A. Andrews **TEST OF SENSITIVITY TO LOW SPAN DISEQUILIBRIUM**
4-Dec-01

**This worksheet contains a test to determine the maximum impact of the low span disequilbration.
The values in the 'co2' column are from the SYYMMDD.VAL file. The 'original' values are calculated using a regression from an r.pri file.
The perturbed values have the low span shifted by +0.5 ppm and +0.25 ppm to simulate the effect of the low span disequilibrium.
We have ground cal data for all gases for the first (000728) and last (000824) flight days only.
The in flight cals of the primary agree with the ground cal data to within 0.1 ppm. By trial and error, I determined that
+0.5 ppm was the upper bound on the low span disequilibrium effect that was consistent with a +0.1 ppm error on the primary.
Note that the 'co2(low+0.5)' - original value for the primary is ~0.1 ppm. Note also that the in-flight cal on 00728 was ~0.1 ppm LOW compared to
the pre-mission cal, and the 000824 in-flight cals were higher than the post mission cal by 0.06 ppmv.
The low span disequilibrium problem would act to make the primary too high, so that cannot be responsible for the -0.1 ppm difference seen on 000728.
Because of the relatively small CO2 errors indicated by the upper limit case considered below,
(see figure!) I decided not to apply any correction for low span disquilibrium to the flight data. Keep in mind that
the vast majority of the data is between 351 and 372 ppmv. Also, this upper limit case assumes that the primary is high by 0.1ppm
(upper limit) in flight and that is entirely due to low span disequilibrium (worst case, since there could be other factors). Thus, the 0.1 ppm case
is a very conservative estimate of the low span disequilibrium error!!

Below is the line from the r300824.pri file used. The corresponding CO2 values for the standards are taken from the s300824.val file.

GMT (s)| GMT (hr)| co2 pri | mv lo | mv ref | mv hi | mv pri
79375.0 22.049 366.025 105.89 621.72 930.86 448.40 2

(If I have done things right, the CO2 value for the primary in the 'original' column will match the value from the r.pri file. It does, which is good!)

From s300823.val			**From r300824.pri:**	**GMT=79375**						
					calculated from regression					
co2	**co2 (low +0.5)**	**co2 (low +0.25)**	**mV**	**mV^2**	**calc co2**	**residuals**	**low+0.5**	**low+0.5-orig**	**low+0.25**	**low+0.25-orig**
347.3	**347.8**	**347.55**	105.89	11212.69	347.3	0	347.8	0.5	347.55	0.25
375.59	375.59	375.59	621.72	386535.8	375.59	-5.1E-13	375.59	5.6843E-13	375.59	0
392.8	392.8	392.8	930.86	866500.3	392.8	0	392.8	0	392.8	0
347.3	**347.8**	**347.55**	105.89	11212.69	347.3	0	347.8	0.5	347.55	0.25
375.59	375.59	375.59	621.72	386535.8	375.59	-5.1E-13	375.59	5.6843E-13	375.59	0
392.8	392.8	392.8	930.86	866500.3	392.8	0	392.8	0	392.8	0
								0	341.8986	341.8985919
365.96	365.96	365.96	448.4	201062.6	*366.0249944*	0.064994	366.123245	**0.09825061**	366.0741	**0.049125304**

These columns show the difference between the perturbed and original cases over entire CO2 range (i.e., a conservative estimate of the maximum impact of low span disequilibrium as a function of [CO2]): SEE 'CHART 1' .

mV	mV^2	original	low+0.5	low+0.5-orig	low+0.25	low+0.25-orig
100	10000	346.9800511	347.4893709	**0.50931983**	347.2347	**0.254659917**
150	22500	349.6982967	350.1310921	**0.43279548**	349.9147	**0.216397741**
200	40000	352.421554	352.7837	**0.36214596**	352.6026	**0.181072979**
250	62500	355.1498232	355.4471945	**0.29737127**	355.2985	**0.148685633**
300	90000	357.8831042	358.1215756	**0.2384714**	358.0023	**0.119235701**
350	122500	360.6213971	360.8068434	**0.18544637**	360.7141	**0.092723183**
400	160000	363.3647017	363.5029979	**0.13829616**	363.4338	**0.069148081**
450	202500	366.1130182	366.210039	**0.09702078**	366.1615	**0.048510392**
500	250000	368.8663465	368.9279667	**0.06162024**	368.8972	**0.030810119**
550	302500	371.6246866	371.6567811	**0.03209452**	371.6407	**0.01604726**
600	360000	374.3880385	374.3964821	**0.00844363**	374.3923	**0.004221816**
650	422500	377.1564022	377.1470698	**-0.0093324**	377.1517	**-0.004666213**
700	490000	379.9297778	379.9085441	**-0.0212337**	379.9192	**-0.010616828**
750	562500	382.7081652	382.6809051	**-0.0272601**	382.6945	**-0.013630028**
800	640000	385.4915644	385.4641527	**-0.0274116**	385.4779	**-0.013705813**
850	722500	388.2799754	388.258287	**-0.0216884**	388.2691	**-0.010844183**
900	810000	391.0733982	391.0633079	**-0.0100903**	391.0684	**-0.005045139**
950	902500	393.8718328	393.8792155	**0.00738264**	393.8755	**0.003691319**