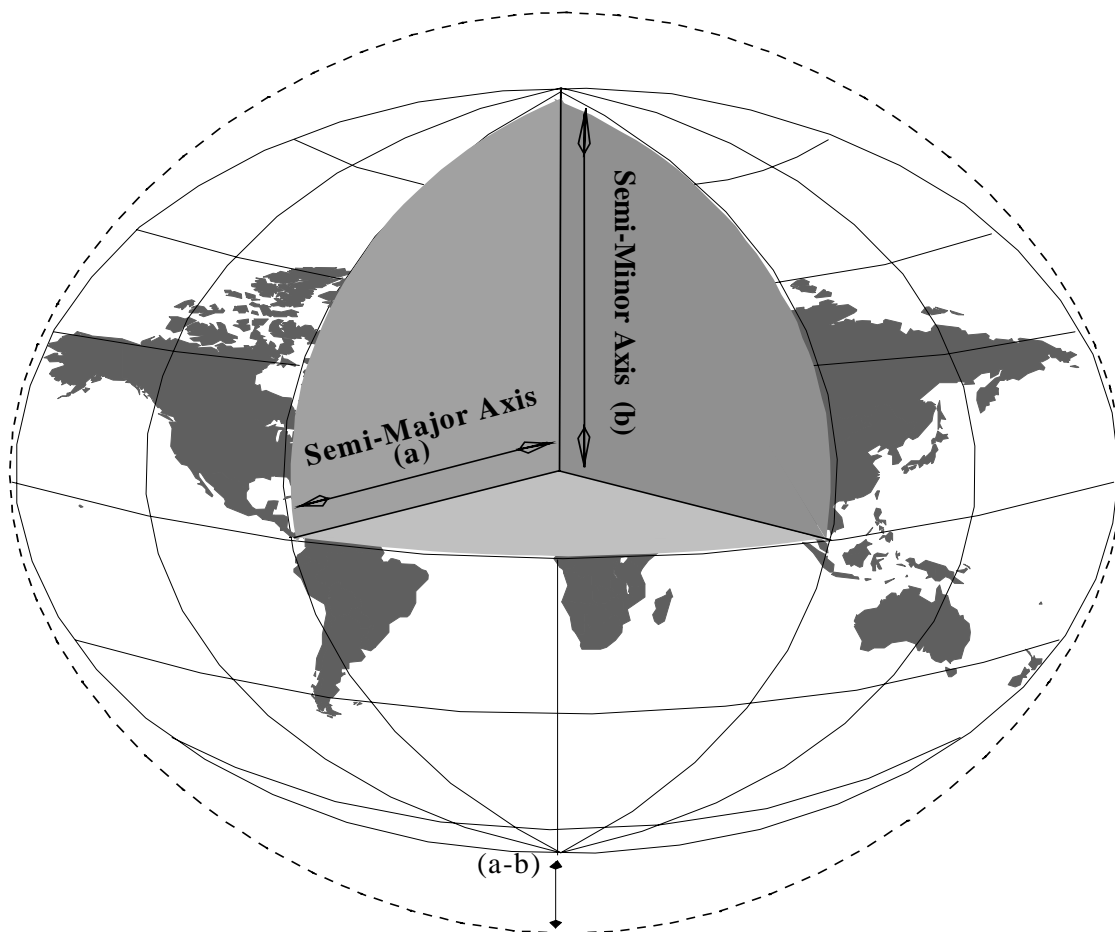


APPENDIX A

ELLIPSOIDS AND DATUMS



DRAFT

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(APPENDIX A)

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GENERAL INFORMATION (APPENDIX A)

1. REFERENCES.

a. The following references were used to compile the information found in this appendix:

1. DMA TM 8358.1 (Sept 1990)
2. NIMA TR 8350.2 Third Edition (4 July 1997)
3. National Geodetic Survey, Geodetic Glossary (Sept 1986)
4. ST 6-2-40 (1 Mar 1991) BUCS DDCT
5. MADTRAN, Edition 2 and 4 (NIMA Program referencing NIMA TR 8350.2 above)
6. DOD Glossary of Mapping, Charting, and Geodetic Terms (1991)
7. MERCATOR Program (NIMA Program referencing DMA TM 8358.2 dtd Sept 1989)
8. TM 08837A-12/1A (28 Oct 1988) w/ ch3 (9 Sept 1992) PADS

b. When the information in the references above conflicted, NIMA TR 8350.2 was considered the senior publication.

c. The numbers in front of the references above correspond to the reference numbers in the tables of this appendix. Reference #8 was used to determine the PADS Ellipsoid Code; reference #4 was used to determine the BUCS DDCT (Rev 0) code.

2. TABLES.

a. Ellipsoids:

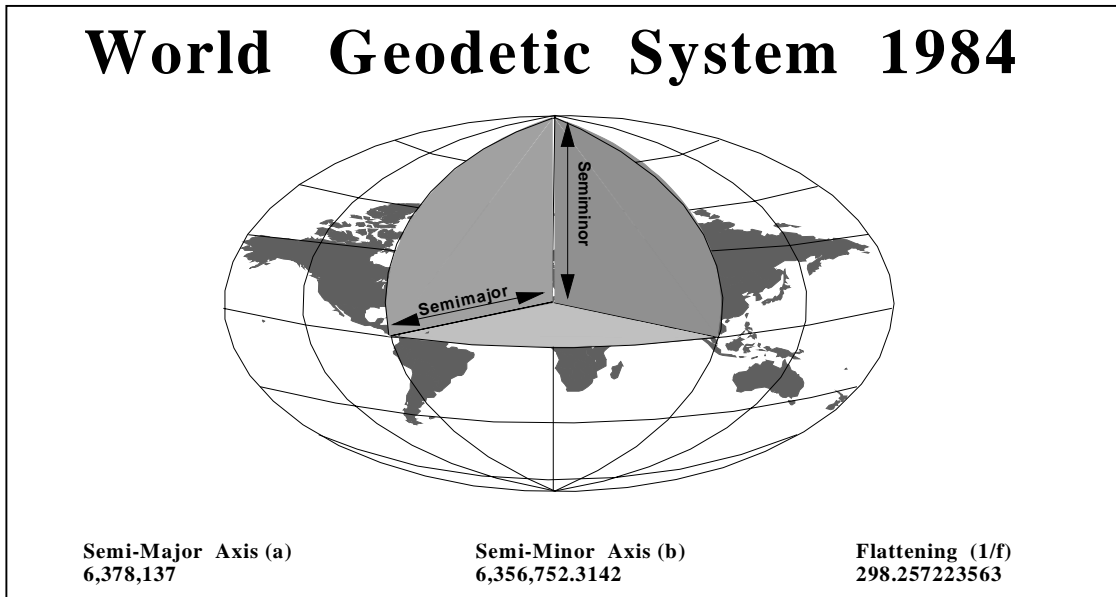
1. Tables A-1a and A-1b are a compilation of all ellipsoids and their parameters as published in the references above. This is not a list of all ellipsoids, however it is the most complete list of ellipsoids and their parameters available to artillery surveyors in one table. Table A-1a includes those reference ellipsoids that have datum transformation parameters in Tables A-3 through A-25. Table A-1b includes those ellipsoids that do **not** have datum transformation parameters in Tables A-3 through A-25.

2. Table A-2 is a cross-reference between Datums and Reference Ellipsoids.

b. Datums:

1. The Datum Transformation Parameters are listed corresponding to the ellipsoid they are referenced to. The transformation parameters are from the local geodetic datum to WGS 84, therefore, a datum table with WGS 84 will not be published. Only the reference ellipsoids in Table A-1a will have a corresponding Datum Table in A-3 through A-25.

2. Differences in data published in the above references are explained in the notes section at the end of this appendix.



NIMA has designated WGS-84 as the preferred ellipsoid and datum for all mapping, charting, and geodetic products, however, some areas of the world can still be covered by other systems. This section is intended to show the need for updating to WGS-84 and also to explain the similarities as well as the differences between the WGS-84 and GRS-80 ellipsoids.

Because of the large amount of mapping, charting, and geodetic products produced by the National Imagery and Mapping Agency (NIMA) for the Department of Defense (DoD); it became apparent that a single geocentric coordinate system was needed to insure accuracy and easier user interface. A geocentric system provides a basic reference for the mathematical figure of the Earth. It also provides a means for establishing various geodetic datums to an Earth Centered, Earth-Fixed (ECEF) coordinate system. This system is termed the World Geodetic System (WGS).

Previously, DoD has adopted three such systems: WGS-60, WGS-66, and WGS-72. With each system proving more accurate than the last, WGS-72 can still be used for some applications, although it does have several shortcomings. For example, the WGS-72 Earth Gravitational Model and Geoid are obsolete. Also, more accurate datum shifts from local geodetic datums to a WGS were needed. Several other factors contributed to the need to replace WGS-72. These include the replacement of NAD 27 with NAD 83 and the development of the Australian Geodetic Datum 1984. Also, a large increase in data and more advanced types of data (satellite ranging for example) became available. WGS-84 was developed as the replacement for WGS-72.

In determining the WGS-84 ellipsoid and its defining parameters, the WGS-84 Development Committee closely followed the procedures used by the International Union of Geodesy and Geophysics (IUGG) who had already developed the Geodetic Reference System 1980 (GRS-80). Four parameters were used to develop WGS-84: the semi-major axis (a), the Earth's gravitational constant (GM), the normalized second degree zonal gravitational constant, and the angular velocity of the Earth. All are identical to GRS-80 except that the normalized second degree zonal used is that of the WGS-84 gravitational model instead of the notation used for GRS-80.

As a result of that difference, the ellipsoid parameters differ slightly between GRS-80 and WGS-84. These differences are insignificant from a practical application standpoint; therefore, it has been accepted that GRS-80 and WGS-84 are the same and their associated datums are based on the same ellipsoid.

