

NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



THESIS

**EVALUATION OF THE BOEING PAN AIR
TECHNOLOGIES CODE (A502I) THROUGH
PREDICTION OF SEPARATION FORCES
ON THE GBU-24**

by

Matthew A. LeTourneau

March, 1996

Thesis Advisor:

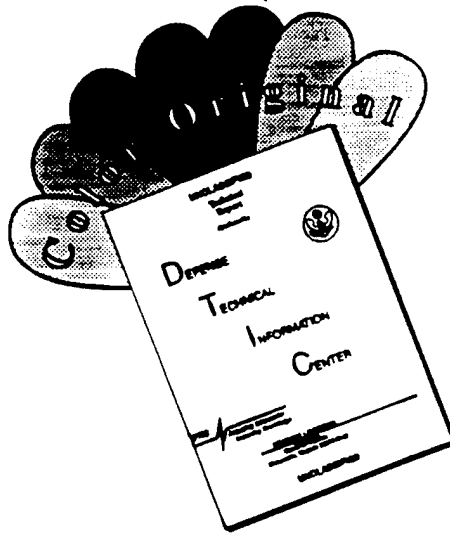
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THROUGH PREDICTION OF SEPARATION FORCES ON THE GBU-24

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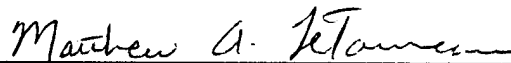
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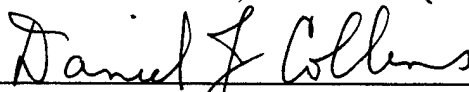
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ABSTRACT

The Boeing PAN AIR Technologies code (A502i) is investigated to explore its suitability for determination of separation forces on ordnance. To this end, A502i is first assessed by applying it to three problems for which other solutions and experimental data are available, i.e. steady flow past a rectangular, parabolic arc wing and a delta wing at both subsonic and supersonic conditions. Good agreement is found in all cases. A502i is then applied to the GBU-24's being in two configurations for a subsonic case and a supersonic case. Good agreement is found with data obtained from wind tunnel experiments for low angles of attack.

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I. INTRODUCTION

In the past, ballistic trajectory determination for manual or computer predicted ordnance delivery from an aircraft was determined through measurement of separation forces on the piece of ordnance via wind tunnel or captive carry measurements. The advent of panel method codes using linearized potential theory, such as A502i, or its full potential version TranAir, allow for a cheaper and safer method of predicting separation forces. Furthermore, A502i allows for any arbitrary configuration to be modelled within the limitations of the number of panels and networks allowed and excluding transonic flow.

The purpose of this work was to determine the separation forces on a GBU-24 carried by an F-14 on stations 3 or 6 or both. It was also the purpose of this work to provide an analysis of the code itself to see if it is a viable tool for the study of flow characteristics over arbitrary wing configurations for use in the Naval Postgraduate School's (NPS) Department of Aeronautics and Astronautics. The majority of the work was conducted on the NPS computer systems. The Department of Aeronautics and Astronautics Silicon Graphics Incorporated (SGI) workstations were utilized for most of the input files as well as the execution of the code. Due to the amount of disk space required, storage of the output files took place on the NPS Computer Center's Y-MP EL98 Cray computer. The bulk of the GBU-24 data was calculated using the SGI workstations at the Naval Air Warfare Center in Warminster.

The scope of this analysis was to understand the capabilities of the A502i code. The approach was to validate A502i against existing data and linear theory. The code was run for three different geometries under assorted Mach and AOA conditions. Comparisons were made for each of the geometries.

II. OVERVIEW OF THE A502i CODE

The A502i code is used to computationally analyze inviscid subsonic or supersonic flows about arbitrary configurations. The code differs from other panel methods in that it is a higher order panel method; that is, the singularity strengths are not constant on each panel. A502i solves the linearized potential flow boundary-value problem at subsonic and supersonic Mach numbers.

The aerodynamic solution provides surface flow properties (flow directions, pressures, Mach number), configuration forces and moments, sectional forces and moments, and pressures. Additionally, A502i calculates flow properties in the flow-field points and flow-field streamlines. Results are limited to subsonic and supersonic cases (transonic cases excluded) with attached flow. Results are not usually applicable to cases where viscous effects and separation are dominant.

A. THEORY

The basic equations describing the flow of a viscous, compressible, heat-conducting fluid are the Navier-Stokes equations. These are:

(a) The continuity equation,

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{V}) = \frac{\partial \rho}{\partial t} + \sum_{i=1}^3 \frac{\partial (\rho V_i)}{\partial x_i} = 0 \quad (2.1)$$

where $\nabla = (\frac{\partial}{\partial x_1}, \frac{\partial}{\partial x_2}, \frac{\partial}{\partial x_3})$ is the gradient operator with respect to the location vector

$\vec{x} = (x_1, x_2, x_3)$, and where the conventional index notation is used instead of $\vec{x} = (x, y, z)$. In addition, t is time, $\rho(\vec{x}, t)$ is the density and $\vec{V}(\vec{x}, t)$ is the velocity vector, with components $\vec{V} = (V_1, V_2, V_3)$.

(b) The conservation of momentum equation,

$$\frac{\partial}{\partial t}(\rho V_j) + \sum_{i=1}^3 \frac{\partial}{\partial x_i}(\rho V_i V_j) = -\frac{\partial p}{\partial x_j} + \sum_{i=1}^3 \frac{\partial}{\partial x_i} \tau_{ji} + \rho f_j \quad (j = 1, 2, 3) \quad (2.2)$$

where τ_{ij} is the deviatoric portion of the stress tensor which vanishes for a frictionless fluid, $\vec{f}(\vec{x}, t)$ is an external body force per unit mass exerted on the fluid, and $p(\vec{x}, t)$ is the pressure.

(c) The conservation of energy equation

$$\begin{aligned} \frac{\partial}{\partial t}(\rho e + \frac{1}{2} \rho |\vec{V}|^2 + p) + \sum_{i=1}^3 \frac{\partial}{\partial x_i} [(\rho e + \frac{1}{2} \rho |\vec{V}|^2 + p) V_i] \\ = \frac{\partial p}{\partial t} + \sum_{i,m} \frac{\partial}{\partial x_i} (\tau_{im} V_m + k \frac{\partial T}{\partial x_i}) + \rho \sum_i f_i V_i \end{aligned} \quad (2.3)$$

where $e(\vec{x}, t)$ is the internal energy of the fluid, k is the coefficient of heat conductivity for the fluid, and $T(\vec{x}, t)$ is the temperature.

(d) The equation of state

$$f(\rho, p, T) = 0 \quad (2.4)$$

where the function f depends on the type of fluid. The derivations of these equations can be found in Refs. 1, 2 and 3.

The Navier-Stokes equations can be simplified by the neglect of viscosity, which is equivalent to setting the deviatoric stress tensor to zero. Combining the momentum and continuity equations yields

$$\rho \frac{dV_j}{dt} = -\frac{\partial p}{\partial x_j} + \rho f_j \quad j = 1, 2, 3 \quad (2.5)$$

where the convective derivative operator is defined as

$$\frac{d}{dt} = \frac{\partial}{\partial t} + \sum_i V_i \frac{\partial}{\partial x_i}$$

Equation (2.5) is referred to as Euler's equation. The continuity and energy equations can

Equation (2.5) is referred to as Euler's equation. The continuity and energy equations can be reduced to

$$\rho \frac{d}{dt} \left(\frac{1}{2} |\vec{V}|^2 \right) = -\vec{V} \cdot \nabla p + \rho \vec{V} \cdot \vec{f} \quad (2.6)$$

and the rate of increase of heat per unit mass is given by

$$q = \frac{1}{\rho} \nabla \cdot (k \nabla T) = \frac{dp}{dt} + p \frac{d}{dt} \left(\frac{1}{\rho} \right) \quad (2.7)$$

Equations 2.5, 2.6 and 2.7 can be reduced to a single equation when four further assumptions are made. First, assume isentropic flow, thus

$$q=0 \quad (2.8)$$

Second, assume irrotationality

$$\nabla \times \vec{V} = 0 \quad (2.9)$$

which allows for the introduction of the potential function [Refs 2,3]

$$\nabla \Phi = \vec{V} \quad (2.10)$$

Third, assume the existence of a freestream potential Φ_∞ , whose gradient is the uniform velocity $\vec{V}_\infty$ attained at points sufficiently distant from the disturbance being analyzed, and thus write

$$\phi = \Phi - \Phi_\infty \quad (2.11)$$

and

$$\vec{V} = (u, v, w) = \nabla \Phi = \nabla \Phi_\infty + \nabla \phi = \vec{V}_\infty + \nabla \phi \quad (2.12)$$

The quantities ϕ and $\vec{v}$ are called the perturbation potential and velocity [Ref 3]. Fourth, assume that

$$|\vec{v}|^2 \ll a_\infty^2 \quad (2.13)$$

everywhere, where a_∞ is the freestream speed of sound.

Based on these four assumptions, the unsteady potential equation is obtained [Refs 1,3]:

$$\begin{aligned}
& (1 - M_\infty^2)\phi_{xx} + \phi_{yy} + \phi_{zz} - 2M_\infty^2\phi_{xt} - M_\infty^2\phi_{tt} \\
& = M_\infty^2 \left[\frac{1}{2}(\gamma - 1)(2u + 2\phi_t + |\vec{v}|^2) \nabla^2 \phi \right. \\
& \quad + (2u - u^2)\phi_{xx} + v^2\phi_{yy} + 2vw\phi_{yz} + w^2\phi_{zz} \\
& \quad \left. + 2(1 + u)(v\phi_{xy} + w\phi_{xz}) + 2(uu_t + vv_t + ww_t) \right]
\end{aligned} \tag{2.14}$$

Assuming the flow conditions do not change with time yields the steady non-linear potential equation.

$$\begin{aligned}
& (1 - M_\infty^2)\phi_{xx} + \phi_{yy} + \phi_{zz} \\
& = M_\infty^2 \left[\frac{1}{2}(\gamma - 1)(2u + |\vec{v}|^2) \nabla^2 \phi \right. \\
& \quad + (2u + u^2)\phi_{xx} + v^2\phi_{yy} + 2vw\phi_{yz} + w^2\phi_{zz} \\
& \quad \left. + 2(1 + u)(v\phi_{xy} + w\phi_{xz}) \right]
\end{aligned} \tag{2.15}$$

When $M_\infty = 0$, equation (2.15) reduces to Laplace's equation,

$$\nabla^2 \phi = 0 \tag{2.16}$$

For the case of $M_\infty \neq 0$, the following is supposed,

$$M_\infty^2 |\vec{v}| \ll 1 - M_\infty^2 \tag{2.17}$$

$$M_\infty^2 |\vec{v}| \ll 1 \tag{2.18}$$

which are small perturbation assumptions [Refs. 1,2]. With these assumptions the steady non-linear potential equation reduces to the Prandtl-Glauert equation [Ref 1]:

$$(1 - M_\infty^2)\phi_{xx} + \phi_{yy} + \phi_{zz} = 0 \tag{2.19}$$

Through a coordinate transformation [Refs. 1,2,3], the Prandtl-Glauert equation can be rewritten as:

$$s\phi_{\bar{x}\bar{x}} + \phi_{\bar{y}\bar{y}} + \phi_{\bar{z}\bar{z}} = 0 \quad (2.20)$$

where when $s=1$, it is the subsonic case and Laplace's equation applies and when $s=-1$, it is the supersonic case and the wave equation applies. Applying Green's third identity [Ref. 1] yields the following integral equation,

$$\phi(P) = -\frac{1}{4\pi} \int \int_s \left[\frac{\sigma}{R} - \mu \hat{n} \cdot \nabla \frac{1}{R} \right] dS \quad (2.21)$$

where σ represents the source strength and μ represents the doublet strength. When supplemented with boundary conditions, it is equation (2.21) that A502i solves.

A502i solves equation (2.21) through a discretization process. The general idea of the process falls into two parts. The first is developing finite dimensional approximate representation formulas for the singularity functions, which creates a system of equations with unknown coefficients, λ_i . The second part involves solving the set of equations for all λ_i . This allows for completely determining the source and doublet functions. Then, by virtue of equation (2.21), the potential function $\phi(P)$ is determined for all points P , solving the problem.

The features of A502i which distinguish it from predecessors are three-fold. The first is a feature known as "continuous geometry", the second is linear source and quadratic doublet variation, the third is continuity of doublet strength.

Most panel methods approximate the configuration geometry with panels whose planform is a quadrilateral. Thus, if the panels themselves are planar, only a small class of configurations (such as cylinders and flat wings) can be described without gaps being left between panels. These gaps are generally small, except for highly twisted surfaces. The

gaps cause little numerical error in subsonic flow, but in supersonic flow, the cumulative effect of the gaps is serious [Ref. 1]. The problem is not associated with leakage of flow through the gaps, but with the doublet strength jumping abruptly from a non-zero value to zero at a panel edge which does not exactly meet the adjacent edge. In A502i, gaps are closed by means of panels which are comprised of several planar regions.

The feature of linear source and quadratic doublet variation is what makes A502i a higher order panel method. The basis function corresponding to a source parameter is locally linear, while the basis function corresponding to a doublet parameter is locally quadratic. This is what allows for A502i to find supersonic solutions. Numerical solution of the wave equation is far more sensitive to the numerical idiosyncracies of a panel method than is the solution of Laplace's equation for subsonic flow. Experimental evidence [Ref. 1] indicates that exact surface analysis is not feasible in supersonic flow without doublet continuity, thus the potential for numerical error is greatly reduced by requiring the doublet singularity strength to be continuous across panels.

B. GENERAL A502i USAGE

The use of the A502i code consists of generating an input file, which can be arbitrarily named, and which contains the information defining the geometry of the configuration, flow field points of interest, the flow conditions and wakes. The process of building a geometry is difficult in that A502i is particular about its input format. Simple configurations, such as a rectangular, planform wing can be modelled manually, but more complex structures require a pre-processing program, such as MACGS, where a geometry can be graphically built. MACGS will output a data file in a format that, with minor modifications, via another pre-processing program that can move the data from three columns to six columns, will be readily usable by A502i. Currently, the school does not have a copy of MACGS, but it can be acquired through McDonnell-Douglas. To complete

this thesis, MACGS was used on the SGI workstations at NAWC Warminster. Wakes also must be constructed in the same manner as the structure to be analyzed. More detailed instructions on the specifics of wakes and surface geometries can be found in Ref. [4]. Appendix A is a portion of an output file, but lines 1 thru 1120 are an exact duplicate of the input file.

1. Running A502i with an Existing Executable

Assuming an A502i executable file (e.g., A502) has already been placed in a user executable directory (e.g., /usr/local/bin), the only other necessary items needed to produce a set of A502i output files is the input file and a large amount of storage space. Anything modelled with more than one thousand panels total will use more than one hundred mb of disk space. If the maximum number of panels (20,000) is used, the disk space required will be on the order of 2 gb.

To run A502i, enter after the UNIX prompt:

A502 <input file> output file

Prior to running the code, it is highly recommended that a Cray account be opened and linked to the department's SGI workstations. This is done by assigning the same user i.d. number to the Cray account as is assigned to the account with the department. User i.d. numbers can be changed by the computer center at the user's request. This is required due to the limited disk space available to individual accounts in the department. Once an account is opened, log on to a department workstation, change directories to an existing Cray directory, for example (after the UNIX prompt):

cd /jedi/d1/maletour

Transfer the input file to the Cray directory and execute the code. The screen will display what portion of the code it is performing and how long it took to perform each portion in CPU time. The code outputs numerous files in addition to the arbitrarily named output file.

The two output files of interest, in the vast majority of cases, are the arbitrarily named output file and the ft13 file. In order to run another solution all output files must be deleted or renamed prior to re-executing the code. Relevant results should not be kept on the Cray account as files on disks d1, d2 and u1 are considered temporary storage and subject to erasure after a period of time.

2. Creating an A502i Input File

The input file, which can be arbitrarily named, consists of two portions, the largest being the geometry data. Appendix A is a complete recreation of the input file for the GBU-24 with canards. The file begins with line 1, \$TITLE, and ends with line 1120, \$END. The line numbers are for reference only and are not part of the actual input file. The first portion consists of creating the initial conditions, i.e., the free-stream Mach number and angle of attack, the type of analysis to be performed, i.e., solution or datacheck, what types of output that are to be included in the arbitrarily named output file, and reference points to be used in calculating forces and moments. The geometry data consists of the points that bound each panel, that in turn belong to a specific group of panels that make up a network. The overall structure being modelled consists of a series of networks. A502i can run up to 150 networks and or 20,000 panels with a limit of 8,000 panels per network. Referencing Appendix A, line 28 represents the first network of the model, a canard. Line 29 represents the number of networks that will be classified under this \$POINTS statement. Line 30 indicates what kind of surface the network will be, a three-dimensional surface with flow properties to be calculated, a wake and a base are several examples. Line 31 is the number of y points and the number of x points respectively that make up the grid of that network. Line 32 is where the panel points start. Reference 4 contains detailed instructions on the options and meaning of each of the non-geometry inputs, including some capabilities not shown in Appendix A.

Two types of solutions can be run, a datacheck and a full solution. Reference 4 explains how to enter either one into the input file. The datacheck only analyzes the geometry. This can be accomplished in a matter of seconds for a simple geometry as it is only running the first several portions of the code. The full solution can take a couple of hours for a geometry of the size of 4,000 panels. The datacheck should be run once the geometry has been modelled. It will check for any panel edges that do not abut properly, and when column 4 of line 20 in Appendix A is a 1, the datacheck will list the unit normal vectors, which must be facing outward. The datacheck will also see if the wakes are attached properly. A502i is capable of giving warnings both on-screen and in the arbitrarily named output file when an edge or a wake is not modelled properly, but it only lists the unit normal vectors. The directions of the vectors must be manually checked by the user. The full solution performs the datacheck first, so the data is repeated in the arbitrarily named output file. Appendix B is a portion of the output file that contains the summary of facing surfaces. Each panel edge is looked at to see what it abuts against. Sections such as wingtips, leading edges of a flat plate or any surface that does not need a wake attached, but is unabutted to any other panel on that edge will draw probable error messages or warnings from the code. The user must ensure that the edge is not supposed to abut against anything or need a wake attached. If that is the case, the warnings may be ignored. Appendix D is the first page of the portion of the output file that lists the unit normal vectors. The three columns under zc are the x-y-z coordinates of the given panel's center. The three columns under znc are the x-y-z coordinates of the unit normal vector. In most cases, when the y coordinates are of the same sign, then the unit normal vector is pointing outward.

C. GEOMETRY MODELLING

Five geometries needed to be modelled, each of increasing complexity. Modelling proved to be the most difficult task, in that A502i is a FORTRAN code and is very format sensitive, but the sheer number of points that need to be generated can take a lot of time and the order those points are listed in the input file is what determines whether or not the shape is correctly modelled. Of the five geometries modelled, none were done completely manually. A spreadsheet was used for generating the parabolic arc airfoil and the deltawing since those structures can be constructed out of one network, excluding wingtips and wakes, and the surface can be defined by a mathematical function. The bombs and the F-14 required the use of MACGS to be properly modelled. MACGS is indifferent as to the order that geometries are built, and often doesn't require many coordinate inputs if building a model on top of an existing IGS file. The output file from MACGS is automatically formatted and the points placed in the appropriate order for A502i to understand. Although, the order may be reversed where the unit outward normal vector is concerned. MACGS has the ability to output files in several different panel method code input formats, including PMARC. Reference 4 gives detailed instructions on how to properly order points to build a group of networks that will model a geometry. A502i uses a right-handed coordinate system that is similar to an aircraft body axes. When put in terms of a wing, the x axis is positive from leading edge to trailing edge. The z axis is positive up and the y axis is positive out the right wing

1. The Parabolic Arc Airfoil

The parabolic arc airfoil is the simplest of all the geometries. The airfoil has a chord of five and a span of ten. The maximum thickness is .15. The model consists of approximately 600 panels, including the wake and wingtips. A spreadsheet was used to develop the geometry portion of the input file. Line 32 of Appendix A demonstrates the

format that the spreadsheet used. Rows consist of two points, with coordinates $x_1, y_1, z_1, x_2, y_2, z_2$ using a format of 6F10.0. The chord was divided into 25 points (x coordinate) from trailing edge to leading edge and then another 25 points from leading edge to trailing edge (bottom half). The span was divided into 12 points (y coordinate) from left to right. Due to the symmetry of a rectangular planform, the y coordinate was constant along the 50 x coordinates that constituted a chordwise cross-section. To attain a maximum thickness of .15 the formula,

$$z = .3 * \left(\frac{x}{c} - \frac{x}{c^2} \right) \quad (2.22)$$

was utilized to generate the values of the z coordinates. The wingtips simply connect the x coordinate on the top side with it's symmetrical counterpart on the bottom side. Due to a trailing edge composed of a straight line, the wake is modelled by a single panel that spans the trailing edge and has a length aft of 100. Figure 2.1 shows the panel distribution across the top surface of the parabolic arc airfoil, where the thickness is represented by the color scheme. A panel and a point are numbered to show how they were entered into the input file.

2. The Deltawing

The deltawing represented a step up in complexity over the parabolic arc airfoil. The chordwise cross-section is parabolic, while the spanwise cross-section is linear. The procedure for building the geometry on a spreadsheet was the same as that for the parabolic arc airfoil, only the chord length is not constant along the span. For simplicity in design, the number of panels per column of panels is constant on the deltawing, as on the parabolic arc airfoil. This means an increasing panel density in the direction of the wing tip. The wake is modelled the same as the airfoil. The right wingtip ended in a point, so no extra panelling was needed to close any gaps. The symmetry of the deltawing allowed for

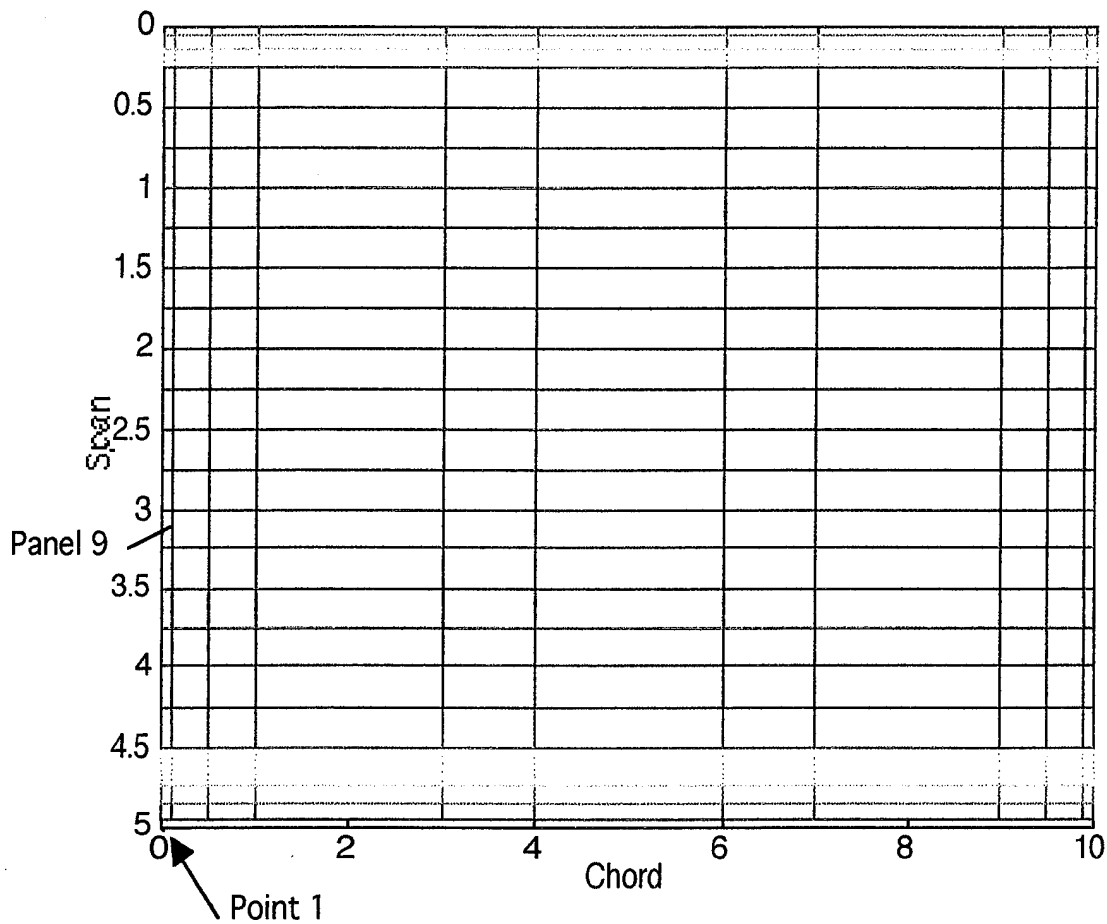


Figure 2.1 Parabolic Arc Panel Distribution

further simplification and reduction of the code's run time by only modelling from the centerline to the right tip. A502i allows the user to stipulate whether there is symmetry in the x-z plane and or the x-y plane (see line 5 and 6 of Appendix A). This means that the gap between the top and bottom panels at the center line does not need to be bridged as in the parabolic arc airfoil (symmetry could have also been used in the airfoil's case). The chord of the deltawing has a length of 90 and the semi-span has a length of 15. The maximum thickness occurs midway along the centerline and is .05. The model consists of 880 panels. Figure 2.2 shows the panel distribution along the top surface of the deltawing.

Thickness is represented by the color scheme.

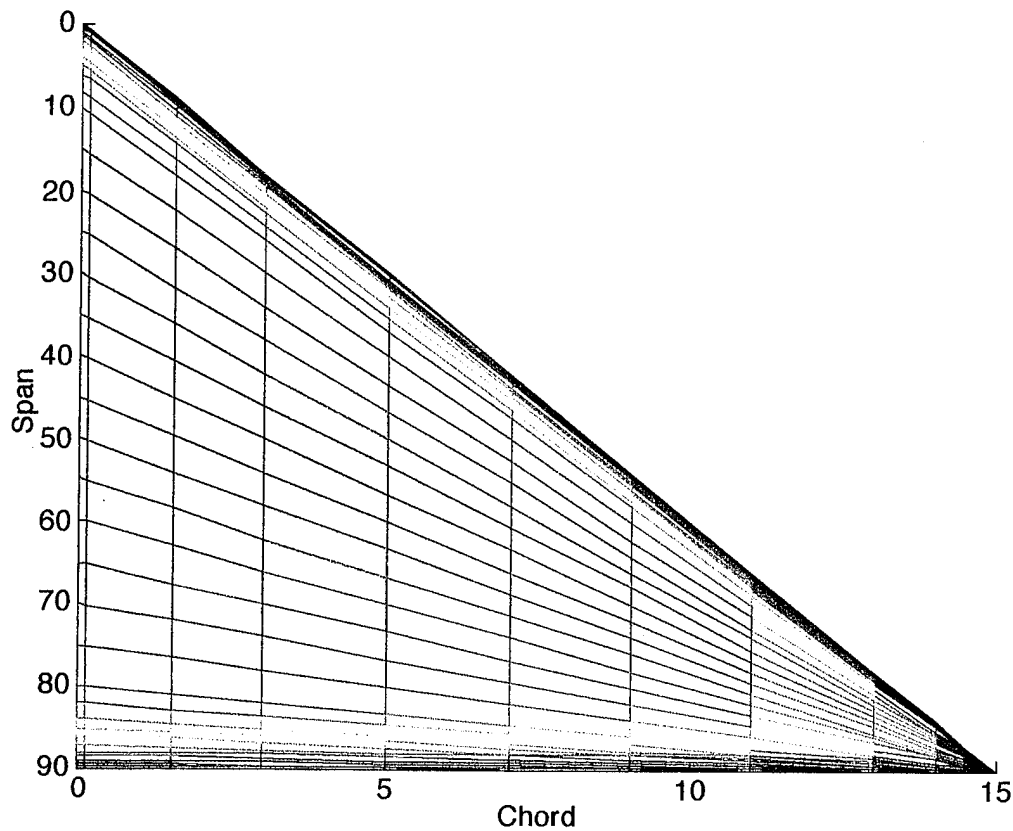


Figure 2.2 Panel Distribution of Deltawing

3. GBU-24

Wind tunnel experiments were run on the GBU-24 without canards attached, so it was deemed relevant to build a model with and without canards as a comparison of the code's performance. The model of the GBU-24 was too complex to build with a spreadsheet, so MACGS was used. The bomb was modelled at NAWC Warminster by superimposing a group of networks on top of an IGS file being displayed by MACGS. The complete configuration consists of approximately 1300 panels. Figures 2.3 and 2.4 are displays of the GBU-24 with canards, with Figure 2.4 including the wakes. Figure 2.5

is included to show how the GBU-24 model was assembled. Each different color represents a network.

