acceleration of the vehicle body and a slow turn of the velocity vector, (4) erroneous accumulation of velocity bits by the guidance system. Many other Mode-5 responses are so convoluted that they defy description or categorization.

3.1 Effects of Mode-5 Shaping Constants

The primary part of the Mode-5 impact-density function was presented previously as Eq. (1). As originally formulated, the function contained three shaping constants. If both numerator and denominator of the equation are divided by the constant C, and B is substituted for D/C, one unnecessary constant disappears so that the function may be expressed as follows:

$$f(R,\phi) = \frac{e^{A\phi} + B/R}{2\left(T_b - T_p\right)\left[\frac{1}{A}\left(e^{A\pi} - 1\right) + \frac{B\pi}{R}\right]R\dot{R}} \qquad (3)$$

The values chosen for the shaping constants A and B that appear in Eq. (3) influence, but do not change, the basic nature of the Mode-5 impact-density function. For many years values of A = 2.5 and B = 1000 were used in the Eastern Range ship-hit computations, although in more recent risk studies the value of A has been increased to 3.0. This increase resulted from the observation that, in recent years, vehicles that experience Mode-5 failure responses seem less likely than earlier developmental vehicles to deviate significantly from the intended flight line. To see how A and B affect the distribution of Mode-5 impacts, and to further understanding of the function, the results of choosing various values of A and B are provided in Appendix B.

3.2 Effects of Shaping Constant on DAMP Results

As pointed out in the Introduction, two important types of constant parameters required by DAMP for risk estimations must be determined. They are: (1) probability of a Mode-5 failure response, and (2) values of the Mode-5 shaping constants A and B, currently set at 3.0 and 1000, respectively. As will be demonstrated later, DAMP results are far more sensitive to changes in A than in B.

The following cases illustrate the effects that constant A has on calculated risks.

Case 1: Baseline Risks for Atlas IIA

In the baseline risk analysis for Atlas IIA[3], the probability of a Mode-5 failure response was estimated at 12.5% of the total failure probability during the first 120 seconds of flight. Even so, risks resulting from Mode-5 responses accounted for about 90% of the total risks for people inside the impact limit lines (ILL). Table 1 indicates the range of risks inside the ILLs for day launches from Pad A using various estimates of the shaping constant A and a value of B = 1000.