Geodetic Datum of Indonesian Maritime Boundaries: Status and Problems

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Key words: Indonesia, Geodetic Datum, Maritime, Boundaries, WGS84

SUMMARY

Indonesia has maritime boundaries with 10 countries namely: Australia, Timor Leste, Papua New Guinea (PNG), Palau, Philippines, Vietnam, Thailand, Malaysia, Singapore and India. Many treaties have been ratified concerning these boundaries. Unfortunately, many coordinates of boundary points mentioned in the treaties are not clear in relation with their geodetic datum.

The uncertainty in geodetic datum of boundary points introduces complications and problems in spatial management of Indonesia's maritime boundaries, since it can displace the boundary lines from their assumed true location. The displacements of boundaries in WGS84 datum are generally in the order of a few hundred meters, i.e. about 200 to 400 m, depending on the assumed original geodetic datum of the boundaries stated in the treaties. These boundary displacements are spatially advantageous for Indonesia in some cases and also disadvantageous in others. Paper will be sum up with some conclusions and recommendations.

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1. INTRODUCTION

Indonesia has the maritime boundaries with ten neighboring countries, i.e. Australia, Timor Leste, Papua New Guinea (PNG), Palau, Philippines, Vietnam, Thailand, Malaysia, Singapore and India as shown in Figure 1. The total length of these maritime boundaries is about several thousand kilometers.

Figure 1. Indonesia and its Neighboring Countries.

In delimitating its maritime boundaries, based on the UN Convention of the Law of the Sea (UNCLOS) 1982, Indonesia has the rights to establish boundaries of four maritime zones, namely: *Territorial Sea*, *Contiguous Zone*, *Economic Exclusive Zone* (EEZ) and *Continental Shelf* [*IHO*, 1993]. The spatial extension of these maritime zones is simplistically shown in Figure 2.

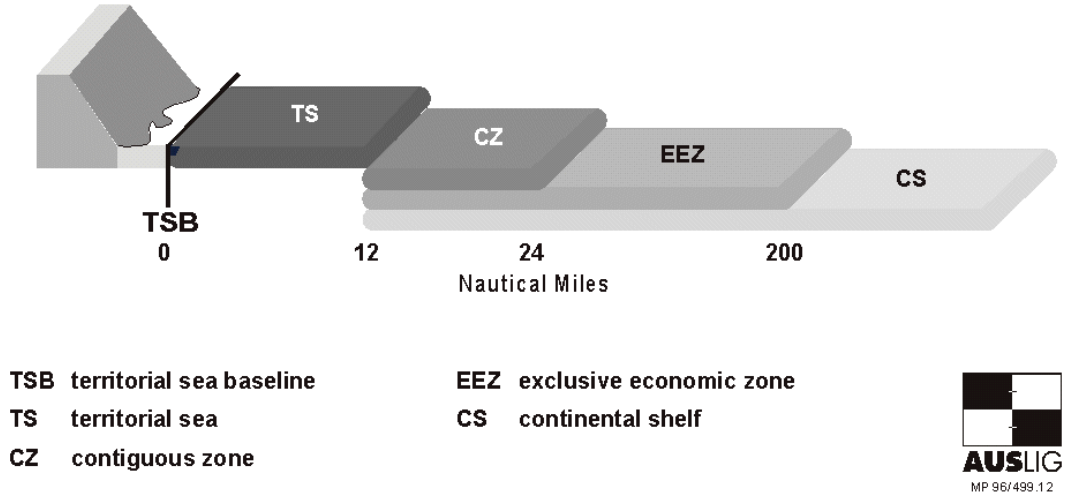

Figure 2. Limits of Maritime Zones [*AUSLIG*, 2004].

Maritime boundaries between Indonesia and its neighboring countries are usually represented by the lines connecting several boundary points which their geographic coordinates are stated in the respective treaties (bilateral or trilateral). Location of the boundary points and configuration of boundary line are usually shown in the chart, which is usually annexed to the treaty document. Unfortunately the geodetic datum of those geographic coordinates is mostly not explicitly stated in the treaty. Datum information usually could not also be inferred from the attached treaty chart. However, the treaty usually contains an article that states "*actual location of the above mentioned points (i.e. boundary points) at sea shall be determined by a method to be mutually agreed upon by the competent authorities of the two countries*".

Geodetic datum can be seen as the set of parameters that describes the relationship between the real Earth and the "mathematical" Earth, which is usually represented by a reference ellipsoid. These datum parameters include the size and shape of reference ellipsoid being used and its orientation to the real Earth. According to *Torge* (2001), geodetic datum describes the orientation of any geodetic system with respect to the global geocentric system.

