APPENDIX D

Balloon Analysis Program - Input

The input for the analysis program consists of three identifying data cards; a deck of manufactured radius, film weight and tape weight; and a deck containing the design shape in nondimensional units.

Card 1. Format (5E15.7)

Columns	Variable	Description
1-15	PD	Design Payload in pounds
16-30	PTOP	Nondimensional top load (P_{TOP}/PD)
31-45	WBAL	Nondimensional balloon weight (W/PD)
46-60	SMAX	Underformed gore length in feet
61-75	LAMBDA	Design $\lambda=(PD/b_d)**1./3.$

Card 2. Format (3E15.7, I15)

1-15	NU	Poissons ratio
16-30	KBAR	Total tape stiffness, NK_T/PD
31-45	EBAR	Film stiffness, $Et\lambda/PD$
46-60	N	Number of gores

Card 3. Format (I15, 2E15.7)

1-15	KMAX	Number of points to be considered
16-30	ABAR	Nondimensional superpressure, a/S_{max}
31-45	BBAR	Ratio of specific lift at altitude to design altitude

Card 4. Format (4E15.7) KMAX Required

Columns	Variable	Description
1-15	GP(K)	Gore position of point K in feet
16-30	RO(K)	Half gore width at point K in inches
31-45	WT(K)	Weight increment between K and K+1 including tape
46-60	WTAPE(K)	Weight increment of a single tape between points K and K+1

Card 5. Format (5E15.7) KMAX Required

1-15	X(L+2)	Normalized design radius at point K, r/λ
16-30	X(L+3)	Normalized design height at point K, z/λ
31-45	X(L+4)	Normalized design load in meridional direction at point K, $T/2\pi PD$
46-60	X(L+5)	Design angle at point K, θ
61-75	X(L+6)	Normalized design volume at point K, $V/\pi\lambda^3$

Output consists of computed payload ratio, normalized deformed shape and stress distributions for any altitude designated as BBAR on card 3. Principal stresses and tension field patterns are computed when necessary. A sample of this output is as follows:

DESIGN VALUES

PAYLOAD=	4000.43 LBS	LAMBDA=165.		EBAR=	82.52
VOLUME=	0.5844D 07 FT(3)	NUF	0.68	ABAR=	0.00
CORE LENGTH=	350.85 FT	KBAR=	25.66	BBAR=	1.00
NUMBER OF TAPES=	91				
NUMBER OF POINTS=	87				

BETA	R	Z	T	THETA	VOL
1.5217	0.0000	0.0000	0.2705	0.9465	0.1353
0.0209	0.0095	0.0069	0.2707	0.9457	0.1353
0.0193	0.0191	0.0137	0.2708	0.9447	0.1353
0.0188	0.0286	0.0206	0.2709	0.9434	0.1353
0.0186	0.0381	0.0275	0.2710	0.9418	0.1353
0.0185	0.0476	0.0344	0.2712	0.9399	0.1352
0.0185	0.0571	0.0413	0.2715	0.9377	0.1352
0.0186	0.0666	0.0482	0.2717	0.9349	0.1351
0.0186	0.0760	0.0551	0.2721	0.9317	0.1350
0.0187	0.0855	0.0621	0.2724	0.9279	0.1348
0.0188	0.0949	0.0691	0.2728	0.9235	0.1347
0.0188	0.1043	0.0761	0.2733	0.9184	0.1344
0.0189	0.1137	0.0831	0.2738	0.9127	0.1342
0.0190	0.1230	0.0902	0.2743	0.9062	0.1339
0.0190	0.1323	0.0974	0.2748	0.8988	0.1335
0.0191	0.1416	0.1046	0.2754	0.8906	0.1331
0.0191	0.1508	0.1119	0.2760	0.8814	0.1326
0.0192	0.1599	0.1192	0.2765	0.8712	0.1320
0.0192	0.1690	0.1266	0.2772	0.8600	0.1314
0.0193	0.1780	0.1341	0.2778	0.8476	0.1307
0.0193	0.1870	0.1416	0.2784	0.8341	0.1299
0.0193	0.1958	0.1495	0.2791	0.8193	0.1290
0.0193	0.2045	0.1573	0.2797	0.8033	0.1280
0.0193	0.2132	0.1653	0.2803	0.7858	0.1270
0.0193	0.2217	0.1733	0.2810	0.7670	0.1258
0.0192	0.2300	0.1816	0.2816	0.7467	0.1244
0.0192	0.2382	0.1900	0.2822	0.7249	0.1230
0.0192	0.2462	0.1985	0.2828	0.7016	0.1214
0.0191	0.2541	0.2072	0.2834	0.6766	0.1197
0.0190	0.2617	0.2161	0.2839	0.6499	0.1179
0.0190	0.2692	0.2251	0.2844	0.6216	0.1159
0.0189	0.2764	0.2344	0.2849	0.5915	0.1137
0.0188	0.2833	0.2438	0.2854	0.5596	0.1113
0.0187	0.2899	0.2535	0.2856	0.5259	0.1088
0.0185	0.2963	0.2633	0.2861	0.4905	0.1062
0.0184	0.3024	0.2733	0.2864	0.4532	0.1033
0.0182	0.3079	0.2836	0.2867	0.4141	0.1003
0.0180	0.3132	0.2940	0.2869	0.3731	0.0971
0.0178	0.3181	0.3046	0.2870	0.3304	0.0937
0.0176	0.3225	0.3154	0.2870	0.2860	0.0901
0.0174	0.3265	0.3264	0.2869	0.2398	0.0864
0.0171	0.3300	0.3375	0.2868	0.1920	0.0825
0.0168	0.3330	0.3488	0.2865	0.1431	0.0785
0.0161	0.3354	0.3602	0.2862	0.0923	0.0744
0.0158	0.3373	0.3717	0.2858	0.0436	0.0702
0.0130	0.3386	0.3832	0.2852	-0.0097	0.0659
0.0129	0.3393	0.3948	0.2845	-0.0488	0.0616
0.0061	0.3396	0.4065	0.2837	-0.1046	0.0573

