

NASA Contractor Report 178299

DESCRIPTION OF AN AERONAUTICAL
GEOMETRY CONVERSION PACKAGE:
WAVE-DRAG TO LANGLEY TO SIMP

(NASA-CR-178299) DESCRIPTION OF AN AERONAUTICAL GEOMETRY CONVERSION PACKAGE:
WAVE-DRAG TO LANGLEY WIREFRAME GEOMETRY STANDARD (LANGS) TO SUPERSONIC IMPLICIT MARCHING POTENTIAL (Computer Sciences Corp.)

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FOREWORD

This document was prepared by Computer Sciences Corporation, Applied Technology Division, for the National Aeronautics and Space Administration, Langley Research Center at Hampton, Virginia. The work was performed under contract No. NAS1-17999. Mr. Kenneth Jones was the NASA Project Monitor for this task.

SUMMARY

This document describes a translator that will convert a model data file described in either wave-drag or LaWGS geometry format into the Supersonic Implicit Marching Potential (SIMP) program input format. Four programs are incorporated into the procedure used to generate the cross-sectional data required by SIMP. Each program is described and a sample case is presented.

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INTRODUCTION

Many programs have been developed to allow researchers to numerically define arbitrary shapes for analysis or construction of experimental models. One frequently used program is the geometry generation portion of the supersonic zero-lift wave-drag computer program¹. With this program the configuration geometry is described with discrete points. The contours of the configuration are then formed by connecting the points with straight lines. The discrete points are set up so that when the proper connection scheme is followed the result is a wireframe model representation of the geometry.

The Langley Wireframe Geometry Standard² (LaWGS) has been established so that the same numerical model can be used by many application programs. This wireframe geometry standard provides the common link and simplifies the translation of geometry from one format to another. Existing programs that use geometry formats that are not LaWGS compatible need translators that will convert their non-standard formats into the LaWGS format.

A geometry can be described as one complete component or a sum of individual components (e.g. body, wing, tail). Typically, complex aircraft configurations are defined as a sum of components. Fuselage type components are defined by sets of discrete points at constant X locations while lifting surface type components are defined at constant Y locations. These components are then merged together to form the complete configuration. This type of geometry definition works well for

the zero-lift wave-drag computer program but not for all aerodynamic analysis programs.

One program this geometry is not compatible with is the Supersonic Implicit Marching Potential³ (SIMP) program. The SIMP code is an aerodynamic analysis program that is formulated from the conservative potential equation. Configurations must be defined with discrete points at constant X locations. These X location descriptions must be for all components at that X location, including lifting surface type components. Since many aircraft configuration geometry definitions can be written in LaWGS format or can be translated to that format, a procedure was needed to allow these configurations to be examined with the SIMP code.

Four computer programs have been developed that convert wave-drag geometry to the LaWGS input format and then into an input format compatible with the SIMP code. The first program, KWD2LWG, converts the wave-drag geometry description into the LaWGS input format. The second program, KINTERL, is used to calculate the leading and trailing intersection points between the fuselage and lifting surfaces intersecting the fuselage (e.g. fuselage/wing, fuselage/canard, fuselage/fin). The third program KLINCRX, is used to generate the discrete points at constant X locations. This translation of the LaWGS input format to the discrete point SIMP input is accomplished using linear interpolation between the wave-drag fuselage type components and the lifting surface type components. The fourth program, KLINFIX, is used to interactively enhance the output from program KLINCRX.

A functional flow diagram of this translator that converts wave-drag format to the SIMP format is provided in figure 1.

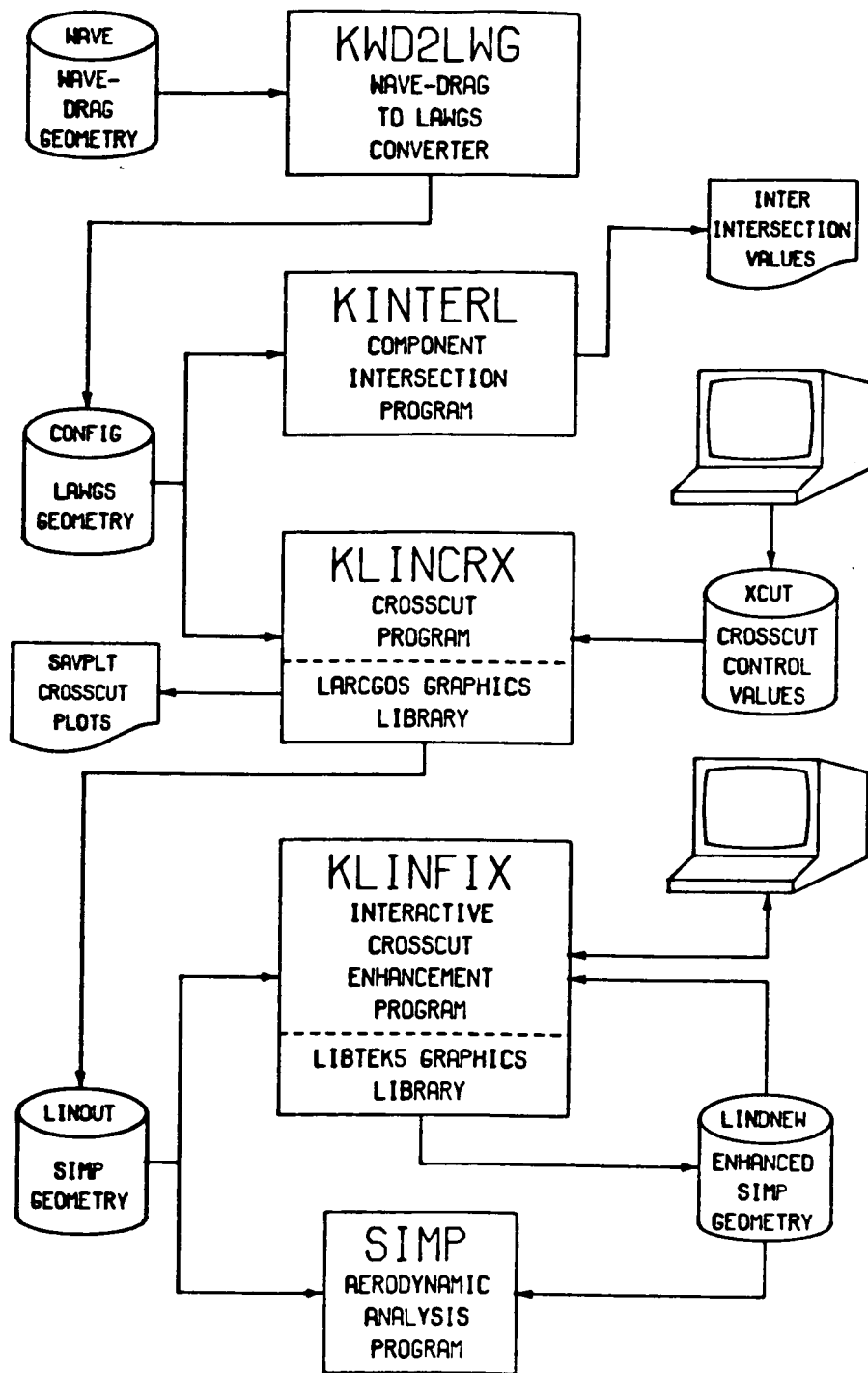


Figure 1: Functional Flow of Translator

MODEL GEOMETRY

The wireframe geometry uses points and lines rather than solid elements or surfaces in its definition. A 3-D right-handed Cartesian coordinate system is used with the Z-axis positive upward, the Y-axis positive out the right wing, and the X-axis positive down the body. It is assumed that the configuration is symmetric about the X-Z plane at a Y value of zero and that all components are defined with respect to a global coordinate system. Therefore, only those parts of the fuselage, pod, wing, horizontal tail, and canard on the positive side of the Y-axis are described in the model geometry database. For a fin centered on the line of symmetry, both left and right sides of each airfoil must be described in the database. Figure 2 illustrates the coordinate system conventions.

The fuselage is described by a series of cross sections in the X-axis direction. The data at each unique axial location is ordered clockwise top to bottom when viewed from the rear looking toward the nose.

The wing, canard, and horizontal tail (if present) are defined by unique airfoil sections which proceed inboard to outboard in the Y-axis direction. All three must intersect the fuselage. Airfoil data is ordered clockwise leading edge to trailing edge (top) and then trailing edge to leading edge (bottom). The number of points on top must equal the number of points on the bottom. The tip chord of the wing and canard must be an airfoil with zero thickness. An open ended component is not allowed.

The fin is defined by unique airfoil sections which proceed inboard to outboard in the Z-axis direction. It must intersect the fuselage. Airfoil data is ordered clockwise leading edge to trailing edge (positive Y) and then trailing edge to leading edge (negative Y). The number of points on the right and left sides must be equal.

A pod is described by a series of unique cross sections in the X-axis direction. The data at each axial location is ordered clockwise and the last point must equal the first point. The pod must intersect the wing.