Geodetic coordinates of a point will depend on its geodetic datum. Same geodetic coordinates but with different geodetic datum will lead to different locations on the Earth surface. Uncertainty in geodetic datum of maritime boundary points will lead to uncertainty of its real location on the sea surface. This will introduce not only technical but also legal implications, since it will not only alter the listed coordinates in the treaty, but will also shift the boundary lines that have been agreed by the neighboring countries. The spatial and non-spatial implications caused by this uncertainty in geodetic datum of Indonesia's maritime boundaries will be discussed and analyzed in this paper.

2. STATUS OF INDONESIA'S MARITIME BOUNDARIES

The delimitation process of maritime boundaries between Indonesia and its neighboring countries has been done since 1960s. The maritime boundary treaties that have been signed and ratified are shown in Table 1. This Table also shows that several boundaries of maritime zones have still to be agreed. Only with three countries, i.e. Philippines, Palau and Timor Leste, Indonesia has not yet signed any maritime boundary treaties.

Table 3. Status of Indonesia's Maritime Boundary Agreements with its Neighboring Countries [*The Geographer*, 1990; *Forbes*, 1995].

Border Country	Type of Boundary	Date (dd-mm-yr)	
		Signing	Ratification
Singapore	Territorial Sea	25-05-73	29-08-74
Malaysia	Territorial Sea	17-03-70	08-10-71
	Continental Shelf (3)	27-10-69	07-11-69
	Continental Shelf (+ Thailand)	21-12-71	16-07-73
	EEZ (Economic Exclusive Zone)	not yet	not yet
Vietnam	Continental Shelf	26-06-03	not yet
	EEZ (Economic Exclusive Zone)	not yet	not yet
Philippines	Continental Shelf	not yet	not yet
	EEZ (Economic Exclusive Zone)	not yet	not yet
Papua New Guinea	Territorial Sea (2)	12-02-73	26-11-74
	Continental Shelf	13-12-80	10-07-82
	EEZ (Economic Exclusive Zone)	not yet	not yet
Australia	Continental Shelf (Seabed) (2)	18-05-71 09-10-72	08-11-73
	Fishing Zone	29-10-81	01-02-82
	Continental Shelf (Zone of Cooperation)	11-12-89	09-02-91
	EEZ (Economic Exclusive Zone)	14-03-97	not yet
Timor Leste	Territorial Sea	not yet	not yet
	EEZ (Economic Exclusive Zone)	not yet	not yet
	Continental Shelf	not yet	not yet
India	Continental Shelf	08-08-74	17-12-74
	Continental Shelf	14-01-77	15-08-77
	Continental Shelf (+ Thailand)	22-06-78	02-03-79
	EEZ (Economic Exclusive Zone)	not yet	not yet
Thailand	Continental Shelf (2)	17-12-71 11-12-75	16-07-73 18-02-78
	Continental Shelf (+ Malaysia)	21-12-71	16-07-73
	Continental Shelf (+ India)	22-06-78	02-03-79
	EEZ (Economic Exclusive Zone)	not yet	not yet
Palau	EEZ (Economic Exclusive Zone)	not yet	not yet
	Continental Shelf	not yet	not yet

3. GEODETIC DATUM OF INDONESIA'S MARITIME BOUNDARIES

In the maritime boundary treaties between Indonesia and its neighboring countries, the geographic coordinates (latitude, longitude) of boundary points are usually stated, and their locations are usually shown in the chart which is usually annexed to the treaty document. Table 1 shows a text example of the territorial sea boundary agreement between Indonesia and Singapore. Unfortunately the geodetic datum of those geographic coordinates are mostly not explicitly stated in the treaty, as can be seen also in Table 4. From all maritime boundary treaties that have been signed by Indonesia and its neighboring countries, only the EEZ treaty between Indonesia and Australia 1973 that explicitly states the geodetic datum used for the coordinates of boundary points.

Table 4. Example of part of the territorial sea boundary agreement between Indonesia and Singapore on May 25, 1973 (*The Geographer*, 1974).

Article I

1. The boundary line of the territorial seas of the Republic of Indonesia and the Republic of Singapore in the Strait drawn between points, the co-ordinates of which are as follows :

Points	*Latitude North*	*Longitude East*
1	*1° 10' 46".0*	*103° 40' 14".6*
2	*1° 07' 49".3*	*103° 44' 26".5*
3	*1° 10' 17".2*	*103° 48' 18".0*
4	*1° 11' 45".5*	*103° 51' 35".4*
5	*1° 12' 26".1*	*103° 52' 50".7*
6	*1° 16' 10".2*	*104° 02' 00".0*

2. *The co-ordinates of the points specified in paragraph 1 are geographical co-ordinates and the boundary line connecting them is indicated on the chart attached as Annexure "A" to this Treaty.*
3. *The actual location of the above mentioned points at sea shall be determined by a method to be mutually agreed upon by the competent authorities of the two countries.*
4. *For the purpose of paragraph 3, "Competent authorities in relation to the Republic of Indonesia means the Ketua Badan Koordinasi Survey dan Pemataan Nasional (Chief of the Coordination Body for National Survey and Mapping) and in relation to the Republic of Singapore means any persons so authorized by the Government of the Republic of Singapore.*

Article II

Any disputes between the two countries arising out of the interpretation or implementation of this Treaty shall be settled peacefully by consultation or negotiation.