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Ellipsoid Parameters

(Ellipsoids Referenced to Datum Tables A-3 through A-25)

Ellipsoid	a	$\triangle a$	b	1/f	$\triangle f \times 10^4$
Airy	6,377,563.396	+573.604	6,356,256.910	299.32496 46	+0.11960023
Modified Airy	6,377,340.189	+796.811	6,356,034.446	299.32496 46	+0.11960023
Australian National ‡	6,378,160	-23	6,356,774.7192	298.25	-0.00081204
Bessel 1841	6,377,397.155	+739.845	6,356,078.9629	299.15281 28	+0.10037483
Bessel 1841 (Namibia)	6,377,483.865	+653.135	6,356,165.383	299.15281 28	+0.10037483
Clarke 1866	6,378,206.4	-69.4	6,356,583.8	294.97869 82	-0.37264639
Clarke 1880 †	6,378,249.145	-112.145	6,356,514.8696	293.465	-0.54750714
Everest 1830	6,377,276.34518	+860.655	6,356,075.41511	300.8017	+0.28361368
Everest 1948	6,377,298.556	+838.444	6,356,097.550	300.8017	+0.28361368
Mod. Everest 1948 *	6,377,304.063	+832.937	6,356,103.039	300.8017	+0.28361368
Everest 1956	6,377,301.243	+835.757	6,356,100.228	300.8017	+0.28361368
Everest (Pakistan)	6,377,309.613	+827.397	6,356,108.571	300.8017	+0.28361368
Mod. Fischer 1960	6,378,155.0	-18	6,356,773.320	298.3	+0.00480795
GRS-80	6,378,137	0	6,356,752.3141	298.25722 2101	+0.00000016
GRS-80 CHINA	6,378,140	-3	6,356,755.288	298.257	-0.00002514
Helmert 1906	6,378,200	-63	6,356,818.170	298.3	+0.00480795
Hough 1960	6,378,270	-133	6,356,684.34343	297	-0.14192702
Indonesian 1974	6,378,160.0	-23	6,356,774.504	298.247	-0.00114930
International 1924	6,378,388	-251	6,356,911.9462	297	-0.14192702
Krassovsky 1940	6,378,245	-108	6,356,863.019	298.3	+0.00480795
SGS-85	6,378,136	+1	6,356,751.302	298.257	-0.00002514
South American 1969‡	6,378,160	-23	6,356,774.7192	298.25	-0.00081204
WGS-72	6,378,135	+2	6,356,750.5	298.26	+0.00031211
WGS-84	6,378,137	N/A	6,356,752.3142	298.25722 3563	N/A

Table A-1a

a : semi-major axis

b : semi-minor axis

1/f : inverse of flattening

$\triangle a$: is the difference between the WGS-84 semi-major axis and the local ellipsoid semi-major axis. WGS-84 - Local Ellipsoid = $\triangle a$

$\triangle f \times 10^4$: is the difference between the WGS-84 flattening and the local ellipsoid flattening multiplied by 10,000.

Semi-minor Axes printed in bold were computed using the formula $b=a(1-f)$, then rounded to three places.

* Also known as Malayan Ellipsoid.

† See NOTE 2 on Pg Appendix A-44

‡ See NOTE 6 on Pg Appendix A-45

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Ellipsoid Parameters

(Ellipsoids NOT Referenced to Datum Tables A-3 through A-25)

Ellipsoid	a	$\triangle a$	b	1/f	$\triangle f \times 10^4$
Airy 1830	6,377,563.541	+573.459	6,356,257.053	299.325	+0.11960418
Clarke 1858	6,378,361	-224	6,356,685	294.26	-0.45544531
Clarke 1880 French †	6,378,249.2	-112.2	6,356,515.0	293.46598	-0.54739335
Clarke 1880 Mod. †	6,378,249.145	-112.145	6,356,514.966	293.46630 7656	+0.54735530
Clarke 1880 Palestine†	6,378,300.790	-163.79	6,356,566.435	293.46630 7656	+0.54735530
Clarke 1880 †	6,378,249.14532 6	-112.145326	6,356,514.96672 1	293.46630 76	-0.54735531
Danish	6,377,104.430	+1032.57	6,355,847.415	300.0000	+0.19477331
Delambre	6,376,523.300	+1613.7	6,355,863.232	308.640	+1.12789929
Everest 1969	6,377,295.664	+841.336	6,356,094.668	300.8017	+0.28361368
Fischer 1960	6,378,166.0	-29	6,356,784.284	298.3	+0.00480795
GRS-1967 ‡	6,378,160	-23	6,356,774.504	298.247	-0.00114930.
Hayford 1909	6,378,388.0	-251	6,356,909.0	297.00	-0.14192702
Plessis	6,376,523.3	-1613.7	6,355,863.232	308.640	+1.12789929
Schott 1900	6,378,157	-20	6,357,210.672	304.5	+0.68738415
Struve	6,378,298.3	-161.3	6,356,657.143	294.730	-0.40125243
War Office 1924	6,378,300.58	-163.58	6,356,752.267	296	-0.25567714
WGS-60	6,378,165	-28	6,356,783.287	298.3	+0.00480795
WGS-66	6,378,145	-8	6,356,759.769	298.25	-0.00081204
WGS-84	6,378,137	N/A	6,356,752.3142	298.25722 3563	N/A

Table A-1b

a : semi-major axis

b : semi-minor axis

1/f : inverse of flattening

$\triangle a$: is the difference between the WGS-84 semi-major axis and the local ellipsoid semi-major axis. WGS-84 - Local Ellipsoid = $\triangle a$

$\triangle f \times 10^4$: is the difference between the WGS-84 flattening and the local ellipsoid flattening multiplied by 10,000.

Semi-minor Axes printed in bold were computed using the formula $b=a(1-f)$, then rounded to three places.

* Also known as Malayan Ellipsoid.

† See NOTE 2 on Pg Appendix A-44

‡ See NOTE 6 on Pg Appendix A-45

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DATUM TO ELLIPSOID CROSS REFERENCE Table A-2

DATUM	AREA	ELLIPSOID	TABLE
Adindan	North Africa	Clarke 1880	A-9a
Afgooye	Somalia	Krassovsky 1940	A-22
Ain El Abd 1970	Bahrain Island	International 1924	A-21a
American Samoa 1962	US Samoan Islands	Clarke 1866	A-8a
Anna 1 Astro 1965	Cocos Islands	Australian National	A-5
Antigua Island Astro 1943	Antigua and Leeward Islands	Clarke 1880	A-9a
Arc 1950	Central Africa	Clarke 1880	A-9a,b
Arc 1960	Kenya and Tanzania	Clarke 1880	A-9b
Ascension Island 1958	Ascension Island	International 1924	A-21a
Astro Beacon "E" 1945	Iwo Jima	International 1924	A-21a
Astro Dos 71/4	St Helena Island	International 1924	A-21a
Astro Tern Island (Frig) 1961	Tern Island	International 1924	A-21a
Astronomical Station 1952	Marcus Island	International 1924	A-21a
Australian Geodetic 1966	Australia and Tasmania	Australian National	A-5
Australian Geodetic 1984	Australia and Tasmania	Australian National	A-5
Ayabelle Lighthouse	Djibouti	Clarke 1880	A-9b
Beijing 1982 (Peking 1982)	China	GRS 1980 (China)	A-17
Bellevue (IGN)	Efate and Erromango Islands	International 1924	A-21a
Bermuda 1957	Bermuda	Clarke 1866	A-8a
Bissau	Guinea-Bissau	International 1924	A-21a
Bogota Observatory	Columbia	International 1924	A-21a
Bukit Rimpah	Indonesia	Bessel 1841	A-6
Camp Area Astro	Camp McMurdo, Antarctica	International 1924	A-21a
Campo Inchauspe 1969	Argentina	International 1924	A-21a
Canton Astro 1966	Phoenix Islands	International 1924	A-21b
Cape	South Africa	Clarke 1880	A-9b
Cape Canaveral	Florida and Bahamas	Clarke 1866	A-8a
Carthage	Tunisia	Clarke 1880	A-9b
Chatham Island Astro 1971	Chatham Island	International 1924	A-21b
Chua Astro	Paraguay	International 1924	A-21b
Corrego Alegre	Brazil	International 1924	A-21b
Coordinate System 1937 (Estonia)	Estonia	Bessel 1841	A-6
Dabola	Guinea	Clarke 1880	A-9b
Deception Island	Deception Is. Antarctica	Clarke 1880	A-9b
Djakarta (Batavia)	Indonesia	Bessel 1841	A-6
Dos 1968	Gizo Island	International 1924	A-21b
Easter Island 1967	Easter Island	International 1924	A-21b
European 1950	North Africa/Europe/Middle East	International 1924	A-21b,c
European 1979	Europe	International 1924	A-21c
Fort Thomas 1955	Nevis and St Kitts	Clarke 1880	A-9c

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DATUM TO ELLIPSOID CROSS REFERENCE Table A-2 Cont.

DATUM	AREA	ELLIPSOID	TABLE
Gan 1970 (Gandajika Base)	Republic of Maldives	International 1924	A-21d
Geodetic Datum 1949	New Zealand	International 1924	A-21d
Graciosa Base SW 1948	Azores	International 1924	A-21d
Guam 1963	Guam	Clarke 1866	A-8a
Gunung Segara	Indonesia	Bessel 1841	A-6
Gux 1 Astro	Guadalcanal	International 1924	A-21d
Herat North	Afghanistan	International 1924	A-21d
Herat North	Afghanistan	Krassovsky 1940	A-22
Hermannskogel	Croat Republics	Bessel 1841	A-6
Hjorsey 1955	Iceland	International 1924	A-21d
Hong Kong 1963	Hong Kong	International 1924	A-21d
Hu-Tzu-Shan	Taiwan	International 1924	A-21d
Indian	Bangladesh	Everest 1830	A-10
Indian	India and Nepal	Everest 1956	A-13
Indian	Pakistan	Everest (Pakistan)	A-14
Indian 1954	Thailand	Everest 1830	A-10
Indian 1960	Vietnam	Everest 1830	A-10
Indian 1975	Thailand	Everest 1830	A-10
Indonesian 1974	Indonesia	Indonesian 1974	A-20
Ireland 1965	Ireland	Modified Airy	A-4
ISTS 061 Astro 1968	South Georgia Islands	International 1924	A-21d
ISTS 073 Astro 1969	Diego Garcia	International 1924	A-21d
Johnston Island 1961	Johnston Island	International 1924	A-21d
Kandawala	Sri Lanka	Everest 1830	A-10
Kerguelen Island 1949	Kerguelen Island	International 1924	A-21e
Kertau 1948	West Malaysia and Singapore	Mod. Everest 1948	A-12
Kusaie Astro 1961	Caroline Islands/Micronesia	International 1924	A-21e
LC 5 Astro 1961	Cayman Brac Islands	Clarke 1866	A-8a
Leigon	Ghana	Clarke 1880	A-9c
Liberia 1964	Liberia	Clarke 1880	A-9c
Luzon	Philippines	Clarke 1866	A-8a
Mahe 1971	Mahe Island	Clarke 1880	A-9c
Massawa	Ethiopia	Bessel 1841	A-6
Merchich	Morocco	Clarke 1880	A-9c
Midway Astro 1961	Midway Islands	International 1924	A-21e
Minna	Cameroon and Nigeria	Clarke 1880	A-9c
Montserrat Island Astro 1958	Montserrat	Clarke 1880	A-9a
M'Poraloko	Gabon	Clarke 1880	A-9c

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DATUM TO ELLIPSOID CROSS REFERENCE Table A-2 Cont.