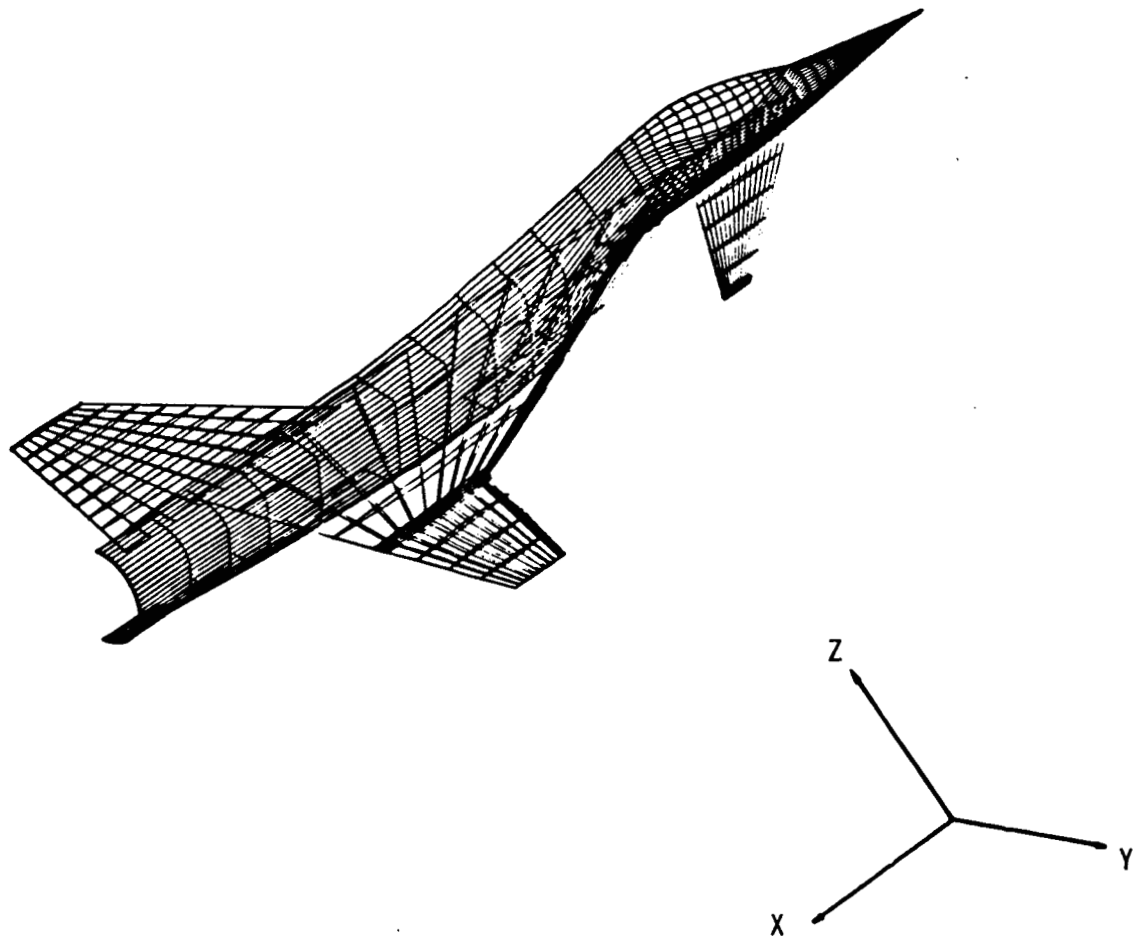


Figure 2: Coordinate System Conventions

PROGRAM KWD2LWG

Program KWD2LWG is used to translate the wave-drag geometry description into the LaWGS input format. The file descriptions are:

<u>File Name</u>	<u>Description</u>
WAVE	wave-drag geometry
CONFIG	LaWGS geometry

Arrays in KWD2LWG are sized via parameter statements. These parameter variables are:

<u>Variable</u>	<u>Description</u>
NVL	maximum number of contour lines per component, currently 50
NVP	maximum number of points per contour line, currently 50

GEOMETRY INPUT FILE CONFIG

The data description file which is used as input to KINTERL and KLINCRX is named CONFIG. A maximum of one fuselage, one wing, one canard or horizontal tail, one fin, and one pod are allowed. The structure of this file follows the Langley Wireframe Geometry Standard (LaWGS) format.

Data is entered into a LaWGS file in list-directed format which complies with the American National Standards Institute (ANSI) FORTRAN 77 language. List-directed input/output processes coded data without a FORMAT statement. The input data values are free-form with separators rather than fixed-size fields. Separators can be one or more blanks, commas, or slashes, either of which can be preceded or followed by any number of blanks. Character strings must be enclosed in single quotes. The LaWGS input format is:

<u>Record</u>	<u>Variable</u>	<u>Description</u>
1	IDCONF	Identification of LaWGS configuration (1-80 alphanumeric characters enclosed in single quotes).
		(Repeat record sets 2, 3, and 4 for each object.)
2	IDOBJ	Object identification (1-80 alphanumeric characters enclosed in single quotes).
3	NOBJ	Object number (integer identification unique to object).
	NLINE	Number of contour lines to be listed for object.
	NPNT	Number of points listed for each contour line.

<u>Record</u>	<u>Variable</u>	<u>Description</u>
	ISYML	In its local coordinate system, the object is = 0, not symmetrical. = 1, symmetrical about its local X-Z axis. = 2, symmetrical about its local X-Y axis. = 3, symmetrical about its local Y-Z axis.
	RX RY RZ	Rotation of the object about its local X, Y, Z axes, respectively (roll, pitch, yaw), in degrees.
	TX TY TZ	Translation of the object along the X, Y, Z axes, respectively, to move the object to the global system from its local system, in units consistent with object input points.
	XSCALE YSCALE ZSCALE	Scale factors applied to the X, Y, Z coordinates, respectively, that will transform the object points into global units.
	ISYMG	In the global coordinate system, the object is = 0, not symmetrical. = 1, symmetrical about the global X-Z axis. = 2, symmetrical about the global X-Y axis. = 3, symmetrical about the global Y-Z axis.
4	$(x,y,z)_{m,n}$	Point coordinates of the object, where $m = 1$ to NPNT for each $n = 1$ to NLINE. For readability, begin a new record image for each contour: $(x,y,z)_{1,1} \text{ --- } (x,y,z)_{NPNT,1}$ $(x,y,z)_{1,2} \text{ --- } (x,y,z)_{NPNT,2}$ - - $(x,y,z)_{1,NLINE} \text{ --- } (x,y,z)_{NPNT,NLINE}$

An example of this format is shown in figures 3a thru 3i.

PAB102 FORWARD FUSELAGE

FUSELAGE													
1	32	30	0	.0	.0	.0	.0	.0	.0	1.0	1.0	1.0	1
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1.000	.000	.213	1.000	.000	.213	1.000	.000	.213	1.000	.000	.213	1.000	.000
1.000	.000	.213	1.000	.017	.211	1.000	.034	.207	1.000	.051	.201	1.000	.000
1.000	.067	.193	1.000	.081	.183	1.000	.094	.171	1.000	.106	.158	1.000	.000
1.000	.115	.143	1.000	.124	.128	1.000	.131	.112	1.000	.136	.095	1.000	.000
1.000	.140	.078	1.000	.142	.060	1.000	.141	.043	1.000	.138	.025	1.000	.000
1.000	.132	.009	1.000	.123	-.006	1.000	.111	-.020	1.000	.098	-.031	1.000	.000
1.000	.084	-.041	1.000	.068	-.049	1.000	.052	-.055	1.000	.035	-.060	1.000	.000
1.000	.017	-.062	1.000	.000	-.064	1.000	.000	-.064	1.000	.000	-.064	1.000	.000
2.000	.000	.427	2.000	.000	.427	2.000	.000	.427	2.000	.000	.427	2.000	.000
2.000	.000	.427	2.000	.035	.422	2.000	.069	.415	2.000	.102	.403	2.000	.000
2.000	.133	.387	2.000	.162	.366	2.000	.188	.342	2.000	.211	.315	2.000	.000
2.000	.231	.287	2.000	.247	.256	2.000	.261	.223	2.000	.272	.190	2.000	.000
2.000	.280	.156	2.000	.284	.121	2.000	.283	.086	2.000	.276	.051	2.000	.000
2.000	.264	.018	2.000	.246	-.012	2.000	.223	-.039	2.000	.197	-.062	2.000	.000
2.000	.167	-.082	2.000	.136	-.098	2.000	.103	-.111	2.000	.070	-.120	2.000	.000
2.000	.035	-.125	2.000	.000	-.128	2.000	.000	-.128	2.000	.000	-.128	2.000	.000
3.000	.000	.640	3.000	.000	.640	3.000	.000	.640	3.000	.000	.640	3.000	.000
3.000	.000	.640	3.000	.052	.632	3.000	.103	.620	3.000	.153	.603	3.000	.000
3.000	.200	.579	3.000	.243	.548	3.000	.282	.513	3.000	.317	.473	3.000	.000
3.000	.346	.429	3.000	.371	.383	3.000	.392	.335	3.000	.408	.284	3.000	.000
3.000	.420	.233	3.000	.426	.181	3.000	.424	.128	3.000	.414	.076	3.000	.000
3.000	.396	.027	3.000	.369	-.019	3.000	.335	-.059	3.000	.295	-.093	3.000	.000
3.000	.251	-.123	3.000	.204	-.147	3.000	.155	-.166	3.000	.104	-.179	3.000	.000
3.000	.052	-.187	3.000	.000	-.192	3.000	.000	-.192	3.000	.000	-.192	3.000	.000
3.500	.000	.747	3.500	.000	.747	3.500	.000	.747	3.500	.000	.747	3.500	.000
3.500	.000	.747	3.500	.061	.737	3.500	.121	.723	3.500	.178	.703	3.500	.000
3.500	.233	.675	3.500	.284	.640	3.500	.329	.598	3.500	.369	.552	3.500	.000
3.500	.404	.501	3.500	.433	.447	3.500	.457	.390	3.500	.476	.332	3.500	.000
3.500	.490	.272	3.500	.497	.211	3.500	.495	.149	3.500	.483	.089	3.500	.000
3.500	.462	.031	3.500	.430	-.022	3.500	.390	-.069	3.500	.344	-.109	3.500	.000
3.500	.293	-.143	3.500	.238	-.172	3.500	.181	-.194	3.500	.122	-.209	3.500	.000
3.500	.061	-.218	3.500	.000	-.224	3.500	.000	-.224	3.500	.000	-.224	3.500	.000
4.000	.000	.854	4.000	.000	.854	4.000	.000	.854	4.000	.000	.854	4.000	.000
4.000	.000	.846	4.000	.070	.838	4.000	.139	.825	4.000	.205	.804	4.000	.000
4.000	.268	.772	4.000	.325	.730	4.000	.377	.683	4.000	.423	.629	4.000	.000
4.000	.462	.572	4.000	.495	.510	4.000	.523	.445	4.000	.544	.378	4.000	.000
4.000	.560	.310	4.000	.568	.240	4.000	.566	.170	4.000	.552	.101	4.000	.000
4.000	.527	.035	4.000	.491	-.025	4.000	.446	-.079	4.000	.393	-.125	4.000	.000
4.000	.334	-.164	4.000	.272	-.196	4.000	.207	-.222	4.000	.139	-.239	4.000	.000
4.000	.070	-.250	4.000	.000	-.256	4.000	.000	-.256	4.000	.000	-.256	4.000	.000
4.500	.000	.960	4.500	.000	.960	4.500	.000	.960	4.500	.000	.960	4.500	.000
4.500	.000	.960	4.500	.078	.947	4.500	.155	.930	4.500	.229	.904	4.500	.000
4.500	.300	.868	4.500	.365	.823	4.500	.423	.769	4.500	.475	.709	4.500	.000
4.500	.520	.644	4.500	.557	.575	4.500	.587	.502	4.500	.612	.427	4.500	.000
4.500	.630	.349	4.500	.639	.271	4.500	.636	.192	4.500	.622	.114	4.500	.000
4.500	.594	.040	4.500	.553	-.028	4.500	.502	-.088	4.500	.442	-.140	4.500	.000
4.500	.377	-.184	4.500	.306	-.221	4.500	.233	-.249	4.500	.157	-.269	4.500	.000
4.500	.079	-.281	4.500	.000	-.288	4.500	.000	-.288	4.500	.000	-.288	4.500	.000
5.000	.000	1.067	5.000	.000	1.067	5.000	.000	1.067	5.000	.000	1.067	5.000	.000