Datum information usually could not also be inferred from the attached treaty chart. Figure 3 shows an example of the chart, which is annexed to the territorial sea boundary treaty between Indonesia and Singapore. It can be realized from this chart legend that it is not easy to decide what geodetic datum is being used for the coordinates of the boundary points'

coordinates. Regarding the chart annexed to the treaty, only in the maritime boundary agreement between Indonesia and Thailand, the type of charts being used are stated explicitly in the treaty text namely BAC (British Admiralty Chart) No. 793 and 830.

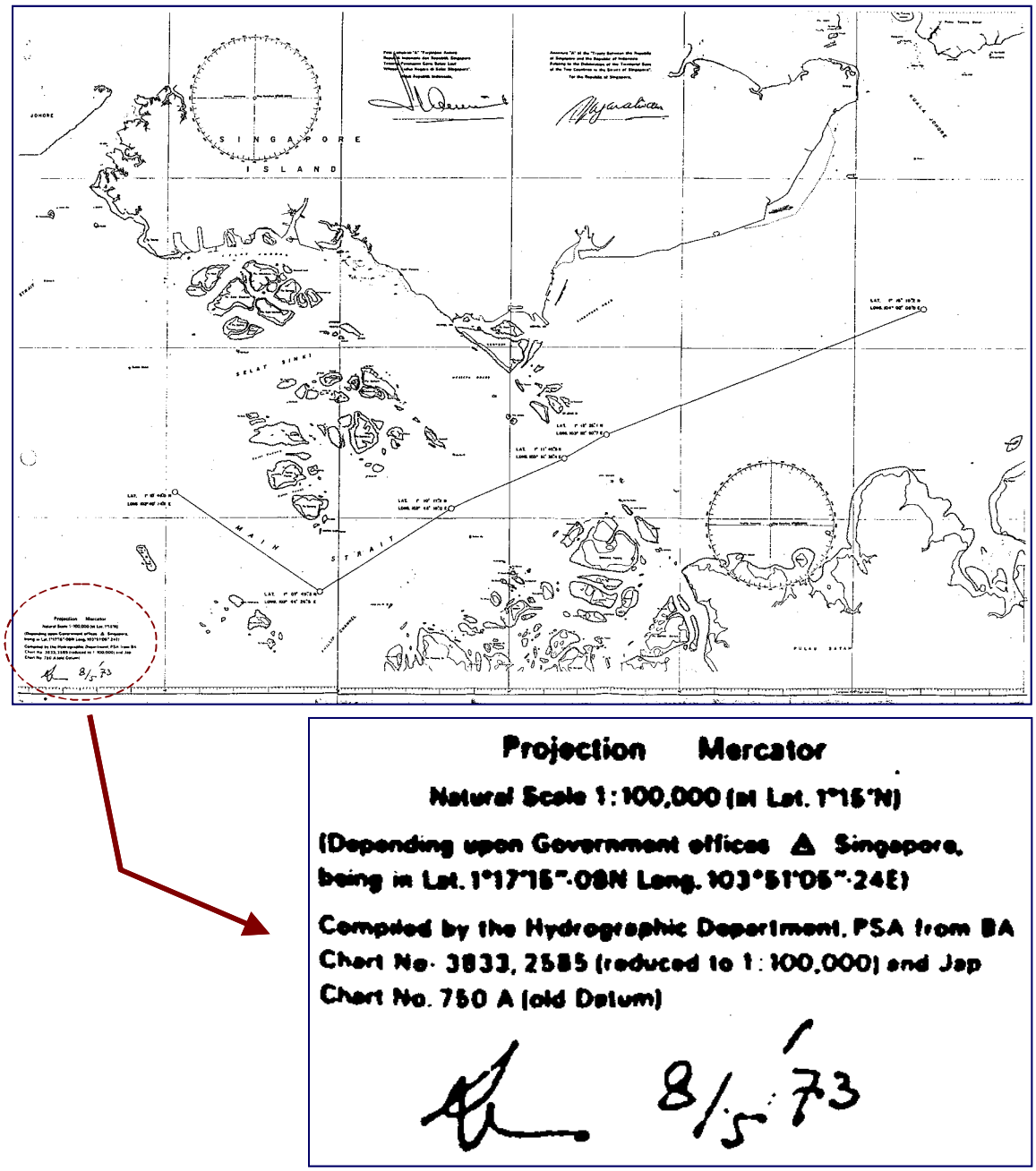

Figure 3. Chart annexed to the territorial sea boundary treaty between Indonesia and Singapore.

