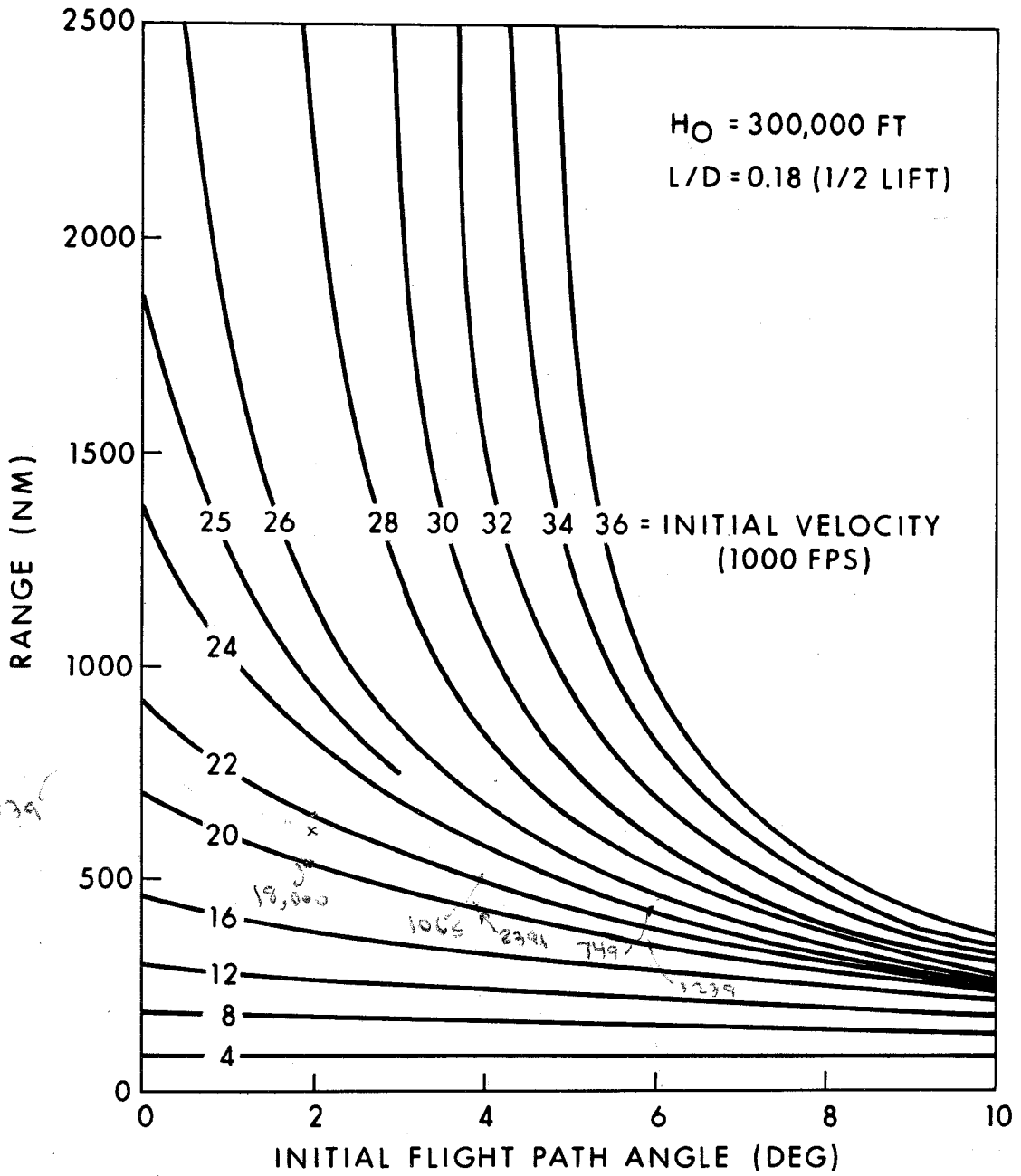


Massachusetts Institute of Technology  
Instrumentation Laboratory  
Cambridge, Massachusetts

