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OCT 31 1967

U. S. Atomic Energy Commission
Attn: Mr. George P. Dix
Chief, Safety Branch
Space Electric Power Office
Washington, D. C. 20545 M1163

Dear Mike:

Re: Impact Probability Estimates (U)

Enclosed is one copy of a table giving estimates of probabilities of the SNAP 19 impacting cities of the world. The impact probabilities given reentry from a polar orbit are generalized and can be applied to any object reentering from a polar orbit.

Sincerely yours,

Samuel McAlees, Jr 10/31/67

for V. E. Blake, Manager
Aerospace Nuclear Safety

LAH:9319:mh

Enc. Table X

Copy to:
J. D. Appel, 9319, w/enc.
V. E. Blake, 9310, w/enc.

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TABLE X

Probabilities of An Object Impacting Large C

| City | Population[2] (people x $10^3$) | Area[2] ($mi^2$) | Population Density (people/$mi^2$) | Latitude | Area Correction[3] Divisor |
|---|---|---|---|---|---|
| Tokyo/Yokohama | 17,403 | 398 | 43,726 | 35°N | 1.21 |
| New York | 15,663 | 1705 | 9,186 | 40°N | 1.12 |
| London | 8,699 | 620 | 14,030 | 51°N | 0.93 |
| Los Angeles | 8,161 | 1317 | 6,196 | 34°N | 1.23 |
| Paris | 7,822 | 409 | 19,124 | 49°N | 0.98 |
| Shanghai | 7,100 | 92 | 77,173 | 31°N | 1.27 |
| Chicago | 6,805 | 947 | 7,185 | 42°N | 1.10 |
| Moscow | 6,375 | 229 | 27,838 | 55°N | 0.86 |
| Calcutta | 6,261 | 341 | 18,360 | 22°N | 1.44 |
| Bombay | 4,871 | 81 | 60,135 | 19°N | 1.51 |
| Peking | 4,200 | 117 | 35,897 | 39°N | 1.14 |
| Philadelphia | 4,087 | 642 | 6,366 | 40°N | 1.12 |

1. Twelve largest cities selected per 1966 National Geographic Atlas excluding Buenos Aires

2. P-95 data from Bureau of the Census.

3. Function of a proportionate area in latitude range and impact probability in latitude ra

4. Impact probability = $\frac{\text{effective area}}{\text{earth's surface area}}$

5. Impact probability = $\frac{\text{(effective area)}}{\text{(earth's surface area} = 1.97 \times 10^8 \text{ square miles)}}$ (Probability of

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TABLE X

Probabilities of An Object Impacting Large Cities

| opulation[2] ople x $10^3$) | Area[2] ($mi^2$) | Population Density (people/$mi^2$) | Latitude | Area Correction[3] Divisor | Effective Area[1] ($mi^2$) | Impact (Give from P |
|---|---|---|---|---|---|---|
| 17,403 | 398 | 43,726 | 35°N | 1.21 | 329 | 1.7 |
| 15,663 | 1705 | 9,186 | 40°N | 1.12 | 1522 | 7.7 |
| 8,699 | 620 | 14,030 | 51°N | 0.93 | 667 | 3.4 |
| 8,161 | 1317 | 6,196 | 34°N | 1.23 | 1071 | 5.4 |
| 7,822 | 409 | 19,124 | 49°N | 0.98 | 417 | 2.1 |
| 7,100 | 92 | 77,173 | 31°N | 1.27 | 72 | 3.7 |
| 6,805 | 947 | 7,185 | 42°N | 1.10 | 861 | 4.4 |
| 6,375 | 229 | 27,838 | 55°N | 0.86 | 266 | 1.4 |
| 6,261 | 341 | 18,360 | 22°N | 1.44 | 237 | 1.2 |
| 4,871 | 81 | 60,135 | 19°N | 1.51 | 54 | 2.7 |
| 4,200 | 117 | 35,897 | 39°N | 1.14 | 103 | 5.2 |
| 4,087 | 642 | 6,366 | 40°N | 1.12 | 573 | 2.9 |

ities selected per 1966 National Geographic Atlas excluding Buenos Aires, for which P-95 data w

ureau of the Census.

oportionate area in latitude range and impact probability in latitude range (SC-RR-66-41).

$$\text{ty} = \frac{\text{effective area}}{\text{earth's surface area}}$$

$$\text{ty} = \frac{(\text{effective area})}{(\text{earth's surface area} = 1.97 \times 10^8 \text{ square miles})}$$

(Probability of SNAP-19 getting in a s

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TABLE X

ilities of An Object Impacting Large Cities

| ensity $mi^2$) | Latitude | Area Correction[3] Divisor | Effective Area[1] ($mi^2$) | Impact Probability[4] (Given Reentry from Polar Orbit) | Impact Probability[5] (SNAP-19, Prelaunch |
|---|---|---|---|---|---|
| 26 | 35°N | 1.21 | 329 | $1.7 \times 10^{-6}$ | $2.7 \times 10^{-}$ |
| 6 | 40°N | 1.12 | 1522 | $7.7 \times 10^{-6}$ | $1.2 \times 10^{-7}$ |
| 0 | 51°N | 0.93 | 667 | $3.4 \times 10^{-6}$ | $5.4 \times 10^{-8}$ |
| 6 | 34°N | 1.23 | 1071 | $5.4 \times 10^{-6}$ | $8.6 \times 10^{-8}$ |
| 4 | 49°N | 0.98 | 417 | $2.1 \times 10^{-6}$ | $3.4 \times 10^{-8}$ |
| 3 | 31°N | 1.27 | 72 | $3.7 \times 10^{-7}$ | $5.9 \times 10^{-9}$ |
| 5 | 42°N | 1.10 | 861 | $4.4 \times 10^{-6}$ | $7.0 \times 10^{-8}$ |
| 8 | 55°N | 0.86 | 266 | $1.4 \times 10^{-6}$ | $2.2 \times 10^{-8}$ |
| 0 | 22°N | 1.44 | 237 | $1.2 \times 10^{-6}$ | $1.9 \times 10^{-8}$ |
| 5 | 19°N | 1.51 | 54 | $2.7 \times 10^{-7}$ | $4.4 \times 10^{-9}$ |
| 7 | 39°N | 1.14 | 103 | $5.2 \times 10^{-7}$ | $8.3 \times 10^{-9}$ |
| 6 | 40°N | 1.12 | 573 | $2.9 \times 10^{-6}$ | $4.7 \times 10^{-8}$ |

eographic Atlas excluding Buenos Aires, for which P-95 data were not available.

e and impact probability in latitude range (SC-RR-66-41).

rea)
x $10^8$ square miles)

(Probability of SNAP-19 getting in a short orbit = 0.016.)

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