Since most of the Indonesia's maritime boundary treaties are not explicit on the geodetic datum of the boundary points, the possible datum has to be studied and analyzed. Considering the signing dates of the treaties, their geographical coverage and the already used datum in

the areas [*DMA*, 1991; *Smith*, 1997; *Dana*, 2004], then possible datum can be selected as shown in Table 5. It should be noted in this case that the chosen geodetic datum should be accepted and agreed by the neighboring countries.

Table 5. Possible Geodetic Datum of Indonesia's Maritime Boundaries

Border Country	Boundary Type	Signing Date	Possible Geodetic Datum
Singapore	Territorial Sea	25-05-73	1. KERTAU48 2. KERTAU68 3. GENUK 4. SOUTH ASIA
Malaysia	Territorial Sea	17-03-70	1. GENUK 2. KERTAU68
	Continental Shelf, (Malacca St).	27-10-69	
	Continental Shelf, South China Sea, Western part	27-10-69	1. KERTAU48 2. KERTAU68
	Continental Shelf, South China Sea, Eastern part	27-10-69	1. TIMBALAI48 2. TIMBALAI68
	Continental Shelf (+ Thailand)	21-12-71	1. GENUK 2. KERTAU68 3. INDIAN54
Papua New Guinea	Territorial Sea (2)	12-02-73	AGD (AUSTRALIAN GEODETIC DATUM) 1966
	Continental Shelf	13-12-80	
Australia	Continental Shelf (Seabed) (2)	18-05-71 09-10-72	
	Fishing Zone	29-10-81	
India	Continental Shelf	08-08-74	1. GENUK 2. INDIAN
	Continental Shelf	14-01-77	
	Continental Shelf (+ Thailand)	22-06-78	
Thailand	Continental Shelf (2)	17-12-71 11-12-75	1. GENUK 2. INDIAN54
	Continental Shelf (+ Malaysia)	21-12-71	
	Continental Shelf (+ India)	22-06-78	

4. TRANSFORMATION OF COORDINATES TO WGS84 DATUM

At the present times, WGS84 datum [*DMA*, 1991] is widely used all over the world. In the recent continental shelf boundary agreement between Indonesia and Vietnam, which signed on 26 June 2003, WGS84 is also used as the datum for boundary points. Therefore in this study, the coordinates of boundary points in the possible datum are transformed to WGS84 datum.

Two transformation models are used in this study, namely 3-parameter (translation) model and 7-parameter (Bursa-Wolf) model. The values of parameters used in the transformation are adopted from *DMA* (1991), *JUPEM* (2003) and *PCTrans* (2004).

In the case of 3-parameter (translation) model, the following model is used in this study :

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{WGS84} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{LOCAL\,DATUM} + \begin{bmatrix} \Delta X \\ \Delta Y \\ \Delta Z \end{bmatrix} m, \quad (1)$$

with the values of transformation parameters as given in table 6.

Table 6. Transformation Parameters from Local Datum to WGS84 Datum [*DMA*, 1991].

Local Datum	ΔX (m)	ΔY (m)	ΔZ (m)	Ellipsoid	a (m)	1/f
AGD 1966	-133	-48	148	Australian National	6378160	298.25
Genuk	-377	681	-50	Bessel 1841	6377397.155	299.1528128
Indian	295	736	257	Everest (India 1956)	6377301.243	300.8017
Indian 1954	217	823	299	Everest (India 1830)	6377276.345	300.8017
Kertau 1948	-11	851	5	Everest (Malaysia-Singapore)	6377304.063	300.8017
South Asia	7	-10	-26	Modified Fischer 1960	6378155	298.3
Timbalai 1948	-679	669	-48	Everest (Sabah Sarawak)	6377298.556	300.8017

In the case of coordinate transformation from KERTAU68 datum to WGS84, the following Bursa-Wolf model is used :

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{KERTAU68} = \begin{bmatrix} Dx \\ Dy \\ Dz \end{bmatrix}_{WGS84} + (1+Scal). \begin{bmatrix} 1 & R_z & -R_y \\ -R_z & 1 & R_x \\ R_y & -R_x & 1 \end{bmatrix} . \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{WGS84} . \quad (2)$$

with the values of transformation parameters are as given in Figure 4 depending on the areas. In the case of transformation from TIMBALAI68 and AGD66, the following Bursa-Wolf model is used :

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{WGS84} = \begin{bmatrix} \Delta X \\ \Delta Y \\ \Delta Z \end{bmatrix} + (1+Scal). \begin{bmatrix} 1 & R_z & -R_y \\ -R_z & 1 & R_x \\ R_y & -R_x & 1 \end{bmatrix} . \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{LOCAL\,DATUM} . \quad (3)$$

with the values of transformation parameters given in Table 7.

The coordinate transformation is performed using PCTrans commercial software [*PCTrans*, 2004] and also in-house transformation software.

Table 7. Transformation Parameters to WGS84 Datum [*PCTrans*, 2004; *ICSM*, 2002].

