APPENDIX B

Development of Stress-Range Histograms
Used to Calculate Fatigue Damage

Channel 2

Bin size (ksi)				Level of Truncation			
				None	0.5 ksi	1.0 ksi	1.5 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	67945	0.0510	-	-	-
0.5	1.0	0.75	2202	0.0132	0.4074	-	-
1.0	1.5	1.25	74	0.0021	0.0634	1.8530	-
1.5	2.0	1.75	2	0.0002	0.0047	0.1374	2.6797
2.0	2.5	2.25	1	0.0002	0.0050	0.1460	2.8477
2.5	3.0	2.75	1	0.0003	0.0091	0.2666	5.1992

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL=16 ksi	% Exceedance CAFL = 16 ksi
No truncation	0.41	70225	0	0.0
0.5	0.79	2280	0	0.0
1.0	1.34	78	0	0.0
1.5	2.21	4	0	0.0

Where effective stress range (S_{reff}) was determined by:

$S_{reff} = (\sum(f_i \times S_{ri}^3))^{1/3}$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 4

Bin size (ksi)				Level of Truncation				
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	497436	0.0426	-	-	-	-
0.5	1.0	0.75	116046	0.0794	0.4112	-	-	-
1.0	1.5	1.25	2176	0.0069	0.0357	1.4162	-	-
1.5	2.0	1.75	569	0.0049	0.0256	1.0162	3.6963	-
2.0	2.5	2.25	235	0.0043	0.0225	0.8920	3.2446	10.4562
2.5	3.0	2.75	18	0.0006	0.0031	0.1247	0.4538	1.4623
3.0	3.5	3.25	3	0.0002	0.0009	0.0343	0.1248	0.4023

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles} > CAFL=16 ksi	% Exceedance CAFL = 16 ksi
No truncation	0.52	616483	0	0.0
0.5	0.79	119047	0	0.0
1.0	1.52	3001	0	0.0
1.5	1.96	825	0	0.0
2.0	2.31	256	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum(f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 6

Bin size (ksi)				Level of Truncation					
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi	2.5 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	895209	0.0408	-	-	-	-	-
0.5	1.0	0.75	154368	0.0563	0.2498	-	-	-	-
1.0	1.5	1.25	80398	0.1358	0.6022	1.4760	-	-	-
1.5	2.0	1.75	24047	0.1115	0.4942	1.2114	4.9589	-	-
2.0	2.5	2.25	1378	0.0136	0.0602	0.1475	0.6040	8.0825	-
2.5	3.0	2.75	466	0.0084	0.0372	0.0911	0.3729	4.9904	17.1832
3.0	3.5	3.25	73	0.0022	0.0096	0.0236	0.0964	1.2904	4.4432
3.5	4	3.75	21	0.0010	0.0042	0.0104	0.0426	0.5702	1.9635
4	4.5	4.25	1	0.0001	0.0003	0.0007	0.0030	0.0395	0.1361
4.5	5.0	4.75	1	0.0001	0.0004	0.0010	0.0041	0.0552	0.1900
5	5.5	5.25	2	0.0003	0.0011	0.0027	0.0111	0.1490	0.5131

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles} > CAFL=16ksi	% Exceedance CAFL = 16 ksi
No truncation	0.72	1155964	0	0.0
0.5	1.13	260755	0	0.0
1.0	1.43	106387	0	0.0
1.5	1.82	25989	0	0.0
2.0	2.43	1942	0	0.0
2.5	2.90	564	0	0.0

Where effective stress range (S_{reff}) was determined by:

$S_{reff} = (\sum(f_i \times S_{ri}^3))^{1/3}$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 8

