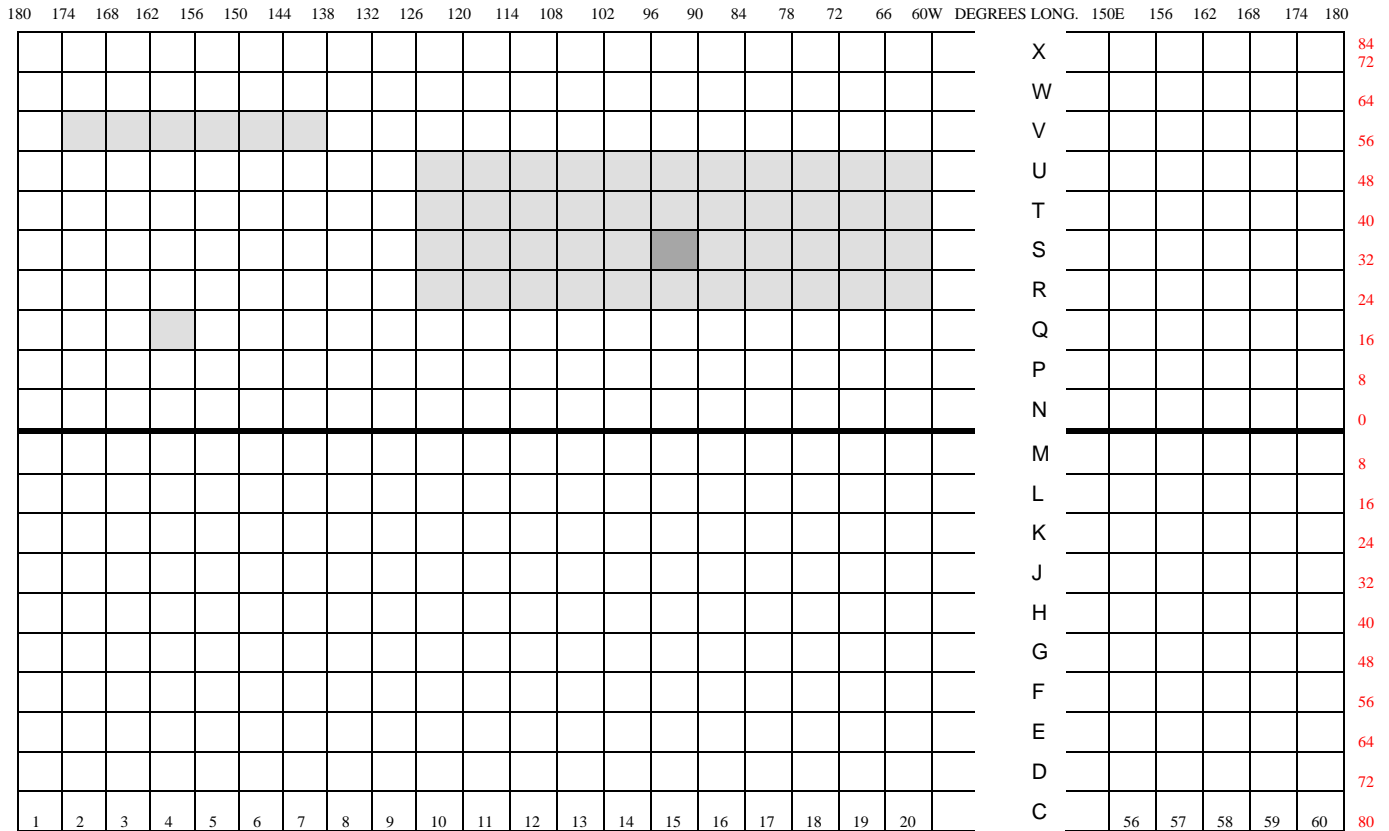


UNIVERSAL TRANSVERSE MERCATOR (UTM) SYSTEM

The UTM projection system for showing the spherical earth on a plane map uses a rectangular grid (see below) consisting of 60 side-by-side north-south zones, each 6 degrees wide in longitude, with the longitude of the boundary edges multiples of 6° . The longitudes of the central meridians of each zone are therefore odd multiples of 3° (e.g., 3, 9, 15, up to 171, 177°). (Arkansas is mostly in Zone 15S - the dark shaded block.)

