

## **Improving Estimation of Ground Casualty Risk from Reentering Space Objects**

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A recent improvement to the long-term estimation of ground casualties from reentering space debris is the further refinement and update to the human population distribution. Previous human population distributions were based on global totals with simple scaling factors for future years, or a coarse grid of population counts in a subset of the world's countries, each cell having its own projected growth rate. The newest population model includes a 5-fold refinement in both latitude and longitude resolution. All areas along a single latitude are combined to form a global population distribution as a function of latitude, creating a more accurate population estimation based on non-uniform growth at the country and area levels.

Previous risk probability calculations used simplifying assumptions that did not account for the ellipsoidal nature of the earth. The new method uses first, a simple analytical method to estimate the amount of time spent above each latitude band for a debris object with a given orbit inclination, and second, a more complex numerical method that incorporates the effects of a non-spherical Earth. These new results are compared with the prior models to assess the magnitude of the effects on reentry casualty risk.