Distortion in Map Projections: Its Effect on the Interpretation of Maritime Boundaries and Related Activities

Austin H. Gedney III
University of Rhode Island

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DISTORTION IN MAP PROJECTIONS: ITS EFFECT ON THE INTERPRETATION OF MARITIME BOUNDARIES AND RELATED ACTIVITIES

BY

AUSTIN H. GEDNEY III

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN GEOGRAPHY

UNIVERSITY OF RHODE ISLAND 1977
MASTER OF ARTS THESIS

OF

AUSTIN H. GEDNEY III

Approved:

Thesis Committee

Major Professor

Gerald H. Krause

Lewis M. Carpenter

Francis X. Cameron

A. A. Hiebert

Dean of the Graduate School

UNIVERSITY OF RHODE ISLAND

1977
Thesis Abstract

Distortion inherent in map projections can effect the delimitation of maritime boundaries. Thirty-nine maps of three study areas representative of the world were drawn, and the envelope and median line offshore boundaries were constructed on them. Every country's enclosed boundary area was measured in each of the four categories of distortion; equivalency, conformality, equidistance and constant bearing. How a nation wants to use or develop the territory within its sea boundary can be associated with the preservation or deformation of one or two of these distortive qualities. The distortion data was tabulated and ranked according to total scores. The result revealed a number of projections that indicate a wide range of usefulness depending on the degree of deformation and preservation of properties for a particular study area. Depending on the longitudinal and latitudinal position, maritime activities are variously effected by the amount of deformation and preservation inherent in each projection. Thus depending on a nation's global location and its interest in the use of its enclosed offshore boundary area, the most appropriate choice of projection is recommended for polar, mid-latitudinal and equatorial maritime areas.
Acknowledgements

The author wishes to extend his thanks to all the members of the Department of Geography at the University of Rhode Island who, for the past two years have done so much to make this thesis possible. Special thanks are due to Dr. Gerald H. Krausse who served as my major professor during my stay at the University, and was instrumental in helping with the completion of this work. Equally valuable were the contributions of Dr. Lewis M. Alexander who planted the original idea of this work in me, and the comments of Dr. Francis X. Cameron from the Department of Marine Affairs. Lastly I want to thank all those who kept me company in the Cartographic Room during my many long stays at the drafting table.
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CHAPTER 1

INTRODUCTION

When viewed from space, the earth appears to be a spherical globe consisting of three dimensions, length, width and depth. A problem that has plagued cartographers for centuries is how to represent the entire globe or portions of the globe on a two dimensional medium of length and width. There is no possible way, geometric, trigonometric or by computer that all the qualities present on the globe can be simultaneously represented on a two dimensional map. In referring to a popular analogy, it is the old problem of trying to apply an "orange peel" to a flat surface. In order to do this, the orange peel must be distorted either by stretching, shrinking or tearing.

Different projections are used to achieve representations which possess certain properties favorable for the specific purpose required. There are four categories of favorable properties that should be preserved. They are equivalency, conformality, equidistance and constant bearing (direction). Equivalency is that of trying to keep a correct representation of area. In other words the property of equivalency in a projection will show the area of a portion of the earth exactly as it is on the globe. Conformality
or orthomorphism, is the correct representation of shapes. Equidistance is the maintaining of a correct measure of distances on the map as well as on the globe. Constant bearing is the preservation of a straight line of a particular direction on the globe. Equivalency, conformality and equidistance are all mutually exclusive. Lines of constant bearing can be found with any one of these properties on the same projection. A projection can be designed that will consist of some of these properties but will never contain all of them. That can only be found on the globe.

The purpose of this study is to examine the various properties of area, shape, distance and direction inherent in the most widely used projections and to determine their suitability for particular maritime interests. A distortion in any one of these properties can alter a country's limits and possible use of its offshore area. An attempt is made to find the most appropriate impression of the desired areas, pointing out the advantages and disadvantages of the projections involved.

As a basis for comparison, the 200-mile offshore boundary system as presently proposed at the Third Law of the Sea Conference will be used. There are three types of boundary delimitation. The first is the uninhibited 200-mile envelope type, unobstructed by any other national claim. This will be used when there is a distance of at least 400 miles between the shoreline of one country and another. The second boundary delimitation type is used when the distance of
shoreline to shoreline between two countries is less than 400 miles. In this case, a line of equidistance or a median line is drawn. It is drawn so that every point on the boundary line is at an equal distance from the opposing shoreline. The third type of boundary delimitation is also called a line of equidistance or median line. This is a boundary line beginning from a point on the shoreline where the land boundaries of two adjacent countries meet, extending seaward till it reaches either the envelope or median boundary line.

The many special circumstances and special rights that can be claimed by certain countries, such as straight baselines¹ and historic rights will not receive consideration in this study. These problems are still under much debate at the Law of the Sea Conference and have no bearing on the results of this investigation.

There are various uses of the enclosed maritime boundary area. They can have political, visual, navigational or territorial implications. Each application demands different projections. The uses of the boundary areas have been grouped here into general classifications that incorporate as many of the interests as possible. Each interest will be

¹Straight baselines are used along a coast which is deeply indented and cut into, or if there is a fringe of islands in its immediate vicinity. The line is drawn along the outer perimeter of promontories and islands. All waters landward from the line are internal. The boundary line is drawn seaward from the straight baseline.
coordinated with the preservation of one of the classifications of distortion. Interests such as maximum fishing area, control over continental shelf exploitation and shipping passage that deal with aeral distortion will form one category. The same will be true for the other distortion qualities of shape, distance and direction.

Review of Literature

Many articles and books have been written about map projections and their characteristics. The majority of them fall into a category that describe projections in general, giving the common properties of the more commonly used projections. Some typical examples of these are Burnham (1934), Stewart (1943), Robinson (1949), Strahler (1951), Bowyer (1959), and Steward (1970). For the purpose of this analysis, the information contained in these articles provided useful background information. Another category of literature deals with a single particular projection and examines it in great detail. These writings ranged widely in terms of their utility for this study. They included explanations on the technical, geometric and trigonometric constructions, information on distortion, map manipulation and other aspects of projections. Sources of this nature include Steers (1927), Robinson (1943), Barr (1947), Robinson (1951), Hirt (1960), and Roblin (1969). The source by Steers contains formulas and gives directions for the construction of projections which are used in this thesis. A third group
of articles deals specifically with the properties of projections. Other literature describes the role of maps in boundary disputes. For the construction of boundaries, the most informative account is that of Robert D. Hodgson, the U.S. Geographer (1975). It gives the necessary information for the construction of an equidistant boundary and describes the types of projections that would be best suited for a "fair" boundary demarcation at all latitudes of the globe.

The search of literature was valuable only to a limited extent. It gave the necessary background and historical information needed to understand the problem of boundary delimitation using various types of projections. Most of the data used for analysis in this study was derived from a series of maps constructed by the author. Some specific literature, however, provided the necessary technical information for the construction of the special-purpose maps.

For accurate delimitation of national maritime boundaries, the territory enclosed by each boundary and the marine related interests within it, a correct choice of map projections is mandatory. The selection of an inappropriate projection can lead to a highly misleading data representation and hence be disadvantageous to the coastal country involved.

Hypothesis

For each marine interest there is a choice of projections that will be appropriate for application to each study
area. Depending on which projection the maritime boundaries are drawn between countries, the area enclosed will differ by a noticeable margin. Thus depending on the location on the face of the earth, and the marine related activity to be shown, this study attempts to present the optimal projection. It is hypothesized that with the proper choice of projections, in relation to the study areas, the most equitable maritime boundaries can be established.

**Study Area**

The areas that have been chosen for study are representative of almost any position, along similar lines of latitude and longitude on the globe. For every place on the earth's surface there are a number of map projections that can be used to represent a given area. Each projection shows a selected area in a different way according to the type of projection used. A particular map projection will change a study area depending on its latitudinal position. In other words, a projection at the equator will create one kind of distortion while the same projection located nearer to the poles may create a completely different impression because of the curvature of the lines of longitude. Along the equator the meridians begin to converge, finally joining at the poles.

Because of this cartographic fact, three very different study area have been chosen. Since the north-south orientation is important in projection distortion, the study areas
were chosen to cover as much as the latitudinal spectrum as possible. There is no difference with the graticules of longitude and latitude between the northern and southern hemispheres. The northern hemisphere were chosen because the larger amount of land mass, enclosed seas and diversified coastline gave a greater selection to choose from. The relative location of the study areas are shown in Figure 1.

The equatorial study area chosen is Insular Southeast Asia, excluding the Philippine Islands. It has a north-south latitudinal spread from 15° South to 15° North. Only four countries are included in this group. They are Brunei, Indonesia, Malaysia and Portuguese Timor. The Territory of Ocussi, belonging to Portugal, was drawn on the maps but not measured because its size is too small to show any appreciable differences from map to map. Similarly, Singapore was omitted because the size of the territory prevented measuring an accurate boundary. In addition, the distortion change from one projection to another would be too minute to measure.

The mid-latitudinal study area is the Mediterranean Sea and the countries that border on it. The study area has a north-south latitudinal spread from 25° North to 50° North. The countries surrounding this enclosed sea are: Spain, France, Italy, Malta, Yugoslavia, Albania, Greece, Turkey, Cyprus, Syria, Lebanon, Israel, Egypt, Libya, Tunisia, Algeria and Morocco. The country of Monaco and the Territory of Gibraltar were omitted for the same reasons as
mentioned earlier.

The northern, or polar study area encompasses the territory around the Bering Sea. It has a latitudinal spread from 45° North to 75° North. It includes most of the State of Alaska and the eastern portion of the U.S.S.R. known as the Chukotskiy Peninsula. The eastern border of Alaska is cut off at 140° West longitude and the Chukotskiy Peninsula has a western border of 170° East longitude. This area was chosen because it was the northern-most area in which a boundary conflict could potentially occur.

Since this study focuses on maritime boundaries, only the coastal portions of many countries are shown. This is especially true for the oblique, Mediterranean Sea area. This allows maps of a larger scale, with greater accuracy to be constructed. Each of these study areas occupies a position extreme enough (equator, mid-latitude, polar) to encompass the realm of possible distortive elements for each projection.
CHAPTER II

NATURE AND PROPERTIES OF MAP PROJECTIONS

The development of map projections can be traced far into the past, yet the study of projections, their properties and uses still continues, and has important implications in the world today. Each projection takes information from the globe and represents it on a plane surface in its own unique way. According to Robinson (1969), the actual process of transformation is called projection, and the term "projection" stems from the fact that many ways of transformation can be accomplished by geometrically "projecting" with lines or shadows, the homologous points from the sphere to a plane surface. Actual geometric projection from the sphere to the plane includes only a few of the possibilities, however, there are many possibilities for the retention of significant earth relationships that can be worked out mathematically. These are also called projections, but no useful purpose is served by attempting to distinguish between geometric and mathematical projections. During the early stages of projections, development which dates back to Before Christ (B.C.) the perspective (projected) type projection served

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the limited needs of the map users. Shalowitz (1964) states that one objection to the perspective projections is that in their use one is limited to the properties which they already possess; they cannot be made to satisfy any special conditions which may be of importance in the particular mapping under consideration, or they may possess features which are not desirable on the map or chart.  

With the advent of trigonometry and more widespread application of maps, an entirely new phase of map projections was created, the "mathematically projected" projections. Mathematical and perspective projections, both of which are used in this study, can be grouped according to the global properties they preserve, such as equivalence, equidistance, conformality and constant bearing or direction. They can be grouped as to whether they are geometric, trigonometric or sheer mathematical projections. Another method of classification is based on the projection surface, the kind of plane, cone or cylinder a projection is transformed onto. Accordingly they are known as Azimuthal, Conic and Cylindrical. It is this approach of classifying projections that has been applied in this study. See Figure 2.  

Concerning the Azimuthal projections, Richardus and Adler (1972) says that they have certain characteristics specific to their class, namely that they are theoretically  

---

Figure 2
and actually "projected" on a plane from the spherical datum surface. They are often called perspective projections, the term originating from the generation process employed. In this class of projections, a plane, or sheet of paper is assumed to touch the globe at a single point. This point of tangency may be at either pole, along the equator or any point inbetween. Thus they are referred to as Azimuthal Polar, Azimuthal Equatorial and Azimuthal Oblique projections respectively. Within these three azimuthal types further variation can be created depending on how the geographical grid is projected from the globe to the plane surface. As the light in a transparent globe is moved from the center, to the edge opposite the point of tangency and beyond to infinity, a different variety of Azimuthal projection will result.

Another unique property of the Azimuthal class is Great Circles. If the projection plane is tangent to the data source on the globe there is no deformation of any kind at the center. In such a case, all great circles passing through the point of tangency will be straight lines on the projection surface, showing correct azimuths from the center to any point, hence the name Azimuthal projections. An azimuth is a true compass bearing, so all azimuths from the point of tangency are true. For example in the case of an Azimuthal Polar projection, with the pole as the point of tangency, all azimuths are true.

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tangency, the azimuths would be the meridians.