0.0081	0.3390	0.4181	0.2825	-0.1286	0.0530
0.0183	0.3354	0.4297	0.2817	-0.1868	0.0487
0.0184	0.3365	0.4412	0.2818	-0.2448	0.0445
0.0182	0.3342	0.4526	0.2830	-0.3030	0.0404
0.0177	0.3310	0.4638	0.2830	-0.3613	0.0365
0.0176	0.3273	0.4748	0.2841	-0.4195	0.0327
0.0174	0.3228	0.4856	0.2841	-0.4775	0.0291
0.0174	0.3176	0.4961	0.2848	-0.5350	0.0257
0.0174	0.3119	0.5062	0.2849	-0.5921	0.0225
0.0175	0.3056	0.5160	0.2852	-0.6486	0.0195
0.0177	0.2987	0.5255	0.2853	-0.7043	0.0168
0.0180	0.2913	0.5345	0.2853	-0.7591	0.0144
0.0184	0.2833	0.5431	0.2853	-0.8129	0.0122
0.0189	0.2750	0.5512	0.2854	-0.8657	0.0102
0.0195	0.2661	0.5589	0.2854	-0.9173	0.0084
0.0201	0.2569	0.5661	0.2854	-0.9676	0.0069
0.0208	0.2473	0.5728	0.2854	-1.0165	0.0056
0.0216	0.2374	0.5790	0.2854	-1.0639	0.0045
0.0223	0.2271	0.5847	0.2855	-1.1097	0.0035
0.0232	0.2167	0.5899	0.2855	-1.1539	0.0027
0.0240	0.2059	0.5946	0.2856	-1.1962	0.0021
0.0248	0.1950	0.5989	0.2856	-1.2366	0.0016
0.0256	0.1839	0.6027	0.2857	-1.2750	0.0012
0.0264	0.1727	0.6061	0.2856	-1.3113	0.0008
0.0272	0.1613	0.6090	0.2855	-1.3455	0.0006
0.0279	0.1499	0.6116	0.2853	-1.3773	0.0004
0.0286	0.1384	0.6138	0.2850	-1.4069	0.0003
0.0292	0.1268	0.6157	0.2845	-1.4340	0.0002
0.0298	0.1151	0.6172	0.2837	-1.4586	0.0001
0.0305	0.1034	0.6184	0.2825	-1.4807	0.0001
0.0314	0.0917	0.6194	0.2808	-1.5004	0.0000
0.0331	0.0800	0.6202	0.2786	-1.5174	0.0000
0.0360	0.0683	0.6207	0.2755	-1.5327	0.0000
0.0409	0.0565	0.6211	0.2716	-1.5449	0.0000
0.0468	0.0448	0.6214	0.2673	-1.5564	0.0000
0.0529	0.0330	0.6215	0.2630	-1.5636	-0.0000
0.0564	0.0212	0.6215	0.2605	-1.5711	-0.0000
0.0546	0.0094	0.6215	0.2605	-1.5729	-0.0000
0.0555	0.0000	0.6215	0.2737	-1.5749	0.0000