Several features of the geometry are relevant to point out. Two of them are modifications made to the geometry that differ from the actual dimensions of the bomb. Dr. Alex Cenko of NAWC Warminster has extensive experience with modelling stores in A502i. The modifications were made on his knowledge of how to get the most accurate results from the code when modelling stores. The first is to model the fins and canards as flat plates, i.e., no thickness, which A502i allows you to do through a single numerical change in the input code for each network that represents a flat plate (see line 30 of Appendix A). The fins and canards are extremely thin when compared to the rest of the bomb, and to add a third dimension to the geometry complicates the construction of the fin or canard for several reasons. The leading and trailing edges must be sharp and the surface the fin or canard attaches to would have to be modified to abut properly with two edges instead of one. Experience has shown that the simpler version yields accurate predictions. A502i is an inviscid code, so it cannot take into account separation effects on its own. The GBU-24 does not have a flat base. In reality, it is more bullet nosed in shape. However, at the speeds with which the bomb is being analyzed, separation does occur near the trailing edge of the bomb. Experience has shown that truncating the end into a flat base and designating it a separated flow region through an appropriate input (see line 702, column 1, Appendix A) yields better results than attempting to model the bomb to exact physical dimensions. The last feature to point out are the wakes, as seen in Figure 2.4. A502i has a limitation in that the wakes must be modelled by the user, and they have the same abutment requirements as physical surfaces. Regardless of angle of attack, the wakes remain stationary with respect to the body to which they are attached. At higher angles of attack, the wakes are no longer close to paralleling the free-stream velocity. Remodelling the wakes is nearly an impossible task. The fin and base wakes would not be too difficult

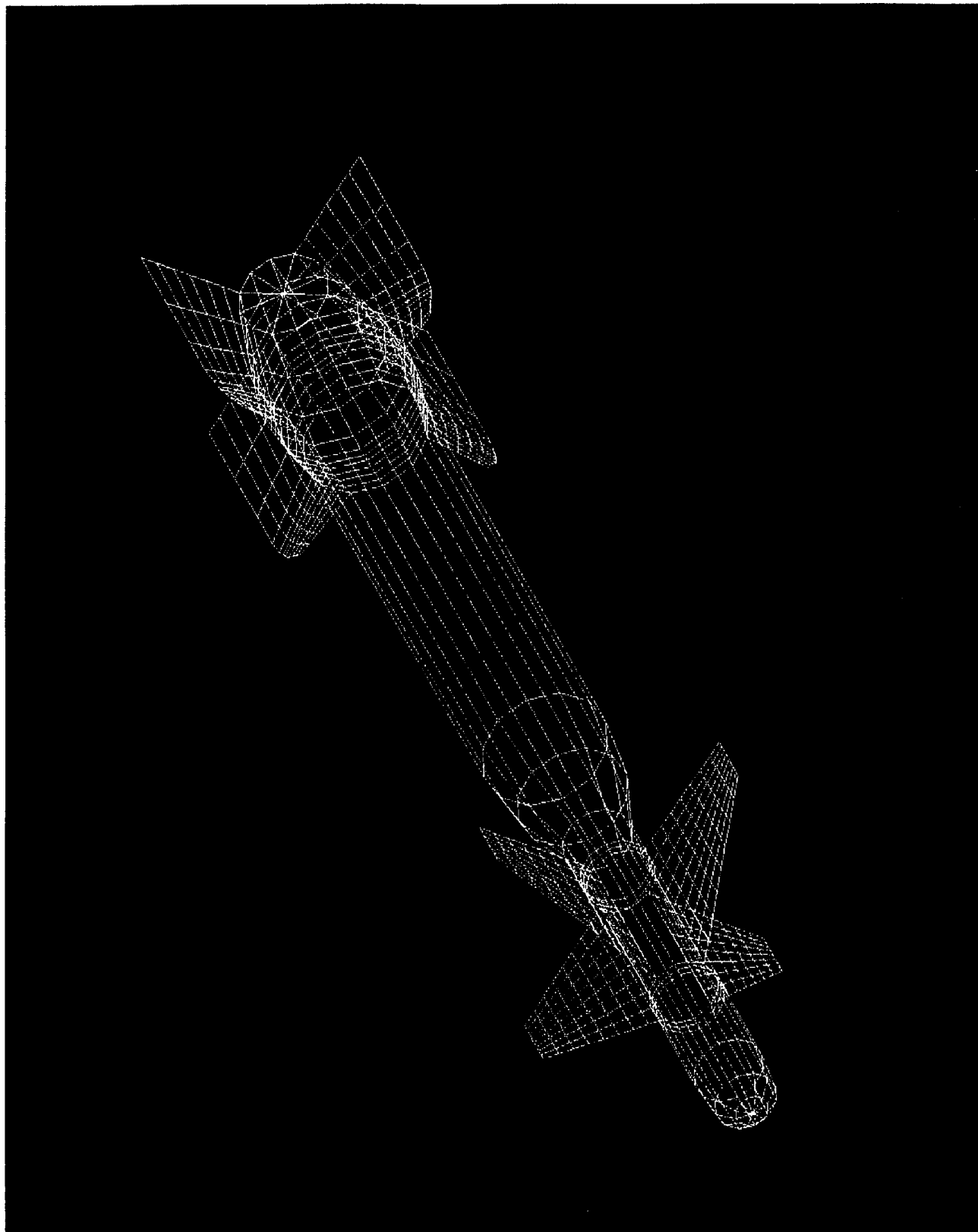


Figure 2.3 GBU-24 Geometry (Wakes not Shown)

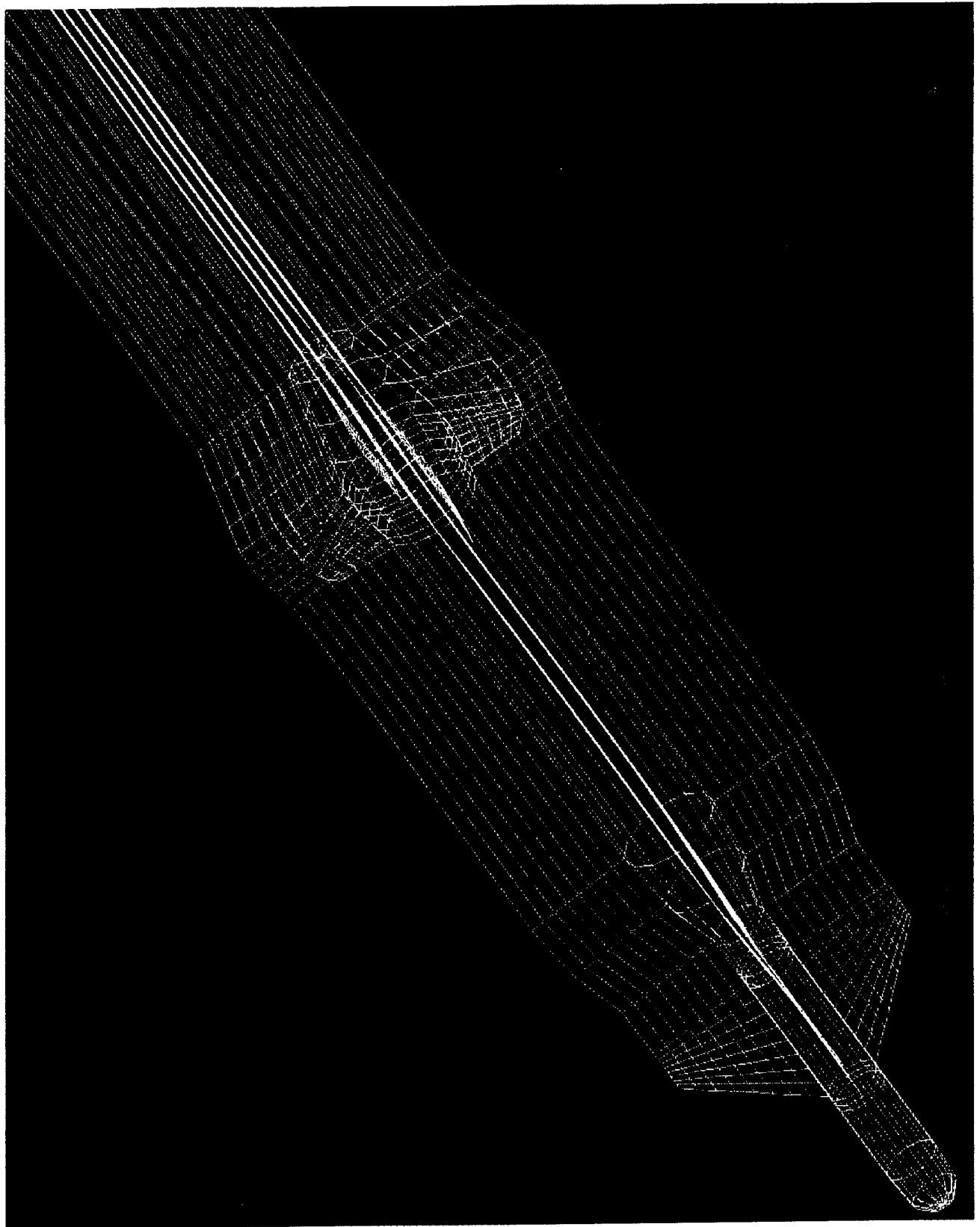


Figure 2.4 GBU-24 Geometry (Wakes Shown)

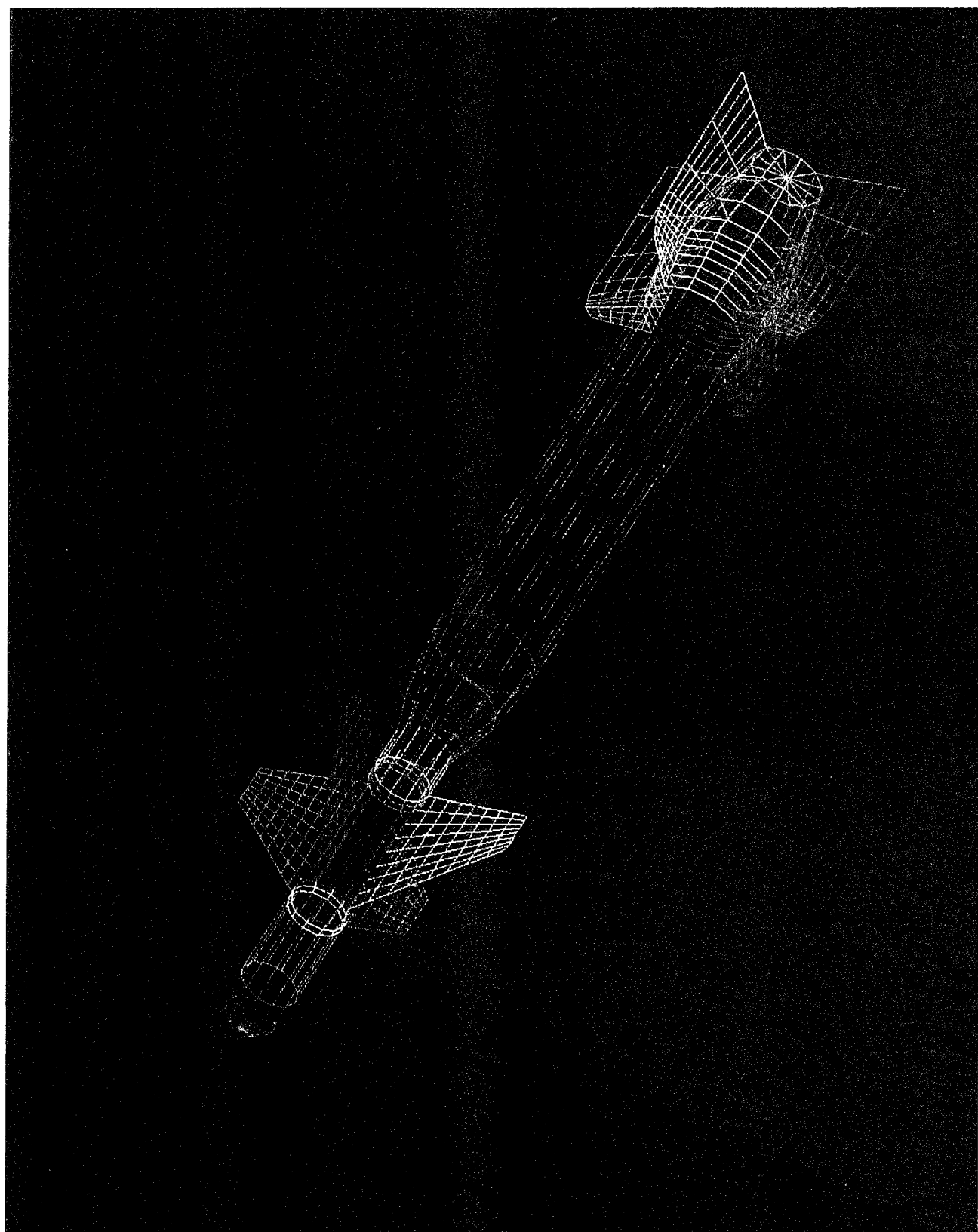


Figure 2.5 GBU-24 Geometry (Network Modelling)

because they do not abut against any physical surfaces except for the surfaces they are trailing from. The canard wakes must abut properly against the bomb's body all the way to the base. Modification of those wakes would entail modification of the entire body, or in a possible simplification, letting the wakes remain attached along the body until the base of the bomb and then shifting them relative to the free-stream.

4. The F-14

The F-14 geometry was modelled in the same fashion as the GBU-24. The geometry consists of approximately 1500 panels. While that may seem fairly coarse for such a complex structure, experience shows that it is all that is required to get accurate predictions. The primary area of interest is the underside of the fuselage forward and between the two nacelles. Higher panel density on the top half is not required. Figures 2.6 and 2.7 display the F-14 geometry without and with wakes shown. Several omissions are made to the model as having a trivial effect on the analysis or no effect at all. Phoenix rails and bomb racks are not modelled along with the chin pod because they are deemed insignificant to achieve reasonably accurate predictions over small angles of attack. External tanks were not considered, but could be modelled much in the same way as the bomb and inserted into the input file to see what effects the drop tanks have on separation forces. The vertical tails and horizontal stabilizers were deemed irrelevant to the prediction of the separation forces and were left out. This reduces the number of panels and networks, which also reduces the amount of time it takes to run a solution.

5. Combination Geometries

The F-14 and GBU-24 were modelled separately, but were combined together as shown in Figure 2.8. The first step to accomplish this was using the FORTRAN code NAVSEP which, among many of its functions will translate coordinates to relocate items in the flow-field. Once accomplished, the GBU-24 file was pasted into the F-14 input file.

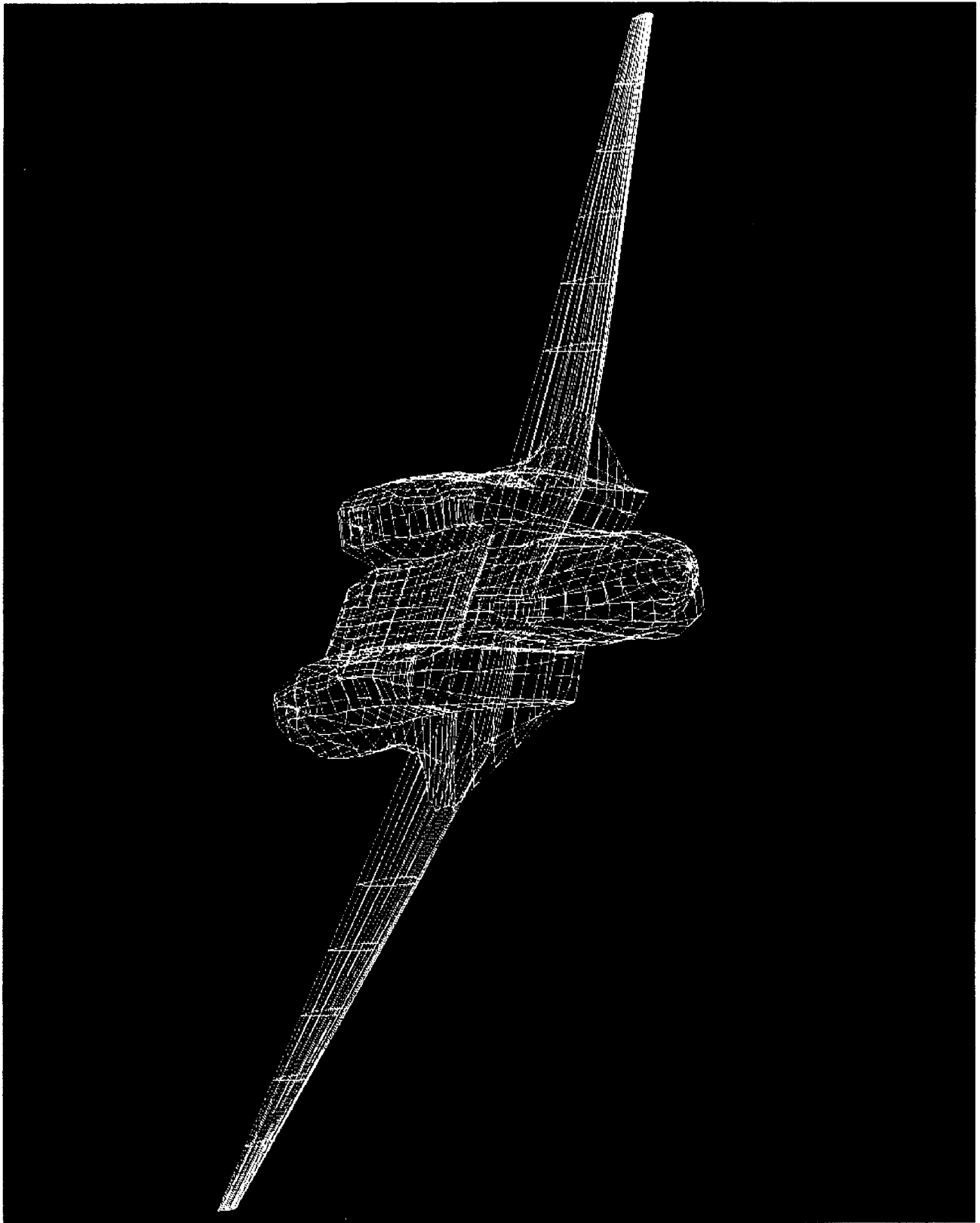


Figure 2.6 F-14 Geometry (Wakes not Shown)

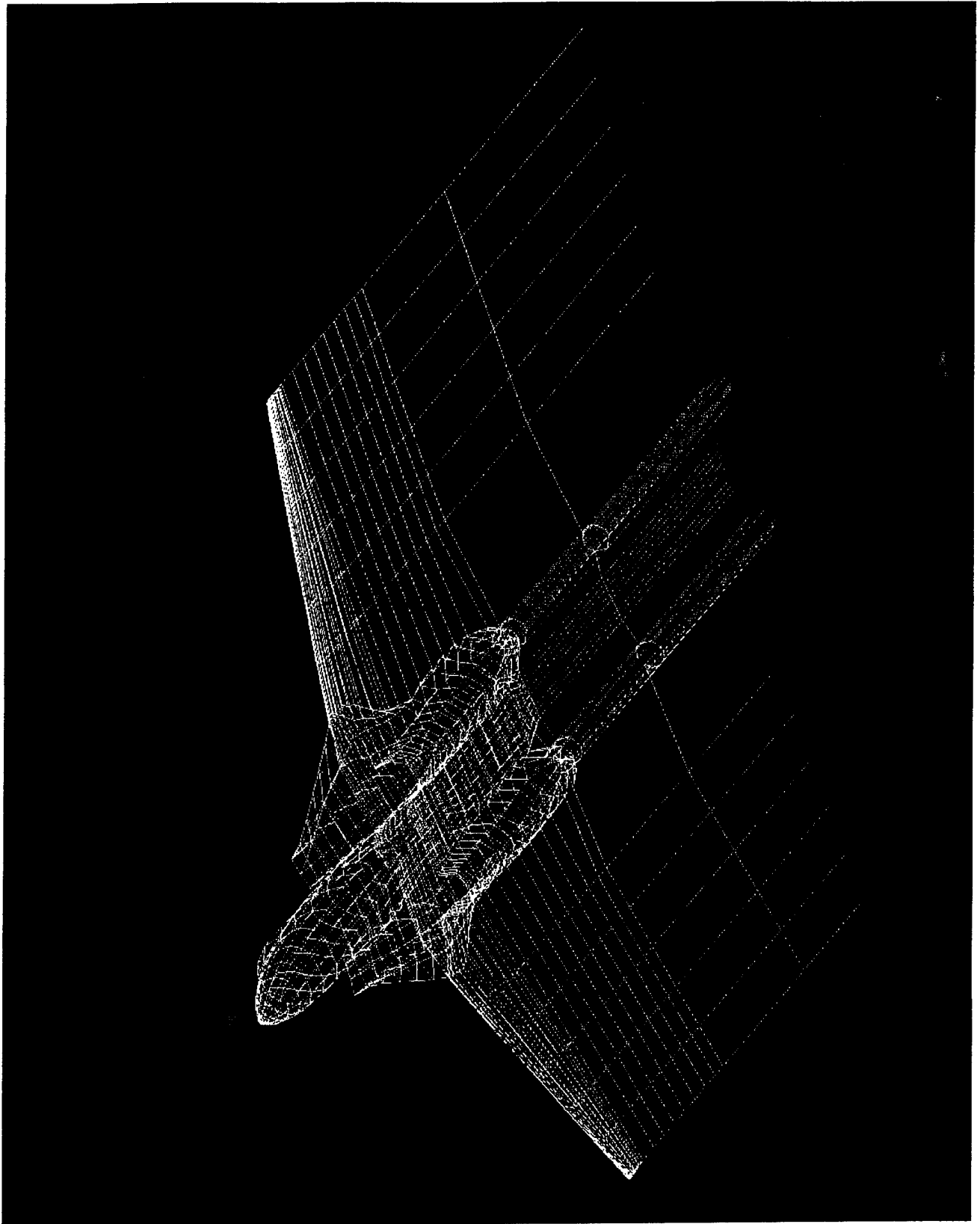


Figure 2.7 F-14 Geometry (Wakes Shown)

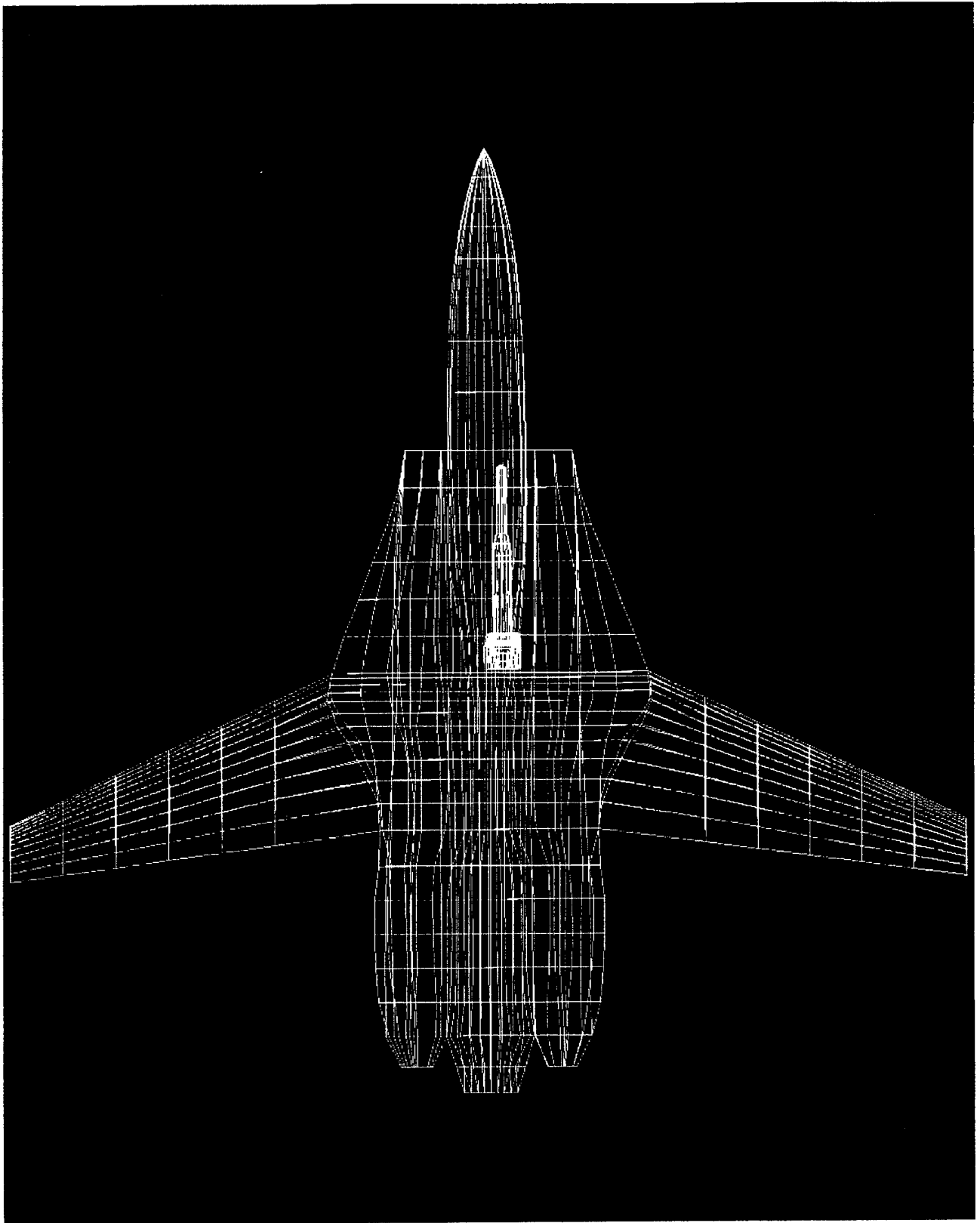


Figure 2.8 F-14 and GBU-24 on Station 3 Combined Geometries

D. GRAPHICS VISUALIZATION

One of the pre/post-processing codes that came with A502i is called RAID. Currently an executable exists in the department's computer system that can be accessed through typing after the UNIX prompt,

raid

Raid is a basic graphics program that can read A502i and TRANAIR input files and display geometries and flow properties from solutions. After accessing raid, it will ask what type of input file it is being asked to visualize. It can handle five other modes of input besides A502i/TRANAIR [Ref. 10]. It will then ask for the name of the input file. A prompt will follow asking about object definition matrices which needs to be answered by,

EACH

The next prompt will ask if the panels are going to be shaded by a C_p value. C_p is used generically in that C_p can be displayed or Mach or any of the relevant 49 surface flow properties [Ref. 4]. This is only used after a solution has been run, data has been extracted and a colorscale for contour plots has been determined. If only the geometry is to be displayed, then hit carriage return for all the next questions until a pink window appears with a menu in the lower left corner of the window. An anomaly of the program is that if you want to display the wakes, then wake display must be deselected. To view the geometry select view on the menu. All selections with the mouse in RAID are made with the center mouse button. A new window appears with a menu bar at the bottom and left and the geometry in the center. From there, rotation, translation, scaling, axes, reflections and other manipulation of the geometry is possible. Figures 2.3 through 2.8 are examples of geometries displayed on RAID.

When presentation of solutions (i.e., C_p or Mach contours) are desired, the use of another post-processing program is required to generate a colormap file. The program is

called crebar. An executable currently exists on the department's system. Type in,

crebar

after the UNIX prompt. The program will ask straightforward questions. Number values associated with colors available can be found in Ref. 10. The color file can be saved under any name, but must lie in the same directory as the input and solution files. The first line of the color file will list four numbers. The first number is the number of colors assigned to the colormap (248 maximum). Occasionally, the color bar displayed in RAID when using a colormap will disappear when certain menu items are selected. To prevent this, change the last three numbers to read 6, 1, -1. Plotting outputs from RAID requires saving the file in a format, such as RGB, that a printer will recognize. It is possible to change the text color and background color, the default is black, to avoid excessive use of black ink in hard copies.

III. DATA EXTRACTION

When a solution has run to completion, there are two files of interest, the arbitrarily named output file and the ft13 file. The arbitrarily named output file contains results for everything that A502i solves for. The ft13 file contains only the 49 surface flow properties on each panel. Appendix D is the solution portion of an arbitrarily named output file for the first network.

For purposes of displaying flow properties on RAID, it is necessary to utilize the ft13 file. A post-processing code called RAIDCONV is used to extract the specific information. To access RAIDCONV, type

raidconv

after the UNIX prompt. An executable currently exists in the department's system. The ft13 file must be in the same directory as RAIDCONV is accessed in. RAIDCONV will prompt the user for which kind of panel method is being used (A502i is one of three choices). The next prompt will ask for the name of the ft13 file. The last prompt will ask for the flow property that is to be extracted. A file called ft13.cp will be created. It can be renamed for purposes of multiple flow properties extraction. Abbreviations for the 49 flow properties can be found at the bottom of page 1 of Appendix D. The two primary flow properties are

LMACHU for local Mach number

CP2ND for second order pressure coefficient

CP2ND is the default setting for RAIDCONV. Once the ft13.cp file is created, RAID can be used as previously discussed to display the flow properties. An anomaly of RAIDCONV is that it does not recognize kt=20 type wakes, used where wakes from a wing abut against a body [Ref. 4]. To assist in extracting all the data, the kt=20 wakes

should be placed at the end of the input file. In general, it is good practice to place all wakes at the end of the input file when using A502i.

The arbitrarily named output file duplicates the data found in the ft13 file and includes moments and forces. A502i will sum up the moments and forces on each network and for all networks so far [App. D]. The moments are computed based on the coordinates entered into the input file [Ref. 4 and App. A].

IV. RESULTS OF A502i COMPUTATIONS

A. PARABOLIC ARC AIRFOIL DISCUSSION

This simple geometry was analyzed primarily to evaluate A502i's capabilities by a comparison to known linear theory. To this end, the geometry discussed in section II-C and shown in Figure 2.1 was run by A502i at a Mach of 0.3 and a Mach of 1.5 at an angle of attack of zero. Two of the 49 flow properties that A502i computes [Ref. 4] for each panel are linear C_p and second order C_p , given by

$$CPLIN = -2u_c \quad (4.1)$$

$$CP2ND = -2u_c - [(1 - M_\infty^2)u_c^2 + v_c^2 + w_c^2] \quad (4.2)$$

Where u_c , v_c and w_c are the compressible components of the perturbation velocity. Figure 4.1 plots the linear theory, A502i linear and second order results for the subsonic case, while Figure 4.2 represents the supersonic solution.

Linear theory for parabolic arc airfoils is outlined in Refs. 2 and 3. The equation representing the subsonic case is given by:

$$Cp(x) = \frac{-8 * \tau_{max}}{\pi * chord * \sqrt{1 - M_\infty^2}} * (1 - (.5 - x) * \ln \left| \frac{1 - x}{x} \right|) \quad \text{where } 0 < x < 1 \quad (4.3)$$

Equation 4.3 includes a Prandtl-Glauert compressibility correction. The equation representing the supersonic case is given by:

$$Cp(x) = \frac{2\theta}{\sqrt{M_\infty^2 - 1}} \quad \text{where } 0 < x < \text{chord} \quad (4.4)$$

$$\text{and } \theta = \tau_{max} * \left(\frac{1}{\text{chord}} - \frac{2x}{\text{chord}^2} \right)$$

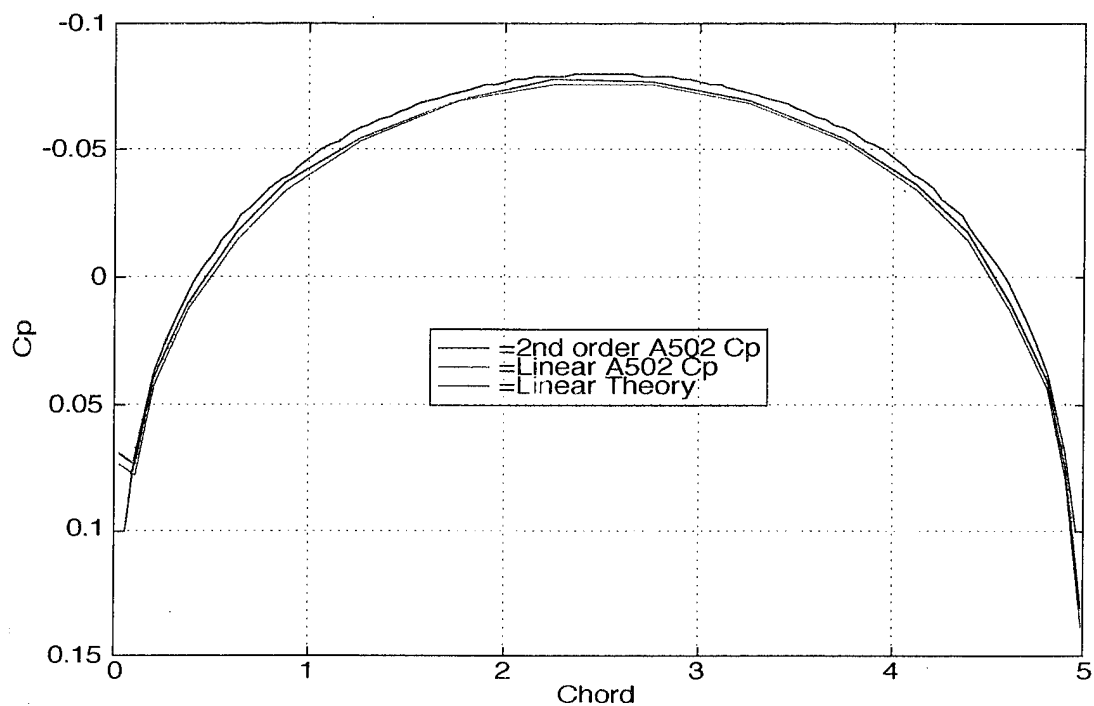


Figure 4.1 C_p Comparison of a Parabolic Arc Airfoil at Mach = 0.3.