Conical projections have their own characteristics. While Azimuthal projections are projected onto a plane tangent at one point, conics are based on a line of tangency. Theoretically a cone is wrapped around the globe and the graticule network (lines of longitude and latitude) is projected onto the cone by a light source similar to the procedure previously mentioned. This line of tangency is called a Standard Parallel; more than one of such lines can be used in the construction of cone based projections. A conic projection can show any portion of the globe, but usually no more than one hemisphere at a time. Along the Standard Parallel the scale is always correct, so when constructing a conic projection for a certain area, the correct placement of one or more Standard Parallels is critical. The area with the least distortion will be that on and near the Standard Parallels.

Cylindrical projections are those constructed around a cylinder. Theoretically a cylinder is wrapped around the globe and the graticules are projected onto it resulting in a cylindrical projection when unrolled. According to Steers, "The cylinder need not touch the equator; it may encircle the globe along any great circle. However, directly some slight calculations are employed in the equatorial case, useful modifications can be made. If the area between any two lines of latitude is preserved correctly, we have the cylindrical equal-area; if the exaggeration of the longitude scale is made to increase in the same proportion as the latitude scale, we have the
Mercator or Cylindrical Orthomorphic Projection."\textsuperscript{5}

As for the conical projections, a line of tangency forms the basis for construction of the cylindrical projection. All the cylindrical projections used in this study are based on a line of tangency that follows the equator.

From the classification system of Azimuthal, Conic and Cylindrical types, the following list of projections were selected for this study.

\begin{center}
\begin{tabular}{|l|l|l|}
\hline
Azimuthal & Conic & Cylindrical \\
\hline
Equal Area & Albers Equal Area & Equal Area \\
Equidistant & Bonne's & Mercator \\
Gnomonic & Conic w/2 STPs* & Mollweide \\
Orthographic & Lambert Equal Area & Simple Cylindrical \\
Stereographic & Polyconic & \\
 & Simple Conic & \\
 & Sinusoidal & \\
\hline
\end{tabular}
\end{center}

In applying these sixteen projections to the three study areas a total of forty-eight maps resulted. However, due to various construction difficulties, nine of them had to be eliminated, reducing the final selection to thirty-nine maps.

In the following pages a summary of the predominant characteristics of each projection are presented. It should be pointed out that for the Azimuthal classification there is a separate listing for each projection, both polar and equatorial. Only in this group do the projection's


* w/2 STPs means with 2 Standard Parallels.
characteristics change from one study area to another. The conic and cylindrical projections are in one listing each because their characteristics remain the same regardless of the global position.
<table>
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<tr>
<th>AZIMUTHAL:</th>
<th>AZIMUTHAL EQUAL AREA (Polar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projection:</td>
<td>Concentric circles becoming closer away from the poles.</td>
</tr>
<tr>
<td>Shape of Parallels:</td>
<td>Straight lines radiating outwards from the poles.</td>
</tr>
<tr>
<td>Shape of Meridians:</td>
<td>Meridians and parallels meet at right angles.</td>
</tr>
<tr>
<td>Intersection of Meridians and Parallels:</td>
<td>Decreases away from the poles.</td>
</tr>
<tr>
<td>Scale along Meridians:</td>
<td>Increases away from the poles.</td>
</tr>
<tr>
<td>Scale along Parallels:</td>
<td>Within 30° of the pole the shape of land is well preserved, because there is only slight compression of lat. from N. to S. and only a slight corresponding stretching from E. to W.</td>
</tr>
<tr>
<td>Representation of Shape:</td>
<td>Equal area.</td>
</tr>
<tr>
<td>Representation of Area:</td>
<td>True direction from the center of the map (the pole) is maintained by a straight line. Only half the globe can be shown. All straight lines drawn through the center point are Great Circles.</td>
</tr>
<tr>
<td>Representation of Direction:</td>
<td>Good for representing polar areas. Suitable for distribution and measuring distances from the center point.</td>
</tr>
<tr>
<td>Uses:</td>
<td>Mathematically projected upon a plane tangent at the pole. Invented by Lambert.</td>
</tr>
</tbody>
</table>
**AZIMUTHAL:**

<table>
<thead>
<tr>
<th><strong>Projection:</strong></th>
<th>AZIMUTHAL EQUIDISTANT (Polar)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape of Parallels:</strong></td>
<td>Concentric circles with the pole as the center. Drawn their true distance apart.</td>
</tr>
<tr>
<td><strong>Shape of Meridians:</strong></td>
<td>Straight lines radiating from the pole. Drawn their true angular distance apart.</td>
</tr>
<tr>
<td><strong>Intersection of Meridians and Parallels:</strong></td>
<td>Right angles.</td>
</tr>
<tr>
<td><strong>Scale along Meridians:</strong></td>
<td>Correct.</td>
</tr>
<tr>
<td><strong>Scale along Parallels:</strong></td>
<td>Progressively exaggerated away from the pole.</td>
</tr>
<tr>
<td><strong>Representation of Shape:</strong></td>
<td>Not Orthomorphic, but reasonable shape within 30° of the pole. Equator-wards of this, progressive E.-W. elongation.</td>
</tr>
<tr>
<td><strong>Representation of Area:</strong></td>
<td>Areas exaggerated progressively polewards.</td>
</tr>
<tr>
<td><strong>Representation of Direction:</strong></td>
<td>Equidistant; direction and distance from the center of the map (pole) are correct. Only half the globe can be shown. Straight lines drawn through the center point are Great Circles.</td>
</tr>
<tr>
<td><strong>Uses:</strong></td>
<td>General purpose maps of Arctic areas. Polar exploration and to some extent polar navigation. Used to measure distances from a center point to all other points.</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>Mathematically projected upon a plane tangent at the pole. Dates from the 16th century but was brought into prominence by Lambert in 1772.</td>
</tr>
<tr>
<td>AZIMUTHAL:</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Projection: AZIMUTHAL GNOMONIC (Polar)</td>
<td></td>
</tr>
<tr>
<td>Shape of Parallels: Concentric circles with the pole as center.</td>
<td></td>
</tr>
<tr>
<td>Shape of Meridians: Straight lines their true angular distance apart and radiating from the pole.</td>
<td></td>
</tr>
<tr>
<td>Intersection of Meridians and Parallels: Right angles.</td>
<td></td>
</tr>
<tr>
<td>Scale along Meridians: Progressively increases away from the pole.</td>
<td></td>
</tr>
<tr>
<td>Scale along Parallels: Progressively increases away from the pole.</td>
<td></td>
</tr>
<tr>
<td>Representation of Shape: Reasonable shape within $30^\circ$ of the pole, but equatorwards of about $60^\circ$ lat., very rapid and great elongation of areas from E.-W.</td>
<td></td>
</tr>
<tr>
<td>Representation of Area: Areas progressively exaggerated equatorwards. Exaggeration is pronounced equatorwards of $60^\circ$ lat.</td>
<td></td>
</tr>
<tr>
<td>Representation of Direction: Direction from the center of the map (pole) is correct. Any straight line drawn on the map is a Great Circle.</td>
<td></td>
</tr>
<tr>
<td>Uses: Navigational and general purpose maps of Arctic areas. Used in conjunction with Mercator for navigation. Substitutes for the Mercator in polar latitudes.</td>
<td></td>
</tr>
<tr>
<td>Notes: Geometrically projected upon a plane tangent at the pole. Source of light for the projection is at the center of the projecting sphere. Considered to be the oldest true projection. Credit is given to Thales, father of abstract geometry, who lived in the 6th century B.C.</td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Projection</td>
<td>AZIMUTHAL GNOMONIC (Equatorial)</td>
</tr>
<tr>
<td>Shape of Parallels</td>
<td>The equator, a Great Circle, is represented by a straight line. Other parallels are composite curves, more markedly curved polewards.</td>
</tr>
<tr>
<td>Shape of Meridians</td>
<td>Parallel straight lines at right angles to the equator. All Great Circles, including Meridians are represented by straight lines.</td>
</tr>
<tr>
<td>Intersection of Meridians and Parallels</td>
<td>Equator cuts straight meridians at right angles. Parallels cut meridians increasingly obliquely; towards the margins of the map and polewards.</td>
</tr>
<tr>
<td>Scale along Meridians</td>
<td>Increases progressively polewards. Exaggeration along successive meridians is progressively greater E. and W. of the central meridian.</td>
</tr>
<tr>
<td>Scale along Parallels</td>
<td>Progressive exaggeration polewards.</td>
</tr>
<tr>
<td>Representation of Shape</td>
<td>Shapes progressively elongated N.-S. and E.-W. away from the equator and central meridian respectively. Shape is reasonably represented within 35° of both the equator and the central meridian.</td>
</tr>
<tr>
<td>Representation of Area</td>
<td>Area exaggerated progressively N.-S. and E.-W. away from the equator and central meridian respectively. Area is reasonably represented with 35° of both the equator and the central meridian.</td>
</tr>
<tr>
<td>Representation of Direction</td>
<td>Direction from the center of the map is correct. Any straight line drawn on the map is a Great Circle.</td>
</tr>
<tr>
<td>Uses</td>
<td>Gives good representation of areas near the center of the projection provided they do not extend more than 35° in any direction. Because of correct direction from the center and representation of a Great Circle by a straight line, it is suitable for Africa and tropical South American areas.</td>
</tr>
<tr>
<td>Notes</td>
<td>Mathematically projected on a plane tangent along the Equator.</td>
</tr>
<tr>
<td>AZIMUTHAL:</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Projection:</td>
<td>AZIMUTHAL ORTHOGRAPHIC (Polar)</td>
</tr>
<tr>
<td>Shape of Parallels:</td>
<td>Concentric circles becoming closer towards the outside edges of the map.</td>
</tr>
<tr>
<td>Shape of Meridians:</td>
<td>Straight lines radiating outwards from the pole.</td>
</tr>
<tr>
<td>Intersection of Meridians and Parallels:</td>
<td>Right angles.</td>
</tr>
<tr>
<td>Scale along Meridians:</td>
<td>Decreases away from the poles.</td>
</tr>
<tr>
<td>Scale along Parallels:</td>
<td>Progressively exaggerated away from the pole.</td>
</tr>
<tr>
<td>Representation of Shape:</td>
<td>Shape is not correctly represented.</td>
</tr>
<tr>
<td>Representation of Area:</td>
<td>Area is not correctly represented.</td>
</tr>
<tr>
<td>Representation of Direction:</td>
<td>True direction from the center point. All straight lines drawn through the center point are Great Circles.</td>
</tr>
<tr>
<td>Uses:</td>
<td>Pictorial representations of the earth similar to a satellite photo. Good for illustrations in books on political or military strategic problems.</td>
</tr>
<tr>
<td>Notes:</td>
<td>Geometrically projected upon a plane. Point of projection is at infinity. An ancient projection used chiefly as an artistic representation of the globe during the Renaissance. It has had a revival in the Space Age.</td>
</tr>
</tbody>
</table>
AZIMUTHAL:

Projection: AZIMUTHAL ORTHOGRAPHIC (Equatorial)

Shape of Parallels: Straight parallel lines.

Shape of Meridians: Composite curves, not arcs of circles and ellipses.

Intersection of Meridians and Parallels: Central meridian and parallels meet at right angles.

Scale along Meridians: Decreases away from the equator.

Scale along Parallels: Decreases away from the Central Meridian.

Representation of Shape: Shape is not correctly represented.

Representation of Area: Area is not correctly represented.

Representation of Direction: Direction is not correctly represented.

Uses: A good visual relationship between countries. Great distortion in the areas on the margins of the hemisphere. It is rarely used because of this.

Notes: Geometrically projected upon a plane. The line of tangency is the equator.
AZIMUTHAL:

Projection: AZIMUTHAL STEREOGRAPHIC (Polar)

Shape of Parallels: Concentric circles, the distance between them increasing away from the poles.

Shape of Meridians: Straight lines radiating outward from the poles.

Intersection of Meridians and Parallels: Right angles.

Scale along Meridians: Increases away from the poles.

Scale along Parallels: Increases away from the central meridian.

Representation of Shape: Conformal (Orthomorphic).

Representation of Area: Area is not correctly represented.

Representation of Direction: True direction from the center point (the pole). All straight lines drawn through the center point are Great Circles.

Uses: It can cover up to one hemisphere. Used for navigation in high latitudes. Mapping distributions where positions are important. Plotting ranges from radiating objects. Important because of long range missile and aircraft operation over the poles.

Notes: Geometrically projected upon a plane. Point of projection is opposite the point of tangency. Dates from the 2nd. century B.C. and is ascribed to Hipparchus, a Greek astronomer. Also known as the Azimuthal Conformal Projection. Basis for the Universal Polar Stereographic Military Grid System for latitudes between 80° and the poles. It is used for World Aeronautical Charts by the U.S.G.S. scale 1:1,000,000 for latitudes 80° to the poles. U.S.Weather Bureau daily weather map is on this projection.
AZIMUTHAL:

Projection: AZIMUTHAL STEREOGRAPHIC (Equatorial)

Shape of Parallels: Arcs of circles.

Shape of Meridians: Arcs of circles.

