NGA Office of GEOINT Sciences Coordinate Systems Analysis (CSAT)

Phone: 314-676-9124

Unclassified Email: coordsys@nga.mil

March 2007

THE UNIVERSAL GRID SYSTEM

- Universal Transverse Mercator (UTM)
- Military Grid Reference System (MGRS)
- Universal Polar Stereographic (UPS)
- United States National Grid (USNG)

A simplified definition and explanation of UTM and related systems

THE UTM SYSTEM

UTM coordinates are based on a family of 120 Transverse Mercator map projections (two for each UTM zone, with one for each N/S hemisphere).

• The earth is divided into 60 zones, each 6° wide in longitude (with the exception of a few non-standard-width zones for Svalbard and southwest Norway). See Figure 1.

UTM ZONE NUMBERS

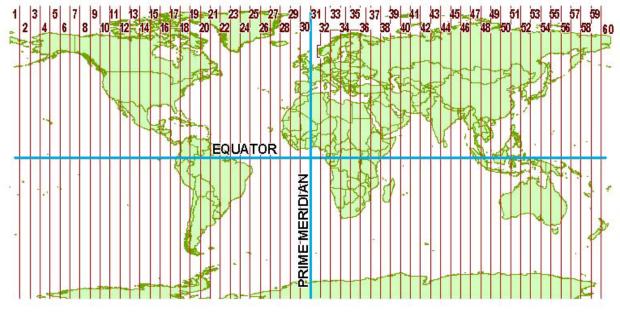


Figure 1.



- Numbering of zones begins at 180° and proceeds eastward.
 - o Zone 1 is from 180°W to 174°W,
 - o Zone 2 is from 174°W to 168°W, and so on.
- Each zone has a central meridian.
 - Zone 1 central meridian is 177°W,
 - o Zone 2 central meridian is 171°W, and so on.
- The X value, called the Easting, has a value of 500,000m at the central meridian of each zone (Figure 2).
- The Y value, called the Northing, has a value of 0m at the equator for the northern hemisphere (Figure 3), 10,000,000m at the equator for the southern hemisphere.

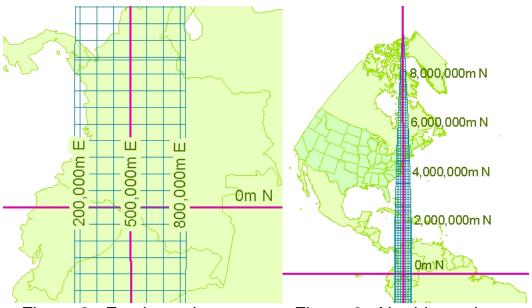


Figure 2. Easting values.

Figure 3. Northing values.

 UTM is limited to the area between 84°N and 80°S. Beyond that, Universal Polar Stereographic (UPS) coordinates are used. See section on UPS.



REFERENCING / EXPRESSING A POSITION IN UTM COORDINATES

- In the UTM system, positions are expressed as Easting / Northing, e.g. "580817mE, 4251205mN". In some cases, the letters are left off, e.g. "580817 4251205".
- If positions occur near UTM zone junctions, the UTM zone may also be specified, e.g. "580817mE, 4251205mN, Zone 15".
- Since the above expresses two possible positions on the earth, the hemisphere may also be specified, e.g. "580817mE, 4251205mN, Zone 15, Northern Hemisphere" (Figure 4).



Figure 4. Example of position expressed in both Lat/Long and UTM coordinates.

- Many systems abbreviate the above, representing the hemisphere as a single letter, "N" for northern hemisphere, and "S" for southern hemisphere, e.g. "15N 580817 4251205".
- CAUTION: IN MANY SYSTEMS, THE LETTER AFTER THE ZONE NUMBER DESIGNATES A LATITUDINAL BAND, NOT A HEMISPHERE. MORE ON THIS BELOW.