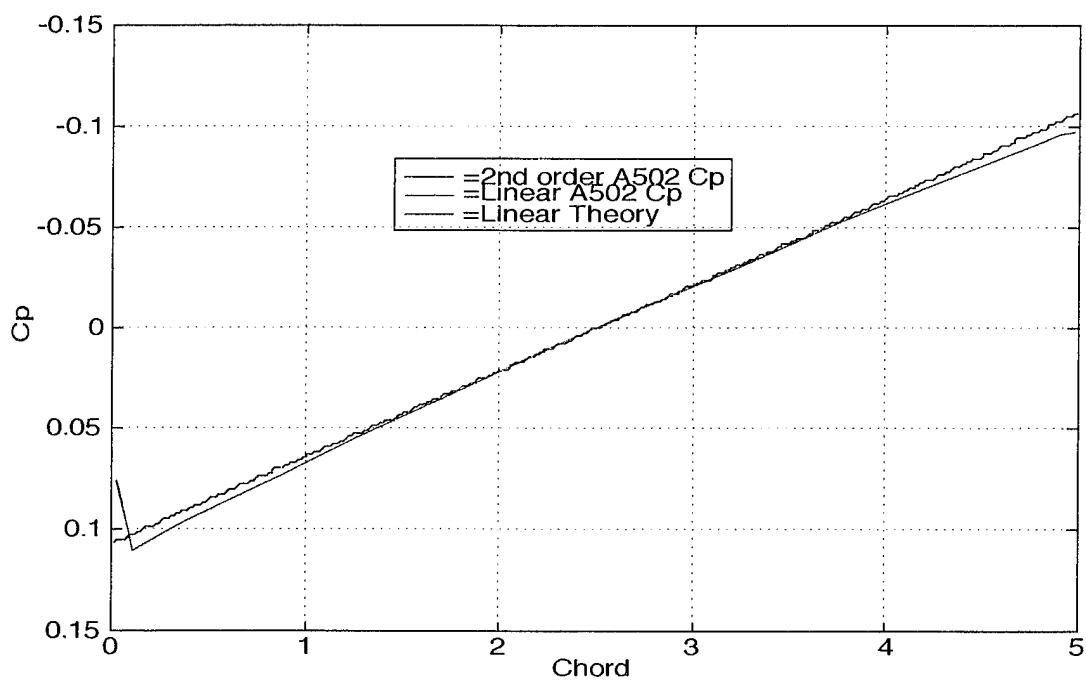


Figure 4.2 C_p Comparison of a Parabolic Arc Airfoil at Mach = 1.5.

Figure 4.1 shows very good agreement with the linear theory curve. There is a small but noticeable difference between A502i's linear results and second order results, with the second order results being more accurate, as expected. The maximum difference between the linear theory curve and the second order A502i curve amounts to a value of 2.5% right at mid-chord. The gap between the two curves from .25 chord to .75 chord were the result of thin panel density in that region.

Figure 4.2 shows excellent agreement with the linear theory curve. The A502i values of C_p for the linear and second order analysis are virtually identical. There are small deviations from linear theory near the leading and trailing edges, but this is expected due to numerical error associated with the discontinuity A502i would encounter right on the leading or trailing edges.

B. DELTAWING DISCUSSION

Reference 9 provides data on Mach distribution, using approximated linear theory, over a deltawing of the configuration discussed in section II-D. This simple geometry provided another test of A502i's capabilities. Figures 4.3 and 4.5 show the A502i results for the subsonic and supersonic case, while Figures 4.4 and 4.6 reflect the results from Ref. 9. For both cases, good agreement is found with the linear theory, with A502i's subsonic analysis being physically more accurate than the approximate linear theory, while A502i's supersonic analysis is not as physically accurate.

A comparison of Figures 4.3 and 4.4 reveals several points of interest. The Mach contour representing the free-stream value is given by the dashed line. All lines outside the dashed line represent areas where the Mach value is less than free-stream, and inside the dashed line is where the Mach value is more than free-stream. The location of where the free-stream Mach contour, in Figure 4.3, intersects the centerline agrees very well with Figure 4.4. However, Figure 4.4 does not have the contour extending all the way to the

tip. This is a physical limitation of the approximate theory used in Figure 4.4 and A502i is giving a more realistic solution. Figure 4.4 suggests that the peak Mach value occurs at approximately two-thirds chord along the centerline. The A502i results show the peak Mach contour occurring out midway along the semi-span. Those Mach values are less than 1% larger than the yellow Mach contour surrounding it, and can be attributed to how the panel density increases with movement towards the wingtip. A502i performed very well for this subsonic case.

A comparison of Figures 4.5 and 4.6 shows that A502i did not perform as well as in the subsonic case. Again, the contour representing the free-stream value of $Mach = 1.414$ is given by the dashed line. All lines forward are below free-stream and all lines aft are above free-stream. Figure 4.6 shows the intersection of the free-stream Mach contour on the centerline occurring at approximately 39% chord, which is in excellent agreement with A502i's result. Figure 4.6 shows the peak Mach value occurring at the trailing edge on the centerline. This makes more physical sense than the results that A502i yielded. The maximum thickness of the delta wing occurs along the centerline, allowing for greater expansion. The discrepancy may be attributable to panel density and accumulation of numerical error. A close study of the A502i results reveals some discontinuities along the column of panels out at the wing-tip which would have adversely affected the solution and caused errors to propagate along the semi-span.

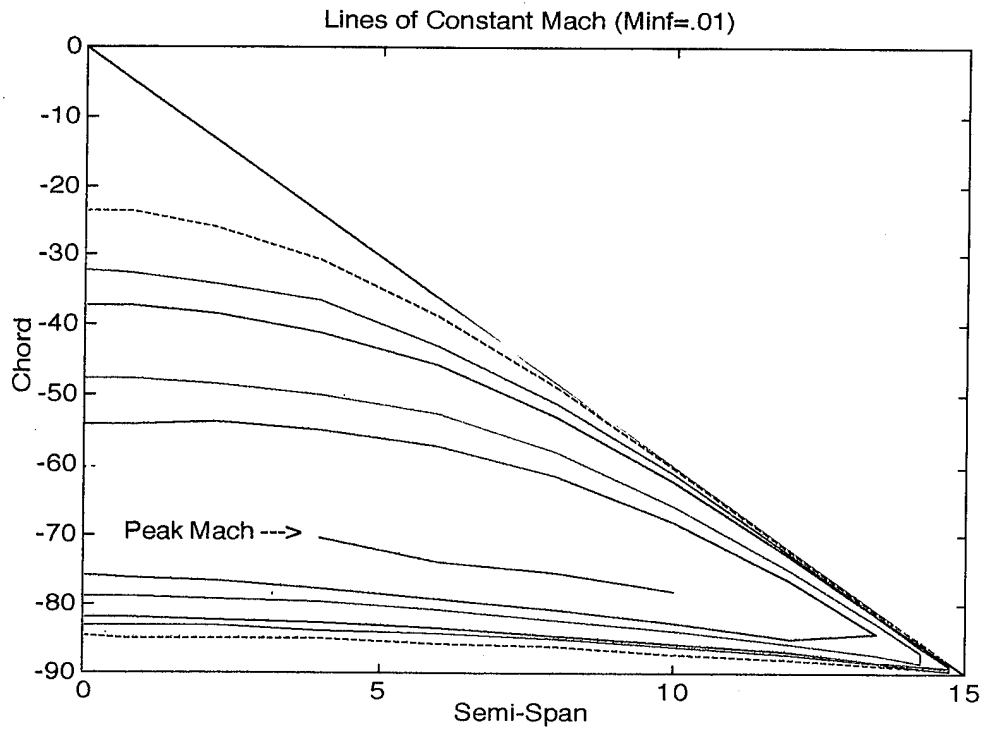


Figure 4.3 A502i Mach Contour Plot ($M_{\infty}=.01$)

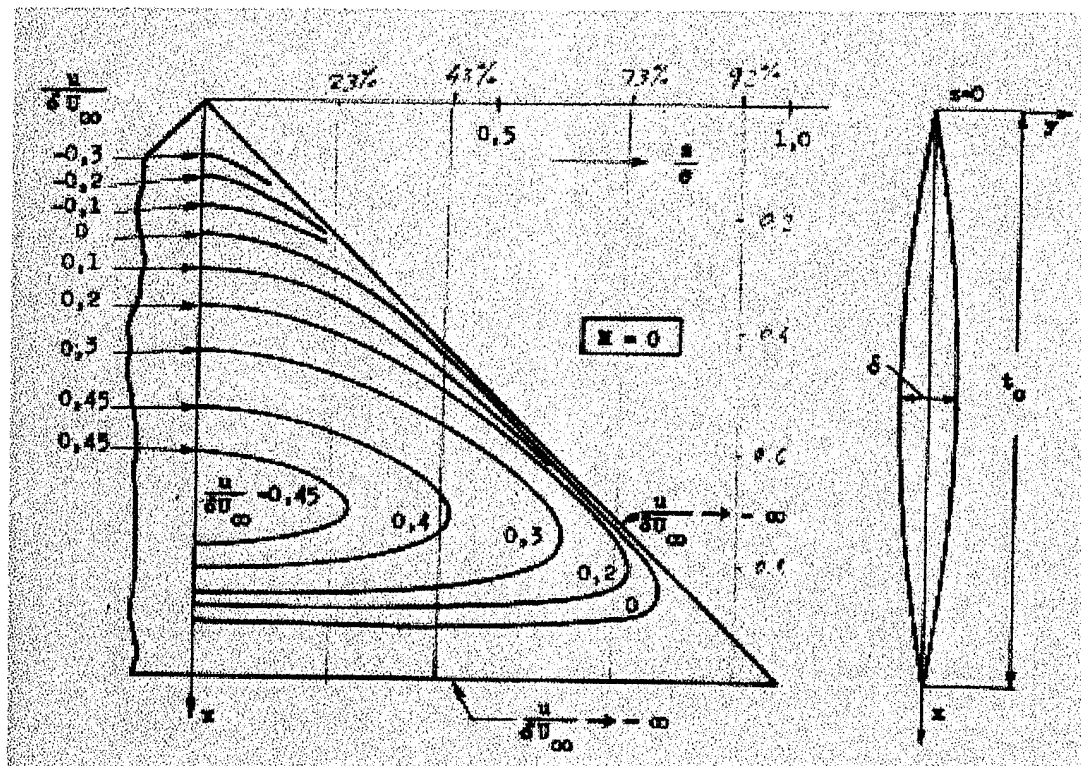


Figure 4.4 Approximate Linear Theory [Ref. 9] $M_{\infty}=0$

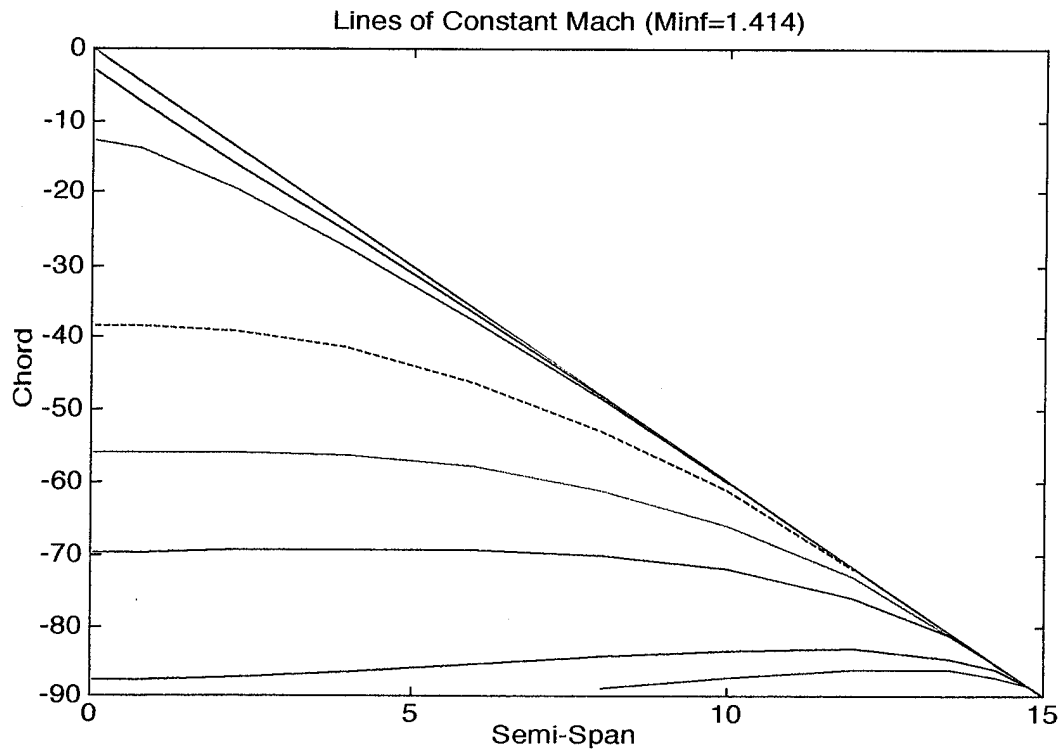


Figure 4.5 A502i Mach Contour Plot ($M_{\infty}=1.414$)

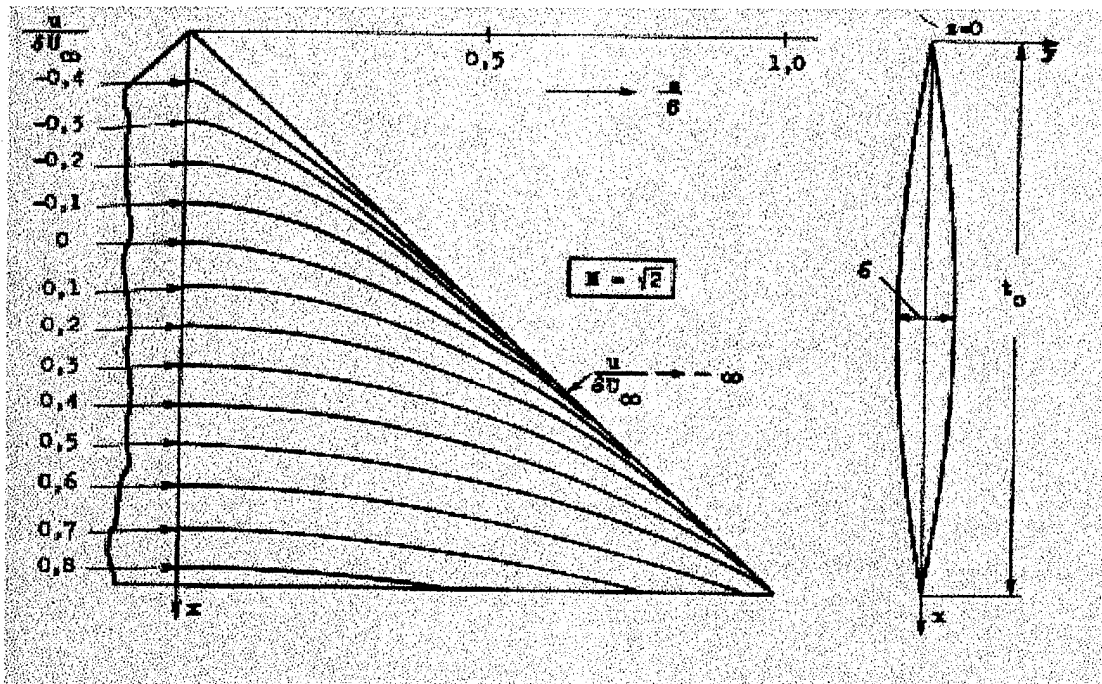


Figure 4.6 Approximate Linear Theory [Ref. 9] $M_{\infty}=1.414$

C. GBU-24 FREE-STREAM (NO CANARDS) DISCUSSION

A free-stream measurement of separation forces on the GBU-24, without canards, was conducted in a wind tunnel for various Mach numbers from .8 to 1.2 [Ref. 7]. Since A502i uses linear potential theory, the model of the GBU-24, without canards, was evaluated at both Mach .8 and 1.2, avoiding the transonic regime, to ascertain the accuracy of the code with the given geometry. Normal forces and pitching moments for both cases are plotted and compared to the wind tunnel data.

1. Subsonic Case ($M_\infty=0.8$)

The GBU-24 model, without the canards, was run for angles of attack varying from -10 to +10 degrees in two degree increments. Values much higher than that ran into wake modelling problems as the wake's angle relative to the free-stream was getting large enough that results would become questionable, and remodelling the wake was too difficult for such a complex geometry. The results of the A502i analysis are displayed in Figures 4.7 and 4.8. For angles of attack between -4 and +4 degrees, A502i does a good job of predicting the separation forces. The pitching moment, which happens to be unstable without the canards, is approximately linear over the -4 to +4 degree range and is the limiting factor to the models accuracy. The normal force is approximately linear over a wider range, and A502i does a good job of predicting the normal forces from -6 to +6 degrees.

2. Supersonic Case ($M_\infty=1.2$)

The results for the subsonic case demonstrated that the effective range of angle of attack that A502i needed to explore was from -6 to +6 degrees. Figures 4.9 and 4.10 plot the comparison of wind tunnel data versus A502i results for pitching moment and normal force. The results for the supersonic case are slightly better than that of the subsonic case. The actual pitching moment of the GBU-24 is approximately linear over a wider angle of

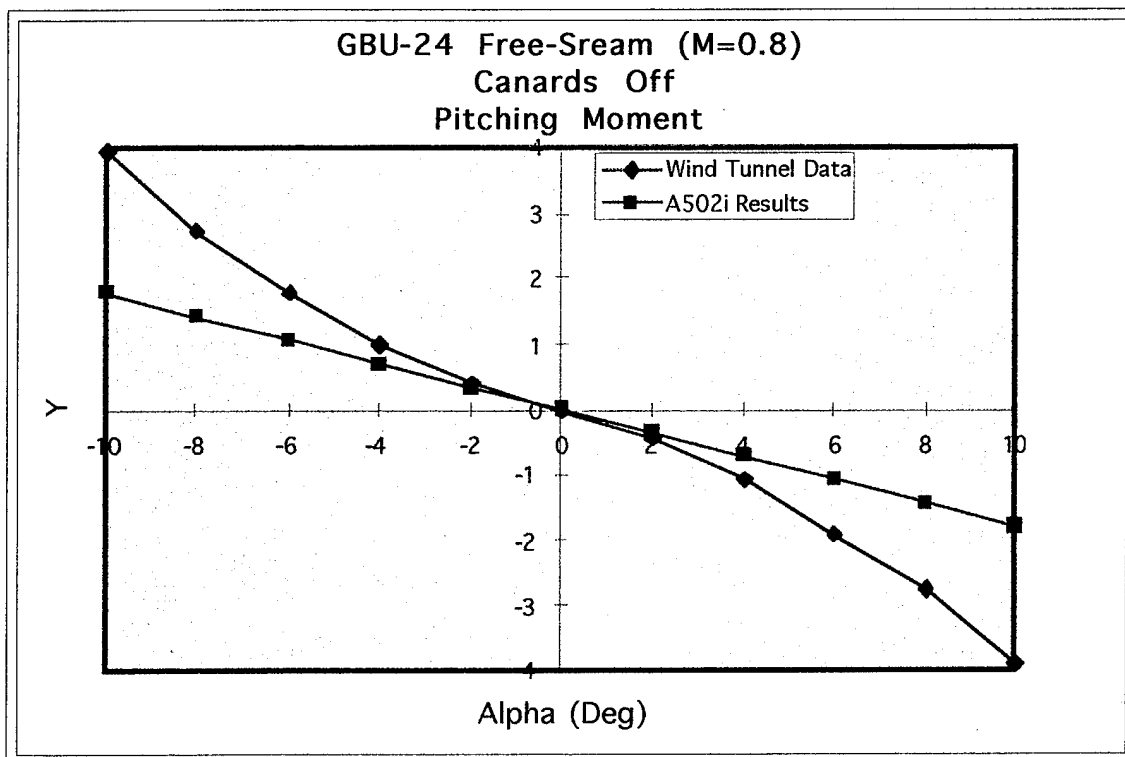


Figure 4.7 Comparison of Pitching Moments

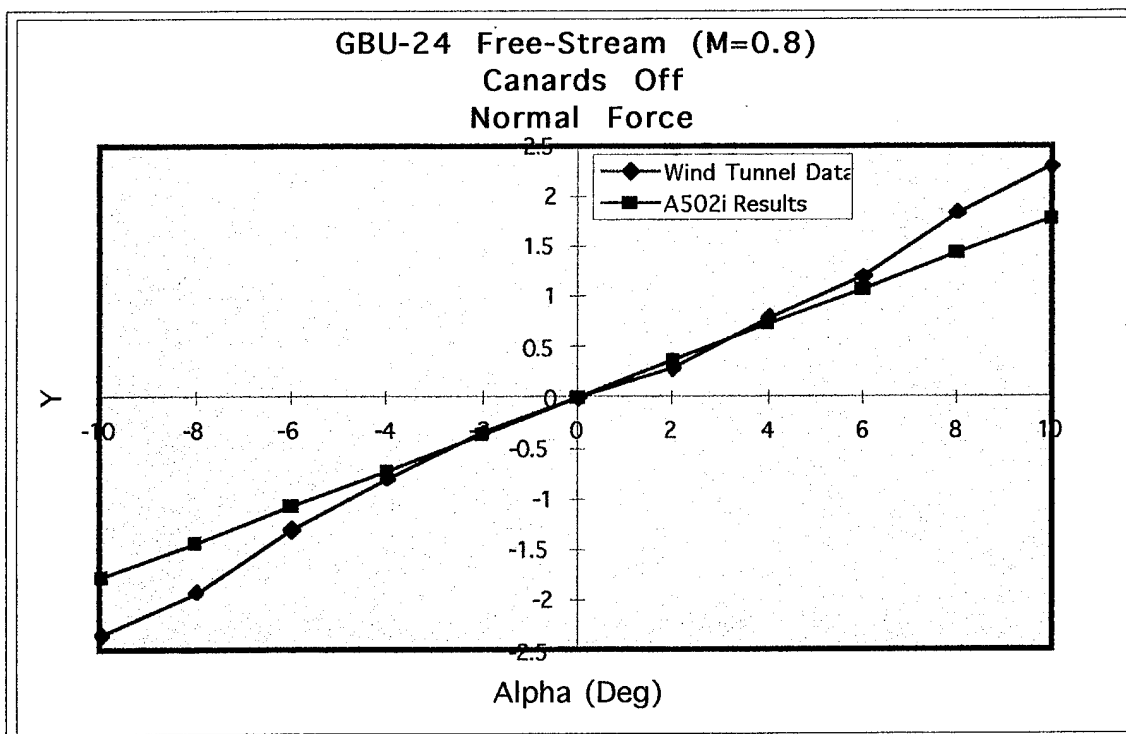


Figure 4.8 Comparison of Normal Forces

attack region, but fluctuations in the data at -6 and +6 degrees means that the model is still only viable from -4 to +4 degrees. The normal force line is nearly linear from -10 to +10 degrees and extrapolating the A502i results out to 10 degrees would still yield good predictions.

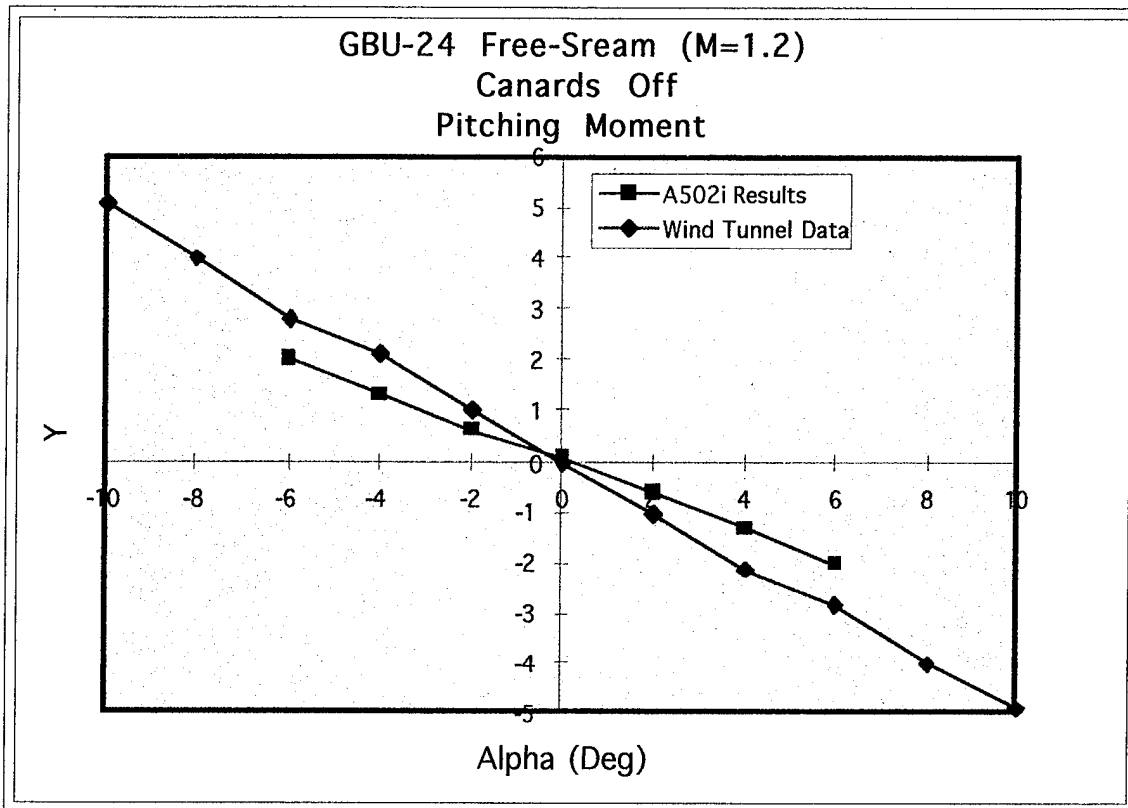


Figure 4.9 Comparison of Pitching Moments

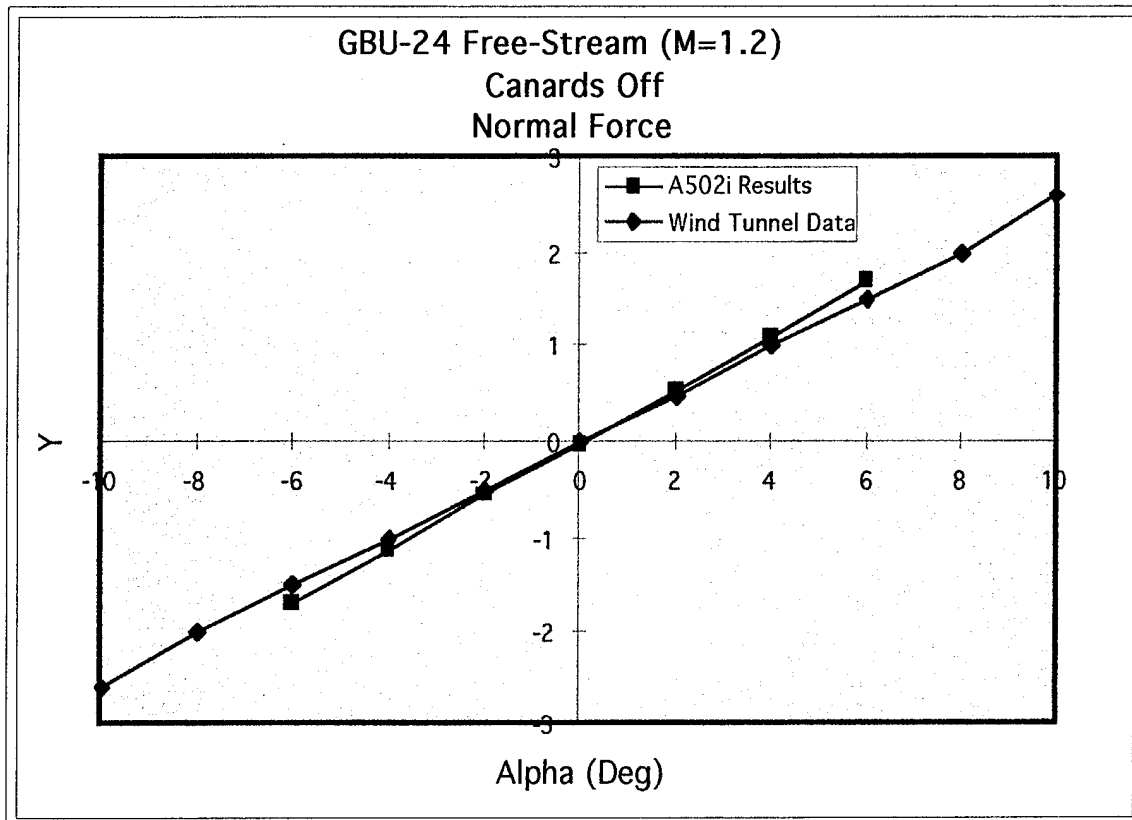


Figure 4.10 Comparison of Normal Forces

D. GBU-24 FREE-STREAM (WITH CANARDS) DISCUSSION

As in the case with no canards, free-stream measurements of the separation forces on GBU-24 were taken from Mach .8 to 1.2 in a wind tunnel [Ref. 7]. Again, due to the limitations of linear theory inherent in the code, an analysis was done for Mach numbers of .8 and 1.2 to minimize transonic effects. Even with the more complex geometry, A502i does an accurate job of predicting the separation forces over the range of angles of attack that are approximately linear.

