	4.7	4.4	-0.0325	-0.04225
1.4	-0.35	4.75	4.4	-0.0375	-0.0525
1.5	-0.4	4.8	4.4	-0.0425	-0.06375
1.6	-0.45	4.85	4.4	-0.0475	-0.076
1.7	-0.5	4.9	4.4	-0.05	-0.085
1.8	-0.5	4.9	4.4	-0.0525	-0.0945
1.9	-0.55	4.95	4.4	-0.055	-0.1045
2	-0.55	4.95	4.4	-0.0575	-0.115
2.1	-0.6	5	4.4	-0.0625	-0.13125
2.2	-0.65	5.05	4.4	-0.0675	-0.1485
2.3	-0.7	5.1	4.4	-0.0725	-0.16675
2.4	-0.75	5.15	4.4	-0.0775	-0.186
2.5	-0.8	5.2	4.4	-0.0825	-0.20625
2.6	-0.85	5.25	4.4	-0.085	-0.221
2.7	-0.85	5.25	4.4	-0.0875	-0.23625
2.8	-0.9	5.3	4.4	-0.09	-0.252
2.9	-0.9	5.3	4.4	-0.0875	-0.25375
3	-0.85	5.25	4.4	-0.08	-0.24
3.1	-0.75	5.15	4.4	-0.0725	-0.22475
3.2	-0.7	5.1	4.4	-0.0725	-0.232
3.3	-0.75	5.15	4.4	-0.0675	-0.22275
3.4	-0.6	5	4.4	-0.05	-0.17
3.5	-0.4	4.8	4.4	-0.03	-0.105
3.6	-0.2	4.6	4.4	-0.015	-0.054
3.7	-0.1	4.5	4.4	-0.0075	-0.02775
3.8	-0.05	4.45	4.4	-0.005	-0.019
3.9	-0.05	4.45	4.4	-0.0025	-0.00975
4	0	4.4	4.4	0	0

Theta = -0.8814 degree
Dist = 0.06 inch

BACK 0.08 inch	FRONT 0.04 inch						
DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)

-0.5	0	4.35	4.35	0.0025	-0.00125	-68.9121	0.001148
-0.4	0.05	4.3	4.35	0.005	-0.002		
-0.3	0.05	4.3	4.35	0.0015	-0.00045		
-0.28	0.1	4.25	4.35	0.002	-0.00056		
-0.26	0.1	4.25	4.35	0.0025	-0.00065		
-0.24	0.15	4.2	4.35	0.0035	-0.00084		
-0.22	0.2	4.15	4.35	0.005	-0.0011		
-0.2	0.3	4.05	4.35	0.0075	-0.0015		
-0.18	0.45	3.9	4.35	0.012	-0.00216		
-0.16	0.75	3.6	4.35	0.019	-0.00304		
-0.14	1.15	3.2	4.35	0.0285	-0.00399		
-0.12	1.7	2.65	4.35	0.0435	-0.00522		
-0.1	2.65	1.7	4.35	0.063	-0.0063		
-0.08	3.65	0.7	4.35	0.0815	-0.00652		
-0.06	4.5	-0.15	4.35	0.0965	-0.00579		
-0.04	5.15	-0.8	4.35	0.105	-0.0042		
-0.02	5.35	-1	4.35	0.1085	-0.00217		
0	5.5	-1.15	4.35	0.111	0		
0.02	5.6	-1.25	4.35	0.1105	0.00221		
0.04	5.45	-1.1	4.35	0.104	0.00416		
0.06	4.95	-0.6	4.35	0.091	0.00546		
0.08	4.15	0.2	4.35	0.0795	0.00636		
0.1	3.8	0.55	4.35	0.071	0.0071		
0.12	3.3	1.05	4.35	0.063	0.00756		
0.14	3	1.35	4.35	0.0585	0.00819		
0.16	2.85	1.5	4.35	0.056	0.00896		
0.18	2.75	1.6	4.35	0.0545	0.00981		
0.2	2.7	1.65	4.35	0.13375	0.02675		
0.25	2.65	1.7	4.35	0.12375	0.030938		
0.3	2.3	2.05	4.35	0.09875	0.029625		
0.35	1.65	2.7	4.35	0.05875	0.020563		
0.4	0.7	3.65	4.35	0.0075	0.003		
0.45	-0.4	4.75	4.35	-0.0325	-0.01463		
0.5	-0.9	5.25	4.35	-0.05	-0.025		
0.55	-1.1	5.45	4.35	-0.05625	-0.03094		
0.6	-1.15	5.5	4.35	-0.05875	-0.03525		
0.65	-1.2	5.55	4.35	-0.06	-0.039		
0.7	-1.2	5.55	4.35	-0.1175	-0.08225		
0.8	-1.15	5.5	4.35	-0.1075	-0.086		
0.9	-1	5.35	4.35	-0.095	-0.0855		
1	-0.9	5.25	4.35	-0.09	-0.09		
1.1	-0.9	5.25	4.35	-0.0875	-0.09625		
1.2	-0.85	5.2	4.35	-0.08	-0.096		
1.3	-0.75	5.1	4.35	-0.0725	-0.09425		
1.4	-0.7	5.05	4.35	-0.0675	-0.0945		
1.5	-0.65	5	4.35	-0.0625	-0.09375		
1.6	-0.6	4.95	4.35	-0.055	-0.088		

1.7	-0.5	4.85	4.35	-0.0475	-0.08075
1.8	-0.45	4.8	4.35	-0.045	-0.081
1.9	-0.45	4.8	4.35	-0.045	-0.0855
2	-0.45	4.8	4.35	-0.0425	-0.085
2.1	-0.4	4.75	4.35	-0.04	-0.084
2.2	-0.4	4.75	4.35	-0.04	-0.088
2.3	-0.4	4.75	4.35	-0.0375	-0.08625
2.4	-0.35	4.7	4.35	-0.035	-0.084
2.5	-0.35	4.7	4.35	-0.035	-0.0875
2.6	-0.35	4.7	4.35	-0.0325	-0.0845
2.7	-0.3	4.65	4.35	-0.03	-0.081
2.8	-0.3	4.65	4.35	-0.03	-0.084
2.9	-0.3	4.65	4.35	-0.03	-0.087
3	-0.3	4.65	4.35	-0.03	-0.09
3.1	-0.3	4.65	4.35	-0.0275	-0.08525
3.2	-0.25	4.6	4.35	-0.025	-0.08
3.3	-0.25	4.6	4.35	-0.0225	-0.07425
3.4	-0.2	4.55	4.35	-0.02	-0.068
3.5	-0.2	4.55	4.35	-0.0175	-0.06125
3.6	-0.15	4.5	4.35	-0.015	-0.054
3.7	-0.15	4.5	4.35	-0.0125	-0.04625
3.8	-0.1	4.45	4.35	-0.01	-0.038
3.9	-0.1	4.45	4.35	-0.0075	-0.02925
4	-0.05	4.4	4.35	0.1	0.4

Theta = -0.8814
degree
Dist = 0.10
inch

BACK 0.12 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	-0.05	4.45	4.4	-0.005	0.0025	2.5461	-0.05233
-0.4	-0.05	4.45	4.4	-0.0075	0.003		
-0.3	-0.1	4.5	4.4	-0.002	0.0006		
-0.28	-0.1	4.5	4.4	-0.002	0.00056		
-0.26	-0.1	4.5	4.4	-0.0015	0.00039		
-0.24	-0.05	4.45	4.4	8.88E-18	-2.1E-18		
-0.22	0.05	4.35	4.4	0.0015	-0.00033		
-0.2	0.1	4.3	4.4	0.0035	-0.0007		
-0.18	0.25	4.15	4.4	0.0075	-0.00135		

-0.16	0.5	3.9	4.4	0.014	-0.00224
-0.14	0.9	3.5	4.4	0.023	-0.00322
-0.12	1.4	3	4.4	0.0335	-0.00402
-0.1	1.95	2.45	4.4	0.044	-0.0044
-0.08	2.45	1.95	4.4	0.0535	-0.00428
-0.06	2.9	1.5	4.4	0.059	-0.00354
-0.04	3	1.4	4.4	0.0615	-0.00246
-0.02	3.15	1.25	4.4	0.062	-0.00124
0	3.05	1.35	4.4	0.0615	0
0.02	3.1	1.3	4.4	0.0605	0.00121
0.04	2.95	1.45	4.4	0.0565	0.00226
0.06	2.7	1.7	4.4	0.0505	0.00303
0.08	2.35	2.05	4.4	0.0435	0.00348
0.1	2	2.4	4.4	0.037	0.0037
0.12	1.7	2.7	4.4	0.0305	0.00366
0.14	1.35	3.05	4.4	0.0235	0.00329
0.16	1	3.4	4.4	0.0165	0.00264
0.18	0.65	3.75	4.4	0.0105	0.00189
0.2	0.4	4	4.4	0.00625	0.00125
0.25	-0.15	4.55	4.4	-0.01625	-0.00406
0.3	-0.5	4.9	4.4	-0.03	-0.009
0.35	-0.7	5.1	4.4	-0.03875	-0.01356
0.4	-0.85	5.25	4.4	-0.0425	-0.017
0.45	-0.85	5.25	4.4	-0.04375	-0.01969
0.5	-0.9	5.3	4.4	-0.045	-0.0225
0.55	-0.9	5.3	4.4	-0.045	-0.02475
0.6	-0.9	5.3	4.4	-0.045	-0.027
0.65	-0.9	5.3	4.4	-0.045	-0.02925
0.7	-0.9	5.3	4.4	-0.09	-0.063
0.8	-0.9	5.3	4.4	-0.09	-0.072
0.9	-0.9	5.3	4.4	-0.0875	-0.07875
1	-0.85	5.25	4.4	-0.085	-0.085
1.1	-0.85	5.25	4.4	-0.085	-0.0935
1.2	-0.85	5.25	4.4	-0.0825	-0.099
1.3	-0.8	5.2	4.4	-0.08	-0.104
1.4	-0.8	5.2	4.4	-0.08	-0.112
1.5	-0.8	5.2	4.4	-0.0775	-0.11625
1.6	-0.75	5.15	4.4	-0.075	-0.12
1.7	-0.75	5.15	4.4	-0.075	-0.1275
1.8	-0.75	5.15	4.4	-0.075	-0.135
1.9	-0.75	5.15	4.4	-0.075	-0.1425
2	-0.75	5.15	4.4	-0.075	-0.15
2.1	-0.75	5.15	4.4	-0.075	-0.1575
2.2	-0.75	5.15	4.4	-0.0725	-0.1595
2.3	-0.7	5.1	4.4	-0.07	-0.161
2.4	-0.7	5.1	4.4	-0.07	-0.168
2.5	-0.7	5.1	4.4	-0.0725	-0.18125
2.6	-0.75	5.15	4.4	-0.075	-0.195

2.7	-0.75	5.15	4.4	-0.075	-0.2025
2.8	-0.75	5.15	4.4	-0.075	-0.21
2.9	-0.75	5.15	4.4	-0.0725	-0.21025
3	-0.7	5.1	4.4	-0.065	-0.195
3.1	-0.6	5	4.4	-0.0575	-0.17825
3.2	-0.55	4.95	4.4	-0.055	-0.176
3.3	-0.55	4.95	4.4	-0.055	-0.1815
3.4	-0.55	4.95	4.4	-0.0475	-0.1615
3.5	-0.4	4.8	4.4	-0.0325	-0.11375
3.6	-0.25	4.65	4.4	-0.02	-0.072
3.7	-0.15	4.55	4.4	-0.0125	-0.04625
3.8	-0.1	4.5	4.4	-0.0075	-0.0285
3.9	-0.05	4.45	4.4	-0.0025	-0.00975
4	0	4.4	4.4	0	0

Theta = -1.322 degree
Dist = 0.07 inch

BACK 0.1 inch	FRONT 0.04 inch						
DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0.05	4.35	4.4	0.0075	-0.00375	2.780855	-0.03591
-0.4	0.1	4.3	4.4	0.01	-0.004		
-0.3	0.1	4.3	4.4	0.0025	-0.00075		
-0.28	0.15	4.25	4.4	0.0035	-0.00098		
-0.26	0.2	4.2	4.4	0.0045	-0.00117		
-0.24	0.25	4.15	4.4	0.0055	-0.00132		
-0.22	0.3	4.1	4.4	0.007	-0.00154		
-0.2	0.4	4	4.4	0.0105	-0.0021		
-0.18	0.65	3.75	4.4	0.0165	-0.00297		
-0.16	1	3.4	4.4	0.03	-0.0048		
-0.14	2	2.4	4.4	0.0585	-0.00819		
-0.12	3.85	0.55	4.4	0.08	-0.0096		
-0.1	4.15	0.25	4.4	0.0915	-0.00915		
-0.08	5	-0.6	4.4	0.105	-0.0084		
-0.06	5.5	-1.1	4.4	0.1105	-0.00663		
-0.04	5.55	-1.15	4.4	0.1095	-0.00438		
-0.02	5.4	-1	4.4	0.108	-0.00216		
0	5.4	-1	4.4	0.107	0		
0.02	5.3	-0.9	4.4	0.101	0.00202		

