**EFFECT OF RIFLING GROOVES ON THE PERFORMANCE OF SMALL-CALIBEag1 Tf-0 Tc -3.33**

**spark-range firings of bullets from the standard twist barrel spanning the range of velocities typically**

## 2. COMPUTATIONAL APPROACH

computer system triggers the spark sources that project a vertical and horizontal direct shadow image of the passing

within ±1% of the single pitching moment coefficient reported from the wind tunnel test. More sign7T0 1Gtt-4(nglefo)4mr t-4(mh122(e M)4ma)2(g)4mns (the4(md122(e)nglefo)4mrc

2.5 and 1.35 at two degrees angle of attack at standard atmospheric conditions. The rifling on the computational geometry was modeled as six grooves that are 0.18 calibers wide and 0.01 calibers deep with the twist rate of the M16A2 barrel. Additional CFD simulations were completed on the smooth body model over a larger range over Mach numbers for additional comparison to the experimental results.

Similar to the wind tunnel model, very little difference in most of the aerodynamic coefficients was seen between configurations indicating that neither spin rate nor engraving has a significant effect for either the

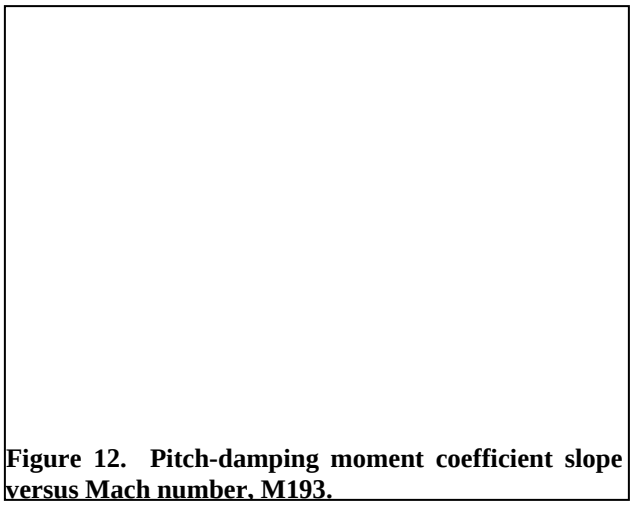

**Figure 12. Pitch-damping moment coefficient slope versus Mach number, M193.**

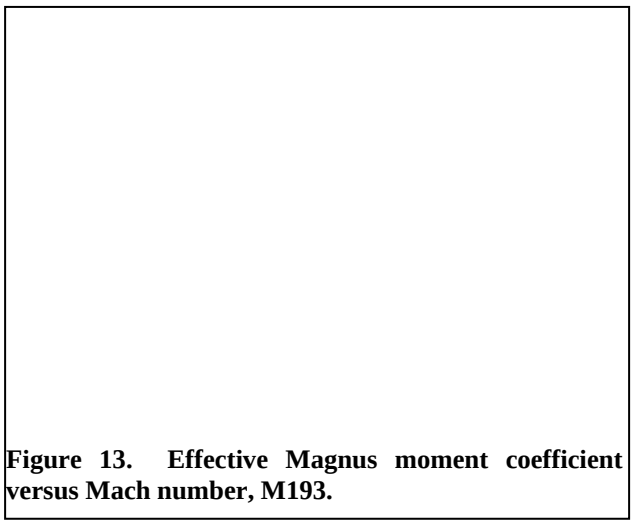

**Figure 13. Effective Magnus moment coefficient versus Mach number, M193.**

Figure 14 shows the effective roll-damping coefficient for the M193 con-figurations investigated. The error bars on the spark range data represent one standard deviation from the mean roll-damping coefficient. At (near) launch velocity the range data and the computational results show a slightly lower roll-damping coefficient for the smooth body configuration. Within the error of the ballistic testing, the variations are not significant. At the next two lower Mach atio.h1492( )TJ-0.3623 Tc 041521 Tw 0 -1.15 TDrsthh th

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Additionally, the projectile must remain within the dynamic stability bound as defined by

$$\frac{1}{S_g}\{\ S_d /2\,4\,S_d \Big(\qquad (5)$$

corresponds to the Mach number being investigated. Fortunately, the current results indicate that the effect of