1. Subsonic Case ($M_\infty=0.8$)

The GBU-24 model, with canards, was run in two degree increments of angle of attack from -10 to +10. The wake modelling limitation, as well as reviewing the data from the wind tunnel measurements [Ref. 7] showed the non-linearity of the separation forces at

the higher values of angle of attack, precluded any attempts to predict forces beyond the aforementioned angle of attack interval. The results of the A502i analysis are displayed in Figures 4.11 and 4.12. The addition of the canards makes the pitching moment stable, but linear over a smaller region than without the canards. A502i gave accurate results from -2 to +2 degrees angle of attack when predicting pitching moment. The prediction of normal forces fared better, showing accurate results from -3 to +3 degrees angle of attack.

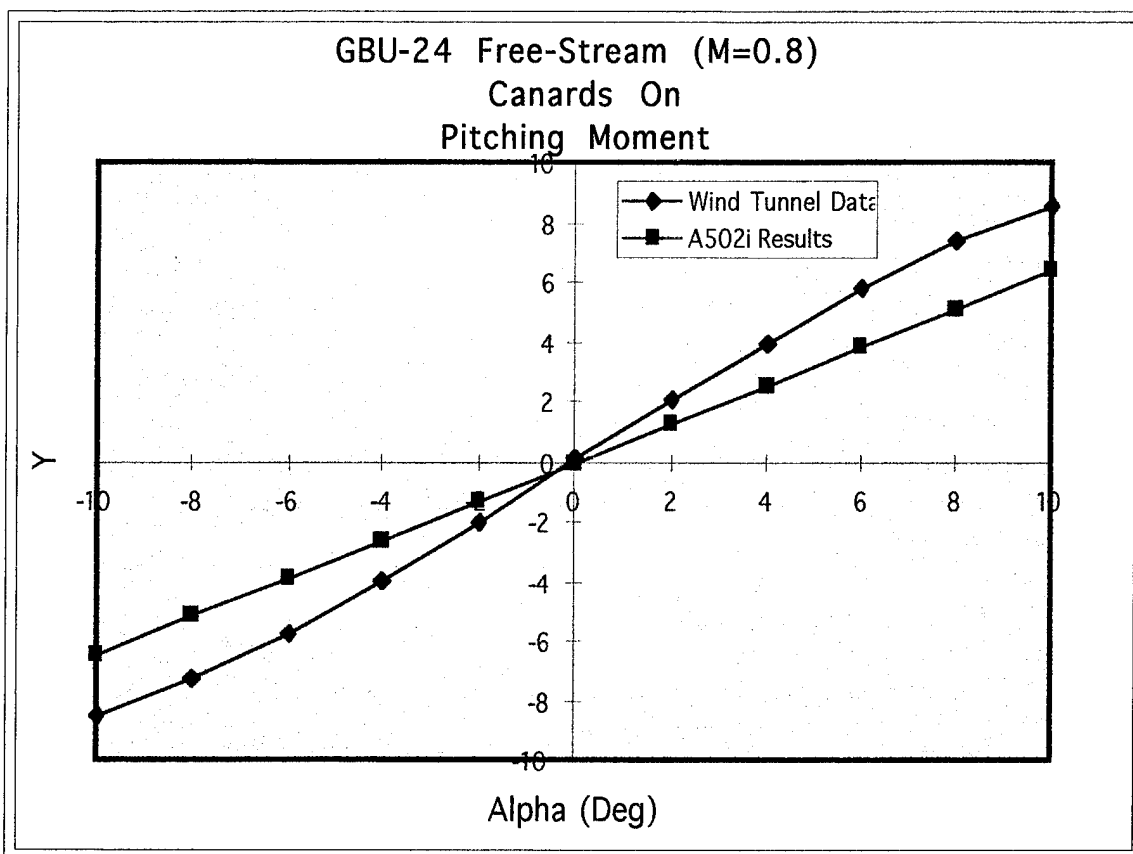


Figure 4.11 Comparison of Pitching Moments

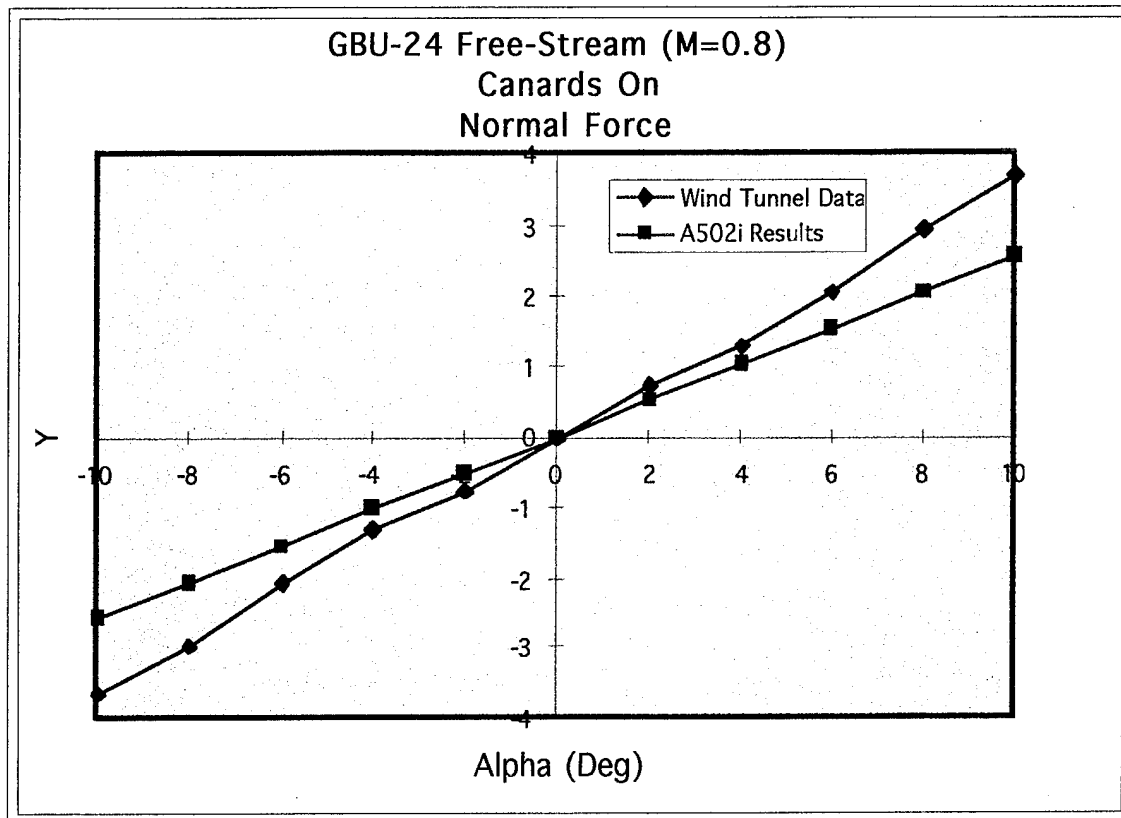


Figure 4.12 Comparison of Normal Forces

2. Supersonic Case ($M_{\infty}=1.2$)

As in the case with no canards, the region of accuracy, with the model used, was assumed to be less than + or - 10 degrees angle of attack. Cases were run from -6 to +6 degrees angle of attack in two degree increments. A comparison of A502i results with wind tunnel data is shown in Figures 4.13 and 4.14. For both the pitching moment and the normal force, A502i does a much better job of prediction than when subsonic. The wind tunnel data is nearly linear in both pitch moment and normal force from -8 to +8 degrees angle of attack. Extrapolating the A502i data out to + or - 8 degrees angle of attack, shows excellent agreement with the wind tunnel data.

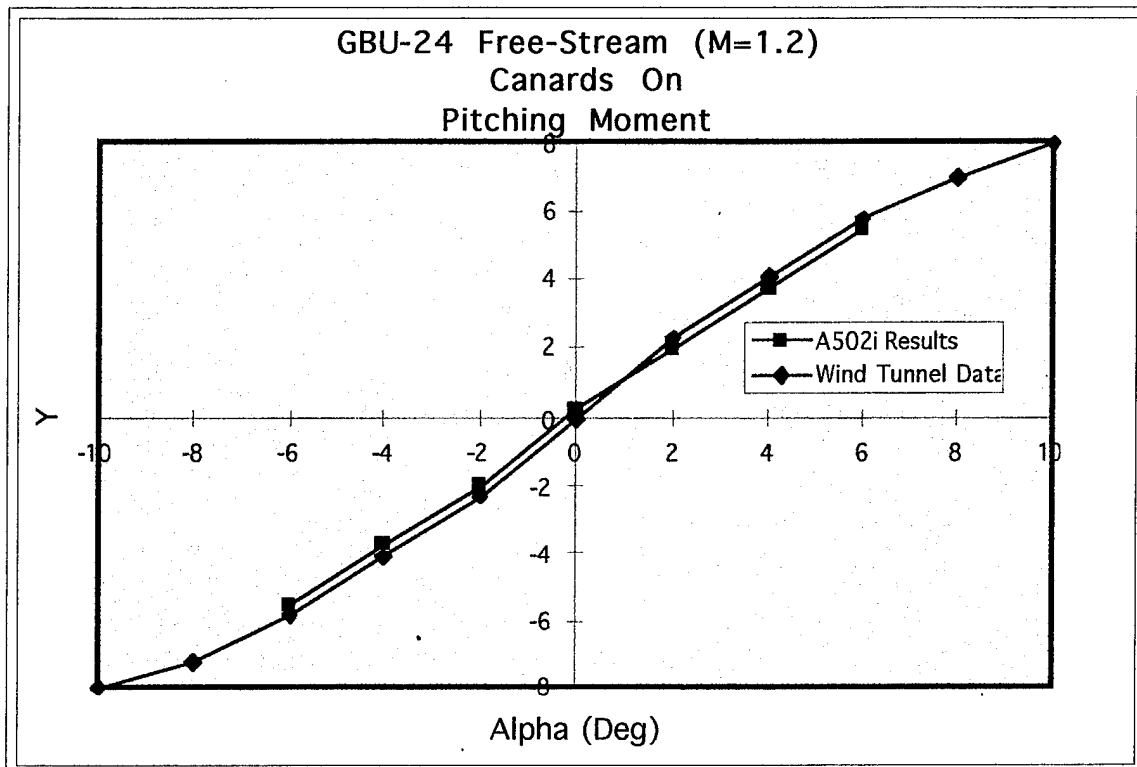


Figure 4.13 Comparison of Pitching Moments

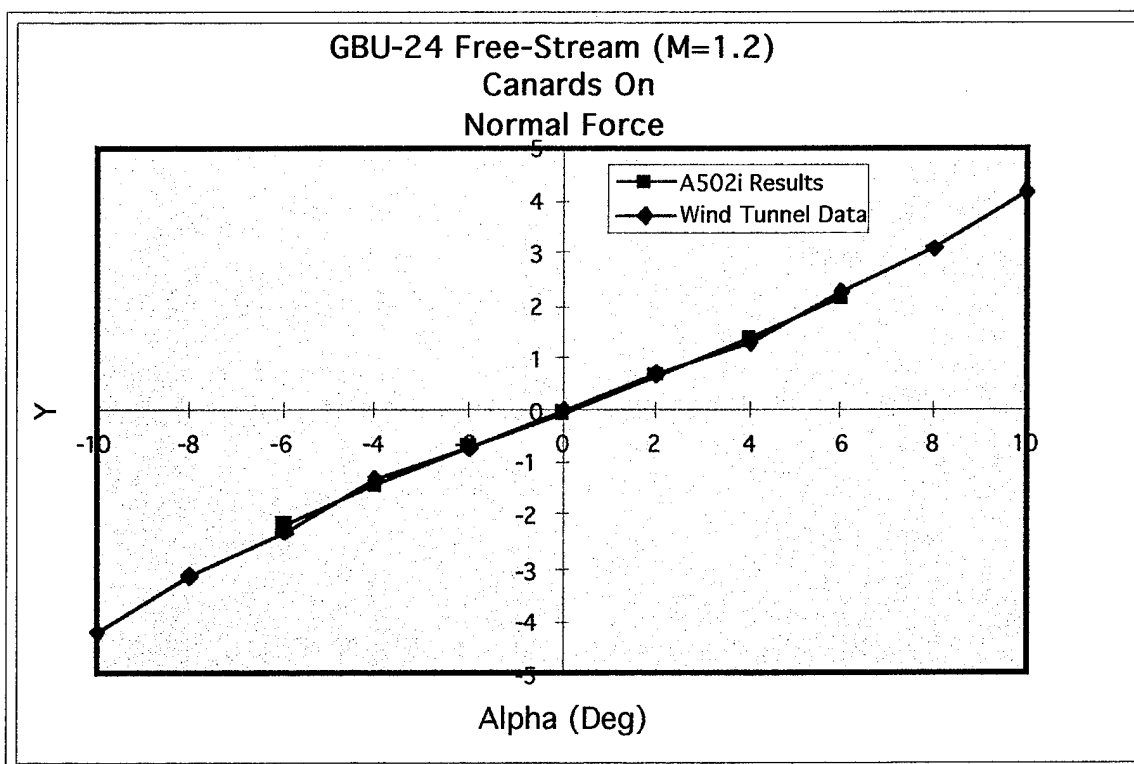


Figure 4.14 Comparison of Normal Forces

E. F-14 DISCUSSION

The GBU-24, without canards was located at station 3 of the F-14 via the NAVSEP code. In the process of running a solution, the combined geometries were found to have a total of 150 networks (A502i's maximum). The combined geometry had about 4,000 panels, far short of the 20,000 panel maximum, so there was room for more detailed modelling, but there was not a chance to insert the GBU-24, with canards, into the F-14's flow field and analyze the forces on the bomb. The geometry with the canardless bomb ran to a solution that appeared to be valid, so there is a high degree of confidence that if the number of networks could be reduced to allow the GBU-24, with canards, to be inserted into the F-14 flow field, the code would yield accurate predictions at small angles of attack on the forward stations. To reduce the total number of networks by combining existing networks would have required a large time investment and the use of MACGS, which the department currently does not possess, the two reasons why it was not done. Figure 4.15 shows a Mach distribution of the solution of the canardless bomb and F-14 at Mach = 0.8 and 0 degrees angle of attack

F. POST-PROCESSING DISCUSSION

The Mach values for the subsonic case of the GBU-24, with canards, at 4 degrees angle of attack, were extracted from the ft13 file. These values, used in conjunction with RAID are shown in Figures 4.16 and 4.17. The color distribution over the nose in Figure 4.16 indicates that the bomb is at an angle of attack, and scanning the rest of the model showed no discontinuous solutions, which is generally represented in A502i by a Mach value of 0 or 1,000. The visual representation is a quick way of telling if A502i ran an accurate solution. The only other way is to individually check the Mach or C_p values of each panel in the ft13 file or the arbitrarily named output file. The other point of interest in Figure 4.16 is the lack of panel density along the mid-section of the bomb. The goal, in the

case of stores separation prediction, is to have as simple a model as possible that still gives accurate predictions. The fewer the number of panels, the shorter the run time. The fact that A502i is a higher order panel method allows the luxury of using fewer panels. Figure 4.17 highlights the approach used to take into account separation effects as discussed on page 16.



Figure 4.15 Mach Distribution over GBU-24 and F-14 ($M_\infty=0.8$, $\alpha=0^\circ$)

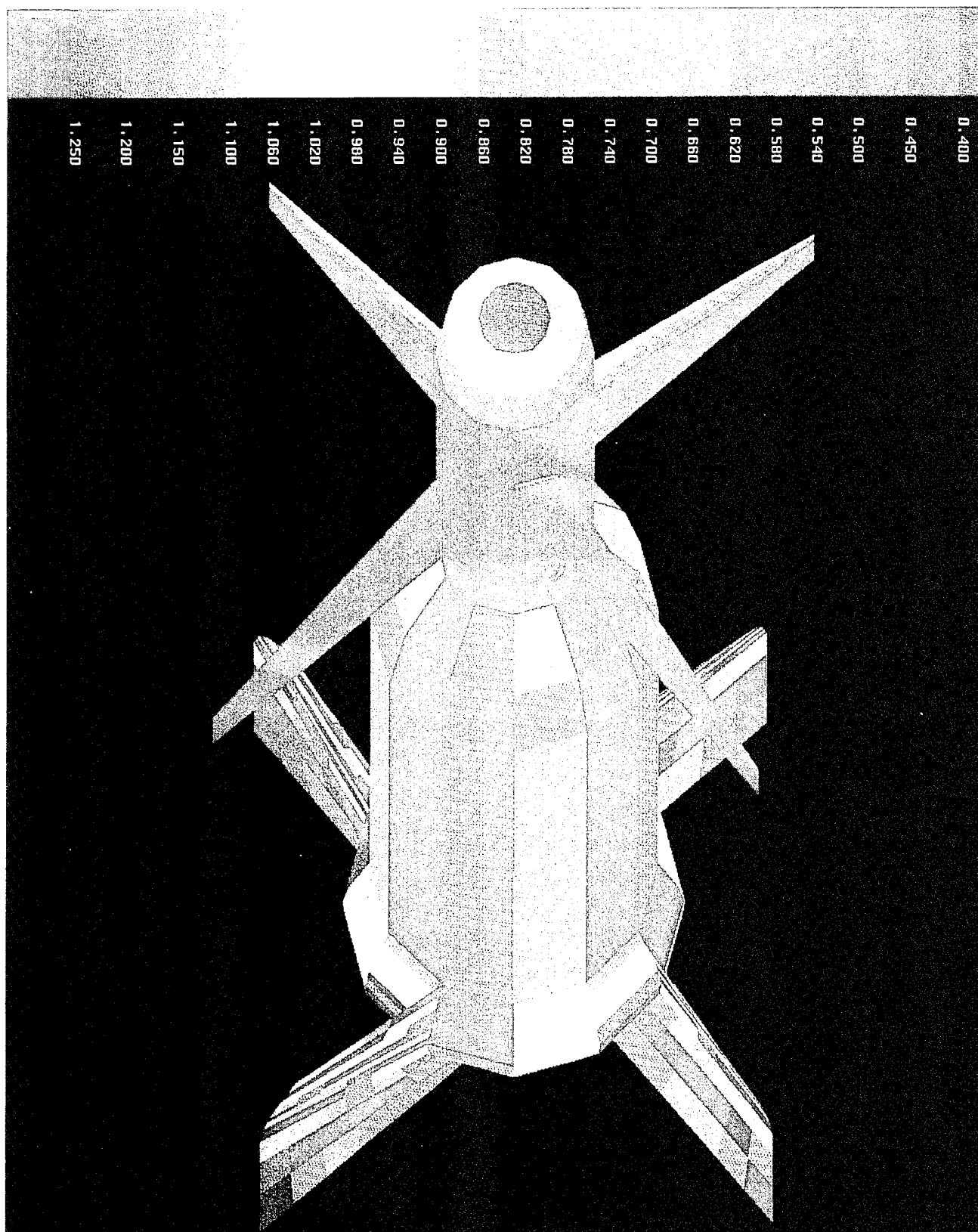


Figure 4.16 Mach Distribution over GBU-24 ($M_\infty=0.8$, $\alpha=4^\circ$)

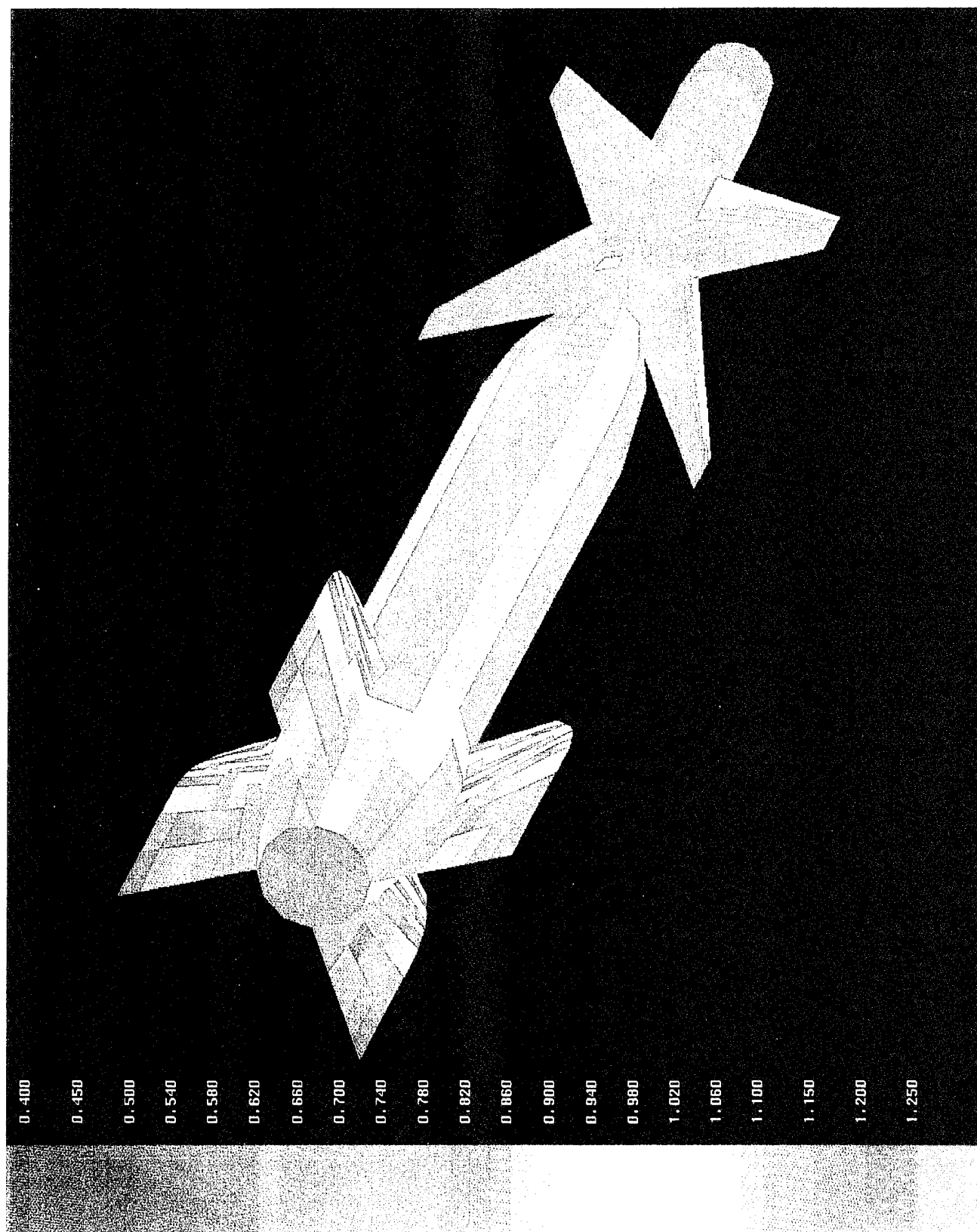


Figure 4.17 Mach Distribution over GBU-24 ($M_\infty=0.8$, $\alpha=4^\circ$)

V. SUMMARY AND CONCLUSIONS

The main goal of this analysis is to determine the accuracy of A502i on both simple geometries and complex geometries. To accomplish this, A502i is compared with results available from linear theory and wind tunnel experiments. This allows conclusions to be drawn on the capabilities as well as the limitations of A502i.

In general, A502i can accurately predict flow properties, forces and moments on simple and complex geometries at low angles of attack. The predictions are valid over a wide Mach range, from 0 up to and including 0.8 and from 1.2 and above. The supersonic solutions are available due to A502i's higher order capabilities.

The limitations of A502i are consistent with most panel methods. A502i cannot predict flow dominated by viscous, separated or transonic effects. It cannot predict flow with different total pressures, such as flow properties inside a jet plume or a propeller slipstream swirl. The biggest shortcoming of A502i is its inability to handle unsteady cases and automatically determine wake shapes.

Experience or knowledge of the flow properties around the geometry being tested is important in building an accurate model. An accurate model may not be physically accurate. Flight test results revealed a yawing moment on the GBU-24 that was not discovered in wind tunnel experiments when the bomb was carried on an aft station. The yawing moment may be caused by the fact that the canards are not fixed, but spring-damped. A502i predictions would not be accurate without inputting a moment to simulate the deflection of the canards, since the canards are fixed by the geometry. A502i, while a powerful tool in terms of cost savings and time, cannot completely substitute for wind tunnel experiments and flight tests, as constructing a complex geometry to exact physical specifications will probably not yield accurate predictions.

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results

Page 1

dynamic memory management initialization				
max no. levels	15	max no. arrays	200	maximum scratch storage
addr(maplev)	0	addr(maplws)	0	addr(scratch storage)
				total storage provided
				1

wopen call on unit	1	blocks:	10	status:	0
wopen call on unit	2	blocks:	10	status:	0
wopen call on unit	3	blocks:	10	status:	0

```
* * * * *
```

```
a502 - pan-air technology program
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* * * * *
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```
potehtial flow about arbitrary configurations  
version id = ht2 (12 feb 92) boeing ver i00
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* * * * *
```

```
                                07-Mar-9
```

```
* * * * *
```

```
GBU-24 FREESTREAM M=0.8
```

```
* * $SOLUTION
```

```
* * * * *
```

```
0*b*input-da
```

```
1
```

```
-- list of a502 input data cards -
```

```

1 $TITLE
2 GBU-24 FREESTREAM M=0.8
3 $SOLUTION
4 $SYMMETRY
5 = MISYMM MJSYMM
6 0. 0.
7 $MACH NUMBER
8 =AMACH
9 .8
10 $CASES
11 =NCASE
12 1.
13 $ANGLES-OF-ATTACK
14 =ALPC
15 2.
16 =ALPHA(1)

```

17 2.	18 SPRINTOUT OPTIONS	19 =ISINGS	IGEOMP	ISINGP	ICONTP	IBCONP	IEDGEP
20 0.	0.	0.	0.	1.	0.	0.	0.
21 0.	0.	0.	0.	1.	0.	0.	0.
22 0.	0.	0.	0.	1.	0.	0.	0.
23 0.	0.	0.	0.	1.	0.	0.	0.
24 0.	0.	0.	0.	1.	0.	0.	0.
25 0.	0.	0.	0.	1.	0.	0.	0.
26 0.	0.	0.	0.	1.	0.	0.	0.
27 0.	0.	0.	0.	1.	0.	0.	0.
28 0.	0.	0.	0.	1.	0.	0.	0.
29 0.	0.	0.	0.	1.	0.	0.	0.
30 0.	0.	0.	0.	1.	0.	0.	0.
31 0.	0.	0.	0.	1.	0.	0.	0.
32 0.	0.	0.	0.	1.	0.	0.	0.
33 0.	0.	0.	0.	1.	0.	0.	0.
34 0.	0.	0.	0.	1.	0.	0.	0.
35 0.	0.	0.	0.	1.	0.	0.	0.
36 0.	0.	0.	0.	1.	0.	0.	0.
37 0.	0.	0.	0.	1.	0.	0.	0.
38 0.	0.	0.	0.	1.	0.	0.	0.
39 0.	0.	0.	0.	1.	0.	0.	0.
40 0.	0.	0.	0.	1.	0.	0.	0.
41 0.	0.	0.	0.	1.	0.	0.	0.
42 0.	0.	0.	0.	1.	0.	0.	0.
43 0.	0.	0.	0.	1.	0.	0.	0.
44 0.	0.	0.	0.	1.	0.	0.	0.
45 0.	0.	0.	0.	1.	0.	0.	0.
46 0.	0.	0.	0.	1.	0.	0.	0.
47 0.	0.	0.	0.	1.	0.	0.	0.
48 0.	0.	0.	0.	1.	0.	0.	0.
49 0.	0.	0.	0.	1.	0.	0.	0.
50 0.	0.	0.	0.	1.	0.	0.	0.
51 0.	0.	0.	0.	1.	0.	0.	0.
52 0.	0.	0.	0.	1.	0.	0.	0.
53 0.	0.	0.	0.	1.	0.	0.	0.
54 0.	0.	0.	0.	1.	0.	0.	0.
55 0.	0.	0.	0.	1.	0.	0.	0.
56 0.	0.	0.	0.	1.	0.	0.	0.
57 0.	0.	0.	0.	1.	0.	0.	0.
58 0.	0.	0.	0.	1.	0.	0.	0.
59 0.	0.	0.	0.	1.	0.	0.	0.
60 0.	0.	0.	0.	1.	0.	0.	0.
61 0.	0.	0.	0.	1.	0.	0.	0.
62 0.	0.	0.	0.	1.	0.	0.	0.
63 0.	0.	0.	0.	1.	0.	0.	0.
64 0.	0.	0.	0.	1.	0.	0.	0.
65 0.	0.	0.	0.	1.	0.	0.	0.
66 0.	0.	0.	0.	1.	0.	0.	0.
67 0.	0.	0.	0.	1.	0.	0.	0.
68 0.	0.	0.	0.	1.	0.	0.	0.
69 0.	0.	0.	0.	1.	0.	0.	0.
70 0.	0.	0.	0.	1.	0.	0.	0.
71 0.	0.	0.	0.	1.	0.	0.	0.
72 0.	0.	0.	0.	1.	0.	0.	0.
73 0.	0.	0.	0.	1.	0.	0.	0.