Intersection of Meridians and Parallels: Right angles.

Scale along Meridians: Increases away from the equator.

Scale along Parallels: Increases away from the central meridian.

Representation of Shape: Shape is not correctly represented.

Representation of Area: Area is not correctly represented.

Representation of Direction: Direction is not correctly represented.

Uses: Mapping distributions where positions are important.

Notes: Geometrically projected upon a plane. Neither shape or area is preserved very well.
<table>
<thead>
<tr>
<th><strong>CONIC:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Projection:</strong></td>
<td>ALBERS EQUAL AREA</td>
</tr>
<tr>
<td><strong>Shape of Parallels:</strong></td>
<td>Concentric circles.</td>
</tr>
<tr>
<td><strong>Shape of Meridians:</strong></td>
<td>Straight lines that meet at a common point beyond the limits of the map.</td>
</tr>
<tr>
<td><strong>Intersection of Meridians and Parallels:</strong></td>
<td>Right angles.</td>
</tr>
<tr>
<td><strong>Scale along Meridians:</strong></td>
<td>Between the 2 Standard Parallels the scale is too large. Outside of them it is too small.</td>
</tr>
<tr>
<td><strong>Scale along Parallels:</strong></td>
<td>Scale along the Standard Parallels is correct. Scale between the 2 Standard Parallels is too small, outside it is too large.</td>
</tr>
<tr>
<td><strong>Representation of Shape:</strong></td>
<td>Shape is not correctly represented.</td>
</tr>
<tr>
<td><strong>Representation of Area:</strong></td>
<td>Area is not correctly represented.</td>
</tr>
<tr>
<td><strong>Representation of Direction:</strong></td>
<td>Direction is not correctly represented.</td>
</tr>
<tr>
<td><strong>Uses:</strong></td>
<td>Mapping distributions where aerial size relationships are important at continent or lesser size.</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td>Mathematical projection, projected on a cone with 2 Standard Parallels. Developed by H.C. Albers in 1805.</td>
</tr>
</tbody>
</table>
CONIC:

Projection: BONNE'S

Shape of Parallels: Concentric circles the correct distance apart. The pole is represented by a point.

Shape of Meridians: Composite curves, not arcs of circles.

Intersection of Meridians and Parallels: Only the Central Meridian cuts the parallels at right angles. Obliquity between the meridians and parallels increases towards the margins of the map.

Scale along Meridians: Increases progressively towards the margins of the map, especially in the middle and high latitudes. Along the Central Meridian the scale is correct.

Scale along Parallels: All correct.

Representation of Shape: Shape deteriorates with increasing distance from the Central Meridian, especially in middle and high latitudes.

Representation of Area: Equal area.

Representation of Direction: Direction is not correctly represented.

Uses: Suitable for areas in one hemisphere provided that the E.-W. extent is not too great. General purpose, distribution and statistical maps.

Notes: Developed by the French engineer Rigobert Bonne (1727-1795). Modification of the Simple Conic.
<table>
<thead>
<tr>
<th><strong>CONIC:</strong></th>
<th><strong>CONIC WITH 2 STANDARD PARALLELS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Projection:</td>
<td></td>
</tr>
<tr>
<td>Shape of Parallels:</td>
<td>Concentric circles, the correct distance apart. The pole is represented by an arc of a circle.</td>
</tr>
<tr>
<td>Shape of Meridians:</td>
<td>Straight lines converging on the center of the curvature of the parallels.</td>
</tr>
<tr>
<td>Intersection of Meridians and Parallels:</td>
<td>Right angles.</td>
</tr>
<tr>
<td>Scale along Meridians:</td>
<td>All correct.</td>
</tr>
<tr>
<td>Scale along Parallels:</td>
<td>Scale along the 2 Standard Parallels is correct. Those between the 2 Standards are too short. Outside the Standards, the scale increases progressively.</td>
</tr>
<tr>
<td>Representation of Shape:</td>
<td>Not orthomorphic, although an improvement on the One Standard Parallel Conic. Land masses are elongated E.-W. progressively polewards and equatorwards of the Standard Parallels.</td>
</tr>
<tr>
<td>Representation of Area:</td>
<td>Not equal area. Increasing exaggeration of area polewards and equatorwards of the Standard Parallels.</td>
</tr>
<tr>
<td>Representation of Direction:</td>
<td>Direction is not correctly represented.</td>
</tr>
<tr>
<td>Uses:</td>
<td>An improvement on the One Standard Parallel Conic. Error of parallel scale is more evenly spread, but areas are increasingly exaggerated beyond the Standard Parallels as the meridians become increasingly elongated E.-W.</td>
</tr>
</tbody>
</table>
CONIC:

Projection: LAMBERT CONICAL EQUAL AREA

Shape of Parallels: Concentric circles getting farther apart away from the poles.

Shape of Meridians: Straight lines that may or may not be radiating outward from the pole.

Intersection of Meridians and Parallels: Central Meridian cuts the parallels at right angles.


Representation of Shape: Shape is not correctly represented.

Representation of Area: Equal area.

Representation of Direction: Direction is not correctly represented.

Uses: Suitable for mapping aerial distributions.

Notes: Originated by Lambert.
CONIC:

Projection: POLYCONIC

Shape of Parallels: Arcs of circles, but not concentric. Each parallel has its own radius.

Shape of Meridians: Curved lines but not arcs of circles.

Intersection of Meridians and Parallels: Central Meridian cuts parallels at right angles. Increasing obliquity away from the Central Meridian.

Scale along Meridians: Correct only along the Central Meridian. Increasing exaggeration away from the Central Meridian.

Scale along Parallels: All correct.

Representation of Shape: Shape badly distorted as meridians become progressively elongated away from the Central Meridian.

Representation of Area: Areas increasingly exaggerated away from the Central Meridian.

Representation of Direction: Direction is not correctly represented.

Uses: Suitable for relief maps, but only for small areas. It is the basis for the International Map on a scale of 1:1,000,000. Because of its suitability for large scale maps of relatively small areas, it is of great interest to photo interpreters.

Notes: The U.S.G.S devised it and used it as a base map in their early topographic series. Originator was Ferdinand Hassler, first superintendent of the Coastal Survey.
<table>
<thead>
<tr>
<th><strong>CONIC:</strong></th>
<th><strong>SIMPLE CONIC</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Projection:</strong></td>
<td>Concentric circles, the correct distance apart. The pole is represented by an arc of a circle.</td>
</tr>
<tr>
<td><strong>Shape of Parallels:</strong></td>
<td>Straight lines converging on the center of curvature of the parallels.</td>
</tr>
<tr>
<td><strong>Shape of Meridians:</strong></td>
<td>Right angles.</td>
</tr>
<tr>
<td><strong>Intersection of Meridians and Parallels:</strong></td>
<td>All correct.</td>
</tr>
<tr>
<td><strong>Scale along Meridians:</strong></td>
<td>Correct along the Standard Parallel. All other parallels are too long. Exaggeration is progressively increased polewards and equatorwards of the Standard Parallel.</td>
</tr>
<tr>
<td><strong>Scale along Parallels:</strong></td>
<td>Shapes are increasingly badly distorted away from the Standard Parallel. They are badly stretched E.- W.</td>
</tr>
<tr>
<td><strong>Representation of Shape:</strong></td>
<td>Exaggeration of area increases rapidly polewards and equatorwards of the Standard Parallel.</td>
</tr>
<tr>
<td><strong>Representation of Area:</strong></td>
<td>Direction is not correctly represented.</td>
</tr>
<tr>
<td><strong>Representation of Direction:</strong></td>
<td>Cannot be used for areas of great extent in latitude. Suitable only for small countries, with not more than 10° extent from N.- S.</td>
</tr>
<tr>
<td><strong>Uses:</strong></td>
<td><strong>Uses:</strong></td>
</tr>
</tbody>
</table>
### CONIC:

<table>
<thead>
<tr>
<th>Projection:</th>
<th>SINUSOIDAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of Parallels:</td>
<td>Straight lines of correct length and correct distance apart.</td>
</tr>
<tr>
<td>Shape of Meridians:</td>
<td>All except the Central Meridian are sine curves.</td>
</tr>
<tr>
<td>Intersection of Meridians and Parallels:</td>
<td>Only the Central Meridian cuts the parallels at right angles. All others are increasingly oblique to the parallels.</td>
</tr>
<tr>
<td>Scale along Meridians:</td>
<td>Increasingly exaggerated E. and W. of the Central Meridian.</td>
</tr>
<tr>
<td>Scale along Parallels:</td>
<td>All correct.</td>
</tr>
<tr>
<td>Representation of Shape:</td>
<td>Very bad peripheral distortion of shape. Extreme eastern and western margins elongated and pulled out of upright.</td>
</tr>
<tr>
<td>Representation of Area:</td>
<td>Equal area.</td>
</tr>
<tr>
<td>Representation of Direction:</td>
<td>Direction is not correctly represented.</td>
</tr>
<tr>
<td>Uses:</td>
<td>Seldom used for the whole globe without interruption. Gives a good equal area map of continents lying astride the equator with relatively small E.- W. extent.</td>
</tr>
<tr>
<td>Notes:</td>
<td>Mathematical projection. Invented by Mercator late in his life. Sometimes called the Mercator Equal Area. Was used extensively by Sanson and Flamsteed in the 17th and 19th centuries, and is also known as the Sanson-Flamsteed Projection.</td>
</tr>
</tbody>
</table>
CYLINDRICAL:

Projection: CYLINDRICAL EQUAL AREA

Shape of Parallels: Parallels are straight lines and parallel.

Shape of Meridians: Meridians are straight lines and parallel.

Intersection of Meridians and Parallels: Right angles.

Scale along Meridians: Diminishes polewards. At any point it is as much too small as the parallel scale is too big.

Scale along Parallels: Equator is correct, all others exaggerated as the secant of the latitude.

Representation of Shape: Badly distorted polewards of 45° latitude. Shapes elongated E.- W. but compressed N.- S.

Representation of Area: Equal area. Meridian and parallel scales compensatory.

Representation of Direction: Direction is not correctly represented.

Uses: Good for distribution maps in tropical areas.

Notes: Developed by Lambert.
CYLINDRICAL:

Projection: MERCATOR

Shape of Parallels: Parallels are straight lines and parallel.

Shape of Meridians: Meridians are straight lines and parallel.

Intersection of Meridians and Parallels: Right angles.

Scale along Meridians: Increases progressively polewards in the same ratio as the exaggeration of the parallel scale.

Scale along Parallels: Equator is correct, all others exaggerated polewards as the secant of the latitude.

Representation of Shape: Conformal (Orthomorphic), correct for infinitely small areas. Large areas with great extent in latitude are top heavy.

Representation of Area: Area is greatly exaggerated polewards as the square of the secant of the latitude.

Representation of Direction: Any straight line is a line of constant bearing ie. a rhumb-line or a loxodrome. Great Circles are curved lines convex polewards.

Uses: Especially suitable for air and sea navigation or any purpose for which representation of direction and shape is required.

Notes: Mathematically projected upon a cylinder tangent at the equator. Developed by Mercator in 1569. Sometimes it is called the Cylindrical Orthomorphic projection.
CYLINDRICAL:

Projection: MOLLWEIDE

Shape of Parallels:
Parallels are straight lines and parallel. Lines get closer together polewards.

Shape of Meridians:
Ellipses, except the Central Meridian which is a straight line.

Intersection of Meridians and Parallels:
Only the Central Meridian cuts the parallels at right angles. All others are increasingly oblique to the parallels towards the E.-W. margins.

Scale along Meridians:
Central Meridian is too short. Increases away from the central, and eventually becomes progressively exaggerated.

Scale along Parallels:
Equator and other parallels to about 45° latitude are too short. Between 45° latitude and the poles, the parallels are too long.

Representation of Shape:
Bad peripheral distortion of shape. Shape within 30° of the Central Meridian is good.

Representation of Area:
Equal area.

Representation of Direction:
Direction is not correctly represented.

Uses:
Peripheral distortion of shape handicaps its use for the entire globe, but interruption and recentering improves the shape. Good for mapping distributions.

Notes:
Developed by Mollweide.
CYLINDRICAL:

Projection: SIMPLE CYLINDRICAL

Shape of Parallels: Parallels are straight lines and parallel.

Shape of Meridians: Meridians are straight lines and Parallel.

Intersection of Meridians and Parallels: Right angles.

Scale along Meridians: All correct

Scale along Parallels: Equator is correct, all others exaggerated as the secant of the latitude.

Representation of Shape: Not Orthomorphic. The tropical areas are of reasonable shape, land masses stretched E.-W. in higher latitudes.

Representation of Area: Not equal area. Areas progressively exaggerated polewards.

Representation of Direction: Direction is not correctly represented.

Uses: Its use is restricted to tropical areas. It is rarely used. Equal area projections are more suitable.

Notes: Sometimes known as the Plate Carree.
The preceding information was compiled from the following sources:


Central Intelligence Agency, Projection Handbook.


