

5. Computation of Failure Probabilities

The test results for Atlas, Delta, and Titan in the tables of Appendix D have been used for three primary purposes:

- (1) To predict or estimate the overall probability that each vehicle will fail during the various phases of flight (see Table 39, Appendix D, for flight-phase definitions).
- (2) To establish the relative and overall probabilities for Response Modes 1 through 5.
- (3) To establish the relative frequency of tumble for Response Modes 3 and 4.

5.1 Overall Failure Probability

To predict failure probabilities for Atlas, Delta, and Titan, the test results in Appendix D for representative configurations (i.e., "1" in last column) have been filtered using three different weighting techniques described in Appendix C:

- (1) Equal weighting
- (2) Index-count weighting
- (3) Exponential weighting

In computing filtered or weighted failure probabilities, a test is assigned a score of one to indicate the occurrence of a failure or some anomalous behavior, and a score of zero if no failure occurred. Admittedly, there may be disagreements about the classification of a few flights, since the launch agency may consider as successful or partially successful some flights that are shown as failures in Appendix D. To avoid such disagreements, it is better to think of some non-normal events, particularly those occurring late in flight, as anomalies rather than failures. The flight phases, as shown in column 2 of Table 2 and defined in Appendix D.1.3, are inclusive; e.g., flight phase "0 - 3" includes phases 0, 1, 1.5, 2, 2.5, and 3. An 'NA' in the response-mode column in the tables of Appendix D indicates that some failure or anomalous behavior has had an effect on the final orbit or impact point without producing additional risks to people on the ground or necessarily failing the mission. In the failure-probability calculations of Table 2 and Table 3, an 'NA' has been considered as a success for all flight phases except "0 - 5", irrespective of the phase in which the failure or anomalous behavior took place. Only in flight phase "0 - 5" is an 'NA' response considered a failure. The filtered results for representative configurations (defined in Appendix D.1.4) are given in Table 2 for six flight phases. For flights with multiple entries in the Response-Mode and Flight-Phase columns (e.g., see Appendix D.2.1, No. 257), the first listed value was used in the filtering process.