Damage Probability Computer for Point Targets with P and Q Vulnerability Numbers

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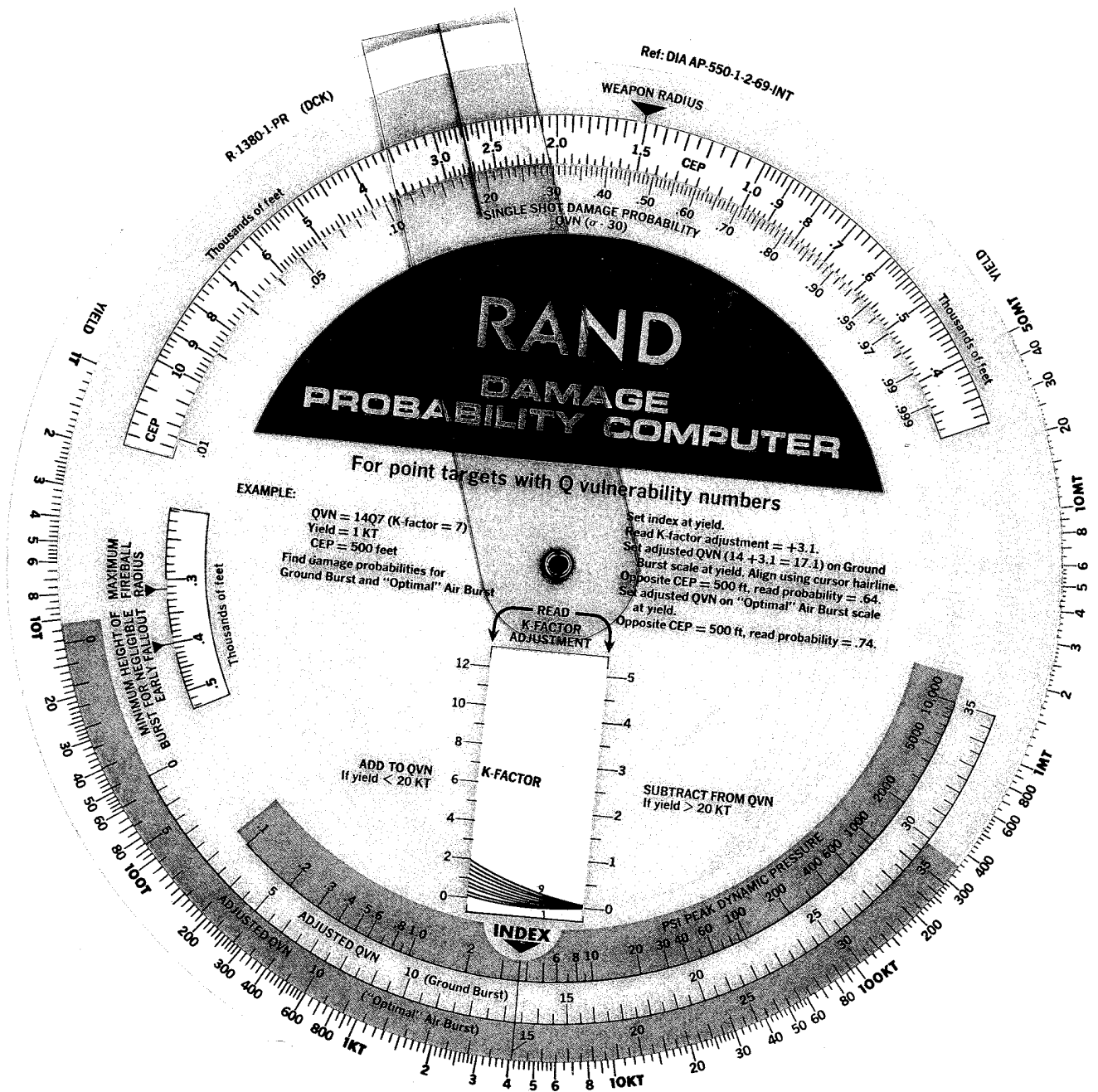| 16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT **Same as Report (SAR)**	18. NUMBER OF PAGES **4**	19a. NAME OF RESPONSIBLE PERSON
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TO THE USER

The Damage Probability Computer for Point Targets with P and Q Vulnerability Numbers—first issued in February 1974 and modified in February 1977—is designed to aid military analysts and planners in making quick estimates of the expected outcomes of attacks against overpressure-sensitive targets (PVNs) and dynamic-pressure-sensitive targets (QVNs). It was prepared under the Project RAND task entitled "Future Strategic Aerospace Force Requirements."