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74	41.655	15.170	-12.381	40.866	15.170	-12.379
75	40.076	15.169	-12.376	39.287	15.169	-12.374
76	38.497	15.168	-12.371			
77	\$POINTS NETWORK = ZCAN3					
78	1.0					
79	2.0					
80	9.0	9.0				
81	45.236	-2.324	-3.138	42.548	-2.324	-3.138
82	39.859	-2.324	-3.138	37.171	-2.324	-3.138
83	34.483	-2.324	-3.138	31.795	-2.324	-3.138
84	29.107	-2.324	-3.138	26.418	-2.324	-3.138
85	23.730	-2.324	-3.138			
86	45.183	-3.583	-4.642	42.732	-3.582	-4.642
87	40.281	-3.582	-4.642	37.830	-3.582	-4.642
88	35.380	-3.581	-4.642	32.929	-3.581	-4.642
89	30.478	-3.581	-4.642	28.027	-3.580	-4.642
90	25.576	-3.580	-4.642			
91	45.130	-4.841	-6.146	42.917	-4.840	-6.146
92	40.703	-4.840	-6.146	38.489	-4.839	-6.146
93	36.276	-4.839	-6.146	34.063	-4.838	-6.146
94	31.849	-4.837	-6.146	29.635	-4.837	-6.146
95	27.422	-4.836	-6.145			
96	45.077	-6.100	-7.650	43.101	-6.099	-7.650
97	41.125	-6.098	-7.650	39.149	-6.097	-7.650
98	37.173	-6.096	-7.650	35.196	-6.095	-7.650
99	33.220	-6.094	-7.650	31.244	-6.093	-7.649
100	29.268	-6.092	-7.649			
101	45.025	-7.358	-9.155	43.286	-7.357	-9.155
102	41.547	-7.355	-9.154	39.808	-7.354	-9.154
103	38.069	-7.353	-9.154	36.330	-7.352	-9.154
104	34.591	-7.350	-9.153	32.853	-7.349	-9.153
105	31.114	-7.348	-9.153			
106	44.972	-8.616	-10.659	43.470	-8.615	-10.659
107	41.969	-8.613	-10.659	40.467	-8.612	-10.658
108	38.966	-8.610	-10.658	37.464	-8.608	-10.658
109	35.963	-8.607	-10.658	34.461	-8.605	-10.657
110	32.959	-8.603	-10.657			
111	44.919	-9.875	-12.163	43.655	-9.873	-12.163
112	42.390	-9.871	-12.163	41.126	-9.869	-12.162
113	39.862	-9.867	-12.162	38.598	-9.865	-12.162
114	37.334	-9.863	-12.161	36.069	-9.861	-12.161
115	34.805	-9.859	-12.161			
116	44.866	-11.133	-13.668	43.839	-11.131	-13.667
117	42.812	-11.129	-13.667	41.785	-11.127	-13.667
118	40.759	-11.124	-13.666	39.732	-11.122	-13.666
119	38.705	-11.120	-13.665	37.678	-11.117	-13.665
120	36.651	-11.115	-13.665			
121	44.813	-12.392	-15.172	44.024	-12.389	-15.172
122	43.254	-12.387	-15.171	42.445	-12.384	-15.171
123	41.655	-12.381	-15.170	40.866	-12.379	-15.170
124	40.076	-12.376	-15.169	39.287	-12.374	-15.169
125	38.497	-12.371	-15.168			
126	\$POINTS NETWORK = ZCAN1					
127	1.0					
128	2.0					
129	9.0	9.0				
130	45.236	2.324	3.138	42.548	2.324	3.138

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131	39.859	2.324	3.138	37.171	2.324	3.138
132	34.483	2.324	3.138	31.795	2.324	3.138
133	29.107	2.324	3.138	26.418	2.324	3.138
134	23.730	2.324	3.138			
135	45.183	3.582	4.642	42.732	3.582	4.642
136	40.281	3.582	4.642	37.830	3.582	4.642
137	35.380	3.581	4.642	32.929	3.581	4.642
138	30.478	3.581	4.642	28.027	3.580	4.642
139	25.576	3.580	4.642			
140	45.130	4.841	6.146	42.917	4.840	6.146
141	40.703	4.840	6.146	38.489	4.839	6.146
142	36.276	4.839	6.146	34.063	4.838	6.146
143	31.849	4.837	6.146	29.635	4.837	6.146
144	27.422	4.836	6.145			
145	45.077	6.100	7.650	43.101	6.099	7.650
146	41.125	6.098	7.650	39.149	6.097	7.650
147	37.173	6.096	7.650	35.196	6.095	7.650
148	33.220	6.094	7.650	31.244	6.093	7.649
149	29.268	6.092	7.649			
150	45.025	7.358	9.155	43.286	7.357	9.155
151	41.547	7.355	9.154	39.808	7.354	9.154
152	38.069	7.353	9.154	36.330	7.352	9.154
153	34.591	7.350	9.153	32.853	7.349	9.153
154	31.114	7.348	9.153			
155	44.972	8.616	10.659	43.470	8.615	10.659
156	41.969	8.613	10.659	40.467	8.612	10.658
157	38.966	8.610	10.658	37.464	8.608	10.658
158	35.963	8.607	10.658	34.461	8.605	10.657
159	32.959	8.603	10.657			
160	44.919	9.875	12.163	43.655	9.873	12.163
161	42.390	9.871	12.163	41.126	9.869	12.162
162	39.862	9.867	12.162	38.598	9.865	12.162
163	37.334	9.863	12.161	36.069	9.861	12.161
164	34.805	9.859	12.161			
165	44.866	11.133	13.668	43.839	11.131	13.667
166	42.812	11.129	13.667	41.785	11.127	13.667
167	40.759	11.124	13.666	39.732	11.122	13.666
168	38.705	11.120	13.665	37.678	11.117	13.665
169	36.651	11.115	13.665			
170	44.813	12.392	15.172	44.024	12.389	15.172
171	43.234	12.387	15.171	42.445	12.384	15.171
172	41.655	12.382	15.170	40.866	12.379	15.170
173	40.076	12.376	15.169	39.287	12.374	15.169
174	38.497	12.371	15.168			
175	POINTS NETWORK = ZCAN2					
176	1.0					
177	2.0					
178	9.0	9.0				
179	45.236	-3.138	2.324	42.548	-3.138	2.324
180	39.859	-3.138	2.324	37.171	-3.138	2.324
181	34.483	-3.138	2.324	31.795	-3.138	2.324
182	29.107	-3.138	2.324	26.418	-3.138	2.324
183	23.730	-3.138	2.324			
184	45.183	-4.642	3.583	42.732	-4.642	3.582
185	40.281	-4.642	3.582	37.830	-4.642	3.582
186	35.380	-4.642	3.581	32.929	-4.642	3.581
187	30.478	-4.642	3.581	28.027	-4.642	3.580

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188	25.576	-4.642	3.580	42.917	-6.146	4.840
189	45.130	-6.146	4.841	38.489	-6.146	4.839
190	40.703	-6.146	4.840	34.063	-6.146	4.838
191	36.276	-6.146	4.839	29.635	-6.146	4.837
192	31.849	-6.146	4.837	43.101	-7.650	6.099
193	27.422	-6.145	4.836	39.149	-7.650	6.097
194	45.077	-7.650	6.100	35.196	-7.650	6.095
195	41.125	-7.650	6.098	31.244	-7.649	6.093
196	37.173	-7.650	6.096	43.286	-9.155	7.357
197	33.220	-7.650	6.094	39.808	-9.154	7.354
198	29.268	-7.649	6.092	36.330	-9.154	7.352
199	45.025	-9.155	7.358	32.853	-9.153	7.349
200	41.547	-9.154	7.355	43.470	-10.659	8.615
201	38.069	-9.154	7.353	40.467	-10.658	8.612
202	34.591	-9.153	7.350	37.464	-10.658	8.608
203	31.114	-9.153	7.348	34.461	-10.657	8.605
204	44.972	-10.659	8.616	43.655	-12.163	9.873
205	41.969	-10.659	8.613	41.126	-12.162	9.869
206	38.966	-10.658	8.610	39.732	-12.162	9.865
207	35.963	-10.658	8.607	36.069	-12.161	9.861
208	32.959	-10.657	8.603	43.839	-13.667	11.131
209	44.919	-12.163	9.875	41.785	-13.667	11.127
210	42.390	-12.163	9.871	39.732	-13.666	11.122
211	39.862	-12.162	9.867	37.678	-13.665	11.117
212	37.334	-12.161	9.863	44.024	-15.172	12.389
213	34.805	-12.161	9.859	42.445	-15.171	12.384
214	44.866	-13.668	11.133	40.866	-15.170	12.379
215	42.812	-13.667	11.129	39.287	-15.169	12.374
216	40.759	-13.666	11.124			
217	38.705	-13.665	11.120			
218	36.651	-13.665	11.115			
219	44.813	-15.172	12.392			
220	43.234	-15.171	12.387			
221	41.655	-15.170	12.382			
222	40.076	-15.169	12.376			
223	38.497	-15.168	12.371			
224	224 SPONITS NETWORK = ZNOSE					
225	1.0					
226	1.0					
227	4.0	13.0	3.999	2.498	0.000	3.564
228	8.499	0.000	1.853	0.000	0.000	0.000
229	0.482	0.000	3.465	0.000	0.000	0.000
230	8.499	1.995	1.605	0.000	0.000	0.000
231	0.482	0.924	2.007	2.498	3.086	1.788
232	8.499	3.463	0.930	0.000	0.000	0.000
233	0.482	1.604	0.000	2.498	3.565	0.000
234	8.499	3.999	0.000	0.000	0.000	0.000
235	0.482	1.853	0.000	2.498	3.086	-1.789
236	8.499	3.463	-2.007	0.000	0.000	0.000
237	0.482	1.604	-0.930	0.000	0.000	0.000
238	8.499	2.007	-3.463	2.498	1.789	-3.087
239	0.482	0.930	-1.604	0.000	0.000	0.000
240	8.499	0.000	-4.000	2.498	0.000	-3.565
241	0.482	0.000	-1.853	0.000	0.000	0.000
242	8.499	-2.007	-3.463	2.498	-1.788	-3.086
243	0.482	-0.930	-1.604	0.000	0.000	0.000
244	8.499	-3.463	-2.007	2.498	-3.086	-1.789

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245	0.482	-1.604	-0.930	0.000	0.000	0.000
246	8.499	-3.999	0.000	2.498	-3.565	0.000
247	0.482	-1.853	0.000	0.000	0.000	0.000
248	8.499	-3.463	2.007	2.498	-3.086	1.788
249	0.482	-1.604	0.930	0.000	0.000	0.000
250	8.499	-1.995	3.464	2.498	-1.778	3.088
251	0.482	-0.924	1.605	0.000	0.000	0.000
252	8.499	0.000	3.999	2.498	0.000	3.565
253	0.482	0.000	1.853	0.000	0.000	0.000
254	\$POINTS NETWORK = ZNOSFT					
255	1.0					
256	1.0					
257	13.0	2.0	3.999	8.499	1.995	3.465
258	8.499	0.000	2.007	8.499	3.999	0.000
259	8.499	3.463	-2.007	8.499	-2.007	-3.463
260	8.499	0.000	-4.000	8.499	-2.007	-3.463
261	8.499	-3.463	2.007	8.499	-3.999	0.000
262	8.499	-3.463	-2.007	8.499	-1.995	3.464
263	8.499	0.000	3.999	21.730	1.995	3.465
264	21.730	0.000	2.007	21.730	3.999	0.000
265	21.730	3.463	-2.007	21.730	-2.007	-3.463
266	21.730	0.000	-4.000	21.730	-3.999	0.000
267	21.730	-3.463	2.007	21.730	-1.995	3.465
268	21.730	0.000	3.999	21.730	0.000	0.000
269	21.730	-3.463	-2.007	21.730	-3.999	0.000
270	21.730	0.000	2.007	21.730	-1.995	3.465
271	21.730	0.000	3.999	21.730	0.000	0.000
272	\$POINTS NETWORK = ZCANFWDI					
273	1.0					
274	1.0					
275	3.0	13.0	2.324	22.730	-3.300	2.165
276	23.730	-3.138	2.007	22.730	-1.995	3.465
277	21.730	-1.995	3.465	22.730	0.000	4.000
278	23.730	0.000	3.999	22.730	2.159	3.301
279	21.730	1.995	3.465	22.730	3.463	2.007
280	23.730	0.000	2.007	22.730	4.000	0.000
281	21.730	3.463	0.000	22.730	3.301	-2.166
282	23.730	-3.138	-2.007	22.730	-3.464	-2.007
283	21.730	-1.995	-3.463	22.730	0.000	-4.000
284	23.730	0.000	-4.000	22.730	-2.165	-3.301
285	21.730	-3.138	-3.463	22.730	-3.463	-2.007
286	23.730	-2.007	-2.324	22.730	-4.000	0.000
287	21.730	2.007	2.324	22.730	-3.463	-2.007
288	23.730	0.000	3.999	22.730	-4.000	0.000
289	21.730	3.463	-2.007	22.730	-3.463	-2.007
290	23.730	-3.138	-3.463	22.730	-4.000	0.000
291	21.730	-1.995	-3.463	22.730	-3.300	2.165
292	23.730	0.000	-4.000	22.730	0.000	0.000
293	21.730	-3.138	-3.463	22.730	-2.165	-3.301
294	23.730	-2.007	-2.324	22.730	-3.463	-2.007
295	21.730	2.007	2.324	22.730	-4.000	0.000
296	23.730	0.000	3.999	22.730	-3.463	-2.007
297	21.730	3.463	-2.007	22.730	-4.000	0.000
298	23.730	-3.138	-3.463	22.730	-3.300	2.165
299	21.730	-1.995	-3.463	22.730	0.000	0.000
300	23.730	0.000	-4.000	22.730	-2.165	-3.301
301	21.730	-3.463	2.007	22.730	0.000	0.000

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302 SPOINTS NETWORK = BODCAN1									
303 1.									
304 1.	0.	0.							
305 4.	2.								
306	23.730	2.324	3.138		23.730		0.000	4.000	
307	23.730	-1.995	3.465		23.730		-3.138	2.324	
308	45.236	2.324	3.138		45.236		0.000	4.000	
309	45.236	-1.995	3.465		45.236		-3.138	2.324	
310 SPOINTS NETWORK = BODCAN2									
311 1.									
312 1.	0.	0.							
313 4.	2.								
314	23.730	-3.138	2.324		23.730		-4.000	0.000	
315	23.730	-3.463	-2.007		23.730		-2.324	-3.138	
316	45.236	-3.138	2.324		45.236		-4.000	0.000	
317	45.236	-3.463	-2.007		45.236		-2.324	-3.138	
318 SPOINTS NETWORK = BODCAN3									
319 1.									
320 1.	0.	0.							
321 4.	2.								
322	23.730	-2.324	-3.138		23.730		0.000	-4.000	
323	23.730	2.007	-3.464		23.730		3.138	-2.324	
324	45.236	-2.324	-3.138		45.236		0.000	-4.000	
325	45.236	2.007	-3.464		45.236		3.138	-2.324	
326 SPOINTS NETWORK = BODCAN4									
327 1.									
328 1.	0.	0.							
329 4.	2.								
330	23.730	3.138	-2.324		23.730		4.000	0.000	
331	23.730	3.463	2.007		23.730		2.324	3.138	
332	45.236	3.138	-2.324		45.236		4.000	0.000	
333	45.236	3.463	2.007		45.236		2.324	3.138	
334 SPOINTS NETWORK = ZCANAF1									
335 1.0									
336 1.0	0.	0.							
337	3.0	13.0							
338	47.236	-3.463	2.007		46.236		-3.300	2.165	
339	45.236	-3.138	2.324				-4.000	0.000	
340	47.236	-4.000	0.000		45.236				
341	45.236	-4.000	0.000						
342	47.236	-3.463	-2.007		46.236		-3.463	-2.007	
343	45.236	-3.463	-2.007						
344	47.236	-2.007	-3.464		46.236		-2.166	-3.301	
345	45.236	-2.324	-3.138						
346	47.236	0.000	-4.000		46.236		0.000	-4.000	
347	45.236	0.000	-4.000						
348	47.236	2.007	-3.464		46.236		2.007	-3.464	
349	45.236	2.007	-3.464						
350	47.236	3.464	-2.007		46.236		3.301	-2.166	
351	45.236	3.138	-2.324						
352	47.236	4.000	0.000		46.236		4.000	0.000	
353	45.236	4.000	0.000						
354	47.236	3.463	2.007		46.236		3.463	2.007	
355	45.236	3.463	2.007						
356	47.236	1.995	-3.465		46.236		2.159	3.301	
357	45.236	2.324	3.138						
358	47.236	0.000	4.000		46.236		0.000	4.000	

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416	132.459	-6.278	-3.639	132.459	-7.250	-0.000
417	132.459	-6.278	3.638	132.459	-3.616	6.281
418	134.175	-6.549	-3.796	134.175	-7.564	-0.000
419	134.175	-6.549	3.795	134.175	-3.773	6.552
420	135.865	-6.816	-3.951	135.865	-7.872	0.000
421	135.865	-6.817	3.950	135.865	-3.927	6.820
422	137.500	-7.075	-4.100	137.500	-8.171	0.000
423	137.500	-7.075	4.100	137.500	-4.076	7.078
424	138.947	-7.239	-4.196	138.947	-8.361	0.000
425	138.947	-7.240	4.195	138.947	-4.170	7.243
426	140.100	-7.341	-4.254	140.100	-8.479	0.000
427	140.100	-7.341	4.254	140.100	-4.229	7.344
428	141.551	-7.469	-4.328	141.551	-8.626	0.000
429	141.551	-7.469	4.328	141.551	-4.302	7.472
430	143.975	-7.420	-4.300	143.975	-8.569	0.000
431	143.975	-7.420	4.299	143.975	-4.274	7.423
432	148.235	-6.650	-3.854	148.235	-7.680	0.000
433	148.235	-6.649	3.853	148.235	-3.830	6.652
434	153.934	-5.619	-3.257	153.934	-6.489	0.000
435	153.934	-5.619	3.256	153.934	-3.237	5.621
436	160.353	-4.457	-2.584	160.353	-5.148	-0.000
437	160.353	-4.457	2.583	160.353	-2.568	4.459
438 \$POINTS NETWORK = ZBOD43						
439	1.0					
440	1.0					
441	4.0	11.0				
442	132.459	3.639	-6.278	132.459	0.000	-7.251
443	132.459	-3.638	-6.279	132.459	-6.278	-3.639
444	134.175	3.796	-6.550	134.175	0.000	-7.564
445	134.175	-3.795	-6.550	134.175	-6.549	-3.796
446	135.865	3.951	-6.817	135.865	0.000	-7.873
447	135.865	-3.950	-6.817	135.865	-6.816	-3.951
448	137.500	4.100	-7.076	137.500	0.000	-8.172
449	137.500	-4.100	-7.076	137.500	-7.075	-4.100
450	138.947	4.195	-7.240	138.947	0.000	-8.361
451	138.947	-4.195	-7.240	138.947	-7.239	-4.196
452	140.100	4.254	-7.341	140.100	0.000	-8.479
453	140.100	-4.254	-7.341	140.100	-7.341	-4.254
454	141.551	4.328	-7.469	141.551	0.000	-8.626
455	141.551	-4.328	-7.469	141.551	-7.469	-4.328
456	143.975	4.300	-7.420	143.975	0.000	-8.569
457	143.975	-4.300	-7.420	143.975	-7.420	-4.300
458	148.235	3.853	-6.650	148.235	0.000	-7.680
459	148.235	-3.853	-6.650	148.235	-6.650	-3.854
460	153.934	3.256	-5.619	153.934	0.000	-6.489
461	153.934	-3.256	-5.619	153.934	-5.619	-3.257
462	160.353	2.584	-4.458	160.353	0.000	-5.148
463	160.353	-2.583	-4.458	160.353	-4.457	-2.584
464 \$POINTS NETWORK = ZBOD42						
465	1.0					
466	1.0					
467	4.0	11.0				
468	132.459	6.278	3.638	132.459	7.251	0.000
469	132.459	-6.279	-3.638	132.459	-6.278	-3.639
470	134.175	6.550	3.795	134.175	7.564	0.000
471	134.175	-6.550	-3.796	134.175	-6.550	-3.796
472	135.865	6.817	3.950	135.865	7.873	0.000

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473	135.865	6.817	-3.950	135.865	3.951	-6.817
474	137.500	7.075	4.100	137.500	8.172	0.000
475	137.500	7.075	-4.100	137.500	4.100	-7.076
476	138.947	7.240	4.195	138.947	8.361	0.000
477	138.947	7.239	-4.196	138.947	4.195	-7.240
478	140.100	7.341	4.254	140.100	8.479	0.000
479	140.100	7.341	-4.254	140.100	4.254	-7.341
480	141.551	7.469	4.328	141.551	8.526	0.000
481	141.551	7.469	-4.328	141.551	4.328	-7.469
482	143.975	7.420	4.300	143.975	8.569	0.000
483	143.975	7.420	-4.300	143.975	4.300	-7.420
484	148.235	6.649	3.853	148.235	7.680	0.000
485	148.235	6.649	-3.853	148.235	3.853	-6.650
486	153.934	5.618	3.256	153.934	6.489	0.000
487	153.934	5.619	-3.256	153.934	3.256	-5.619
488	160.353	4.457	2.583	160.353	5.148	0.000
489	160.353	4.457	-2.583	160.353	2.584	-4.458
490	SPOINTS NETWORK = ZFIN2					
491	1.0					
492	2.0					
493	11.0	7.0				
494	132.459	6.278	3.638	134.176	6.550	3.795
495	135.865	6.817	3.950	137.500	7.075	4.100
496	138.948	7.240	4.195	140.101	7.341	4.254
497	141.551	7.469	4.328	143.975	7.420	4.300
498	148.235	6.649	3.853	153.934	5.618	3.256
499	160.353	4.457	2.583			
500	132.480	7.119	4.856	133.996	7.408	5.052
501	135.495	7.695	5.246	136.960	7.975	5.436
502	138.272	8.147	5.552	139.314	8.249	5.619
503	140.676	8.382	5.708	143.055	8.379	5.718
504	147.477	7.746	5.351	153.507	6.882	4.850
505	160.341	5.903	4.283			
506	132.502	7.960	6.074	133.818	8.267	6.307
507	135.128	8.572	6.540	136.422	8.874	6.770
508	137.598	9.055	6.907	138.530	9.156	6.983
509	139.801	9.294	7.086	142.132	9.335	7.134
510	146.713	8.835	6.844	153.075	8.140	6.441
511	160.328	7.348	5.983			
512	132.523	8.801	7.291	133.642	9.125	7.562
513	134.763	9.448	7.833	135.885	9.773	8.104
514	136.926	9.962	8.261	137.749	10.062	8.344
515	138.929	10.205	8.462	141.207	10.288	8.548
516	145.945	9.917	8.333	152.641	9.394	8.030
517	160.316	8.794	7.682			
518	132.544	9.642	8.508	133.469	9.982	8.815
519	134.402	10.324	9.123	135.350	10.671	9.437
520	136.255	10.869	9.615	136.970	10.966	9.702
521	138.059	11.115	9.835	140.281	11.238	9.960
522	145.175	10.994	9.819	152.205	10.643	9.616
523	160.303	10.239	9.382			
524	132.566	10.484	9.725	133.301	10.838	10.066
525	134.047	11.198	10.413	134.817	11.569	10.770
526	135.587	11.775	10.968	136.195	11.869	11.058
527	137.190	12.023	11.206	139.354	12.185	11.371
528	144.403	12.065	11.301	151.768	11.888	11.199
529	160.291	11.685	11.081			

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530	132.587	11.325	10.943	133.137	11.318
531	133.701	12.073	11.702	134.288	12.467
532	134.924	12.681	12.320	135.424	12.102
533	136.323	12.929	12.574	138.428	12.769
534	143.632	13.131	12.781	151.331	13.131
535	160.278	13.130	12.781	151.331	12.781
536 SPOINIS NETWORK = ZFIN4					
537	1.0				
538	2.0				
539	11.0	7.0			
540	132.459	-6.278	-3.639	134.175	-3.796
541	135.865	-6.816	-3.951	137.500	-4.100
542	138.947	-7.239	-4.196	140.100	-4.254
543	141.551	-7.469	-4.328	143.975	-4.420
544	148.235	-6.650	-3.854	153.934	-3.257
545	160.353	-4.457	-2.584		
546	132.480	-7.119	-4.856	133.996	-7.408
547	135.495	-7.695	-5.246	136.960	-5.052
548	138.272	-8.147	-5.552	139.314	-5.436
549	140.676	-8.382	-5.708	143.055	-5.619
550	147.477	-7.746	-5.351	153.507	-5.718
551	160.341	-5.903	-4.283		-4.850
552	132.502	-7.960	-6.074	133.818	-8.267
553	135.128	-8.572	-6.540	136.422	-6.307
554	137.598	-9.055	-6.907	138.530	-6.770
555	139.801	-9.294	-7.086	142.132	-6.983
556	146.713	-8.835	-6.844	153.075	-7.134
557	160.328	-7.348	-5.983		-6.441
558	132.523	-8.801	-7.291	133.642	-9.125
559	134.763	-9.448	-7.833	135.885	-8.773
560	136.926	-9.862	-8.261	137.749	-8.104
561	138.929	-10.205	-8.462	141.207	-8.344
562	145.945	-9.917	-8.333	152.641	-8.548
563	160.316	-8.794	-7.682		-8.030
564	132.544	-9.642	-8.508	133.469	-9.982
565	134.402	-10.324	-9.123	135.350	-8.815
566	136.255	-10.869	-9.615	136.970	-10.671
567	138.059	-11.115	-9.835	140.281	-9.437
568	145.175	-10.994	-9.819	152.205	-9.702
569	160.303	-10.239	-9.382		-9.960
570	132.566	-10.484	-9.726	133.301	-10.643
571	134.047	-11.198	-10.413	134.817	-9.616
572	135.587	-11.775	-10.968	136.195	-10.838
573	137.190	-12.023	-11.206	139.354	-10.770
574	144.403	-12.065	-11.301	151.768	-11.058
575	160.291	-11.685	-11.081		-11.371
576	132.587	-11.325	-10.943	133.137	-11.888
577	133.701	-12.073	-11.702	134.288	-11.199
578	134.924	-12.681	-12.320	135.424	-11.695
579	136.323	-12.929	-12.574	138.428	-11.318
580	143.632	-13.131	-12.781	151.331	-12.102
581	160.278	-13.130	-12.781		-12.410
582 SPOINIS NETWORK = ZFIN3					
583	1.0				-13.131
584	2.0				-12.781
585	11.0	7.0			
586	132.459	3.639	-6.278	134.175	3.796
					-6.550

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587	135.865	3.951	-6.817	137.500	4.100	-7.076
588	138.947	4.195	-7.240	140.100	4.254	-7.341
589	141.551	4.328	-7.469	143.975	4.300	-7.420
590	148.235	3.853	-6.650	153.934	3.256	-5.619
591	160.353	2.584	-4.458			
592	132.480	4.856	-7.119	133.996	5.052	-7.408
593	135.495	5.246	-7.695	136.960	5.436	-7.975
594	138.272	5.552	-8.147	139.314	5.619	-8.249
595	140.676	5.708	-8.382	143.055	5.718	-8.379
596	147.477	5.351	-7.746	153.507	4.850	-6.882
597	160.341	4.283	-5.903			
598	132.502	6.074	-7.960	133.818	6.307	-8.267
599	135.128	6.540	-8.572	136.422	6.770	-8.874
600	137.598	6.907	-9.055	138.530	6.983	-9.156
601	139.801	7.086	-9.294	142.132	7.134	-9.335
602	146.713	6.844	-8.835	153.075	6.441	-8.140
603	160.328	5.983	-7.348			
604	132.523	7.291	-8.801	133.642	7.562	-9.125
605	134.763	7.833	-9.448	135.885	8.104	-9.773
606	136.926	8.261	-9.962	137.749	8.344	-10.062
607	138.929	8.462	-10.205	141.207	8.548	-10.288
608	145.945	8.333	-9.917	152.641	8.030	-9.394
609	160.316	7.682	-8.794			
610	132.544	8.508	-9.642	133.469	8.815	-9.982
611	134.402	9.123	-10.324	135.350	9.437	-10.671
612	136.255	9.615	-10.869	136.970	9.702	-10.966
613	138.059	9.835	-11.115	140.281	9.960	-11.238
614	145.175	9.819	-10.994	152.205	9.616	-10.643
615	160.303	9.382	-10.239			
616	132.566	9.726	-10.484	133.301	10.066	-10.838
617	134.047	10.413	-11.198	134.817	10.770	-11.569
618	135.587	10.968	-11.775	136.195	11.058	-11.869
619	137.190	11.206	-12.023	139.354	11.371	-12.185
620	144.403	11.301	-12.065	151.768	11.199	-11.888
621	160.291	11.081	-11.685			
622	132.587	10.943	-11.325	133.137	11.318	-11.695
623	133.701	11.702	-12.073	134.288	12.102	-12.467
624	134.924	12.320	-12.681	135.424	12.410	-12.769
625	136.323	12.574	-12.929	138.428	12.781	-13.131
626	143.632	12.781	-13.131	151.331	12.781	-13.130
627	160.278	12.781	-13.130			
628 \$POINTS NETWORK = ZBODAI						
629	1.0					
630	1.0					
631	4.0	11.0	6.281	132.459	0.000	7.250
632	132.459	-3.616	6.281	132.459	6.278	3.638
633	132.459	3.616	6.281	132.459	0.000	7.563
634	134.175	-3.773	6.552	134.175	6.550	3.795
635	134.175	3.773	6.552	134.175	0.000	7.872
636	135.865	-3.927	6.820	135.865	6.817	3.950
637	135.865	3.927	6.820	135.865	0.000	8.170
638	137.500	-4.076	7.078	137.500	7.075	4.100
639	137.500	4.076	7.078	137.500	0.000	8.360
640	138.947	-4.170	7.243	138.947	7.240	4.195
641	138.947	4.170	7.243	138.947	0.000	8.477
642	140.100	-4.229	7.344	140.100	7.344	4.254
643	140.100	4.229	7.344	140.100	0.000	8.477