DATUM	AREA	ELLIPSOID	TABLE
Nahrwan	Sanai Peninsula	Clarke 1880	A-9c
Naparima BWI	Trinidad and Tobago	International 1924	A-21e
North American Datum 1927	North and Central America	Clarke 1866	A-8a,b,c
North American Datum 1983	North and Central America	GRS 1980	A-16
North Sahara 1959	Algeria	Clarke 1880	A-9d
Observatorio Meteorologico 1939	Azores	International 1924	A-21e
Old Egyptian 1907	Egypt	Helmert 1906	A-18
Old Hawaiian	Hawaiian Islands	Clarke 1866	A-8a
Oman	Oman	Clarke 1880	A-9d
Ord. Survey of Great Britain 1936	United Kingdom	Airy	A-3
Peking 1954	Shanghai, China	Krassovsky 1940	A-22
Pico De Las Nieves	Canary Islands	International 1924	A-21e
Pitcairn Astro 1967	Pitcairn Island	International 1924	A-21e
Point 58	Burkino Faso and Niger	Clarke 1880	A-9d
Pointe Noire 1948	Congo	Clarke 1880	A-9d
Porto Santo 1936 (Southeast Base)	Porto Santo and Madeira Islands	International 1924	A-21e
Potsdam	Germany	Bessel 1841	A-6
Provisional South American 1956	South America	International 1924	A-21e,f
Provisional South Chilean 1963	Southern Chile	International 1924	A-21f
Puerto Rico	Puerto Rico and Virgin Is.	Clarke 1866	A-8c
Pulkovo 1942	Russia	Krassovsky 1940	A-22
Qatar National	Qatar	International 1924	A-21f
Qornoq	South Greenland	International 1924	A-21f
Reunion	Mascarene Island	International 1924	A-21f
Rome 1940	Sardinia	International 1924	A-21f
S-42 (Pulkovo 1942)	Eastern Europe	Krassovsky 1940	A-22
Santo (Dos) 1965	Espirito Santo Islands	International 1924	A-21f
Sao Braz	Azores	International 1924	A-21g
Sapper Hill 1943	East Falkland Islands	International 1924	A-21g
Schwarzeck	Namibia	Bessel 1841 (Namibia)	A-7
Selvagem Grande 1938	Salvage Islands	International 1924	A-21g
Sierra Leone 1960	Sierra Leone	Clarke 1880	A-9d
S-JTSK	Czechoslovakia	Bessel 1841	A-6
South American 1969	South America	South American 1969	A-23
South Asia	Singapore	Mod. Fischer 1960	A-15
Soviet Geodetic System 1985	Asia and Europe	SGS 1985	A-24
Tananarive Observatory 1925	Madagascar	International 1924	A-21g
Timbalai 1948	Brunei and East Malaysia	Everest 1948	A-11
Tokyo	Korea and Japan	Bessel 1841	A-6
Tristan Astro 1968	Tristan Da Cunha	International 1924	A-21g

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DATUM TO ELLIPSOID CROSS REFERENCE Table A-2 Cont.

DATUM	AREA	ELLIPSOID	TABLE
Viti Levu 1916	Viti Levu Island	Clarke 1880	A-9d
Voirol 1874	Tunisia and Algeria	Clarke 1880	A-9d
Voirol 1960	Algeria	Clarke 1880	A-9d
Wake-Eniwetok 1960	Marshall Islands	Hough 1960	A-19
Wake Island Astro 1952	Wake Atoll	International 1924	A-21g
Yacare	Uruguay	International 1924	A-21g
Zanderij	Suriname	International 1924	A-21g

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DATUM TABLES

MODIFIED AIRY

a: 6377340.189

b: 6356034.446

1/f: 299.32496 46

Δa : +796.811

$\Delta f \times 10^4$: +0.11960023

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
IRELAND 1965	IRELAND	506	-122	611	IRL	38	2

Table A-4

$\Delta f \times 10^7$: +119.600

PADS CODE: 11

1. The Datum Transformation Tables include the following information:

- a. Ellipsoid Name, Semi-major axis (a), Semi-minor axis (b), Flattening (1/f), , and as listed in Table A-1a.
- b. $\Delta f \times 10$ listed at the bottom of the table and is to be used along with Δa for the user defined option in the AN/PSN-11 (PLGR) program version 613-9854-002.
- c. PADS Code as listed in TM 08837A-12/1A. In cases where two or more ellipsoids have the same parameters, the same PADS code was listed for each even when not listed in the reference. For example, Australian National and South American 1969 can both use code 8. **These codes are for Version 4 PADS.** If a PADS Code is not listed, the User Defined option should be used.
- d. Local Geodetic Datum. The datum name as it appears in NIMA TR 8350.2. In cases where a datum has more than one name, the second name is listed in parenthesis.
- e. Country/Area. This information is mostly as it appears in NIMA TR 8350.2. The only variations from the reference are listings of states and countries published under Mean Solutions.
- f. Transformation Parameters (shifts in X,Y, and Z axis) as listed in NIMA TR 8350.2. These parameters are from the local datum to WGS 84.
- g. Datum Code. The codes in this column match the programmed datum codes from the AN/PSN-11 (PLGR). The datum codes listed in this column that are not a programmed option of the PLGR must be selected as User Defined. All Datum Codes published in this table are from NIMA TR 8350.2.

DRAFT

AIRY

a: 6377563.396

b: 6356256.910

1/f: 299.32496 46

Δa : +573.604

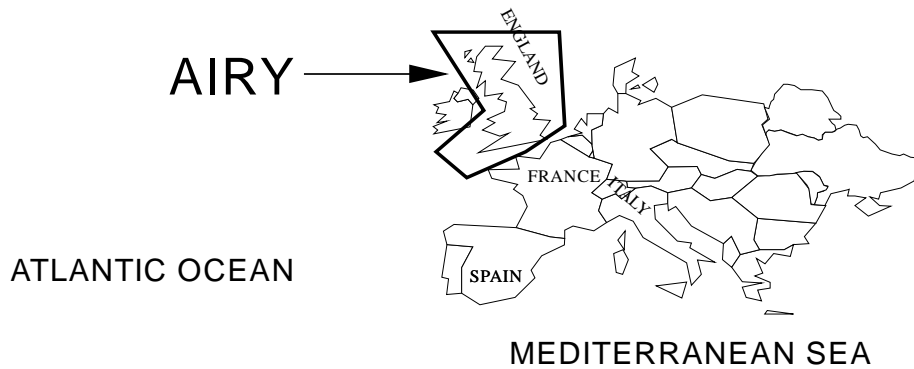
$\Delta f \times 10^4$: +0.11960023

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
ORDNANCE SURVEY OF GREAT BRITAIN 1936	MEAN SOLUTION	375	-111	431	OGB		2
	(ENGLAND, ISLE OF MAN, SCOTLAND, SHETLAND ISLANDS, AND WALES				OGB-M	76	2
	ENGLAND	371	-112	434	OGB-A		2
	ENGLAND, ISLE OF MAN, AND WALES	371	-111	434	OGB-B		2
	SCOTLAND AND THE SHETLAND ISLANDS	384	-111	425	OGB-C		2
	WALES	370	-108	434	OGB-D		2

Table A-3

$\Delta f \times 10^7$: +119.600

PADS CODE: 10



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AUSTRALIAN NATIONAL SEE NOTE SIX

a: 6378160

b: 6356774.7192

1/f: 298.25

Δa : -023.000

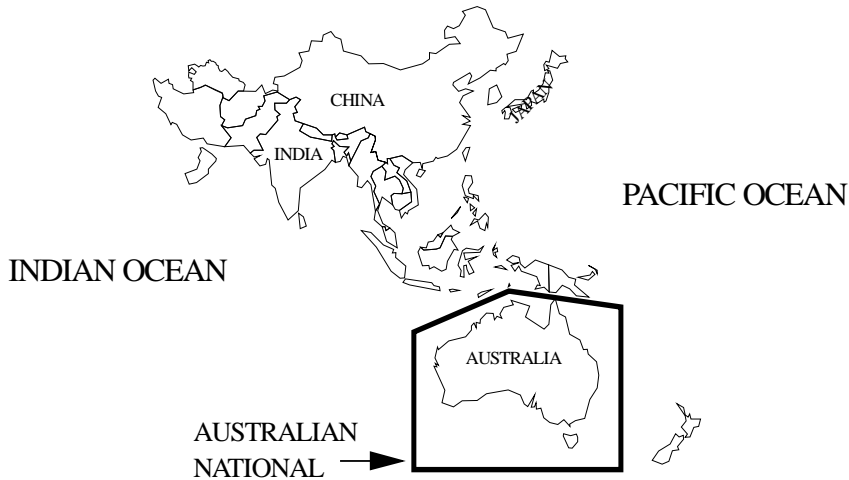
$\Delta f \times 10^4$: -0.00081204

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
ANNA 1 ASTRO 1965	COCOS ISLANDS	-491	-22	435	ANO	4	2
AUSTRALIAN GEODETIC 1966	AUSTRALIA AND TASMANIA	-133	-48	148	AUA	12	2
AUSTRALIAN GEODETIC 1984	AUSTRALIA AND TASMANIA	-134	-48	149	AUG	13	2

Table A-5

$\Delta f \times 10^7$: -000.812

PADS CODE: 8



DRAFT

BESSEL 1841

a: 6377397.155

b: 6356078.9629

1/f: 299.15281 28

Δa : +739.845

$\Delta f \times 10^4$: +0.10037483

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
BUKIT RIMPAH	INDONESIA	-384	664	-48	BUR		2
SEE NOTE EIGHT	(BANGKA AND BELITUNG ISLS)						
COORDINATE SYSTEM 1937 OF ESTONIA	ESTONIA	374	150	588	EST		2
DJAKARTA (BATAVIA)	INDONESIA (SUMATRA)	-377	681	-50	BAT		2
GUNUNG SEGARA	INDONESIA (KALIMANTAN)	-403	684	41	GSE		2
HERMANNSKOGEL	YUGOSLAVIA	682	-203	480	HER		2
SEE NOTE EIGHT	(Prior to 1990) (Currently Serbia, Slovenia, Croatia, and Bosnia and Herzegovina)						
MASSAWA	ETHIOPIA (ERITREA)	639	405	60	MAS		2
POTSDAM	GERMANY						4
SEE NOTE FIVE							
S-JTSK	CZECHOSLOVAKIA PRIOR TO 1 JAN 1993	589	76	480	CCD		2
TOKYO					TOY		2
	MEAN SOLUTION (JAPAN, OKINAWA, AND SOUTH KOREA)	-148	507	685	TOY-M	SEE NOTE ONE	2
	JAPAN	-148	507	685	TOY-A		2
	OKINAWA	-158	507	676	TOY-C		2
	KOREAN PENIN. (NORTH AND SOUTH KOREA)	-147	506	687	TOY-B		2

