6.3.2 Launch-Area Mode-5 Risks

Using values of A and B from Figure 24 and Figure 25, program DAMP was run to compute Mode-5 launch-area risks for population centers inside the impact limit lines for a Delta-GEM/GPS-10 daytime launch from Pad 17A. Results from these and two other cases are shown in Table 23. The Mode-5 E_C in the first line (old baseline case) is presented for comparison. It was obtained from the first line of Table 55 of an earlier RTI study[3]. In that study, the total Delta failure probability during the first 130 seconds of flight was set at 0.02, with the probability of a Mode-5 response assumed to be 0.0025. The second line in Table 23 shows the result of a recomputation of the Mode-5 risks, again with B = 1,000 and A = 3, using failure probabilities derived earlier in this report. From Table 6 and Table 15, the failure probability during flight phases 0 - 2 is 0.013, and the relative frequency of occurrence of a Mode-5 response is 0.08. The absolute probability of a Mode-5 response thus becomes $0.013 \times 0.08 \cong 0.001$.

Table 23. Shaping Constants and Related Risks for Delta-GEM

p_5	T_B (sec)	Breakup $q\alpha$ (deg-lb/ft^2)	B	A	Mode-5 E_C (x 10^{-6})
0.0025	130	12,000 * (baseline)	1,000	3.00	394
0.001	270	12,000 * (new p_5 & T_B)	1,000	3.00	88.8
0.001	270	none 20,000 10,000 5,000	1,000	1.90 2.90 3.10 4.30	220.0 104.4 74.1 5.2
0.001	270	none 20,000 10,000 5,000	10,000 2,000 2,000 4	2.60 3.15 3.35 3.50	224.4 102.4 72.0 5.1

* Interpolated from data contained in Figure 24

As in the case of Atlas, Table 23 again shows that the risks in the launch area are highly dependent on $q\alpha$ and thus on A, but relatively insensitive to changes in B if a proper value is selected for A. For example, if $q\alpha$ = 10,000, the computed risks for B = 1,000 (A = 3.10) and B = 2,000 (A = 3.35) differ by less than 3%. For the no-breakup cases where B = 1,000 and then 10,000, the computed risks in the launch area differ by less than 2%.

Launch-area risks are highly dependent on the vehicle's capability to withstand aerodynamic forces. Except early in flight, low-strength vehicles generally break up quickly after a malfunction turn begins. The later such turns occur, the more likely pieces are to impact downrange of the launch point, thus lessening risks to uprange populations. The effects of vehicle strength on risk are clearly seen in Table 23 where,