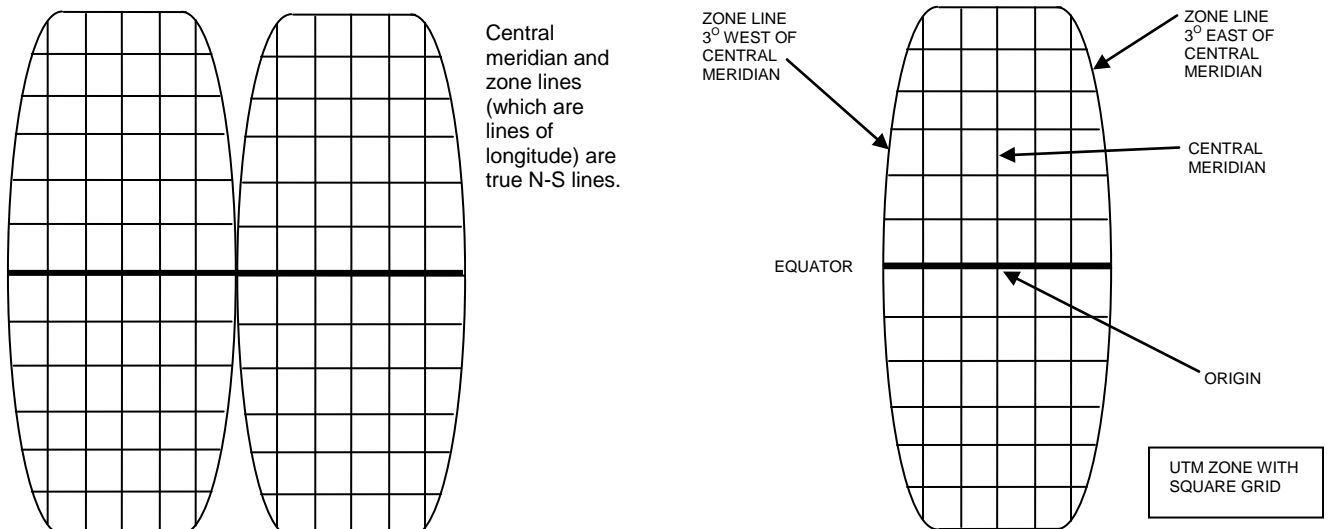


UTM ZONE NUMBERS ARE INDICATED ON THE LINE ABOVE - - - - THE APPROXIMATE LOCATION OF THE UNITED STATES (AK, HI, & LOWER 48 STATES) IS SHADED ABOVE

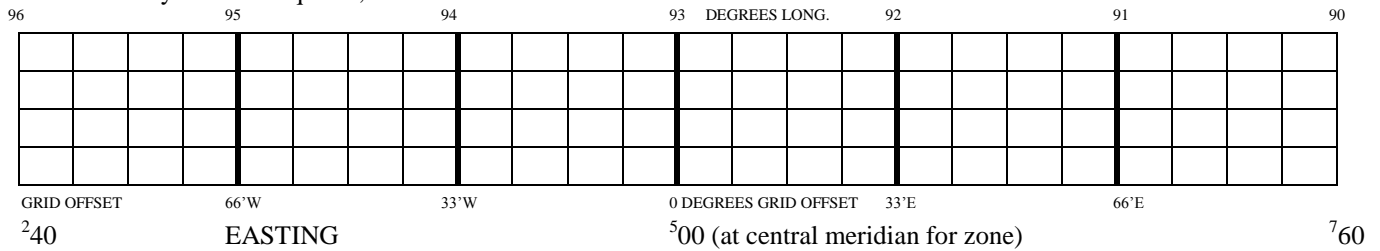
UTM GRID ZONE DESIGNATIONS FOR THE EARTH

Zones are numbered consecutively, starting with zone 1 from 180°W to 174°W longitude and zone 60 from 174°E to 180°E . UTM is used only for latitudes between 80°S and 84°N (see above right edge) due to excessive distortion closer to the poles. The 8° latitude zones are designated by letters C thru X, as indicated above.

UTM assumes a number of converging lines (lines of longitude) running from the equator to the poles called zone lines. (See illustration below.) Within each 6° -wide zone, there is a square grid. Although the outer zone lines converge toward the poles, the grid lines do not. As one travels away from the equator, the zones become narrower. The vertical lines within the grid are parallel, and do not curve to follow lines of longitude.