K	F	MER. STRESS	CIR. STRESS	MER. SHEAR	PRINCIPAL STRESSES S1	S2	MAX SHEAR	ANGLE
1	0.0187	0.8628	0.0000	-0.0241	0.8634	0.0000	0.4314	-0.0279
2	0.0181	0.8380	0.0007	-0.0231	0.8387	0.0001	0.4193	-0.0276
3	0.0176	0.8153	0.0026	-0.0219	0.8159	0.0020	0.4069	-0.0269
4	0.0171	0.7947	0.0055	-0.0207	0.7952	0.0050	0.3951	-0.0262
5	0.0167	0.7758	0.0094	-0.0197	0.7763	0.0089	0.3837	-0.0257
6	0.0162	0.7586	0.0141	-0.0186	0.7591	0.0137	0.3727	-0.0252
7	0.0158	0.7429	0.0198	-0.0180	0.7434	0.0193	0.3620	-0.0249
8	0.0154	0.7286	0.0262	-0.0173	0.7290	0.0258	0.3516	-0.0246
9	0.0150	0.7155	0.0334	-0.0166	0.7159	0.0330	0.3415	-0.0244
10	0.0146	0.7035	0.0412	-0.0161	0.7039	0.0408	0.3315	-0.0243
11	0.0143	0.6928	0.0497	-0.0156	0.6928	0.0493	0.3218	-0.0242
12	0.0139	0.6824	0.0588	-0.0151	0.6827	0.0584	0.3122	-0.0243
13	0.0136	0.6731	0.0683	-0.0147	0.6734	0.0680	0.3027	-0.0243
14	0.0132	0.6645	0.0784	-0.0144	0.6648	0.0780	0.2934	-0.0245
15	0.0129	0.6566	0.0889	-0.0140	0.6569	0.0885	0.2842	-0.0247
16	0.0126	0.6493	0.0997	-0.0137	0.6496	0.0994	0.2751	-0.0249
17	0.0123	0.6426	0.1109	-0.0134	0.6429	0.1105	0.2662	-0.0252
18	0.0120	0.6363	0.1224	-0.0131	0.6366	0.1220	0.2573	-0.0255
19	0.0117	0.6305	0.1340	-0.0129	0.6306	0.1336	0.2486	-0.0259
20	0.0114	0.6251	0.1458	-0.0126	0.6254	0.1455	0.2400	-0.0263
21	0.0111	0.6201	0.1578	-0.0124	0.6204	0.1575	0.2314	-0.0268
22	0.0108	0.6154	0.1700	-0.0121	0.6157	0.1697	0.2230	-0.0272
23	0.0106	0.6110	0.1822	-0.0119	0.6114	0.1819	0.2147	-0.0277
24	0.0103	0.6070	0.1945	-0.0117	0.6073	0.1941	0.2066	-0.0283
25	0.0100	0.6032	0.2068	-0.0114	0.6035	0.2065	0.1985	-0.0288
26	0.0098	0.5997	0.2191	-0.0112	0.6000	0.2188	0.1906	-0.0294
27	0.0095	0.5964	0.2314	-0.0110	0.5967	0.2311	0.1828	-0.0300
28	0.0093	0.5934	0.2437	-0.0107	0.5937	0.2434	0.1751	-0.0307
29	0.0090	0.5906	0.2560	-0.0105	0.5909	0.2557	0.1676	-0.0314
30	0.0088	0.5880	0.2683	-0.0103	0.5884	0.2680	0.1602	-0.0321
31	0.0086	0.5857	0.2805	-0.0101	0.5861	0.2802	0.1529	-0.0329
32	0.0083	0.5837	0.2928	-0.0098	0.5840	0.2925	0.1458	-0.0338
33	0.0081	0.5819	0.3051	-0.0096	0.5822	0.3048	0.1387	-0.0347
34	0.0079	0.5804	0.3174	-0.0094	0.5807	0.3171	0.1318	-0.0357
35	0.0077	0.5791	0.3296	-0.0092	0.5795	0.3295	0.1250	-0.0368
36	0.0075	0.5782	0.3423	-0.0090	0.5785	0.3419	0.1183	-0.0380
37	0.0073	0.5775	0.3549	-0.0088	0.5779	0.3545	0.1117	-0.0393
38	0.0071	0.5772	0.3676	-0.0086	0.5776	0.3673	0.1051	-0.0408
39	0.0069	0.5773	0.3806	-0.0084	0.5776	0.3802	0.0987	-0.0425
40	0.0067	0.5777	0.3938	-0.0082	0.5780	0.3934	0.0923	-0.0444
41	0.0065	0.5785	0.4072	-0.0081	0.5789	0.4069	0.0860	-0.0471
42	0.0064	0.5799	0.4210	-0.0079	0.5803	0.4212	0.0795	-0.0497
43	0.0062	0.5815	0.4356	-0.0093	0.5821	0.4350	0.0735	-0.0634
44	0.0059	0.5870	0.4604	-0.0091	0.5877	0.4598	0.0639	-0.0711
45	0.0056	0.5895	0.4750	-0.0165	0.5918	0.4726	0.0596	-0.1404
46	0.0052	0.6111	0.5470	-0.0161	0.6149	0.5432	0.0358	-0.2328
47	0.0050	0.6142	0.5612	-0.0237	0.6233	0.5521	0.0356	-0.3651