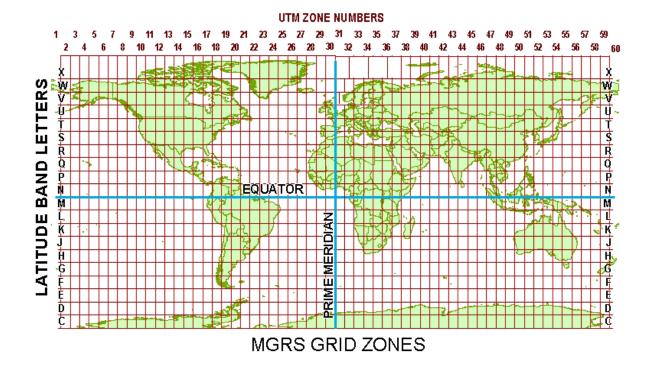


MGRS

The Military Grid Reference System (MGRS) is an alpha-numeric system for expressing UTM / UPS coordinates. A single alpha-numeric value references a position that is unique for the entire earth. The components of MGRS values are as follows:

(Example: 15SWC8081751205)

- The first two characters represent the 6° wide UTM zone.
 - o Leading zeroes are included so that Zone 9 is "09".
 - For polar areas outside the UTM area, these characters are omitted.
- The third character is a letter designating a band of latitude.
 - Beginning at 80°S and preceding northward, the 20 bands are lettered C through X, omitting I and O.
 - o The bands are all 8° high except band X, which is 12° high.
 - Outside the UTM area, A and B are used near the South Pole, Y and Z near the North Pole.



 The vertical UTM boundaries and horizontal latitudinal band boundaries form (generally) 6° X 8° Grid Zones. Hence, the first



three letters of the MGRS value, e.g. "15S", are referred to as the *Grid Zone Designator (GZD)*.

• The fourth and fifth characters are a pair of letters identifying one of the 100,000-meter grid squares within the grid zone (or UPS area). See Figure 6.

IVII	- 1) .	N	TH	Uŀ	1	VH	WH	XH	YΗ	-	<u>CN</u>	+	N-	E	,	FM (BM KC	3
MM NM		VI P	Μφi	/ITG	UG		VG	WG	XG	ΥG	BM	CN	1 [M	EM		——	17	7
ML	14 PLQ		LTF	UF		1 VF	WF	XF	ΥF	BL	CI	- \ _			EL	FL	GL K		
MK			1	TE	UE	Ξ	VE	WE	XE	ΥE	ВК	С	K	DK		EΚ	FK	GK K	
IVIK	- NK	P	QI	TE	U		VE	VVE	XE	ΥĒ	BK		K.	DK	-	<u>=K</u>		1	
MJ	NJ	PJ	QJ	TD	W.	9	VD	WD	XD	YD	BJ		J L	מם		EJ 	FJ	GJ	L
МН	NH	PH	QH	тс	U		VC	WC	хс	YC	Bŀ	1 0	ж	DН		탡	FH	1 / ; _GH	1
MG	NG	PG	QG	ТВ	U	3	VB	WB	ХВ	YE	В	S	G.	DO		EG	FO	GG)
MF							13	9			1	7			Ψ	9	FI	GI	FÌ
1011	NF	PF	QF	TΑ	U/	1	-VA	WA	XA	ΥA	B	FI	CF.	DI	=	EF	1		1
ME	NE	PE	QE	TV	U١	/	W	w	ΧV	Ϋ́	/ E	E	CE	DI	E	EE	F	E G	iΕ
_ [ND NC.	PD	QD OC	TU	Ul	J	VU	WU	XU	Υl		BD BC	CD	D	D C	EC		_	D C
	LIV.	10-	4674						-			~~	-00				- 1	0	~

Figure 6.

In this sample area, the Grid Zone Designators are shown in brown. The smaller gray letters are the 100,000-meter grid square identifiers. The example point "15SWC8081751205" is located in square "WC" near the center of the figure.

- The remaining characters consist of the numeric Easting and Northing values within the 100,000-meter grid square (Figure 7).
- MGRS coordinates may be rounded to reflect lesser refinement. For example:

15SWC8081751205 is at one-meter refinement. 15SWC80825121 is at 10-meter refinement. 15SWC808512 is at 100-meter refinement. 15SWC8151 is at 1000-meter refinement.



DOCKET

Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time** alerts and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