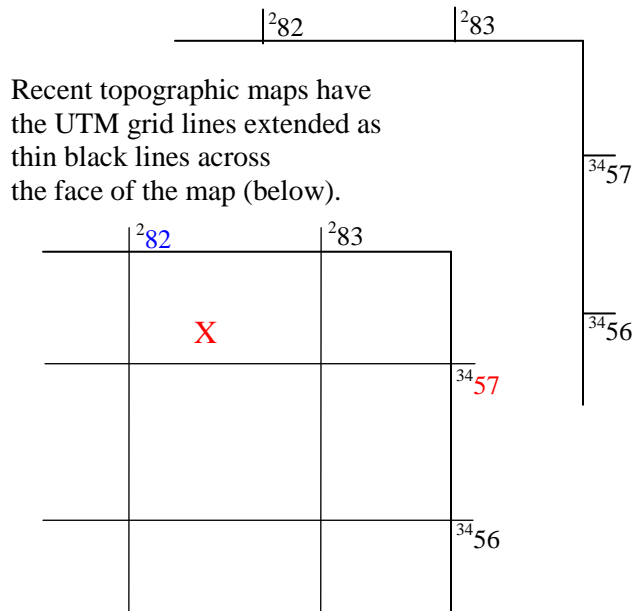
Within each 6° wide UTM zone, only the central meridian coincides with a line of longitude - and is a north-south line. Because the lines of longitude converge to meet at the poles, all the other vertical grid lines within a zone are at some small angle with true north-south lines. (See illustration at bottom of previous page.) This difference (grid offset) between grid north and true north is identified in the declination diagram near the bottom left of most quadrangle maps. At the latitude of Los Angeles - or Arkansas, this grid offset amounts to approximately 1/2 degree for each degree of longitude away from the central meridian of the UTM zone (up to 1-1/2 degrees at east and west zone lines) (or 4' angular difference per 7-1/2' map). Further away from the equator, this difference increases.



ZONE 15 RUNS FROM 96°W (near Tulsa) to 90°W (near Memphis) so almost all of Arkansas is in Zone 15 except for a small area (Mississippi County) near Blytheville and Osceola (north of Memphis) that is in Zone 16.

UTM is a rectangular coordinate system of determining location on the earth's surface, similar to latitude-longitude, but defined in meters rather than degrees-minutes-seconds.

USGS topo maps have the UTM grid indicated by blue tick marks on the map boundaries (see below). The tick marks are spaced one kilometer apart and each has a unique number within a UTM zone.



Recent topographic maps have the UTM grid lines extended as thin black lines across the face of the map (below).

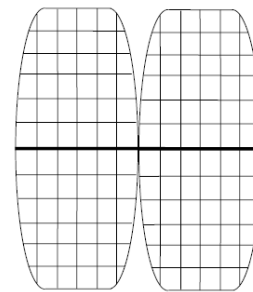
NOTE: The meter was once defined as one ten-millionth the distance from the equator to the pole.

In the illustration above, the line marked as ³⁴56 is 3,456,000 meters (3456 kilometers) north of the equator. The distance between ³⁴56 and ³⁴57 is 1000 meters or one kilometer. At the northern edge, the marking ²82 indicates a UTM coordinate of 282,000 meters easting, referenced to the center meridian of the UTM zone designated as 500,000 meters, marked ⁵00 on the map.

A location is specified by the coordinates of a point, giving the zone number (such as 15S for most of Arkansas) first, then the easting, then the northing. This

convention of east (right) first, then north (up), starting at the southwest corner can be remembered by the mnemonic **read right up**. The three parts of a coordinate may be separated by a slash or space.

The point **X** (below left) is approx. 410 meters east of the line through tick marks labeled 282 at the top and bottom of the map (282410) and is approx. 250 meters north of line through tick marks labeled 3457 at the left and right borders of the map (3457250). The UTM designation of point **X** is 15S/282410/3457250 with a precision of 1 meter, 15S/28241/345725 with a precision of 10 meters, or 15S/2824/34573 if rounded to the nearest 100 meters.



Use by Hikers:
In hiking within a single quadrangle, hikers may omit the zone number and the small numbers (2 and 34) and identify point X simply as 8241 / 5725 - or possibly 82415725 or 824573.

Because the western boundary of one UTM zone and the eastern boundaries of the adjacent zone curve away from each other, eastings range (at our latitude) from a low of around ²40 at the western boundary of a zone to around ⁷70 at the eastern boundary of a zone (with the central meridian designated at ⁵00 - or 500000).

Hot Springs at 93°W is the center of Zone 15 and has a designated easting of 500000. The Oklahoma border has an easting around 370000. Village Creek State Park (east Arkansas) has an easting of around 709000.

One advantage of the UTM system: The distance between any two points A and B (within a UTM zone) can be determined by use of the Pythagorean theorem (square root of the sum of the squares). To do this, record the easting and northing of each point. ΔE = the difference between the two eastings, $E_1 - E_2$. ΔN = the difference between the two northings, $N_1 - N_2$. The distance from A to B is the square root of $(\Delta E^2 + \Delta N^2)$.