

# **Appendixes**

# Appendix A

## Collision Probabilities for Satellites

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The probability of collision (PC) between a satellite and debris during a mission of duration T is represented by

$$PC = 1 - e^{-(SPD * VREL * AC * T)} \quad (1)$$

where SPD = spatial density, objects per km<sup>3</sup>

VREL = relative velocity, km/s

AC = cross-sectional area, km<sup>2</sup>

T = mission duration, sec

When the probability of collision is very small, less than 0.190, the equation above may be approximated by

$$PC = SPD * VREL * AC * T. \quad (2)$$

Table A-1 summarizes typical values of the terms in the PC equation for LEO and GEO orbits over a mission period of 1 year.

**Table A-1 - Probability of Collision**

	LEO	GEO
SPD	10 <sup>-10</sup> to 10 <sup>-7</sup>	10 <sup>-11</sup> to 10 <sup>-7</sup>
VREL	6 to 14 km/s	0.1 to 0.8 km/s
AC	10 m <sup>2</sup>	10 m <sup>2</sup>
T	year	1 year
PC	10 <sup>-7</sup> to 10 <sup>-4</sup> per year	10 <sup>-12</sup> to 10 <sup>-7</sup> per year

NOTES: For the GEO calculations the maximum values for SPD and VREL cannot be used simultaneously to arrive at a maximum PC.

The PC for a GEO satellite is clearly orders of magnitude smaller than for a LEO satellite

SOURCE: Darren S McKnight