0.04	4.8	-0.4	4.4	0.089	0.00356
0.06	4.1	0.3	4.4	0.0765	0.00459
0.08	3.55	0.85	4.4	0.066	0.00528
0.1	3.05	1.35	4.4	0.0575	0.00575
0.12	2.7	1.7	4.4	0.051	0.00612
0.14	2.4	2	4.4	0.0465	0.00651
0.16	2.25	2.15	4.4	0.0435	0.00696
0.18	2.1	2.3	4.4	0.04	0.0072
0.2	1.9	2.5	4.4	0.0775	0.0155
0.25	1.2	3.2	4.4	0.03375	0.008438
0.3	0.15	4.25	4.4	-0.02375	-0.00712
0.35	-1.1	5.5	4.4	-0.08	-0.028
0.4	-2.1	6.5	4.4	-0.115	-0.046
0.45	-2.5	6.9	4.4	-0.1275	-0.05738
0.5	-2.6	7	4.4	-0.13125	-0.06563
0.55	-2.65	7.05	4.4	-0.13125	-0.07219
0.6	-2.6	7	4.4	-0.1275	-0.0765
0.65	-2.5	6.9	4.4	-0.1175	-0.07637
0.7	-2.2	6.6	4.4	-0.205	-0.1435
0.8	-1.9	6.3	4.4	-0.1775	-0.142
0.9	-1.65	6.05	4.4	-0.1575	-0.14175
1	-1.5	5.9	4.4	-0.14	-0.14
1.1	-1.3	5.7	4.4	-0.12	-0.132
1.2	-1.1	5.5	4.4	-0.105	-0.126
1.3	-1	5.4	4.4	-0.0975	-0.12675
1.4	-0.95	5.35	4.4	-0.0875	-0.1225
1.5	-0.8	5.2	4.4	-0.075	-0.1125
1.6	-0.7	5.1	4.4	-0.065	-0.104
1.7	-0.6	5	4.4	-0.06	-0.102
1.8	-0.6	5	4.4	-0.0575	-0.1035
1.9	-0.55	4.95	4.4	-0.0525	-0.09975
2	-0.5	4.9	4.4	-0.0475	-0.095
2.1	-0.45	4.85	4.4	-0.0425	-0.08925
2.2	-0.4	4.8	4.4	-0.04	-0.088
2.3	-0.4	4.8	4.4	-0.0375	-0.08625
2.4	-0.35	4.75	4.4	-0.035	-0.084
2.5	-0.35	4.75	4.4	-0.035	-0.0875
2.6	-0.35	4.75	4.4	-0.0325	-0.0845
2.7	-0.3	4.7	4.4	-0.03	-0.081
2.8	-0.3	4.7	4.4	-0.03	-0.084
2.9	-0.3	4.7	4.4	-0.03	-0.087
3	-0.3	4.7	4.4	-0.0275	-0.0825
3.1	-0.25	4.65	4.4	-0.025	-0.0775
3.2	-0.25	4.65	4.4	-0.0225	-0.072
3.3	-0.2	4.6	4.4	-0.02	-0.066
3.4	-0.2	4.6	4.4	-0.0175	-0.0595
3.5	-0.15	4.55	4.4	-0.0125	-0.04375
3.6	-0.1	4.5	4.4	-0.0075	-0.027

3.7	-0.05	4.45	4.4	-0.005	-0.0185
3.8	-0.05	4.45	4.4	-0.0025	-0.0095
3.9	0	4.4	4.4	0	0
4	0	4.4	4.4	0	0

Theta = -1.322 degree
Dist = 0.11 inch

BACK 0.14 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.5	0	4.4	4.4	0	0	1.431793	-0.10852
-0.4	0	4.4	4.4	-0.005	0.002		
-0.3	-0.1	4.5	4.4	-0.002	0.0006		
-0.28	-0.1	4.5	4.4	-0.002	0.00056		
-0.26	-0.1	4.5	4.4	-0.0025	0.00065		
-0.24	-0.15	4.55	4.4	-0.003	0.00072		
-0.22	-0.15	4.55	4.4	-0.0025	0.00055		
-0.2	-0.1	4.5	4.4	-0.002	0.0004		
-0.18	-0.1	4.5	4.4	-0.001	0.00018		
-0.16	0	4.4	4.4	0.0015	-0.00024		
-0.14	0.15	4.25	4.4	0.0065	-0.00091		
-0.12	0.5	3.9	4.4	0.014	-0.00168		
-0.1	0.9	3.5	4.4	0.021	-0.0021		
-0.08	1.2	3.2	4.4	0.027	-0.00216		
-0.06	1.5	2.9	4.4	0.032	-0.00192		
-0.04	1.7	2.7	4.4	0.0355	-0.00142		
-0.02	1.85	2.55	4.4	0.04	-0.0008		
0	2.15	2.25	4.4	0.0425	0		
0.02	2.1	2.3	4.4	0.0405	0.00081		
0.04	1.95	2.45	4.4	0.036	0.00144		
0.06	1.65	2.75	4.4	0.028	0.00168		
0.08	1.15	3.25	4.4	0.019	0.00152		
0.1	0.75	3.65	4.4	0.009	0.0009		
0.12	0.15	4.25	4.4	8.88E-18	1.07E-18		
0.14	-0.15	4.55	4.4	-0.008	-0.00112		
0.16	-0.65	5.05	4.4	-0.0175	-0.0028		
0.18	-1.1	5.5	4.4	-0.0265	-0.00477		
0.2	-1.55	5.95	4.4	-0.09625	-0.01925		
0.25	-2.3	6.7	4.4	-0.12625	-0.03156		

0.3	-2.75	7.15	4.4	-0.14	-0.042
0.35	-2.85	7.25	4.4	-0.14125	-0.04944
0.4	-2.8	7.2	4.4	-0.13875	-0.0555
0.45	-2.75	7.15	4.4	-0.13375	-0.06019
0.5	-2.6	7	4.4	-0.1275	-0.06375
0.55	-2.5	6.9	4.4	-0.12125	-0.06669
0.6	-2.35	6.75	4.4	-0.115	-0.069
0.65	-2.25	6.65	4.4	-0.10875	-0.07069
0.7	-2.1	6.5	4.4	-0.2025	-0.14175
0.8	-1.95	6.35	4.4	-0.185	-0.148
0.9	-1.75	6.15	4.4	-0.1675	-0.15075
1	-1.6	6	4.4	-0.1575	-0.1575
1.1	-1.55	5.95	4.4	-0.15	-0.165
1.2	-1.45	5.85	4.4	-0.1375	-0.165
1.3	-1.3	5.7	4.4	-0.1275	-0.16575
1.4	-1.25	5.65	4.4	-0.12	-0.168
1.5	-1.15	5.55	4.4	-0.11	-0.165
1.6	-1.05	5.45	4.4	-0.1	-0.16
1.7	-0.95	5.35	4.4	-0.0925	-0.15725
1.8	-0.9	5.3	4.4	-0.0875	-0.1575
1.9	-0.85	5.25	4.4	-0.08	-0.152
2	-0.75	5.15	4.4	-0.0725	-0.145
2.1	-0.7	5.1	4.4	-0.0675	-0.14175
2.2	-0.65	5.05	4.4	-0.065	-0.143
2.3	-0.65	5.05	4.4	-0.0625	-0.14375
2.4	-0.6	5	4.4	-0.06	-0.144
2.5	-0.6	5	4.4	-0.06	-0.15
2.6	-0.6	5	4.4	-0.0575	-0.1495
2.7	-0.55	4.95	4.4	-0.055	-0.1485
2.8	-0.55	4.95	4.4	-0.055	-0.154
2.9	-0.55	4.95	4.4	-0.055	-0.1595
3	-0.55	4.95	4.4	-0.0525	-0.1575
3.1	-0.5	4.9	4.4	-0.05	-0.155
3.2	-0.5	4.9	4.4	-0.0475	-0.152
3.3	-0.45	4.85	4.4	-0.0425	-0.14025
3.4	-0.4	4.8	4.4	-0.0375	-0.1275
3.5	-0.35	4.75	4.4	-0.035	-0.1225
3.6	-0.35	4.75	4.4	-0.0325	-0.117
3.7	-0.3	4.7	4.4	-0.025	-0.0925
3.8	-0.2	4.6	4.4	-0.015	-0.057
3.9	-0.1	4.5	4.4	-0.005	-0.0195
4	0	4.4	4.4	0	0

APPENDIX D

PRESSURE DISTRIBUTION DATA FOR AIR BAR D WITHOUT TRAILING SLOTTED VENT HOLES

Theta = 0.4407 degree
Dist = 0.05 inch

BACK 0.04 inch FRONT 0.06 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0	-0.35	-0.35	0.01	-0.004	0.774116	0.159437
-0.3	0.2	-0.55	-0.35	0.0125	-0.00375		
-0.25	0.3	-0.65	-0.35	0.02375	-0.00594		
-0.2	0.65	-1	-0.35	0.05125	-0.01025		
-0.15	1.4	-1.75	-0.35	0.10625	-0.01594		
-0.1	2.85	-3.2	-0.35	0.18875	-0.01888		
-0.05	4.7	-5.05	-0.35	0.048	-0.0024		
-0.04	4.9	-5.25	-0.35	0.04925	-0.00197		
-0.03	4.95	-5.3	-0.35	0.04975	-0.00149		
-0.02	5	-5.35	-0.35	0.05	-0.001		
-0.01	5	-5.35	-0.35	0.05075	-0.00051		
0	5.15	-5.5	-0.35	0.051	0		
0.01	5.05	-5.4	-0.35	0.05025	0.000503		
0.02	5	-5.35	-0.35	0.0495	0.00099		
0.03	4.9	-5.25	-0.35	0.048	0.00144		
0.04	4.7	-5.05	-0.35	0.04625	0.00185		
0.05	4.55	-4.9	-0.35	0.0445	0.002225		
0.06	4.35	-4.7	-0.35	0.0425	0.00255		
0.07	4.15	-4.5	-0.35	0.04	0.0028		
0.08	3.85	-4.2	-0.35	0.0375	0.003		
0.09	3.65	-4	-0.35	0.03525	0.003173		
0.1	3.4	-3.75	-0.35	0.065	0.0065		
0.12	3.1	-3.45	-0.35	0.06	0.0072		
0.14	2.9	-3.25	-0.35	0.0565	0.00791		
0.16	2.75	-3.1	-0.35	0.055	0.0088		
0.18	2.75	-3.1	-0.35	0.055	0.0099		
0.2	2.75	-3.1	-0.35	0.14125	0.02825		
0.25	2.9	-3.25	-0.35	0.14625	0.036563		
0.3	2.95	-3.3	-0.35	0.14625	0.043875		
0.35	2.9	-3.25	-0.35	0.14125	0.049438		
0.4	2.75	-3.1	-0.35	0.13375	0.0535		
0.45	2.6	-2.95	-0.35	0.12625	0.056813		
0.5	2.45	-2.8	-0.35	0.12	0.06		
0.55	2.35	-2.7	-0.35	0.115	0.06325		
0.6	2.25	-2.6	-0.35	0.11125	0.06675		
0.65	2.2	-2.55	-0.35	0.11	0.0715		
0.7	2.2	-2.55	-0.35	0.10875	0.076125		
0.75	2.15	-2.5	-0.35	0.10625	0.079688		
0.8	2.1	-2.45	-0.35	0.10375	0.083		
0.85	2.05	-2.4	-0.35	0.10125	0.086063		

0.9	2	-2.35	-0.35	0.09875	0.088875
0.95	1.95	-2.3	-0.35	0.09625	0.091438
1	1.9	-2.25	-0.35	0.1875	0.1875
1.1	1.85	-2.2	-0.35	0.1825	0.20075
1.2	1.8	-2.15	-0.35	0.175	0.21
1.3	1.7	-2.05	-0.35	0.1675	0.21775
1.4	1.65	-2	-0.35	0.1625	0.2275
1.5	1.6	-1.95	-0.35	0.155	0.2325
1.6	1.5	-1.85	-0.35	0.1475	0.236
1.7	1.45	-1.8	-0.35	0.14	0.238
1.8	1.35	-1.7	-0.35	0.13	0.234
1.9	1.25	-1.6	-0.35	0.12	0.228
2	1.15	-1.5	-0.35	0.215	0.43
2.2	1	-1.35	-0.35	0.19	0.418
2.4	0.9	-1.25	-0.35	0.155	0.372
2.6	0.65	-1	-0.35	0.105	0.273
2.8	0.4	-0.75	-0.35	0.045	0.126
3	0.05	-0.4	-0.35	-0.03	-0.09
3.2	-0.35	0	-0.35	-0.065	-0.208
3.4	-0.3	-0.05	-0.35	-0.06	-0.204
3.6	-0.3	-0.05	-0.35	-0.045	-0.162
3.8	-0.15	-0.2	-0.35	-0.015	-0.057
4	0	-0.35	-0.35		

Theta = 0.4407 degree
Dist = 0.07 inch

BACK 0.06 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.1	-0.45	-0.35	0.0125	-0.005	-0.05605	0.099274
-0.3	0.15	-0.5	-0.35	0.01	-0.003		
-0.25	0.25	-0.6	-0.35	0.0175	-0.00438		
-0.2	0.45	-0.8	-0.35	0.03875	-0.00775		
-0.15	1.1	-1.45	-0.35	0.1025	-0.01538		
-0.1	3	-3.35	-0.35	0.18875	-0.01888		
-0.05	4.55	-4.9	-0.35	0.04775	-0.00239		
-0.04	5	-5.35	-0.35	0.05075	-0.00203		
-0.03	5.15	-5.5	-0.35	0.0515	-0.00155		
-0.02	5.15	-5.5	-0.35	0.05125	-0.00103		
-0.01	5.1	-5.45	-0.35	0.052	-0.00052		
0	5.3	-5.65	-0.35	0.05275	0		
0.01	5.25	-5.6	-0.35	0.052	0.00052		
0.02	5.15	-5.5	-0.35	0.051	0.00102		
0.03	5.05	-5.4	-0.35	0.04975	0.001493		
0.04	4.9	-5.25	-0.35	0.048	0.00192		
0.05	4.7	-5.05	-0.35	0.0455	0.002275		