48	0.0041	0.6524	0.6820	-0.0232	0.6947	0.6397	0.0275	2.0727
49	0.0040	0.6558	0.6947	-0.0347	0.7150	0.6554	0.0398	2.1009
50	0.0025	0.7195	0.2769	-0.0321	0.7216	0.2746	0.2235	-0.0720
51	0.0025	0.7238	0.2808	0.0001	0.7238	0.2808	0.2215	0.0002
52	0.0025	0.7331	0.2908	-0.0002	0.7331	0.2908	0.2212	-0.0004
53	0.0025	0.7413	0.3041	0.0001	0.7413	0.3041	0.2186	0.0002
54	0.0025	0.7527	0.3130	0.0006	0.7527	0.3130	0.2198	0.0013
55	0.0026	0.7637	0.3241	0.0008	0.7637	0.3241	0.2198	0.0019
56	0.0026	0.7769	0.3320	0.0013	0.7769	0.3320	0.2224	0.0030
57	0.0026	0.7907	0.3401	0.0017	0.7907	0.3401	0.2253	0.0037
58	0.0027	0.8061	0.3462	0.0022	0.8062	0.3462	0.2300	0.0048
59	0.0028	0.8229	0.3510	0.0027	0.8229	0.3510	0.2360	0.0058
60	0.0028	0.8412	0.3542	0.0033	0.8412	0.3541	0.2436	0.0068
61	0.0029	0.8613	0.3557	0.0039	0.8613	0.3557	0.2528	0.0077
62	0.0030	0.8832	0.3556	0.0045	0.8832	0.3558	0.2637	0.0085
63	0.0031	0.9071	0.3544	0.0051	0.9072	0.3544	0.2764	0.0093
64	0.0033	0.9333	0.3518	0.0058	0.9334	0.3518	0.2908	0.0099
65	0.0034	0.9619	0.3481	0.0064	0.9620	0.3480	0.3070	0.0105
66	0.0036	0.9932	0.3435	0.0071	0.9933	0.3434	0.3250	0.0110
67	0.0038	1.0275	0.3381	0.0079	1.0276	0.3380	0.3448	0.0114
68	0.0040	1.0650	0.3321	0.0087	1.0651	0.3320	0.3665	0.0118
69	0.0042	1.1061	0.3257	0.0095	1.1062	0.3256	0.3903	0.0122
70	0.0044	1.1512	0.3190	0.0104	1.1514	0.3188	0.4163	0.0125
71	0.0047	1.2008	0.3120	0.0114	1.2009	0.3119	0.4445	0.0128
72	0.0049	1.2553	0.3050	0.0125	1.2554	0.3048	0.4753	0.0131
73	0.0052	1.3153	0.2980	0.0136	1.3155	0.2979	0.5088	0.0134
74	0.0056	1.3817	0.2914	0.0149	1.3819	0.2912	0.5453	0.0137
75	0.0059	1.4552	0.2856	0.0164	1.4554	0.2854	0.5850	0.0140
76	0.0063	1.5371	0.2814	0.0179	1.5373	0.2811	0.6281	0.0142
77	0.0068	1.6287	0.2802	0.0195	1.6290	0.2799	0.6746	0.0145
78	0.0072	1.7321	0.2837	0.0213	1.7324	0.2834	0.7245	0.0147
79	0.0078	1.8497	0.2953	0.0234	1.8501	0.2949	0.7776	0.0150
80	0.0085	1.9840	0.3142	0.0259	1.9844	0.3138	0.8353	0.0155
81	0.0090	2.1399	0.3450	0.0299	2.1404	0.3446	0.8979	0.0166
82	0.0097	2.3167	0.3694	0.0362	2.3174	0.3687	0.9743	0.0186
83	0.0107	2.5256	0.3557	0.0466	2.5267	0.3846	1.0710	0.0218
84	0.0119	2.7675	0.3551	0.0635	2.7691	0.3534	1.2079	0.0263
85	0.0136	3.0802	0.2780	0.0885	3.0850	0.2752	1.4039	0.0315
86	0.0160	3.4906	0.1324	0.1279	3.4954	0.1275	1.6840	0.0380
87	0.0196	4.1551	0.0000	0.1775	4.1626	-0.0076	2.0851	0.0426