

TOLCOMER

GEOPHYSICAL CONSTANTS FOR USE IN GEMINI

MISSION PLANNING STUDIES

1. The gravitational and related constants listed below have been established for use in Project Gemini.
2. Gravitational model. - All constants below are used as exact with the exception of b and μ , which are derived from other constants in the list. Accuracies are shown for information only.

a = Earth's gravitational radius = 6,378,166 (+70) meters
 = 20,925,741 International feet

b = 6,356,784 meters

$1/f$ = Reciprocal of earth's flattening = 298.3 ± 0.1

g_E = 9.78030 meters/sec²

$\mu_e = GM_e$ = Geocentric gravitational constant derived from g_E
 = 3.986031×10^{14} (+44 X 10⁸) meters³/sec²
 = 1.407654×10^{16} International feet³/sec²

$$\Phi = \frac{GM_e}{R} \left[1 + \frac{J R_e^2}{3R^2} (1 - 3 \sin^2 \phi) + \frac{H}{5} \frac{R_e^3}{R^3} (3 - 5 \sin^2 \phi) (\sin \phi) + \frac{D}{35} \frac{R_e^4}{R^4} (3 - 30 \sin^2 \phi + 35 \sin^4 \phi) \right]$$

$J = 1623.46 \times 10^{-6}$
 $H = -0.575 \times 10^{-5}$
 $D = 0.7875 \times 10^{-5}$

$T = \sqrt{a^3/\mu} = \text{canonical unit of time} = 806.8137 \text{ sec}$

$\omega = \text{Rotational speed of earth} = 0.729211508 \times 10^{-4} \text{ radians/sec}$

3. Conversion Factors. -

1 International foot = 0.3048 meter (exact)

1 International nautical mile = 1852 meters (exact) =
6076.115486 International feet

1 International pound = 0.45359237 kilogram

1 Slug = $(9.80665 + 0.3048)$ = 32.174048 pounds (International
Commission on Weights and Measures)

1 American Survey foot = 0.30480061 meter