Figure 3a: File CONFIG

5.000	.000	1.067	5.000	.087	1.053	5.000	.172	1.033	5.000	.255	1.005
5.000	.333	.965	5.000	.405	.914	5.000	.470	.855	5.000	.528	.788
5.000	.577	.716	5.000	.619	.639	5.000	.653	.558	5.000	.680	.474
5.000	.700	.388	5.000	.710	.301	5.000	.707	.213	5.000	.691	.127
5.000	.660	.045	5.000	.614	-.031	5.000	.558	-.098	5.000	.492	-.156
5.000	.418	-.205	5.000	.340	-.245	5.000	.259	-.277	5.000	.174	-.299
5.000	.087	-.312	5.000	.000	-.320						
5.500	.000	1.258	5.500	.066	1.229	5.500	.114	1.176	5.500	.152	1.114
5.500	.180	1.047	5.500	.261	1.018	5.500	.341	.985	5.500	.415	.943
5.500	.484	.892	5.500	.547	.832	5.500	.602	.767	5.500	.651	.696
5.500	.692	.620	5.500	.725	.541	5.500	.750	.459	5.500	.768	.374
5.500	.776	.289	5.500	.773	.203	5.500	.755	.118	5.500	.725	.038
5.500	.680	-.036	5.500	.625	-.103	5.500	.561	-.160	5.500	.490	-.209
5.500	.414	-.250	5.500	.336	-.285	5.500	.254	-.312	5.500	.171	-.331
5.500	.086	-.343	5.500	.000	-.351						
6.000	.000	1.436	6.000	.124	1.386	6.000	.218	1.289	6.000	.290	1.174
6.000	.346	1.050	6.000	.417	1.004	6.000	.486	.954	6.000	.550	.899
6.000	.609	.837	6.000	.663	.771	6.000	.710	.700	6.000	.751	.626
6.000	.784	.547	6.000	.809	.466	6.000	.826	.382	6.000	.833	.298
6.000	.830	.212	6.000	.814	.128	6.000	.786	.047	6.000	.745	-.027
6.000	.693	-.095	6.000	.631	-.154	6.000	.563	-.205	6.000	.490	-.249
6.000	.413	-.286	6.000	.334	-.317	6.000	.252	-.342	6.000	.169	-.359
6.000	.085	-.370	6.000	.000	-.378						
6.500	.000	1.603	6.500	.176	1.535	6.500	.311	1.401	6.500	.416	1.241
6.500	.496	1.067	6.500	.556	1.007	6.500	.614	.944	6.500	.667	.878
6.500	.715	.807	6.500	.759	.734	6.500	.798	.658	6.500	.830	.579
6.500	.855	.498	6.500	.872	.414	6.500	.882	.329	6.500	.882	.244
6.500	.870	.159	6.500	.847	.076	6.500	.811	-.001	6.500	.763	-.072
6.500	.705	-.136	6.500	.640	-.191	6.500	.568	-.238	6.500	.493	-.279
6.500	.415	-.314	6.500	.335	-.344	6.500	.253	-.367	6.500	.170	-.383
6.500	.085	-.393	6.500	.000	-.401						
7.000	.000	1.756	7.000	.220	1.675	7.000	.392	1.510	7.000	.524	1.313
7.000	.627	1.098	7.000	.676	1.027	7.000	.723	.954	7.000	.766	.879
7.000	.804	.801	7.000	.839	.722	7.000	.869	.640	7.000	.893	.557
7.000	.911	.473	7.000	.922	.387	7.000	.927	.300	7.000	.921	.213
7.000	.905	.128	7.000	.877	.045	7.000	.836	-.031	7.000	.783	-.101
7.000	.721	-.162	7.000	.653	-.216	7.000	.579	-.262	7.000	.502	-.301
7.000	.422	-.336	7.000	.341	-.365	7.000	.257	-.388	7.000	.172	-.403
7.000	.086	-.414	7.000	.000	-.422						
7.500	.000	1.896	7.500	.256	1.804	7.500	.456	1.616	7.500	.611	1.389
7.500	.731	1.142	7.500	.772	1.063	7.500	.811	.983	7.500	.845	.901
7.500	.876	.817	7.500	.903	.732	7.500	.926	.646	7.500	.944	.559
7.500	.956	.471	7.500	.964	.382	7.500	.966	.293	7.500	.958	.204
7.500	.939	.117	7.500	.908	.033	7.500	.864	-.045	7.500	.808	-.115
7.500	.744	-.177	7.500	.672	-.231	7.500	.596	-.277	7.500	.517	-.318
7.500	.435	-.352	7.500	.350	-.382	7.500	.264	-.405	7.500	.177	-.421
7.500	.089	-.432	7.500	.000	-.440						
8.000	.000	2.019	8.000	.275	1.918	8.000	.489	1.713	8.000	.654	1.466
8.000	.783	1.199	8.000	.822	1.115	8.000	.860	1.031	8.000	.893	.944
8.000	.921	.856	8.000	.946	.767	8.000	.967	.677	8.000	.982	.586
8.000	.992	.494	8.000	.999	.402	8.000	1.000	.309	8.000	.993	.217
8.000	.974	.125	8.000	.942	.038	8.000	.897	-.043	8.000	.840	-.116
8.000	.773	-.181	8.000	.699	-.238	8.000	.620	-.286	8.000	.537	-.328
8.000	.452	-.364	8.000	.364	-.394	8.000	.275	-.418	8.000	.184	-.435
8.000	.092	-.447	8.000	.000	-.456						
8.500	.000	2.123	8.500	.271	2.012	8.500	.476	1.796	8.500	.632	1.542
8.500	.751	1.269	8.500	.800	1.185	8.500	.846	1.099	8.500	.887	1.011
8.500	.923	.920	8.500	.954	.828	8.500	.980	.734	8.500	1.001	.639
8.500	1.015	.543	8.500	1.026	.446	8.500	1.031	.349	8.500	1.027	.252
8.500	1.010	.155	8.500	.980	.062	8.500	.936	-.025	8.500	.878	-.104

Figure 3b: File CONFIG (cont.)

8.500	.810	-.174	8.500	.733	-.235	8.500	.651	-.287	8.500	.564	-.331
8.500	.474	-.370	8.500	.383	-.403	8.500	.289	-.429	8.500	.194	-.447
8.500	.097	-.459	8.500	.000	-.469						
9.000	.000	2.203	9.000	.255	2.086	9.000	.440	1.869	9.000	.579	1.619
9.000	.683	1.353	9.000	.742	1.268	9.000	.798	1.182	9.000	.849	1.093
9.000	.895	1.001	9.000	.936	.906	9.000	.972	.810	9.000	1.002	.711
9.000	1.025	.611	9.000	1.042	.509	9.000	1.053	.407	9.000	1.057	.304
9.000	1.046	.201	9.000	1.019	.101	9.000	.977	.006	9.000	.920	-.080
9.000	.851	-.157	9.000	.772	-.224	9.000	.686	-.281	9.000	.595	-.330
9.000	.501	-.372	9.000	.404	-.407	9.000	.305	-.436	9.000	.205	-.456
9.000	.103	-.469	9.000	.000	-.480						
9.500	.000	2.246	9.500	.227	2.131	9.500	.387	1.927	9.500	.504	1.695
9.500	.591	1.450	9.500	.659	1.365	9.500	.725	1.277	9.500	.787	1.187
9.500	.843	1.093	9.500	.894	.997	9.500	.942	.898	9.500	.983	.797
9.500	1.017	.693	9.500	1.044	.587	9.500	1.064	.479	9.500	1.078	.370
9.500	1.077	.261	9.500	1.058	.153	9.500	1.020	.050	9.500	.965	-.046
9.500	.895	-.131	9.500	.815	-.206	9.500	.726	-.269	9.500	.631	-.323
9.500	.531	-.369	9.500	.429	-.409	9.500	.324	-.440	9.500	.217	-.462
9.500	.109	-.477	9.500	.000	-.489						
10.000	.000	2.228	10.000	.190	2.127	10.000	.319	1.951	10.000	.413	1.752
10.000	.480	1.542	10.000	.557	1.456	10.000	.632	1.368	10.000	.703	1.277
10.000	.769	1.182	10.000	.832	1.085	10.000	.890	.985	10.000	.943	.882
10.000	.990	.777	10.000	1.029	.668	10.000	1.061	.556	10.000	1.086	.442
10.000	1.099	.327	10.000	1.091	.212	10.000	1.060	.100	10.000	1.007	-.004
10.000	.938	-.098	10.000	.856	-.179	10.000	.763	-.249	10.000	.664	-.308
10.000	.559	-.359	10.000	.452	-.402	10.000	.342	-.437	10.000	.229	-.463
10.000	.115	-.481	10.000	.000	-.495						
10.500	.000	2.171	10.500	.154	2.084	10.500	.259	1.936	10.500	.336	1.771
10.500	.394	1.599	10.500	.477	1.512	10.500	.559	1.424	10.500	.637	1.332
10.500	.711	1.238	10.500	.780	1.140	10.500	.847	1.039	10.500	.908	.936
10.500	.964	.830	10.500	1.012	.720	10.500	1.054	.607	10.500	1.089	.490
10.500	1.111	.371	10.500	1.114	.252	10.500	1.090	.133	10.500	1.041	.022
10.500	.972	-.078	10.500	.887	-.163	10.500	.791	-.237	10.500	.688	-.299
10.500	.580	-.352	10.500	.469	-.397	10.500	.354	-.435	10.500	.238	-.463
10.500	.119	-.484	10.500	.000	-.500						
11.000	.000	2.099	11.000	.127	2.026	11.000	.216	1.905	11.000	.283	1.771
11.000	.334	1.629	11.000	.421	1.542	11.000	.507	1.454	11.000	.590	1.363
11.000	.669	1.268	11.000	.744	1.170	11.000	.815	1.069	11.000	.883	.966
11.000	.945	.860	11.000	1.000	.750	11.000	1.048	.636	11.000	1.090	.519
11.000	1.120	.398	11.000	1.130	.275	11.000	1.111	.153	11.000	1.065	.037
11.000	.995	-.066	11.000	.909	-.155	11.000	.811	-.230	11.000	.705	-.294
11.000	.595	-.348	11.000	.480	-.395	11.000	.363	-.434	11.000	.243	-.463
11.000	.122	-.485	11.000	.000	-.503						
11.500	.000	2.017	11.500	.110	1.957	11.500	.186	1.858	11.500	.244	1.747
11.500	.291	1.632	11.500	.368	1.537	11.500	.465	1.455	11.500	.561	1.371
11.500	.644	1.277	11.500	.720	1.178	11.500	.793	1.077	11.500	.865	.975
11.500	.932	.869	11.500	.992	.761	11.500	1.045	.647	11.500	1.092	.530
11.500	1.128	.408	11.500	1.142	.284	11.500	1.125	.161	11.500	1.079	.043
11.500	1.009	-.062	11.500	.921	-.152	11.500	.822	-.228	11.500	.715	-.293
11.500	.603	-.348	11.500	.487	-.395	11.500	.368	-.434	11.500	.247	-.464
11.500	.124	-.486	11.500	.000	-.504						
13.200	.000	1.684	13.200	.122	1.628	13.200	.212	1.525	13.200	.316	1.436
13.200	.419	1.346	13.200	.515	1.250	13.200	.611	1.153	13.200	.703	1.052
13.200	.791	.947	13.200	.878	.843	13.200	.953	.729	13.200	1.032	.617
13.200	1.087	.494	13.200	1.130	.362	13.200	1.161	.232	13.200	1.161	.095
13.200	1.161	-.042	13.200	1.161	-.178	13.200	1.161	-.314	13.200	1.161	-.451
13.200	1.161	-.588	13.200	1.092	-.689	13.200	.955	-.705	13.200	.819	-.705
13.200	.682	-.705	13.200	.546	-.705	13.200	.409	-.705	13.200	.273	-.705
13.200	.136	-.705	13.200	.000	-.705						
15.000	.000	1.349	15.000	.144	1.260	15.000	.277	1.154	15.000	.437	1.081

Figure 3c: File CONFIG (cont.)