CHAPTER III

DISTORTION AND MARITIME BOUNDARIES

Regardless of what type of transformation process is used to create a projection there will always be a distortion in area, shape, distance or direction. The correct understanding and manipulation of these distortion properties can be invaluable to marine mapping and hence to the maritime policy making for sea oriented nations.

A working knowledge of area distortion is a valuable asset to cartographers of such nations, for example by controlling distortions, a maritime country may be able to stretch, expand or reduce its national median line boundaries to include or exclude portions of neighboring areas. When the spherical characteristic of area is retained, the process is known as equivalence or equal area. As appropriately explained by Robinson (1969), "If a system of projection is employed such that the product of the scales in directions that are perpendicular on the projection and on the globe is equal at every point, then all areas of figures on the projection will be represented in correct relative size." Such a projection, near the area of tangency, can have the scale constant in all directions at only one or two points or along one or two lines.

At all other places away from the area of tangency, the scale will be different in different directions from each point. This means then, that the angles around all such points will be deformed.

Area distortion is quite different than shape distortion which is otherwise called angular distortion. Everywhere on the globe a compass rose will appear the same. This property of angular relations can be retained to some extent on certain projections. When this is accomplished, the projection is called conformal or orthomorphic. Robinson (1969) asserts that, "It is important to understand that these terms apply to the directions or angles that obtain at infinitely small points. The property of conformality is not meant to apply to areas of any significant dimension, since no projection can provide correct shape to areas of any extent." On the globe, the scale is correct everywhere. On a projection, because of the necessary expansion and compression of areas, the scale is not the same at all places. With a conformal projection, it is possible to arrange the stretching and compression so that at each point the scale is the same in all directions, but it must vary from point to point. If a uniform scale is maintained in all directions around each point, then all directions around each point will be represented correctly, and the parallels and meridians will intersect at right angles.

7 Ibid., p. 206.
This does not mean however that every projection with lines of longitude and latitude crossing at 90° angles is conformal. Suppose a graticule formed by lines of longitude and latitude on the globe formed a square. All four angles would be 90° and a diagonal running from one corner to the opposite would bisect it into two 45° angles (Figure 3). If a graticule was projected onto a plane in the form of a rectangle, the four angles would also be 90° each but the diagonal would strike an angle different from the square. In this case the projection would not be orthomorphic, even though its parallels and meridians crossed at right angles.

By examining the scale requirements for equivalence and conformality it can be seen that they are contradictory. No projection can be both equivalent and conformal. All conformal projections will present similar shapes with unequal sizes and all equal-area projections will retain area and deform most earth angles.

Figure 3
The ability to control distortion in distance and direction consequently plays an important role for the maritime nation. It is important to know about distance and its distortion when it comes to constructing maritime boundaries, especially in the case of an equidistant type boundary between two neighboring and opposite nations. It is obvious that all map projections represent distances correctly, provided the variations in the scale are known. It is generally understood that distance representation is a matter of maintaining consistency of scale. For distances to be represented correctly the scale must be uniform along the particular line involved. Distance, or scale, may be maintained in one direction, for example along a meridian or a parallel. When scale is preserved along a line, it is referred to as Standard. Scale may also be maintained in all directions from one or two points. Projections where such characteristics prevail are called equidistant.

It is impossible to represent all global directions on the map with a straight line. Conformal projections represent angular relationships around each point correctly and the scale can be arranged so as to obtain straight rhumb lines or Great Circles. Robinson (1969) states that, "No projection can show true direction in the proper sense that all great circles will be shown as straight lines that will have the same angular relations to the graticule of the map that they have with the earth's graticule."  

8 Ibid., p. 208.
Based on the Mercator projection, the rhumb line (Loxodromic curve), is straight and cuts all meridians at a constant angle. It follows then, that since the meridians on a Mercator chart are parallel, the direction or bearing of a rhumb line between any two points on the chart can be measured with a protractor from the nearest meridian or from the compass rose at any convenient place on the chart. The projection being conformal, directions and angles are correctly represented. On the other hand, Shallowitz says that a great circle (Orthodromic curve), which represents the shortest distance between two points on the surface of the earth, appears as a curved line on a Mercator chart concave toward the equator. Exceptions to this are the great circles represented by the prime meridian and the equator which are straight lines on this type of projection.\(^9\) When directions are properly defined as great circle bearings and if correct direction is shown as a great circle being a straight line on the map having the proper azimuth readings with the meridians, two types of representations can be shown. Great circle arcs between all points may be shown as straight lines for a limited area. Secondly, straight great circles with correct azimuths may be shown for all directions from one or two points. These projections are called azimuthal.

The preservation and the positive and negative deformation of each of these qualities should be an integral part

of a maritime nation's policy formation concerning the
demarcation of its offshore boundaries. As pointed out, a
straight line on the globe may appear to be curved on certain
projections. This distortion becomes proportionately greater
as the area covered by the map increases. Geometrical lines
drawn on flat surfaces may have different properties from
lines through corresponding points on the earth. For example,
on the Mercator and some other projections, parallels of
latitude are straight lines. On the earth they are curves.\textsuperscript{10}
By having a knowledge of projection deformation and manipu-
lation, one could possibly add many square miles of property
which otherwise could be lost to a neighboring nation.

\section*{Boundary Delimitation}

The determination of the actual construction of the 200-
mile offshore boundaries and the equidistant (median line)
boundaries are technically complex and politically sensitive.
Usually three types of lines are involved in the construction
of offshore boundaries but they vary depending on the kinds
of limits required (Figure 4). The first is the envelope
type which is formed by 200 mile arcs emanating from points
on the nation's shoreline. The second is an equidistant or
median line boundary between two or more nations on opposite
sides of a water body. The third boundary type used is the

lateral boundary. This is a line of equidistance emanating from the point on the shoreline where the land boundary of two adjacent countries ends, seaward till it intersects with the median line or envelope boundary line.

The techniques of constructing the 200-mile envelope boundary line is a fairly straightforward procedure. As described by Pearcy (1959) a boundary can be marked on a chart by constructing an envelope of arcs of circles. Arcs of circles are swung from every point along the coast in order to project the outermost limit as far seaward as possible. In this way every point on the line denoting this limit is neither more than nor less than 200 miles from the closest coastal point.11 The maps made for this study were based on the same construction principals. An ordinary bow compass was used, a 200-mile radius was set on it corresponding to the scale in the area to be delimited, and the arcs were drawn. The compass arcs were made from the same points on each map in order to achieve some comparability. No matter what the projection is, the arcs are still going to be 200 miles away from the shoreline. It is the difference in scale that makes the distance seem to vary.

The envelope boundary is not as susceptible to distortion as the equidistant boundaries. With the equidistant case, a change in the projection or location will cause a variation.

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in the distance of the boundary from the shoreline, regardless of scale.

The boundary line between two countries opposite each other whose coasts are less than 400 miles apart should be drawn differently. According to Hodgson (1975), the boundary should as a general rule be the median line, every point of which is equidistant from the baselines of the state concerned. Unless otherwise agreed between the adjacent states, all islands should be taken into consideration in drawing the median line. Likewise, drying rocks and shoals within 200 miles of only one state should be taken into account, but similar elevations of undetermined sovereignty, that are within 200 miles of both states, should be disregarded in laying down the median line.\(^{12}\)

Concerning the construction of the lateral boundary between two adjacent states, Hodgson states that, if not already fixed otherwise, they should be drawn according to the principle of equidistance from the respective coastlines.\(^{13}\)

These were the methods used in drawing the two equidistant type boundaries.

The same basic procedure outlined by Hodgson was followed and the same reference points along the coast to draw


\(^{13}\)Ibid., p. 3.
either the envelope arc boundary or the equidistant boundaries were used. The delimitation process was accomplished with little complication because all special claims were eliminated. Some of these special claims that can divert the boundary from the median line are historic or special navigation and fishing rights. Circumstances such as these would add water area to certain countries and change the course of the boundary line. Acceptance of such a circumstance involves much deliberation with the nations concerned and at times are difficult to agree upon. Another method used for obtaining more national territory is to declare straight baselines. Basically this would mean a straight line would be drawn along a country's coast touching at specific points. Then the 200-mile boundary would be drawn from this new straight line. This is frequently used by island nations and countries with a highly irregular coastline. However these claim have little bearing on this study and are therefore excluded from consideration. What is of considerable importance is that the areas within the boundaries of each country are treated and measured in the same way. The objective is to find out to what extent territorial water bodies change by using different projections for the same countries.

How an individual maritime nation uses the projections can be broken down into different categories depending on what area, shape, distance and direction would be most beneficial to a particular marine problem. Robinson (1969) says that the notion that one projection is by nature better
than another has insufficient basis in actual fact. Each projection is a device to use for a particular purpose, and some will be good for one purpose and poor for another, but there is no such thing as a bad projection, there are only poor choices.14

Maritime Interests

In examining the measurement of area there are various reasons why a particular nation would want to deviate from the true global measurement. Nations near rich fishing grounds and potential continental shelf resources would want to maximize their enclosed boundary areas for the obvious reason of having more exclusive control over these resources. By having such control, a nation will be able to determine who has priorities to conduct scientific research and to exploit the resources. The larger the territory the more economic and political advantage may be obtained.

The major reason why shape would be preserved is for visual reasons. Conformal projections would give the best visual interpretation of the globe, with the shapes of the countries and their boundaries correct. A distortion in shape could be used for political leverage. By making a country's shape appear larger than it normally is, a psychological and perceptual advantage may be gained. As Greenhood (1964) explains, the navigator, the engineer, and

the military strategist all ask for conformal maps. The shape of a country tells them what kind of mobilization and strategy to plan. The configuration of neighboring shores may help decide such developments as port facilities and other shorebased activities.15

Equidistance or scale is impossible to keep correct over an entire map. If a country wants a true equidistant boundary drawn, it would have to be drawn on the correct projection and near that section of the projection that preserves scale. If the area to be delimited does not fall on a section of the map that maintains scale, then there will be an unequal division of area. For example if a strait was to be divided between two countries on opposite sides, a fair division would give both countries equal jurisdiction over the strait. An unequal or biased division would develop if the equidistant boundary was drawn on a part or a projection that does not preserve equidistance or scale.

The principle advantage of preserving constant bearing on maps would be to facilitate navigation. Boundaries drawn on maps that preserve constant bearing as a straight line, such as the Mercator makes Coast Guard protection of the area easier plus it may prevent accidental trespassing of national territory. If the boundaries are drawn on a projection that distorts constant compass bearing, patrolling of the enclosed

area would be hindered by the difficulty of navigation. According to the particular needs of a nation's 200-mile offshore boundary area, the correct choice of map projection is mandatory. Hodgson asserts that the delimitation commission must seek the map projection which will maintain, to the greatest degree possible, the aerial and angular relationships for the particular boundary area to be delimited.¹⁶

CHAPTER IV

CONSTRUCTION AND MEASUREMENT OF MARITIME BOUNDARIES

This chapter deals with the delimitation of offshore boundaries and the measurement of various types of distortion. More specifically, the problem of aerial and linear distortion are discussed and how they effect the accuracy of marine boundary delimitation.

In order to preserve global representation, water bodies were chosen in the polar, mid-latitudinal and equatorial locations as earlier described. The selection was based on ocean orientated countries and areas where maritime boundary conflicts are more likely to occur. Such areas are straits, semi-enclosed seas, large bays and island groups.

The equatorial area is the Insular Southeast Asia area. The oblique area is the Mediterranean Sea and the countries that border on it. The northern-most area that had a potential boundary conflict was that of the Bering Strait between the U.S.A. and the U.S.S.R. An area closer to the poles would have been better, but there was no suitable area to be included in this study.

In the selection process of locations on the globe the north-south orientation was of critical importance. In the
direction parallel to the lines of longitude, a change in the shape of the graticule and distortion properties occurs. In terms of the east-west extent, no distinction in location was made. As one proceeds east or west along the parallels of latitude it is evident that the resulting intersecting lines do not change shape.

As to the choice of projections, the two controlling factors were their wide application and the availability of construction information. The final selection incorporates a fairly even spread of projections for each of the three major classes.

The first step in the construction was to draw the graticule network for each map. This was done by following the formulas given by Steers (1927).

Once the projection grids were drawn, the next step was to draw in the coastline of the countries involved. This was done by carefully locating the coordinates for specific coastal areas, and transferring them onto the projections. Then the coastline between the located points was carefully filled in. An attempt was made to follow the natural outline of the land forms and water bodies as best as possible. The small errors that were introduced into each map should be similar throughout each study area and each map, so the comparability of the data was not affected.

The next step was to draw in the 200-mile envelope and equidistant boundaries. Again there is a margin for an
error, but in most cases it was so small that it was insignificant in the final analysis. Such errors may have been due to the weight of a pencil line or the instruments used for measuring the distortions, but in both cases the effect on the results were rather marginal.

Just as important as the map construction is the measurement and the gathering of information. Several attempts on how to measure deformation are briefly summarized.