Table A-6

$\Delta f \times 10^7$: +100.374

PADS CODE: 5

****Map on next page.****

DRAFT

BESSEL 1841 (Namibia)

a: 6377483.865

b: 6356165.383

1/f: 299.15281 28

Δa : +653.135

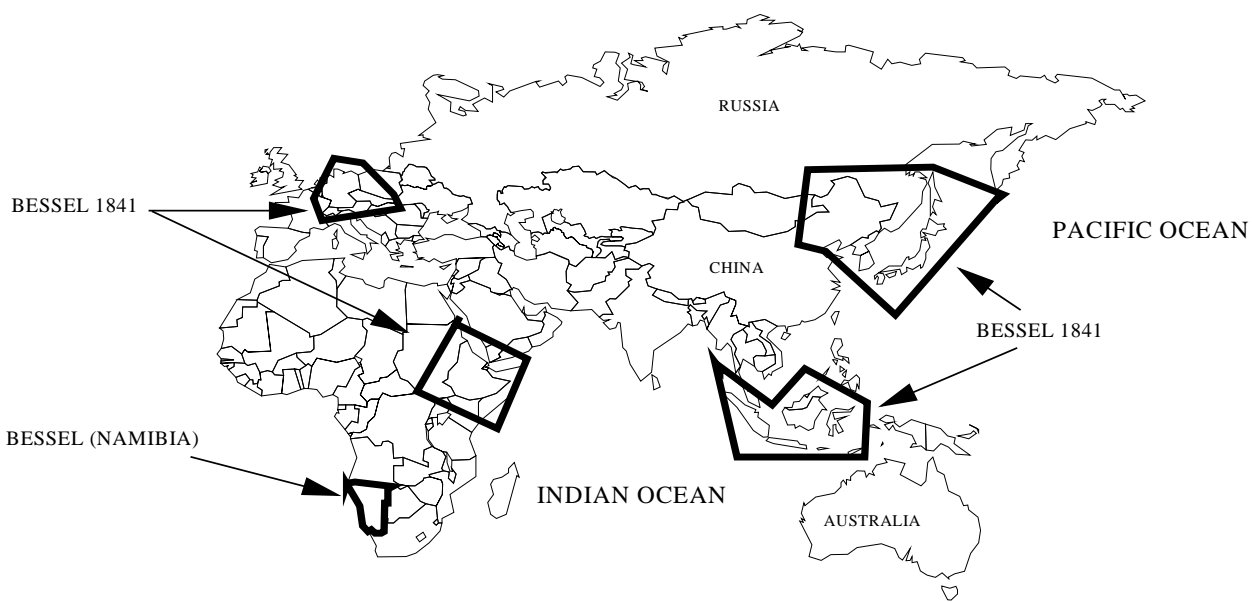
$\Delta f \times 10^4$: +0.10037483

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
SCHWARZECK	NAMIBIA	616	97	-251	SCK	SEE NOTE ONE	2

Table A-7

$\Delta f \times 10^7$: +100.374

PADS CODE:



DRAFT

CLARKE 1866

a: 6378206.4

b: 6356583.8

1/f: 294.97869 82

Δa : -069.400

$\Delta f \times 10^4$: -0.37264639

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
AMERICAN SAMOA 1962	US SAMOAN IS.	-115	118	426	AMA		2
BERMUDA 1957	BERMUDA IS.	-73	213	296	BER	15	2
CAPE CANAVERAL	MEAN SOLUTION BAHAMAS AND FLORIDA	-2	151	181	CAC	SEE NOTE ONE	2
GUAM 1963	GUAM	-100	-248	259	GUA	32	2
LC 5 ASTRO 1961	CAYMAN BRAC IS	42	124	147	LCF	45	2
LUZON					LUZ		2
	PHILIPPINES (EXCLUDING MINDANAO IS.)	-133	-77	-51	LUZ-A	47	2
	MINDANAO IS.	-133	-79	-72	LUZ-B	48	2
NORTH AMERICAN 1927					NAS		2
	MEAN SOLUTION (CONUS)	-8	160	176	NAS-C	60	2
UNITED STATES							
	EASTERN U.S.	-9	161	179	NAS-A		2
	WESTERN U.S.	-8	159	175	NAS-B		2
	ALASKA (EXCLUDING THE ALEUTIAN ISLANDS)	-5	135	172	NAS-D	61	2
	ALEUTIAN IS.						
	EAST OF 180 Deg WEST	-2	152	149	NAS-V		2
	WEST OF 180 Deg WEST	2	204	105	NAS-W		2

Table A-8a

$\Delta f \times 10^7$: -372.646

PADS CODE: 1

DRAFT

CLARKE 1866 cont.

a: 6378206.4

b: 6356583.8

1/f: 294.97869 82

Δ a: -069.400

$\Delta f \times 10^4$: -0.37264639

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
NORTH AMERICAN 1927					NAS		2
	MEAN SOLUTION	-10	158	187	NAS-E	64	2
CANADA	CANADA; INCLUDING NEWFOUNDLAND						
	ALBERTA AND BRITISH COLUMBIA	-7	162	188	NAS-F		2
	EASTERN CANADA (NEWFOUNDLAND, NEW BRUNSWICK, NOVA SCOTIA, AND QUEBEC)	-22	160	190	NAS-G		2
	MANITOBA AND ONTARIO	-9	157	184	NAS-H		2
	NORTHWEST TERRITORIES AND SASKATCHEWAN	4	159	188	NAS-I		2
	YUKON	-7	139	181	NAS-J		2
NORTH AMERICAN 1927	BAHAMAS	-4	154	178	NAS-Q	62	2
OTHER THAN US AND CANADA	(EXCLUDING SAN SALVADOR IS.)						
	CANAL ZONE	0	125	201	NAS-O	65	2
	CARIBBEAN	-3	142	183	NAS-P	66	2
	CENTRAL AMERICA (BELIZE, COSTA RICA, EL SALVADOR, GUATEMALA, HONDURAS, AND NICARAGUA)	0	125	194	NAS-N	67	2
	CUBA	-9	152	178	NAS-T	68	2

Table A-8b

$\Delta f \times 10^7$: -372.646

PADS CODE: 1

DRAFT

CLARKE 1866 cont.

a: 6378206.4

b: 6356583.8

1/f: 294.97869 82

Δa : -069.400

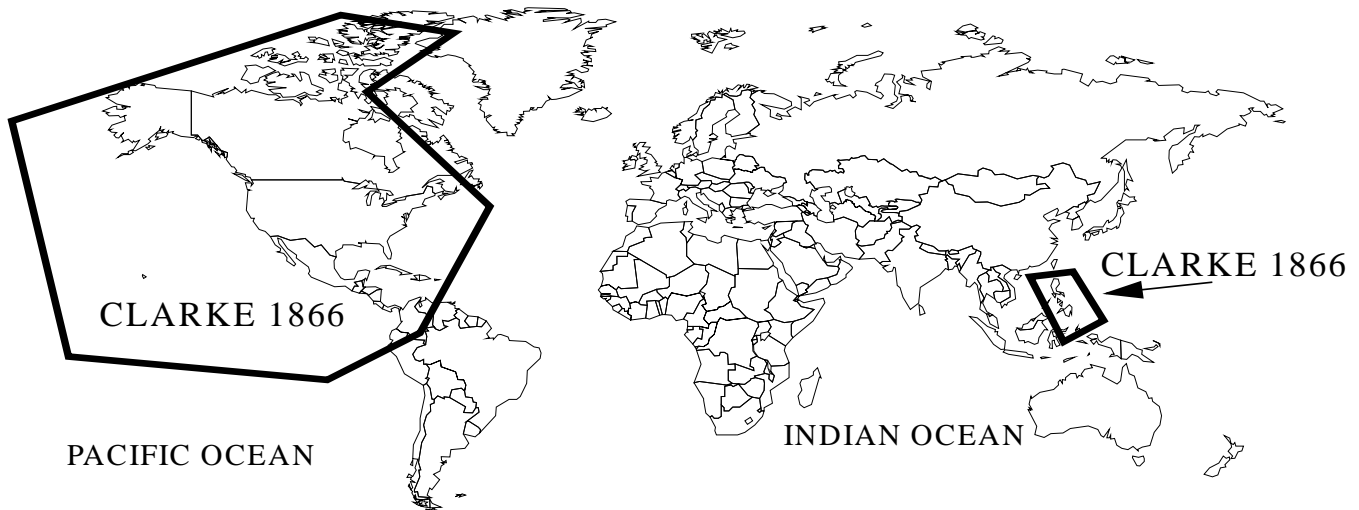
$\Delta f \times 10^4$: -0.37264639

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
NORTH AMERICAN 1927					NAS		2
	GREENLAND (HAYES PENINSULA)	11	114	195	NAS-U	69	2
	MEXICO	-12	130	190	NAS-L	70	2
	SAN SALVADOR IS.	1	140	165	NAS-R	63	2
OLD HAWAIIAN				OHA			
	MEAN SOLUTION	61	-285	-181	OHA-M	74	2
	HAWAII	89	-279	-183	OHA-A		2
	KAUAI	45	-290	-172	OHA-B		2
	MAUI	65	-290	-190	OHA-C		2
	OAHU	58	-283	-182	OHA-D		2
PUERTO RICO	PUERTO RICO AND VIRGIN ISLANDS	11	72	-101	PUR	81	2

Table A-8c

$\Delta f \times 10^7$: -372.646

PADS CODE: 1



DRAFT

CLARKE 1880 SEE NOTE TWO

a: 6378249.145

b: 6356514.8696

1/f: 293.465

Δ a: -112.145

$\Delta f \times 10^4$: -0.54750714

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
ADINDAN					ADI		2
	MEAN SOLUTION (ETHIOPIA AND SUDAN)	-166	-15	204	ADI-M	1	2
	BURKINA FASO	-118	-14	218	ADI-E		2
	CAMEROON	-134	-2	210	ADI-F		2
	ETHIOPIA	-165	-11	206	ADI-A		2
	MALI	-123	-20	220	ADI-C		2
	SENEGAL	-128	-18	224	ADI-D		2
	SUDAN	-161	-14	205	ADI-B		2
ANTIGUA ISLAND ASTRO 1943							2
	ANTIGUA AND LEEWARD ISLANDS	-270	13	62	AIA		2
ARC 1950 SEE NOTE TWO					ARF		2
	MEAN SOLUTION (BOTSWANA, LESOTHO, MALAWI, SWAZILAND, ZAIRE, ZAMBIA, AND ZIMBABWE)	-143	-90	-294	ARF-M	5	2
	BOTSWANA	-138	-105	-289	ARF-A		2
	BURUNDI	-153	-5	-292	ARF-H		2