0.06	4.4	-4.75	-0.35	0.04275	0.002565
0.07	4.15	-4.5	-0.35	0.04025	0.002818
0.08	3.9	-4.25	-0.35	0.03775	0.00302
0.09	3.65	-4	-0.35	0.03475	0.003128
0.1	3.3	-3.65	-0.35	0.0625	0.00625
0.12	2.95	-3.3	-0.35	0.056	0.00672
0.14	2.65	-3	-0.35	0.0505	0.00707
0.16	2.4	-2.75	-0.35	0.0475	0.0076
0.18	2.35	-2.7	-0.35	0.0465	0.00837
0.2	2.3	-2.65	-0.35	0.11875	0.02375
0.25	2.45	-2.8	-0.35	0.12375	0.030938
0.3	2.5	-2.85	-0.35	0.12375	0.037125
0.35	2.45	-2.8	-0.35	0.1175	0.041125
0.4	2.25	-2.6	-0.35	0.10875	0.0435
0.45	2.1	-2.45	-0.35	0.1025	0.046125
0.5	2	-2.35	-0.35	0.0975	0.04875
0.55	1.9	-2.25	-0.35	0.09375	0.051562
0.6	1.85	-2.2	-0.35	0.09125	0.05475
0.65	1.8	-2.15	-0.35	0.09	0.0585
0.7	1.8	-2.15	-0.35	0.08875	0.062125
0.75	1.75	-2.1	-0.35	0.08625	0.064688
0.8	1.7	-2.05	-0.35	0.08375	0.067
0.85	1.65	-2	-0.35	0.08125	0.069063
0.9	1.6	-1.95	-0.35	0.07875	0.070875
0.95	1.55	-1.9	-0.35	0.07625	0.072438
1	1.5	-1.85	-0.35	0.1475	0.1475
1.1	1.45	-1.8	-0.35	0.1425	0.15675
1.2	1.4	-1.75	-0.35	0.1375	0.165
1.3	1.35	-1.7	-0.35	0.13	0.169
1.4	1.25	-1.6	-0.35	0.1225	0.1715
1.5	1.2	-1.55	-0.35	0.115	0.1725
1.6	1.1	-1.45	-0.35	0.105	0.168
1.7	1	-1.35	-0.35	0.095	0.1615
1.8	0.9	-1.25	-0.35	0.085	0.153
1.9	0.8	-1.15	-0.35	0.075	0.1425
2	0.7	-1.05	-0.35	0.12	0.24
2.2	0.5	-0.85	-0.35	0.075	0.165
2.4	0.25	-0.6	-0.35	0.025	0.06
2.6	0	-0.35	-0.35	-0.03	-0.078
2.8	-0.3	-0.05	-0.35	-0.1	-0.28
3	-0.7	0.35	-0.35	-0.18	-0.54
3.2	-1.1	0.75	-0.35	-0.205	-0.656
3.4	-0.95	0.6	-0.35	-0.205	-0.697
3.6	-1.1	0.75	-0.35	-0.155	-0.558
3.8	-0.45	0.1	-0.35	-0.075	-0.285
4	-0.3	-0.05	-0.35		

Theta = 0.4407 degree
Dist = 0.09 inch

BACK FRONT

0.08 inch 0.1 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.05	-0.4	-0.35	0.0075	-0.003	-9.89081	0.014258
-0.3	0.1	-0.45	-0.35	0.00625	-0.00188		
-0.25	0.15	-0.5	-0.35	0.01	-0.0025		
-0.2	0.25	-0.6	-0.35	0.01625	-0.00325		
-0.15	0.4	-0.75	-0.35	0.0475	-0.00713		
-0.1	1.5	-1.85	-0.35	0.11625	-0.01163		
-0.05	3.15	-3.5	-0.35	0.0335	-0.00168		
-0.04	3.55	-3.9	-0.35	0.0375	-0.0015		
-0.03	3.95	-4.3	-0.35	0.0405	-0.00122		
-0.02	4.15	-4.5	-0.35	0.04225	-0.00085		
-0.01	4.3	-4.65	-0.35	0.043	-0.00043		
0	4.3	-4.65	-0.35	0.0425	0		
0.01	4.2	-4.55	-0.35	0.041	0.00041		
0.02	4	-4.35	-0.35	0.03925	0.000785		
0.03	3.85	-4.2	-0.35	0.03675	0.001103		
0.04	3.5	-3.85	-0.35	0.03375	0.00135		
0.05	3.25	-3.6	-0.35	0.0315	0.001575		
0.06	3.05	-3.4	-0.35	0.02975	0.001785		
0.07	2.9	-3.25	-0.35	0.02775	0.001943		
0.08	2.65	-3	-0.35	0.02575	0.00206		
0.09	2.5	-2.85	-0.35	0.02425	0.002183		
0.1	2.35	-2.7	-0.35	0.0455	0.00455		
0.12	2.2	-2.55	-0.35	0.042	0.00504		
0.14	2	-2.35	-0.35	0.039	0.00546		
0.16	1.9	-2.25	-0.35	0.038	0.00608		
0.18	1.9	-2.25	-0.35	0.037	0.00666		
0.2	1.8	-2.15	-0.35	0.08875	0.01775		
0.25	1.75	-2.1	-0.35	0.08625	0.021563		
0.3	1.7	-2.05	-0.35	0.0825	0.02475		
0.35	1.6	-1.95	-0.35	0.0775	0.027125		
0.4	1.5	-1.85	-0.35	0.07375	0.0295		
0.45	1.45	-1.8	-0.35	0.07125	0.032063		
0.5	1.4	-1.75	-0.35	0.06875	0.034375		
0.55	1.35	-1.7	-0.35	0.06625	0.036437		
0.6	1.3	-1.65	-0.35	0.06375	0.03825		
0.65	1.25	-1.6	-0.35	0.0625	0.040625		
0.7	1.25	-1.6	-0.35	0.06125	0.042875		
0.75	1.2	-1.55	-0.35	0.05875	0.044063		
0.8	1.15	-1.5	-0.35	0.05625	0.045		
0.85	1.1	-1.45	-0.35	0.05375	0.045688		
0.9	1.05	-1.4	-0.35	0.05125	0.046125		
0.95	1	-1.35	-0.35	0.04875	0.046313		
1	0.95	-1.3	-0.35	0.0925	0.0925		
1.1	0.9	-1.25	-0.35	0.085	0.0935		
1.2	0.8	-1.15	-0.35	0.075	0.09		
1.3	0.7	-1.05	-0.35	0.0675	0.08775		

1.4	0.65	-1	-0.35	0.0575	0.0805
1.5	0.5	-0.85	-0.35	0.045	0.0675
1.6	0.4	-0.75	-0.35	0.0325	0.052
1.7	0.25	-0.6	-0.35	0.02	0.034
1.8	0.15	-0.5	-0.35	0.0075	0.0135
1.9	0	-0.35	-0.35	-0.005	-0.0095
2	-0.1	-0.25	-0.35	-0.045	-0.09
2.2	-0.35	0	-0.35	-0.095	-0.209
2.4	-0.6	0.25	-0.35	-0.16	-0.384
2.6	-1	0.65	-0.35	-0.235	-0.611
2.8	-1.35	1	-0.35	-0.32	-0.896
3	-1.85	1.5	-0.35	-0.355	-1.065
3.2	-1.7	1.35	-0.35	-0.36	-1.152
3.4	-1.9	1.55	-0.35	-0.325	-1.105
3.6	-1.35	1	-0.35	-0.11	-0.396
3.7	-0.85	0.5	-0.35		

Theta = 0.8814 degree
Dist = 0.06 inch

BACK 0.04 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.15	-0.5	-0.35	0.0175	-0.007	1.024415	0.201666
-0.3	0.2	-0.55	-0.35	0.01125	-0.00338		
-0.25	0.25	-0.6	-0.35	0.01875	-0.00469		
-0.2	0.5	-0.85	-0.35	0.045	-0.009		
-0.15	1.3	-1.65	-0.35	0.08625	-0.01294		
-0.1	2.15	-2.5	-0.35	0.15	-0.015		
-0.05	3.85	-4.2	-0.35	0.04	-0.002		
-0.04	4.15	-4.5	-0.35	0.04275	-0.00171		
-0.03	4.4	-4.75	-0.35	0.045	-0.00135		
-0.02	4.6	-4.95	-0.35	0.0465	-0.00093		
-0.01	4.7	-5.05	-0.35	0.0475	-0.00048		
0	4.8	-5.15	-0.35	0.048	0		
0.01	4.8	-5.15	-0.35	0.0475	0.000475		
0.02	4.7	-5.05	-0.35	0.046	0.00092		
0.03	4.5	-4.85	-0.35	0.044	0.00132		
0.04	4.3	-4.65	-0.35	0.04225	0.00169		
0.05	4.15	-4.5	-0.35	0.04025	0.002013		
0.06	3.9	-4.25	-0.35	0.03775	0.002265		
0.07	3.65	-4	-0.35	0.0355	0.002485		
0.08	3.45	-3.8	-0.35	0.0335	0.00268		
0.09	3.25	-3.6	-0.35	0.03175	0.002858		
0.1	3.1	-3.45	-0.35	0.059	0.0059		
0.12	2.8	-3.15	-0.35	0.0545	0.00654		

0.14	2.65	-3	-0.35	0.052	0.00728
0.16	2.55	-2.9	-0.35	0.0505	0.00808
0.18	2.5	-2.85	-0.35	0.0505	0.00909
0.2	2.55	-2.9	-0.35	0.13	0.026
0.25	2.65	-3	-0.35	0.135	0.03375
0.3	2.75	-3.1	-0.35	0.1375	0.04125
0.35	2.75	-3.1	-0.35	0.13625	0.047688
0.4	2.7	-3.05	-0.35	0.135	0.054
0.45	2.7	-3.05	-0.35	0.13375	0.060188
0.5	2.65	-3	-0.35	0.1325	0.06625
0.55	2.65	-3	-0.35	0.13125	0.072187
0.6	2.6	-2.95	-0.35	0.12875	0.07725
0.65	2.55	-2.9	-0.35	0.1275	0.082875
0.7	2.55	-2.9	-0.35	0.1275	0.08925
0.75	2.55	-2.9	-0.35	0.12625	0.094688
0.8	2.5	-2.85	-0.35	0.125	0.1
0.85	2.5	-2.85	-0.35	0.125	0.10625
0.9	2.5	-2.85	-0.35	0.125	0.1125
0.95	2.5	-2.85	-0.35	0.12375	0.117563
1	2.45	-2.8	-0.35	0.2425	0.2425
1.1	2.4	-2.75	-0.35	0.24	0.264
1.2	2.4	-2.75	-0.35	0.2375	0.285
1.3	2.35	-2.7	-0.35	0.2325	0.30225
1.4	2.3	-2.65	-0.35	0.2275	0.3185
1.5	2.25	-2.6	-0.35	0.2225	0.33375
1.6	2.2	-2.55	-0.35	0.2175	0.348
1.7	2.15	-2.5	-0.35	0.2125	0.36125
1.8	2.1	-2.45	-0.35	0.2075	0.3735
1.9	2.05	-2.4	-0.35	0.2	0.38
2	1.95	-2.3	-0.35	0.38	0.76
2.2	1.85	-2.2	-0.35	0.355	0.781
2.4	1.7	-2.05	-0.35	0.315	0.756
2.6	1.45	-1.8	-0.35	0.255	0.663
2.8	1.1	-1.45	-0.35	0.165	0.462
3	0.55	-0.9	-0.35	0.02	0.06
3.2	-0.35	0	-0.35	-0.08	-0.256
3.4	-0.45	0.1	-0.35	-0.08	-0.272
3.6	-0.35	0	-0.35	-0.07	-0.252
3.8	-0.35	0	-0.35	-0.0425	-0.1615
3.9	-0.5	0.15	-0.35		

Theta = 0.8814 degree
Dist = 0.08 inch

BACK 0.04 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)

-0.4	0.1	-0.55	-0.45	0.015	-0.006	-0.71114	0.076978
-0.3	0.2	-0.65	-0.45	0.0125	-0.00375		
-0.25	0.3	-0.75	-0.45	0.02	-0.005		
-0.2	0.5	-0.95	-0.45	0.03375	-0.00675		
-0.15	0.85	-1.3	-0.45	0.07875	-0.01181		
-0.1	2.3	-2.75	-0.45	0.1575	-0.01575		
-0.05	4	-4.45	-0.45	0.041	-0.00205		
-0.04	4.2	-4.65	-0.45	0.04375	-0.00175		
-0.03	4.55	-5	-0.45	0.04625	-0.00139		
-0.02	4.7	-5.15	-0.45	0.04725	-0.00095		
-0.01	4.75	-5.2	-0.45	0.04775	-0.00048		
0	4.8	-5.25	-0.45	0.048	0		
0.01	4.8	-5.25	-0.45	0.0475	0.000475		
0.02	4.7	-5.15	-0.45	0.04625	0.000925		
0.03	4.55	-5	-0.45	0.0445	0.001335		
0.04	4.35	-4.8	-0.45	0.0425	0.0017		
0.05	4.15	-4.6	-0.45	0.04025	0.002013		
0.06	3.9	-4.35	-0.45	0.03775	0.002265		
0.07	3.65	-4.1	-0.45	0.035	0.00245		
0.08	3.35	-3.8	-0.45	0.0325	0.0026		
0.09	3.15	-3.6	-0.45	0.03075	0.002768		
0.1	3	-3.45	-0.45	0.0565	0.00565		
0.12	2.65	-3.1	-0.45	0.0515	0.00618		
0.14	2.5	-2.95	-0.45	0.0485	0.00679		
0.16	2.35	-2.8	-0.45	0.0465	0.00744		
0.18	2.3	-2.75	-0.45	0.0455	0.00819		
0.2	2.25	-2.7	-0.45	0.1125	0.0225		
0.25	2.25	-2.7	-0.45	0.1125	0.028125		
0.3	2.25	-2.7	-0.45	0.11125	0.033375		
0.35	2.2	-2.65	-0.45	0.10875	0.038063		
0.4	2.15	-2.6	-0.45	0.10625	0.0425		
0.45	2.1	-2.55	-0.45	0.10375	0.046688		
0.5	2.05	-2.5	-0.45	0.10125	0.050625		
0.55	2	-2.45	-0.45	0.1	0.055		
0.6	2	-2.45	-0.45	0.09875	0.05925		
0.65	1.95	-2.4	-0.45	0.09625	0.062562		
0.7	1.9	-2.35	-0.45	0.09375	0.065625		
0.75	1.85	-2.3	-0.45	0.09125	0.068438		
0.8	1.8	-2.25	-0.45	0.08875	0.071		
0.85	1.75	-2.2	-0.45	0.08625	0.073313		
0.9	1.7	-2.15	-0.45	0.08375	0.075375		
0.95	1.65	-2.1	-0.45	0.08125	0.077188		
1	1.6	-2.05	-0.45	0.155	0.155		
1.1	1.5	-1.95	-0.45	0.145	0.1595		
1.2	1.4	-1.85	-0.45	0.135	0.162		
1.3	1.3	-1.75	-0.45	0.125	0.1625		
1.4	1.2	-1.65	-0.45	0.115	0.161		
1.5	1.1	-1.55	-0.45	0.105	0.1575		
1.6	1	-1.45	-0.45	0.0925	0.148		
1.7	0.85	-1.3	-0.45	0.08	0.136		
1.8	0.75	-1.2	-0.45	0.0675	0.1215		

