



# Co-ordinate Positioning Strategy

## *Information Paper*

### **Introduction**

This paper sets out the intended strategy of Ordnance Survey Ireland (OSi) on a series of issues related to co-ordinate positioning. In places we assume knowledge of technical terms and concepts connected with co-ordinate positioning. For readers who are not familiar with these terms and concepts, references are given to other technical publications where they are explained in detail.

### **National Positioning Standards**

Over the last decade the use of the US Global Positioning System (GPS) for precise positioning activities on the surface of earth has increased dramatically to a point now where most field operations are undertaken using GPS receivers. Our responsibility as custodians of the mapping infrastructure for the Republic of Ireland is to meet the needs of mapping users by providing the most appropriate frameworks to sustain all types of survey and mapping activities.

Positioning work carried out and described by OSi will continue to conform to international standards such as those being developed in the International Organisation for Standardisation (ISO 19100 series).

### **The Irish Grid**

The Irish Grid [1] co-ordinate reference system is currently the horizontal positioning standard for Ireland and was originally realised from a network of triangulation stations (including Trig pillars) distributed around the island. Using GPS surveying instrumentation the Irish Grid is now realised from the IRENET95 [2] GPS reference frame by means of definitive Ordnance Survey transformations [2] that relate IRENET95 co-ordinates (ETRF89<sup>1</sup>) to Irish Grid co-ordinates and visa versa.

It is intended by the end of 2001 that the necessary GPS infrastructure will be in place to enable Irish Grid co-ordinates to be realised by means of an Ordnance Survey active GPS network (permanently installed, continuously operating GPS reference stations) combined with Ordnance Survey transformations to convert IRENET95 co-ordinates to Irish Grid co-ordinates.

Once this active GPS network is fully operational we do not intend to maintain any of the Trig pillars or other control markers (stations) that are not part of the IRENET95 zero order network. We do, however, recognise that there are a limited number of Trig pillars on high ground that may be vital for public safety. We will discuss the long-term issues associated with these Trig pillars with safety and other organisations as to which ones should be maintained. Of the Trig pillars not to be maintained, if any are considered to be in dangerous condition, we will remove or repair them.

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<sup>1</sup> European Terrestrial Reference Frame 1989

Existing services for the supply of Trig pillar and triangulation station co-ordinate information will continue.

### **ITM (Irish Transverse Mercator)**

We are currently consulting on the introduction of ITM [3], a GPS compatible co-ordinate reference system for Ireland. Adoption of ITM would provide GPS compatible positioning that is realised directly from the active or passive IRENET95 GPS network.

The linkage between the Irish Grid horizontal positioning standard and the proposed new ITM horizontal positioning standard would be maintained using Ordnance Survey transformations [2] that relate Irish Grid co-ordinates to GPS co-ordinates and vice versa to within a specified tolerance.

### **Vertical Datum**

The Malin Head vertical datum [1] is the vertical datum for all small scale mapping (1:50,000 and smaller) across Ireland and for a series of levelling networks (Primary, Secondary, and Tertiary) of permanent benchmarks across the Republic of Ireland. The Belfast Lough vertical datum is used for a series of levelling networks (Primary, Secondary, and Tertiary) of permanent benchmarks across Northern Ireland. Heights relative to the Malin Head datum have been determined for the Fundamental Benchmark's (FBM's) throughout Ireland.

It is intended that by early 2002 it will be possible to realise both vertical datums in Ireland using GPS instrumentation by means of an Ordnance Survey Geoid model which will be known as OSGM01 (Ordnance Survey Geoid Model 2001). The use of OSGM01 will allow conversion of ellipsoidal heights relating to the GRS80 ellipsoid to orthometric heights that relate to the local Malin Head or Belfast Lough vertical datums. OSGM01 will become the new vertical positioning standard for the Republic of Ireland.

We do not intend to maintain the Primary, Secondary, or Tertiary levelling networks but do intend to maintain the Fundamental Benchmark (FBM) levelling network. The existing FBM's will be included in an extensive GPS campaign that will be carried out in the autumn of 2001.