15.000	.583	.988	15.000	.718	.881	15.000	.850	.770	15.000	.972	.647
15.000	1.075	.508	15.000	1.143	.348	15.000	1.168	.178	15.000	1.166	.005
15.000	1.168	-.168	15.000	1.172	-.340	15.000	1.175	-.513	15.000	1.178	-.686
15.000	1.178	-.858	15.000	1.178	-1.031	15.000	1.178	-1.204	15.000	1.178	-1.376
15.000	1.178	-1.549	15.000	1.178	-1.722	15.000	1.168	-1.894	15.000	1.038	-1.971
15.000	.863	-1.971	15.000	.690	-1.971	15.000	.518	-1.971	15.000	.345	-1.971
15.000	.173	-1.971	15.000	.000	-1.971						
16.500	.000	1.134	16.500	.145	1.035	16.500	.278	.923	16.500	.457	.888
16.500	.625	.825	16.500	.780	.741	16.500	.930	.644	16.500	1.061	.522
16.500	1.140	.364	16.500	1.169	.188	16.500	1.173	.010	16.500	1.180	-.167
16.500	1.188	-.345	16.500	1.195	-.522	16.500	1.204	-.700	16.500	1.205	-.877
16.500	1.205	-1.055	16.500	1.205	-1.233	16.500	1.205	-1.410	16.500	1.205	-1.588
16.500	1.205	-1.766	16.500	1.205	-1.944	16.500	1.195	-2.121	16.500	1.069	-2.209
16.500	.888	-2.209	16.500	.711	-2.209	16.500	.533	-2.209	16.500	.355	-2.209
16.500	.178	-2.209	16.500	.000	-2.209						
18.000	.000	.965	18.000	.167	.897	18.000	.319	.800	18.000	.484	.740
18.000	.665	.712	18.000	.834	.650	18.000	.994	.568	18.000	1.131	.449
18.000	1.210	.289	18.000	1.222	.107	18.000	1.238	-.072	18.000	1.252	-.252
18.000	1.266	-.432	18.000	1.282	-.611	18.000	1.294	-.791	18.000	1.294	-.972
18.000	1.294	-1.152	18.000	1.294	-1.332	18.000	1.294	-1.513	18.000	1.294	-1.693
18.000	1.294	-1.874	18.000	1.287	-2.053	18.000	1.232	-2.225	18.000	1.083	-2.317
18.000	.902	-2.317	18.000	.722	-2.317	18.000	.541	-2.317	18.000	.361	-2.317
18.000	.180	-2.317	18.000	.000	-2.317						
20.000	.000	.797	20.000	.182	.767	20.000	.356	.704	20.000	.523	.624
20.000	.699	.567	20.000	.881	.533	20.000	1.064	.512	20.000	1.250	.495
20.000	1.391	.381	20.000	1.388	.193	20.000	1.389	.009	20.000	1.390	-.176
20.000	1.391	-.360	20.000	1.395	-.545	20.000	1.400	-.730	20.000	1.400	-.915
20.000	1.400	-1.100	20.000	1.400	-1.285	20.000	1.400	-1.470	20.000	1.392	-1.654
20.000	1.374	-1.839	20.000	1.315	-2.012	20.000	1.245	-2.183	20.000	1.091	-2.290
20.000	.926	-2.348	20.000	.740	-2.348	20.000	.555	-2.348	20.000	.370	-2.348
20.000	.185	-2.348	20.000	.000	-2.348						
22.000	.000	.661	22.000	.179	.635	22.000	.357	.599	22.000	.534	.560
22.000	.711	.519	22.000	.887	.477	22.000	1.067	.457	22.000	1.248	.451
22.000	1.390	.352	22.000	1.400	.171	22.000	1.400	-.010	22.000	1.400	-.191
22.000	1.400	-.372	22.000	1.400	-.554	22.000	1.400	-.735	22.000	1.400	-.916
22.000	1.400	-1.097	22.000	1.400	-1.279	22.000	1.400	-1.460	22.000	1.399	-1.641
22.000	1.374	-1.821	22.000	1.316	-1.994	22.000	1.217	-2.147	22.000	1.077	-2.266
22.000	.906	-2.332	22.000	.725	-2.340	22.000	.544	-2.340	22.000	.362	-2.340
22.000	.181	-2.340	22.000	.000	-2.340						
25.000	.000	.620	25.000	.173	.596	25.000	.346	.572	25.000	.516	.531
25.000	.685	.489	25.000	.853	.440	25.000	1.020	.390	25.000	1.185	.335
25.000	1.353	.284	25.000	1.400	.123	25.000	1.400	-.052	25.000	1.400	-.227
25.000	1.400	-.401	25.000	1.400	-.576	25.000	1.400	-.751	25.000	1.400	-.925
25.000	1.400	-1.100	25.000	1.400	-1.274	25.000	1.390	-1.449	25.000	1.360	-1.621
25.000	1.331	-1.793	25.000	1.261	-1.953	25.000	1.151	-2.092	25.000	1.015	-2.202
25.000	.859	-2.280	25.000	.752	-2.285	25.000	.644	-2.289	25.000	.430	-2.299
25.000	.215	-2.308	25.000	.000	-2.317						
27.000	.000	.620	27.000	.167	.603	27.000	.335	.590	27.000	.498	.551
27.000	.661	.509	27.000	.818	.451	27.000	.971	.381	27.000	1.121	.306
27.000	1.263	.216	27.000	1.369	.086	27.000	1.400	-.076	27.000	1.400	-.245
27.000	1.400	-.413	27.000	1.400	-.581	27.000	1.400	-.749	27.000	1.400	-.917
27.000	1.399	-1.084	27.000	1.382	-1.252	27.000	1.361	-1.418	27.000	1.331	-1.584
27.000	1.279	-1.747	27.000	1.202	-1.899	27.000	1.098	-2.030	27.000	.967	-2.136
27.000	.821	-2.223	27.000	.665	-2.287	27.000	.499	-2.290	27.000	.332	-2.292
27.000	.166	-2.294	27.000	.000	-2.297						
28.500	.000	.620	28.500	.163	.609	28.500	.324	.592	28.500	.484	.561
28.500	.641	.517	28.500	.793	.459	28.500	.941	.391	28.500	1.085	.314
28.500	1.208	.207	28.500	1.303	.075	28.500	1.388	-.063	28.500	1.400	-.226
28.500	1.400	-.388	28.500	1.400	-.551	28.500	1.400	-.714	28.500	1.400	-.877
28.500	1.400	-1.040	28.500	1.374	-1.201	28.500	1.336	-1.359	28.500	1.298	-1.517

Figure 3d: File CONFIG (cont.)

28.500	1.247	-1.672	28.500	1.164	-1.810	28.500	1.053	-1.932	28.500	.924	-2.038	
28.500	.784	-2.130	28.500	.637	-2.206	28.500	.484	-2.261	28.500	.363	-2.265	
28.500	.242	-2.269	28.500	.000	-2.278							
30.000	.000	.620	30.000	.156	.601	30.000	.313	.584	30.000	.468	.561	
30.000	.622	.523	30.000	.771	.469	30.000	.911	.397	30.000	1.040	.307	
30.000	1.159	.203	30.000	1.263	.085	30.000	1.327	-.057	30.000	1.368	-.212	
30.000	1.400	-.366	30.000	1.400	-.523	30.000	1.400	-.681	30.000	1.400	-.838	
30.000	1.400	-.995	30.000	1.395	-1.153	30.000	1.364	-1.307	30.000	1.305	-1.455	
30.000	1.223	-1.594	30.000	1.123	-1.720	30.000	1.007	-1.830	30.000	.881	-1.925	
30.000	.745	-2.006	30.000	.602	-2.074	30.000	.455	-2.131	30.000	.305	-2.178	
30.000	.153	-2.219	30.000	.000	-2.257							
32.000	.000	.620	32.000	.151	.601	32.000	.301	.576	32.000	.449	.539	
32.000	.592	.486	32.000	.726	.414	32.000	.851	.327	32.000	.965	.226	
32.000	1.068	.113	32.000	1.158	-.009	32.000	1.235	-.140	32.000	1.299	-.279	
32.000	1.348	-.423	32.000	1.381	-.572	32.000	1.398	-.723	32.000	1.397	-.875	
32.000	1.379	-1.026	32.000	1.344	-1.175	32.000	1.294	-1.318	32.000	1.230	-1.457	
32.000	1.154	-1.589	32.000	1.066	-1.713	32.000	.965	-1.827	32.000	.852	-1.930	
32.000	.727	-2.016	32.000	.591	-2.084	32.000	.447	-2.135	32.000	.300	-2.172	
32.000	.150	-2.201	32.000	.000	-2.226							
WING												
2	13	30	0	.0	.0	.0	.0	.0	1.0	1.0	1.0	1
7.700	.000	.230	8.111	.000	.242	8.523	.000	.254	8.934	.000	.266	
9.346	.000	.277	9.758	.000	.288	11.815	.000	.333	13.873	.000	.365	
15.932	.000	.385	17.990	.000	.391	20.048	.000	.385	22.107	.000	.365	
24.165	.000	.333	26.222	.000	.288	28.280	.000	.230	28.280	.000	.230	
26.222	.000	.172	24.165	.000	.127	22.107	.000	.095	20.048	.000	.075	
17.990	.000	.069	15.932	.000	.075	13.873	.000	.095	11.815	.000	.127	
9.758	.000	.172	9.346	.000	.183	8.934	.000	.194	8.523	.000	.206	
8.111	.000	.218	7.700	.000	.230							
11.450	1.365	.230	11.781	1.365	.242	12.111	1.365	.255	12.441	1.365	.267	
12.771	1.365	.279	13.102	1.365	.290	14.753	1.365	.337	16.405	1.365	.370	
18.058	1.365	.391	19.710	1.365	.397	21.362	1.365	.391	23.015	1.365	.370	
24.667	1.365	.337	26.318	1.365	.290	27.970	1.365	.230	27.970	1.365	.230	
26.318	1.365	.170	24.667	1.365	.123	23.015	1.365	.090	21.362	1.365	.069	
19.710	1.365	.063	18.058	1.365	.069	16.405	1.365	.090	14.753	1.365	.123	
13.102	1.365	.170	12.771	1.365	.181	12.441	1.365	.193	12.111	1.365	.205	
11.781	1.365	.218	11.450	1.365	.230							
15.200	2.730	.230	15.449	2.730	.243	15.698	2.730	.256	15.947	2.730	.268	
16.196	2.730	.281	16.445	2.730	.292	17.691	2.730	.341	18.937	2.730	.376	
20.183	2.730	.396	21.430	2.730	.403	22.676	2.730	.396	23.923	2.730	.376	
25.169	2.730	.341	26.414	2.730	.292	27.659	2.730	.230	27.659	2.730	.230	
26.414	2.730	.168	25.169	2.730	.119	23.923	2.730	.084	22.676	2.730	.064	
21.430	2.730	.057	20.183	2.730	.064	18.937	2.730	.084	17.691	2.730	.119	
16.445	2.730	.168	16.196	2.730	.179	15.947	2.730	.192	15.698	2.730	.204	
15.449	2.730	.217	15.200	2.730	.230							
18.951	4.095	.230	19.119	4.095	.240	19.286	4.095	.249	19.454	4.095	.259	
19.622	4.095	.268	19.790	4.095	.277	20.629	4.095	.313	21.469	4.095	.339	
22.310	4.095	.355	23.150	4.095	.360	23.990	4.095	.355	24.831	4.095	.339	
25.670	4.095	.313	26.510	4.095	.277	27.349	4.095	.230	27.349	4.095	.230	
26.510	4.095	.183	25.670	4.095	.147	24.831	4.095	.121	23.990	4.095	.105	
23.150	4.095	.100	22.310	4.095	.105	21.469	4.095	.121	20.629	4.095	.147	
19.790	4.095	.183	19.622	4.095	.192	19.454	4.095	.201	19.286	4.095	.211	
19.119	4.095	.220	18.951	4.095	.230							
22.124	5.250	.230	22.223	5.250	.237	22.322	5.250	.244	22.421	5.250	.251	
22.521	5.250	.257	22.620	5.250	.264	23.116	5.250	.290	23.612	5.250	.308	
24.109	5.250	.320	24.605	5.250	.323	25.102	5.250	.320	25.599	5.250	.308	
26.095	5.250	.290	26.591	5.250	.264	27.086	5.250	.230	27.086	5.250	.230	
26.591	5.250	.196	26.095	5.250	.170	25.599	5.250	.152	25.102	5.250	.140	
24.605	5.250	.137	24.109	5.250	.140	23.612	5.250	.152	23.116	5.250	.170	
22.620	5.250	.196	22.521	5.250	.203	22.421	5.250	.209	22.322	5.250	.216	

