Geospatial Sciences Division

These Warfighters are *Ready* for Combat...

✔️ **Weapon**   ✔️ **Helmet**   **..and**

✔️ **Ammo**   ✔️ **Water**   ✔️ **Datum**

*"O.K. - we know we need our gear,
but what's a datum?
Why should we care?"*

"What's a datum?"

Simply put, **a datum is the mathematical model of the Earth we use to calculate the coordinates** on any map, chart, or survey system. *All* coordinates reference some particular set of numbers for the size and shape of the Earth.

The problem for warfighters is that many countries use their own datum when they make their maps and surveys--what we call **local datums**. Other nations' maps often use coordinates computed assuming the Earth is a *completely different size and shape* from what the Department of Defense uses, but we have to be ready to fight around the world.

US forces now use a datum called **World Geodetic System 1984**, or **WGS 84**. The National Imagery and Mapping Agency (NIMA) produces all of its *new* maps with this system. Unfortunately, we reprint many of our maps from products made by allied countries that use local datums. Our old maps were made on several different local datums, or sometimes WGS 72 (maps using this datum were often printed "World Geodetic System" with no year identification). So the old maps we're reproducing, and the foreign ones we reprint, might use those other datums.

"Why should I care?"

The coordinates for a point on the Earth's surface in one datum will not match the coordinates from another datum *for that same point!* A grid shift exists between datums because each datum has a different origin. Grid shifts may be relatively small, or in the case of Korea, very large. You may encounter a second problem when you plot Military Grid Reference System (MGRS) coordinates. There are two possible schemes for "100,000m Square Identifiers" (the XE in 51SXE12345678). These letters change when datums are converted to WGS 84 in Africa and Asia, or North American Datum 1983 (NAD 83) in North America. *Take the example below:* The datum of the left map is WGS 84. The coordinate for the buildings circled in red is 51SXE28181402. The datum of the right map is Tokyo Datum. The coordinate for the same set of buildings is 51SXQ28341331. ***Total grid shift in this example is 729 meters (+156mE. -712mN), plus the change in 100,000m square identifiers.*** You can see the problem in passing target coordinates if you are using a different datum than your supporting artillery.
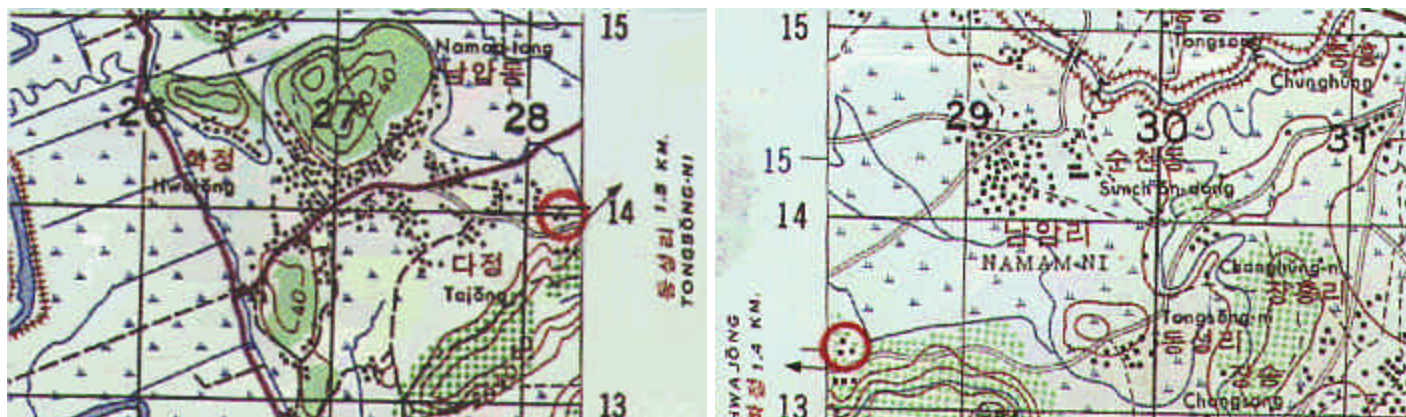
"How can I check my datum?"

All of the maps and charts NIMA distributes will have the datum printed somewhere in the margin like this:

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ELLIPSOID.....................WORLD GEODETIC SYSTEM 1984
GRID..............................1,000 METER UTM ZONE 51
PROJECTION............................TRANSVERSE MERCATOR
VERTICAL DATUM............................MEAN SEA LEVEL
HORIZONTAL DATUM..............WORLD GEODETIC SYSTEM 1984
HYDROGRAPHIC DATUM...........APPROXIMATE LEVEL OF LOWEST
                                               LOW WATER
PRINTED BY...................................NIMA 4-98


        COORDINATE CONVERSION WGS 84 TO TOKYO
           Grid: Add 156m.E.; Subtract 712m.N
      Geographic: Add 7.0" Long.;Subtract 8.8" Lat.
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Notice there is a "Horizontal Datum" for location and a "Vertical Datum" for elevation. Almost all maps and charts use mean sea level for elevation, but they might use any of over hundred different horizontal position datums. Sometimes, a map will have more than one grid on it. *Normally, each grid is for a different datum!*

"Won't the Navstar Global Positioning System (GPS) fix this?"

Maybe. GPS receivers usually give you the option to read your coordinates in several datums, including WGS 84. For example, the Precise Lightweight GPS Receiver or "PLGR", allows you to use 49 predefined datums and two "user datums". The datums already programmed in are some of the ones you're most likely to see now on maps. If US forces go to a place where the maps are on some datum that the PLGR doesn't have, your command will get the figures for you to put in as the User Datum. Consult your GPS manuals to find out how to switch datums. But be careful; GPS coordinates are almost always more accurate than the ones you read off a map. The specification for the 1:50,000 Topo Line Map says objects are plotted on the sheet to within 50 meters of their true position. And you could add 50 more meters error just in reading the point. *That's why maps should never be used for very precise targeting!*

The bottom line is this: *In the past, we didn't worry much about datums because our weapons usually didn't need highly accurate positions. But nowadays, precise coordinates are vital for mission success. Ignoring the fine print in the margin of a map could get you killed!* **Find out what datum is on your map. Set your GPS receiver to read in that datum. Pass the datum along with the grid numbers when trasmitting your coordinates.**

"Where can I get some more info?"

- Every higher headquarters staff has a Mapping Charting and Geodesy (MC&G) Officer. He or she can help you find out which datums are in use in your AOR, and help you make sure you're using the right one. The unit that orders your maps should be able to tell you the MC&G Officer's number. If you can't find it, call one of the numbers below for help.

- NIMA has Action Officers who track the status of maps in each potential region where US forces may be deployed. They work in the Plans and Customer Operations Directorate at NIMA Headquarters, and can be reached at DSN 520-3065 or (703) 264-3065 Commercial.

- The NIMA College will provide you with plenty of assistance. Mobile training teams can come to your location anywhere in the world at NIMA expense to get you on the right track. Call NIMA College at DSN 655-3206 or (703) 805-3206 Commercial.

- NIMA publishes software called GEOTRANS which can convert coordinates from latitude/longitude to UTM or MGRS, and the reverse. It can also transform coordinates between WGS 84 and over a hundred other datums. GEOTRANS will work on any IBM PC-compatible computer. GEOTRANS is available on the website http://164.214.2.59/GandG/pubs.html. An email extention of .mil or .gov is required.

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