

ARMY MAP SERVICE
Corps of Engineers, U. S. Army

6 December 1946

MEMORANDUM TO: Chief of Engineers

SUBJECT: Recommendations for Military Grids

1. Included herein are certain recommendations for grid numbers and grid references. A pertinent discussion and background information follows each recommendation.

2. The Universal Transverse Mercator Grid supersedes approximately 85 previously used grids which made up an undesirable heterogeneous system. This modernization should be further expanded to revise the outmoded standards for grid numbers and grid references which were designed primarily for fire control purposes only. The inadequacy of the present system for use in making general grid references became apparent during the past war. To satisfy their needs it was necessary for the individual theater commanders to devise new methods to fill this deficiency. There was an unfortunate lack of consistency for the systems used varied with the theater. Before formulating these recommendations an exhaustive study was made of all the war-time provisional systems. The best of each is incorporated within these recommendations, which if adopted would assure a standard but simple fool-proof system, designed, at the same time, to accommodate changing techniques in warfare.

3. GRID INTERVALS

a. RECOMMENDATION - It is recommended that grid intervals be:

Maps 1:5,000 and larger	1,000 yards (or meters) with grid lines ticked at 100 yard (or meter) intervals
Maps 1:10,000) 1:25,000) 1:50,000)	1,000 yards (or meters)
Maps 1:100,000) 1:250,000)	10,000 yards (or meters)

b. The grid intervals authorized at present are:

Maps larger than 1:5,000	100 yards
Maps 1:5,000 to 1:63,360 inclusive	1,000 yards
Maps smaller than 1:63,360 to larger than 1:100,000	5,000 yards

Maps 1:100,000 to larger than 1:400,000 10,000 yards

Maps 1:400,000 to 1:500,000 inclusive 50,000 yards

c. The intervals of British grids are:

Maps larger than 1:5,000 100 meters (or yards)

Maps 1:5,000 to 1:100,000 inclusive* 1,000 meters (or yards)

Maps smaller than 1:100,000* to 1:500,000 10,000 meters (or yards)

d. It is noted that according to the new edition of AR 300-15, authorized map scales are:

Small scale (1:1,000,000

Medium scale (1:250,000
(1:100,000

Large scale (1:50,000
(1:25,000
(1:10,000
(1:5,000

- e. The war proved that generally the British grid intervals were superior. The U. S. 5,000 yard interval was awkward and confusing inasmuch as the abbreviated reference for a common point on maps of different scales would be dissimilar in all instances. Authorization should be granted to revise the grid intervals to overcome this defect and to make them more compatible to the revised authorized map scales.

4. GRID REFERENCES

- a. RECOMMENDATION - To satisfy particular needs two types of grid references should be made standard: general references, and fire control references.

- (1) General reference - Such a reference should generally consist of the grid zone designation followed by a group of numbers expressing the E and N coordinates of the referred point; examples:

30 NC 80432864 27 SF 69143872 (1,000 unit reference)

30 NC 804286 27 SF 691387 (10,000 unit reference)

*In all areas except Europe, AMS sheets of 1:100,000 falling in British Grid areas were gridded at 10,000 meter (or yard) intervals

(a) Grid zones

1. Zones for the Universal Transverse Mercator grid are identified with the IMW column (6° E-W) numbers, starting at the international date line (180° meridian) and reading 1 to 60 in an easterly direction. (See attached index). To prevent similar references for points 1,000,000 units apart (north-south) the IMW row letters preceded by N (for north) or S (for south) should be incorporated within the system and added to the zone number designation. Under the IMW plan, each row (4° N-S) is assigned a letter of the alphabet starting from the equator, proceeding in both directions.
2. To assure proper identification each sheet should carry in its grid reference box its complete zone identification.
3. Within an area assigned to an army the grid zone designation may be deleted at the discretion of the Commanding General for reporting within the grid zone providing sender and receiver are not more than 500 miles apart in a N-S direction. (The zone designation is necessary in such a case since the numerical reference is the same at 1,000,000 units in a N-S direction). For reports to higher headquarters, however, the complete reference must be given.