Figure 3e: File CONFIG (cont.)

22.223	5.250	.223	22.124	5.250	.230						
22.399	5.350	.230	22.492	5.350	.237	22.585	5.350	.243	22.678	5.350	.250
22.772	5.350	.256	22.865	5.350	.262	23.331	5.350	.288	23.798	5.350	.306
24.264	5.350	.317	24.731	5.350	.320	25.198	5.350	.317	25.665	5.350	.306
26.132	5.350	.288	26.598	5.350	.262	27.064	5.350	.230	27.064	5.350	.230
26.598	5.350	.198	26.132	5.350	.172	25.665	5.350	.154	25.198	5.350	.143
24.731	5.350	.140	24.264	5.350	.143	23.798	5.350	.154	23.331	5.350	.172
22.865	5.350	.198	22.772	5.350	.204	22.678	5.350	.210	22.585	5.350	.217
22.492	5.350	.223	22.399	5.350	.230						
22.700	5.460	.230	22.787	5.460	.236	22.873	5.460	.243	22.960	5.460	.249
23.047	5.460	.255	23.133	5.460	.261	23.567	5.460	.286	24.001	5.460	.303
24.435	5.460	.313	24.870	5.460	.317	25.304	5.460	.313	25.738	5.460	.303
26.172	5.460	.286	26.606	5.460	.261	27.039	5.460	.230	27.039	5.460	.230
26.606	5.460	.199	26.172	5.460	.174	25.738	5.460	.157	25.304	5.460	.147
24.870	5.460	.143	24.435	5.460	.147	24.001	5.460	.157	23.567	5.460	.174
23.133	5.460	.199	23.047	5.460	.205	22.960	5.460	.211	22.873	5.460	.217
22.787	5.460	.224	22.700	5.460	.230						
22.733	5.550	.230	22.819	5.550	.236	22.904	5.550	.243	22.990	5.550	.249
23.075	5.550	.255	23.161	5.550	.261	23.589	5.550	.285	24.018	5.550	.302
24.447	5.550	.312	24.876	5.550	.316	25.305	5.550	.312	25.733	5.550	.302
26.162	5.550	.285	26.590	5.550	.261	27.018	5.550	.230	27.018	5.550	.230
26.590	5.550	.199	26.162	5.550	.175	25.733	5.550	.158	25.305	5.550	.148
24.876	5.550	.144	24.447	5.550	.148	24.018	5.550	.158	23.589	5.550	.175
23.161	5.550	.199	23.075	5.550	.205	22.990	5.550	.211	22.904	5.550	.217
22.819	5.550	.224	22.733	5.550	.230						
22.769	5.650	.230	22.854	5.650	.236	22.938	5.650	.243	23.023	5.650	.249
23.107	5.650	.255	23.191	5.650	.260	23.614	5.650	.284	24.037	5.650	.301
24.459	5.650	.311	24.882	5.650	.315	25.306	5.650	.311	25.728	5.650	.301
26.151	5.650	.284	26.574	5.650	.260	26.996	5.650	.230	26.996	5.650	.230
26.574	5.650	.200	26.151	5.650	.176	25.728	5.650	.159	25.306	5.650	.149
24.882	5.650	.145	24.459	5.650	.149	24.037	5.650	.159	23.614	5.650	.176
23.191	5.650	.200	23.107	5.650	.205	23.023	5.650	.211	22.938	5.650	.217
22.854	5.650	.224	22.769	5.650	.230						
23.068	6.470	.230	23.143	6.470	.236	23.217	6.470	.241	23.292	6.470	.247
23.367	6.470	.252	23.441	6.470	.257	23.815	6.470	.278	24.190	6.470	.293
24.564	6.470	.302	24.938	6.470	.305	25.313	6.470	.302	25.687	6.470	.293
26.062	6.470	.278	26.435	6.470	.257	26.809	6.470	.230	26.809	6.470	.230
26.435	6.470	.203	26.062	6.470	.182	25.687	6.470	.167	25.313	6.470	.158
24.938	6.470	.155	24.564	6.470	.158	24.190	6.470	.167	23.815	6.470	.182
23.441	6.470	.203	23.367	6.470	.208	23.292	6.470	.213	23.217	6.470	.219
23.143	6.470	.224	23.068	6.470	.230						
23.436	7.480	.230	23.498	7.480	.235	23.561	7.480	.239	23.624	7.480	.244
23.687	7.480	.248	23.749	7.480	.253	24.064	7.480	.270	24.378	7.480	.283
24.693	7.480	.290	25.007	7.480	.293	25.322	7.480	.290	25.637	7.480	.283
25.951	7.480	.270	26.265	7.480	.253	26.579	7.480	.230	26.579	7.480	.230
26.265	7.480	.207	25.951	7.480	.190	25.637	7.480	.177	25.322	7.480	.170
25.007	7.480	.167	24.693	7.480	.170	24.378	7.480	.177	24.064	7.480	.190
23.749	7.480	.207	23.687	7.480	.212	23.624	7.480	.216	23.561	7.480	.221
23.498	7.480	.225	23.436	7.480	.230						
23.803	8.490	.230	23.854	8.490	.234	23.905	8.490	.238	23.956	8.490	.241
24.007	8.490	.245	24.057	8.490	.248	24.312	8.490	.263	24.567	8.490	.273
24.821	8.490	.279	25.076	8.490	.281	25.331	8.490	.279	25.586	8.490	.273
25.841	8.490	.263	26.095	8.490	.248	26.349	8.490	.230	26.349	8.490	.230
26.095	8.490	.212	25.841	8.490	.197	25.586	8.490	.187	25.331	8.490	.181
25.076	8.490	.179	24.821	8.490	.181	24.567	8.490	.187	24.312	8.490	.197
24.057	8.490	.212	24.007	8.490	.215	23.956	8.490	.219	23.905	8.490	.222
23.854	8.490	.226	23.803	8.490	.230						
24.171	9.500	.230	24.210	9.500	.233	24.249	9.500	.236	24.288	9.500	.239
24.326	9.500	.241	24.365	9.500	.244	24.560	9.500	.255	24.755	9.500	.263
24.950	9.500	.267	25.145	9.500	.269	25.340	9.500	.267	25.535	9.500	.263

Figure 3f: File CONFIG (cont.)