1.9	0.6	-1.05	-0.45	0.055	0.1045
2	0.5	-0.95	-0.45	0.075	0.15
2.2	0.25	-0.7	-0.45	0.025	0.055
2.4	0	-0.45	-0.45	-0.035	-0.084
2.6	-0.35	-0.1	-0.45	-0.105	-0.273
2.8	-0.7	0.25	-0.45	-0.155	-0.434
3	-0.85	0.4	-0.45	-0.215	-0.645
3.2	-1.3	0.85	-0.45	-0.265	-0.848
3.4	-1.35	0.9	-0.45	-0.29	-0.986
3.6	-1.55	1.1	-0.45	-0.235	-0.846
3.8	-0.8	0.35	-0.45	-0.0675	-0.2565
3.9	-0.55	0.1	-0.45		

Theta = 0.8814 degree
Dist = 0.1 inch

BACK 0.08 inch FRONT 0.12 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.1	-0.5	-0.4	0.01	-0.004	-1.11638	0.072638
-0.3	0.1	-0.5	-0.4	0.00625	-0.00188		
-0.25	0.15	-0.55	-0.4	0.01125	-0.00281		
-0.2	0.3	-0.7	-0.4	0.025	-0.005		
-0.15	0.7	-1.1	-0.4	0.065	-0.00975		
-0.1	1.9	-2.3	-0.4	0.14875	-0.01488		
-0.05	4.05	-4.45	-0.4	0.042	-0.0021		
-0.04	4.35	-4.75	-0.4	0.04425	-0.00177		
-0.03	4.5	-4.9	-0.4	0.046	-0.00138		
-0.02	4.7	-5.1	-0.4	0.04725	-0.00095		
-0.01	4.75	-5.15	-0.4	0.048	-0.00048		
0	4.85	-5.25	-0.4	0.0485	0		
0.01	4.85	-5.25	-0.4	0.04825	0.000483		
0.02	4.8	-5.2	-0.4	0.04775	0.000955		
0.03	4.75	-5.15	-0.4	0.047	0.00141		
0.04	4.65	-5.05	-0.4	0.04575	0.00183		
0.05	4.5	-4.9	-0.4	0.044	0.0022		
0.06	4.3	-4.7	-0.4	0.042	0.00252		
0.07	4.1	-4.5	-0.4	0.03975	0.002783		
0.08	3.85	-4.25	-0.4	0.037	0.00296		
0.09	3.55	-3.95	-0.4	0.03425	0.003083		
0.1	3.3	-3.7	-0.4	0.0615	0.00615		
0.12	2.85	-3.25	-0.4	0.0525	0.0063		
0.14	2.4	-2.8	-0.4	0.0455	0.00637		
0.16	2.15	-2.55	-0.4	0.041	0.00656		
0.18	1.95	-2.35	-0.4	0.038	0.00684		
0.2	1.85	-2.25	-0.4	0.0925	0.0185		
0.25	1.85	-2.25	-0.4	0.095	0.02375		

0.3	1.95	-2.35	-0.4	0.1	0.03
0.35	2.05	-2.45	-0.4	0.10375	0.036313
0.4	2.1	-2.5	-0.4	0.105	0.042
0.45	2.1	-2.5	-0.4	0.105	0.04725
0.5	2.1	-2.5	-0.4	0.105	0.0525
0.55	2.1	-2.5	-0.4	0.10375	0.057062
0.6	2.05	-2.45	-0.4	0.1025	0.0615
0.65	2.05	-2.45	-0.4	0.10125	0.065812
0.7	2	-2.4	-0.4	0.1	0.07
0.75	2	-2.4	-0.4	0.09875	0.074063
0.8	1.95	-2.35	-0.4	0.09625	0.077
0.85	1.9	-2.3	-0.4	0.09375	0.079688
0.9	1.85	-2.25	-0.4	0.0925	0.08325
0.95	1.85	-2.25	-0.4	0.09125	0.086688
1	1.8	-2.2	-0.4	0.175	0.175
1.1	1.7	-2.1	-0.4	0.1675	0.18425
1.2	1.65	-2.05	-0.4	0.1625	0.195
1.3	1.6	-2	-0.4	0.1525	0.19825
1.4	1.45	-1.85	-0.4	0.14	0.196
1.5	1.35	-1.75	-0.4	0.13	0.195
1.6	1.25	-1.65	-0.4	0.1175	0.188
1.7	1.1	-1.5	-0.4	0.105	0.1785
1.8	1	-1.4	-0.4	0.0925	0.1665
1.9	0.85	-1.25	-0.4	0.08	0.152
2	0.75	-1.15	-0.4	0.12	0.24
2.2	0.45	-0.85	-0.4	0.06	0.132
2.4	0.15	-0.55	-0.4	-0.015	-0.036
2.6	-0.3	-0.1	-0.4	-0.11	-0.286
2.8	-0.8	0.4	-0.4	-0.23	-0.644
3	-1.5	1.1	-0.4	-0.34	-1.02
3.2	-1.9	1.5	-0.4	-0.37	-1.184
3.4	-1.8	1.4	-0.4	-0.375	-1.275
3.6	-1.95	1.55	-0.4	-0.295	-1.062
3.8	-1	0.6	-0.4	-0.085	-0.323
3.9	-0.7	0.3	-0.4		

Theta = 1.32198 degree
Dist = 0.06 inch

BACK 0.03 inch FRONT 0.09 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.15	-0.6	-0.45	0.0225	-0.009	1.164424	0.226661
-0.3	0.3	-0.75	-0.45	0.02	-0.006		
-0.25	0.5	-0.95	-0.45	0.0325	-0.00813		
-0.2	0.8	-1.25	-0.45	0.05875	-0.01175		
-0.15	1.55	-2	-0.45	0.10875	-0.01631		

-0.1	2.8	-3.25	-0.45	0.1725	-0.01725
-0.05	4.1	-4.55	-0.45	0.042	-0.0021
-0.04	4.3	-4.75	-0.45	0.0435	-0.00174
-0.03	4.4	-4.85	-0.45	0.0445	-0.00134
-0.02	4.5	-4.95	-0.45	0.04525	-0.00091
-0.01	4.55	-5	-0.45	0.04575	-0.00046
0	4.6	-5.05	-0.45	0.046	0
0.01	4.6	-5.05	-0.45	0.04575	0.000458
0.02	4.55	-5	-0.45	0.04525	0.000905
0.03	4.5	-4.95	-0.45	0.0435	0.001305
0.04	4.2	-4.65	-0.45	0.0415	0.00166
0.05	4.1	-4.55	-0.45	0.03975	0.001988
0.06	3.85	-4.3	-0.45	0.03775	0.002265
0.07	3.7	-4.15	-0.45	0.036	0.00252
0.08	3.5	-3.95	-0.45	0.03375	0.0027
0.09	3.25	-3.7	-0.45	0.03175	0.002858
0.1	3.1	-3.55	-0.45	0.059	0.0059
0.12	2.8	-3.25	-0.45	0.0535	0.00642
0.14	2.55	-3	-0.45	0.0495	0.00693
0.16	2.4	-2.85	-0.45	0.047	0.00752
0.18	2.3	-2.75	-0.45	0.0455	0.00819
0.2	2.25	-2.7	-0.45	0.11375	0.02275
0.25	2.3	-2.75	-0.45	0.11625	0.029063
0.3	2.35	-2.8	-0.45	0.12	0.036
0.35	2.45	-2.9	-0.45	0.125	0.04375
0.4	2.55	-3	-0.45	0.1275	0.051
0.45	2.55	-3	-0.45	0.12875	0.057938
0.5	2.6	-3.05	-0.45	0.13	0.065
0.55	2.6	-3.05	-0.45	0.13	0.0715
0.6	2.6	-3.05	-0.45	0.13	0.078
0.65	2.6	-3.05	-0.45	0.13	0.0845
0.7	2.6	-3.05	-0.45	0.13	0.091
0.75	2.6	-3.05	-0.45	0.13	0.0975
0.8	2.6	-3.05	-0.45	0.13	0.104
0.85	2.6	-3.05	-0.45	0.13	0.1105
0.9	2.6	-3.05	-0.45	0.13	0.117
0.95	2.6	-3.05	-0.45	0.12875	0.122313
1	2.55	-3	-0.45	0.255	0.255
1.1	2.55	-3	-0.45	0.255	0.2805
1.2	2.55	-3	-0.45	0.255	0.306
1.3	2.55	-3	-0.45	0.2525	0.32825
1.4	2.5	-2.95	-0.45	0.25	0.35
1.5	2.5	-2.95	-0.45	0.2475	0.37125
1.6	2.45	-2.9	-0.45	0.245	0.392
1.7	2.45	-2.9	-0.45	0.2425	0.41225
1.8	2.4	-2.85	-0.45	0.2375	0.4275
1.9	2.35	-2.8	-0.45	0.2325	0.44175
2	2.3	-2.75	-0.45	0.45	0.9
2.2	2.2	-2.65	-0.45	0.425	0.935
2.4	2.05	-2.5	-0.45	0.39	0.936
2.6	1.85	-2.3	-0.45	0.34	0.884

2.8	1.55	-2	-0.45	0.25	0.7
3	0.95	-1.4	-0.45	0.0675	0.2025
3.1	0.4	-0.85	-0.45	0.015	0.0465
3.2	-0.1	-0.35	-0.45	-0.005	-0.016
3.3	0	-0.45	-0.45	0	0
3.4	0	-0.45	-0.45	-0.01	-0.034
3.5	-0.2	-0.25	-0.45	-0.03	-0.105
3.6	-0.4	-0.05	-0.45	-0.035	-0.126
3.7	-0.3	-0.15	-0.45	-0.0275	-0.10175
3.8	-0.25	-0.2	-0.45	-0.0175	-0.0665
3.9	-0.1	-0.35	-0.45	-0.0075	-0.02925
4	-0.05	-0.4	-0.45		

Theta = 1.32198 degree
Dist = 0.09 inch

BACK 0.06 inch FRONT 0.12 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.05	-0.5	-0.45	0.005	-0.002	-0.11395	0.107857
-0.3	0.05	-0.5	-0.45	0.005	-0.0015		
-0.25	0.15	-0.6	-0.45	0.01125	-0.00281		
-0.2	0.3	-0.75	-0.45	0.0275	-0.0055		
-0.15	0.8	-1.25	-0.45	0.07625	-0.01144		
-0.1	2.25	-2.7	-0.45	0.1625	-0.01625		
-0.05	4.25	-4.7	-0.45	0.0435	-0.00218		
-0.04	4.45	-4.9	-0.45	0.046	-0.00184		
-0.03	4.75	-5.2	-0.45	0.048	-0.00144		
-0.02	4.85	-5.3	-0.45	0.04875	-0.00098		
-0.01	4.9	-5.35	-0.45	0.04925	-0.00049		
0	4.95	-5.4	-0.45	0.04875	0		
0.01	4.8	-5.25	-0.45	0.04725	0.000473		
0.02	4.65	-5.1	-0.45	0.0455	0.00091		
0.03	4.45	-4.9	-0.45	0.0435	0.001305		
0.04	4.25	-4.7	-0.45	0.041	0.00164		
0.05	3.95	-4.4	-0.45	0.03825	0.001913		
0.06	3.7	-4.15	-0.45	0.035	0.0021		
0.07	3.3	-3.75	-0.45	0.032	0.00224		
0.08	3.1	-3.55	-0.45	0.0295	0.00236		
0.09	2.8	-3.25	-0.45	0.027	0.00243		
0.1	2.6	-3.05	-0.45	0.048	0.0048		
0.12	2.2	-2.65	-0.45	0.0425	0.0051		
0.14	2.05	-2.5	-0.45	0.0395	0.00553		
0.16	1.9	-2.35	-0.45	0.0375	0.006		
0.18	1.85	-2.3	-0.45	0.0365	0.00657		
0.2	1.8	-2.25	-0.45	0.0925	0.0185		
0.25	1.9	-2.35	-0.45	0.09875	0.024688		