Space Guidance Analysis Memo # 12-66

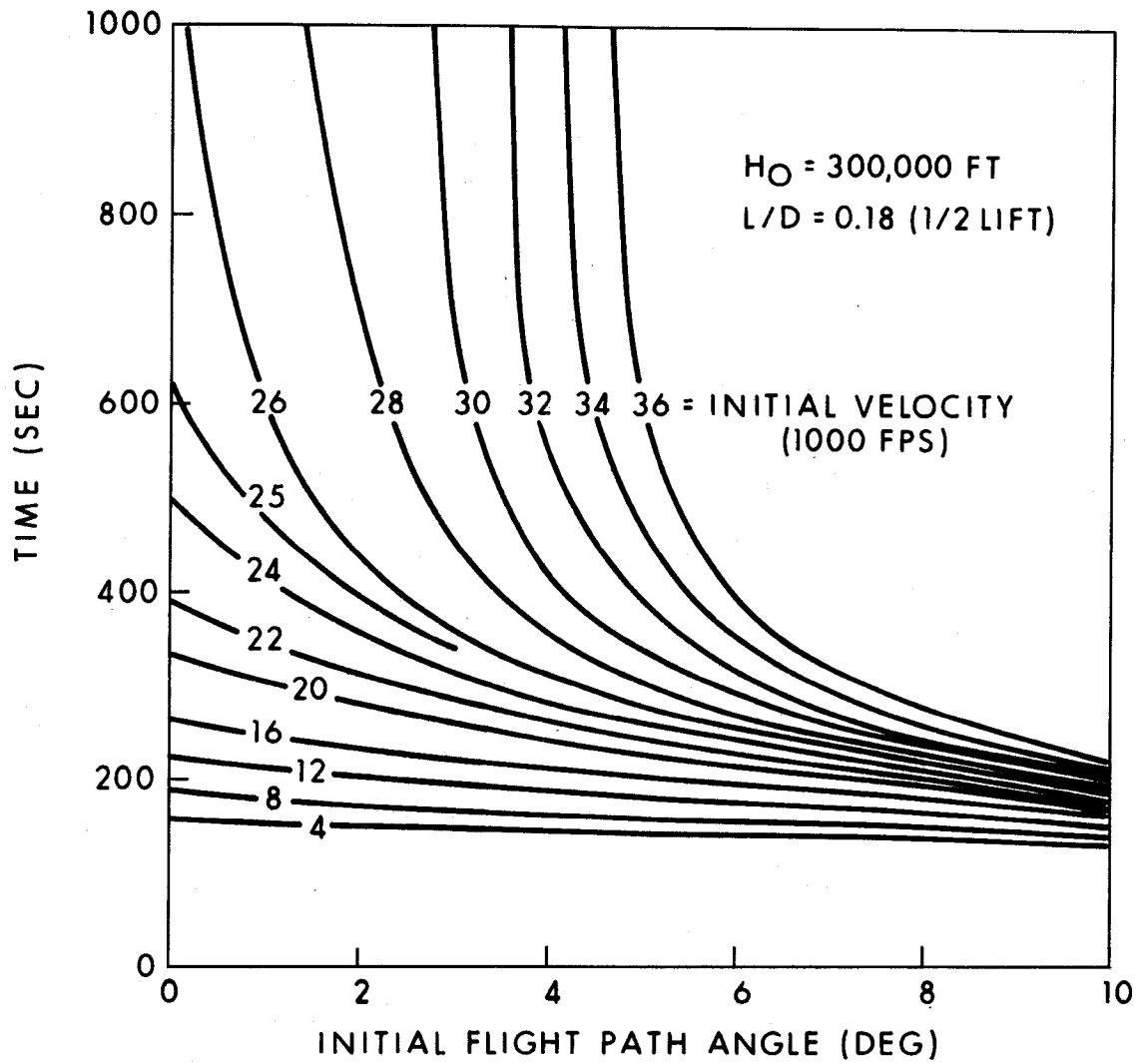
TO: SGA Distribution  
FROM: Ray Morth  
DATE: May 13, 1966  
SUBJECT: Characteristics of Entry Starting at 300,000 Feet

Attached are three pages of curves representing range, time of flight, and maximum g's for entries starting at 300,000 ft. Also attached are empirical formulae, derived by the Auge-Kugel method, by which these data can be approximated.