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758	160.353	2.584	-4.458	160.341	4.283	-5.903
759	160.328	5.983	-7.348	160.316	7.682	-8.794
760	160.303	9.382	-10.239	160.291	11.081	-11.685
761	160.278	12.781	-13.130			
762	1160.353	2.584	-4.458	1160.341	4.283	-5.903
763	1160.328	5.983	-7.348	1160.316	7.682	-8.794
764	1160.303	9.382	-10.239	1160.291	11.081	-11.685
765	1160.278	12.781	-13.130			
766	SPOINTS NETWORK = ZCNBDWK1					
767	1.0					
768	18.0	1.0	0.0	1.0		
769		16.0				
770	45.236	-3.138	2.324	45.183	-4.642	3.583
771	45.130	-6.146	4.841	45.077	-7.650	6.100
772	45.025	-9.155	7.358	44.972	-10.659	8.616
773	44.919	-12.163	9.875	44.866	-13.668	11.133
774	44.813	-15.172	12.392			
775	53.318	-3.463	2.007	53.265	-4.967	3.265
776	53.212	-6.471	4.523	53.160	-7.976	5.782
777	53.107	-9.480	7.040	53.054	-10.984	8.299
778	53.001	-12.489	9.557	52.948	-13.993	10.816
779	52.896	-15.497	12.074			
780	61.785	-5.497	3.185	61.732	-7.001	4.444
781	61.679	-8.505	5.702	61.627	-10.010	6.960
782	61.574	-11.514	8.219	61.521	-13.018	9.477
783	61.468	-14.523	10.736	61.415	-16.027	11.994
784	61.362	-17.531	13.253			
785	71.254	-6.278	3.638	71.201	-7.782	4.896
786	71.148	-9.286	6.155	71.096	-10.790	7.413
787	71.043	-12.295	8.672	70.990	-13.799	9.930
788	70.937	-15.303	11.189	70.884	-16.808	12.447
789	70.831	-18.312	13.705			
790	132.459	-6.278	3.638	132.406	-7.782	4.896
791	132.353	-9.286	6.155	132.301	-10.791	7.413
792	132.248	-12.295	8.672	132.195	-13.799	9.930
793	132.142	-15.304	11.189	132.089	-16.808	12.447
794	132.036	-18.312	13.705			
795	134.175	-6.549	3.795	134.122	-8.054	5.054
796	134.070	-9.558	6.312	134.017	-11.062	7.570
797	133.964	-12.566	8.829	133.911	-14.071	10.087
798	133.858	-15.575	11.346	133.806	-17.079	12.604
799	133.753	-18.583	13.863			
800	135.865	-6.817	3.950	135.812	-8.321	5.208
801	135.759	-9.825	6.467	135.706	-11.329	7.725
802	135.653	-12.834	8.984	135.600	-14.338	10.242
803	135.548	-15.842	11.501	135.495	-17.347	12.759
804	135.442	-18.851	14.018			
805	137.500	-7.075	4.100	137.447	-8.580	5.358
806	137.394	-10.084	6.617	137.341	-11.588	7.875
807	137.288	-13.092	9.134	137.236	-14.597	10.392
808	137.183	-16.101	11.651	137.130	-17.605	12.909
809	137.077	-19.109	14.168			
810	138.947	-7.240	4.195	138.895	-8.744	5.454
811	138.842	-10.248	6.712	138.789	-11.752	7.971
812	138.736	-13.257	9.229	138.683	-14.761	10.488
813	138.631	-16.265	11.746	138.578	-17.770	13.004
814	138.525	-19.274	14.263			

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815	140.100	-7.341	4.254	140.048	-8.845	5.512
816	139.995	-10.350	6.771	139.942	-11.854	8.029
817	139.889	-13.358	9.288	139.836	-14.863	10.546
818	139.784	-16.367	11.805	139.731	-17.871	13.063
819	139.678	-19.375	14.322			
820	141.551	-7.469	4.328	141.498	-8.973	5.586
821	141.445	-10.477	6.845	141.393	-11.981	8.103
822	141.340	-13.486	9.362	141.287	-14.990	10.620
823	141.234	-16.494	11.879	141.181	-17.999	13.137
824	141.129	-19.503	14.396			
825	143.975	-7.420	4.299	143.923	-8.924	5.558
826	143.870	-10.428	6.816	143.817	-11.933	8.075
827	143.764	-13.437	9.333	143.711	-14.941	10.592
828	143.658	-16.445	11.850	143.606	-17.950	13.109
829	143.553	-19.454	14.367			
830	148.235	-6.649	3.853	148.182	-8.154	5.111
831	148.129	-9.658	6.370	148.076	-11.162	7.628
832	148.023	-12.667	8.887	147.971	-14.171	10.145
833	147.918	-15.675	11.404	147.865	-17.179	12.662
834	147.812	-18.684	13.921			
835	153.934	-5.619	3.256	153.881	-7.123	4.514
836	153.828	-8.627	5.773	153.776	-10.131	7.031
837	153.723	-11.636	8.290	153.670	-13.140	9.548
838	153.617	-14.644	10.806	153.564	-16.149	12.065
839	153.512	-17.653	13.323			
840	160.353	-4.457	2.583	160.301	-5.962	3.841
841	160.248	-7.466	5.100	160.195	-8.970	6.358
842	160.142	-10.475	7.617	160.089	-11.979	8.875
843	160.036	-13.483	10.134	159.984	-14.987	11.392
844	159.931	-16.492	12.651			
845	1160.353	-4.457	2.583	1160.301	-5.962	3.841
846	1160.248	-7.466	5.100	1160.195	-8.970	6.358
847	1160.142	-10.475	7.617	1160.089	-11.979	8.875
848	1160.036	-13.483	10.134	1159.984	-14.987	11.392
849	1159.931	-16.492	12.651			
850	POINTS NETWORK = ZCNEDWK2					
851	1.0					
852	18.0	1.0	0.0	1.0		
853		16.0				
854	45.236	-2.324	-3.138	45.183	-3.583	-4.642
855	45.130	-4.841	-6.146	45.077	-6.100	-7.650
856	45.025	-7.358	-9.155	44.972	-8.616	-10.659
857	44.919	-9.875	-12.163	44.866	-11.133	-13.668
858	44.813	-12.392	-15.172			
859	53.318	-2.007	-3.463	53.265	-3.265	-4.967
860	53.212	-4.523	-6.471	53.160	-5.782	-7.976
861	53.107	-7.040	-9.480	53.054	-8.299	-10.984
862	53.001	-9.557	-12.489	52.948	-10.816	-13.993
863	52.896	-12.074	-15.497			
864	61.785	-3.185	-5.497	61.732	-4.444	-7.001
865	61.679	-5.702	-8.505	61.627	-6.960	-10.010
866	61.574	-8.219	-11.514	61.521	-9.477	-13.018
867	61.468	-10.736	-14.523	61.415	-11.994	-16.027
868	61.362	-13.253	-17.531			
869	71.254	-3.638	-6.278	71.201	-4.896	-7.782
870	71.148	-6.155	-9.286	71.096	-7.413	-10.790
871	71.043	-8.672	-12.295	70.990	-9.930	-13.799

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872	70.937	-11.189	-15.303	70.884	-12.447	-16.808
873	70.831	-13.705	-18.312			
874	132.459	-3.638	-6.278	132.406	-4.896	-7.782
875	132.353	-6.155	-9.286	132.301	-7.413	-10.791
876	132.248	-8.672	-12.295	132.195	-9.930	-13.799
877	132.142	-11.189	-15.304	132.089	-12.447	-16.808
878	132.036	-13.705	-18.312			
879	134.175	-3.795	-6.549	134.122	-5.054	-8.054
880	134.070	-6.312	-9.558	134.017	-7.570	-11.062
881	133.964	-8.829	-12.566	133.911	-10.087	-14.071
882	133.858	-11.346	-15.575	133.806	-12.604	-17.079
883	133.753	-13.863	-18.583			
884	135.865	-3.950	-6.817	135.812	-5.208	-8.321
885	135.759	-6.467	-9.825	135.706	-7.725	-11.329
886	135.653	-8.984	-12.834	135.600	-10.242	-14.338
887	135.548	-11.501	-15.842	135.495	-12.759	-17.347
888	135.442	-14.018	-18.851			
889	137.500	-4.100	-7.075	137.447	-5.358	-8.580
890	137.394	-6.617	-10.084	137.341	-7.875	-11.588
891	137.288	-9.134	-13.092	137.236	-10.392	-14.597
892	137.183	-11.651	-16.101	137.130	-12.909	-17.605
893	137.077	-14.168	-19.109			
894	138.947	-4.195	-7.240	138.895	-5.454	-8.744
895	138.842	-6.712	-10.248	138.789	-7.971	-11.752
896	138.736	-9.229	-13.257	138.683	-10.488	-14.761
897	138.631	-11.746	-16.265	138.578	-13.004	-17.770
898	138.525	-14.263	-19.274			
899	140.100	-4.254	-7.341	140.048	-5.512	-8.845
900	139.995	-6.771	-10.350	139.942	-8.029	-11.854
901	139.889	-9.288	-13.358	139.836	-10.546	-14.863
902	139.784	-11.805	-16.367	139.731	-13.063	-17.871
903	139.678	-14.322	-19.375			
904	141.551	-4.328	-7.469	141.498	-5.586	-8.973
905	141.445	-6.845	-10.477	141.393	-8.103	-11.981
906	141.340	-9.362	-13.486	141.287	-10.620	-14.990
907	141.234	-11.879	-16.494	141.181	-13.137	-17.999
908	141.129	-14.396	-19.503			
909	143.975	-4.239	-7.420	143.923	-5.558	-8.924
910	143.870	-6.816	-10.428	143.817	-8.075	-11.933
911	143.764	-9.333	-13.437	143.711	-10.592	-14.941
912	143.658	-11.850	-16.445	143.606	-13.109	-17.950
913	143.553	-14.367	-19.454			
914	148.235	-3.853	-6.849	148.182	-5.111	-8.154
915	148.129	-6.370	-9.658	148.076	-7.628	-11.162
916	148.023	-8.887	-12.667	147.971	-10.145	-14.171
917	147.918	-11.404	-15.675	147.865	-12.662	-17.179
918	147.812	-13.921	-18.684			
919	153.934	-3.256	-5.619	153.881	-4.514	-7.123
920	153.828	-5.773	-8.627	153.776	-7.031	-10.131
921	153.723	-8.290	-11.636	153.670	-9.548	-13.140
922	153.617	-10.806	-14.644	153.564	-12.065	-16.149
923	153.512	-13.323	-17.653			
924	160.353	-2.583	-4.457	160.301	-3.841	-5.962
925	160.248	-5.100	-7.466	160.195	-6.358	-8.970
926	160.142	-7.617	-10.475	160.089	-8.875	-11.979
927	160.036	-10.134	-13.483	159.984	-11.392	-14.987
928	159.931	-12.651	-16.492			

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929	1160.353	-2.583	-4.457	1160.301	-3.841	-5.962
930	1160.248	-5.100	-7.466	1160.195	-6.358	-8.970
931	1160.142	-7.617	-10.475	1160.089	-8.875	-11.979
932	1160.036	-10.134	-13.483	1159.984	-11.392	-14.987
933	1159.931	-12.651	-16.492			
934	POINTS NETWORK = ZCNBDWK3					
935	1.0	0.	0.	1.		
936	18.0	1.	0.	0.		
937		9.0	16.0			
938	45.236	3.138	-2.324	45.183	4.642	-3.583
939	45.130	6.146	-4.841	45.077	7.650	-6.100
940	45.025	9.155	-7.358	44.972	10.659	-8.616
941	44.919	12.163	-9.875	44.866	13.668	-11.133
942	44.813	15.172	-12.392			
943	53.318	3.463	-2.007	53.265	4.967	-3.265
944	53.212	6.471	-4.523	53.160	7.976	-5.782
945	53.107	9.480	-7.040	53.054	10.984	-8.299
946	53.001	12.489	-9.557	52.948	13.993	-10.816
947	52.896	15.497	-12.074			
948	61.785	5.497	-3.185	61.732	7.001	-4.444
949	61.679	8.505	-5.702	61.627	10.010	-6.960
950	61.574	11.514	-8.219	61.521	13.018	-9.477
951	61.468	14.523	-10.736	61.415	16.027	-11.994
952	61.362	17.531	-13.253			
953	71.254	6.278	-3.638	71.201	7.782	-4.896
954	71.148	9.286	-6.155	71.096	10.790	-7.413
955	71.043	12.295	-8.672	70.990	13.799	-9.930
956	70.937	15.303	-11.189	70.884	16.808	-12.447
957	70.831	18.312	-13.705			
958	132.459	6.278	-3.638	132.406	7.782	-4.896
959	132.353	9.286	-6.155	132.301	10.791	-7.413
960	132.248	12.295	-8.672	132.195	13.799	-9.930
961	132.142	15.304	-11.189	132.089	16.808	-12.447
962	132.036	18.312	-13.705			
963	134.175	6.549	-3.795	134.122	8.054	-5.054
964	134.070	9.558	-6.312	134.017	11.062	-7.570
965	133.964	12.566	-8.829	133.911	14.071	-10.087
966	133.858	15.575	-11.346	133.806	17.079	-12.604
967	133.753	18.583	-13.863			
968	135.865	6.817	-3.950	135.812	8.321	-5.208
969	135.759	9.825	-6.467	135.706	11.329	-7.725
970	135.653	12.834	-8.984	135.600	14.338	-10.242
971	135.548	15.842	-11.501	135.495	17.347	-12.759
972	135.442	18.851	-14.018			
973	137.500	7.075	-4.100	137.447	8.580	-5.358
974	137.394	10.084	-6.617	137.341	11.588	-7.875
975	137.288	13.092	-9.134	137.236	14.597	-10.392
976	137.183	16.101	-11.651	137.130	17.605	-12.909
977	137.077	19.109	-14.168			
978	138.947	7.240	-4.195	138.895	8.744	-5.454
979	138.842	10.248	-6.712	138.789	11.752	-7.971
980	138.736	13.257	-9.229	138.683	14.761	-10.488
981	138.631	16.265	-11.746	138.578	17.770	-13.004
982	138.525	19.274	-14.263			
983	140.100	7.341	-4.254	140.048	8.845	-5.512
984	139.995	10.350	-6.771	139.942	11.854	-8.029
985	139.889	13.358	-9.288	139.836	14.863	-10.546

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986	139.784	16.367	-11.805	139.731	17.871	-13.063
987	139.678	19.375	-14.322			
988	141.551	7.469	-4.328	141.498	8.973	-5.586
989	141.445	10.477	-6.845	141.393	11.981	-8.103
990	141.340	13.486	-9.362	141.287	14.990	-10.620
991	141.234	16.494	-11.879	141.181	17.999	-13.137
992	141.129	19.503	-14.396			
993	143.975	7.420	-4.299	143.923	8.924	-5.558
994	143.870	10.428	-6.816	143.817	11.933	-8.075
995	143.764	13.437	-9.333	143.711	14.941	-10.592
996	143.658	16.445	-11.850	143.606	17.950	-13.109
997	143.553	19.454	-14.367			
998	148.235	6.649	-3.853	148.182	8.154	-5.111
999	148.129	9.658	-6.370	148.076	11.162	-7.628
1000	148.023	12.667	-8.887	147.971	14.171	-10.145
1001	147.918	15.675	-11.404	147.865	17.179	-12.662
1002	147.812	18.684	-13.921			
1003	153.934	5.619	-3.256	153.881	7.123	-4.514
1004	153.828	8.627	-5.773	153.776	10.131	-7.031
1005	153.723	11.636	-8.290	153.670	13.140	-9.548
1006	153.617	14.644	-10.806	153.564	16.149	-12.065
1007	153.512	17.653	-13.323			
1008	160.353	4.457	-2.583	160.301	5.962	-3.841
1009	160.248	7.466	-5.100	160.195	8.970	-6.358
1010	160.142	10.475	-7.617	160.089	11.979	-8.875
1011	160.036	13.483	-10.134	159.984	14.987	-11.392
1012	159.931	16.492	-12.651			
1013	1160.353	4.457	-2.583	1160.301	5.962	-3.841
1014	1160.248	7.466	-5.100	1160.195	8.970	-6.358
1015	1160.142	10.475	-7.617	1160.089	11.979	-8.875
1016	1160.036	13.483	-10.134	1159.984	14.987	-11.392
1017	1159.931	16.492	-12.651			
1018	SPRINTS NETWORK = ZCNEDWK4					
1019	1.0					
1020	18.0					
1021	9.0	1.0	0.0			
1022	45.236	2.324	3.138	45.183	3.583	4.642
1023	45.130	4.841	6.146	45.077	6.100	7.650
1024	45.025	7.358	9.155	44.972	8.616	10.659
1025	44.919	9.875	12.163	44.866	11.133	13.668
1026	44.813	12.392	15.172			
1027	53.318	2.007	3.463	53.265	3.265	4.967
1028	53.212	4.523	6.471	53.160	5.782	7.976
1029	53.107	7.040	9.480	53.054	8.299	10.984
1030	53.001	9.557	12.489	52.948	10.816	13.993
1031	52.896	12.074	15.497			
1032	61.785	3.185	5.497	61.732	4.444	7.001
1033	61.679	5.702	8.505	61.627	6.960	10.010
1034	61.574	8.219	11.514	61.521	9.477	13.018
1035	61.468	10.736	14.523	61.415	11.994	16.027
1036	61.362	13.253	17.531			
1037	71.254	3.638	6.278	71.201	4.896	7.782
1038	71.148	6.155	9.286	71.096	7.413	10.790
1039	71.043	8.672	12.295	70.990	9.930	13.799
1040	70.937	11.189	15.303	70.884	12.447	16.808
1041	70.831	13.705	18.312			
1042	132.459	3.638	6.278	132.406	4.896	7.782

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1043	132.353	6.155	9.286	132.301	7.413	10.791
1044	132.248	8.672	12.295	132.195	9.930	13.799
1045	132.142	11.189	15.304	132.089	12.447	16.808
1046	132.036	13.705	18.312			
1047	134.175	3.795	6.549	134.122	5.054	8.054
1048	134.070	6.312	9.558	134.017	7.570	11.062
1049	133.964	8.829	12.566	133.911	10.087	14.071
1050	133.858	11.346	15.575	133.806	12.604	17.079
1051	133.753	13.863	18.583			
1052	135.865	3.950	6.817	135.812	5.208	8.321
1053	135.759	6.467	9.825	135.706	7.725	11.329
1054	135.653	8.984	12.834	135.600	10.242	14.338
1055	135.548	11.501	15.842	135.495	12.759	17.347
1056	135.442	14.018	18.851			
1057	137.500	4.100	7.075	137.447	5.358	8.580
1058	137.394	6.617	10.084	137.341	7.875	11.588
1059	137.288	9.134	13.092	137.236	10.392	14.597
1060	137.183	11.651	16.101	137.130	12.909	17.605
1061	137.077	14.168	19.109			
1062	138.947	4.195	7.240	138.895	5.454	8.744
1063	138.842	6.712	10.248	138.789	7.971	11.752
1064	138.736	9.229	13.257	138.683	10.488	14.761
1065	138.631	11.746	16.265	138.578	13.004	17.770
1066	138.525	14.263	19.274			
1067	140.100	4.254	7.341	140.048	5.512	8.845
1068	139.995	6.771	10.350	139.942	8.029	11.854
1069	139.889	9.288	13.358	139.836	10.546	14.863
1070	139.784	11.805	16.367	139.731	13.063	17.871
1071	139.678	14.322	19.375			
1072	141.551	4.328	7.469	141.498	5.586	8.973
1073	141.445	6.845	10.477	141.393	8.103	11.981
1074	141.340	9.362	13.486	141.287	10.620	14.990
1075	141.234	11.879	16.494	141.181	13.137	17.999
1076	141.129	14.396	19.503			
1077	143.975	4.299	7.420	143.923	5.558	8.924
1078	143.870	6.816	10.428	143.817	8.075	11.933
1079	143.764	9.333	13.437	143.711	10.592	14.941
1080	143.658	11.850	16.445	143.606	13.109	17.950
1081	143.553	14.367	19.454			
1082	148.235	3.853	6.649	148.182	5.111	8.154
1083	148.129	6.370	9.658	148.076	7.628	11.162
1084	148.023	8.887	12.667	147.971	10.145	14.171
1085	147.918	11.404	15.675	147.865	12.662	17.179
1086	147.812	13.921	18.684			
1087	153.934	3.256	5.619	153.881	4.514	7.123
1088	153.828	5.773	8.627	153.776	7.031	10.131
1089	153.723	8.290	11.636	153.670	9.548	13.140
1090	153.617	10.806	14.644	153.564	12.065	16.149
1091	153.512	13.323	17.653			
1092	160.353	2.583	4.457	160.301	3.841	5.962
1093	160.248	5.100	7.466	160.195	6.358	8.970
1094	160.142	7.617	10.475	160.089	8.875	11.979
1095	160.036	10.134	13.483	159.984	11.392	14.987
1096	159.931	12.651	16.492			
1097	1160.353	2.583	4.457	1160.301	3.841	5.962
1098	1160.248	5.100	7.466	1160.195	6.358	8.970
1099	1160.142	7.617	10.475	1160.089	8.875	11.979

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1100	1160.036	10.134	13.483	1159.984	11.392	14.987	
1101	1159.931	12.651	16.492				
1102 \$POINTS NETWORK = ZBODWAK							
1103	1.0						
1104	18.	1.					
1105	13.0	2.0					
1106	160.353	-2.568	4.459	160.353	0.000	5.148	
1107	160.353	2.568	4.460	160.353	4.457	2.583	
1108	160.353	5.148	0.000	160.353	4.457	-2.583	
1109	160.353	2.584	-4.458	160.353	0.000	-5.148	
1110	160.353	-2.583	-4.458	160.353	-4.457	-2.584	
1111	160.353	-5.148	-0.001	160.353	-4.457	2.583	
1112	160.353	-2.568	4.459				
1113	1160.353	-2.568	4.459	1160.353	0.000	5.148	
1114	1160.353	2.568	4.460	1160.353	4.457	2.583	
1115	1160.353	5.148	0.000	1160.353	4.457	-2.583	
1116	1160.353	2.584	-4.458	1160.353	0.000	-5.148	
1117	1160.353	-2.583	-4.458	1160.353	-4.457	-2.584	
1118	1160.353	-5.148	-0.001	1160.353	-4.457	2.583	
1119	1160.353	-2.568	4.459				
1120	\$END						
1							
record of input processing							
\$TIT	kn,kt	1	2	9.0000	0.0000	0.0000	0.0000
\$SYM	network # being processed	1					
\$MAC							
\$CAS							
\$ANG							
\$PRI							
\$REF							
\$POI							
\$POI	kn,kt	1	2	9.0000	0.0000	0.0000	0.0000
\$POI	network # being processed	1					
\$POI							
\$POI	kn,kt	1	2	9.0000	0.0000	0.0000	0.0000
\$POI	network # being processed	1					
\$POI							
\$POI	kn,kt	1	2	9.0000	0.0000	0.0000	0.0000
\$POI	network # being processed	1					
\$POI							
\$POI	kn,kt	1	5	4.0000	13.0000	0.0000	0.0000
\$POI	network # being processed	1					
\$POI							
\$POI	kn,kt	1	6	13.0000	2.0000	0.0000	0.0000
\$POI	network # being processed	1					

APPENDIX B. GBU-24 OUPUT FILE (EDGE ANALYSIS)

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abutment	nw-ident	ntd	knet.edge	nw-ident	ntd	knet.edge	
1		12	1.1-	18	30.1+		
2		18	30.1-	12	1.1+		probable error: unabuttet free edge
3		12	1.2-	12	1.2+		probable error: unabuttet free edge
4		12	1.3-	12	1.3+		
		12	10.2-	12	11.4-		
		12	11.4+	12	1.4+		
5		12	1.4-	12	10.2+		
		18	29.1-	12	2.1+		
6		12	2.2-	12	2.2+		probable error: unabuttet free edge
7		12	2.3-	12	2.3+		probable error: unabuttet free edge
8		12	9.2-	12	10.4-		
		12	10.4+	12	2.4+		
		12	2.4-	12	9.2+		
9		12	3.1-	18	31.1+		
		18	31.1-	12	3.1+		
10		12	3.2-	12	3.2+		probable error: unabuttet free edge
11		12	3.3-	12	3.3+		probable error: unabuttet free edge
12		12	11.2-	12	8.4-		
		12	8.4+	12	3.4+		
		12	3.4-	12	11.2+		
13		12	4.1-	18	28.1+		
		18	28.1-	12	4.1+		
14		12	4.2-	12	4.2+		probable error: unabuttet free edge
15		12	4.3-	12	4.3+		probable error: unabuttet free edge
16		12	8.2-	12	9.4-		
		12	9.4+	12	4.4+		
		12	4.4-	12	8.2+		
17		12	6.4+	12	5.1+		
		12	5.1-	12	6.4-		
18		12	5.4+	12	5.2+		
		12	5.2-	12	5.4-		
19		12	6.3+	12	6.1+		
		12	6.1-	12	6.3-		
20		12	7.3+	12	6.2+		
		12	6.2-	12	7.3-		
21		12	7.3+	12	6.2+		
		12	6.2-	12	7.3-		
22		12	8.1+	12	7.1+		
		12	7.1-	12	8.1-		
23		12	7.1-	12	11.1-		
		12	11.1+	12	7.1+		
24		12	10.1+	12	7.1+		
		12	7.1-	12	10.1-		
25		12	9.1+	12	7.1+		
		12	7.1-	12	9.1-		
26		12	7.4+	12	7.2+		
		12	7.2-	12	7.4-		
27		12	12.2+	12	8.3+		
		12	12.2-	12	12.2-		
28		12	8.3-	12	9.3+		
		12	12.2+	12	12.2-		
29		12	9.3-	12	10.3+		
		12	12.2+	12	12.2-		
30		12	10.3-	12	12.2-		
		12	11.3-	12	11.3+		
		12	12.2+	12	11.3+		

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31	12	12.3+	12	12.1+
32	12	12.1-	12	12.3-
33	12	12.3+	12	12.4+
34	12	12.4-	12	13.3-
35	12	12.3+	12	12.4+
36	12	12.1-	12	13.3-
37	12	12.3+	12	14.3-
38	12	13.1-	12	13.1+
39	12	14.3+	12	14.3-
40	12	13.4+	12	13.2+
41	12	13.2-	12	13.4-
42	12	14.1-	12	21.4-
43	12	21.4+	12	14.1+
44	12	14.1-	12	17.4-
45	12	17.4+	12	14.1+
46	12	14.1-	12	16.4-
47	12	16.4+	12	14.1+
48	12	14.1-	12	15.4-
49	12	15.4+	12	14.1+
50	12	14.4+	12	14.2+
51	12	14.2-	12	14.4-
52	12	16.3+	12	19.4-
53	12	16.3+	12	15.1+
54	12	19.4+	12	16.3-
55	12	15.1-	12	32.1+
56	12	23.4+	12	15.2+
57	12	32.1-	12	23.4-
58	12	15.2-	12	22.4+
	12	21.1+	12	15.3+
	12	22.4-	12	21.1-
	12	15.3-	12	20.4-
	12	17.3+	12	16.1+
	12	20.4+	12	17.3-
	12	16.1-	12	32.1+
	12	23.4+	12	16.2+
	12	32.1-	12	23.4-
	12	16.2-	12	18.4-
	12	21.3+	12	17.1+
	12	18.4+	12	21.3-
	12	17.1-	12	32.1+
	12	23.4+	12	17.2+
	12	32.1-	12	23.4-
	12	17.2-	12	18.1+
	12	18.1-	12	18.2+
	12	18.2-	12	24.1-
	12	18.3-	12	18.3+
	12	24.1+	12	19.1+
	12	19.1-	12	19.2+
	12	19.2-	12	26.1-
	12	19.3-	12	19.3+
	12	26.1+	12	20.1+
	12	20.1-	12	20.2+
	12	20.2-	12	27.1-
	12	20.3-	12	20.3+
	12	27.1+	12	32.1+
	12	23.4+	12	21.2+
	12	32.1-		

probable error: unabuttet free edge
 probable error: unabuttet free edge

probable error: unabuttet free edge
 probable error: unabuttet free edge

probable error: unabuttet free edge
 probable error: unabuttet free edge

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59	12	21.2-	12	23.4-	
60	12	22.1-	12	22.1+	probable error: unabuttet free edge
61	12	22.2-	12	22.2+	probable error: unabuttet free edge
	12	22.3-	18	25.1-	
	18	25.1+	12	22.3+	
62	12	23.1-	12	23.3-	
	12	23.3+	12	23.1+	
63	18	24.2-	18	24.2+	
64	18	24.3-	18	24.3+	
65	18	24.4-	18	24.4+	
66	18	25.2-	18	25.2+	
67	18	25.3-	18	25.3+	
68	18	32.2+	18	32.4+	
	18	32.4-	18	25.4+	
	18	26.2-	18	32.2-	
69	18	26.3-	18	26.2+	
70	18	26.4-	18	26.3+	
71	18	27.2-	18	26.4+	
72	18	27.3-	18	27.2+	
73	18	27.4-	18	27.3+	
74	18	28.2-	18	27.4+	
75	18	28.3-	18	28.2+	
76	18	28.4-	18	28.3+	
77	18	29.2-	18	28.4+	
78	18	29.3-	18	29.2+	
79	18	30.2-	18	29.3+	
80	18	30.3-	18	29.4+	
81	18	30.4-	18	30.2+	
82	18	31.2-	18	30.3+	
83	18	31.3-	18	30.4+	
84	18	31.4-	18	31.2+	
85	18	32.3-	18	31.3+	
86	18		18	31.4+	
87	18		18	32.3+	

surfaces associated with various regions of the configuration

region	nw-id	nw-name	dbit-type	surface	material	r/ctr
1	1	analysis	upper	air	75.546633	0.341333
	1	analysis	lower	air		-0.739267
	2	analysis	upper	air		
	2	analysis	lower	air		
	3	analysis	upper	air		
	3	analysis	lower	air		
	4	analysis	upper	air		
	4	analysis	lower	air		
	5	analysis	upper	air		
	5	analysis	lower	air		
	6	analysis	upper	air		
	6	analysis	lower	air		
	7	analysis	upper	air		
	7	analysis	lower	air		
	8	analysis	upper	air		
	8	analysis	lower	air		
	9	analysis	upper	air		
	9	analysis	lower	air		
	10	analysis	upper	air		
	10	analysis	lower	air		
	11	analysis	upper	air		
	11	analysis	lower	air		
	12	analysis	upper	air		
	12	analysis	lower	air		
	13	analysis	upper	air		
	13	analysis	lower	air		
	14	analysis	upper	air		
	14	analysis	lower	air		
	15	analysis	upper	air		
	15	analysis	lower	air		

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16	analysis	upper	air		
17	analysis	upper	air		
18	analysis	upper	air		
18	analysis	lower	air		
19	analysis	upper	air		
19	analysis	lower	air		
20	analysis	upper	air		
20	analysis	lower	air		
21	analysis	upper	air		
22	analysis	upper	air		
22	analysis	lower	air		
24	nt=18 wake	upper	air		
24	nt=18 wake	lower	air		
25	nt=18 wake	upper	air		
25	nt=18 wake	lower	air		
26	nt=18 wake	upper	air		
26	nt=18 wake	lower	air		
27	nt=18 wake	upper	air		
27	nt=18 wake	lower	air		
28	nt=18 wake	upper	air		
28	nt=18 wake	lower	air		
29	nt=18 wake	upper	air		
29	nt=18 wake	lower	air		
30	nt=18 wake	upper	air		
30	nt=18 wake	lower	air		
31	nt=18 wake	upper	air		
31	nt=18 wake	lower	air		
32	nt=18 wake	lower	air		
2	analysis	lower	air	68.013867	-1.775733
5	analysis	lower	air		
6	analysis	lower	air		
7	analysis	lower	air		
8	analysis	lower	air		
9	analysis	lower	air		
10	analysis	lower	air		
11	analysis	lower	air		
12	analysis	lower	air		
13	analysis	lower	air		
14	analysis	lower	air		
15	analysis	lower	air		
16	analysis	lower	air		
17	analysis	lower	air		
21	analysis	lower	air		
23	analysis	lower	air		
3	analysis	upper	air	160.353000	-4.458000
23	nt=18 wake	upper	air		
32	nt=18 wake	upper	air		
0*b*extra-cp					
0 ***** summary of extra control points *****					
nw edge point row col fine grid location					
1.	6	2	11	2	21 3
2.	7	1	4	1	4 1 7
3.	7	1	7	1	7 1 13

