Appendix 3.1 – EXPERIMENTAL RESULTS FROM NASA LANGLEY

by

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A3.1.1 SUMMARY

In this Appendix, sample data are provided in support of Chapter 18. Links and references are also provided.

A3.1.2 PRESSURE MEASUREMENTS

Data from the National Transonic Facility (NTF) have been published in references 1 to 4. These reports include both summary plots and data tabulations and can be accessed through the NASA report server link http://ntrs.nasa.gov/search.jsp, for example, by searching with the report number NASA TM-4645.

For AVT-113, considerable attention was placed upon a condition exhibiting part-span leading-edge vortex separation that included dual co-rotating vortices. These results corresponded to M = 0.4, R_{mac} = 6 x 10^6, α = 13.3° for the medium bluntness leading edge, and are presented in Figure 18-8 of Chapter 18. These pressure data can be found in Reference 3 and are also presented in Table A3.1-1.

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Table A3.1-1: NTF Delta Wing Surface Pressure Coefficients.
Medium leading-edge bluntness, M = 0.4, R_{mac} = 6 x 10^6, α = 13.3°

2y/b \ x/c_R	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95
0.050		-0.2285		-0.1942		-0.0349				
0.100		-0.2299		-0.1875		-0.0578				
0.150		-0.2636		-0.1928		-0.0763				
0.200		-0.2757		-0.1912		-0.0964				-0.2711
0.250				-0.2048		-0.1103		-0.1780		-0.2519
0.300		-0.3175		-0.2029		-0.1363		-0.1670		-0.2549
0.350				-0.2072		-0.1476		-0.1632		-0.2686
0.400		-0.3591		-0.2209		-0.1572		-0.1578		-0.2822
0.450		-0.3812		-0.2481		-0.1721		-0.1783		-0.2818
0.500		-0.4055		-0.2753		-0.1935		-0.2143		-0.2484
0.525				-0.3141		-0.2240		-0.1987		-0.2540
0.550		-0.4308		-0.3674		-0.2845		-0.1860		-0.2670
0.575				-0.4144		-0.3428		-0.1728		-0.2926
0.600		-0.4829		-0.4734		-0.3756		-0.1730		-0.3111
0.625						-0.3373		-0.1711		-0.3352
0.650		-0.5266		-0.6529		-0.3226		-0.1681		-0.3605
0.675				-0.7393		-0.3028		-0.1820		-0.3989
0.700		-0.5741		-0.7711		-0.3081		-0.2190		-0.4983
0.725				-0.7516				-0.3345		-0.6339
0.750		-0.6343		-0.7479				-0.5914		-0.7634
0.775				-0.7398		-0.4496		-0.9427		-0.8086
0.800		-0.7103		-0.7612		-0.7490		-1.2245		
0.825				-0.7389		-1.1767		-1.3358		-0.6424
0.850		-0.8101		-0.7145		-1.4874		-1.1747		-0.5218
0.875				-0.7153		-1.5737		-0.9304		-0.4876
0.900		-0.9404		-0.7552		-1.5235		-0.8751		-0.4869
0.925				-1.1008		-1.4016		-0.8423		-0.4780
0.950		-1.1972		-2.1184		-1.3167		-0.8030		-0.3879
0.975				-2.1575		-1.2297		-0.7806		-0.3375
1.000	-1.4583	-2.6237	-3.5857	-2.2709	-1.5979	-1.1227	-0.9577	-0.7932		-0.4124

(a) Upper Surface

2y/b \ x/c_R	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95
0.200		0.2609		0.2355		0.2368				-0.2897
0.400		0.2613		0.2503		0.2118		0.0642		-0.3359
0.600		0.2753		0.2530		0.2196		0.0942		-0.3318
0.700		0.2925		0.2642		0.2232		0.1058		-0.3628
0.800		0.2925		0.2773		0.2399		0.1335		-0.3925
0.850		0.2687		0.2841		0.2531		0.1539		-0.4007
0.900				0.2620		0.2508		0.1798		-0.3976
0.950		0.0777		0.1640		0.2085		0.1882		-0.1463
0.975				-0.0375		0.0818		0.1416		0.0097
1.000		-2.5640		-1.5652		-1.0384		-0.7393		-0.3794

(b) Lower Surface

A3.1.3 FORCE MEASUREMENTS

Limited data from the Low Turbulence Pressure Tunnel (LTPT) have been published in reference 5. Further links to these data are unavailable at time of this publication.