Bin size (ksi)				Level of Truncation								
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	4.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	1138643	0.037	-	-	-	-	-	-	-	-
0.5	1.0	0.75	282005	0.073	0.237	-	-	-	-	-	-	-
1.0	1.5	1.25	114720	0.137	0.447	1.020	-	-	-	-	-	-
1.5	2.0	1.75	41937	0.137	0.448	1.023	2.141	-	-	-	-	-
2.0	2.5	2.25	48356	0.336	1.098	2.507	5.247	8.738	-	-	-	-
2.5	3.0	2.75	13333	0.169	0.553	1.262	2.641	4.399	18.889	-	-	-
3.0	3.5	3.25	884	0.018	0.060	0.138	0.289	0.481	2.067	22.529	-	-
3.5	4	3.75	303	0.010	0.032	0.073	0.152	0.253	1.088	11.862	34.511	-
4	4.5	4.25	117	0.005	0.018	0.041	0.086	0.142	0.612	6.668	19.399	56.135
4.5	5.0	4.75	16	0.001	0.003	0.008	0.016	0.027	0.117	1.273	3.704	10.717
5	5.5	5.25	15	0.001	0.004	0.010	0.021	0.034	0.148	1.611	4.688	13.566
5.5	6.0	5.75	10	0.001	0.004	0.009	0.018	0.030	0.130	1.411	4.106	11.882
6.0	6.5	6.25	1	0.000	0.000	0.001	0.002	0.004	0.017	0.181	0.527	1.526
6.5	7.0	6.75	1	0.000	0.001	0.001	0.003	0.005	0.021	0.228	0.664	1.922

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL= 16 ksi	% Exceedance CAFL = 16 ksi
No truncation	0.97	1640341	0	0.0
0.5	1.42	501698	0	0.0
1.0	1.81	219693	0	0.0
1.5	2.18	104973	0	0.0
2.0	2.39	63036	0	0.0
2.5	2.84	14680	0	0.0
3.0	3.58	1347	0	0.0
3.5	4.07	463	0	0.0
4.0	4.57	160	0	0.0

Where effective stress range (S_{reff}) was determined by:

$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 10

Bin size (ksi)				Level of Truncation								
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	4.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	1248915	0.036	-	-	-	-	-	-	-	-
0.5	1.0	0.75	328669	0.075	0.229	-	-	-	-	-	-	-
1.0	1.5	1.25	132045	0.139	0.426	0.931	-	-	-	-	-	-
1.5	2.0	1.75	111411	0.322	0.986	2.156	4.119	-	-	-	-	-
2.0	2.5	2.25	28326	0.174	0.533	1.165	2.226	9.620	-	-	-	-
2.5	3.0	2.75	3462	0.039	0.119	0.260	0.497	2.147	13.811	-	-	-
3.0	3.5	3.25	1402	0.026	0.079	0.174	0.332	1.435	9.232	27.486	-	-
3.5	4	3.75	269	0.008	0.023	0.051	0.098	0.423	2.721	8.101	40.646	-
4	4.5	4.25	59	0.002	0.007	0.016	0.031	0.135	0.869	2.587	12.978	56.615
4.5	5.0	4.75	17	0.001	0.003	0.007	0.013	0.054	0.349	1.041	5.220	22.774
5	5.5	5.25	4	0.000	0.001	0.002	0.004	0.017	0.111	0.331	1.658	7.235

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL= 16 ksi	% Exceedance CAFL = 16 ksi
No truncation	0.93	1854579	0	0.0
0.5	1.33	605664	0	0.0
1.0	1.67	276995	0	0.0
1.5	1.93	144950	0	0.0
2.0	2.36	33539	0	0.0
2.5	3.00	5213	0	0.0
3.0	3.41	1751	0	0.0
3.5	3.93	349	0	0.0
4.0	4.42	80	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 12

Bin size (ksi)				Level of Truncation								
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	4.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.38	1228375	0.037	-	-	-	-	-	-	-	-
0.5	1.0	0.75	287110	0.070	0.241	-	-	-	-	-	-	-
1.0	1.5	1.25	115770	0.131	0.449	1.047	-	-	-	-	-	-
1.5	2.0	1.75	46458	0.144	0.495	1.153	2.485	-	-	-	-	-
2.0	2.5	2.25	45343	0.298	1.027	2.392	5.155	9.613	-	-	-	-
2.5	3.0	2.75	6560	0.079	0.271	0.632	1.362	2.539	16.270	-	-	-
3.0	3.5	3.25	808	0.016	0.055	0.128	0.277	0.516	3.308	15.198	-	-
3.5	4	3.75	792	0.024	0.083	0.193	0.417	0.777	4.981	22.885	41.067	-
4	4.5	4.25	186	0.008	0.028	0.066	0.143	0.266	1.703	7.824	14.040	63.460
4.5	5.0	4.75	30	0.002	0.006	0.015	0.032	0.060	0.383	1.762	3.161	14.290
5	5.5	5.25	8	0.001	0.002	0.005	0.012	0.022	0.138	0.634	1.138	5.145
5.5	6	5.75	1	0.000	0.000	0.001	0.002	0.004	0.023	0.104	0.187	0.845