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4.	7	1	10	1	10	1	19
5.	7	3	11	3	3	5	5
6.	12	2	4	4	3	7	5
7.	12	2	7	7	3	13	5
8.	12	2	10	10	3	19	5
9.	12	4	3	11	1	21	1
10.	13	1	12	1	12	1	23
11.	13	3	3	2	11	3	21
12.	14	1	4	1	4	1	7
13.	14	1	7	1	7	1	13
14.	14	1	10	1	10	1	19
15.	14	3	12	4	2	7	3
16.	23	4	4	10	1	19	1
17.	23	4	7	7	1	13	1
18.	23	4	10	4	1	7	1
19.	32	1	4	1	4	1	7
20.	32	1	7	1	7	1	13
21.	32	1	10	1	10	1	19
0*e*extra-cp							
0*b*extra-vp							

0 ***** summary of extra v-parameter points *****									
		nw	edge	point	row	col	fine grid location		
1.	6	2	11	11	2	21	3		
2.	7	1	4	1	4	1	7		
3.	7	1	7	1	7	1	13		
4.	7	1	10	1	10	1	19		
5.	7	3	11	3	3	5	5		
6.	12	2	4	4	3	7	5		
7.	12	2	7	7	3	13	5		
8.	12	2	10	10	3	19	5		
9.	12	4	3	11	1	21	1		
10.	13	1	12	1	12	1	23		
11.	13	3	3	2	11	3	21		
12.	14	1	4	1	4	1	7		
13.	14	1	7	1	7	1	13		
14.	14	1	10	1	10	1	19		
15.	14	3	12	4	2	7	3		
16.	23	4	4	10	1	19	1		
17.	23	4	7	7	1	13	1		
18.	23	4	10	4	1	7	1		
19.	32	1	4	1	4	1	7		
20.	32	1	7	1	7	1	13		
21.	32	1	10	1	10	1	19		
0*e*extra-vp									
0*b*abutment									
1									
abutment summary									

0abutment #	1	dblt edge	starts at ai # 1 ends at ai # 2				
nw edge	nw/id	type	type	matching	kutta-fl	corresponding edge points (-) indicates point moved by \$eat	
1.1	12	4	1	2	3	4 5 6 7 8 9	
30.1	18	5	1	2	3	4 5 6 7 8 9	
0abutment #	2	doublet strength	matched to zero along this abutment				*** warning **

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*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	2	ends at ai #	3	indicates point moved by \$eat					
1.2	12	4	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	3	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	3	ends at ai #	4	indicates point moved by \$eat					
1.3	12	4	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	4	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	4	ends at ai #	5	indicates point moved by \$eat					
1.4	12	4	mu-match		1	2	3	4	5	6	7	8	9	
10.2	12	4			1	0	0	0	0	0	0	0	2	
11.4	12	4			2	0	0	0	0	0	0	0	1	
0abutment #	5	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	5	ends at ai #	6	indicates point moved by \$eat					
2.1	12	4	mu-match		1	2	3	4	5	6	7	8	9	
29.1	18	5	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	6	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	6	ends at ai #	7	indicates point moved by \$eat					
2.2	12	4	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	7	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	7	ends at ai #	8	indicates point moved by \$eat					
2.3	12	4	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	8	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	8	ends at ai #	9	indicates point moved by \$eat					
2.4	12	4	mu-match		1	2	3	4	5	6	7	8	9	
9.2	12	4			1	0	0	0	0	0	0	0	2	
10.4	12	4			2	0	0	0	0	0	0	0	1	
0abutment #	9	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	9	ends at ai #	10	indicates point moved by \$eat					
3.1	12	4	mu-match		1	2	3	4	5	6	7	8	9	
31.1	18	5	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	10	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	10	ends at ai #	11	indicates point moved by \$eat					
3.2	12	4	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	11	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	11	ends at ai #	12	indicates point moved by \$eat					
3.3	12	4	mu-match		1	2	3	4	5	6	7	8	9	
0abutment #	12	doublet	strength matched to zero along this abutment											
*														
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai #	12	ends at ai #	9	indicates point moved by \$eat					
3.4	12	4	mu-match		1	2	3	4	5	6	7	8	9	
8.4	12	4			2	0	0	0	0	0	0	0	1	
11.2	12	4			1	0	0	0	0	0	0	0	2	

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Oabutment # 13	dblt edge nw/edge 4.1 28.1	type 12 18	matching mu-match	kutta-fl	starts at ai # 13 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 14 6 7 8 9	*** warning **
Oabutment # 14	dblt edge nw/edge 4.2	type 12 12	matching mu-match	kutta-fl	starts at ai # 14 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 15 6 7 8 9	*** warning **
Oabutment # 15	dblt edge nw/edge 4.3	type 12 12	matching mu-match	kutta-fl	starts at ai # 15 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 16 6 7 8 9	*** warning **
Oabutment # 16	dblt edge nw/edge 4.4	type 12 12	matching mu-match	kutta-fl	starts at ai # 16 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 17 6 7 8 9	*** warning **
Oabutment # 17	dblt edge nw/edge 4.5	type 12 12	matching mu-match	kutta-fl	starts at ai # 17 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 18 6 7 8 9	*** warning **
Oabutment # 18	dblt edge nw/edge 4.6	type 12 12	matching mu-match	kutta-fl	starts at ai # 18 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 19 6 7 8 9	*** warning **
Oabutment # 19	dblt edge nw/edge 4.7	type 12 12	matching mu-match	kutta-fl	starts at ai # 19 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 20 6 7 8 9	*** warning **
Oabutment # 20	dblt edge nw/edge 4.8	type 12 12	matching mu-match	kutta-fl	starts at ai # 20 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 21 6 7 8 9	*** warning **
Oabutment # 21	dblt edge nw/edge 4.9	type 12 12	matching mu-match	kutta-fl	starts at ai # 21 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 22 6 7 8 9	*** warning **
Oabutment # 22	dblt edge nw/edge 4.10	type 12 12	matching mu-match	kutta-fl	starts at ai # 22 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 23 6 7 8 9	*** warning **
Oabutment # 23	dblt edge nw/edge 4.11	type 12 12	matching mu-match	kutta-fl	starts at ai # 23 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 24 6 7 8 9	*** warning **
Oabutment # 24	dblt edge nw/edge 4.12	type 12 12	matching mu-match	kutta-fl	starts at ai # 24 corresponding edge points (minus (-) indicates point moved by \$eat	ends at ai # 25 6 7 8 9	*** warning **

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nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 8 ends at ai # 4 corresponding edge points (minus (-) indicates point moved by \$eat
7.1	12	4			7 8 9 10
10.1	12	4	mu-match		4 3 2 1
Oabutment # 25					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 16 ends at ai # 8 corresponding edge points (minus (-) indicates point moved by \$eat
7.1	12	4			10 11 12 13
9.1	12	4	mu-match		4 3 2 1
Oabutment # 26					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 20 ends at ai # 16 corresponding edge points (minus (-) indicates point moved by \$eat
7.2	12	4			1 2 3
7.4	12	4	mu-match		3 2 1
Oabutment # 27					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 9 ends at ai # 13 corresponding edge points (minus (-) indicates point moved by \$eat
8.3	12	4			1 2 3 4
12.2	12	4	mu-match		13 12 11 10
Oabutment # 28					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 13 ends at ai # 5 corresponding edge points (minus (-) indicates point moved by \$eat
9.3	12	4			1 2 3 4
12.2	12	4	mu-match		4 3 2 1
Oabutment # 29					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 5 ends at ai # 1 corresponding edge points (minus (-) indicates point moved by \$eat
10.3	12	4			1 2 3 4
12.2	12	4	mu-match		7 6 5 4
Oabutment # 30					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 1 ends at ai # 9 corresponding edge points (minus (-) indicates point moved by \$eat
11.3	12	4			1 2 3 4
12.2	12	4	mu-match		10 9 8 7
Oabutment # 31					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 13 ends at ai # 21 corresponding edge points (minus (-) indicates point moved by \$eat
12.1	12	4			1 2 3
12.3	12	4	mu-match		3 2 1
Oabutment # 32					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 22 ends at ai # 21 corresponding edge points (minus (-) indicates point moved by \$eat
12.4	12	4			1 2 3
13.3	12	4	mu-match		3 2 1
Oabutment # 33					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 21 ends at ai # 22 corresponding edge points (minus (-) indicates point moved by \$eat
12.4	12	4			3 4 5 6 7 8 9 10 11 12 13
13.3	12	4	mu-match		13 12 11 10 9 8 7 6 5 4 3
Oabutment # 34					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 24 ends at ai # 23 corresponding edge points (minus (-) indicates point moved by \$eat
13.1	12	4			1 2 3 4 5 6 7 8 9 10 11 12
14.3	12	4	mu-match		12 11 10 9 8 7 6 5 4 3 2 1
Oabutment # 35					
nw.edge nw/id		dblt edge type type	matching	kutta-fl	starts at ai # 23 ends at ai # 24 corresponding edge points (minus (-) indicates point moved by \$eat

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13.1	12	4	12	13	
14.3	12	4	13	12	
Oabutment # 36					
nw.edge	nw/id	dblt edge			ends at ai # 23
13.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
13.4	12	4		1	
Oabutment # 37					
nw.edge	nw/id	dblt edge			ends at ai # 25
14.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
21.4	12	4		1	
Oabutment # 38					
nw.edge	nw/id	dblt edge			ends at ai # 26
14.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
17.4	12	4		1	
Oabutment # 39					
nw.edge	nw/id	dblt edge			ends at ai # 27
14.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
16.4	12	4		1	
Oabutment # 40					
nw.edge	nw/id	dblt edge			ends at ai # 28
14.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
15.4	12	4		1	
Oabutment # 41					
nw.edge	nw/id	dblt edge			ends at ai # 24
14.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
14.4	12	4		1	
Oabutment # 42					
nw.edge	nw/id	dblt edge			ends at ai # 29
15.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
16.3	12	4		1	
19.4	12	4		1	
Oabutment # 43					
nw.edge	nw/id	dblt edge			ends at ai # 30
15.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
23.4	12	4		1	
32.1	18	5		1	
Oabutment # 44					
nw.edge	nw/id	dblt edge			ends at ai # 25
15.3	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
21.1	12	4		1	
22.4	12	4		1	
Oabutment # 45					
nw.edge	nw/id	dblt edge			ends at ai # 31
16.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat
17.3	12	4		1	
20.4	12	4		1	
Oabutment # 46					

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nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 31	ends at ai # 29	
16.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
23.4	12	4			1 2 3 4		
32.1	18	5	mu-match		7 6 5 4		
Oabutment # 47					7 8 9 10		
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 32	ends at ai # 26	
17.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
18.4	12	4			1 -2 3 4 -5 -6 7 8 9 10 11		
21.3	12	4	mu-match		11 -10 9 8 -7 -6 5 4 3 2 1		
Oabutment # 48					11 -10 9 8 -7 -6 5 4 3 2 1		
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 32	ends at ai # 31	
17.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
23.4	12	4			1 2 3 4		
32.1	18	5	mu-match		10 9 8 7		
Oabutment # 49					4 5 6 7		*** warning **
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 26	ends at ai # 33	
18.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
Oabutment # 50					1 2 3 4 5 6 7		*** warning **
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 33	ends at ai # 34	
18.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
Oabutment # 51					1 2 3 4 5 6 7 8 9 10 11		
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 32	ends at ai # 34	
18.3	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
24.1	18	5	vor-mtch		1 2 3 4 5 6 7		
Oabutment # 52					7 6 5 4 3 2 1		*** warning **
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 28	ends at ai # 35	
19.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
Oabutment # 53					1 2 3 4 5 6 7		*** warning **
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 35	ends at ai # 36	
19.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
Oabutment # 54					1 2 3 4 5 6 7 8 9 10 11		
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 29	ends at ai # 36	
19.3	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
26.1	18	5	vor-mtch		1 2 3 4 5 6 7		
Oabutment # 55					7 6 5 4 3 2 1		*** warning **
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 27	ends at ai # 37	
20.1	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
Oabutment # 56					1 2 3 4 5 6 7		*** warning **
nw.edge	nw/id	dblt edge	matching	kutta-fl	starts at ai # 37	ends at ai # 38	
20.2	12	type			corresponding edge points (minus (-) indicates point moved by \$eat		
					1 2 3 4 5 6 7 8 9 10 11		*** warning **

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```

Oabutment # 57
nw.edge nw/id      dblt edge
20.3    12 4      type type
27.1    18 5      matching kutta-fl
Oabutment # 58      vor-mtch
nw.edge nw/id      dblt edge
21.2    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match vor-mtch
Oabutment # 59      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 60      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 61      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 62      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 63      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 64      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 65      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 66      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 67      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl
Oabutment # 68      doublet strength matched to zero along this abutment
nw.edge nw/id      dblt edge
22.1    12 4      type type
23.4    12 4      matching kutta-fl
32.1    18 5      mu-match kutta-fl

```

starts at ai # 31 ends at ai # 38
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7
7 6 5 4 3 2 1

starts at ai # 30 ends at ai # 32
corresponding edge points (minus (-) indicates point moved by \$eat
1 -2 3 4
13 -12 11 10
1 -2 3 4
wake filaments will be added

starts at ai # 25 ends at ai # 39
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7
wake filaments will be added

starts at ai # 39 ends at ai # 40
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11
wake filaments will be added

starts at ai # 30 ends at ai # 40
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7
wake filaments will be added

starts at ai # 41 ends at ai # 30
corresponding edge points (minus (-) indicates point moved by \$eat
1 2
wake filaments will be added

starts at ai # 34 ends at ai # 42
corresponding edge points (minus (-) indicates point moved by \$eat
1 2
wake filaments will be added

starts at ai # 42 ends at ai # 43
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7
wake filaments will be added

starts at ai # 43 ends at ai # 32
corresponding edge points (minus (-) indicates point moved by \$eat
1 2
wake filaments will be added

starts at ai # 40 ends at ai # 44
corresponding edge points (minus (-) indicates point moved by \$eat
1 2
wake filaments will be added

starts at ai # 44 ends at ai # 45
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7
wake filaments will be added

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```

nw.edge nw/id dblt edge matching kutta-fl
29.3 18 2
Oabutment # 80 wake side edge left unabuttet
*
nw.edge nw/id dblt edge matching kutta-fl
29.4 18 2
Oabutment # 81 wake side edge left unabuttet
*
nw.edge nw/id dblt edge matching kutta-fl
30.2 18 2
Oabutment # 82 wake trailing edge unabuttet.
*
nw.edge nw/id dblt edge matching kutta-fl
30.3 18 2
Oabutment # 83 wake side edge left unabuttet
*
nw.edge nw/id dblt edge matching kutta-fl
30.4 18 2
Oabutment # 84 wake side edge left unabuttet
*
nw.edge nw/id dblt edge matching kutta-fl
31.2 18 2
Oabutment # 85 wake trailing edge unabuttet.
*
nw.edge nw/id dblt edge matching kutta-fl
31.3 18 2
Oabutment # 86 wake side edge left unabuttet
*
nw.edge nw/id dblt edge matching kutta-fl
31.4 18 2
Oabutment # 87 wake trailing edge unabuttet.
*
nw.edge nw/id dblt edge matching kutta-fl
32.3 18 2
O*abutment
O*B*newdgmov
1 nw.edge ***** movement of network edge points
dz(max) motion
dz(i)

5.2 ** lt. eps ** tolerance = 0.1911E-02
0.50E-03 0.000000 0.000500 0.000000 0.000000
1 orig x 8.499000 2.498000 0.482000 0.000000
y 0.000000 0.000000 0.000000 0.000000
z 3.999000 3.565000 1.853000 0.000000
moved x 8.499000 2.498000 0.482000 0.000000
y 0.000000 0.000000 0.000000 0.000000

```

starts at ai # 52 ends at ai # 53
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 *** warning **

starts at ai # 53 ends at ai # 5
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 *** warning **

starts at ai # 2 ends at ai # 54
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 *** gentle reminder **
wake filaments will be added

starts at ai # 54 ends at ai # 55
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 *** warning **

starts at ai # 55 ends at ai # 1
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 *** warning **

starts at ai # 10 ends at ai # 56
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 *** gentle reminder **
wake filaments will be added

starts at ai # 56 ends at ai # 57
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 *** warning **

starts at ai # 57 ends at ai # 9
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 *** gentle reminder **
wake filaments will be added

starts at ai # 45 ends at ai # 45
corresponding edge points (minus (-) indicates point moved by \$eat
1 2 3 4 5 6 7 8 9 10 11 12 13

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[illegible]

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```

nrcalc=      influence coefficient generation i/o count
0         0      nwrdrd=      0      nwrdrd=      0

```

```

0
logical flags for cp/2 iteration:
  F = bkprnt, print flag for solver statistics
  wopen call on unit 19 blocks: 100 status: 0

```

```
* * * condition indicators * * *
```

$$10^b \text{ solution}$$

simultaneous solution number 1

```
mach number = 0.80000    angle of attack = 2.00000    sideslip angle = 0.00000    freestream speed = 1.00000
compressibility factor = 0.60000    compressibility angle of attack = 2.00000    compressibility angle of sideslip = 0.0000
00
freestream velocity = ( 0.99939, 0.00000, 0.03490)    compressibility direction = ( 0.99939, 0.00000, 0.03490)
```