Parameters	TIMBALAI 1968	AGD 1966
ΔX (m)	- 541.80	-117.808
ΔY (m)	+ 667.65	-51.536
ΔZ (m)	- 63.42	137.784
Rx (“)	- 0.478	- 0.303
Ry (“)	- 0.240	- 0.446
Rz (“)	- 4.019	- 0.234
Scal (ppm)	+ 9.139	- 0.290

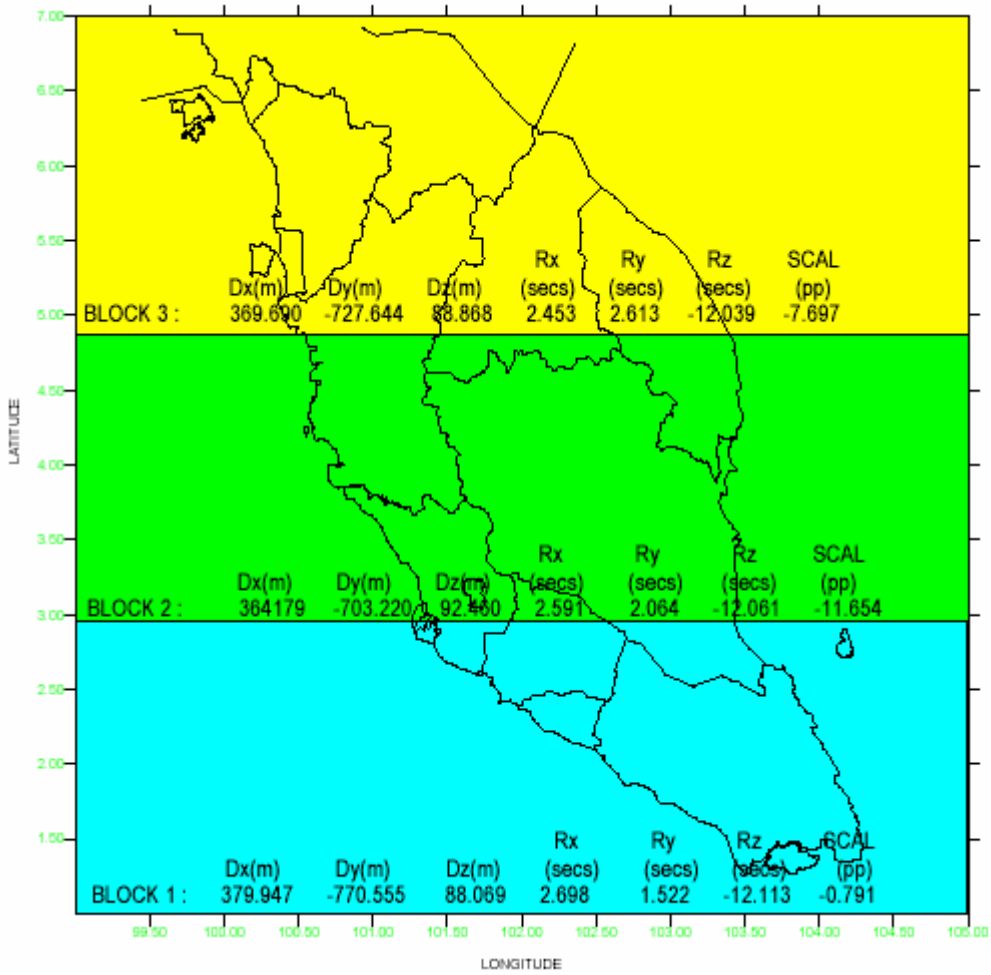

Figure 4. Values of transformation parameters from WGS84 to KERTAU68 [*JUPEM*, 2003].

5. IMPLICATIONS CAUSED BY UNCERTAINTY IN GEODETIC DATUM

Uncertainty in geodetic datum of Indonesia’s maritime boundary datum will introduce technical and legal implications, both in spatial and non-spatial domains. This paper however, will concentrate on the technical and spatial implications only.

5.1. Displacement of Boundary Points

Each point on the Earth's surface will have different geodetic coordinates with different geodetic datum. The adoption of a wrong datum for the already agreed coordinates can lead to the displacements from their true locations in the field. In case of maritime boundary between two countries, displacements of boundary points can introduce legal problem, since the displacements will likely be advantageous for one party and disadvantageous for another. The example is shown in Figure 5, in the case of continental shelf boundary between Indonesia and Malaysia in Malacca strait. This Figure illustrates that if KERTAU68 is assumed as the geodetic datum for the geographic coordinates listed in the corresponding treaty, then their transformed WGS84 coordinates will shift to the East direction toward Indonesian territory for about 120 to 180 m. However if GENUK is assumed as the original geodetic datum, then the boundary line will shift to the Southeast direction toward Malaysian territory for about 210 to 290 m. Therefore, Malaysia will spatially be benefited if the adopted original datum is KERTAU68 and vice versa if the adopted original datum is GENUK then Indonesia will be in favorable position. The displacements of other Indonesia's maritime boundaries are summarized in Table 8.