25.730	9.500	.255	25.925	9.500	.244	26.120	9.500	.230	26.120	9.500	.230
25.925	9.500	.216	25.730	9.500	.205	25.535	9.500	.197	25.340	9.500	.193
25.145	9.500	.191	24.950	9.500	.193	24.755	9.500	.197	24.560	9.500	.205
24.365	9.500	.216	24.326	9.500	.219	24.288	9.500	.221	24.249	9.500	.224
24.210	9.500	.227	24.171	9.500	.230						
CANARD											
3	7	30	0	.0	.0	.0	.0	1.0	1.0	1.0	1
4.850	.000	.230	5.152	.000	.249	5.454	.000	.267	5.756	.000	.284
6.058	.000	.298	6.360	.000	.308	6.663	.000	.314	6.965	.000	.316
7.267	.000	.314	7.570	.000	.308	7.872	.000	.298	8.174	.000	.284
8.476	.000	.267	8.778	.000	.249	9.080	.000	.230	9.080	.000	.230
8.778	.000	.211	8.476	.000	.193	8.174	.000	.176	7.872	.000	.162
7.570	.000	.152	7.267	.000	.146	6.965	.000	.144	6.663	.000	.146
6.360	.000	.152	6.058	.000	.162	5.756	.000	.176	5.454	.000	.193
5.152	.000	.211	4.850	.000	.230						
6.040	.833	.230	6.304	.833	.247	6.567	.833	.263	6.831	.833	.277
7.094	.833	.289	7.358	.833	.298	7.622	.833	.304	7.886	.833	.305
8.150	.833	.304	8.414	.833	.298	8.678	.833	.289	8.941	.833	.277
9.205	.833	.263	9.468	.833	.247	9.732	.833	.230	9.732	.833	.230
9.468	.833	.213	9.205	.833	.197	8.941	.833	.183	8.678	.833	.171
8.414	.833	.162	8.150	.833	.156	7.886	.833	.155	7.622	.833	.156
7.358	.833	.162	7.094	.833	.171	6.831	.833	.183	6.567	.833	.197
6.304	.833	.213	6.040	.833	.230						
7.230	1.667	.230	7.455	1.667	.244	7.680	1.667	.258	7.905	1.667	.270
8.131	1.667	.281	8.356	1.667	.288	8.581	1.667	.293	8.807	1.667	.294
9.032	1.667	.293	9.258	1.667	.288	9.483	1.667	.281	9.708	1.667	.270
9.934	1.667	.258	10.159	1.667	.244	10.384	1.667	.230	10.384	1.667	.230
10.159	1.667	.216	9.934	1.667	.202	9.708	1.667	.190	9.483	1.667	.179
9.258	1.667	.172	9.032	1.667	.167	8.807	1.667	.166	8.581	1.667	.167
8.356	1.667	.172	8.131	1.667	.179	7.905	1.667	.190	7.680	1.667	.202
7.455	1.667	.216	7.230	1.667	.230						
8.420	2.500	.230	8.607	2.500	.242	8.794	2.500	.253	8.980	2.500	.263
9.167	2.500	.272	9.354	2.500	.278	9.541	2.500	.282	9.728	2.500	.283
9.915	2.500	.282	10.102	2.500	.278	10.289	2.500	.272	10.475	2.500	.263
10.662	2.500	.253	10.849	2.500	.242	11.035	2.500	.230	11.035	2.500	.230
10.849	2.500	.218	10.662	2.500	.207	10.475	2.500	.197	10.289	2.500	.188
10.102	2.500	.182	9.915	2.500	.178	9.728	2.500	.177	9.541	2.500	.178
9.354	2.500	.182	9.167	2.500	.188	8.980	2.500	.197	8.794	2.500	.207
8.607	2.500	.218	8.420	2.500	.230						
9.610	3.333	.230	9.759	3.333	.239	9.907	3.333	.248	10.055	3.333	.257
10.203	3.333	.263	10.352	3.333	.268	10.500	3.333	.271	10.649	3.333	.272
10.797	3.333	.271	10.946	3.333	.268	11.094	3.333	.263	11.242	3.333	.257
11.391	3.333	.248	11.539	3.333	.239	11.687	3.333	.230	11.687	3.333	.230
11.539	3.333	.221	11.391	3.333	.212	11.242	3.333	.203	11.094	3.333	.197
10.946	3.333	.192	10.797	3.333	.189	10.649	3.333	.188	10.500	3.333	.189
10.352	3.333	.192	10.203	3.333	.197	10.055	3.333	.203	9.907	3.333	.212
9.759	3.333	.221	9.610	3.333	.230						
10.801	4.167	.230	10.910	4.167	.237	11.020	4.167	.244	11.130	4.167	.250
11.240	4.167	.255	11.350	4.167	.258	11.460	4.167	.261	11.570	4.167	.261
11.680	4.167	.261	11.790	4.167	.258	11.900	4.167	.255	12.010	4.167	.250
12.119	4.167	.244	12.229	4.167	.237	12.339	4.167	.230	12.339	4.167	.230
12.229	4.167	.223	12.119	4.167	.216	12.010	4.167	.210	11.900	4.167	.205
11.790	4.167	.202	11.680	4.167	.199	11.570	4.167	.199	11.460	4.167	.199
11.350	4.167	.202	11.240	4.167	.205	11.130	4.167	.210	11.020	4.167	.216
10.910	4.167	.223	10.801	4.167	.230						
11.991	5.000	.230	12.062	5.000	.235	12.133	5.000	.239	12.205	5.000	.243
12.276	5.000	.246	12.348	5.000	.248	12.419	5.000	.250	12.491	5.000	.250
12.562	5.000	.250	12.634	5.000	.248	12.705	5.000	.246	12.777	5.000	.243
12.848	5.000	.239	12.919	5.000	.235	12.991	5.000	.230	12.991	5.000	.230
12.919	5.000	.225	12.848	5.000	.221	12.777	5.000	.217	12.705	5.000	.214

Figure 3g: File CONFIG (cont.)

12.634	5.000	.212	12.562	5.000	.210	12.491	5.000	.210	12.419	5.000	.210
12.348	5.000	.212	12.276	5.000	.214	12.205	5.000	.217	12.133	5.000	.221
12.062	5.000	.225	11.991	5.000	.230						
FIN											
4	10	28	0	.0	.0	.0	.0	1.0	1.0	1.0	1
22.650	.000	.000	22.650	.002	.000	22.651	.003	.000	22.653	.005	.000
22.655	.005	.000	23.576	.069	.000	24.498	.117	.000	25.420	.148	.000
26.341	.164	.000	27.263	.163	.000	28.185	.147	.000	29.107	.114	.000
30.028	.065	.000	30.950	.000	.000	30.950	.000	.000	30.028	-.065	.000
29.107	-.114	.000	28.185	-.147	.000	27.263	-.163	.000	26.341	-.164	.000
25.420	-.148	.000	24.498	-.117	.000	23.576	-.069	.000	22.655	-.005	.000
22.653	-.005	.000	22.651	-.003	.000	22.650	-.002	.000	22.650	.000	.000
23.709	.000	.611	23.709	.002	.611	23.710	.003	.611	23.711	.005	.611
23.713	.005	.611	24.564	.064	.611	25.416	.108	.611	26.267	.137	.611
27.119	.152	.611	27.970	.151	.611	28.821	.136	.611	29.673	.105	.611
30.524	.060	.611	31.375	.000	.611	31.375	.000	.611	30.524	-.060	.611
29.673	-.105	.611	28.821	-.136	.611	27.970	-.151	.611	27.119	-.152	.611
26.267	-.137	.611	25.416	-.108	.611	24.564	-.064	.611	23.713	-.005	.611
23.711	-.005	.611	23.710	-.003	.611	23.709	-.002	.611	23.709	.000	.611
24.767	.000	1.222	24.767	.002	1.222	24.768	.003	1.222	24.770	.005	1.222
24.772	.005	1.222	25.553	.059	1.222	26.334	.099	1.222	27.115	.126	1.222
27.896	.139	1.222	28.676	.138	1.222	29.457	.124	1.222	30.238	.097	1.222
31.019	.055	1.222	31.800	.000	1.222	31.800	.000	1.222	31.019	-.055	1.222
30.238	-.097	1.222	29.457	-.124	1.222	28.676	-.138	1.222	27.896	-.139	1.222
27.115	-.126	1.222	26.334	-.099	1.222	25.553	-.059	1.222	24.772	-.005	1.222
24.770	-.005	1.222	24.768	-.003	1.222	24.767	-.002	1.222	24.767	.000	1.222
25.825	.000	1.833	25.826	.002	1.833	25.827	.003	1.833	25.828	.005	1.833
25.830	.005	1.833	26.541	.054	1.833	27.251	.091	1.833	27.962	.115	1.833
28.673	.127	1.833	29.383	.126	1.833	30.094	.113	1.833	30.804	.088	1.833
31.515	.050	1.833	32.226	.000	1.833	32.226	.000	1.833	31.515	-.050	1.833
30.804	-.088	1.833	30.094	-.113	1.833	29.383	-.126	1.833	28.673	-.127	1.833
27.962	-.115	1.833	27.251	-.091	1.833	26.541	-.054	1.833	25.830	-.005	1.833
25.828	-.005	1.833	25.827	-.003	1.833	25.826	-.002	1.833	25.825	.000	1.833
26.884	.000	2.444	26.884	.002	2.444	26.885	.003	2.444	26.887	.005	2.444
26.889	.005	2.444	27.529	.049	2.444	28.169	.082	2.444	28.809	.104	2.444
29.450	.114	2.444	30.090	.114	2.444	30.730	.102	2.444	31.370	.079	2.444
32.011	.045	2.444	32.651	.000	2.444	32.651	.000	2.444	32.011	-.045	2.444
31.370	-.079	2.444	30.730	-.102	2.444	30.090	-.114	2.444	29.450	-.114	2.444
28.809	-.104	2.444	28.169	-.082	2.444	27.529	-.049	2.444	26.889	-.005	2.444
26.887	-.005	2.444	26.885	-.003	2.444	26.884	-.002	2.444	26.884	.000	2.444
27.942	.000	3.056	27.943	.002	3.056	27.944	.003	3.056	27.945	.005	3.056
27.947	.005	3.056	28.517	.044	3.056	29.087	.073	3.056	29.657	.092	3.056
30.227	.102	3.056	30.796	.101	3.056	31.366	.091	3.056	31.936	.070	3.056
32.506	.040	3.056	33.076	.000	3.056	33.076	.000	3.056	32.506	-.040	3.056
31.936	-.070	3.056	31.366	-.091	3.056	30.796	-.101	3.056	30.227	-.102	3.056
29.657	-.092	3.056	29.087	-.073	3.056	28.517	-.044	3.056	27.947	-.005	3.056
27.945	-.005	3.056	27.944	-.003	3.056	27.943	-.002	3.056	27.942	.000	3.056
29.001	.000	3.667	29.001	.002	3.667	29.002	.003	3.667	29.004	.005	3.667
29.006	.005	3.667	29.505	.039	3.667	30.005	.064	3.667	30.504	.081	3.667
31.004	.089	3.667	31.503	.089	3.667	32.003	.079	3.667	32.502	.062	3.667
33.002	.035	3.667	33.501	.000	3.667	33.501	.000	3.667	33.002	-.035	3.667
32.502	-.062	3.667	32.003	-.079	3.667	31.503	-.089	3.667	31.004	-.089	3.667
30.504	-.081	3.667	30.005	-.064	3.667	29.505	-.039	3.667	29.006	-.005	3.667
29.004	-.005	3.667	29.002	-.003	3.667	29.001	-.002	3.667	29.001	.000	3.667
30.059	.000	4.278	30.060	.002	4.278	30.061	.003	4.278	30.062	.005	4.278
30.064	.005	4.278	30.493	.034	4.278	30.922	.056	4.278	31.351	.070	4.278
31.781	.077	4.278	32.210	.076	4.278	32.639	.068	4.278	33.068	.053	4.278
33.497	.030	4.278	33.926	.000	4.278	33.926	.000	4.278	33.497	-.030	4.278
33.068	-.053	4.278	32.639	-.068	4.278	32.210	-.076	4.278	31.781	-.077	4.278
31.351	-.070	4.278	30.922	-.056	4.278	30.493	-.034	4.278	30.064	-.005	4.278

Figure 3h: File CONFIG (cont.)