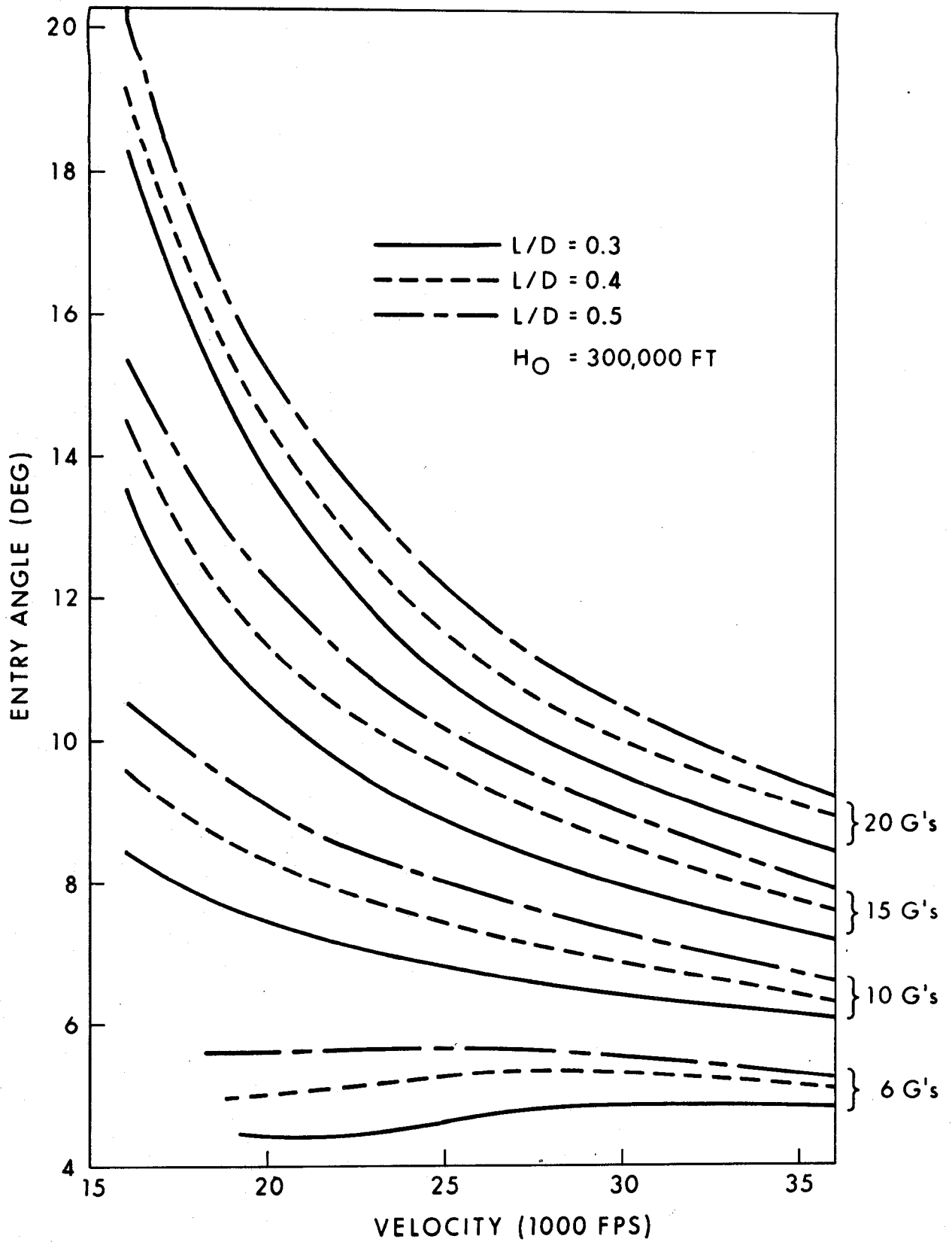
ENTRY RANGE

Fig. 1



TIME OF FLIGHT

Fig. 2



MAXIMUM G CONTOURS

Fig. 3

### Range Formula

$$\theta = K_1 / (\gamma - K_2)$$

where

$$K_1 = \begin{cases} 5500 & , & V \leq 21000 \\ 2400 + .443 (28000 - V) & , & 21000 < V \leq 28000 \\ 2400 & , & 28000 < V \end{cases}$$

$$K_2 = \begin{cases} -3.2 + .001225 (24000 - V) & , & V \leq 24000 \\ 1 + .00105 (28000 - V) & , & 24000 < V \leq 28400 \\ 2.4 + .000285 (V - 32000) & , & 28400 < V \end{cases}$$

### Time Formula

$$T = \begin{cases} 8660 \theta / V & , & V < 26000 \\ \theta / 3 & , & 26000 \leq V \end{cases}$$

### Max g Formula

$$g - 10 = \frac{4}{1 + 3 \bar{V}^2} (\gamma - 6.05 - 2.4 \bar{V}^2) - 10 (L/D - .3)$$

where  $\theta$  = range (nm)

$\gamma$  = flight path angle at 300,000 ft., positive down (deg.)

$V$  = velocity at 300,000 ft.(fps)

$T$  = flight time (seconds)

$g$  = maximum acceleration (g - units)

$\bar{V}$  =  $(V - 36000) / 20000$

$L/D$  = vehicle lift to-drag ratio