It is intended that the new OSGM01 geoid model will be supplied to customers for a minimal charge. Existing services for the supply of levelling benchmark heights will continue.

## **National GPS Networks**

In order to provide GPS compatible mapping to users we have, in conjunction with the Ordnance Survey of Northern Ireland (OSNI), over the past five years established a passive network of points throughout Ireland and made it available to users. Recently, we took the decision to establish the infrastructure to sustain an active network of permanently recording stations for our own operational purposes and, once it has proven to be stable, the recorded data will also be made available to users.

### **Passive GPS Network – IRENET95**

IRENET95 [2] is the existing passive (user-accessible ground markers) GPS reference frame standard in Ireland. The IRENET95 framework is made up of two networks of GPS co-ordinate reference stations, a Zero order network consisting of 11 stations and a Densification network consisting of 173 network stations.

We intend, on a periodic basis with OSNI, to monitor the co-ordinates of the IRENET95 Zero order network stations as they form the primary realisation of ETRF89 (GPS co-ordinate system) in Ireland and are of significant scientific value. We do not, however, intend to maintain the IRENET95 Densification network as the Ordnance Survey active GPS network,

when proven stable and reliable, will become the new standard for the realisation of ETRF89.

With the implementation of the planned Ordnance Survey active GPS reference network, it is intended that all OSi passive GPS reference network co-ordinates (IRENET95) will be made available free of charge by means of publication on our Internet web site.

### **Active GPS Network**

It is intended by the end of 2001 that the necessary permanent GPS infrastructure will be in place to provide a geodetic standard of positioning for all of the island of Ireland whereby users can combine the active GPS network data with their own GPS observations. The planned active GPS network for the Republic of Ireland will comprise of 13 permanent GPS stations with the break down as follows:

- 10 Ordnance Survey Ireland stations (of which 4 will be situated in Dublin to provide a real time solution); and
- 3 Commissioners of Irish Lights stations (Tory, Loop, and Mizen Head).

It is the intention that the planned Active GPS network will also incorporate the 3 Ordnance Survey of Northern Ireland GPS network stations.

In the autumn of 2001 we intend to carry out an extensive GPS campaign in conjunction with OSNI to ensure that all the major positioning standards in Ireland, both existing and developing, are compatible. The GPS campaign will include the positioning stations of the IRENET95 Zero Order passive GPS reference network, the FBM's, the 3 EUVN'97<sup>2</sup> passive GPS reference stations, the new active GPS reference network in the Republic of Ireland, and the Commissioners of Irish Lights active GPS reference stations.

Once this campaign has been completed and data from the active stations has been proven to be stable and reliable, we intend to supply, early in 2002, the active GPS network data to customers for post-processing with their own GPS observations free of charge for a pilot period. A decision has not yet been made on whether this data will remain free of charge to users.

It is intended that the OSi active GPS network will provide a real time GPS positioning service for Dublin. For the real time solution we are intending on using a GSM mobile phone communication solution by which the surveyor will not only receive the required GPS information but will also be charged for using the system on a per usage basis. Although initially a real time solution will only be provided for Dublin, if the demand dictates, the real time GPS positioning service will be expanded to the other major urban areas such as Cork, Galway, and Limerick.

### **Control (Trig) Office Services**

The services provide by the OSi Control (Trig) Office will be kept under review in order to make required services more accessible to the customer. We are for instance currently in the process of designing an Excel spreadsheet that will allow co-ordinates to be transformed / converted from one co-ordinate system to another. Customers will be able to download this spreadsheet free of charge from OSi's corporate web site.

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<sup>2</sup> European Vertical Reference Network GPS Campaign 1997

## Contact

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## References

- [1] Ordnance Survey Ireland, 1996. ***The Irish Grid***. OSi, Dublin
- [2] Ordnance Survey Ireland, Ordnance Survey of Northern Ireland, 1999. ***Making Maps Compatible with GPS***. OSi, Dublin. OSNI, Belfast.
- [3] Ordnance Survey Ireland, Ordnance Survey of Northern Ireland, 2001. ***A New Projection for Ireland – Consultation paper***. OSi, Dublin. OSNI, Belfast.