Inputs to the computer are the target vulnerability number (VN), the warhead yield, and the warhead delivery CEP. The damage probability calculation is based on the sigma-20 damage function for PVNs, and on the sigma-30 damage function for QVNs, as defined in the *Physical Vulnerability Handbook—Nuclear Weapons* (U), Defense Intelligence Agency, AP-550-1-2-69-INT (Confidential). The *Handbook* also provides the warhead-effects data used to calibrate weapon radius as a function of yield and adjusted VN. The "optimal" air-burst results obtained with the computer approximate the highest probability of blast damage achievable without regard to other effects such as cratering, ground shock, and fallout. Users should be aware that expected outcomes obtained using the calculator could be grossly in error owing to uncertainties in bomb yield, bomb delivery accuracy, height of burst, target location, and target vulnerability, none of which are accounted for here.

This calculator is a companion to Rand report R-1168-PR* and its supplements, R-1168/1-PR and R-1820-PR, which contain tables of damage probability computed as a function of weapon yield and delivery accuracy, for selected PVNs and QVNs associated with military targets. R-1168-PR provides an interactive computing program for printing damage probability tables for other combinations of input parameters. The program also calculates damage probabilities with an offset-aim-point option for both point targets and circular area targets.

The calculator includes scales giving the minimum height of burst for negligible early (local) radiation fallout, and the maximum fireball radius, both as a function of yield. Scales derived from the DIA *Handbook*, relating peak overpressure or peak dynamic pressure in lb/sq in. (psi) to adjusted VNs, are also included. For convenience the psi values are calibrated to the adjusted VN (Ground Burst) scales. The same calibrations would apply also to the Air Burst scales. While the overpressure and dynamic pressure scales are useful to determine psi at the weapon radius given the adjusted VN, it is not valid to use psi values as inputs to the calculator in lieu of adjusted VNs except for K-factor = 0, or yield = 20 KT, or unless the specified target psi hardening is explicitly identified with a particular yield—thus implying a previous K-factor adjustment. The foregoing is a consequence of the fact that the K-factor adjustment of a VN takes into account the yield-dependent response of a target. The psi value "equivalent" to a VN can vary over a wide range according to the K-factor and the weapon yield. For example, if the VN is 36P6, the overpressure at the weapon radius is 410 psi using a 1-MT weapon, or 990 psi using a 10-KT weapon. (The previously issued Rand Bomb Damage Effect Computer (1958, 1960, 1964) employs the sigma-0 damage function and uses as inputs yield, CEP, and peak overpressure at the target.)

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* D. C. Kephart, *Some Aids for Estimating Damage Probabilities in Attacks Against Targets with P and Q Vulnerability Numbers*, The Rand Corporation, R-1168-PR, March 1973 (For Official Use Only).

RAND
DAMAGE
PROBABILITY COMPUTER

For point targets with Q vulnerability numbers

EXAMPLE:

QVN = 14Q7 (K-factor = 7)
Yield = 1 KT
CEP = 500 feet
Find damage probabilities for
Ground Burst and "Optimal" Air Burst

Set index at yield.
Read K-factor adjustment = +3.1.
Set adjusted QVN (14 + 3.1 = 17.1) on Ground
Burst scale at yield. Align using cursor hairline.
Opposite CEP = 500 ft, read probability = .64.
Set adjusted QVN on "Optimal" Air Burst scale
at yield.
Opposite CEP = 500 ft, read probability = .74.

READ K-FACTOR ADJUSTMENT

ADD TO QVN
If yield < 20 KT

K-FACTOR

SUBTRACT FROM QVN
If yield > 20 KT

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