An analysis of compressibility effects on normal force coefficient for the medium bluntness leading edge with data from both LTPT and NTF was presented in reference 5 and can be found in Figure 18-14 of Chapter 18. A tabulation of these normal force coefficients is presented in Table A3.1-2.

Table A3.1-2: Normal Force Measurements from LTPT and NTF Experiments. Medium bluntness leading edge.

LTPT $M = 0.2$, $R_{mac} = 8 \times 10^6$		NTF $M = 0.4$, $R_{mac} = 6 \times 10^6$		NTF $M = 0.6$, $R_{mac} = 6 \times 10^6$	
α	C_N	α	C_N	α	C_N
-2.2	-0.078	-0.4	-0.023	-0.4	-0.033
-1.0	-0.042	0.1	-0.008	0	-0.017
0.0	0.000	1.1	0.028	1.1	0.029
1.0	0.021	2.2	0.065	2.1	0.061
2.1	0.063	3.2	0.092	3.2	0.100
3.2	0.089	4.2	0.132	4.2	0.138
4.2	0.115	5.2	0.160	5.2	0.170
5.4	0.147	6.2	0.199	6.3	0.206
6.4	0.180	7.3	0.234	7.3	0.244
7.5	0.208	8.3	0.268	8.3	0.287
8.5	0.251	9.3	0.318	9.3	0.344
9.7	0.289	10.3	0.368	10.3	0.395
10.6	0.343	11.3	0.409	11.3	0.453
11.8	0.394	12.3	0.466	12.4	0.511
12.8	0.441	13.3	0.517	13.4	0.568
14.0	0.501	14.3	0.563	14.4	0.616
15.0	0.542	16.4	0.649	16.5	0.721
16.1	0.578	18.4	0.793	18.5	0.830
17.3	0.632	20.4	0.911	20.5	0.937
18.3	0.681	22.4	1.013	22.5	1.042
19.5	0.736	24.5	1.102	24.6	1.146
20.6	0.798	26.5	1.217	26.6	1.263
21.7	0.856				

A3.1.4 REFERENCES

[A3.1-1] Chu, J. and Luckring, J.M.: *Experimental Surface Pressure Data Obtained on 65° Delta Wing Across Reynolds Number and Mach Number Ranges, Volume 1 – Sharp Leading Edge*, NASA TM-4645, February 1996.

[A3.1-2] Chu, J. and Luckring, J.M.: *Experimental Surface Pressure Data Obtained on 65° Delta Wing Across Reynolds Number and Mach Number Ranges, Volume 2 – Small Leading Edge*, NASA TM-4645, February 1996.

[A3.1-3] Chu, J. and Luckring, J.M.: *Experimental Surface Pressure Data Obtained on 65° Delta Wing Across Reynolds Number and Mach Number Ranges, Volume 3 – Medium Leading Edge*, NASA TM-4645, February 1996.

[A3.1-4] Chu, J. and Luckring, J.M.: *Experimental Surface Pressure Data Obtained on 65° Delta Wing Across Reynolds Number and Mach Number Ranges, Volume 4 – Large Leading Edge*, NASA TM-4645, February 1996.

[A3.1-5] Luckring, J.M.: *Initial Experiments and Analysis of Vortex Flow on Blunt Edged Delta Wings*, AIAA Paper 2008-0378, 2008.