M.A. Tissot (1881) in his treatise on map projections developed a method for analyzing the amount and distribution of deformation. In this he employed a mental construct he called the indicatrix. This involved an infinitely small circle on the globe, located at the intersection of a line of longitude and latitude. When projected onto the plane this original circle will appear larger or smaller if the angles have been preserved or as an ellipse if the angles have not been preserved. By analysing the geometric changes, the magnitude of deformation can be calculated. From this method, deformational data in area, shape and scalar distance can be determined. Unfortunately this method can only measure deformation at a point. It cannot give any indication of deformation relationships between widely spaced points on a map, and for this reason was not used in this study.

Another alternative was proposed by O.M. Miller. He

covers the globe with a system of twenty spherical triangles, all equal-angle, equal-area and equal sides being great circle arcs. In projecting it, the triangles are maintained. The resulting pattern provides a method of measuring area and angle deformation as well as a good visual representation of shape distortion.\(^{18}\) It is a good method for comparing different areas, yet it is not useful in this investigation because the use of triangles as large as the ones required would serve no practicable purpose.

Another method is to tabulate the characteristics of the earth's graticule and use them as a checklist against its transformed appearance on the map.\(^{19}\) It is this method, slightly modified, that is used in this project.

For distortion in area, the unit area of each country's 200-mile offshore boundary is measured and compared to global qualities. To do this an OTT Compensating Polar Planimeter was used. The measurements of this instrument are reasonably accurate for the purpose in mind. The area was measured three times for increased accuracy and the obtained values were averaged. In the case of island nations such as Indonesia, the total area was first measured and then any large significant islands were subtracted from the total value. The multitude of small islands in the Aleutian chain

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\(^{19}\) Ibid., p. 399.
or the Indonesian Archipelago were not measured because they showed no significant readings on the planimeter. Secondly, these small islands are also subject to the same type of distortions as everything else on the map. Once the values had been obtained, there was the problem of what to compare them to. A certain number of the chosen projections are equal-area projections. According to their definition, the value of area is preserved as it is on the globe. By calculating the average area values of the equal-area projections, a figure representing the global value was obtained. The distorted values from the maps were then compared against the global quality. In this way the distortion from the true, equal-area value could be measured. A table of the measured values can be found in Appendix I.

The measurement of distortion in shape was perhaps the most subjective of all types of distortion considered. There does not seem to be any way of accurately measuring the amount of distortion from one map to another. As far as shape is concerned, Robinson (1959) states that shape distortion does not appear to be suitable for measurement and exact expression, at least not at the present. The best attempts have been visually.  

As a basis for comparison, maps that had the property of conformality were used. Although

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this method of comparison is not necessarily precise, it is the only method available at this time. By comparison it was possible to select those maps that distorted from the correct global shape in general terms. As the shapes approach the actual configurations, or as the amount of shape distortion decreased, the ability to rank the maps became increasingly difficult.

Distance or scale distortion involved measuring the 5 degree lengths of longitude and latitude on each map and converting it to statute miles. These figures were then compared to the true globular lengths between each 5 degrees of longitude and latitude. The measured deviation, plus or minus, from the true values is a direct measurement of the amount of distance distortion present on the maps.

Since every degree could not be measured on each projection, measurements were made on specific intervals of degrees longitude on the latitude scale and vice versa. In terms of degrees of longitude, the separation of 5 degrees measured on the extreme (top and bottom of the maps) parallels was used. In the case where projections have Standard Parallels, a 5 degree measurement was also included along each Standard Parallel. For instance, in the Polar type projections, excluding the Standard Parallel measurements, 5 degree measurements in degrees longitude on the latitude scale was taken at 45°N. and 75°N. For the latitude measurement on the longitude scale, the 5 degree spread between
45°N.-50°N. and 70°N.-75°N. were measured. In the Oblique case, 25°N. and 50°N. were used for the extreme measurements for the longitudinal spread, and 25°N.-30°N. and 45°N.-50°N. were used in the latitudinal measurement. For the longitudinal extreme measurements in the Equatorial case, 0° and 15°N. were used. The spread between 0°-5°N. and 10°N.-15°N. was used for the latitudinal measurement. In the Equatorial case, the extremes located in the southern hemisphere were not used because the results would be identical to those obtained in the northern hemisphere. Careful selection of each point of measurement was necessary in order to encompass the maximum range of distance distortions. In the cases of the Equatorial series, the maximum or minimum value was not always contained in the measured extremes but elsewhere on the projection. It was usually found on the eastern or western portion of the projection. These values were also included in the final ranking of distortions. The distance measurements and their deviation from the globular value are listed in Appendix II. Among all types of distortion, distance has the least room for error. Most of the figures for calculation and comparison came directly from formulas and known values. Only a few of the distances on the projection were actually measured.

Distortion in direction of deviation from a true bearing is the final type of deformation to be evaluated in this study. The values (Appendix III) were obtained in a similar fashion than that for distortion in distance, except that
selected angles were measured and then compared to the true values. On each projection three graticules were chosen. They represented the two extremes of angle deviation and a median value. The three measured angles reflects angle deformation from the maximum to minimum for each projection. Each study area has its own set of graticules. In the Polar area they were the graticules bounded on the south by 70°N. and on the east by 170°E., on the east by 55°N. and on the east by 170°W., and on the south by 45°N. and on the east by 145°W. The Mid-latitudinal area's graticules were bounded on the south by 45°N. and on the east by 10°W., and 35°N. - 10°E., and 25°N. - 35°E. The Equatorial graticules are also bounded on the south and east by 10°N. - 140°E., 5°N. - 100°E. and 0° - 110°E. By the use of trigonometry, the value for the desired angle could be found. The southern and eastern lines of latitude and longitude form two sides of a right triangle. If the hypotenuse is drawn, an angle is formed in the south-western corner of the graticule. By use of the tangent trigonometric function, this angle can be found.

One of the properties of the Mercator projection is that all lines of constant compass bearing are straight lines. This allows the values for the drawn angles on the Mercator projection to serve as a standard against which values from other projections can be compared. The only errors were introduced in cases where the 5 degree length values could not be derived from formulas and had to be measured manually.
Once all distortion values were obtained, the next step was to put the data into proper perspective through a system of ranking. Accordingly, the number 1 was given to a projection with the least distortion from the global value and the highest number was a projection that had the most distortion. In the case of area distortion, several projections have the same ranked value of 1. This is because they are all equal-area projections which means technically they should all have identical observed values. As can be seen from the data, their values differ only slightly. In this case an average value was calculated for all the equal-area projections. The other projections were ranked by their deviation from the average value of the equal-area projections. The sum of the four ranked values of distortion for each projection was then combined into an index. A closer analysis of this data will be the subject of the next chapter.
CHAPTER V

CLASSIFICATION OF PROJECTIONS ACCORDING TO
SUITABILITY FOR MARITIME
BOUNDARY DELIMITATION

The degree of distortion in area, shape, distance and
direction and how it affects maritime boundary delimitation
is determined by a method of comparison. The method of
analysis is similar to that proposed by Steward (1970).
Briefly, he proposes that the global qualities of the
preservation of area, shape, distance and direction be tabu­
lated and compared against the distorted qualities obtained
from the boundary areas of this study's projections. This
method of analysing the data was preferred over the other
previously mentioned methods of distortion analysis because
it can be applied to linear and aerial values. The other
methods can only determine distortion at an infinitely small
point.

For the purpose of comparison, an index of distortion
has been arbitrarily determined based on the ranking of the
score. As mentioned in the previous chapter the data, after
comparison against the globular characteristics, was ranked.
The lower the score given to a projection for a particular
distortion quality, the more appropriate the projection is
for a specific use. Conversely, the higher the number, the more distorted the projection tends to be.

When drawing a 200-mile arc envelope boundary on the high seas, where there is no conflict for territory with a neighboring country, the choice of projection is less critical. The 200-mile arcs, as long as they are drawn to scale will have a radius of 200 miles. It is concerning the two varieties of equidistant boundaries that distortion plays a major role in their delimitation. As Hodgson (1975) rightly indicates, "Maps which are to provide precise measurements of angles, distances and directions as a basis for an equidistant boundary require conformal projections. Unfortunately, no one conformal projection will prove satisfactory for all areas of the earth."\(^{21}\) When determining a fair equidistant boundary, a conformal projection is best suited. If a country intends to take advantage of another country by drawing a non-equidistant or unfair boundary, another type of projection might prove desireable.

Table 1 shows the classification of projections for maritime interests in polar areas. Conic projections appear to be the most suitable for this area. This is reflected in consistently lower scores as compared to the other categories. In terms of aeral distortion, there are several projections, all equal-area types (Azimuthal Equal Area, Albers Equal Area,

Bonne's, Lambert Equal Area, Sinusoidal, Cylindrical Equal Area, and Mollweide) that will provide the best representation. The two conformal projections, the Azimuthal Stereographic and the Mercator, are among the best in preservation of shape. As to the preservation of distance, the findings show that almost every azimuthal and cylindrical projection is extremely unsuitable for polar regions. Among the conics, the Polyconic distorted the least because of its construction. Each parallel represents a Standard Parallel which has a correct scale. It should be pointed out that the Azimuthal Equidistant has the property of correct distance measurement from any place on the map to the point of tangency. This is an exceptional quality, but in terms of overall measurements in any direction, it falls short of all other types. As expected, the Mercator projection was the best in preserving constant compass direction. The Cylindrical Equal Area distorted direction the most, distorted shape the most and distorted distance to a large degree. It seems that its use is rather limited in the polar area other than for preserving area. If area was to be preserved in the polar latitudes, a choice of an alternate equal-area projection that preserved other properties would be chosen. A good choice would be the Conic: Bonne’s projection. In the Azimuthal group, the Azimuthal Equal Area appears to be the best qualified projection for use. It is the only one of the class that preserves area and does better than the others in its class in reducing distortion in shape, direction and distance. As a
### TABLE 1: POLAR STUDY AREA

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<th>Distance</th>
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group, the conical class scored the lowest in overall suitability. Other than the Bonne's, which did well in all categories, all the conics did well in preserving area, and better than average in the other distortion characteristics. In the polar study area, except for the Mercator projection, the cylindrical class did the poorest. In almost every category they consistently scored high. It is interesting to examine the results of the Mercator. It scored best in preserving shape and direction and the worst in preserving area and distance. The great distortion of area in the high latitudes on the Mercator projection explains why it was equally as poor in distance preservation. On the globe the lines of longitude converge at the poles. To preserve conformality, the Mercator prevents the lines of longitude converging by keeping them parallel. To compensate for this progressive east-west stretching there is a proportional north-south elongation of the graticule. This preserves shape but as a result greatly distorts area and distance measurement.

The classification of projections for the mid-latitudinal study area are shown in Table 2. Again the conic projections appear to be the most suitable in reducing distortion for maritime boundary delimitation. The projections that best reduced area distortion were the equal-areas. They include the Albers Equal Area, Bonne's, Lambert Equal Area, Sinusoidal, Cylindrical Equal Area and the Mollweide. Again the
Mercator distorted area the most for the same reason as previously stated. On the other hand, the Mercator is the most suitable for the preservation of shape in this study area. This is due to its property of conformality. Aside from the Mercator, the entire cylindrical class scored the worst in this category. In terms of preserving distance, the conic projections scored far better than the cylindrical types. The Polyconic proved to be the most accurate for the same reason as stated before. The best choice for maintaining constant compass direction again is the Mercator. The reason for its extreme suitability is because it was originally developed to preserve constant compass direction for early navigators. Other than the Mercator, the cylindrical class did the poorest. The poor showing to the cylindrical class is because of the nature of their construction. The cylindrical group are all based on a single line of tangency along the equator. The farther away from the equator, the more distorted the projection usually becomes in certain areas. Conversely, the conics have their lines of tangency or Standard Parallels in the mid-latitudes. This allows the lines of tangency to be closer to the study areas involved and thus less distortion. The best projection for reducing overall distortion in this study area appears to be the Bonne's. It did very well in maintaining area, distance and direction and close to average in shape preservation. As in the polar study, the Cylindrical Equal Area, with the
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<td>Equal Area</td>
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exception of area preservation, proved to be extremely unsuitable. A choice other than this projection would be the most profitable in choosing a projection. There are other equal-area projections such as the Bonne's that would do a better job.

The variation in the distortions of projections drawn for the Equatorial study area are shown in Table 3. In this area, the cylindrical projections prove to be the most suitable in preserving overall distortion. This is because, as previously stated, the cylindrical projections are based on the Equator being the line of tangency. Because of the proximity to the Equator, all distortions are minimized. Consequently, the polar group did the poorest because their point of tangency, the north pole, is at a maximum distance, thus encouraging large amounts of distortion. The conical class falls into the middle of the ranking. This too is based on the proximity of the lines of tangency to the study area. In general the equal-area projections proved to be those which did the best in preserving aerial characteristics. These projections are the Albers Equal Area, Sinusoidal, Cylindrical Equal Area and the Mollweide. The three worst in preserving aerial distortions are the three azimuthal projections. In terms of shape distortion, the cylindrical class again performed very well in preserving it. This is due to the study area's proximity to the Equator. Near the Equator the graticules on the cylindrical projections come
<table>
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very close to the global network of longitude and latitude. The best of the cylindrical group is the Mercator because of its property of conformality. The Stereographic projection, because of its property of conformality would be expected to rank high along with the Mercator. This is not true. Although it preserves shape well in the center of the map, there is bad shape distortion around the periphery. This deformation limits its usefulness in preserving shape in the equatorial area. The Polyconic again is best for the preservation of distance. This is true for the same reason as previously mentioned. The worst in reducing distance distortion was the azimuthal class. This is because these projections are projected from a point of tangency instead of a line like the conical and cylindrical groups. As a result, these projections are susceptible to distance distortion. The cylindrical class make a good showing in direction distortion. As usual, the Mercator proved best for the preservation of constant compass direction.