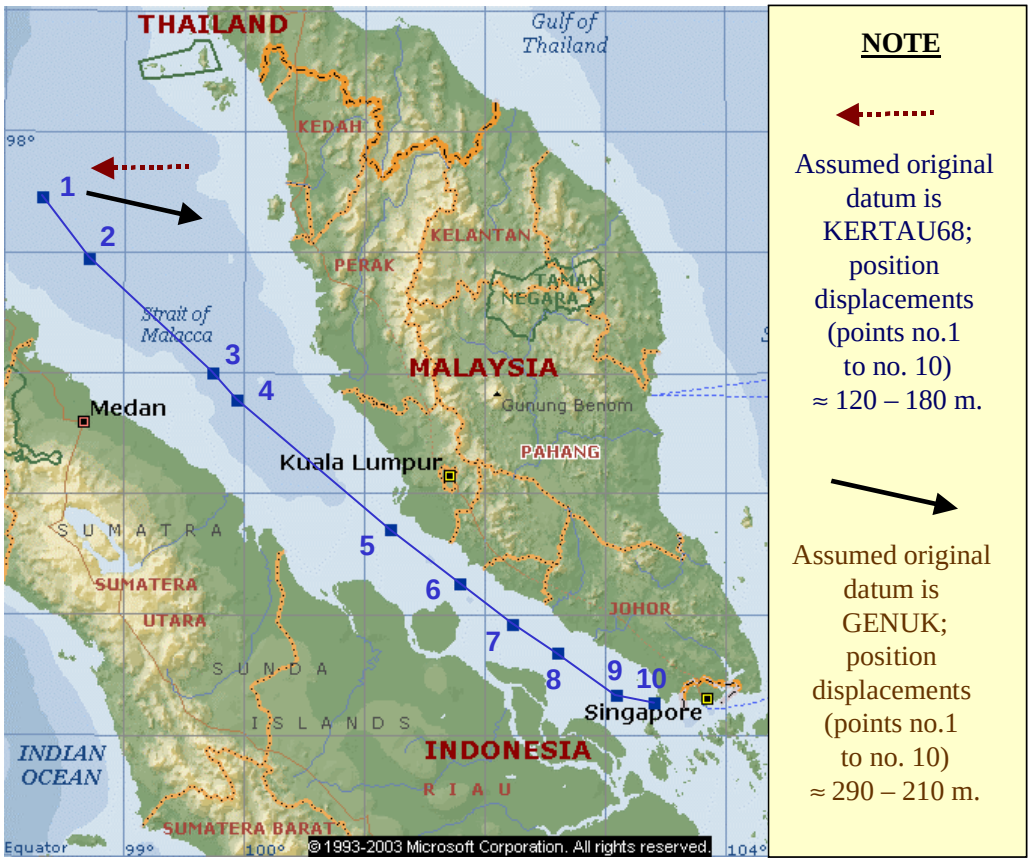

Figure 5. Displacements of the 1969 continental shelf boundary between Indonesia and Malaysia on WGS84 datum, depending on the assumed original datum.

Table 8. Displacements of Indonesia's maritime boundaries, with respect to the assumed original datum.

Border Country	Boundary Type	Possible Datum	Boundary Displacement in m (Direction)	Advantage for :
Singapore	Territorial Sea	KERTAU48	190-196 (West)	Indonesia
		KERTAU68	188-193 (West)	Indonesia
		GENUK	210-215 (Southeast)	Singapore
		SOUTH ASIA	25-26 (West)	Indonesia
Malaysia	Territorial Sea	GENUK	220-250 (Southeast)	Indonesia
		KERTAU68	150-180 (West)	Malaysia
	Continental Shelf, (Malacca St).	GENUK	210-290 (Southeast)	Indonesia
		KERTAU68	120-180 (West)	Malaysia
	Continental Shelf, South China Sea, Western part	KERTAU48	195-225 (West)	Indonesia
		KERTAU68	150-220 (West)	Indonesia
	Continental Shelf, South China Sea, Eastern part	TIMBALAI48	417-420 (Southeast)	Indonesia
		TIMBALAI68	412-415 (Southeast)	Indonesia
India	Continental Shelf	GENUK	330-360 (Southeast)	India
		INDIAN	400-420 (Northwest)	Indonesia
Thailand	Continental Shelf	GENUK	300-335 (Southeast)	Indonesia
		INDIAN54	380-420 (Northwest)	Thailand
Papua New Guinea	Territorial Sea (2)	AGD 1966	198-205 (Northeast)	Indonesia
	Continental Shelf			
Australia	Continental Shelf (Seabed) (2)	AGD 1966	200-210 (Northeast)	Australia
	Fishing Zone			

The results shown in Table 5 indicate that the displacement of Indonesia's maritime boundaries in WGS84 datum are in the order of a few hundred meters, i.e. about 200 to 400 m in general, depending on the assumed original geodetic datum of the boundaries. The displacements also spatially vary in magnitudes.