Table A-9a

$\Delta f \times 10^7$: -547.507

PADS CODE: 2

DRAFT

CLARKE 1880 cont. SEE NOTE TWO

a: 6378249.145

b: 6356514.8696

1/f: 293.465

Δ a: -112.145

Δ f x 10⁴ : -0.54750714

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		Δ X	Δ Y	Δ Z			
ARC 1950 cont SEE NOTE TWO					ARF		2
	LESOTHO	-125	-108	-295	ARF-B		2
	MALAWI	-161	-73	-317	ARF-C		2
	SWAZILAND	-134	-105	-295	ARF-D		2
	ZAIRE	-169	-19	-278	ARF-E		2
	ZAMBIA	-147	-74	-283	ARF-F		2
	ZIMBABWE	-142	-96	-293	ARF-G		2
ARC 1960	MEAN SOLUTION	-160	-6	-302	ARS-M	6	2
	KENYA	-157	-2	-299	ARS-A		2
	TANZANIA	-175	-23	-303	ARS-B		2
AYABELLE LIGHTHOUSE	DJIBOUTI	-79	-129	145	PHA		2
CAPE	SOUTH AFRICA	-136	-108	-292	CAP	19	2
CARTHAGE SEE NOTE TWO	TUNISIA	-263	6	431	CGE		2
DABOLA	GUINEA	-83	37	124	DAL		2
DECEPTION ISLAND	DECEPTION IS., ANTARCTICA	260	12	-147	DID		2

Table A-9b

Δ f x 10⁷: -547.507

PADS CODE: 2

DRAFT

CLARKE 1880 cont. SEE NOTE TWO

a: 6378249.145

b: 6356514.8696

1/f: 293.465

Δ a: -112.145

$\Delta f \times 10^4$: -0.54750714

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
FORT THOMAS 1955	NEVIS AND ST KITTS (LEEWARDS IS)	-7	215	225	FOT		2
LEIGON	GHANA	-130	29	364	LEH		2
LIBERIA 1964	LIBERIA	-90	40	88	LIB	46	2
MAHE 1971	MAHE ISLAND	41	-220	-134	MIK	49	2
MERCHICH SEE NOTE TWO	MOROCCO	31	146	47	MER		2
MINNA					MIN		
	CAMEROON	-81	-84	115	MIN-A		2
	NIGERIA	-92	-93	122	MIN-B	54	2
MONTSERRAT ISLAND ASTRO 1958	MONTSERRAT (LEEWARDS IS)	174	359	365	ASM		2
M'PORALOKO	GABON	-74	-130	42	MPO		2
NAHRWAN					NAH		
	MASIRAH ISLAND (OMAN)	-247	-148	369	NAH-A	55	2
	SAUDI ARABIA	-243	-192	477	NAH-C	SEE NOTE ONE	2
	UNITED ARAB EMIRATES	-249	-156	381	NAH-B	56	2

Table A-9c

$\Delta f \times 10^7$: -547.507

PADS CODE: 2

DRAFT

CLARKE 1880 cont. SEE NOTE TWO

a: 6378249.145

b: 6356514.8696

1/f: 293.465

Δa : -112.145

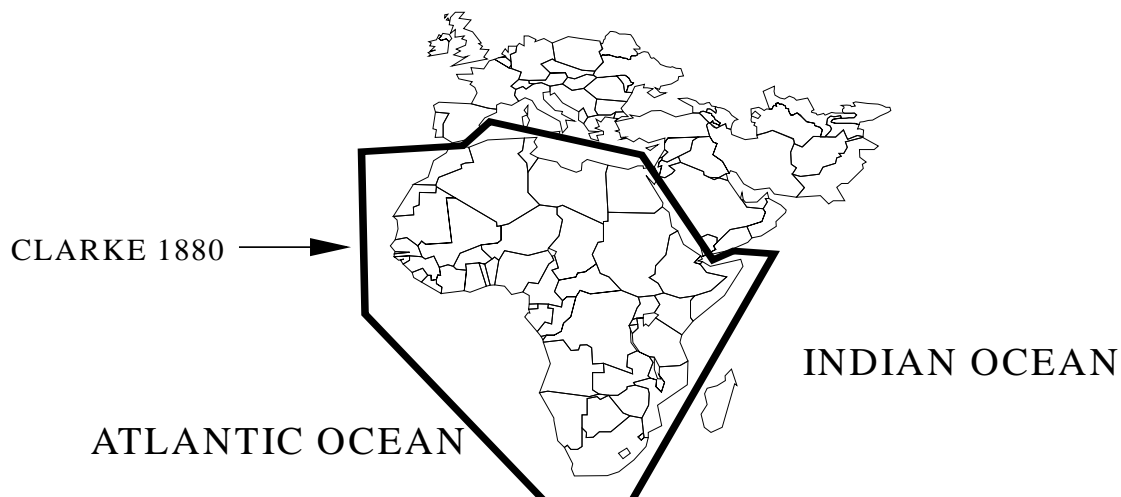
$\Delta f \times 10^4$: -0.54750714

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
NORTH SAHARA 1959	ALGERIA	-186	-93	310	NSD		2
OMAN	OMAN	-346	-1	224	FAH	75	2
POINT 58	MEAN SOLUTION (BURKINO FASO AND NIGER)	-106	-129	165	PTB		2
POINTE NOIRE 1948	CONGO	-148	51	-291	PTN		2
SIERRA LEONE 1960	SIERRA LEONE	-88	4	101	SRL		2
VITI LEVU 1916	VITI LEVU ISLAND (FIJI ISLANDS)	51	391	-36	MVS	95	2
VOIROL 1874 SEE NOTE EIGHT	TANZANIA/ALGERIA	-73	-247	227	VOI		2
VOIROL 1960 SEE NOTE TWO	ALGERIA	-123	-206	219	VOR		2

Table A-9d

$\Delta f \times 10^7$: -547.507

PADS CODE: 2



DRAFT

EVEREST 1830

a: 6377276.34518

b: 6356075.41511

1/f: 300.8017

Δa : +860.655

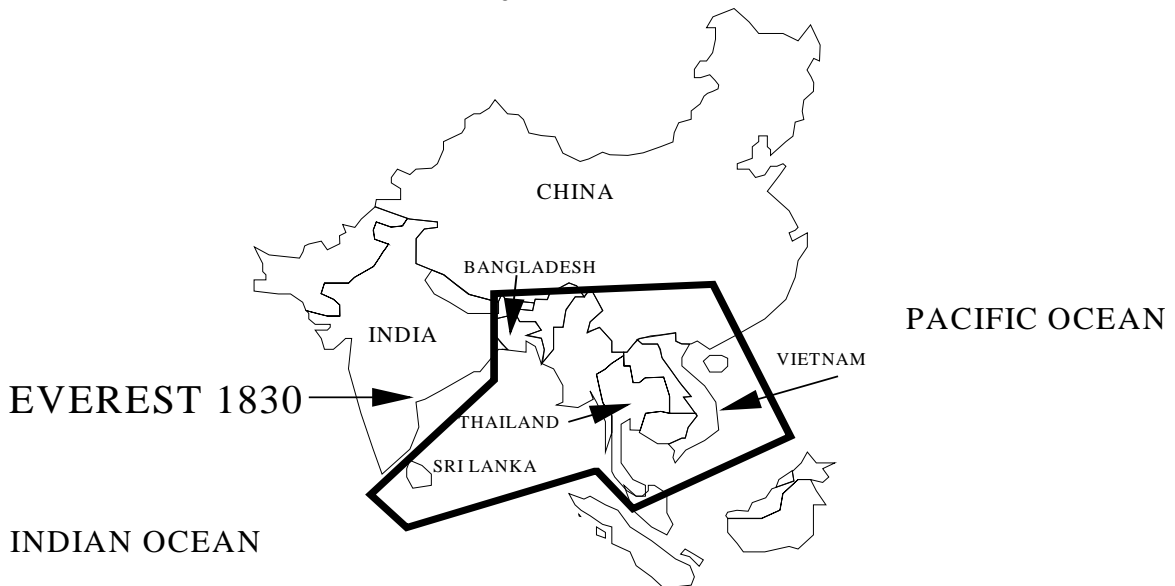
$\Delta f \times 10^4$: +0.28361368

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
INDIAN	BANGLADESH	282	726	254	IND-B	SEE NOTE ONE	2
INDIAN 1954	THAILAND	217	823	299	INF-A	SEE NOTE ONE	2
INDIAN 1960					ING		2
	CON SON ISLAND (VIETNAM)	182	915	344	ING-B	SEE NOTE ONE	2
	VIETNAM Near 16 deg N	198	881	317	ING-A	SEE NOTE ONE	2
INDIAN 1975					INH		
	THAILAND	210	814	289	INH-A	SEE NOTE ONE	2
KANDAWALA	SRI LANKA	-97	787	86	KAN	41	2

Table A-10

$\Delta f \times 10^7$: +283.614

PADS CODE: 4



DRAFT

GEODETIC REFERENCE SYSTEM 1980

a: 6378137

b: 6356752.3141

1/f: 298.25722 2101

Δa : 000.000

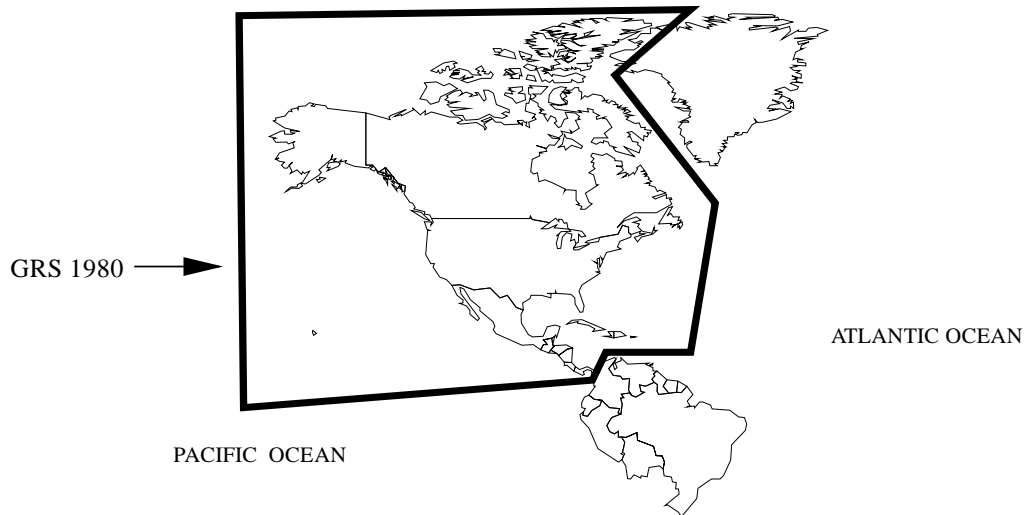
$\Delta f \times 10^4$: +0.00000016

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
NORTH AMERICAN 1983					NAR		2
	ALASKA	0	0	0	NAR-A	71	2
	(EXCLUDING THE ALEUTIAN ISLANDS)						
	ALEUTIAN ISLANDS	-2	0	4	NAR-E		2
	CANADA	0	0	0	NAR-B	71	2
	CONUS	0	0	0	NAR-C	71	2
	HAWAII	1	1	-1	NAR-H		2
	MEXICO AND CENTRAL AMERICA	0	0	0	NAR-D	71	2