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL= 16 ksi	% Exceedance CAFL = 16 ksi
No truncation	0.92	1731441	0	0.0
0.5	1.36	503066	0	0.0
1.0	1.75	215956	0	0.0
1.5	2.10	100186	0	0.0
2.0	2.33	53728	0	0.0
2.5	2.99	8385	0	0.0
3.0	3.64	1825	0	0.0
3.5	3.91	1017	0	0.0
4.0	4.37	225	0	0.0

Where effective stress range (S_{reff}) was determined by:

$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAF L = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 14

Bin size (ksi)				Level of Truncation								
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	4.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	564581	0.036	-	-	-	-	-	-	-	-
0.5	1.0	0.75	168743	0.085	0.260	-	-	-	-	-	-	-
1.0	1.5	1.25	75194	0.175	0.536	1.395	-	-	-	-	-	-
1.5	2.0	1.75	27578	0.176	0.539	1.404	4.910	-	-	-	-	-
2.0	2.5	2.25	1578	0.021	0.066	0.171	0.597	7.124	-	-	-	-
2.5	3.0	2.75	811	0.020	0.062	0.160	0.560	6.685	17.848	-	-	-
3.0	3.5	3.25	115	0.005	0.014	0.037	0.131	1.565	4.177	29.461	-	-
3.5	4	3.75	15	0.001	0.003	0.008	0.026	0.314	0.837	5.903	41.632	-
4	4.5	4.25	3	0.000	0.001	0.002	0.008	0.091	0.244	1.719	12.121	57.574
4.5	5.0	4.75	1	0.000	0.000	0.001	0.004	0.042	0.113	0.800	5.641	26.793

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL= 16 ksi	% Exceedance CAFL = 16 ksi
No truncation	0.80	838619	0	0.0
0.5	1.14	274038	0	0.0
1.0	1.47	105295	0	0.0
1.5	1.84	30101	0	0.0
2.0	2.49	2523	0	0.0
2.5	2.85	945	0	0.0
3.0	3.36	134	0	0.0
3.5	3.90	19	0	0.0
4.0	4.39	4	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 16 ksi, therefore the remaining fatigue life is infinite.

Channel 15

Bin size (ksi)				Level of Truncation				
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	2591	0.0472	-	-	-	-
0.5	1.0	0.75	266	0.0388	0.3691	-	-	-
1.0	1.5	1.25	15	0.0101	0.0964	0.7710	-	-
1.5	2.0	1.75	9	0.0167	0.1587	1.2693	2.0971	-
2.0	2.5	2.25	8	0.0315	0.2998	2.3980	3.9620	6.5089
2.5	3.0	2.75	4	0.0287	0.2736	2.1891	3.6168	5.9420
3.0	3.5	3.25	2	0.0237	0.2258	1.8067	2.9851	4.9040

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL= 7 ksi	% Exceedance CAFL = 7 ksi
No truncation	0.58	2895	0	0.0
0.5	1.12	304	0	0.0
1.0	2.04	38	0	0.0
1.5	2.33	23	0	0.0
2.0	2.59	14	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 7 ksi, therefore the remaining fatigue life is infinite.

Channel 16

Bin size (ksi)				Level of Truncation				
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	182296	0.029	-	-	-	-
0.5	1.0	0.75	141812	0.179	0.392	-	-	-
1.0	1.5	1.25	10208	0.060	0.131	1.867	-	-
1.5	2.0	1.75	454	0.007	0.016	0.228	5.144	-
2.0	2.5	2.25	17	0.001	0.001	0.018	0.409	10.192
2.5	3.0	2.75	1	0.000	0.000	0.002	0.044	1.095
3.0	3.5	3.25	1	0.000	0.000	0.003	0.073	1.807

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL= 7 ksi	% Exceedance CAFL = 7 ksi
No truncation	0.65	334789	0	0.0
0.5	0.81	152493	0	0.0
1.0	1.28	10681	0	0.0
1.5	1.78	473	0	0.0
2.0	2.36	19	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 7 ksi, therefore the remaining fatigue life is infinite.