5.2. Effects on the Other Boundary Lines

Since the coordinates of boundary points depend on their geodetic datum, then the location and orientation of boundary lines will also depend on the adopted geodetic datum. Theoretically speaking, geodetic datum of Indonesia's maritime boundary should be unique and consistent throughout the whole boundary lines. However since maritime boundary agreements were conducted on country-by-country basis related to certain maritime zone, and they were not explicitly stated in the treaties, then in reality it is difficult to expect the existence of unique and consistent throughout the boundary lines.

Therefore the uncertainty in geodetic datum of certain boundary line, will also affect the other boundary lines connected to that line. If there are two adopted original geodetic datum for two consecutive boundary lines, then after they are transformed to WGS84 datum, those two boundary lines may not be properly connected. The WGS84 coordinates of the junction point will also be different, and indeed it will create technical and also legal problems. This complication is illustrated in Figure 6 related to maritime boundary between Indonesia and

Thailand. From this Figure it can be realized that the displacement of maritime boundary line between Indonesia and Thailand, will create the problem not just only for Indonesia and Thailand, but also will affect the boundary lines of Indonesia - Malaysia, Malaysia - Thailand, Indonesia - India, and India – Thailand.

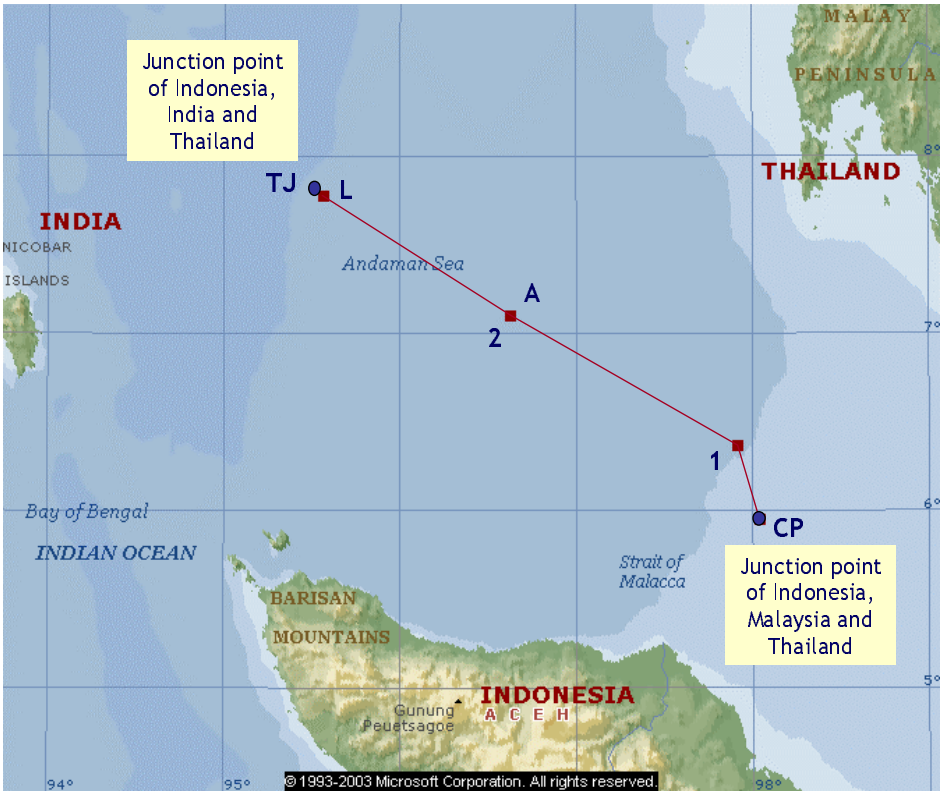

Figure 6. Maritime boundary line of Indonesia and Thailand.

5.3. Precise Navigation Requirement

In this era where the precise navigation of vessel (sub-meter level accuracy) is possible with the utilization of ECDIS and DGPS positioning system [*Forbes*, 2004], the need for certainty in geodetic datum of maritime boundary points is increasing. The good example in this case is the maritime boundary between Indonesia and Singapore, which lies in Singapore Strait. This strait is one of the busiest navigation channel in the region, which is sailed by various small and large vessels throughout the days.

As shown in previous Table 8, the maritime boundary line between Indonesia and Singapore may be displaced by about 25 to 220 m, depending on the assumed original datum of agreed boundary points' coordinates. Considering that DGPS system can provide real-time relative positioning accuracy at a meter level or better; or even absolute GPS positioning can give a position accuracy at about 5 to 10 m level, then the certainty of geodetic datum of Indonesia-Singapore maritime boundary is indeed necessary.