This data presents a range of choices from the best to the worst projections that are relevant to the representation of the 200-mile offshore boundary. By examining the statistics and the constructed maps, it should be possible to determine the proper projection that is characterized by the lowest degree of distortion for a particular study area. Hodgson (1975) in giving his opinion of the best projections
to be used in determining a fair equidistant boundary by stating that,

"The Mercator projection charts may be used for the basic delimitation process in the area from $15^\circ$ south to $15^\circ$ north of the Equator. Unfortunately, in its mathematical development it grossly distorts distances in the areas poleward of $15^\circ$ and should not be used in these regions. Lambert Conformal projection maps will be satisfactory for the zones from $4^\circ$ to approximately $72^\circ$ north and south of the Equator. Area exaggerations between and near the Standard Parallels are relatively small, and thus the Lambert Conformal projection will provide excellent direction and good shape relationships for the east-west latitude zone on which it is developed. The Stereographic projection is recommended for polar regions. Area exaggeration increases outward from the center and hence the application of the projection should be restricted to the areas poleward of $60^\circ$ north and south. The projection is both conformal and azimuthal."  

Hodgson's opinion in many respects is supportive of the results that were obtained from my analysis. For the equatorial area, he chose the Mercator, a cylindrical projection. These results here show that the best overall projection in the equatorial study area is the Mercator. In the total ranking, the Mercator revealed the lowest value.

As to the Lambert Conformal in the mid-latitude study area, this study showed different results. The Lambert Conformal, as a conical projection, revealed the best qualities for this area, but the Bonne's projection is equally as good. Except for its ranking in shape, which is highly subjective in the first place, there is little

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22 Ibid., pp. 21-22.
difference between the two.

In the polar study area, Hodgson preferred the Azimuthal Stereographic projection because of its conformal properties and it is azimuthal. Although the results show that a conic projection would be a better overall projection, this study's ranked data has no way of evaluating the importance of being azimuthal. The property of being azimuthal is limited only to this type of projection. When examining the Azimuthal projections as a group, the Stereographic was found to be rated among the best.

It is becoming evident from the data that the point or line of tangency of each class of projections plays a major role in determining its suitability. The equatorial study area is centered upon the line of tangency of the cylindrical projections, the Equator. Boundaries drawn near the Equator will receive minimal amounts of distortion because along the line of tangency, the distortive qualities are the closest to globular.

The conical class reduced distortion most effectively in the mid-latitudinal study area. This is because of the placement of the line or lines of tangency, Standard Parallels. The placement of the Standard Parallels is arbitrary but usually they are placed near the areas to be delimited, reducing minimal distortions.

In the polar study area this study showed the conical class to be the best. If the study area were located over
the pole, the Azimuthal class would have proven superior. The reason for the success of the conical class was that the study area was located between the latitudes of 45°N. and 75°N. Although it is near the polar area, the study area can also be considered to be an oblique one too. Since the conicals did so well in the mid-latitudinal (oblique) study area, it is not surprising then to see the conics the most suitable in the polar study area as well.
AZIMUTHAL: Equidistant
CYLINDRICAL: Equal Area
AZIMUTHAL: Sinusoidal
CONIC: Simple Conic
CONIC: Conic with Two Standard Parallels
CONIC: Albers Equal Area
CYLINDRICAL: Simple Cylindrical
CYLINDRICAL: Simple Cylindrical
CYLINDRICAL: Equal Area
CONIC: Simple Conic
CONIC: Polyconic
CONIC: Conic with Two Standard Parallels
AN ANALYSIS OF INDONESIA'S TERRITORIAL WATER'S CLAIM: A CASE STUDY

by

Rondell K. Wood

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Kingston, R.I.
ABSTRACT

Traditionally, there has been a narrow band of ocean contiguous to a state's land mass known as the Territorial Sea over which the state has complete sovereignty. After Grotius published a brief treatise entitled *Mare Liberum* in 1609 in which he outlined the concept of freedom of the seas, customary international law came to recognize three miles as the breadth of the territorial sea.

At the 1958 Geneva Conferences on the Law of the Sea the Convention on the Territorial Sea and the Contiguous Zone was signed. It failed, however, to specify the breadth of the territorial sea and was extremely ambiguous in establishing a method for determining baselines. As a result, states have made numerous claims based on varying circumstances, the most important of which are the geographic characteristics, its economic dependence upon the sea, the need for military security and its political motivations.

Indonesia has made a special claim to territorial seas called the "archipelago theory" of delimitation of territorial waters. It advocates drawing straight baselines around the outermost islands thus forming a perimeter, the areas inside of which are claimed as internal seas over which Indonesia claims sovereignty.

Justification for such a claim was based on geographic circumstances, historic rights, economic dependence upon the sea, and the need for military security. In analyzing these various factors one can easily appreciate Indonesia's reasons for the claim based upon
her unique position. On the other hand limiting use of the large expanses of ocean involved would seriously restrict world intercourse.

Based on existing international law there appears to be no legal basis for such an extensive claim as that made by Indonesia. Given prior precedent and evidences of the law, however, there does appear to be legal justification for enclosing certain groups of islands as a unit. Principles for the delimitation of territorial seas which take into consideration historical, geographical, political, economic, and military factors appear to offer up the best approach to the problem. The varying circumstances of the many states tend to mitigate against a uniform and universal rule as a practical solution.
PREFACE

And I saw a new heaven and a new earth; for the first heaven and the first earth were passed away; and there was no more sea.

New Testament: Revelation 21:1

My personal reasons for undertaking the study of Indonesia's territorial water's claim are two-fold. First, the claim is an intriguing and unique one that presents a challenge that requires exploration to understand its explanation. And second, this is a strategic part of the world apt to grow in importance in the next decade. Moreover, the Indian Ocean, her western water kin, is a formidable area for world interaction--especially with the anticipated power vacuum and the rush to fill it.

With the interest being displayed in the ocean and the envisioned riches lying therein, States are rushing to make varying claims to numerous sovereign rights with respect to this body of water. Although not supported by international law many of these claims have been defended by successfully challenging would-be intruders on these claimed sovereign rights. Given these circumstances it is conceivable that future incidents could lead to serious conflict and perhaps even to the use of armed force.

The Marine Corps has played a role in this part of the world for the past 35 years or more and will most likely continue to be on the scene in the foreseeable future. Marines, as part of the naval service and an amphibious force, could be employed in this area should conflict result. Thus it is, as a student of Marine Affairs this study affords
me the opportunity to explore further some of the many problems of the ocean and as a Marine Corps Career Officer it complements my background by familiarizing me with a strategic part of the world.

The exigencies of time preclude exhaustive research on this topic. In practically every discipline, however, the stochastic system of statistical sampling is widely accepted for drawing valid conclusions and making decisions. It is on this premise, that this paper has sampled those factors relevant to the issues and drawn conclusions from these samples. Moreover, it has been said that there are really no new scientific discoveries as such, but that all new inventions are simply an assimilation and organization of bits of already known information such that they construct a concept which heretofore had not been put forth. So perhaps it is with written works. There is essentially nothing written that is new or a revolutionary idea. And even if it were it is doubtful that it would be first accepted without being repeated many times and in various forms to really be digested and judged relevant and practical.

I wish to express special appreciation for the advice and assistance of Dr. Lewis M. Alexander. The assistance of Miss Dee Ward for many hours of typing, editing and copying is greatly appreciated. And finally, a good many of the issues in this paper derive from the opinions of the researcher drawn from experience and study over the years. Acknowledgment, therefore, is extended to those who have contributed to the moulding of these thoughts.
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majority, are envisioned as being within the surrounding waters.

To the politician it is a Southeast Asian plum occupying the spotlight in the struggle for influence within the area; a region that controls the spigots between the Indian and Pacific Oceans and forms a stepping stone between the continents of Australia and Asia.

To the publicist, and especially one who deals with the Law of the Sea, it is an area that gives rise to legal questions and international disputes which occupy his thoughts and exercise his wits in trying to consummate a satisfactory and practical solution to the problem.

But more importantly, and most probably the least considered, to the Indonesian it is home. It is a place of hope and aspiration, a place in which he will live and die and except for the very few it is the only part of the world he will ever see. To him his interests are national and what is good for Indonesia is his primary concern. He is probably given to distrust powerful countries because of the memory still lingering from the long period of colonialism from which he has recently been liberated. His map places Indonesia in the center and relegates all others to a secondary place on the periphery.

Purpose of the Study

This study will examine a particular aspect of the territorial seas question. The purpose is to explore and analyze the "archipelago theory" which advocates the drawing of baselines around groups of islands forming a perimeter inside of which the waters are claimed as internal seas. This paper will not get embroiled in the dispute
Figure 1 - Indonesia and peripheral areas
over the breadth of the territorial sea which has received more than adequate analysis in the past few years. Rather, the purpose is to examine the uniqueness of the method of drawing the baselines. It will discuss Indonesia's claim to territorial waters and attempt to assess its legal aspect in terms of international law. An examination will be made in relation to the economic, political, and military factors. From an analysis it will attempt to develop some general and valid principles for determining methods for delimiting the territorial seas of similar countries or regions under varying circumstances.

Organization of the Study

The approach that this study will take is to define the problem, through a methodical examination of the different factors, in order that the complexities and nuances may be understood. This Chapter has introduced the subject. The Second Chapter will be devoted to setting forth a more detailed definition of the problem. Next will be a geographic orientation of the area, which may appear to be extensive for a paper such as this. It is necessary, however, to describe the entire island area, water area, and its people and their livelihood and to analyze its economic and habitable features in order to determine its dependence on the sea and the sea's capability to contribute to its future development. Chapter Four will attempt to assess the legal aspects of the claim based on the principles of international law. The following two chapters will analyze the claim by considering the factors of political necessity, economic dependence, and military
security. Additionally, any facets of international law relating to these factors will be highlighted. And finally, an integrated analysis will be made, hopefully resulting in some valid principles which may be useful in solving problems of this nature that may arise in the future.

An Introduction to the Problem

Although the 1958 Geneva Conventions on the Law of the Sea reached a milestone in the codification of international law with regards to the sea it failed to stem the tide of controversy to varying claims. One such dispute concerns the territorial sea. Two aspects generally contributing to this dispute are the delimitation of their baselines and outer boundaries, and the breadth of the territorial sea.\(^1\) As a result, States have made numerous claims based on varying circumstances, the most important of which are the geographic characteristics, its economic dependence upon the sea, the need for military security and its political motivations. Indonesia has made a special claim to territorial seas called the "Archipelago Theory" of delimitation of territorial waters.

Briefly, this theory, which will be discussed in greater detail later in the paper, advocates drawing straight baselines around the outermost islands thus forming a perimeter, the areas inside of which are claimed as internal seas.\(^*\) In keeping with current practice a 12 mile territorial sea breadth was established seaward from this baseline perimeter. Since the breadth of the territorial sea has

\(^*\)For a definition of internal seas, see p. 9. Also see Figure 2.
been widely debated and is not a peculiar problem to archipelagos, this facet of territorial waters will not be discussed. It is the method of baseline construction in the delimitation of the internal waters that is peculiar to the theme and it is on this problem that this paper will dwell.

Limitations of the Study

A basic limitation of the study, as is probably true with any study, is the inability of the researcher to be completely objective, free of some pre-conceived opinions. These result from being a part of a culture, a way of life, and a system which promotes loyalty to a certain State. Of course this happens in all cultures. It awaits the diplomat in negotiations to attempt to strip away these prejudices and come to an agreement based on the concept of what is good for mankind and not just good for a kind of man. Moreover, as a layman, the legal assessment may not coincide with the views of expert witnesses of international law. Every effort has been made, however, to rely on the opinions of text writers and prior Court decisions as evidences of the law.

Of necessity, the question of the bi-polar world—Communist vs Non-Communist—will be highlighted. The reasoning for this judgment is that it is a part of the real world and cannot be ignored when matters of a political or military nature are considered. And in the foreseeable future differing political views are likely to adhere. Again it is at the conference table where these matters are to be compromised.
This researcher, leading with the above caveat, has tried to make an objective study setting aside as many of the prejudices and pre-conceived opinions as possible.

Assumptions Underlying the Study

From the researcher's viewpoint it is assumed that the claim was based upon a fundamental conceived necessity and not from the viewpoint of political blackmail. As a relatively new Asian Nation born out of Colonialism it is assumed that Indonesia is as eager to accept the responsibilities as she is willing to receive the rights that international law confers on her. And finally, it is assumed that the claimant is genuinely interested in seeking world peace and developing a better world community.