(b) Numerical reference - To facilitate making such references from a 1,000 unit grid, a reference should be simply an eight digit number; for example: 80472866. The "804" represents the 100,000, 10,000 and 1,000 digits of the easting grid line to the west of the referenced point, the "7" represents the estimated tenths from the easting grid line to the point, the "286" represents the 100,000, 10,000 and 1,000 digits of the northing grid line south of the referenced point, and the "6" represents the estimated tenths from the northing grid line to the point. To maintain a relationship between similar grid references from different scale maps, a reference from a 10,000 unit grid should be a six digit number; for example: 804286. The "80" represents the 100,000 and 10,000 digits of the easting grid line to the west of the referenced point, the "4" represents the estimated tenths from the easting grid line to the point, the "28" represents the 100,000 and 10,000 digits of the northing grid line south of the referenced point, and the "6" represents the estimated tenths from the northing grid line to the point.

- (2) Fire control references to be used within the sphere of the equivalent of one adjacent 1:50,000 sheet in all directions (two 1:25,000 sheets, four 1:10,000 sheets, etc.) - Existing

methods for determining grid references for fire control as outlined in FM 6-40, Part Four, Chapter 2, should be retained with but one modification: Sheet name designations should never be used. When a grid reference is being sent to a station outside the sphere of the equivalent of one adjacent 1:50,000 sheet in all directions (for example: a long range gun), then the full grid reference should be sent preceded by the zone designation (see (1) above); for example:

30 NC (804.72-1286.68)

b. Existing regulations (See FM 6-40, Part Four, Chapter 2) designate the following methods for reading a grid reference:

- (1) Designation of sheet, parenthesis, X coordinate, decimal, location to nearest yard, a dash, Y coordinate, decimal, location to nearest yard, parenthesis.

Example: Annapolis (804.729-1286.684)

- (2) When the map is definitely understood, its designation may be omitted.

Example: (804.729-1286.684)

- (3) If the location to the nearest 10 or nearest 100 yards only is desired, or if the measurements cannot be made with greater accuracy, the digits indicating units or tens may be omitted.

Examples: (a) (804.72-1286.68) to nearest 10 yards

(b) (804.7-1286.7) to nearest 100 yards

- (4) For expediency it is permissible to include only two digits to the left of the decimal point (10,000 and 1,000 digits), omitting any preceding digits.

Examples: (a) (04.729-86.684)

(b) (04.72-86.68)

(c) (04.7-86.6)

- (5) If the point is fixed within an area 10,000 yards square, only one digit need be given before the decimal point of each coordinate.

Examples: (a) (4.729-6.684)

(b) (4.72-6.68)

(c) (4.7-6.7)

- (6) If a large number of points are being designated by the abbreviated coordinates shown in example (c), the decimals and dashes may be omitted and the reference given as (4767).

c. References for British Grids are read according to the following methods:

- (1) Maps bearing a 10,000 unit interval (1:100,000 to 1:500,000): letter of 500,000 unit square (written as a small capital letter), letter of 100,000 unit square (written as a large capital letter), 10,000 digit of easting line to the left of the point, estimated tenths (1,000 units) eastward to point, 10,000 digit of northing line south of the point, estimated tenths (1,000 units) northward to the point.

Example: cA1428

This locates point to nearest 1,000 units.

- (2) Maps bearing a 1,000 unit interval (1:5,000 to 1:100,000 inclusive): Letter of 100,000 unit square, 10,000 and 1,000 digits of easting line to left of point, estimated tenths (100 units) eastward to point, 10,000 and 1,000 digits of northing line south of the point, estimated tenths (100 units) northward to the point.

Example: A143286

This locates point to nearest 100 units.