30.062	-.005	4.278	30.061	-.003	4.278	30.060	-.002	4.278	30.059	.000	4.278		
31.118	.000	4.889	31.118	.002	4.889	31.119	.003	4.889	31.121	.005	4.889		
31.122	.005	4.889	31.481	.029	4.889	31.840	.047	4.889	32.199	.059	4.889		
32.558	.064	4.889	32.916	.064	4.889	33.275	.057	4.889	33.634	.044	4.889		
33.993	.025	4.889	34.351	.000	4.889	34.351	.000	4.889	33.993	-.025	4.889		
33.634	-.044	4.889	33.275	-.057	4.889	32.916	-.064	4.889	32.558	-.064	4.889		
32.199	-.059	4.889	31.840	-.047	4.889	31.481	-.029	4.889	31.122	-.005	4.889		
31.121	-.005	4.889	31.119	-.003	4.889	31.118	-.002	4.889	31.118	.000	4.889		
32.176	.000	5.500	32.177	.002	5.500	32.178	.003	5.500	32.179	.005	5.500		
32.181	.005	5.500	32.469	.024	5.500	32.758	.038	5.500	33.046	.047	5.500		
33.335	.052	5.500	33.623	.051	5.500	33.911	.046	5.500	34.200	.035	5.500		
34.488	.020	5.500	34.777	.000	5.500	34.777	.000	5.500	34.488	-.020	5.500		
34.200	-.035	5.500	33.911	-.046	5.500	33.623	-.051	5.500	33.335	-.052	5.500		
33.046	-.047	5.500	32.758	-.038	5.500	32.469	-.024	5.500	32.181	-.005	5.500		
32.179	-.005	5.500	32.178	-.003	5.500	32.177	-.002	5.500	32.176	.000	5.500		
POD													
5	3	9	0	.0	.0	.0	.0	.0	.0	1.0	1.0	1.0	1
22.500	6.500	.230	22.500	7.250	.230	22.500	8.500	.230	22.500	8.500	.000		
22.500	8.500	-.770	22.500	7.250	-.770	22.500	6.500	-.770	22.500	6.500	.000		
22.500	6.500	.230											
25.000	6.500	.230	25.000	7.250	.230	25.000	8.500	.230	25.000	8.500	.000		
25.000	8.500	-.770	25.000	7.250	-.770	25.000	6.500	-.770	25.000	6.500	.000		
25.000	6.500	.230											
27.500	6.500	.230	27.500	7.250	.230	27.500	8.500	.230	27.500	8.500	.000		
27.500	8.500	-.770	27.500	7.250	-.770	27.500	6.500	-.770	27.500	6.500	.000		
27.500	6.500	.230											

Figure 3i: File CONFIG (concluded)

PROGRAM KINTERL

Program KINTERL is used to obtain the leading and trailing intersection points between a fuselage and a wing/canard/fin/horizontal tail. The file descriptions are:

<u>File Name</u>	<u>Description</u>
CONFIG	input file containing model geometry description
INTER	output file containing intersection values

Arrays in KINTERL are sized via parameter statements. These parameter variables are:

<u>Variable</u>	<u>Description</u>
NVL	maximum number of contour lines per component, currently 50
NVP	maximum number of points per contour line, currently 50

An example of output file INTER appears in figure 4. Note that an intersection point is listed for each spanwise line of the lifting surface and that the most leading and trailing intersection points are given at the end of this list.

INTERSECTION RESULTS FOR PAB102 FORWARD FUSELAGE
 FUSELAGE & WING

LINE 1	X=	.107605E+02	Y=	.111394E+01	Z=	.230000E+00
LINE 2	X=	.111390E+02	Y=	.112631E+01	Z=	.242399E+00
LINE 3	X=	.115119E+02	Y=	.113716E+01	Z=	.254706E+00
LINE 4	X=	.118834E+02	Y=	.114795E+01	Z=	.266777E+00
LINE 5	X=	.122486E+02	Y=	.115673E+01	Z=	.278488E+00
LINE 6	X=	.125886E+02	Y=	.115563E+01	Z=	.289703E+00
LINE 7	X=	.142452E+02	Y=	.112895E+01	Z=	.336418E+00
LINE 8	X=	.159811E+02	Y=	.113629E+01	Z=	.369567E+00
LINE 9	X=	.177310E+02	Y=	.115533E+01	Z=	.389657E+00
LINE 10	X=	.195886E+02	Y=	.126865E+01	Z=	.396802E+00
LINE 11	X=	.213405E+02	Y=	.134227E+01	Z=	.390460E+00
LINE 12	X=	.229650E+02	Y=	.129027E+01	Z=	.370147E+00
LINE 13	X=	.246106E+02	Y=	.121249E+01	Z=	.336658E+00
LINE 14	X=	.263089E+02	Y=	.122902E+01	Z=	.289821E+00
LINE 15	X=	.280012E+02	Y=	.122641E+01	Z=	.230000E+00
LINE 16	X=	.280012E+02	Y=	.122641E+01	Z=	.230000E+00
LINE 17	X=	.263149E+02	Y=	.131413E+01	Z=	.170042E+00
LINE 18	X=	.246796E+02	Y=	.140000E+01	Z=	.122802E+00
LINE 19	X=	.230380E+02	Y=	.140000E+01	Z=	.894392E-01
LINE 20	X=	.213930E+02	Y=	.139680E+01	Z=	.693052E-01
LINE 21	X=	.197227E+02	Y=	.137509E+01	Z=	.627221E-01
LINE 22	X=	.178269E+02	Y=	.121688E+01	Z=	.700787E-01
LINE 23	X=	.160666E+02	Y=	.118241E+01	Z=	.902590E-01
LINE 24	X=	.143237E+02	Y=	.116543E+01	Z=	.123477E+00
LINE 25	X=	.125983E+02	Y=	.115957E+01	Z=	.170291E+00
LINE 26	X=	.122088E+02	Y=	.114086E+01	Z=	.181532E+00
LINE 27	X=	.118424E+02	Y=	.113197E+01	Z=	.193239E+00
LINE 28	X=	.114768E+02	Y=	.112380E+01	Z=	.205303E+00
LINE 29	X=	.111189E+02	Y=	.111886E+01	Z=	.217603E+00
LINE 30	X=	.107605E+02	Y=	.111394E+01	Z=	.230000E+00

LEADING INTERSECTION :

X = .107605E+02 Y = .111394E+01 Z = .230000E+00

TRAILING INTERSECTION :

X = .280012E+02 Y = .122641E+01 Z = .230000E+00

PROGRAM KLINCRX

Program KLINCRX is used to obtain the crosscut data. The file descriptions are:

<u>File Name</u>	<u>Description</u>
CONFIG	input file containing model geometry description
XCUT	input file containing crosscut control parameters
LINOUT	output file containing the crosscut data
SAVPLT	output plot vector file containing plots of each crosscut, maybe plotted on Tektronix terminal or sent to line plotter

Note that KLINCRX requires NASA Langley graphics library LARCGOS.

Arrays in KLINCRX are sized via parameter statements. These parameter variables are:

<u>Variable</u>	<u>Description</u>
NVL	maximum number of contour lines per component, currently 50
NVP	maximum number of points per contour line, currently 50
NCT	maximum number of crosscuts, currently 150
NVS	maximum number of separation lines, currently 5

CROSS CUT INPUT FILE XCUT

The crosscut control file which is used as input to KLINCRX is named XCUT. This file is list directed and is comprised of:

<u>Record</u>	<u>Variable</u>	<u>Description</u>
1	NIP	integer value for the number of fuselage separation lines; along with the fuselage-wing/canard intersection lines, these separation lines define a top/bottom split for the fuselage
2	XI1,ZI1,XI2,ZI2	real values for X-Z pair defining the start and stop of separation line 1; XI1, ZI1 should be the nose of the fuselage and XI2, ZI2 is the leading intersection of the wing or canard
	XI1,ZI1,XI2,ZI2	real values for X-Z pair defining the start and stop of separation line NIP; XI1, ZI1 should be the trailing intersection of the wing or canard and XI2, ZI2 is at the end of the fuselage
3	NXCT	integer number of cross-cuts to take
4	XCT	real X value for crosscut 1
	.	
	.	
	XCT	real X value for crosscut NXCT

Figure 5 lists an example of file XCUT. Figure 6 presents a picture of the separation lines. Note that for this configuration, line 1 is from the fuselage nose to the leading intersection point for the canard; line 2 is from the canard trailing intersection point to the wing leading intersection point; and line 3 is from the wing trailing intersection point to the rear of the fuselage. Also note that the intersection values which are entered into file XCUT are obtained from running program KINTERL.

```
3
0. 0. 6.05 .23
9.9 .23 10.8 .23
28. .23 32. .23
5
3.5
7.5
11.5
26.
31.5
```

Figure 5: File XCUT

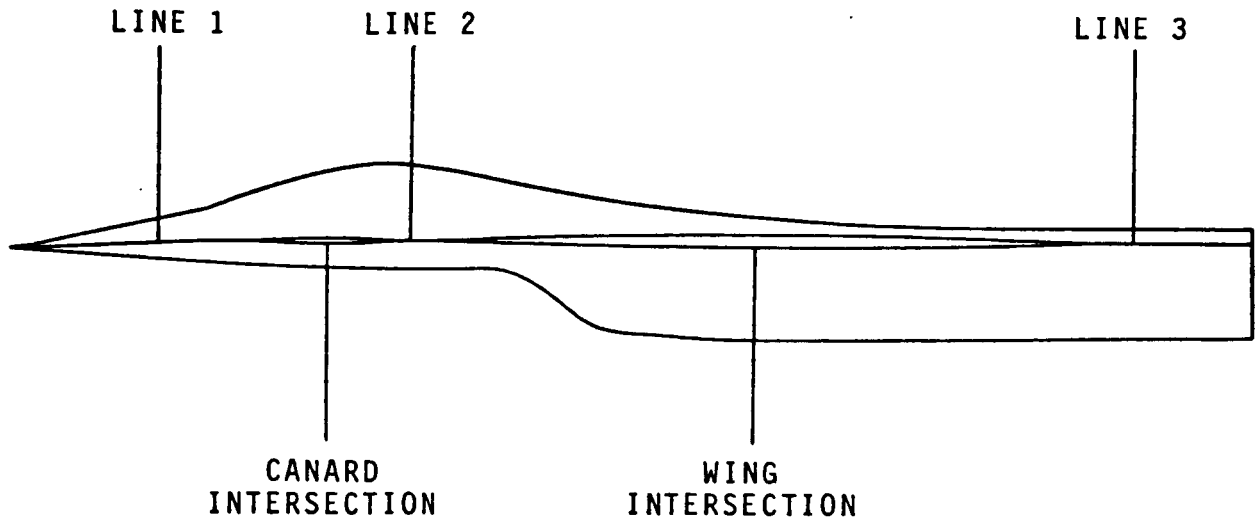


Figure 6: Separation Lines

CROSSCUT OUTPUT FILE LINOUT

The crosscut data output file from KLINCRX is named LINOUT. This formatted file lists the data as a set of patches (with Z-Y valued points) for each crosscut. The structure of file LINOUT corresponds to the input format that the SIMP program requires. Each patch corresponds to a piece of a component. Those points which were inside another component have been deleted and the patches thus constitute a continuous set of discrete points. The contents of file LINOUT are:

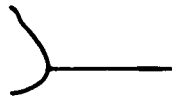
<u>Record</u>	<u>Variable</u>	<u>Description</u>
1	NX	Integer I5 value defining the number of crosscuts taken
		(Records 2 thru 4 are repeated for each crosscut)
2	XC, IP	real F15.6 value for the X value of the crosscut, integer I5 value for the number of patches.
		(Records 3 thru 4 are repeated for each patch)
3	ID, NN, IC	integer 3I5 values for the patch number, number of points in the patch, and point concentration flag
4	Z, Y	real 2F15.6 Z-Y values for point 1
	:	
	:	
	Z, Y	point NN

An example of KLINCRX output file LINOUT is shown in figure 7 and output file SAVPLT in figure 8.

