(1) What is the largest number of airplanes that could be in blindly random flight, over the continental United States and between 15 000 and 30 000 ft altitude, without risking more than one fatality per billion passenger miles as a result of midair collisions?

The number of passengers in a plane doesn't matter; both the number of passenger-miles accumulated before a collision and the number of fatalities in the collision contain it as a factor. All we require is that the mean free path of an airplane shall be greater than 10^9 miles. With N particles in volume V, the mean free path is $V/N\sigma$ where σ is the collision cross section. The volume is about 10^7 cubic miles (3 million square miles, 3 miles thick). For σ I adopt an area 200 ft wide by 50 ft high, which amounts to 4×10^{-4} square miles. Setting $V/N\sigma = 10^9$ miles, I find $N = 25$. Obviously the estimate of σ introduces by far the largest uncertainty.