



NATIONAL IMAGERY AND MAPPING AGENCY

TECHNICAL REPORT



NIMA TR8350.2

THIRD EDITION

AMENDMENT 1

3 JANUARY 2000

DEPARTMENT OF DEFENSE WORLD GEODETIC SYSTEM 1984

Its Definition and Relationships with
Local Geodetic Systems

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NIMA STOCK NO. DMATR83502WGS84
NSN 7643-01-402-0347

APPENDIX E

WGS 72 TO WGS 84 TRANSFORMATION

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WGS 72 to WGS 84 TRANSFORMATION

1. Situations arise where only WGS 72 coordinates are available for a site. In such instances, the WGS 72 to WGS 84 transformation listed in Table E.1 can be used with the following equations to obtain WGS 84 coordinates for the sites:

$$\phi_{\text{WGS 84}} = \phi_{\text{WGS 72}} + \Delta\phi$$

$$\lambda_{\text{WGS 84}} = \lambda_{\text{WGS 72}} + \Delta\lambda$$

$$h_{\text{WGS 84}} = h_{\text{WGS 72}} + \Delta h$$

2. As indicated in Table E.1, when proceeding directly from WGS 72 coordinates to obtain WGS 84 values, the WGS 84 coordinates will differ from the WGS 72 coordinates due to a shift in the coordinate system origin, a change in the longitude reference, a scale change (treated through Δr) and changes in the size and shape of the ellipsoid. In addition, it is important to be aware that $\Delta\phi$, $\Delta\lambda$, Δh values calculated using Table E.1 do not reflect the effect of differences between the WGS 72 and WGS 84 EGMs and geoids. The following cases are important to note:

a. Table E.1 equations are to be used for direct transformation of Doppler-derived WGS 72 coordinates. These transformed coordinates should agree to within approximately ± 2 meters with the directly surveyed WGS 84 coordinates using TRANSIT or GPS point positioning.

b. Table E.1 should not be used for satellite local geodetic stations whose WGS 72 coordinates were determined using datum shifts from [36]. The preferred approach is to transform such WGS 72 coordinates, using datum shifts from [36], back to their respective local datums, and then transform the local datum coordinates to WGS 84 using Appendices B or C.

c. Table E.1 should be used only when no other approach is applicable.

Table E.1
Formulas and Parameters
to Transform WGS 72 Coordinates
to WGS 84 Coordinates

FORMULAS	$\Delta\phi'' = (4.5 \cos \phi) / (a \sin 1'') + (\Delta f \sin 2\phi) / (\sin 1'')$ $\Delta\lambda'' = 0.554$ $\Delta h = 4.5 \sin \phi + a \Delta f \sin^2 \phi - \Delta a + \Delta r \quad (\text{Units} = \text{Meters})$
PARAMETERS	$\Delta f = 0.3121057 \times 10^{-7}$ $a = 6378135 \text{ m}$ $\Delta a = 2.0 \text{ m}$ $\Delta r = 1.4 \text{ m}$
INSTRUCTIONS	<p>To obtain WGS 84 coordinates, add the $\Delta\phi$, $\Delta\lambda$, Δh changes calculated using WGS 72 coordinates to the WGS 72 coordinates (ϕ, λ, h, respectively).</p> <p>Latitude is positive north and longitude is positive east (0° to 180°).</p>