```

1
network id: 1 source type = 0 doublet type = 12 number rows = 8 number columns = 8

```

[illegible]

results

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.0990	0.7889	0.9920	-0.0815	0.0680	-1.0905	0.9809	-0.0815	0.0676	0.0348	0.0270	0.0269	0
.0268	0.0000	0.0000	-0.0269	-0.0269	0.9500	0.9866	0.1377	0.0856	0.0825	0.0739	0.0728	0
.0722												
13	2	41.3597	3.8858	-2.9495	0.5707	-0.0349	0.0896	-0.0757	0.0000	0.0000	0.0196	0
.0234												
.0851	0.7630	0.9851	0.0430	-0.0360	-0.4911	0.9554	0.0430	-0.0370	0.0930	0.0862	0.0854	0
.0157	0.7932	0.9960	-0.0465	0.0389	-1.0617	0.9903	-0.0465	0.0387	0.0179	0.0157	0.0157	0
.0694	0.0000	0.0000	-0.0268	-0.0268	0.9571	0.9921	0.0905	0.0392	0.0750	0.0704	0.0697	0
14	3	38.7894	3.8858	-2.9495	0.6353	-0.0168	0.0389	-0.0330	0.0000	0.0000	0.0196	0
.0234												
.0609	0.7731	0.9896	0.0174	-0.0145	-0.3976	0.9691	0.0174	-0.0152	0.0641	0.0614	0.0610	0
.0273	0.7878	0.9949	-0.0216	0.0181	-1.0330	0.9859	-0.0216	0.0177	0.0281	0.0274	0.0273	0
.0336	0.0000	0.0000	-0.0268	-0.0268	0.9694	0.9863	0.0546	0.0146	0.0359	0.0340	0.0337	0
15	4	36.2197	3.8859	-2.9493	0.6558	0.0012	0.0043	-0.0036	0.0000	0.0000	0.0196	0
.0234												
.0396	0.7824	0.9932	-0.0004	0.0002	-0.3345	0.9801	-0.0004	-0.0003	0.0410	0.0398	0.0397	0
.0419	0.7814	0.9927	-0.0048	0.0038	-0.9903	0.9790	-0.0048	0.0033	0.0431	0.0421	0.0419	0
.0023	0.0000	0.0000	-0.0269	-0.0269	0.9801	0.9790	0.0294	0.0263	-0.0021	-0.0023	-0.0023	-0
16	5	33.6500	3.8860	-2.9491	0.6287	0.0201	-0.0166	0.0143	0.0000	0.0000	0.0196	0
.0234												
.0188	0.7916	0.9967	-0.0114	0.0095	-0.2984	0.9905	-0.0114	0.0093	0.0196	0.0189	0.0188	0
.0589	0.7739	0.9898	0.0051	-0.0043	-0.9271	0.9704	0.0051	-0.0050	0.0608	0.0592	0.0589	0
.0400	0.0000	0.0000	-0.0268	-0.0268	0.9906	0.9704	0.0118	0.0414	-0.0411	-0.0404	-0.0401	-0
17	6	31.0801	3.8861	-2.9492	0.5518	0.0400	-0.0253	0.0220	0.0000	0.0000	0.0196	0
.0234												
.0015	0.8008	1.0003	-0.0168	0.0140	-0.2883	1.0005	-0.0168	0.0140	-0.0008	-0.0015	-0.0015	-0
.0782	0.7654	0.9863	0.0085	-0.0071	-0.8401	0.9606	0.0085	-0.0080	0.0806	0.0788	0.0782	0
.0797	0.0000	0.0000	-0.0268	-0.0268	1.0007	0.9606	0.0012	0.0516	-0.0814	-0.0803	-0.0797	-0
18	7	28.5100	3.8862	-2.9490	0.4202	0.0661	-0.0279	0.0248	0.0000	0.0000	0.0196	0
.0234												
.0288	0.8131	1.0051	-0.0197	0.0162	-0.3060	1.0140	-0.0197	0.0166	-0.0280	-0.0287	-0.0288	-0
.1031	0.7545	0.9818	0.0082	-0.0070	-0.7263	0.9479	0.0082	-0.0082	0.1060	0.1042	0.1032	0

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network id:		index: 1 source type = 0 doublet type = 12 number rows = 8 number columns = 8													
jc	ip	x	y	z	d0	dx	dy	dz	s0	anx	any	a			
nz	lmachu	wxu	wyu	wzu	pheu	vxu	vyu	vzu	cplinu	cpelnu	cp2ndu	cpi			
snu	lmachl	wxl	wyl	wzl	phel	vxl	vyl	vzl	cpllnl	cpslnl	cp2ndl	cpi			
snl	wnu	wnl	pwnu	pwml	vtu	vtl	pvtu	pvtl	cplind	cpslnd	cp2ndd	cpi			
snd															
.0212	24	11	39.3297	5.3900	-4.2074	0.6593	-0.0025	0.0030	-0.0026	0.0000	0.0178	0			
.0478	.0212		0.9917	-0.0043	0.0034	-0.3620	0.9760	-0.0043	0.0028	0.0490	0.0478	0			
.0427	.07810		0.9925	-0.0073	0.0059	-1.0213	0.9785	-0.0073	0.0054	0.0438	0.0427	0			
.0051	.0427	0.0000	0.0000	-0.0269	0.9760	0.9786	0.0291	0.0247	0.0053	0.0052	0.0051	0			
.0212	25	12	36.9972	5.3901	-4.2069	0.6518	-0.0072	0.0063	0.0000	0.0000	0.0178	0			
.0309	.07863		0.9946	-0.0095	0.0077	-0.3185	0.9844	-0.0095	0.0073	0.0318	0.0309	0			
.0500	.0309	0.7778	0.9913	-0.0022	0.0017	-0.9703	0.9749	-0.0022	0.0011	0.0514	0.0503	0			
	.0500	0.0000	0.0000	-0.0269	-0.0269	0.9845	0.9749	0.0182	0.0316	-0.0196	-0.0193	-0.0192	-0		
</															

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.0191															
26 13	34.6651	5.3901	-4.2065	0.6136	0.0236	-0.0160	0.0139	0.0000	0.0000	0.0178	0				
.0212	0.7937	-0.0143	0.0117	-0.2934	0.9928	-0.0143	0.0116	0.0149	0.0141	0.0141	0				
.0141	0.7728	0.0017	-0.0016	-0.9070	0.9692	0.0017	-0.0023	0.0630	0.0617	0.0613	0				
.0613	0.0000	-0.0269	-0.0269	0.9929	0.9692	0.0077	0.0393	-0.0481	-0.0475	-0.0472	-0				
.0472															
27 14	32.3324	5.3902	-4.2061	0.5403	0.0398	-0.0247	0.0216	0.0000	0.0000	0.0177	0				
.0212	0.8018	-0.0194	0.0160	-0.2881	1.0016	-0.0194	0.0160	-0.0031	-0.0038	-0.0038	-0				
.0038	0.7665	0.0053	-0.0047	-0.8284	0.9618	0.0053	-0.0055	0.0780	0.0764	0.0759	0				
.0758	0.0000	-0.0269	-0.0269	1.0019	0.9618	0.0036	0.0481	-0.0810	-0.0802	-0.0797	-0				
.0796															
28 15	29.9996	5.3903	-4.2057	0.4231	0.0656	-0.0397	0.0347	0.0000	0.0000	0.0177	0				
.0212	0.8146	-0.0279	0.0231	-0.3068	1.0152	-0.0279	0.0234	-0.0308	-0.0317	-0.0318	-0				
.0318	0.7561	0.0119	-0.0101	-0.7299	0.9496	0.0119	-0.0113	0.1027	0.1006	0.0996	0				
.0995	0.0000	-0.0270	-0.0270	1.0159	0.9498	0.0211	0.0630	-0.1335	-0.1323	-0.1314	-0				
.1313															
29 16	27.6671	5.3902	-4.2053	0.2271	0.1435	-0.0939	0.0817	0.0000	0.0000	0.0177	0				
.0212	0.8544	-0.0565	0.0472	-0.3662	1.0551	-0.0565	0.0485	-0.1124	-0.1157	-0.1169	-0				
.1166	0.7257	0.0373	-0.0312	-0.5933	0.9116	0.0373	-0.0333	0.1801	0.1745	0.1716	0				
.1709	0.0000	-0.0268	-0.0268	1.0578	0.9130	0.0763	0.1137	-0.2925	-0.2902	-0.2884	-0				
.2875															
32 17	44.0611	6.8941	-5.4668	0.6451	-0.0028	0.0028	-0.0024	0.0000	0.0000	0.0160	0				
.0191	0.7693	-0.0034	0.0023	-0.4654	0.9651	-0.0034	0.0016	0.0708	0.0697	0.0693	0				
.0692	0.7717	-0.0062	0.0047	-1.1105	0.9679	-0.0062	0.0040	0.0651	0.0641	0.0638	0				
.0637	0.0000	-0.0271	-0.0271	0.9652	0.9679	0.0391	0.0349	0.0057	0.0056	0.0055	0				
.0055															
33 18	41.9658	6.8941	-5.4660	0.6518	-0.0021	-0.0022	0.0018	0.0000	0.0000	0.0160	0				
.0191	0.7750	-0.0073	0.0058	-0.4002	0.9717	-0.0073	0.0052	0.0574	0.0565	0.0562	0				
.0562	0.7768	-0.0050	0.0040	-1.0521	0.9738	-0.0050	0.0034	0.0534	0.0524	0.0521	0				
.0521	0.0000	-0.0269	-0.0269	0.9717	0.9738	0.0308	0.0304	0.0041	0.0041	0.0041	0				
.0041															
34 19	39.8703	6.8942	-5.4653	0.6513	0.0039	-0.0078	0.0066	0.0000	0.0000	0.0160	0				

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network id:		index: 1		source type = 0		doublet type = 12		number rows = 8		number columns = 8	
jc	ip	x	y	z	d0	dx	dy	dz	s0	any	a
nz	lmachu	wxu	wyu	wzu	pheu	vxu	vyu	vzu	cplnu	cp2ndu	cp1
snu	lmachl	wxl	wyl	wzl	phel	vxl	vyl	vzl	cplnl	cp2ndl	cp1
snl	wnu	wnl	pwu	pwvl	vtu	vtl	pvtu	pvtl	cplnd	cp2ndd	cp1
snd											
36	21	35.6799	6.8943	-5.4639	0.5927	0.0260	-0.0197	0.0170	0.0000	0.0159	0
.0191											
.0109	0.7952	0.9980	-0.0179	0.0144	-0.2957	0.9943	-0.0179	0.0143	0.0117	0.0109	0
0.7720	0.9890	0.9890	0.0018	-0.0020	-0.8884	0.9683	0.0018	-0.0027	0.0648	0.0635	0
.0631	0.0000	0.0000	-0.0271	-0.0271	0.9945	0.9683	0.0051	0.0402	-0.0532	-0.0522	-0
.0522											
37	22	33.5845	6.8944	-5.4630	0.5225	0.0419	-0.0284	0.0247	0.0000	0.0159	0
.0191											
0.8034	1.0011	0.0029	-0.0229	0.0186	-0.2942	1.0033	-0.0229	0.0187	-0.0066	-0.0074	-0
.0074	0.9866	0.9866	0.0055	-0.0051	-0.8167	0.9614	0.0055	-0.0060	0.0788	0.0772	0
.0766	0.0000	0.0000	-0.0271	-0.0271	1.0037	0.9614	0.0081	0.0487	-0.0854	-0.0846	-0
.0839											
38	23	31.4892	6.8943	-5.4624	0.4118	0.0690	-0.0454	0.0395	0.0000	0.0159	0
.0191											
0.8171	1.0062	0.0062	-0.0320	0.0267	-0.3148	1.0177	-0.0320	0.0271	-0.0360	-0.0371	-0
.0372	0.7554	0.9822	0.0133	-0.0112	-0.7266	0.9487	0.0133	-0.0124	0.1046	0.1023	0
.1012	0.0000	0.0000	-0.0268	-0.0268	1.0186	0.9489	0.0268	0.0649	-0.1406	-0.1394	-0
.1384											
39	24	29.3942	6.8939	-5.4617	0.2250	0.1566	-0.1066	0.0926	0.0000	0.0159	0
.0191											

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0.8624	1.0217	-0.0639	0.0531	-0.3754	1.0626	-0.0639	0.0545	-0.1277	-0.1320	-0.1335	-0
.1332	0.9673	0.0427	-0.0359	-0.6004	0.9059	0.0427	-0.0380	0.1919	0.1852	0.1819	0
.1810	0.0000	-0.0270	-0.0270	1.0659	0.9077	0.0883	0.1227	-0.3195	-0.3172	-0.3154	-0
.3142											
42 25	44.1269	8.3988	-6.7254	0.6354	0.0002	-0.0095	0.0080	0.0000	0.0000	0.0142	0
.0169	0.9890	-0.0100	0.0078	-0.4399	0.9689	-0.0100	0.0071	0.0628	0.0620	0.0616	0
.0616	0.7726										
.0621	0.7725	0.9891	-0.0005	-1.0752	0.9688	-0.0005	-0.0009	0.0637	0.0625	0.0621	0
.0000	0.0000	-0.0272	-0.0272	0.9690	0.9688	0.0321	0.0380	-0.0009	-0.0005	-0.0005	-0
.0005											
43 26	42.2688	8.3986	-6.7242	0.6339	0.0024	-0.0117	0.0098	0.0000	0.0000	0.0141	0
.0169	0.9910	-0.0125	0.0099	-0.3885	0.9747	-0.0125	0.0093	0.0512	0.0504	0.0502	0
.0501	0.7756	0.9904	0.0001	-1.0224	0.9723	-0.0008	-0.0005	0.0566	0.0554	0.0551	0
.0551	0.0000	-0.0272	-0.0272	0.9748	0.9723	0.0256	0.0349	-0.0054	-0.0050	-0.0049	-0
.0049											
44 27	40.4108	8.3984	-6.7230	0.6254	0.0075	-0.0148	0.0126	0.0000	0.0000	0.0141	0
.0169	0.9932	-0.0150	0.0120	-0.3482	0.9808	-0.0150	0.0116	0.0388	0.0381	0.0380	0
.0379	0.7764	0.9908	-0.0004	-0.9737	0.9733	-0.0002	-0.0010	0.0547	0.0535	0.0533	0
.0532	0.0000	-0.0272	-0.0272	0.9810	0.9733	0.0189	0.0347	-0.0159	-0.0154	-0.0153	-0
.0153											
45 28	38.5529	8.3985	-6.7221	0.6045	0.0161	-0.0183	0.0156	0.0000	0.0000	0.0141	0
.0169	0.9956	-0.0174	0.0140	-0.3198	0.9876	-0.0174	0.0137	0.0251	0.0244	0.0243	0
.0243	0.7748	0.9901	-0.0013	-0.9243	0.9715	0.0009	-0.0019	0.0584	0.0571	0.0568	0
.0567	0.0000	-0.0272	-0.0272	0.9878	0.9715	0.0118	0.0370	-0.0332	-0.0327	-0.0324	-0
.0324											
46 29	36.6947	8.3986	-6.7211	0.5641	0.0281	-0.0236	0.0203	0.0000	0.0000	0.0141	0
.0169	0.9983	-0.0206	0.0167	-0.3050	0.9954	-0.0206	0.0166	0.0093	0.0086	0.0086	0
.0086	0.7711	0.9887	-0.0030	-0.8690	0.9672	0.0029	-0.0037	0.0670	0.0656	0.0652	0
.0651	0.0000	-0.0272	-0.0272	0.9957	0.9672	0.0057	0.0420	-0.0576	-0.0570	-0.0566	-0
.0565											
47 30	34.8366	8.3984	-6.7200	0.4978	0.0443	-0.0322	0.0279	0.0000	0.0000	0.0141	0
.0169	1.0016	-0.0256	0.0208	-0.3059	1.0048	-0.0256	0.0209	-0.0098	-0.0106	-0.0106	-0
.0106	0.7653	0.9863	0.0066	-0.0061	0.9604	0.0066	-0.0070	0.0808	0.0791	0.0785	0

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network id:		index:		1		source type = 0		doublet type = 12		number rows = 8		number columns = 8							
jc	ip	x	y	z	do	pheu	dx	vyu	dz	s0	anx	any	a						
nz	lmachu	wxu	wyu	wzu			vxu	vyl	vzu	cplinu	cpslnu	cp2ndu	cpl						
sn	lmachl	wxl	wyl	wzl		phel	vxl	vyl	vzl	cpllnl	cpslnl	cp2ndl	cpl						
snl	wnu	wnl	wnu	wnl	vtu		vtl	pvtu	pvtl	cplind	cpslnd	cp2ndd	cpl						
sd																			
48	31	32.9791	8.3980	-6.7188	0.3938		0.0734	-0.0501	0.0435	0.0000	0.0000	0.0141	0						
.0784																			
.0891																			
1																			
49	32	31.1216	8.3979	-6.7179	0.2164		0.1693	-0.1168	0.1013	0.0000	0.0000	0.0141	0						
.0169																			
.0429																			
.1046																			
.1475																			
50	33	44.1925	9.9036	-7.9837	0.5979		0.0014	-0.0196	0.0165	0.0000	0.0000	0.0123	0						
.0148																			
.0554																			
.0585																			
.0032																			
51	34	42.5718	9.9034	-7.9822	0.5938		0.0046	-0.0206	0.0173	0.0000	0.0000	0.0123	0						
.0148																			
.0455																			
.0550																			
.0095																			
52	35	40.9511	9.9029	-7.9807	0.5827		0.0091	-0.0221	0.0187	0.0000	0.0000	0.0123	0						
.0148																			
.0354																			
.0540																			

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network id:		index:		1		source type = 0		doublet type = 12		number rows = 8		number columns = 8		1					
jc	ip	x	y	z	d0	dx	dy	vzu	vyl	pvtu	vtl	vtu	phel	phel	vtu	vtu	vtu	vtu	vtu
nz	lmachu	wxu	wyu	wzu	pheu	vxu	vyu	vzu	vyl	pvtl	vtl	vtu	phel	phel	vtu	vtu	vtu	vtu	vtu
snu	lmachl	wxl	wyl	wzl	phel	vxl	vyl	vzl	vyl	pvtl	vtl	vtu	phel	phel	vtu	vtu	vtu	vtu	vtu
snl	wnu	wnl	pwnu	pwnl	vtu	vtl	pvtu	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl	pvtl
55	36	39.3304	9.9027	-7.9795	0.5632	0.0167	-0.0239	0.0204	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0000	0.0000
.0148																			
.07896		0.9957	-0.0208	0.0164	-0.3323	0.9879	-0.0208	0.0162	0.0242	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234
.0234		0.9901	0.0031	-0.0035	-0.8956	0.9713	0.0031	-0.0042	0.0589	0.0571	0.0571	0.0571	0.0571	0.0571	0.0571	0.0571	0.0571	0.0571	0.0571
.0571		0.0000	-0.0275	-0.0275	0.9883	0.9713	0.0121	0.0393	-0.0347	-0.0338	-0.0338	-0.0338	-0.0338	-0.0338	-0.0338	-0.0338	-0.0338	-0.0338	-0.0338
.0337																			
56	37	37.7098	9.9028	-7.9781	0.5269	0.0293	-0.0281	0.0241	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0000	0.0000
.0148																			
.07969		0.9985	-0.0235	0.0187	-0.3200	0.9960	-0.0235	0.0186	0.0080	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071
.0071																			
.0662		0.9885	0.0046	-0.0047	-0.8469	0.9667	0.0046	-0.0055	0.0682	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667
.0662		0.0000	-0.0275	-0.0275	0.9964	0.9667	0.0083	0.0440	-0.0603	-0.0591	-0.0591	-0.0591	-0.0591	-0.0591	-0.0591	-0.0591	-0.0591	-0.0591	-0.0591
.0591																			
57	38	36.0892	9.9027	-7.9767	0.4661	0.0467	-0.0362	0.0313	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0000	0.0000
.0148																			
.08062		1.0021	-0.0281	0.0228	-0.3224	1.0060	-0.0281	0.0229	-0.0124	-0.0134	-0.0134	-0.0134	-0.0134	-0.0134	-0.0134	-0.0134	-0.0134	-0.0134	-0.0134
.0134																			
.07644		0.9859	0.0082	-0.0075	-0.7885	0.9593	0.0082	-0.0084	0.0831	0.0812	0.0812	0.0812	0.0812	0.0812	0.0812	0.0812	0.0812	0.0812	0.0812
.0805																			
.00000		0.0000	-0.0273	-0.0273	1.0067	0.9594	0.0154	0.0525	-0.0955	-0.0940	-0.0940	-0.0940	-0.0940	-0.0940	-0.0940	-0.0940	-0.0940	-0.0940	-0.0940
.0939																			
58	39	34.4689	9.9023	-7.9753	0.3703	0.0782	-0.0549	0.0476	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0000	0.0000
.0148																			
.08222		1.0079	-0.0380	0.0311	-0.3443	1.0229	-0.0380	0.0316	-0.0467	-0.0482	-0.0482	-0.0482	-0.0482	-0.0482	-0.0482	-0.0482	-0.0482	-0.0482	-0.0482
.0484																			
.07521		0.9808	0.0169	-0.0148	-0.7146	0.9447	0.0169	-0.0160	0.1128	0.1090	0.1090	0.1090	0.1090	0.1090	0.1090	0.1090	0.1090	0.1090	0.1090
.1088																			
.00000		0.0000	-0.0273	-0.0273	1.0241	0.9450	0.0359	0.0712	-0.1595	-0.1574	-0.1574	-0.1574	-0.1574	-0.1574	-0.1574	-0.1574	-0.1574	-0.1574	-0.1574
.1571																			
59	40	32.8484	9.9021	-7.9739	0.2042	0.1828	-0.1270	0.1100	0.0000	0.0000	0.0123	0.0000	0.0000	0.0123	0.0000	0.0000	0.0000	0.0000	0.0000
.0148																			
.08773		1.0265	-0.0749	0.0615	-0.4030	1.0762	-0.0749	0.0632	-0.1555	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640
.1634																			
.07122		0.9630	0.0522	-0.0444	-0.6072	0.8934	0.0522	-0.0468	0.2175	0.2045	0.2045	0.2045	0.2045	0.2045	0.2045	0.2045	0.2045	0.2045	0.2045
.2032																			
.00000		0.0000	-0.0275	-0.0275	1.0807	0.8962	0.1078	0.1406	-0.3731	-0.3684	-0.3684	-0.3684	-0.3684	-0.3684	-0.3684	-0.3684	-0.3684	-0.3684	-0.3684
.3666																			

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snd																	
62	41	44.2579	11.4079	-9.2422	0.5332	0.0019	-0.0316	0.0265	0.0000	0.0000	0.0105	0					
.0126		0.9909	-0.0220	0.0173	-0.4324	0.9746	-0.0220	0.0168	0.0508	0.0500	0.0497	0					
.0497		0.7779	0.0096	-0.0091	-0.9657	0.9728	0.0096	-0.0097	0.0564	0.0544	0.0541	0					
.0540		0.7761	0.0000	-0.0276	0.9750	0.9729	0.0253	0.0447	-0.0056	-0.0044	-0.0043	-0					
.0043																	
63	42	42.8745	11.4079	-9.2404	0.5290	0.0052	-0.0318	0.0267	0.0000	0.0000	0.0105	0					
.0126		0.9923	-0.0235	0.0182	-0.4007	0.9786	-0.0235	0.0177	0.0428	0.0420	0.0418	0					
.0418		0.7814	0.0083	-0.0084	-0.9297	0.9734	0.0083	-0.0090	0.0550	0.0530	0.0528	0					
.0527		0.7767	0.0000	-0.0279	0.9790	0.9735	0.0219	0.0432	-0.0122	-0.0111	-0.0110	-0					
.0109																	
64	43	41.4910	11.4075	-9.2387	0.5189	0.0087	-0.0320	0.0269	0.0000	0.0000	0.0105	0					
.0126		0.9936	-0.0240	0.0196	-0.3750	0.9824	-0.0240	0.0192	0.0350	0.0342	0.0341	0					
.0341		0.7848	0.0080	-0.0071	-0.8939	0.9738	0.0080	-0.0077	0.0542	0.0524	0.0521	0					
.0521		0.7769	0.0000	-0.0271	0.9829	0.9738	0.0189	0.0421	-0.0192	-0.0182	-0.0180	-0					
.0180																	
65	44	40.1079	11.4070	-9.2370	0.5042	0.0150	-0.0326	0.0276	0.0000	0.0000	0.0105	0					
.0126		0.9954	-0.0255	0.0199	-0.3543	0.9874	-0.0255	0.0196	0.0250	0.0241	0.0241	0					
.0241		0.7893	0.0071	-0.0073	-0.8584	0.9724	0.0071	-0.0080	0.0570	0.0552	0.0549	0					
.0549		0.7757	0.0000	-0.0279	0.9879	0.9724	0.0154	0.0426	-0.0320	-0.0311	-0.0308	-0					
.0308																	
66	45	38.7248	11.4071	-9.2351	0.4755	0.0279	-0.0352	0.0300	0.0000	0.0000	0.0105	0					
.0126		0.9982	-0.0275	0.0215	-0.3428	0.9954	-0.0275	0.0214	0.0090	0.0080	0.0080	0					
.0080		0.7965	0.0077	-0.0079	-0.8183	0.9674	0.0077	-0.0086	0.0669	0.0651	0.0647	0					
.0646		0.7714	0.0000	-0.0279	0.9960	0.9675	0.0131	0.0465	-0.0579	-0.0570	-0.0566	-0					
.0566																	
67	46	37.3418	11.4069	-9.2334	0.4248	0.0469	-0.0415	0.0357	0.0000	0.0000	0.0105	0					
.0126		1.0020	-0.0309	0.0250	-0.3443	1.0061	-0.0309	0.0251	-0.0127	-0.0138	-0.0138	-0					
.0138		0.8064	0.0106	-0.0096	-0.7691	0.9593	0.0106	-0.0106	0.0834	0.0814	0.0807	0					
.0806		0.7644	0.0000	-0.0274	1.0069	0.9594	0.0187	0.0548	-0.0962	-0.0952	-0.0945	-0					
.0944																	
68	47	35.9585	11.4065	-9.2317	0.3406	0.0821	-0.0598	0.0517	0.0000	0.0000	0.0105	0					

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.0126	0.8242	1.0086	-0.0408	0.0328	-0.3642	1.0248	-0.0408	0.0334	-0.0507	-0.0524	-0.0526	-0
.0526	0.7506	0.9801	0.0190	-0.0170	-0.7048	0.9427	0.0190	-0.0183	0.1170	0.1140	0.1127	0
.1125	0.0000	0.0000	-0.0277	-0.0277	1.0262	0.9431	0.0396	0.0747	-0.1677	-0.1664	-0.1654	-0
.1651												
.69	48	34.5750	11.4064	-9.2298	0.1888	0.1978	-0.1381	0.1195	0.0000	0.0000	0.0105	0
.0126	0.8855	1.0291	-0.0806	0.0657	-0.4193	1.0836	-0.0806	0.0676	-0.1707	-0.1780	-0.1807	-0
.1799												
.07067		0.9604	0.0575	-0.0493	-0.6081	0.8859	0.0575	-0.0519	0.2330	0.2228	0.2179	0
.2164	0.0000	0.0000	-0.0279	-0.0279	1.0887	0.8892	0.1182	0.1511	-0.4036	-0.4009	-0.3986	-0
.3962												
.72	49	44.3232	12.9125	-10.5007	0.4285	0.0014	-0.0546	0.0457	0.0000	0.0000	0.0087	0
.0104	0.7803	0.9914	-0.0341	0.0272	-0.4570	0.9768	-0.0341	0.0267	0.0458	0.0446	0.0444	0
.0444	0.7788	0.9919	0.0204	-0.0185	-0.8854	0.9753	0.0204	-0.0190	0.0519	0.0486	0.0484	0
.0483	0.0000	0.0000	-0.0278	-0.0278	0.9777	0.9757	0.0308	0.0557	-0.0060	-0.0040	-0.0040	-0
.0039												
.73	50	43.1771	12.9122	-10.4987	0.4256	0.0040	-0.0545	0.0457	0.0000	0.0000	0.0087	0
.0104	0.7828	0.9924	-0.0352	0.0277	-0.4325	0.9795	-0.0352	0.0272	0.0403	0.0390	0.0389	0
.0388	0.7789	0.9920	0.0193	-0.0179	-0.8581	0.9755	0.0193	-0.0184	0.0515	0.0484	0.0481	0
.0481	0.0000	0.0000	-0.0281	-0.0281	0.9805	0.9759	0.0297	0.0545	-0.0112	-0.0093	-0.0093	-0
.0092												
1	network id:	index:	1	source type = 0	doublet type = 12	number rows = 8	number columns = 8					
jc	ip	x	y	z	do	dx	dy	dz	s0	anx	any	a
nz	lmachu	wxu	wyu	wzu	pheu	vxu	vyu	vzu	cplnu	cpslnu	cp2ndu	cp1
snu	lmachl	wxl	wyl	wzl	phei	vxl	vyl	vzl	cplnl	cpslnl	cp2ndl	cp1
snl	wnu	wnl	pwnu	pwnl	vtu	vtl	pvtu	pvtl	cplind	cpslnd	cp2ndd	cp1
snd												
.74	51	42.0309	12.9120	-10.4967	0.4194	0.0065	-0.0537	0.0450	0.0000	0.0000	0.0087	0
.0104	0.7852	0.9934	-0.0354	0.0282	-0.4115	0.9822	-0.0354	0.0278	0.0348	0.0335	0.0334	0
.0333	0.7790	0.9920	0.0183	-0.0167	-0.8309	0.9757	0.0183	-0.0172	0.0509	0.0480	0.0477	0
.0477	0.0000	0.0000	-0.0278	-0.0278	0.9833	0.9760	0.0284	0.0530	-0.0162	-0.0145	-0.0144	-0
.0144												
.75	52	40.8853	12.9116	-10.4945	0.4102	0.0110	-0.0534	0.0448	0.0000	0.0000	0.0087	0
.0104												

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0.7885	0.9947	-0.0361	0.0283	-0.3936	0.9859	-0.0361	0.0280	0.0275	0.0262	0.0261	0						
.0261																	
0.7782	0.9917	0.0172	-0.0162	-0.8038	0.9748	0.0172	-0.0168	0.0527	0.0498	0.0495	0						
.0495																	
0.0000	0.0000	-0.0282	-0.0282	0.9869	0.9751	0.0269	0.0524	-0.0252	-0.0236	-0.0234	-0						
.0234																	
76 53	39.7398	12.9114	-10.4924	0.3929	0.0211	-0.0536	0.0452	0.0000	0.0000	0.0087	0						
.0104																	
0.7941	0.9969	-0.0368	0.0290	-0.3813	0.9921	-0.0368	0.0288	0.0150	0.0136	0.0135	0						
.0135																	
0.7749	0.9903	0.0168	-0.0157	-0.7742	0.9711	0.0168	-0.0164	0.0602	0.0574	0.0571	0						
.0570																	
0.0000	0.0000	-0.0281	-0.0281	0.9932	0.9713	0.0254	0.0538	-0.0452	-0.0438	-0.0435	-0						
.0435																	
77 54	38.5940	12.9110	-10.4904	0.3601	0.0390	-0.0560	0.0477	0.0000	0.0000	0.0087	0						
.0104																	
0.8033	1.0005	-0.0382	0.0309	-0.3780	1.0022	-0.0382	0.0309	-0.0053	-0.0068	-0.0068	-0						
.0068																	
0.7680	0.9875	0.0178	-0.0159	-0.7382	0.9632	0.0178	-0.0167	0.0760	0.0732	0.0726	0						
.0725																	
0.0000	0.0000	-0.0276	-0.0276	1.0034	0.9635	0.0269	0.0591	-0.0813	-0.0800	-0.0794	-0						
.0793																	
78 55	37.4480	12.9106	-10.4883	0.2983	0.0783	-0.0700	0.0601	0.0000	0.0000	0.0087	0						
.0104																	
0.8227	1.0078	-0.0463	0.0364	-0.3905	1.0228	-0.0463	0.0369	-0.0470	-0.0491	-0.0493	-0						
.0493																	
0.7523	0.9809	0.0238	-0.0219	-0.6887	0.9445	0.0238	-0.0232	0.1138	0.1101	0.1089	0						
.1087																	
0.0000	0.0000	-0.0285	-0.0285	1.0245	0.9451	0.0437	0.0780	-0.1608	-0.1592	-0.1583	-0						
.1580																	
79 56	36.3021	12.9107	-10.4861	0.1687	0.2123	-0.1512	0.1306	0.0000	0.0000	0.0087	0						
.0104																	
0.8937	1.0315	-0.0871	0.0708	-0.4378	1.0907	-0.0871	0.0728	-0.1852	-0.1940	-0.1970	-0						
.1961																	
0.7016	0.9578	0.0641	-0.0550	-0.6066	0.8784	0.0641	-0.0578	0.2483	0.2364	0.2309	0						
.2289																	
0.0000	0.0000	-0.0282	-0.0282	1.0966	0.8826	0.1291	0.1625	-0.4335	-0.4304	-0.4279	-0						
.4250																	
82 57	44.3885	14.4174	-11.7593	0.2395	-0.0004	-0.1363	0.1141	0.0000	0.0000	0.0069	0						
.0083																	
0.7852	0.9910	-0.0761	0.0613	-0.5250	0.9777	-0.0761	0.0609	0.0415	0.0350	0.0349	0						
.0348																	
0.7847	0.9937	0.0602	-0.0526	-0.7644	0.9781	0.0602	-0.0532	0.0487	0.0375	0.0373	0						
.0371																	
0.0000	0.0000	-0.0285	-0.0285	0.9826	0.9814	0.0781	0.1049	-0.0072	-0.0025	-0.0024	-0						
.0024																	
83 58	43.4799	14.4169	-11.7570	0.2381	0.0018	-0.1356	0.1135	0.0000	0.0000	0.0069	0						
.0083																	
0.7872	0.9918	-0.0760	0.0618	-0.5067	0.9799	-0.0760	0.0614	0.0371	0.0306	0.0305	0						
.0304																	
0.7846	0.9936	0.0596	-0.0515	-0.7448	0.9780	0.0596	-0.0521	0.0487	0.0378	0.0375	0						
.0784																	

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0374	0.0000	0.0000	-0.0281	-0.0281	0.9848	0.9812	0.0778	0.1037	-0.0116	-0.0072	-0.0071	-0
0070												
84	59	42.5713	14.4167	-11.7548	0.2366	0.0029	-0.1345	0.1125	0.0000	0.0000	0.0069	0
0083												
0.7886		0.9923	-0.0766	0.0612	-0.4894	0.9815	-0.0766	0.0608	0.0340	0.0275	0.0274	0
0.0273												
0.7849		0.9938	0.0580	-0.0512	-0.7260	0.9785	0.0580	-0.0517	0.0477	0.0370	0.0368	0
0.0366												
0.0000		0.0000	-0.0289	-0.0289	0.9863	0.9816	0.0775	0.1021	-0.0137	-0.0095	-0.0094	-0
0.0093												
85	60	41.6630	14.4162	-11.7521	0.2332	0.0049	-0.1330	0.1112	0.0000	0.0000	0.0069	0
0.0083												
0.7903		0.9931	-0.0762	0.0612	-0.4741	0.9834	-0.0762	0.0609	0.0301	0.0235	0.0235	0
0.0234												
0.7848		0.9938	0.0568	-0.0498	-0.7072	0.9786	0.0568	-0.0503	0.0476	0.0372	0.0370	0
0.0369												
0.0000		0.0000	-0.0286	-0.0286	0.9883	0.9815	0.0768	0.1004	-0.0175	-0.0137	-0.0136	-0
0.0135												
1	network id:	index:	1	source type = 0	doublet type = 12	number rows = 8	number columns = 8					
jc	ip	x	y	z	d0	dx	dy	dz	s0	anx	any	a
nz	lmachu	wxu	wyu	wzu	pheu	vxu	vyu	vzu	cp1nu	cps1nu	cp2ndu	cp1
sn	lmachl	wxl	wyl	wzl	phel	vxl	vyl	vzl	cp1nl	cps1nl	cp2ndl	cp1
snl	wnl	pwnu	pwnl	vtu	pvtu	vtl	pvtu	pvtl	cp1nd	cps1nd	cp2ndd	cp1
snd												
86	61	40.7547	14.4158	-11.7497	0.2278	0.0077	-0.1302	0.1088	0.0000	0.0000	0.0069	0
0.0083												
0.7923		0.9939	-0.0752	0.0605	-0.4606	0.9858	-0.0752	0.0603	0.0254	0.0191	0.0190	0
0.0190												
0.7841		0.9936	0.0550	-0.0480	-0.6884	0.9780	0.0550	-0.0486	0.0485	0.0386	0.0384	0
0.0383												
0.0000		0.0000	-0.0285	-0.0285	0.9905	0.9808	0.0752	0.0980	-0.0231	-0.0195	-0.0194	-0
0.0193												
87	62	39.8463	14.4154	-11.7475	0.2185	0.0140	-0.1254	0.1050	0.0000	0.0000	0.0069	0
0.0083												
0.7955		0.9954	-0.0731	0.0591	-0.4498	0.9898	-0.0731	0.0589	0.0176	0.0116	0.0116	0
0.0116												
0.7817		0.9927	0.0523	-0.0454	-0.6683	0.9758	0.0523	-0.0460	0.0529	0.0437	0.0435	0
0.0433												
0.0000		0.0000	-0.0282	-0.0282	0.9942	0.9783	0.0722	0.0950	-0.0353	-0.0321	-0.0318	-0
0.0317												
88	63	38.9378	14.4150	-11.7451	0.1989	0.0410	-0.1251	0.1052	0.0000	0.0000	0.0069	0
0.0083												
0.8084		1.0005	-0.0738	0.0587	-0.4450	1.0040	-0.0738	0.0589	-0.0109	-0.0170	-0.0170	-0
0.0169												
0.7706		0.9881	0.0513	-0.0454	-0.6439	0.9631	0.0513	-0.0463	0.0783	0.0693	0.0687	0
0.0685												

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force / moment data for network 1

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5		29.12062	0.00001	0.00945	0.01131	0.15828	0.05062	-0.0422				
8		29.12062	0.00001	0.00972	0.01165	0.16305	0.05440	-0.0454				
2												
	totals for column	5	area	fx	fy	fz	mx	my	mz			
5		25.40189	0.00000	0.00073	0.00088	0.01453	0.00560	-0.0046				
3		25.40189	0.00001	0.00845	0.01012	0.16733	0.04459	-0.0372				
8		25.40189	0.00001	0.00917	0.01100	0.18186	0.05018	-0.0418				
	totals for column	6	area	fx	fy	fz	mx	my	mz			
4		21.67510	0.00000	0.00094	0.00114	0.02161	0.00619	-0.0051				
2		21.67510	0.00001	0.00726	0.00870	0.16598	0.03775	-0.0315				
6		21.67510	0.00001	0.00820	0.00984	0.18759	0.04394	-0.0366				
	totals for column	7	area	fx	fy	fz	mx	my	mz			
6		17.95490	0.00000	0.00085	0.00103	0.02206	0.00525	-0.0043				
6		17.95490	0.00001	0.00580	0.00695	0.14997	0.02966	-0.0247				
2		17.95490	0.00001	0.00665	0.00797	0.17204	0.03491	-0.0291				
	totals for column	8	area	fx	fy	fz	mx	my	mz			
4		14.22880	0.00000	0.00037	0.00045	0.01058	0.00233	-0.0019				
9		14.22880	0.00001	0.00352	0.00422	0.10168	0.01772	-0.0147				
3		14.22880	0.00001	0.00389	0.00467	0.11226	0.02005	-0.0167				
	totals for network		area	fx	fy	fz	mx	my	mz			
9		218.09473	0.00000	-0.00237	-0.00279	0.02527	0.00427	-0.0033				
		218.09473	0.00005	0.06546	0.07837	1.07455	0.35320	-0.2950				

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3																			
2																			
totals for all networks so far																			
9																			
3																			
2																			
0*e*for-mom																			
1																			
network id:		index: 2		source type = 0		doublet type = 12		number rows = 8		number columns = 8									
jc	ip	x	y	z	d0	dx	dy	dz	s0	any	any	any	any	any	any	any	any	any	any
nz	lmachu	wxu	wyu	wzu	pheu	vxu	vzu	vzu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu	cp2ndu
snu	lmachl	wxl	wyl	wzl	phe1	vx1	vyl	vzl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl	cp2ndl
snl	wnu	wnl	pwnu	pwml	vtu	vtl	pvtu	pvtl	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd	cp2ndd
snd																			
112	65	43.9301	-2.9497	-3.8857	-0.3830	0.0239	0.1109	0.1332	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
.0196																			
.0436	0.7810	0.9895	0.0571	0.0684	-1.0960	0.9741	0.0571	0.0679	0.0483	0.0439	0.0437	0.0437	0.0437	0.0437	0.0437	0.0437	0.0437	0.0437	0.0437
.07609	0.9839	-0.0538	-0.0538	-0.0641	-0.7130	0.9501	-0.0538	-0.0653	0.1054	0.0928	0.0918	0.0918	0.0918	0.0918	0.0918	0.0918	0.0918	0.0918	0.0918
.0914																			
.0477	0.0000	0.0000	0.0222	0.0222	0.9781	0.9539	0.0669	0.1218	-0.0571	-0.0489	-0.0481	-0.0481	-0.0481	-0.0481	-0.0481	-0.0481	-0.0481	-0.0481	-0.0481
113	66	41.3597	-2.9495	-3.8858	-0.4581	0.0263	0.0643	0.0775	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
.0196																			
.0265	0.7883	0.9942	0.0345	0.0412	-1.0532	0.9853	0.0345	0.0409	0.0278	0.0266	0.0265	0.0265	0.0265	0.0265	0.0265	0.0265	0.0265	0.0265	0.0265
.0791	0.7655	0.9864	-0.0298	-0.0356	-0.5950	0.9590	-0.0298	-0.0366	0.0857	0.0800	0.0793	0.0793	0.0793	0.0793	0.0793	0.0793	0.0793	0.0793	0.0793
.0526	0.0000	0.0000	0.0224	0.0224	0.9867	0.9601	0.0302	0.0842	-0.0579	-0.0534	-0.0528	-0.0528	-0.0528	-0.0528	-0.0528	-0.0528	-0.0528	-0.0528	-0.0528
114	67	38.7894	-2.9495	-3.8858	-0.5064	0.0122	0.0308	0.0371	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
.0196																			
.0339	0.7849	0.9936	0.0181	0.0216	-1.0143	0.9826	0.0181	0.0212	0.0345	0.0340	0.0339	0.0339	0.0339	0.0339	0.0339	0.0339	0.0339	0.0339	0.0339
.0583	0.7743	0.9901	-0.0127	-0.0152	-0.5079	0.9705	-0.0127	-0.0159	0.0614	0.0587	0.0584	0.0584	0.0584	0.0584	0.0584	0.0584	0.0584	0.0584	0.0584
.0245	0.0000	0.0000	0.0224	0.0224	0.9830	0.9707	0.0168	0.0553	-0.0269	-0.0248	-0.0245	-0.0245	-0.0245	-0.0245	-0.0245	-0.0245	-0.0245	-0.0245	-0.0245
115	68	36.2197	-2.9493	-3.8859	-0.5195	-0.0020	0.0076	0.0091	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
.0196																			
0.7800	0.9921	0.0066	0.0066	0.0081	-0.9653	0.9774	0.0066	0.0076	0.0459	0.0451	0.0449	0.0449	0.0449	0.0449	0.0449	0.0449	0.0449	0.0449	0.0449

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