- d. During the war, the Pacific and Southwest Pacific Commands found it feasible to use a system for reading general grid references similarly to that used with British Grids. Apparently, a broad interpretation of existing regulations was made to find authority for the change. The name of the map is not mentioned (authority: see 4 b (2) above); digits to the left of the 10,000 and 1,000 unit digits are omitted (authority: see 4 b (4) above); decimals and dashes are omitted (authority: see 4 b (6) above).

- (1) To read a reference point on a map employing a 1,000 unit interval read: the 10,000 and 1,000 digits of the easting line to left of point, estimated tenths (100 units) eastward to point, the 10,000 and 1,000 digits of the northing line south of the point, estimated tenths (100 units), northward to the point. Write as a 6 digit continuous number.

Example: 143286

- (2) A similar procedure is followed in reading a reference on a map using a 10,000 unit interval, except that the digits for the grid lines are for the 100,000 and 10,000 units (the last four digits being omitted) and the estimated tenths represent 1,000 units. Thus, a reference for the same point cited in (1) above, might read: 214128

e. Discussion of recommendation (par. 4 a (1), above) for: General references:

- (1) Experience in the Pacific Theater proved that general grid references were frequently used. Usually it was unnecessary that these general grid references possess the same accuracy as that required for fire control purposes. It was deemed sufficient to identify any general grid reference to the nearest 1/10th. of the grid interval (i.e., 100 units at a 1,000 unit grid interval; 1,000 units at a 10,000 unit grid interval). The system which employed a continuous six digit number as a grid reference (example: 143286) proved highly successful. Its principal merits were simplicity and intelligibility. The standard method for reading grid references (see par. 4 b (1), above) was primarily designed for fire control purposes and when used for general purposes becomes very awkward. This was the experience in the Pacific Theater which found that sheet name designations, parentheses, decimal points and hyphens were superfluous and only increased the time necessary to reading and sending general grid references.
- (2) There were two faults with the Pacific system: danger of confusion between a reference taken from a map bearing a 1,000 unit interval and from one of a 10,000 unit interval, inasmuch as both were six digit numbers; and lack of connection between references for a common point taken from a 1,000 unit grid and from a 10,000 unit grid, inasmuch as in reading a reference from a 1,000 unit grid the principal digits were the 10,000 and 1,000 ones and for a reference from a 10,000 unit grid the principal digits were the 100,000 and 10,000 ones. Thus, references for a common point might read: 047866 (from a 1,000 unit grid) and 804286 (from a 10,000 unit grid).
- (3) Under the AMS proposal these faults would be eliminated. An eight digit reference would immediately be recognized as being from a 1,000 unit grid, and a six digit as being from a 10,000 unit grid. Further, a coordination would exist between references from different unit grids for common points, as:

80432863 (reference from 1,000 unit grid)

804286 (reference from 10,000 unit grid)

- (4) Normally, under the system as proposed it is required that in referring a point the entire reference be given - grid zone designation and numerical coordinates. In reporting in a single grid zone between points not more than 500 miles apart in a N-S direction designation of the zone is unnecessary. Consequently, if he is certain that no confusion will result, the theater commander should be permitted to issue instructions to omit the zone designation from grid references. However, in reporting to higher headquarters, between grid zones, and between points in the same grid zone, more than 500 miles apart

in a N-S direction, the grid zone designation should never be omitted. The 500 mile rule is required since a reference will read the same for points which are 1,000,000 units apart in the same grid zone.

- (5) With the new type of warfare in which activities are far-flung it is important that references given in communications identify the area. The use of a sheet name as presently required by regulations is inadequate for the receiver would generally expend too much time searching map catalogs and indices to identify the locale of the sheet. To introduce such a reference with only the designation number of the grid zone would require the use of 1,000,000 digits in the numbers. This is not desirable as it would mean that the numerical reference would differ from that used for a local general reference, and would also require the use of decimal points and hyphens since the 1,000,000 digit might occur only with one coordinate. The solution is to introduce such a grid reference with the designation number of the grid zone followed by a sub-zone letter designation. (See paragraph 4 a (1) above). This makes an absolute identification. Its use would simplify the overall grid reference system in that the numerical reference would be the same for both an abbreviated general local reference and for a reference used in official communications to higher headquarters. The use of the sub-zone letter designation does not create a new system but makes complete utilization of the entire IMW numbering system whose row numbers are the basis of the numbering of the zones of the Universal Transverse Mercator Grid. (See attached diagram).

