

# Publication of Topographical Maps on WGS-84 Datum for Open Use, in view of the National Security Perspective: Pros & Cons

**M.G. ARUR**

Survey of India (Retd.)

**MADHAV N. KULKARNI**

Indian Institute of Technology, Bombay

## ABSTRACT

With the ever-increasing demand of topographical maps by the users, and the restrictions on map-distribution, arising out of the national security considerations, the reference surface - datum - on which the map is based, has assumed great importance. The "WGS-84 Datum" and "The National Security Perspective", the two major elements in the subject topic have been considered in some detail before deliberating on the whole topic. The authors conclude that, since the National Security considerations regarding the publication of topographical maps for public use are independent of the Datum used, any publication of topographical maps for public use on any Datum should continue to be governed by the same accepted restriction policy of the Nation in this respect. Liberalization of this policy in view of the increasing demand of maps from the users, and the digital environment, should be considered on priority basis.

## INTRODUCTION

The subject topic embraces two major elements which we shall first discuss before taking the topic as a whole. The first element is the reference surface - the 'Datum' used for mapping. The datum used for mapping of India is the "Everest Datum", defined through the Indian Great Trigonometrical (G. T.) Triangulation Network, which is very old (defined in 1880), and not geo-centric. The Datum used by modern space geodetic systems like the Global Positioning System (GPS) is the World Geodetic System 1984 (WGS-84). The second element is the security considerations related to topographical maps of a country, which has a close relation with the Datum used for such maps..

## THE WGS-84 DATUM

The WGS-84 Datum is a near-geocentric datum which is defined by the parameters of the ellipsoid and the coordinates of several well distributed and prominent, mutually consistent stations, all round the globe. The associated gravity field is utilized to compute the elevations. GPS uses this datum for tracking its satellites which provide positional information to a user having a GPS receiver.

The Indian Datum is a local datum for mapping, defined by the parameters of the Everest Spheroid and the parameters at the fixed initial point (origin) at Kalianpur. The assumption of zero geoidal undulation at Kalianpur positions the ellipsoid very close to the geoid in our region and keeps the relative undulations very small. It is therefore possible to reduce the surface measurements to the geoid and develop the same on the ellipsoid, which is the mapping surface, and still keep

the difference between the surface measurements and corresponding map measurements well within the plottable error, which is an important requirement from the map user's point of view.

Adoption of the WGS-84 datum would require change to a new ellipsoid, abandoning the concept of initial point (origin) and re-computing our geodetic control in a fresh adjustment, with some well-distributed control points ( whose positions are very precisely determined in the WGS-84 system with the help of GPS), which have been tested to be mutually consistent. GPS gives rectangular co-ordinates which can be transformed to ellipsoidal coordinates and elevation above geoid, if geoid undulations as per the global gravity model are used. These elevations will disagree with the heights now accepted at these control points in the Indian system. Since changing of all the heights would result in an overhaul of the whole mapping system, we may have to stay content with a hybrid solution of changing to WGS-84 for planimetry only and retaining the heights in the present system. At this stage it should be interesting to examine whether in the new global gravity model, the undulations are so small that the surface measurements and the corresponding map measurements continue to disagree well within the plottable error in our region.

It is relevant to point out that such an adjustment is not a one-time affair. The geodetic control in the country needs to be strengthened and updated from time to time taking the help of the improved technology. On the physical plane, the monuments at the ground control points need to be visited systematically and maintained on a regular basis; otherwise

in decades to come, the nation's geodetic ground control will degenerate to exist on paper only.

### **NATIONAL SECURITY PERSPECTIVE**

National security considerations have compelled the Govt. of India to adopt a Restriction Policy in regard to the circulation of Topographic Maps. The main purpose of this policy is to deny access to certain type of map information, such as vital points & installations, to hostile elements.

Map information has two main elements. A vital point shown on a map indicates both the identity (nature/description) of the point as well as its positional information (Latitude / Longitude). In several modern techniques, it is possible for hostile elements (without ground visit) to ascertain the identity of the vital point but it is very difficult to ascertain the very precise ground location without a ground visit.

The above considerations are independent of the datum/coordinate system used in mapping. Irrespective of whether the mapping is done on the present Indian Datum or in WGS-84 datum, the above security considerations will hold.

There is however a valid case for review and liberalisation of the present Restriction Policy. Any revised Policy adopted will also be independent of the mapping system used.

### **Publication of Topographical Maps on WGS -84 Datum for Open use in National Security Perspective**

Now we can consider the subject topic of this discussion as a whole. The motivation for publication of Topo Maps on WGS-84 system may have come from two considerations:

Our Defence forces may be having modern Observation and Surveillance Systems and weaponry with GPS-based

guidance systems. Hence, WGS-84 based maps would facilitate their work.

Secondly GPS receivers are easily available for public use. So a GPS user with a map would like to see an agreement between the receiver given co-ordinates and the map co-ordinates. Thus, a GPS user would prefer a WGS-84 based map.

It is learnt that that Survey of India has produced WGS-84 based maps for open use by applying suitable transformation parameters. This procedure amounts to publication of the map in WGS-84 co-ordinate system and not the change of existing Indian Datum or the adoption of the WGS-84 Datum which requires action as indicated in section 1 above. Such a map will certainly help a public map user as he now has a map, which gives co-ordinates of various attributes with good correspondence with the co-ordinates given by GPS receivers. In restricted areas, a public map user will be happy that he now has access to a map not available to him so far.

However, in the above, the security considerations get thrown overboard completely and all vital information will be available to the hostile elements. It is to be emphasized that a WGS-84 based Topo map is just as sensitive as a Topo map on Indian Datum, for our National Security considerations. Thus, unless a thorough revision of the national security perspective as related to this issue is carried out, which is certainly over-due, publishing maps on WGS-84 will not be in agreement with the existing policy.

### **CONCLUDING REMARKS**

As discussed above, the restriction policy on maps needs a thorough review / liberalization. Within the framework of such a revised policy, Topo maps could be issued for open use in the WGS-84 co-ordinate system for the benefit of GPS users.