Since the ENC (*Electronic Navigation Chart*) which is part of ECDIS, should has a WGS84 datum according to the IMO (*International Maritime Organization*) regulation, then in this regard the coordinates of Indonesia's maritime boundary points should also be better expressed in WGS84 datum.

5.4. Natural Resources Exploration in Border Region

Along the Indonesia's maritime boundaries there are several regions, which are potentially rich with natural resources, e.g. natural gas and oil, such as Natuna Sea, Celebes Sea and Timor Sea. In exploration of these natural resources, the certainty in boundary line location is very important since it will have a huge financial implication.

The GPS positioning technologies have been widely used in marine exploration activities. Considering the high accuracy level that can be provided in real-time by DGPS and RTK (Real Time Kinematic)-GPS systems, i.e. up to dm level, then indeed the coordinates of maritime boundary points should also be known to that level of accuracy in WGS datum. In this regard then the certainty in original geodetic datum of Indonesia's maritime boundaries becomes very crucial, before they can be transformed into WGS84 datum.

6. CLOSING REMARKS

The uncertainty in geodetic datum of Indonesia's maritime boundaries has to be resolved as soon as possible. The discussions, talks and negotiations with the involved countries have to be started and conducted according to the legal procedures usually adopted in maritime boundary delimitation process.

In this negation process there are several matter that should be discussed to be agreed upon. The first thing is about the original geodetic datum that should be adopted for the already stated coordinates of boundary points in the corresponding treaty. The results of this study can be used as an initial input for further analysis. The final geodetic datum that will be used for reconstruction and implementation purposes should also be decided. In this case, WGS84 seems to be the most sensible datum to choose. After the original and final datum is decided, then the involved parties should also determine the coordinate transformation model between the two datum. Method and mechanism for estimating the values of transformation parameters should also be discussed and settled. It should be emphasized here that all decision in these matters should be legally agreed by Indonesia and all related countries.

As previously indicated, the transformed coordinates of boundary points in WGS84 datum can be spatially in favor to certain country and therefore disadvantageous for the other. The mechanism for overcoming this complication should also be negotiated by Indonesia and its neighboring countries.

REFERENCES

AUSLIG (2004). Homepage of *Australian Surveying and Land Information Group,* address: http://www.auslig.gov.au/marbound/ ambisbig.htm, Accessed : December.

Dana, P.H. (2004). *Geodetic Datum Overview*. Internet tutorial, Website address : http://www.colorado.edu/geography/gcraft/notes/datum/, Accessed time : 19 October 2004.

DMA (Defense Mapping Agency) (1991). *Department of Defense World Geodetic System 1984, Its Definition and Relationships with Local Geodetic Systems*. DMA Technical Report 8350.2, September.

Forbes, V.L. (1995). *Indonesia's Maritime Boundaries*. A Malaysian Institute of Maritime Affairs Monograph, ISBN 983-9275-00-3, Malaysian Institute of Maritime Affairs, Kuala Lumpur.

Forbes, V.L. (2004). "ECDIS and Potential Legal Implications: Proceeding with Caution". *The Hydrographic Journal*, No. 111, January, pp. 1-11.

ICSM (Intergovernmental Committee on Surveying and Mapping) (2002). *Geocentric Datum of Australia*, Technical Manual version 2.2, ISBN 0-9579951-0-5.

International Hydrographic Organization (IHO) (1993). *A Manual on Technical Aspects of the United Nations Convention on the Law of the Sea 1982*. Special Publication No. 51, 3rd Edition, July.

JUPEM (2003). *Geodesy in Malaysia*. National Report 2000-2003, A Country Report for the International Union of Geodesy and Geophysics (IUGG) International Association of Geodesy XXIII General Assembly, June 30 – July 12, 2003, Sapporo, Japan.

PCTrans(2004). A windows based program used for geodetic and hydrographic computations. Information in : http://www.hydro.nl/pgs/en/pctrans_en.htm.

The Geographer (1974). "Territorial Sea Boundary: Indonesia-Singapore", *Limits in the Seas, No. 60*, Department of State, Washington, D . C . 20520, 11 November.

The Geographer (1990). "Maritime Boundaries of the World", *Limits in the Seas, No. 108*, Department of State, Washington, D . C . 20520, 30 November.

Torge, W. (2001). *Geodesy*. Third edition, Walter de Gruyter, Berlin, 416 pp.

Villanueva, K.J. (2002). "Mengoptimalkan Peran dan Fungsi Survei Pemetaan Dalam Pengelolaan Batas Wilayah". *Prosiding Forum Komunikasi dan Koordinasi Teknis Batas Wilayah*, Bakosurtanal dan Depdagri, Bogor, 8-9 Juli.pp. 89 – 99.

BIOGRAPHICAL NOTES

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