Channel 17

Bin size (ksi)				Level of Truncation				
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	422341	0.030	-	-	-	-
0.5	1.0	0.75	200135	0.114	0.264	-	-	-
1.0	1.5	1.25	82970	0.218	0.506	1.351	-	-
1.5	2.0	1.75	35996	0.260	0.603	1.608	5.217	-
2.0	2.5	2.25	796	0.012	0.028	0.076	0.245	9.243
2.5	3.0	2.75	168	0.005	0.011	0.029	0.094	3.562
3.0	3.5	3.25	16	0.001	0.002	0.005	0.015	0.560
3.5	4	3.75	1	0.000	0.000	0.000	0.001	0.054

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL = 7 ksi	% Exceedance CAFL = 7 ksi
No truncation	0.86	742423	0	0.0
0.5	1.12	320082	0	0.0
1.0	1.45	119947	0	0.0
1.5	1.77	36977	0	0.0
2.0	2.38	981	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 7 ksi, therefore the remaining fatigue life is infinite.

Channel 18

Bin size (ksi)				Level of Truncation								
				None	0.5 ksi	1.0 ksi	1.5 ksi	2.0 ksi	2.5 ksi	3.0 ksi	3.5 ksi	4.0 ksi
S_{rmin}	S_{rmax}	S_{ravg}	N_{cycles}	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$	$f_i \times S_{ri}^3$
0.25	0.5	0.375	1545558	0.037	-	-	-	-	-	-	-	-
0.5	1.0	0.75	398837	0.076	0.250	-	-	-	-	-	-	-
1.0	1.5	1.25	82523	0.073	0.240	0.588	-	-	-	-	-	-
1.5	2.0	1.75	85742	0.207	0.683	1.678	2.401	-	-	-	-	-
2.0	2.5	2.25	42954	0.221	0.727	1.786	2.557	4.632	-	-	-	-
2.5	3.0	2.75	39753	0.373	1.229	3.018	4.320	7.827	13.190	-	-	-
3.0	3.5	3.25	20533	0.318	1.048	2.573	3.683	6.673	11.246	30.746	-	-
3.5	4	3.75	1691	0.040	0.133	0.326	0.466	0.844	1.423	3.890	37.280	-
4	4.5	4.25	299	0.010	0.034	0.084	0.120	0.217	0.366	1.001	9.596	32.743
4.5	5.0	4.75	233	0.011	0.037	0.091	0.130	0.236	0.398	1.089	10.439	35.622
5	5.5	5.25	117	0.008	0.025	0.062	0.088	0.160	0.270	0.739	7.078	24.152
5.5	6.0	5.75	32	0.003	0.009	0.022	0.032	0.058	0.097	0.265	2.543	8.678
6.0	6.5	6.25	14	0.002	0.005	0.012	0.018	0.032	0.055	0.149	1.429	4.876
6.5	7.0	6.75	6	0.001	0.003	0.007	0.010	0.017	0.029	0.080	0.771	2.632

Notes: $f_i = (N_i/N_{total})$

Level of truncation	S_{reff} (ksi)	N_{total}	N_{cycles}> CAFL = 7 ksi	% Exceedance CAFL = 7 ksi
No truncation	1.09	2218292	0	0.0
0.5	1.61	672734	0	0.0
1.0	2.13	273897	0	0.0
1.5	2.35	191374	0	0.0
2.0	2.67	105632	0	0.0
2.5	3.00	62678	0	0.0
3.0	3.36	22925	0	0.0
3.5	4.10	2392	0	0.0
4.0	4.77	701	0	0.0

Where effective stress range (S_{reff}) was determined by:

$$S_{reff} = (\sum (f_i \times S_{ri}^3))^{1/3}$$

All stress cycles (S_{rmax}) and effective stress range S_{reff} are less than CAFL = 7 ksi, therefore the remaining fatigue life is infinite.