5	3.500000	2	
1	20 0		
	.746900		.000000
	.746900		.000000
	.746900		.000000
	.746900		.000000
	.746900		.000000
	.736799		.060892
	.723413		.120718
	.703473		.178414
	.675244		.232977
	.639730		.283510
	.598205		.329154
	.551701		.369423
	.501058		.404132
	.447086		.433182
	.390463		.456915
	.331824		.475819
	.271759		.489689
	.210762		.496754
	.149346		.495059
	.133058		.491942
2	12 0		
	.133058		.491942
	.088802		.483473
	.031212		.461704
	-.021626		.430086
	-.068638		.390271
	-.109045		.344042
	-.143145		.292907
	-.171541		.238250
	-.193932		.181015
	-.209354		.121803
	-.218345		.061241
	-.224000		.000000

Figure 7: KLINCRX Output File LINOUT

"PAB102 FORWARD FUSELAGE



CROSS CUT AT X = 11.50000



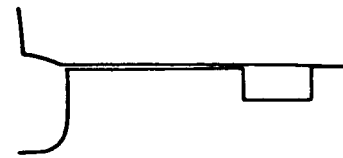
CROSS CUT AT X = 7.50000



CROSS CUT AT X = 31.50000



CROSS CUT AT X = 3.50000



CROSS CUT AT X = 26.00000

PROGRAM KLINFIX

Program KLINFIX is used to interactively enhance the LINOUT output file from KLINCRX. The user has the option of separating any patch into two patches and then saving the modified crosscut as a replacement to the old cut or as an added new cut. This program requires the NASA Langley PLOT10 graphics library LIBTEK5.

The files for KLINFIX are:

<u>File Name</u>	<u>Description</u>
LINOUT or LINDNEW	input crosscut data file, it is either the output from KLINCRX or the KLINFIX output file LINDNEW
LINDNEW	output file containing the enhanced crosscut data, its structure is the same as LINOUT
TTOUT, TTIN	Terminal output, input, used by user to enhance crosscut data for SIMP geometry.

Arrays in KLINFIX are sized via parameter statements. These parameter variables are:

<u>Variable</u>	<u>Description</u>
NCT	maximum number of original crosscuts, currently 200
NPT	maximum number of points per crosscut, currently 150
NCA	maximum number of added crosscuts, currently 20
NPX	maximum number of points per patch, currently 30
IPH	maximum number of patches per crosscut, currently 10

Figures 9 thru 14 present an example of an interactive session of KLINFIX which was conducted on a Tektronix 4014 terminal. Baud rate selection (Figure 9) is a required USER entry when using the LIBTEK5 plotting library.

Information pertaining to program purpose and limits are shown in figure 10. Figure 11 is a list of processing options that can be performed. When option 1 is selected, the list of crosscut locations and the number of patches in each cut are displayed as shown in figure 12. Figure 13 is an example of selecting option 2, operate on a cut, and then entering the number of the crosscut which is to be enhanced. In this example cut number 4 is selected. From figure 12, this corresponds to a X-location of 26.0 and a crosscut which has 5 patches.

As shown in figure 14, once the cut number has been entered the crosscut is drawn and information pertaining to the cut is written above it. Every 10 percent of arclength is denoted with a plus (+) sign. The patch endpoints are highlighted by a square symbol. The user is then prompted to select how many patches are to be subdivided, what each selected patch number is, and where in percent arclength the patch is to be split. In figure 14, patch number 1 has been selected to be subdivided at 8 percent arclength. The location of the split is marked by a diamond symbol.

Once all selected patches have been processed, the user is then prompted to select a completion option. Valid selections are:

- 1) cancel these changes,
- 2) apply these changes to the crosscut, or
- 3) regard these changes as creating an additional crosscut.

If number 3 is selected the user is then prompted to select if this new cut goes before or after (enter a 0 or 1) the original crosscut. This option is included so that transition regions can be properly analyzed.

For example, prior to the first lifting surface, all crosscuts are fuselage sections which originally contain two patches each. On the lifting surface an original crosscut has four patches (two for the fuselage and two for the lifting surface). Therefore, an additional fuselage crosscut which contains four patches would be created at the leading edge of the lifting surface. An additional option that can be selected under completion options 2 and 3 is multi-cut processing. This option allows the user to apply the changes made on a crosscut to other crosscuts which have the same number of patches as the cut that was enhanced.

ENTER BAUD RATE (120 OR 960)

?960

Figure 9: KLINFIX Terminal Output (Baud Rate)

THIS PROGRAM WAS DESIGNED TO USE THE OUTPUT FROM KLINFIX. ITS PURPOSE IS TO ENHANCE EXISTING CROSSCUTS AND TO ADD NEW ONES.

NEW CROSSCUTS ARE CREATED FROM EXISTING ONES. AS AN EXAMPLE, SUPPOSE CUT # 10 OCCURS WHERE A FUSELAGE / WING FIRST MEET. THE ORIGINAL CROSSCUT HAS TWO PATCHES AND A TRANSITION CUT IS REQUIRED INTO THE FOUR PATCH CUT #11 WHERE BOTH FUSELAGE AND WING OCCUR. THEREFORE, CUT #10 WOULD BE USED TO CREATE A NEW FOUR PATCH CUT #10B.

PROGRAM LIMITS ARE :

MAX # OF ORIGINAL CUTS = 200
MAX # OF POINTS PER CUT = 150
MAX # OF ADDED CROSSCUTS = 20
MAX # OF PATCHES PER CUT = 10
MAX # OF POINTS PER PATCH = 30

PRESS RETURN KEY TO CONTINUE

Figure 10: KLINFIX Terminal Output (Limits)

```
ENTER OPTION :
  1 : DISPLAY ORIGINAL CUT LOCATIONS
  2 : OPERATE ON A CUT
  3 : END PROGRAM AND WRITE NEW DATABASE
```

? 1

Figure 11: KLINFIX Terminal Output (Option Selection 1)

LISTED BELOW ARE THE X VALUES FOR THE 5 CROSSCUTS AND THE # OF PATCHES

```
I=  1 X=  3.50000000  #=  2
I=  2 X=  7.50000000  #=  4
I=  3 X= 11.50000000  #=  7
I=  4 X= 26.00000000  #=  5
I=  5 X= 31.50000000  #=  3
```

PRESS RETURN KEY TO CONTINUE

Figure 12: KLINFIX Terminal Output (Crosscuts)

```
ENTER OPTION :
  1 : DISPLAY ORIGINAL CUT LOCATIONS
  2 : OPERATE ON A CUT
  3 : END PROGRAM AND WRITE NEW DATABASE
```

? 2

ENTER THE CROSSCUT #, RANGE IS 1 THRU 5

? 4

Figure 13: KLINFIX Terminal Output (Option Selection 2)

NOTE: DATA IS ORDERED TOP TO BOTTOM
 PATCH ENDPOINTS ARE MARKED BY A SQUARE
 A + SIGN IS AT EVERY 10% ARC LENGTH
 NEW ENDPOINTS ARE MARKED BY A DIAMOND
 CUT# 4 X= 26.0 # PATCHES = 5

ENTER HOW MANY PATCHES ARE TO BE SUBDIVIDED
 ? 1
 ENTER THE 1 PATCH NUMBERS
 ? 2
 ENTER THE % ARC LENGTH WHERE SPLIT OCCURS
 PATCH # 2 RANGE IS 5.49267 TO 10.10325
 ?
 6.

SELECT COMPLETION OPTION :
 1: CANCEL THESE CHANGES
 2: APPLY THESE CHANGES TO THE CROSSCUT
 3: REGARD THIS AS AN ADDED CROSSCUT

? 3
 SELECT LOCATION OPTION :
 0: ADD BEFORE THIS CUT
 1: ADD AFTER THIS CUT
 ? 0

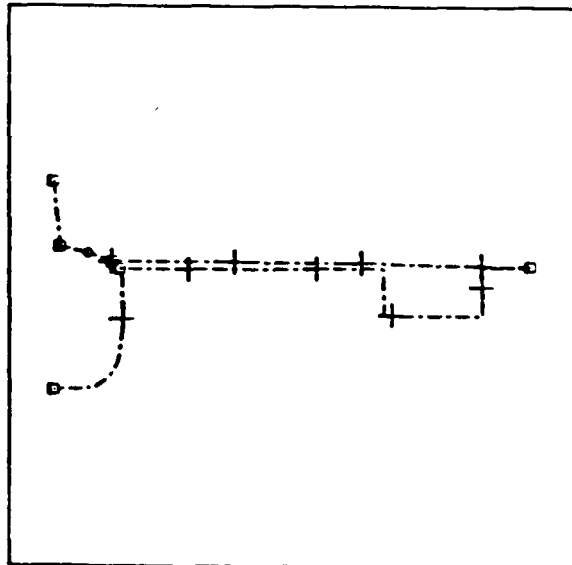


Figure 14: KLINFIX Terminal Output (Patches)

CONCLUDING REMARKS

Three computer programs have been developed to convert geometry that is originally in wave-drag input format to an input format compatible with the SIMP code. The SIMP input is generated by using linear interpolation between the LaWGS definitions of the fuselage type components and the lifting surface components. An additional program was developed which enables a user to interactively enhance the output obtained from the geometry conversion program.

REFERENCES

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15. Supplementary Notes Langley Technical Monitors: John E. Hogge and Kenneth M. Jones					
16. Abstract This paper documents an aeronautical geometry conversion package which translates wave-drag geometry into the Langley Wireframe Geometry Standard (LaWGS) format and then into a format which is used by the Supersonic Implicit Marching Potential (SIMP) program. The programs described in this paper were developed by Computer Sciences Corporation for the Advanced Vehicles Division/Advanced Concepts Branch at NASA Langley Research Center. Included in this document are the input and output from a benchmark test case.					
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