A Few Definitions

Baseline—A term used in the international law of the sea to indicate the reference line from which the outer limits of the (territorial) sea and other offshore zones are measured; the dividing line between inland waters and the (territorial) sea.  

Normal Baseline—The line following the sinuosities of the low water mark, except where indentations are encountered that fall within the category of true bays, when the baseline becomes a straight line between headlands.

Straight Baselines—A system of straight lines drawn along a coast between salient points—without following the sinuosities of the low-water mark—from which the territorial sea is measured. The system is permissible where certain geographic situations obtain.
Territorial Sea--The water area bordering a nation over which it has exclusive jurisdiction, except for the right of innocent passage of foreign vessels. This water area is measured from the applicable baseline outward to a distance not clearly established by international law.

Internal waters--The waters of a country, both tidal and non-tidal, that lie landward of the (territorial) sea ... over which the nation exercises complete sovereignty.

Internal Sea--The water area enclosed by drawing a baseline around a group of islands thus forming a perimeter inside of which is contained a unity of land and water, over which the State exercises complete sovereignty, except where the State declares an exception.*

Territorial waters--Includes the territorial sea, internal waters, and the internal seas of a country by drawing a baseline around the perimeter of its land and water areas.

*This Internal Sea and Territorial waters concept is based on the Indonesian claim. See Appendix II for a detailed discussion.
CHAPTER II

DEFINITION OF THE PROBLEM

It is an old adage that there is nothing worse than the sea to confound a man, be he ever so strong. Homer, *Odyssey*

Territorial Sea and Problem

In analyzing the problems attendant to the many disputes regarding the territorial sea it is perhaps wise to review pertinent parts of the document that has generated a good deal of the controversy. This is the Convention on the Territorial Sea and the Contiguous Zone adopted in 1958 by the United Nations Conference on the Law of the Sea in Geneva. The delegates to the 1958 Conference on the Law of the Sea desperately tried to establish a universal limit to the breadth of the territorial sea. Compromise was beyond question and the Convention limits the territorial sea by stating:

The outer limit of the territorial sea is the line every point of which is at a distance from the nearest point of the baseline equal to the breadth of the territorial sea.

It is evident that such a refinement on measuring the limits of the territorial sea would leave everyone to their own interpretation as to just what the breadth of the territorial sea should be. It is like answering the question of, "how high is up?", by saying that it is two times half the distance.

Naturally, since the breadth of the territorial sea is measured from a baseline it is a foregone conclusion that the question of what
constitutes a baseline must be answered. Again, the Convention was able to draft a great deal of ambiguity in its wording. In regards to baselines the Convention states:

Except where otherwise provided in these articles, the normal baselines for measuring the breadth of the territorial sea is the low water line along the coast... (or) in localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity, the method of strait baselines joining appropriate points may be employed... (or) where the method of strait baselines is applicable... ...account may be taken, in determining particular baselines, of economic interests peculiar to the region concerned, the reality and the importance of which are clearly evidenced by a long usage.

Thus it appears that the Convention tried to establish some latitude for determining baselines based upon the varying conditions of different States. In the furtherance of this precept the Convention specifically took islands into consideration by stating:

An island is a naturally formed area of land, surrounded by water....and the territorial sea of an island is measured in accordance with the provisions of these articles.

Since each island has its own territorial sea, in the case of a group of islands--an archipelago--belonging to one State it can be fragmented by having areas of the high seas in and around its land territory.

Underlying the many disputes on determining the territorial sea is the idea of sovereignty. Sovereignty gives a State the right to exercise supreme law-creating and law-enforcing authority within its sovereign territory and it is free to manage this territory according to its discretion. The Convention establishes sovereignty over the territorial sea by stating:

11
The sovereignty of a State extends, beyond its land territory and its internal waters, to a belt of sea adjacent to its coast, described as the territorial sea. It is only natural that a State would wish to exercise sovereignty over that territory which in its estimation is vital to its interests, be it economic, political or military security. In this regard, the thesis has been advanced that each nation is free to determine the limit of its territorial waters because that nation alone is in a position to determine its national interests.

Intrinsic to the problem of determining the limits of territorial waters is the idea of freedom of the seas. Whereas there is no freedom of the seas in internal waters, freedom of the seas in the territorial sea is limited to the right of innocent passage. The 1958 Convention attempted to clearly indicate that innocent passage was a right enjoyed by ships of all nations. It did, however, outline general prudent rules to be followed by the transiting ships and gave the State broad latitude in preventing passage by regarding passage as innocent "so long as it is not prejudicial to the peace, good order, or security of the Coastal State." It is evident that "prejudicial to good order" can limit innocent passage to the will of the State.

However much the 1958 Geneva Conventions on the Law of the Sea accomplished, the breadth of the territorial sea defied solution and again in a 1960 Conference the matter could not be settled. Thus the determination of a State's territorial sea is a debated subject of controversy that has defied solution despite the efforts of three
CHAPTER III

GEOGRAPHIC ORIENTATION

Ay, many flowering islands lie
In the waters of wide Agony.
Shelley, Lines Written Among
the Fuganean.

THE LAND AND ITS ENVIRONMENT

Area Description

Indonesia is the world’s largest archipelago extending across the equator from longitude 95 degrees to 125 degrees, and from 1 latitude 6 degrees North to 10 degrees South. Sprawled along the equator for over 3,000 miles it forms a series of water-gates between the Pacific and Indian Oceans and a bridge linking the Asian mainland to the northern tip of Australia. Stretching for more than 1,200 miles north and south it connects Australia to the Philippines by another series of island stepping stones. Within this archipelago are 13,677 islands, of which 6,044 are inhabited. There are a few of the islands that are as large as some U.S. western states, but hundreds no larger than a farm in New England and some are merely mud flats. The largest are Sumatra and Java, forming the first two stepping stones off the mainland of Southeast Asia. West Irian occupies the western portion of New Guinea; Kalimantan the southern portion of Borneo; and Sulawesi lies directly south of the Philippines. Indonesia is a very big country comprising a surface area of some 737,000 square miles. It is the third largest Asian country after Communist China
and India and among the thirteen largest countries in the world being
twice the size of Alaska and nearly eight times that of the United
Kingdom. With its inland seas included, it covers nearly 4 million
square miles—an area greater than the land surface of either China
or the United States—thus making the Indonesian archipelago the largest
island complex in the world. With 19,784 nautical miles of coast-
line she ranks third behind Russia and Australia.

Indonesia is also regarded as one of the most regionally frag-
mented of nations. In the Archipelago twelve major regions may be
identified by equating them with major population centers, the most
important being Central and East Java. The other eleven are, from
west to east: Atjeh, Tapanuli, East Sumatra, Minanghaban and Palembang in Sumatra; Sunda in West Java; West Kalimantan (Borneo) and
Bandjar in Southeast Kalimantan; Bugis-Makassar area (South Sulawesi or Celebes), Minhasa in Northeast Sulawesi; and Ambon in South
Maluku (Moluccas). *

Physical Characteristics

Indonesia's topography is one of marked contrasts. The most
extensive mountain system extends from northern Sumatra near its
west coast and curves eastward across southern Java. The section in
Sumatra known as the Barisan mountains rises to 12,467 feet at Mount

* There are actually eighteen population centers in the Archipel-
ago. Among the remaining six, Bali and Madura have been closely
identified with Central and East Java. Lombok, East Sumbawa and
East Flores never played significant roles in the history of the
Archipelago. Ternate and Tidore in Northern Maluku, although his-
torically significant, are very small and have lost much of their
importance. See Nawawi, "Stagnation as a Basis of Regionalism: A
Lesson from Indonesia", *Asian Survey*, December, 1969, p. 935
Kerintji, south of Pedang. Java and Lombok both have volcanic cones which rise to 12,061 and 12,224 feet respectively. Broad plains lie east of the Barisan Mountains in Sumatra, north of the volcanic mountains in Java, and in several parts of Kalimantan. Huge tracts of the Sumatra lowland are useless swamps and Kalimantan is fringed on its southern and western coasts with a similar swamp-belt with its interior non-volcanic ranges rising to about 6,000 feet. West Irian is predominately low and swampy; however, there are peaks rising to above 16,000 feet. Sulawesi rises to several thousand feet within a few miles of its coast and Mount Rantemario, in the center is 11,000 feet. Elsewhere, most level land is found on coastal fringes of mountainous islands. Java's mountains, however, are separated by wide valleys and broad alluvial plains, and there is only a narrow swamp-belt along the coast.

Since the Indonesian islands are characterized by rugged mountains along their western margins they literally have their "backs" to the Indian Ocean. Without exception, the southern chain of the Indonesian islands, from Sumatra through Java and eastwards to Timor, all have rugged, inhospitable southern coasts while all major ports and coastal settlements lie on the north.

Climate and Vegetation

The area is classified as a tropical environment and the greater part of Indonesia as maritime equatorial, with consistently high temperatures and heavy rainfall at all seasons. Temperature is relatively constant throughout the year, the entire region hardly
varying beyond 10 degrees of 90 degrees Fahrenheit. If Indonesia
did not have a great variation in elevation, its climate would be
uniformly oppressive because of its equatorial location and conse-
quently high temperatures. The heat and humidity of the coastal
areas gives way to more moderate temperatures as the altitude rises
to breathtaking heights. Although Irian is predominantly low and
swampy, as is Kalimantan, there are mountains that are snow-covered
throughout the year.

From June to October the area is under the influence of the
south-east monsoon originating from Australia and changing direction
over Indonesia to become the south-west monsoon. It brings little
rain and is known as the dry season. The north-east monsoon origin-
at ing from the South China Sea and Western Pacific becomes westerly
upon crossing the equator and is known as the rainy season. Although
rainfall is varied in amount and regularity from island to island
it is extremely high averaging from 68.3 inches to 126 inches per
year.

Although in the lowlands there are numerous tidal swamps, tropical
evergreen rainforests are prevalent. Sumatra and Kalimantan have some
of the most richly developed tropical evergreen rainforests in all
of Southeast Asia. The trees range from 100-180 feet or more, and
present a dense intertwined canopy which is crowded with a profusion
of climbing plants and undergrowth. Generally, as altitudes increase
and yearly rainfalls decrease the vegetation turns to a less thickly
scattered and generally larger and harder wood. Bushwood and shrubs
cover the mountain tops. The sandalwood tree and bamboo are extremely
important to the area.

THE WATER AND ITS CHARACTERISTICS

Area Description

Indonesia's straight baseline method of determining her territorial sea would cause over 3 million square miles of ocean to be classed as internal waters. Lying entirely within these waters are some fifteen straits. Two additional important straits lie partly within her territorial sea and separate Indonesian land areas from other sovereigns—the Strait of Malacca between Sumatra and West Malaysia and the Ombai Strait between Alor and Portuguese Timor. Wholly within this water area lie two great seas of the world, the Java between Kalimantan (South Borneo) and Java in the west and in the east the Banda Sea surrounded by the Lesser Sundas, Sulawesi (Celebes) and the small islands of Buru and Ceram. North of the Banda Sea lie the smaller Ceram and Molluca Seas rimmed by west Irian (west New Guinea), northern Sulawesi and Aepulauan Talaud just south of the Philippine Islands. The claim encompasses parts of the continental shelf of the Celebes Sea along the northern coast of Sulawesi and the northeastern coast of Kalimantan. The area also encompasses the southern portion of the South China Sea rimmed by Kalimantan (Borneo) to the east, the small islands of Natuna Besar and Depulauan and Anambas to the north and the Bintan Island lying off the Coast of Singapore and west Malaysia. Two lesser seas, the Bali and Flores, form the waterway connecting the Java and Banda Seas.*

*See map of "Southeast Asia" prepared by the National Geographic Society for The National Geographic Magazine, (Washington: Cartographic Division, December, 1968)
Continental Shelf

The Sunda shelf, which has been described as the core of South-east Asia forms the geological link between the mainland and the offshore islands of Indonesia. It is the largest continental shelf in the world, with a mean sea depth of only 120 feet. Not only does a part of this shelf located in the South China Sea fall within Indonesia's internal waters, but the greatest portions fall within the Java Sea which is more than 800 miles from west to east and has a breadth of 250 miles. To the east is another great physical unit, the Sahul shelf, the northern extension of the Australian continental mass, which includes New Guinea south of its central east-west mountain range. In between these two shelves lies a complex of arcs and knots enclosing some twenty deep sea basins, which together form a mediterranean sea between the Asian and Australian continental blocks similar to the one between Europe and Africa.

Currents and Tides

The currents along the entire length of the west coast of Sumatra are generally weak, their velocity not exceeding one-half to three-quarters of a mile per hour. The currents are very rapid in the narrow channels between the Lesser Sunda Islands. In the Strait of Sunda, between Sumatra and Java, they attain a velocity of three and a half miles per hour.