0.3	2.05	-2.5	-0.45	0.105	0.0315
0.35	2.15	-2.6	-0.45	0.10875	0.038063
0.4	2.2	-2.65	-0.45	0.11	0.044
0.45	2.2	-2.65	-0.45	0.11	0.0495
0.5	2.2	-2.65	-0.45	0.11	0.055
0.55	2.2	-2.65	-0.45	0.11	0.0605
0.6	2.2	-2.65	-0.45	0.11	0.066
0.65	2.2	-2.65	-0.45	0.10875	0.070687
0.7	2.15	-2.6	-0.45	0.1075	0.07525
0.75	2.15	-2.6	-0.45	0.1075	0.080625
0.8	2.15	-2.6	-0.45	0.1075	0.086
0.85	2.15	-2.6	-0.45	0.105	0.08925
0.9	2.05	-2.5	-0.45	0.10375	0.093375
0.95	2.1	-2.55	-0.45	0.10375	0.098563
1	2.05	-2.5	-0.45	0.2025	0.2025
1.1	2	-2.45	-0.45	0.1975	0.21725
1.2	1.95	-2.4	-0.45	0.1925	0.231
1.3	1.9	-2.35	-0.45	0.1875	0.24375
1.4	1.85	-2.3	-0.45	0.1825	0.2555
1.5	1.8	-2.25	-0.45	0.1775	0.26625
1.6	1.75	-2.2	-0.45	0.17	0.272
1.7	1.65	-2.1	-0.45	0.16	0.272
1.8	1.55	-2	-0.45	0.15	0.27
1.9	1.45	-1.9	-0.45	0.1375	0.26125
2	1.3	-1.75	-0.45	0.235	0.47
2.2	1.05	-1.5	-0.45	0.18	0.396
2.4	0.75	-1.2	-0.45	0.11	0.264
2.6	0.35	-0.8	-0.45	0.02	0.052
2.8	-0.15	-0.3	-0.45	-0.1	-0.28
3	-0.85	0.4	-0.45	-0.23	-0.69
3.2	-1.45	1	-0.45	-0.27	-0.864
3.4	-1.25	0.8	-0.45	-0.295	-1.003
3.6	-1.7	1.25	-0.45	-0.36	-1.296
3.8	-1.9	1.45	-0.45	-0.245	-0.931
4	-0.55	0.1	-0.45		

Theta = 1.32198 degree
Dist = 0.11 inch

BACK 0.08 inch FRONT 0.14 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.05	-0.5	-0.45	0.0075	-0.003	-1.93527	0.056926
-0.3	0.1	-0.55	-0.45	0.00625	-0.00188		
-0.25	0.15	-0.6	-0.45	0.01125	-0.00281		
-0.2	0.3	-0.75	-0.45	0.02875	-0.00575		
-0.15	0.85	-1.3	-0.45	0.07375	-0.01106		

-0.1	2.1	-2.55	-0.45	0.13875	-0.01388
-0.05	3.45	-3.9	-0.45	0.03525	-0.00176
-0.04	3.6	-4.05	-0.45	0.0365	-0.00146
-0.03	3.7	-4.15	-0.45	0.03725	-0.00112
-0.02	3.75	-4.2	-0.45	0.03775	-0.00076
-0.01	3.8	-4.25	-0.45	0.0375	-0.00038
0	3.7	-4.15	-0.45	0.037	0
0.01	3.7	-4.15	-0.45	0.0365	0.000365
0.02	3.6	-4.05	-0.45	0.0355	0.00071
0.03	3.5	-3.95	-0.45	0.0345	0.001035
0.04	3.4	-3.85	-0.45	0.033	0.00132
0.05	3.2	-3.65	-0.45	0.03125	0.001563
0.06	3.05	-3.5	-0.45	0.02975	0.001785
0.07	2.9	-3.35	-0.45	0.028	0.00196
0.08	2.7	-3.15	-0.45	0.0265	0.00212
0.09	2.6	-3.05	-0.45	0.0255	0.002295
0.1	2.5	-2.95	-0.45	0.048	0.0048
0.12	2.3	-2.75	-0.45	0.0445	0.00534
0.14	2.15	-2.6	-0.45	0.042	0.00588
0.16	2.05	-2.5	-0.45	0.04	0.0064
0.18	1.95	-2.4	-0.45	0.0385	0.00693
0.2	1.9	-2.35	-0.45	0.095	0.019
0.25	1.9	-2.35	-0.45	0.095	0.02375
0.3	1.9	-2.35	-0.45	0.0975	0.02925
0.35	2	-2.45	-0.45	0.10125	0.035438
0.4	2.05	-2.5	-0.45	0.1025	0.041
0.45	2.05	-2.5	-0.45	0.1025	0.046125
0.5	2.05	-2.5	-0.45	0.1025	0.05125
0.55	2.05	-2.5	-0.45	0.1025	0.056375
0.6	2.05	-2.5	-0.45	0.1025	0.0615
0.65	2.05	-2.5	-0.45	0.10125	0.065812
0.7	2	-2.45	-0.45	0.1	0.07
0.75	2	-2.45	-0.45	0.09875	0.074063
0.8	1.95	-2.4	-0.45	0.09625	0.077
0.85	1.9	-2.35	-0.45	0.09375	0.079688
0.9	1.85	-2.3	-0.45	0.09125	0.082125
0.95	1.8	-2.25	-0.45	0.09	0.0855
1	1.8	-2.25	-0.45	0.175	0.175
1.1	1.7	-2.15	-0.45	0.165	0.1815
1.2	1.6	-2.05	-0.45	0.155	0.186
1.3	1.5	-1.95	-0.45	0.145	0.1885
1.4	1.4	-1.85	-0.45	0.135	0.189
1.5	1.3	-1.75	-0.45	0.125	0.1875
1.6	1.2	-1.65	-0.45	0.115	0.184
1.7	1.1	-1.55	-0.45	0.1025	0.17425
1.8	0.95	-1.4	-0.45	0.09	0.162
1.9	0.85	-1.3	-0.45	0.0775	0.14725
2	0.7	-1.15	-0.45	0.11	0.22
2.2	0.4	-0.85	-0.45	0.045	0.099
2.4	0.05	-0.5	-0.45	-0.01	-0.024
2.5	-0.25	-0.2	-0.45	-0.035	-0.0875

2.6	-0.45	0	-0.45	-0.15	-0.39
2.8	-1.05	0.6	-0.45	-0.1225	-0.343
2.9	-1.4	0.95	-0.45	-0.1475	-0.42775
3	-1.55	1.1	-0.45	-0.155	-0.465
3.1	-1.55	1.1	-0.45	-0.1625	-0.50375
3.2	-1.7	1.25	-0.45	-0.23	-0.736
3.3	-2.9	2.45	-0.45	-0.295	-0.9735
3.4	-3	2.55	-0.45	-0.2775	-0.9435
3.5	-2.55	2.1	-0.45	-0.22	-0.77
3.6	-1.85	1.4	-0.45	-0.16	-0.576
3.7	-1.35	0.9	-0.45	-0.12	-0.444
3.8	-1.05	0.6	-0.45		

Theta = -1.32198 degree
Dist = 0.11 inch

BACK 0.14 inch FRONT 0.08 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0	-0.45	-0.45	0	0	1.861949	-0.1591
-0.3	0	-0.45	-0.45	0	0		
-0.25	0	-0.45	-0.45	-0.00125	0.000313		
-0.2	-0.05	-0.4	-0.45	0	0		
-0.15	0.05	-0.5	-0.45	0.0225	-0.00338		
-0.1	0.85	-1.3	-0.45	0.055	-0.0055		
-0.05	1.35	-1.8	-0.45	0.014	-0.0007		
-0.04	1.45	-1.9	-0.45	0.015	-0.0006		
-0.03	1.55	-2	-0.45	0.0155	-0.00047		
-0.02	1.55	-2	-0.45	0.01525	-0.00031		
-0.01	1.5	-1.95	-0.45	0.01475	-0.00015		
0	1.45	-1.9	-0.45	0.01425	0		
0.01	1.4	-1.85	-0.45	0.01375	0.000138		
0.02	1.35	-1.8	-0.45	0.01325	0.000265		
0.03	1.3	-1.75	-0.45	0.01275	0.000383		
0.04	1.25	-1.7	-0.45	0.01175	0.00047		
0.05	1.1	-1.55	-0.45	0.00975	0.000488		
0.06	0.85	-1.3	-0.45	0.00775	0.000465		
0.07	0.7	-1.15	-0.45	0.006	0.00042		
0.08	0.5	-0.95	-0.45	0.004	0.00032		
0.09	0.3	-0.75	-0.45	0.00175	0.000158		
0.1	0.05	-0.5	-0.45	-0.0015	-0.00015		
0.12	-0.2	-0.25	-0.45	-0.0075	-0.0009		
0.14	-0.55	0.1	-0.45	-0.0145	-0.00203		
0.16	-0.9	0.45	-0.45	-0.021	-0.00336		
0.18	-1.2	0.75	-0.45	-0.0265	-0.00477		
0.2	-1.45	1	-0.45	-0.0825	-0.0165		
0.25	-1.85	1.4	-0.45	-0.09625	-0.02406		

0.3	-2	1.55	-0.45	-0.1025	-0.03075
0.35	-2.1	1.65	-0.45	-0.105	-0.03675
0.4	-2.1	1.65	-0.45	-0.10375	-0.0415
0.45	-2.05	1.6	-0.45	-0.1025	-0.04613
0.5	-2.05	1.6	-0.45	-0.10125	-0.05063
0.55	-2	1.55	-0.45	-0.09875	-0.05431
0.6	-1.95	1.5	-0.45	-0.0975	-0.0585
0.65	-1.95	1.5	-0.45	-0.09625	-0.06256
0.7	-1.9	1.45	-0.45	-0.09375	-0.06563
0.75	-1.85	1.4	-0.45	-0.0925	-0.06938
0.8	-1.85	1.4	-0.45	-0.09125	-0.073
0.85	-1.8	1.35	-0.45	-0.08875	-0.07544
0.9	-1.75	1.3	-0.45	-0.08625	-0.07762
0.95	-1.7	1.25	-0.45	-0.085	-0.08075
1	-1.7	1.25	-0.45	-0.1675	-0.1675
1.1	-1.65	1.2	-0.45	-0.1625	-0.17875
1.2	-1.6	1.15	-0.45	-0.1575	-0.189
1.3	-1.55	1.1	-0.45	-0.155	-0.2015
1.4	-1.55	1.1	-0.45	-0.1525	-0.2135
1.5	-1.5	1.05	-0.45	-0.15	-0.225
1.6	-1.5	1.05	-0.45	-0.1475	-0.236
1.7	-1.45	1	-0.45	-0.145	-0.2465
1.8	-1.45	1	-0.45	-0.1425	-0.2565
1.9	-1.4	0.95	-0.45	-0.14	-0.266
2	-1.4	0.95	-0.45	-0.28	-0.56
2.2	-1.4	0.95	-0.45	-0.28	-0.616
2.4	-1.4	0.95	-0.45	-0.285	-0.684
2.6	-1.45	1	-0.45	-0.295	-0.767
2.8	-1.5	1.05	-0.45	-0.295	-0.826
3	-1.45	1	-0.45	-0.275	-0.825
3.2	-1.3	0.85	-0.45	-0.26	-0.832
3.4	-1.3	0.85	-0.45	-0.225	-0.765
3.6	-0.95	0.5	-0.45	-0.16	-0.576
3.8	-0.65	0.2	-0.45	-0.11	-0.418
4	-0.45	0	-0.45		

Theta = -1.32198 degree
Dist = 0.07 inch

BACK 0.1 inch FRONT 0.04 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.1	-0.55	-0.45	0.01	-0.004	-78.9374	0.000947
-0.3	0.1	-0.55	-0.45	0.01	-0.003		
-0.25	0.3	-0.75	-0.45	0.0225	-0.00563		
-0.2	0.6	-1.05	-0.45	0.04875	-0.00975		
-0.15	1.35	-1.8	-0.45	0.11	-0.0165		

-0.1	3.05	-3.5	-0.45	0.19875	-0.01988
-0.05	4.9	-5.35	-0.45	0.05025	-0.00251
-0.04	5.15	-5.6	-0.45	0.052	-0.00208
-0.03	5.25	-5.7	-0.45	0.05275	-0.00158
-0.02	5.3	-5.75	-0.45	0.053	-0.00106
-0.01	5.3	-5.75	-0.45	0.05325	-0.00053
0	5.35	-5.8	-0.45	0.0535	0
0.01	5.35	-5.8	-0.45	0.05325	0.000533
0.02	5.3	-5.75	-0.45	0.0525	0.00105
0.03	5.2	-5.65	-0.45	0.0505	0.001515
0.04	4.9	-5.35	-0.45	0.048	0.00192
0.05	4.7	-5.15	-0.45	0.04575	0.002288
0.06	4.45	-4.9	-0.45	0.04325	0.002595
0.07	4.2	-4.65	-0.45	0.0405	0.002835
0.08	3.9	-4.35	-0.45	0.0375	0.003
0.09	3.6	-4.05	-0.45	0.03475	0.003128
0.1	3.35	-3.8	-0.45	0.067	0.0067
0.12	3.35	-3.8	-0.45	0.062	0.00744
0.14	2.85	-3.3	-0.45	0.0565	0.00791
0.16	2.8	-3.25	-0.45	0.0555	0.00888
0.18	2.75	-3.2	-0.45	0.055	0.0099
0.2	2.75	-3.2	-0.45	0.13625	0.02725
0.25	2.7	-3.15	-0.45	0.1275	0.031875
0.3	2.4	-2.85	-0.45	0.10375	0.031125
0.35	1.75	-2.2	-0.45	0.06	0.021
0.4	0.65	-1.1	-0.45	0.005	0.002
0.45	-0.45	0	-0.45	-0.04125	-0.01856
0.5	-1.2	0.75	-0.45	-0.06625	-0.03313
0.55	-1.45	1	-0.45	-0.07375	-0.04056
0.6	-1.5	1.05	-0.45	-0.075	-0.045
0.65	-1.5	1.05	-0.45	-0.07375	-0.04794
0.7	-1.45	1	-0.45	-0.07125	-0.04988
0.75	-1.4	0.95	-0.45	-0.0675	-0.05063
0.8	-1.3	0.85	-0.45	-0.0625	-0.05
0.85	-1.2	0.75	-0.45	-0.0575	-0.04888
0.9	-1.1	0.65	-0.45	-0.05375	-0.04837
0.95	-1.05	0.6	-0.45	-0.05	-0.0475
1	-0.95	0.5	-0.45	-0.09	-0.09
1.1	-0.85	0.4	-0.45	-0.095	-0.1045
1.2	-1.05	0.6	-0.45	-0.0875	-0.105
1.3	-0.7	0.25	-0.45	-0.0675	-0.08775
1.4	-0.65	0.2	-0.45	-0.0625	-0.0875
1.5	-0.6	0.15	-0.45	-0.0575	-0.08625
1.6	-0.55	0.1	-0.45	-0.0525	-0.084
1.7	-0.5	0.05	-0.45	-0.0475	-0.08075
1.8	-0.45	0	-0.45	-0.045	-0.081
1.9	-0.45	0	-0.45	-0.045	-0.0855
2	-0.45	0	-0.45	-0.085	-0.17
2.2	-0.4	-0.05	-0.45	-0.075	-0.165
2.4	-0.35	-0.1	-0.45	-0.065	-0.156
2.6	-0.3	-0.15	-0.45	-0.06	-0.156