- f. Discussion of recommendation (par. 4 a (2), above) for: Fire control references - The system presently in use is generally quite adequate for its purpose. However, it is deemed more desirable to use grid zone designations instead of sheet identifications.

(For arguments see paragraph 4 c above).

5. GRID REFERENCE BOX

- a. RECOMMENDATION - It is recommended that the grid reference boxes used in foreign areas on AMS maps be made standard practice for use on all maps including areas in the United States. The grid reference box should contain instructions for determining a general reference.
- b. The inclusion of a grid reference box in the margin will assure standard renditions of grid references, eliminating any reference to military manuals by personnel unfamiliar with grids.
- c. It is felt that grid references for fire control come within the category of special purpose and are not as widely used as general grid references as they generally are limited to artillery use. Consequently, the method of determining such references need not

appear in the grid reference box but should be explained in proper military manuals (see par. 7). If considered necessary, reference to such manuals could be included in the grid reference box.

6. GRID NUMBERS

- a. RECOMMENDATION - It is proposed that a modification of the so-called Canadian Grid Numbering System be made standard on all maps published by the Army Map Service. Under the system, grid numbers would appear on all four sides of a sheet labelling each grid line, and "principal digits" would be shown on the face of the map labelling each grid line, appearing east or north of every accentuated grid line (every even tenth line - 10,000 on a 1,000 unit grid and 100,000 on a 10,000 unit grid). On a 1,000 unit interval grid except for the values shown in the southwest corner the last three digits of each grid number are omitted and the principal digits (100,000, 10,000 and 1,000) appear larger than the 1,000,000 digit; for example:

(corner)

1276 000 yds. 1277 1278

Numbers for a 10,000 unit grid appear in a similar manner, except that the last four digits of each number are omitted; for example:

(corner)

127 0000 yds. 128 129

- b. Existing standard practice requires that on grids of intervals of 1,000 units the last three digits be omitted and that on grids of 10,000 units the last four digits be omitted. Regulations do not specifically limit the appearance, frequency or location of the numbers.
- c. The advantages of this numbering system are apparent: the numbers on the face of the map materially aid the map user in reading the grid and in determining references; the use of superior type around the border accentuates the principal digits (100,000, 10,000 and 1,000) materially aiding the map user in making general grid references.
- d. Under the system used in the Pacific for 1,000 unit grids, numbers appeared on all four sides of the sheet labelling each grid line. The last three digits of each number were omitted and the principal digits (10,000 and 1,000) appear larger than the 1,000,000 and 100,000 digits, as for example:

(corner)

1276 000 yds. 1277 1278

The principal digits also appeared on the face of the map labelling each grid line appearing at 10,000 unit intervals east or north of

every 10,000 unit grid line (which are accentuated in weight). The modification to this system recommended in a, above, is necessary since the 100,000, 10,000 and 1,000 digits would appear in a grid reference as recommended in par. 4 a (1), above.

7. GRID MANUALS

- a. RECOMMENDATION - Subject to approval of the recommendations appearing in the preceding paragraphs, a recommendation is made that the Army Map Service be directed to prepare a new military manual covering the subject of grids, and to prepare the text necessary for any revisions to existing manuals.
- b. Investigation reveals that no military manual covers the subject of military grids completely. This is a serious omission and should be remedied.

8. It is felt that the above recommendations will materially improve the use of our grid system. The needs of the various grid users are provided for; a standardization is effected; and full use is made of knowledge gained through experience during the past war.



W. H. MILLS
Colonel, Corps of Engineers
Commanding Officer