Table A-16

$\Delta f \times 10^7$: +000.000

PADS CODE: 9



DRAFT

GEODETIC REFERENCE SYSTEM 1980 CHINA

a: 6378140

b: 6356755.288

1/f: 298.257

Δa : -003.000

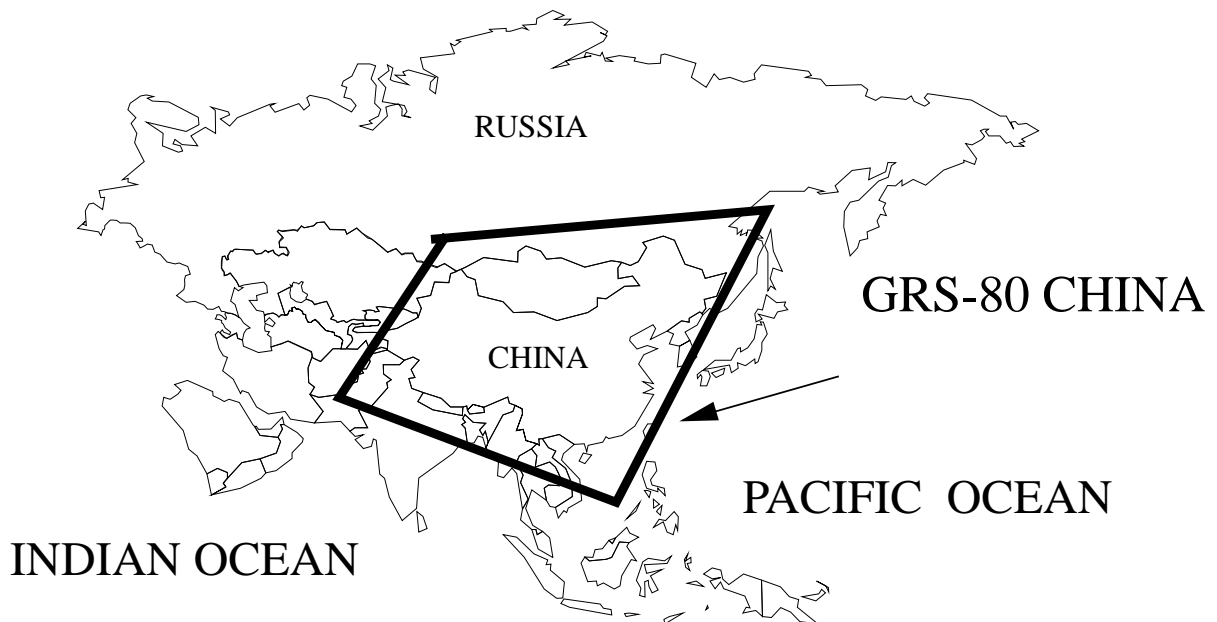
$\Delta f \times 10^4$: -0.00002514

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
BEIJING 1982 (PEKING 1982)	CHINA AFTER 31 DEC 1980						

Table A-17

$\Delta f \times 10^7$: -000.025

PADS CODE:



DRAFT

HELMERT 1906

a: 6378200

b: 6356818.170

1/f: 298.3

Δa : -063.000

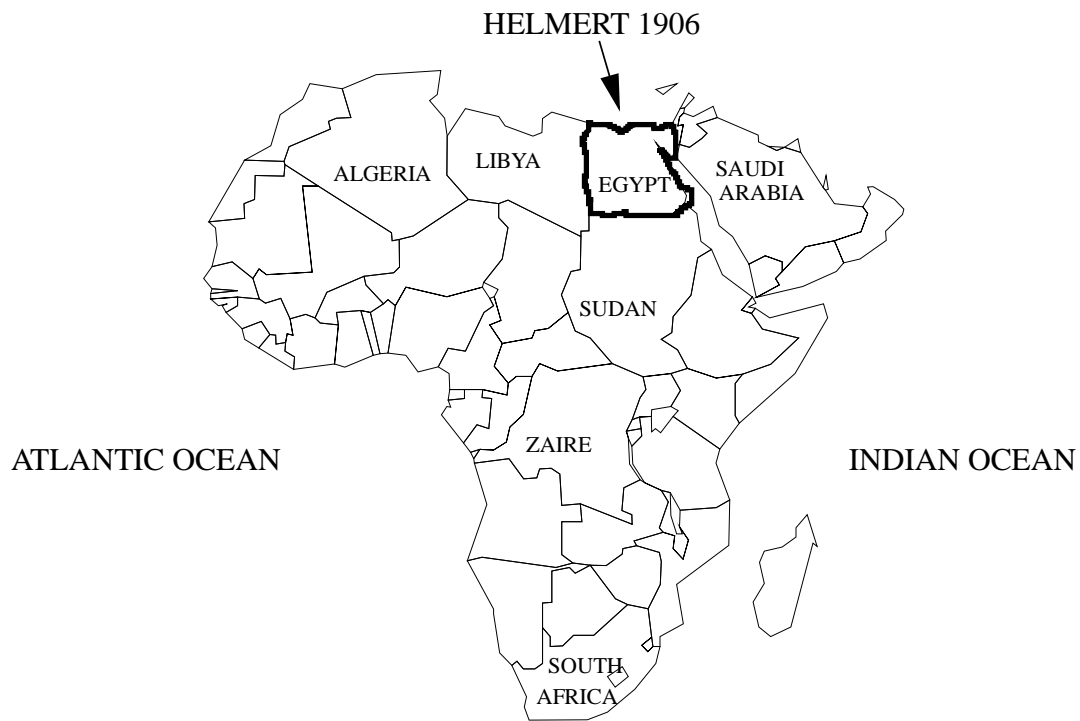
$\Delta f \times 10^4$: +0.00480795

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
OLD EGYPTIAN 1907	EGYPT	-130	110	-13	OEG	73	2

Table A-18

$\Delta f \times 10^7$: +004.808

PADS CODE:



AFRICA

DRAFT

HOUGH 1960

a: 6378270

b: 6356684.34343

1/f: 297

Δa : -133.000

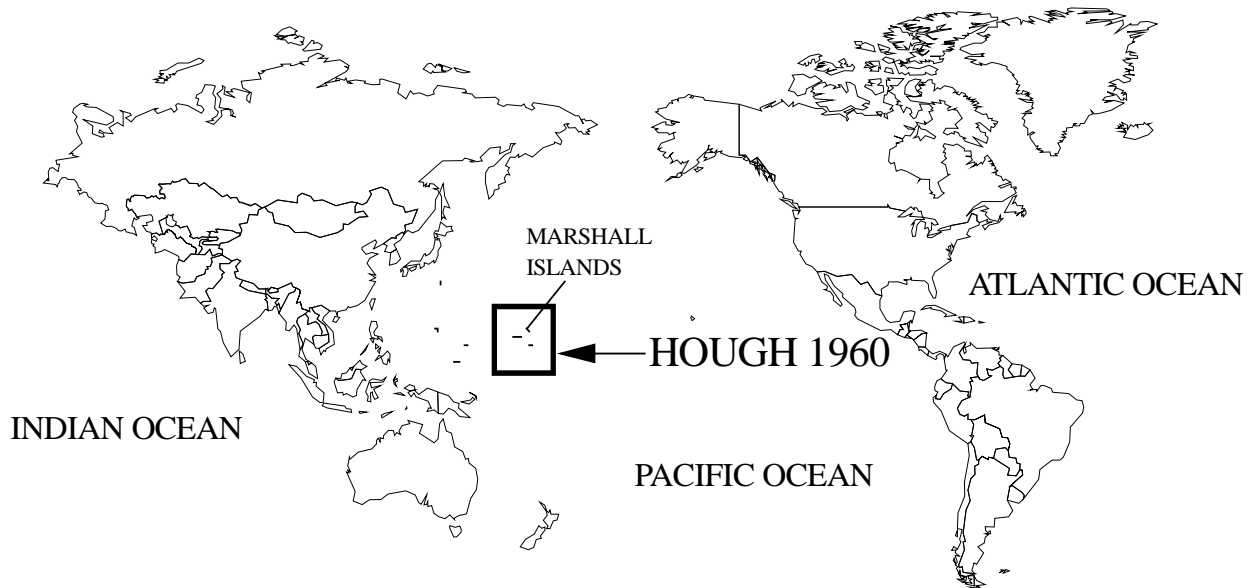
$\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
WAKE- ENIWETOK 1960	MARSHALL IS.	102	52	-38	ENW	SEE NOTE ONE	2

Table A-19

$\Delta f \times 10^7$: -141.927

PADS CODE: 14



DRAFT

INTERNATIONAL 1924

a: 6378388

b: 6356911.9462

1/f: 297

Δa : -251.000

$\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
AIN EL ABD 1970	BAHRAIN ISLAND	-150	-250	-1	AIN-A	SEE NOTE ONE	2
	SAUDI ARABIA	-143	-236	7	AIN-B		2
ASCENSION ISLAND 1958	ASCENSION IS.	-205	107	53	ASC	SEE NOTE ONE	2
ASTRO BEACON "E" 1945	IWO JIMA	145	75	-272	ATF	8	2
ASTRO DOS 71/4	ST. HELENA IS.	-320	550	-494	SHB	10	2
ASTRO TERN IS. (FRIG) 1961	TERN ISLAND	114	-116	-333	TRN	9	2
ASTRONOMICAL STATION 1952	MARCUS ISLAND	124	-234	-25	ASQ	11	2
BELLEVUE (IGN)	EFATE AND ERROMANGO IS.	-127	-769	472	IBE	14	2
BISSAU	GUINEA-BISSAU	-173	253	27	BID		2
BOGOTA OBSERVATORY	COLUMBIA	307	304	-318	BOO	16	2
CAMP AREA ASTRO SEE NOTE EIGHT	CAMP McMURDO, ANTARCTICA	-104	-129	239	CAZ		2
CAMPO INCHAUSPE 1969	ARGENTINA	-148	136	90	CAI	17	2