2.8	-0.3	-0.15	-0.45	-0.055	-0.154
3	-0.25	-0.2	-0.45	-0.045	-0.135
3.2	-0.2	-0.25	-0.45	-0.035	-0.112
3.4	-0.15	-0.3	-0.45	-0.03	-0.102
3.6	-0.15	-0.3	-0.45	-0.025	-0.09
3.8	-0.1	-0.35	-0.45		

Theta = -0.4407 degree
Dist = 0.05 inch

BACK 0.06 inch FRONT 0.04 inch

DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.4	0.2	-0.65	-0.45	0.025	-0.01	-0.4102	0.057195
-0.3	0.3	-0.75	-0.45	0.0175	-0.00525		
-0.25	0.4	-0.85	-0.45	0.0275	-0.00688		
-0.2	0.7	-1.15	-0.45	0.04875	-0.00975		
-0.15	1.25	-1.7	-0.45	0.10125	-0.01519		
-0.1	2.8	-3.25	-0.45	0.1875	-0.01875		
-0.05	4.7	-5.15	-0.45	0.049	-0.00245		
-0.04	5.1	-5.55	-0.45	0.05175	-0.00207		
-0.03	5.25	-5.7	-0.45	0.05275	-0.00158		
-0.02	5.3	-5.75	-0.45	0.053	-0.00106		
-0.01	5.3	-5.75	-0.45	0.05375	-0.00054		
0	5.45	-5.9	-0.45	0.05425	0		
0.01	5.4	-5.85	-0.45	0.05375	0.000538		
0.02	5.35	-5.8	-0.45	0.0525	0.00105		
0.03	5.15	-5.6	-0.45	0.05	0.0015		
0.04	4.85	-5.3	-0.45	0.04825	0.00193		
0.05	4.8	-5.25	-0.45	0.04575	0.002288		
0.06	4.35	-4.8	-0.45	0.04225	0.002535		
0.07	4.1	-4.55	-0.45	0.0395	0.002765		
0.08	3.8	-4.25	-0.45	0.037	0.00296		
0.09	3.6	-4.05	-0.45	0.035	0.00315		
0.1	3.4	-3.85	-0.45	0.0655	0.00655		
0.12	3.15	-3.6	-0.45	0.061	0.00732		
0.14	2.95	-3.4	-0.45	0.0585	0.00819		
0.16	2.9	-3.35	-0.45	0.058	0.00928		
0.18	2.9	-3.35	-0.45	0.0585	0.01053		
0.2	2.95	-3.4	-0.45	0.15	0.03		
0.25	3.05	-3.5	-0.45	0.1525	0.038125		
0.3	3.05	-3.5	-0.45	0.145	0.0435		
0.35	2.75	-3.2	-0.45	0.1225	0.042875		
0.4	2.15	-2.6	-0.45	0.095	0.038		
0.45	1.65	-2.1	-0.45	0.07	0.0315		
0.5	1.15	-1.6	-0.45	0.05	0.025		

0.55	0.85	-1.3	-0.45	0.0375	0.020625
0.6	0.65	-1.1	-0.45	0.03	0.018
0.65	0.55	-1	-0.45	0.02375	0.015438
0.7	0.4	-0.85	-0.45	0.01875	0.013125
0.75	0.35	-0.8	-0.45	0.015	0.01125
0.8	0.25	-0.7	-0.45	0.01125	0.009
0.85	0.2	-0.65	-0.45	0.00875	0.007438
0.9	0.15	-0.6	-0.45	0.0075	0.00675
0.95	0.15	-0.6	-0.45	0.005	0.00475
1	0.05	-0.5	-0.45	0.0025	0.0025
1.1	0	-0.45	-0.45	-0.0025	-0.00275
1.2	-0.05	-0.4	-0.45	-0.0075	-0.009
1.3	-0.1	-0.35	-0.45	-0.01	-0.013
1.4	-0.1	-0.35	-0.45	-0.0125	-0.0175
1.5	-0.15	-0.3	-0.45	-0.015	-0.0225
1.6	-0.15	-0.3	-0.45	-0.015	-0.024
1.7	-0.15	-0.3	-0.45	-0.015	-0.0255
1.8	-0.15	-0.3	-0.45	-0.015	-0.027
1.9	-0.15	-0.3	-0.45	-0.0175	-0.03325
2	-0.2	-0.25	-0.45	-0.04	-0.08
2.2	-0.2	-0.25	-0.45	-0.04	-0.088
2.4	-0.2	-0.25	-0.45	-0.04	-0.096
2.6	-0.2	-0.25	-0.45	-0.04	-0.104
2.8	-0.2	-0.25	-0.45	-0.04	-0.112
3	-0.2	-0.25	-0.45	-0.04	-0.12
3.2	-0.2	-0.25	-0.45	-0.035	-0.112
3.4	-0.15	-0.3	-0.45	-0.035	-0.119
3.6	-0.2	-0.25	-0.45	-0.035	-0.126
3.8	-0.15	-0.3	-0.45		

Theta = 0.4407 degree
Dist = 0.09 inch

BACK 0.1 inch	FRONT 0.08 inch						
DIST (inch)	C.PRESS (inch of oil)	U. PRESS (inch of oil)	STATIC (inch of oil)	LIFT (inch of oil * inch)	MOMENT (inch of oil * inch^2)	CENTER of LIFT (inch)	TOTAL LIFT (lbf / inch)
-0.35	0.1	-0.55	-0.45	0.015	-0.00525	3.946019	-0.04979
-0.25	0.2	-0.65	-0.45	0.01625	-0.00406		
-0.2	0.45	-0.9	-0.45	0.045	-0.009		
-0.15	1.35	-1.8	-0.45	0.11625	-0.01744		
-0.1	3.3	-3.75	-0.45	0.1725	-0.01725		
-0.05	3.6	-4.05	-0.45	0.038	-0.0019		
-0.04	4	-4.45	-0.45	0.04075	-0.00163		
-0.03	4.15	-4.6	-0.45	0.04225	-0.00127		
-0.02	4.3	-4.75	-0.45	0.0435	-0.00087		
-0.01	4.4	-4.85	-0.45	0	0		

-0.01	4.4	-4.85	-0.45	0.04325	-0.00043
0	4.25	-4.7	-0.45	0.04225	0
0.01	4.2	-4.65	-0.45	0.04125	0.000413
0.02	4.05	-4.5	-0.45	0.03975	0.000795
0.03	3.9	-4.35	-0.45	0.038	0.00114
0.04	3.7	-4.15	-0.45	0.036	0.00144
0.05	3.5	-3.95	-0.45	0.03375	0.001688
0.06	3.25	-3.7	-0.45	0.0315	0.00189
0.07	3.05	-3.5	-0.45	0.02925	0.002048
0.08	2.8	-3.25	-0.45	0.0275	0.0022
0.09	2.7	-3.15	-0.45	0.02575	0.002318
0.1	2.45	-2.9	-0.45	0.046	0.0046
0.12	2.15	-2.6	-0.45	0.0405	0.00486
0.14	1.9	-2.35	-0.45	0.0355	0.00497
0.16	1.65	-2.1	-0.45	0.031	0.00496
0.18	1.45	-1.9	-0.45	0.0275	0.00495
0.2	1.3	-1.75	-0.45	0.05125	0.01025
0.25	0.75	-1.2	-0.45	0.0275	0.006875
0.3	0.35	-0.8	-0.45	0.01	0.003
0.35	0.05	-0.5	-0.45	-0.00125	-0.00044
0.4	-0.1	-0.35	-0.45	-0.0075	-0.003
0.45	-0.2	-0.25	-0.45	-0.01125	-0.00506
0.5	-0.25	-0.2	-0.45	-0.01375	-0.00688
0.55	-0.3	-0.15	-0.45	-0.01625	-0.00894
0.6	-0.35	-0.1	-0.45	-0.01875	-0.01125
0.65	-0.4	-0.05	-0.45	-0.02125	-0.01381
0.7	-0.45	0	-0.45	-0.0225	-0.01575
0.75	-0.45	0	-0.45	-0.0225	-0.01688
0.8	-0.45	0	-0.45	-0.02375	-0.019
0.85	-0.5	0.05	-0.45	-0.02625	-0.02231
0.9	-0.55	0.1	-0.45	-0.02875	-0.02588
0.95	-0.6	0.15	-0.45	-0.03	-0.0285
1	-0.6	0.15	-0.45	-0.0625	-0.0625
1.1	-0.65	0.2	-0.45	-0.065	-0.0715
1.2	-0.65	0.2	-0.45	-0.0675	-0.081
1.3	-0.7	0.25	-0.45	-0.07	-0.091
1.4	-0.7	0.25	-0.45	-0.0725	-0.1015
1.5	-0.75	0.3	-0.45	-0.075	-0.1125
1.6	-0.75	0.3	-0.45	-0.0775	-0.124
1.7	-0.8	0.35	-0.45	-0.0825	-0.14025
1.8	-0.85	0.4	-0.45	-0.085	-0.153
1.9	-0.85	0.4	-0.45	-0.085	-0.1615
2	-0.85	0.4	-0.45	-0.175	-0.35
2.2	-0.9	0.45	-0.45	-0.185	-0.407
2.4	-0.95	0.5	-0.45	-0.2	-0.48
2.6	-1.05	0.6	-0.45	-0.215	-0.559
2.8	-1.1	0.65	-0.45	-0.225	-0.63
3	-1.15	0.7	-0.45	-0.21	-0.63
3.2	-0.95	0.5	-0.45	-0.1125	-0.36
3.3	-1.3	0.85	-0.45	-0.1325	-0.43725
3.4	-1.35	0.9	-0.45	-0.13	-0.442

3.5	-1.25	0.8	-0.45	-0.115	-0.4025
3.6	-1.05	0.6	-0.45	-0.17	-0.612
3.8	-0.65	0.2	-0.45		

APPENDIX E

LIFT VS. GAP AND CENTER OF LIFT VS. TILT ANGLE DATA

CENTER OF LIFT AND TOTAL LIFT TABLE
FOR AIR BAR D WITH TRAILING SLOTTED
VENT HOLES

DIST (inch)	THETA (degree)	CENTER OF LIFT (inch)	TOTAL LIFT (lbf/in)
0.05	0.4407	0.5321	0.1443
0.07	0.4407	-0.4146	0.07532
0.09	0.4407	-1.55715	0.04173
0.06	0.8814	0.6336	0.16226
0.08	0.8814	-0.33186	0.0735
0.1	0.8814	-0.1818	0.0849
0.07	1.322	0.5621	0.1464
0.09	1.322	0.213717	0.11423
0.11	1.322	-0.60547	0.05596
0.05	-0.4407	-0.73375	0.04828
0.095	-0.2204	8.05039	-0.0141
0.06	-0.8814	-68.9121	0.06115
0.1	-0.8814	2.5461	-0.0523
0.07	-1.322	2.780855	-0.0359
0.11	-1.322	1.431793	-0.1085

CENTER OF LIFT AND TOTAL LIFT TABLE
FOR AIR BAR D WITHOUT TRAILING
SLOTTED
VENT HOLES

DIST (inch)	THETA (degree)	CENTER OF LIFT (inch)	TOTAL LIFT (lbf/in)
0.05	0.4407	0.774116	0.159437
0.07	0.4407	-0.05605	0.099274
0.09	0.4407	-9.89081	0.014258
0.06	0.8814	1.024415	0.201667
0.08	0.8814	-0.71114	0.076978
0.1	0.8814	-1.11638	0.072638
0.06	1.322	1.164424	0.22661
0.09	1.322	-0.11395	0.107857
0.11	1.322	-1.93527	0.056926
0.11	-1.322	1.861949	-0.1591
0.07	-1.322	-78.9374	0.000947
0.05	-0.4407	-0.4102	0.057195
0.09	-0.4407	3.394602	-0.04975

LIFT VS GAP FOR AIR BAR D WITH SLOTTED VENT HOLES
(SOME INTERPOLATING BETWEEN DATA POINTS)

Gap (inch)	Angle=0.4407 (degree)	Angle=0.8814 (degree)	Angle=1.322 (degree)	Angle=-.8814 (degree)	Angle=-1.322 (degree)
0.05	0.144				
0.06	0.10965	0.1622		0.061148	
0.07	0.0753	0.1176	0.146	0.03278	-0.03591
0.08	0.05851	0.073	0.13011	0.00441	-0.05406
0.09	0.04172	0.0785	0.11422	-0.02396	-0.07222
0.1		0.084	0.08694	-0.05233	-0.09037
0.11			0.05596		-0.10852

