

Table 11. Number of Failures for All Vehicles (1186 Flights)

Flight Phase	Failure-Response Mode						3 & 4 Tumble
	1	2	3	4	5	'NA'	
0	0	0	0	3	0	0	1
0-1	13	4	3	68	15	11	19
0-2	13	4	3	129	27	29	33
0-3	13	4	3	161	28	38	40
0-4	13	4	3	165	28	45	42
0-5	13	4	3	165	28	53	42

Table 12. Date of Most Recent Failure

Response Mode	Vehicle			
	Atlas	Delta	Titan	Thor *
1	03/02/65	none	12/12/59	04/19/58
2	12/18/81	none	05/01/63	12/30/58
3	04/25/61	none	none	07/21/59
4	08/22/92	05/03/86	10/05/93	03/24//64
5	12/08/80	08/27/69	11/30/65	01/24/62

* Last Thor launch was 02/23/65

For the reasons advanced previously, an exponential filter has been used to estimate relative probabilities of occurrence for Modes 1 through 5 and the fraction of Mode-3 and Mode-4 failures that tumble while the vehicle is thrusting. The percentage weightings for various data samples are shown in Table 13 for values of F from 0.980 to 0.999. Because of the large size of the composite sample (1186), the filter-control constant of 0.98 used previously to estimate absolute failure probabilities for individual vehicles does not seem suitable for estimating relative probabilities for the individual response modes. Use of 0.98 would effectively place 98.2% of the total weight on the most recent 200 tests thus, in effect, eliminating the earliest 986 tests from the solution. These are the very tests needed to provide an adequate sample of failures from which to estimate relative frequencies of occurrence of the individual response modes.