Pogo, Solid Motor Oscillation and MECO

Solid motor oscillation (Irvine, SRM Pressure Oscillation Frequencies Rev A)

Longitudinal acoustic modes (closed-ended cavity): $f_n = n\,c/(2L)$

$c \approx 3500$ ft/sec $= 42000$ in/sec $= 1066.8$ m/sec (Dotson et al., 2001)

$f = c/\lambda$, sweep rate $df/dt = -(f/\lambda)\,d\lambda/dt$

English: L, λ [in], c [in/sec]; metric: L, λ [m], c [m/sec]

MECO equivalent sine (Gordon, GSFC, ELV Workshop 2002)

$G_{eq} = 3\sqrt{\frac{\pi}{2} F\,PSD\,Q}\,/\,Q$ [G], F [Hz], PSD [G^2/Hz]

Combustion instability (Irvine, Rev F, Table 2)

10–200 Hz chugging / system (pogo range); 200–1000 Hz acoustical; >1000 Hz screaming

Smooth combustion: $|p'| \le 0.05\,\bar{p}_c$