Lift vs. Gap for different Thetas (solid trailing air foil in air bar D)

dist (inch)	lift at theta=0.4407 degree	lift at theta=0.8814 degree	lift at theta=1.3219 degree	lift at theta=-.4407 degree	lift at theta=-1.3219 degree
0.04					
0.05	0.159437			0.057195	
0.06	0.12936	0.201667	0.22661	0.03045	
0.07	0.099274	0.13932	0.18703	0.0037	0.000947
0.08	0.05677	0.076978	0.14744	-0.02304	-0.03906
0.09	0.014258	0.07481	0.107857	-0.04979	-0.07908
0.1		0.072638	0.08239		-0.11909
0.11			0.056926		-0.1591
0.12					

CENTER OF LIFT VS THETA FOR AIR BAR D WITH TRAILING SLOTTED VENT HOLES (some interpolation)

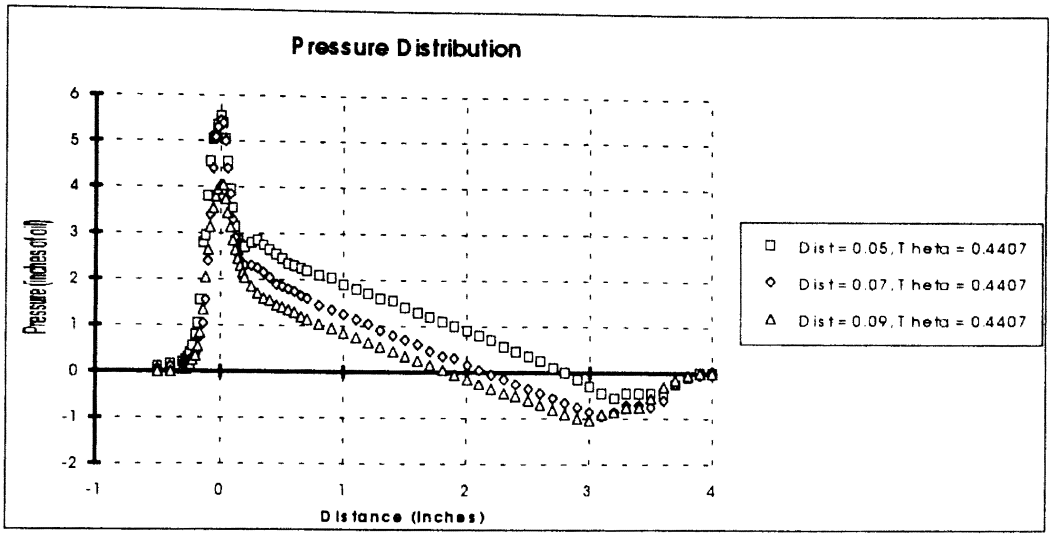
theta (degree)	dist = 0.05 (inch)	dist=0.06 (inch)	dist=0.07 (inch)	dist=0.08 (inch)	dist=0.09 (inch)	dist=0.10 (inch)	dist = 0.11 (inch)
-1.322			2.78085				1.431793
-0.8814			1.98212			2.5461	1.09231
-0.4407	-0.73375		1.18321			1.86413	0.75274
0.4407	0.5321	0.0588	-0.4146	-0.9859	-1.55715	0.50018	0.07359
0.8814		0.6336	0.1509	-0.33186	-0.2568	-0.1818	-0.26598
1.322			0.5621	0.3879	0.213717	-0.1959	-0.60547

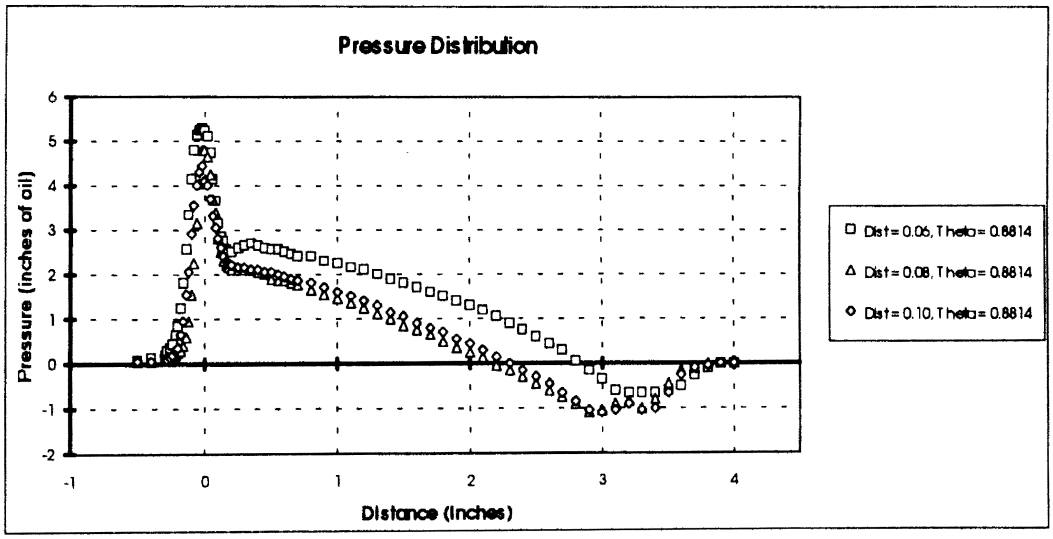
Center of Lift vs. Theta for different Gaps (must interpolate some, solid trailing air foil)

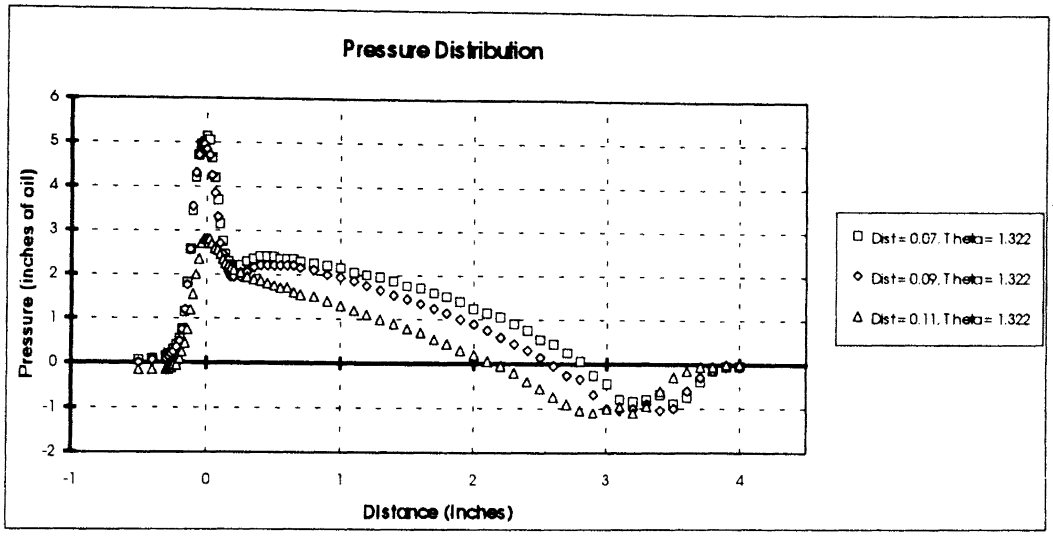
theta (degree)	dist = 0.05 (inch)	dist=0.06 (inch)	dist=0.07 (inch)	dist=0.08 (inch)	dist=0.09 (inch)	dist=0.10 (inch)	dist = 0.11 (inch)
-1.32198							1.861949
-0.8814							1.2292
-0.4407	-0.4102						0.59627
0.4407	0.774116	0.35903	-0.05605				-0.66959
0.8814		1.024415	0.15664	-0.71114	-0.91376	-1.11638	-1.30252
1.32198		1.164424	0.7383	0.31217	-0.11395	-1.02461	-1.93527

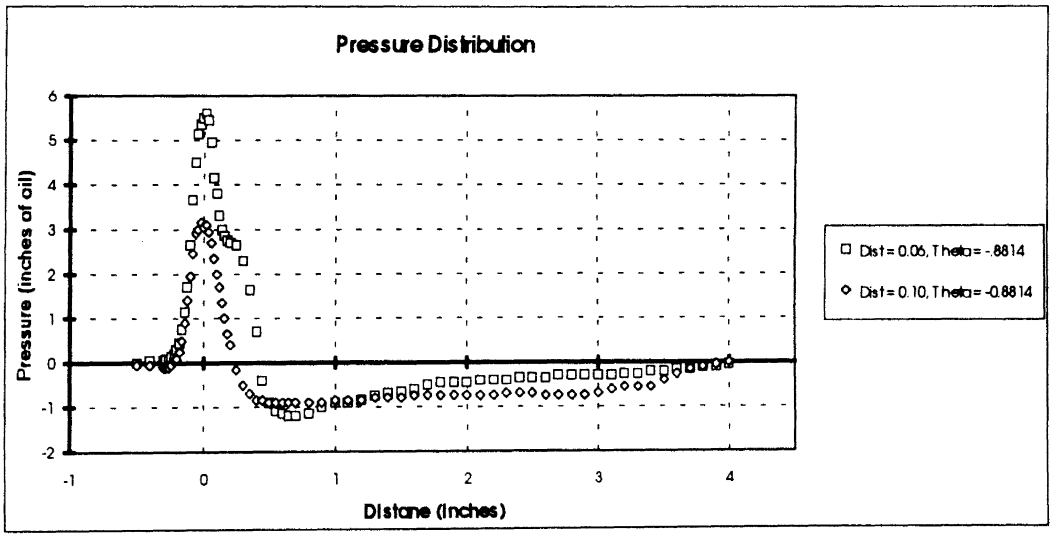
APPENDIX F

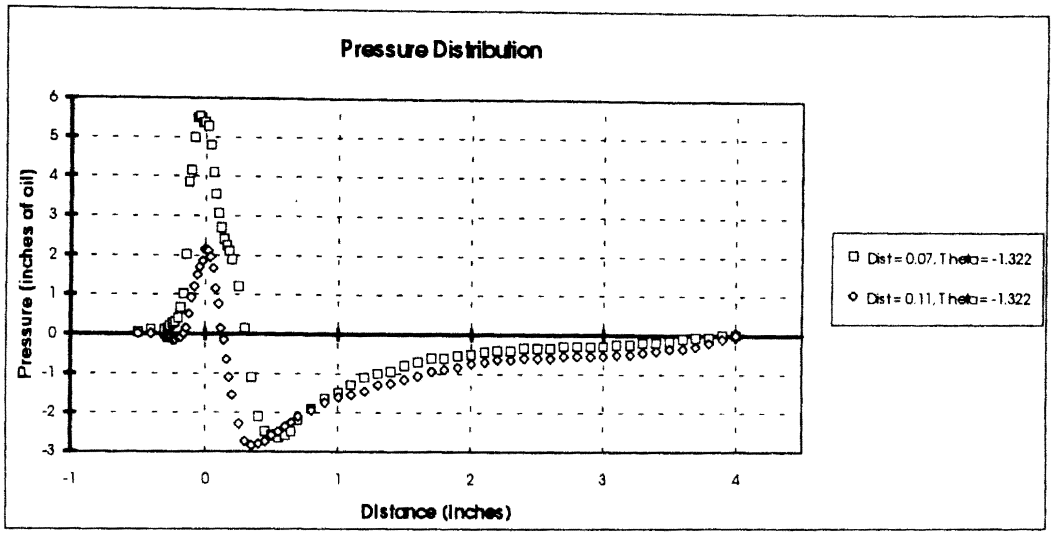
GRAPHS OF THE PRESSURE DISTRIBUTIONS FOR AIR BAR D WITH TRAILING SLOTTED VENT HOLES

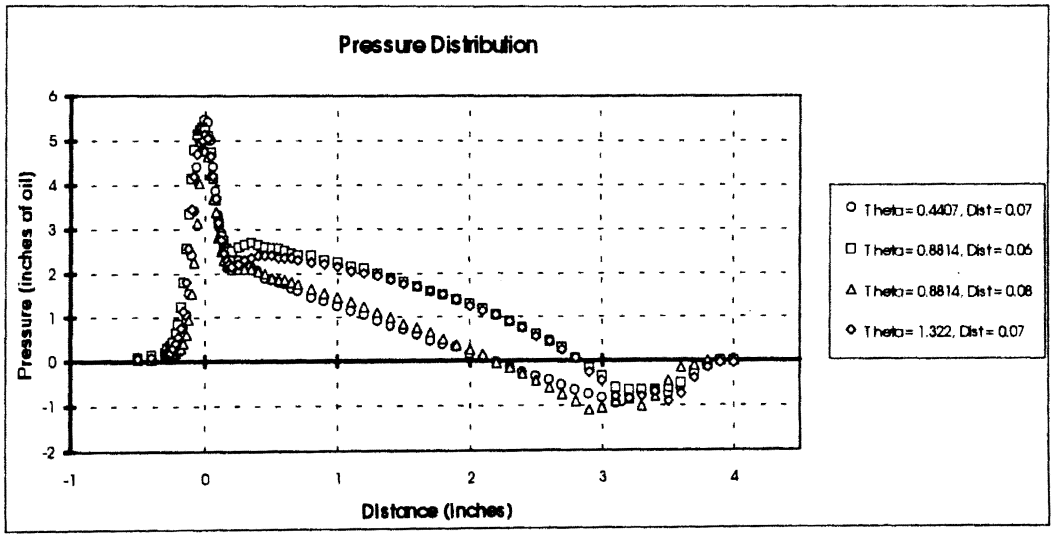

Pressure Distribution
Pressure (inches of oil)
Distance (inches)
Dist = 0.05, Theta = 0.4407
Dist = 0.07, Theta = 0.4407
Dist = 0.09, Theta = 0.4407

