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SAND-97-1515

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JUL 22 1963

MR. T. B. COOK - 5400

Re: Weapons and Penetration Aids

TBC 9/4/63

To show the effect of different mixes of weapons and decoys (or the equivalent in other penetration aids), the attached revised curve shows "D", the number of decoys required for a specified penetration probability, versus "w", the number of real weapons; from one weapon to the total required with no decoys.

The penetration probability assumed is a 0.9 probability that at least one weapon will penetrate. All weapons and decoys are assumed to arrive near-simultaneously over the defended target. (Stanford Research Institute calls this the "saturation attack".) The simultaneous defensive missile capabilities are assumed to be "m" = 50 and "m" = 100, with a kill probability of 0.9 for each missile.

Because of the large numbers for "m", the calculations for "n" greater than "m" are made by the simplified methods that use only the ratio between "n" and "m" and the 0.9 kill probability, where "n" is the total number of offensive objects (D + w). These simplified methods have been shown to be excellent approximations⁽¹⁾ for n/m ratios of 2 or greater. The points near m = n also seem to be correct because the calculation at m = n, which gives a value of nearly 22 for w, are not in error (as slide-rule accuracy is adequate).

The calculations for m/n between 1 and 2 would be lengthy for large numbers of weapons, as long as any decoys are used. Hence a region of uncertainty has been estimated. This does not apply, however, to the number of weapons required without decoys, because the exact number of weapons that can "receive" two defensive missiles, while the remainder receive only one, is known for any given total. Hence W = 59 for m = 100, and w = 35 for m = 50, give very nearly the desired penetration probability.

1st Review Date: 2/20/67	u
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2nd Review Date: 4/3/67	
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C. H. Bidwell
C. H. BIDWELL - 9100S

CHB:9100S:rpb

Attachment: graph dated 7/22/63

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(1) SCTM-53-62(14) and 54-62(14) - "Probabilities of Penetration, etc." - C. H. Bidwell and M. L. Houston, 1421, April 1962.

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Authorized person

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Mr. T. B. Cook - 5400

-2-

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Copy to:

W. F. Roherty, 5422

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[REDACTED]

899 (m=100)

for m=100 - 100 different numbers
 OPTIONS FOR 90% probability that 10% more
 are selected

subunits	days	total objects
1	899	950
2	283	283
3	192	195
4	156	160
5	135	140
6	125	131
7	117	124
8	111	119
9	107	116
10	103	113
20	73	98
30	56	96
40	46	86
50	34	74
60	0	60

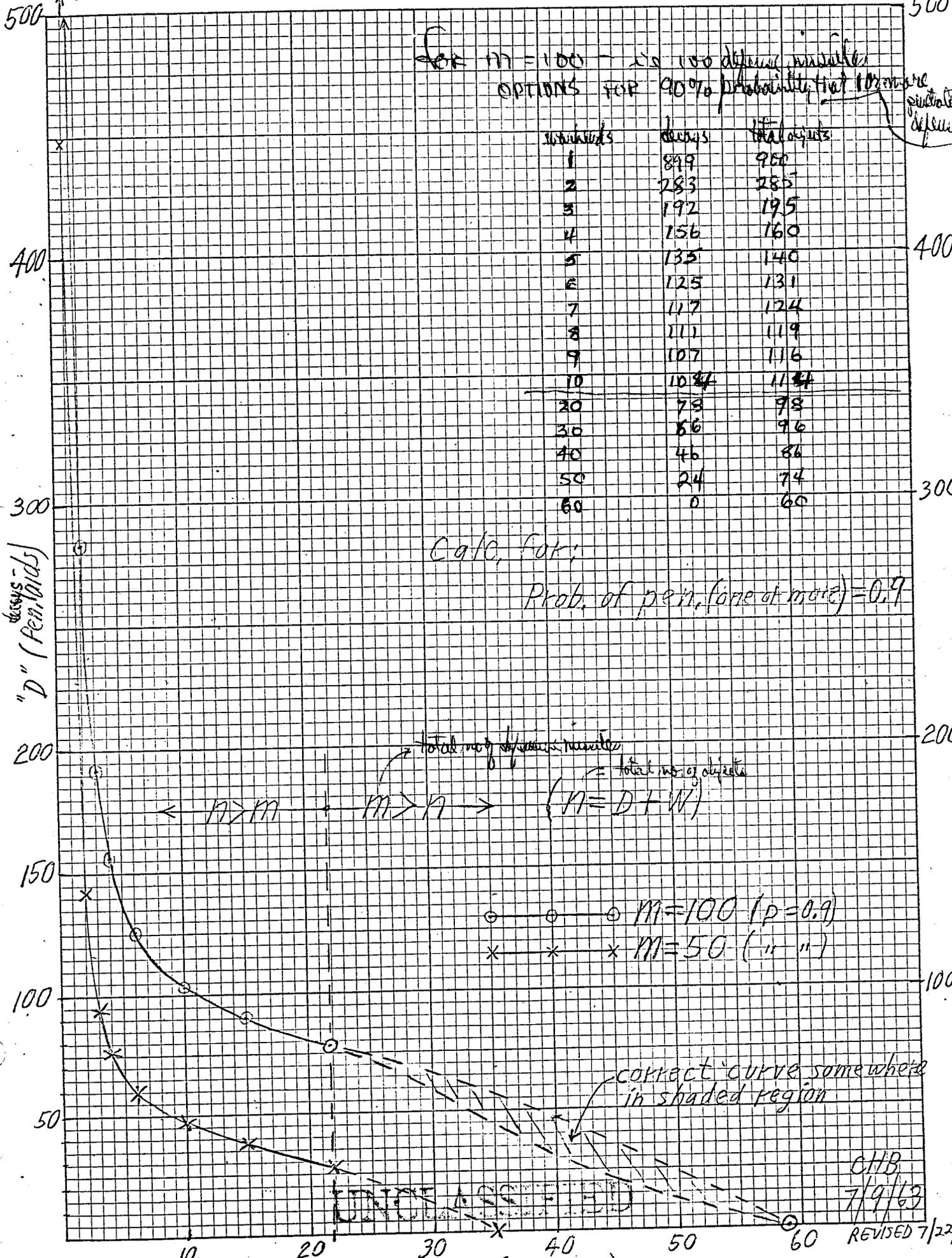
"D" (Pen-days)

Calc. for:

Prob. of pen. (one or more) = 0.9

total no. of days number
 = total no. of objects
 $(N = D + W)$

$n > m$ $m > n$



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CHB
 7/9/63
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