Table A-21a

$\Delta f \times 10^7$: -141.927

PADS CODE: 2

DRAFT

INTERNATIONAL 1924 Cont.

a: 6378388

b: 6356911.9462

1/f: 297

Δa : -251.000

$\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
CANTON ASTRO 1966	PHOENIX ISLANDS	298	-304	-375	CAO	18	2
CHATHAM IS. ASTRO 1971	CHATHAM ISLAND (NEW ZEALAND)	175	-38	113	CHI	22	2
CHUA ASTRO	PARAGUAY	-134	229	-29	CHU	23	2
CORREGO ALEGRE	BRAZIL	-206	172	-6	COA	24	2
DOS 1968	GIZO ISLAND (NEW GEORGIA IS.)	230	-199	-752	GIZ	26	2
EASTER ISLAND 1967	EASTER ISLAND	211	147	111	EAS	27	2
EUROPEAN 1950 AFRICA	EGYPT	-130	-117	-151	EUR-F		2
	TUNISIA	-112	-77	-145	EUR-T		2
EUROPEAN 1950 EUROPE	MEAN SOLUTION	-87	-98	-121	EUR-M	28	2
	WESTERN EUROPE (AUSTRIA, DENMARK, FRANCE, GERMANY, NETHERLANDS, AND SWITZERLAND)	-87	-96	-120	EUR-A		2
	CYPRUS	-104	-101	-140	EUR-E		2
	ENGLAND, CHANNEL ISLANDS, SCOTLAND, AND SHETLAND ISLANDS	-86	-96	-120	EUR-G		2

Table A-21b

$\Delta f \times 10^7$: -141.927

PADS CODE: 2

DRAFT

INTERNATIONAL 1924 Cont.

a: 6378388
 Δa : -251.000

b: 6356911.9462

1/f: 297
 $\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
EUROPEAN 1950					EUR		2
EUROPE Cont.	ENGLAND, IRELAND, SCOTLAND, AND SHETLAND ISLANDS	-86	-96	-120	EUR-K		2
	GREECE	-84	-95	-130	EUR-B		2
	ITALY (SARDINIA)	-97	-103	-120	EUR-I		2
	ITALY (SICILY)	-97	-88	-135	EUR-J		2
	MALTA	-107	-88	-149	EUR-L		2
	NORWAY AND FINLAND	-87	-95	-120	EUR-C		2
	PORTUGAL AND SPAIN	-84	-107	-120	EUR-D		2
EUROPEAN 1950					EUR		
MIDDLE EAST	IRAN	-117	-132	-164	EUR-H		2
EUROPEAN 1950	ISRAEL, KUWAIT,	-103	-106	-141	EUR-S		2
MIDDLE EAST	JORDAN, LEBANON,						
SEE NOTE EIGHT	SAUDI ARABIA, IRAQ, AND SYRIA						
EUROPEAN 1979	MEAN SOLUTION (AUSTRIA, FINLAND, NETHERLANDS, NORWAY, SPAIN, SWEDEN, AND SWITZERLAND)	-86	-98	-119	EUS	29	2

Table A-21c

$\Delta f \times 10^7$: -141.927

PADS CODE: 2

DRAFT

INTERNATIONAL 1924 Cont.

a: 6378388

b: 6356911.9462

1/f: 297

Δa : -251.000

$\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
GAN 1970 (GANDAJIKA BASE)	REPUBLIC OF MALDIVES	-133	-321	50	GAA	30	2
GEODETIC DATUM 1949	NEW ZEALAND	84	-22	209	GEO	31	2
GRACIOSA BASE SW 1948	AZORES (FAIAL, GRACIOSA, PICO, SAO JORGE, AND TERCEIRA IS.)	-104	167	-38	GRA		2
GUX 1 ASTRO	GUADALCANAL	252	-209	-751	DOB	33	2
HERAT NORTH <small>SEE NOTE FOUR SEE NOTE EIGHT</small>	AFGHANISTAN	-333	-222	114	HEN		2
HJORSEY 1955	ICELAND	-73	46	-86	HJO	34	2
HONG KONG 1963	HONG KONG	-156	-271	-189	HKD	35	2
HU-TZU-SHAN	TAIWAN	-637	-549	-203	HTN		2
ISTS 061 ASTRO 1968	SOUTH GEORGIA IS	-794	119	-298	ISG		2
ISTS 073 ASTRO 1969	DIEGO GARCIA	208	-435	-229	IST	39	2
JOHNSTON ISLAND 1961	JOHNSTON ISLAND	189	-79	-202	JOH	SEE NOTE ONE	2

Table A-21d

$\Delta f \times 10^7$: -141.927

PADS CODE: 2

DRAFT

INTERNATIONAL 1924 Cont.

a: 6378388

b: 6356911.9462

1/f: 297

Δ a: -251.000

$\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		Δ X	Δ Y	Δ Z			
KERGUELEN ISLAND 1949	KERGUELEN IS.	145	-187	103	KEG	42	2
KUSAIE ASTRO 1951	CAROLINE ISLANDS MICRONESIA	647	1777	-1124	KUS		2
MIDWAY ASTRO 1961	MIDWAY ISLANDS	912	-58	1227	MID	53	2
NAPARIMA BWI	TRINIDAD AND TOBAGO	-10	375	165	NAP	SEE NOTE ONE	2
OBSERVATORIO METEORO- LOGICO 1939	AZORES (CORVO AND FLORES ISLANDS)	-425	-169	81	FLO	72	2
PICO DE LAS NIEVES	CANARY ISLANDS	-307	-92	127	PLN	77	2
PITCAIRN ASTRO 1967	PITCAIRN ISLAND	185	165	42	PIT	78	2
PORTO SANTO 1936 (SOUTHEAST BASE)	PORTO SANTO AND MADEIRA ISLANDS	-499	-249	314	POS	90	2
PROVISIONAL SOUTH AMERICAN 1956	MEAN SOLUTION (BOLIVIA, CHILE, COLUMBIA, PERU, ECUADOR, GUYANA, AND VENEZUELA)	-288	175	-376	PRP PRP-M	80	2
	BOLIVIA	-270	188	-388	PRP-A		2

Table A-21e

$\Delta f \times 10^7$: -141.927

PADS CODE: 2

DRAFT

INTERNATIONAL 1924 Cont.

a: 6378388

b: 6356911.9462

1/f: 297

Δa : -251.000

$\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
PROVISIONAL SOUTH AMERICAN 1956 Cont.					PRP		
	NORTHERN CHILE (Near 19 deg S)	-270	183	-390	PRP-B		2
	SOUTHERN CHILE (Near 43 deg S)	-305	243	-442	PRP-C		2
	COLUMBIA	-282	169	-371	PRP-D		2
	ECUADOR	-278	171	-367	PRP-E		2
	GUYANA	-298	159	-369	PRP-F		2
	PERU	-279	175	-379	PRP-G		2
	VENEZUELA	-295	173	-371	PRP-H		2
PROVISIONAL SOUTH CHILEAN 1963 (HITO XVIII 1963)							
	SOUTHERN CHILE (Near 53 deg S)	16	196	93	HIT	79	2
QATAR NATIONAL SEE NOTE SEVEN							
	QATAR	-129	-283	21	QAT	82	2
QORNOQ	SOUTH GREENLAND	164	138	-189	QUO	83	2
REUNION	MASCARENE IS.	94	-948	-1262	REU	44	2
ROME 1940	SARDINIA	-225	-65	9	MOD	84	2
SANTO (DOS) 1965							
	ESPIRITO SANTO IS.	170	42	84	SAE	86	2

Table A-21f

$\Delta f \times 10^7$: -141.927

PADS CODE: 2

DRAFT

INTERNATIONAL 1924 Cont.

a: 6378388
 Δa : -251.000

b: 6356911.9462

1/f: 297
 $\Delta f \times 10^4$: -0.14192702

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
SAO BRAZ	AZORES (SAO MIGUEL, SANTA MARIA IS.)	-203	141	53	SAO	85	2
SAPPER HILL 1943	EAST FALKLAND IS	-355	21	72	SAP	SEE NOTE ONE	2
SELVAGEM GRANDE 1938 (MARCO ASTRO)	SALVAGE ISLANDS	-289	-124	60	SGM	50	2
TANANARIVE OBSERVATORY 1925 SEE NOTE EIGHT	MADAGASCAR	-189	-242	-91	TAN		2
TRISTAN ASTRO 1968	TRISTAN DA CUNHA	-632	438	-609	TDC	94	2
WAKE ISLAND ASTRO 1952	WAKE ATOLL	276	-57	149	WAK		2
YACARE SEE NOTE EIGHT	URUGUAY	-155	171	37	YAC		2
ZANDERIJ	SURINAME	-265	120	-358	ZAN	84	2

Table A-21g

$\Delta f \times 10^7$: -141.927

PADS CODE: 2



DRAFT

KRASOVSKY 1940

a: 6378245

b: 6356863.019

1/f: 298.3

Δa : -108.000

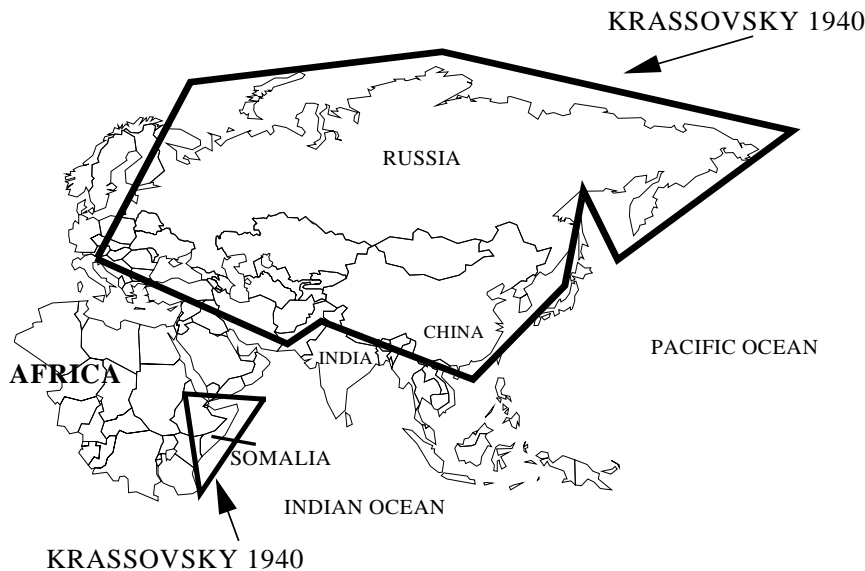
$\Delta f \times 10^4$: +0.00480795

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
AFGOOYE	SOMALIA	-43	-163	45	AFG	2	2
HERAT NORTH SEE NOTE FOUR	AFGHANISTAN						4
PEKING 1954 SEE NOTE EIGHT	SHANGHAI, CHINA	-12	-113	-41			
PULKOVO 1942	RUSSIA	28	-130	-95	PUK		2
S-42 (PULKOVO 1942)	HUNGARY	28	-121	-77	SPK-A		2
	POLAND	23	-124	-82	SPK-B		2
	CZECHOSLOVAKIA PRIOR TO 1 JAN 1993	26	-121	-78	SPK-C		2
	LATVIA	24	-124	-82	SPK-D		2
	KAZAKHSTAN	15	-130	-84	SPK-E		2
	ALBANIA	24	-130	-92	SPK-F		2
	ROMANIA	28	-121	-77	SPK-G		2