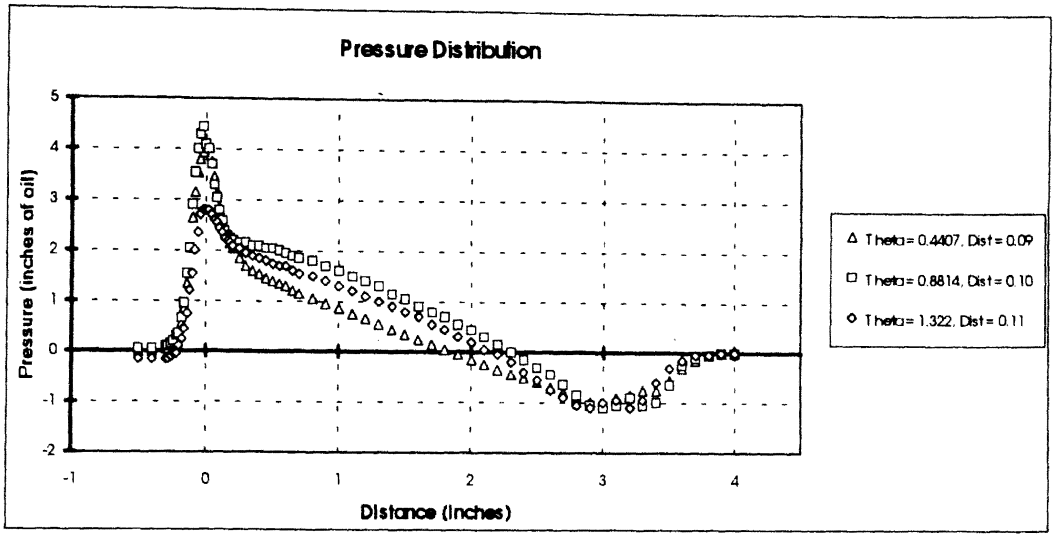

Pressure Distribution
Pressure (inches of oil)
Distance (inches)
Dist = 0.06, Theta = 0.8814
Dist = 0.08, Theta = 0.8814
Dist = 0.10, Theta = 0.8814

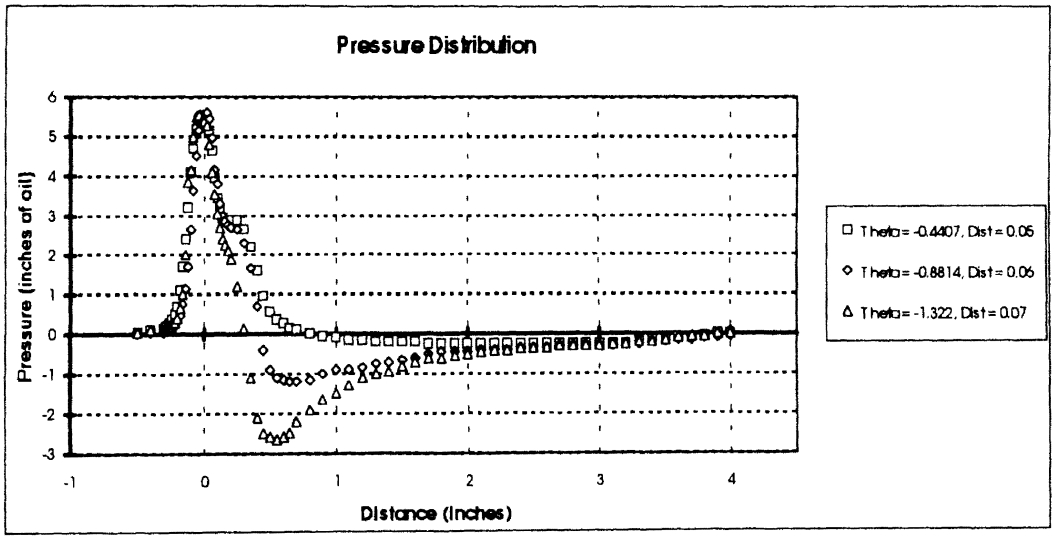

Pressure Distribution
Pressure (inches of oil)
Distance (Inches)
Dist = 0.07, Theta = 1.322
Dist = 0.09, Theta = 1.322
Dist = 0.11, Theta = 1.322

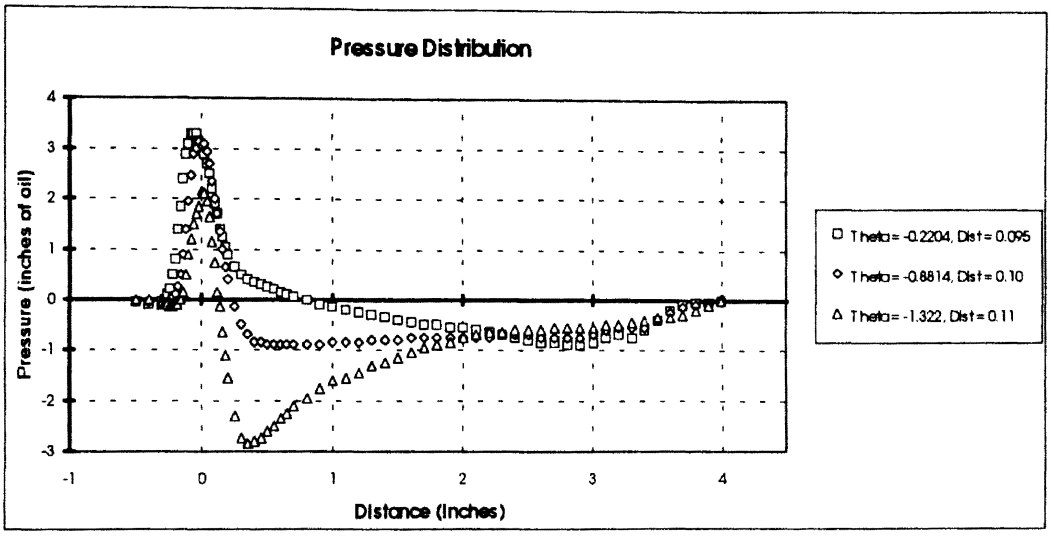

Pressure Distribution
Pressure (inches of oil)
Distane (Inches)
Dist = 0.05, Theta = -.8814
Dist = 0.10, Theta = -0.8814


Pressure Distribution
Pressure (inches of oil)
Distance (inches)
Dist = 0.07, Theta = -1.322
Dist = 0.11, Theta = -1.322


Pressure Distribution
Pressure (inches of oil)
Distance (inches)
Theta = 0.4407, Dist = 0.07
Theta = 0.8814, Dist = 0.06
Theta = 0.8814, Dist = 0.08
Theta = 1.322, Dist = 0.07


Pressure Distribution
Pressure (inches of oil)
Distance (Inches)
Theta = 0.4407, Dist = 0.09
Theta = 0.8814, Dist = 0.10
Theta = 1.322, Dist = 0.11


Pressure Distribution
Pressure (inches of oil)
Distance (Inches)
Theta = -0.4407, Dist = 0.05
Theta = -0.8814, Dist = 0.06
Theta = -1.322, Dist = 0.07


Pressure Distribution
Pressure (inches of oil)
Distance (Inches)
Theta = -0.2204, Dist = 0.095
Theta = -0.8814, Dist = 0.10
Theta = -1.322, Dist = 0.11

APPENDIX G

REQUIRED CALCULATIONS

Pressure Conversions

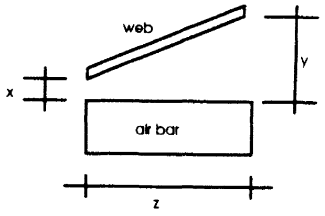
S.G. = specific gravity of the oil = $\rho_{oil}/\rho_w = \rho_{oil}/62.4$ lbm/ft^3 = 0.826

ρ_{oil} = 51.542 lbm/ft^3

$P = \rho_{oil} * (g/g_c)*h$, this will put the units in lbf/in^2

1 inch of oil = 0.0298 lbf/in^2

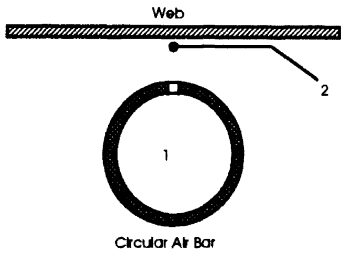
Finding Theta (Tilt Angle) and Mean Gap



$\theta = \tan^{-1}((y-x)/z)$

gap = (x+y)/2

Air and Water Reynolds' Number Calculations



Station 1 is the conditions inside the pressure chamber of air bar A. Station 2 is the conditions at the point of direct impingement of the nozzle on the web. Bernoulli's principal was applied with the assumption that V1 is zero and ρ1 is equal to ρ2 to obtain values for the velocity of air at the plate. These crude

assumptions should yield a rough estimate, which for the purposes here is all that is required.

Air

$\rho_a = 0.002378$ slugs/ft^3

$\mu_a = 39.16*10^{-8}$lbf-s/ft^2

L = 0.10 inches = 0.008333ft

1 slug = 1 lbf-s^2/ft

$V2 = (2*(P1-P2)/\rho_a)^{0.5}$

$R_e = \rho*L*V2/\mu_a$

The values used for P1 and P2 are what was typically recorded for the air experiments.

P1 = 6.2 inch of oil = 26.63 lbf/ft^2

P2 = 4.65 inch of oil = 19.97 lbf/ft^2

$V2 = (2*(26.63-19.972)/0.002378)^{0.5} = 74.83$ ft/s

$(R_e)_a = 0.002378*0.008333*74.83/39.16*10^{-8} = 3787$

Water

$\rho_w = 1.937$ slugs/ft^3

$\mu_w = 20.92*10^{-6}$lbf-s/ft^2

L = 0.10 inches = 0.008333ft

1 slug = 1 lbf-s^2/ft

$(R_e)_w = \rho*L*V2/\mu_w$

VF = 4.5 GPM

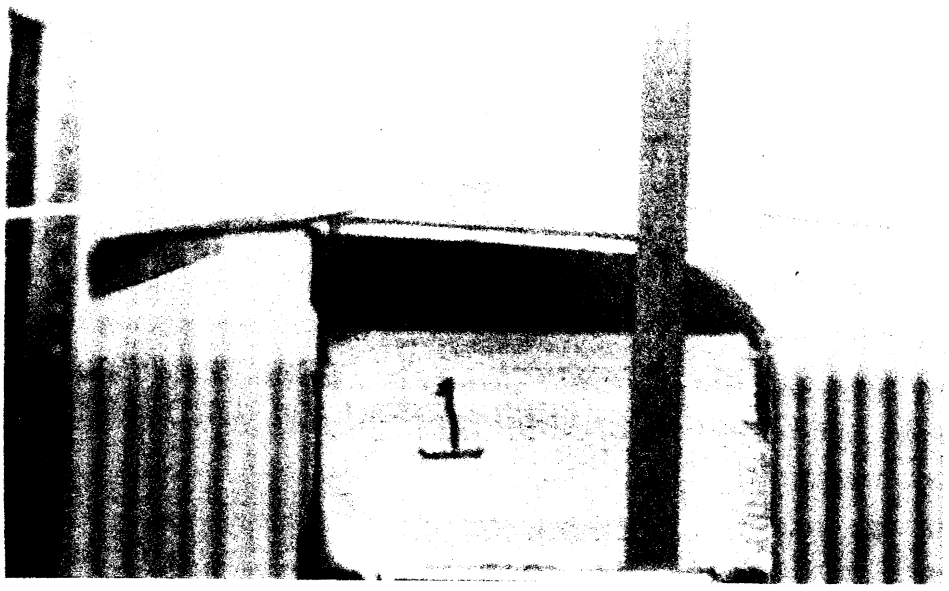
A = 0.002778 ft^2

$V_w = VF/A = 4.5/60/7.4805/0.002778 = 3.6$ ft/s

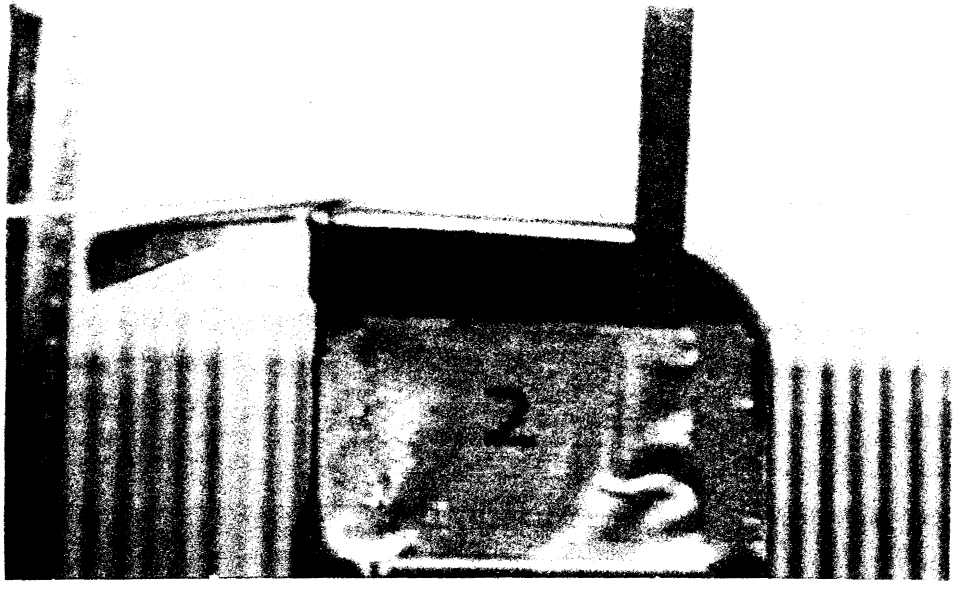
$$(R_e)_W = 1.937*3.6/20.92*10^{-6}/12 = 2785$$

APPENDIX H

FLOTATION PROFILES



Air Foil Air Bar with Vent Slots



Air Foil Air Bar without Vent Slots

VITA

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