Table A-22

$\Delta f \times 10^7$: +004.808

PADS CODE:



DRAFT

SOUTH AMERICAN 1969 SEE NOTE SIX

a: 6378160

b: 6356774.7192

1/f: 298.25

Δa : -023.000

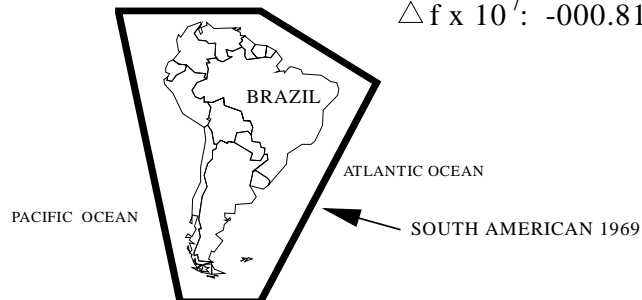
$\Delta f \times 10^4$: -0.00081204

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
SOUTH AMERICAN 1969	MEAN SOLUTION SOUTH AMERICA	-57	1	-41	SAN-M	88	2
	ARGENTINA	-62	-1	-37	SAN-A		2
	BOLIVIA	-61	2	-48	SAN-B		2
	BRAZIL	-60	-2	-41	SAN-C		2
	CHILE	-75	-1	-44	SAN-D		2
	COLOMBIA	-44	6	-36	SAN-E		2
	ECUADOR (EXCLUDING GALAPAGOS IS)	-48	3	-44	SAN-F		2
	ECUADOR (BALTRA, GALAPAOS ISLANDS)	-47	26	-42	SAN-J		2
	GUYANA	-53	3	-47	SAN-G		2
	PARAGUAY	-61	2	-33	SAN-H		2
	PERU	-58	0	-44	SAN-I		2
	TRINIDAD AND TOBAGO	-45	12	-33	SAN-K		2
	VENEZUELA	-45	8	-33	SAN-L		2

Table A-23

$\Delta f \times 10^7$: -000.812

PADS CODE: 8



DRAFT

SOVIET GEODETIC SYSTEM 1985

a: 6378136

b: 6356751.302

1/f: 298.257

Δa : +001.000

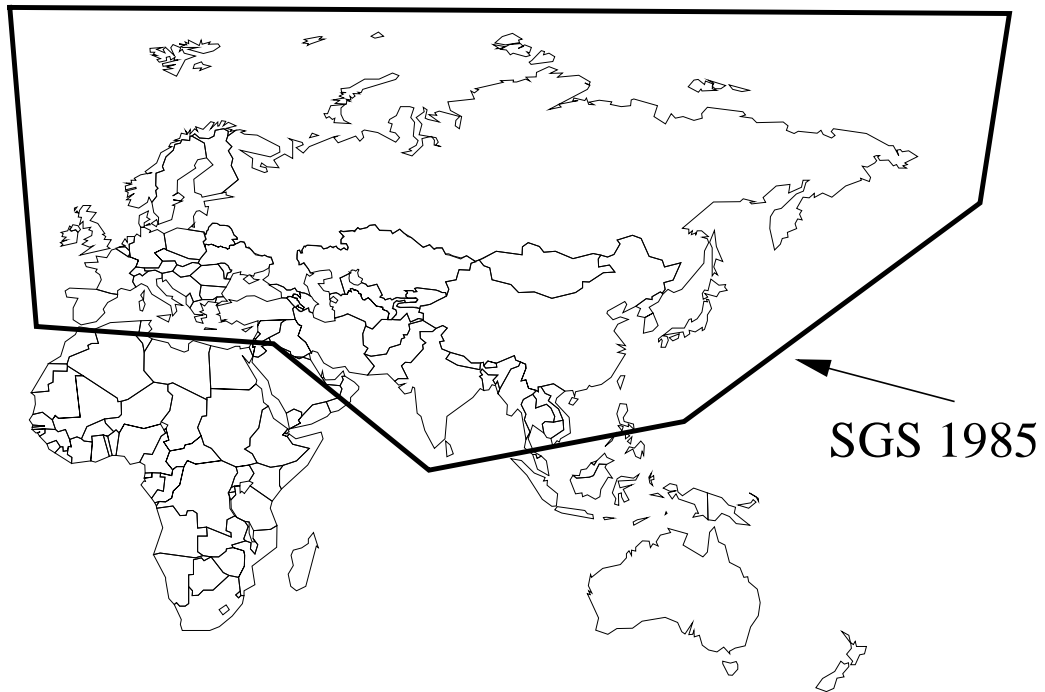
$\Delta f \times 10^4$: -0.00002514

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
SGS 1985	ASIA AND EUROPE	3	9	-9			5

Table A-24

$\Delta f \times 10^7$: -000.025

PADS CODE:



DRAFT

WORLD GEODETIC SYSTEM 1972

a: 6378135

b: 6356750.5

1/f: 298.26

Δa : +2

$\Delta f \times 10^4$: +0.00031211

DATUM TRANSFORMATION PARAMETERS							
LOCAL DATUM TO WGS 84							
LOCAL GEODETIC DATUM	COUNTRY/ AREA	TRANSFORMATION PARAMETERS			DATUM CODE	DDCT CODE	REF
		ΔX	ΔY	ΔZ			
WGS 1972 SEE NOTE THREE	GLOBAL	N/A	N/A	N/A	WD	97	2

Table A-25

$\Delta f \times 10^7$: +000.312

PADS CODE: 13



WGS 1972

DRAFT

NOTES FOR DATUM TABLES (APPENDIX A)

NOTE 1: Any entry reading **SEE NOTE ONE** in Tables A-3 through A-24 of this appendix are so noted due to differences between the ST 6-2-40 Appendix C and NIMA TR 8350.2. The differences are both in ellipsoid and datum areas. The data in Tables A-3 through A-24 is from the NIMA TR 8350.2 and therefore considered more accurate. Any datum with **SEE NOTE ONE** in the DDCT Code column should be transformed to other datums with the user defined option.

NOTE 2: Any entry reading **SEE NOTE TWO** in Tables A-3 through A-24 of this appendix are so noted due to inconsistent listings of datums referenced to the Clarke 1880 ellipsoid. Table A-1 lists five different Clarke 1880 ellipsoids, the National Imagery and Mapping Agency (NIMA) has adopted only one. Different countries have adopted different dimensions for the Clarke 1880 ellipsoid. These differences depend on two things; which of Clarke's original numbers were used: (a,b) or (a,f), and which feet to meters conversion was used.

In areas referenced to the ARC 1950 datum, the Clarke 1880 dimensions adopted are:

a: 6378249.145326 b: 6356514.966721 f: 1/293.4663076

In areas referenced to Carthage, Merchich, and Voirol datums, the adopted dimensions are:

a: 6378249.2 b: 6356515.0 f: 1/293.46598

The NIMA adopted dimensions are:

a: 6378249.145 b: 6356514.8696 f: 1/293.465

NIMA TR 8350.2 lists datum transformation parameters for local datums referenced to the NIMA adopted Clarke 1880 and not the dimensions adopted by other countries. Any datum with **SEE NOTE TWO** in the DDCT Code column should be transformed to other datums with the user defined option.

NOTE 3: WGS-72 is transformed to WGS-84 with a formula that is more accurate than the Abridged Molodensky formulas; therefore, datum shifts are not necessary. The formula used is explained in detail in NIMA TR 8350.2, and are shown below.

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

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

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

Whereas: $\Delta\phi'' = (4.5\cos\phi) / (a \sin 1'') + (\Delta f \sin 2\phi) / (\sin 1'')$

$$\Delta\lambda'' = 0.554$$

$$\Delta h = 4.5 \sin\phi + a\Delta f \sin^2\phi - \Delta a + \Delta r$$

When: $\Delta f = 0.3121057 \times 10^{-7}$

$$a = 6378135 \text{ m.}$$

$$\Delta a = 2.0 \text{ m.}$$

$$\Delta r = 1.4 \text{ m.}$$

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NOTES FOR DATUM TABLES Cont. (APPENDIX A)

NOTE 4: Herat North Datum was used by the Soviet Union with Krassovsky as the reference ellipsoid in northern Afghanistan. The US and UK used Herat North Datum with International as the reference ellipsoid to triangulate in southern Afghanistan. The connection between these two systems usually differs by 20 to 30 meters. Herat North Datum referenced to Krassovsky ellipsoid is a programmed option in the Gauss-Kruger Grid (Module 15) in the BUCS DDCT Rev0.

NOTE 5: Potsdam Datum was used with the Gauss-Kruger Grid in East Germany and is a programmed option in Module 15 of the BUCS DDCT Rev0.

NOTE 6: The International Union of Geodesy and Geophysics (IUGG) recommended the adoption of the ellipsoid GRS-67 at their 1967 meeting in Lucerne, Switzerland. The new ellipsoid was adopted for use when a greater degree of accuracy was needed than could be obtained with the International 1924 ellipsoid. The ellipsoid became part of the Geodetic Reference System of 1967, which was adopted in 1971 by the IUGG meeting in Moscow. This ellipsoid is used in both South America and Australia; however, the name was changed to South American 1969 and Australian National to more conveniently describe the Reference Ellipsoid. NIMA TR 8350.2 lists the more convenient names of these ellipsoids.

NOTE 7: The State of Qatar was subject to a geodetic survey during the period of 18 May - 5 June 1993 by the Centre for Geodetic Information Systems, State of Qatar. DMA (NIMA) adjusted the survey and the resultant transformation parameters are listed here. These parameters are different than those listed in NIMA TR 8350.2. This data is published in DMA Publication GGAD-95-1519 dtd May 1993.

NOTE 8: Any entry reading **SEE NOTE EIGHT** in Tables A-3 through A-24 of this appendix are local geodetic datums related to WGS-84 through non-satellite ties to the local control.