*Also see, "Map of the Pacific Ocean Floor" prepared by the National Geographic Society for The National Geographic Magazine, October, 1969.
Surface currents in the Sunda Sea are westward for eight months, September through May, and are reversed during the remaining months. They range from one to 15 nautical miles per day. The tidal currents range from a maximum of 5 feet at the south entrance of the Bangka Strait to 7 feet in the Sunda Strait. Tidal range in the sea is from 1/5 to 3 feet. Surface currents in the Banda Sea are generally in an easterly direction from December through May and shifting to a westerly direction the remainder of the year. They range from one to 25 nautical miles per day. The maximum tidal currents are between 7.9 and 9.3 knots in the Straits through the Sula Islands. The tidal range in the South Banda Sea is 6 feet. In the Molucca Sea, from November through May, a surface current of 10 nautical miles per day flows southwestward along its eastern margin. In the west half of the sea the current flows in the opposite direction at 10-12 nautical miles per day. The north half of the sea has east-southeast directed currents at 15-25 miles per day. Tidal range amounts to 5 feet.

THE PEOPLE AND THEIR LIVELIHOOD

Population

With a 1969 estimated population of some 118 million people, Indonesia is the fifth most populous nation in the world. According to the 1961 census, the annual average rate of growth of population between 1951 and 1961 was estimated at 2.2 percent. The population is heavily concentrated in Java, making that island one of the most densely peopled areas in the world with a 1967 estimate of 72,600,000 or 650 persons per square mile. The extremes of density are
represented by some parts of Java where densities exceed 2500 per square mile and parts of Kalimantan where densities drop below one-thousandth of this figure. The problem of transmigration is one of Indonesia's top priorities and the overpopulation of Java was to have been dealt with in 1965 by a large-scale scheme which aimed at resettling approximately 500,000 persons. However, in the first six months of 1965 only 27,168 people had been resettled.

Agriculture

About 80% of Indonesian workers are engaged in agriculture and contribute at least 51% of the country's national income. Approximately 42 million acres or only 7.4% of the total land area, are under cultivation, with 35% to 40% of the cultivated land devoted to export crops. Three-fifths of the cultivated land is in Java. There are two main types of farming -- estate farming and small holdings. Estate farming is carried out on plantations producing primarily for export. The principal crops are rubber, sugar, palm-oil, tea, palm-kernels, coffee and tobacco.

Small holders agriculture is usually carried out at subsistence level and both food crops and commercial crops are grown on small holdings. The main food crops are rice, corn, cassava and sweet potatoes. About 20% of the small farmer's crops, the principal ones being rubber, copra and sugar, are cash crops for export.

Indonesia's forests could be very promising. There are estimated to be 240 million acres of forests or two-thirds of the land area of
Indonesia. Seventy four percent of the forests are in Kalimantan and eastern Indonesia, 24% in Sumatra and 2% in Java and Madura. Indonesian timber can bring a considerable addition to the country's income, provide jobs and encourage people to move from over-crowded Java.

Java and Bali are blessed with rich volcanic soil but the other islands, on the whole, have less fertile soil. Torrential rainfalls that occur during the monsoon season wash away old soil and expose an even richer volcanic ash and dirt which is fertile almost beyond belief.

Living and Natural Resources

Just as this region is the world's richest in plant species, so the waters around and between the islands of the archipelago harbor more edible species of fish than anywhere else on earth. The inland seas contain some of the best fisheries in the world. It is estimated that 7 million tons per year could be taken from the surrounding waters without depleting the resources.

The archipelago possesses vast natural resources which promise well for future development. Indonesia is the chief petroleum producer of the monsoon region and ranks ninth among world oil producers even though no more than three percent of the exploitable area has been intensively surveyed. The Sunda shelf probably is one of the largest off-shore petroleum reserves in the world. Foreign companies are rushing to the area in great numbers for the purpose of exploration. Already there are seven producing wells in the Java Sea area.
And oil production increased about ten percent per annum during the period 1960-1967. There is reason to believe that other minerals, as well, exist in the surrounding waters.

On land, there are valuable deposits of tin, reasonable iron ore deposits, significant quantities of bauxite, and an unassessed range of minerals including gold, silver, copper, nickel, lead, zinc, manganese, salt, sulphur, and phosphate.

Insular and Ocean Industry

Indonesian industry is in its infancy with small-scale industry such as hand-made umbrellas, sarongs and cloved cigarettes dominating. Only about five percent of gainfully employed persons work in industrial plants with ten or more workers. Oil and bauxite output, and to a lesser extent, nickel, gold and silver are the prevalent mining industries. Coal and manganese mining, a particularly important sector previously, has been declining for the past two years.

Fish is the chief source of animal protein in the Indonesian diet. Sea fishing is practiced for the most part in primitive sailing vessels and small motor boats. Production has been steadily increasing, however; in 1967 it was 638,000 tons and 762,000 tons in 1969. The surrounding waters are one of the great fishing areas of the world and the fishing industry is capable of large-scale development. Due to primitive methods in the industry, however, the fishermen still remain in poverty.

Offshore oil and gas production, especially on the Sunda shelf, could become one of the best industries in the future.
Figure 3 - Indonesian Geographic Features
Indonesia is a big country but fragmented, not only culturally and ethnically, but more important geographically. The many islands, some of which are divided by hundreds of miles of open sea, present a formidable problem in communications, transportation and distribution of goods and services. Of the land area many square miles of the surface are extremely poor and unsuited for agriculture. Rough volcanic mountain terrain prevails on a number of islands and the mountain chain along the Indian Ocean interface virtually eliminates an ocean economy from the western side of the Sunda Islands.

On the other hand the seas around the islands have potential. The continental shelf is one of the most extensive in the world and could provide Indonesia with enormous wealth. Unity of the country may very well hinge on the ability to transcend the great water barriers to unite the country as one-state, one-territory and one-area, enclosed by a single boundary.

The waters in and around the many land areas may permit bridging and tunneling to connect these surface entities as a continuous economic module. It is now technically feasible to build bridges across wide, deep waterways. As an example, a design study confirmed this concerning the Strait of Gibraltar which is about eight miles wide and as much as 2,800 feet deep. Currents are sometimes faster than five knots and winds up to 60 knots have been recorded. Moreover, the U. S. has linked the Florida keys with a series of spectacular bridges and spanned the Chesapeake Bay for a distance of 17 miles using
a combination of bridges and tunnels. Of course this is an exceedingly optimistic outlook based on Indonesia's financial position, Gross National Product, and low standard of living. It is, however, very well within the realm of possibility.
CHAPTER IV

ASSESSMENT OF THE LEGAL ASPECTS OF THE CLAIM

Tis not juggling that is to be blamed, but much juggling, for the world cannot be governed without it.

John Selden, Table-Talk: Juggling

A Basis for the Claim

In assessing the right to the decreed method of the delimitation of internal waters the Indonesian government in an explanatory memorandum* stated, inter alia,

(1) that the main objection of the traditional method of determining the territorial sea, whereby each island had its own territorial sea, was that it did not take into consideration the specific nature of Indonesia as an archipelago,

(2) that according to history, since time immemorial, the Indonesian Archipelago has been a unity, and that the seas between the islands are an inseparable part of the country, and that

(3) for economic reasons the Indonesian people require fish to supplement their diet, and the natural resources in the form of minerals for the welfare of the Indonesian people, and therefore, it is necessary to utilize and keep in reserve the potential resources in the sea.

Drawing the Baselines

The 1958 Convention on the Territorial Sea and the Contiguous

*For the precise language and explanation by the Indonesian Government, see Appendix I.
Zone established two methods for determining the baseline for measuring the breadth of the territorial sea. First, and the most widely accepted is the normal baseline method. In this instance, the baseline is "the low-water line along the coast as marked on large-scale charts officially recognized by the coastal state."

Secondly, straight baselines may be used, contingent upon the following conditions:

(1) "where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity,"

(2) "they must not depart to any appreciable extent from the general direction of the coast, and the sea areas lying within the lines must be sufficiently closely linked to the land domain to be subject to the regime of internal waters."

In specifying the above criteria, however, the Convention stated that "economic interests peculiar to the region concerned," may be taken into consideration, if they are "clearly evidenced by a long usage."

It is this last method of drawing baselines that leads to multiple interpretations and generates conflicts and disputes among the many diverse interests of nations. This has probably resulted from prior decisions of International Courts and the opinions of expert witnesses being influenced significantly by the varied characteristics of the coastal state. It is these prior decisions and documented opinions that will now be examined.
results in a boundary dispute. This is so since Indonesia claims sovereignty over areas heretofore regarded as high seas. The dispute, however, becomes not merely a boundary dispute between adjoining nations but of worldwide significance.

Historically, the vital interests of a nation have revolved around the maintenance of its territorial integrity. There is evidence that this element is considered to be a factor in the determination of a claim based on "historic waters". In a study prompted by the U.N. Conference on the Law of the Sea in 1958, one conclusion was that "an essential element in the determination of the right to "historic waters" is the question of the vital interests of the coastal state in the area claimed". Since vital interest is an issue in foreign relations and an issue to be determined by the political processes it follows that the claim is again influenced by politics. Moreover, it is assumed that Indonesia looks upon the claimed waters as being vital to her territorial integrity.

Indonesia's Political Policy and Control

To achieve a degree of internal stability the country must have a mature political system which can maintain effective control over the entire territory. Geographically, as well as ethnically and culturally, this is one of the most fragmented countries in the world. Political jurisdiction, with its fragmented territory, is largely concentrated in a "center" with very little influence exerted on the periphery. This can probably be traced to the practices of colonial administrators and advisors finding the difficulty of extending
effective control to the far-flung islands not worth the effort. Thus the colonialists concentrated on hardening the "center", neglecting, as both their predecessors and successors have done, to build out to the fringe on a sound political basis.

Territorially, Indonesia is a nation, but at present lacks the administrative organization to effectively control the remote areas lying outside the political perimeter. Neither are her military or police powers adequate nor are the incentives great enough to entice service in many of these remote areas. Moreover, the inhabitants of these remote areas have been accustomed to being left alone, and now view political control as unwarranted interference. Communications, education, and technology are important means for improving the administrative structures. Additionally, in an effort to correct this situation, Indonesia has endeavored to achieve unity by promoting nationalism.

From its inception the Indonesian nationalist movement saw itself as a part of a world-wide movement against colonial rule. This has instilled Indonesian nationalism with a deep sense of affiliation with the fight for independence elsewhere. She has attempted to throw off the colonial yoke in whatever form and under whatever name even if it should be detrimental to her own interest. Among many of the new nations that were former colonies this is a prevailing

* For an important discussion on the boundaries of Southeast Asia and the problems of political and administrative control caused by the colonial powers constructing arbitrary boundaries based on prominent geographical features see Solomon, "Boundary Concepts and Practices in Southeast Asia," World Politics, October 1970.
attitude. Their theme is that international law is a product of imperialism in which they had no decision-making authority and therefore it does not lend itself to ready adoption by them.

Consequently, Indonesia's claim of territorial waters could be motivated by her nationalism and her attitude that international law is a product of colonialism. This nationalism also engenders a fear for her territorial safety. Moreover, Indonesia believes that "welding together various ethnic groups spread over a number of islands, with different histories, different religions, and different degrees of exposure to the colonial experience, nationalism can be said to have laid the foundation of modernization".

Indonesian nationalism has also promoted the idea that she is the rightful protector of Southeast Asia. Her foreign policy advocates working toward the establishment of regional cooperation in this area for the sake of mutual development as well as for political ends. A primary reason for regional cooperation is the necessity for modernization. She believes that the developing nations themselves have the primary responsibility for accelerating the speed of their recovery and improving their standard of living. And, there are those today who believe that Indonesia is ready to assume a role of constructive leadership in this area. Thus prompted by probably the strongest political force in Indonesia--nationalism--the claim can be viewed as contributing to Indonesia's feeling of "manifest destiny" in this area.

As a political expedient the Indonesian government has nationalized, thus far without compensation, foreign industry. In 1964
the 104 British-owned plantations were confiscated without compensation and are now being managed by Indonesians. In February 1965, the US-owned plantations were confiscated, and a decree of 24 April 1965 placed all foreign enterprise in the country under the control and supervision of the Indonesian government. In March 1965, the government announced a takeover of all foreign-owned oil companies to continue operations under Indonesian control and supervision. Although there are indications that Indonesia may make reparations in the future, this does not necessarily reflect the attitude of future political entities. Today, the Indonesian oil industry, and presumably future mining, is concentrating in off-shore exploration and exploitation in what is now claimed to be internal seas. This fact could materially aid Indonesia to nationalize these industries if she so desired. In any event it gives her a greater degree of control based on the sovereign rights the claim would award.

MILITARY

A Basis for the Claim

Another basis for the special claim of territorial seas was based upon military considerations. The official explanation detailed the following aspects in attempting to justify the claim on the basis of military necessity:

(1) the structure of the territory makes the task of controlling the sea extremely difficult. With both national waters and open seas

* For the detailed explanation see Appendix II
between the islands military control was complicated by the fact that the right to act depended upon their location.

(2) A war between two parties, with their fleets moving freely between the islands would jeopardize the country by:

(a) disrupting communications between the islands
(b) endangering the inhabitants of the islands in the surroundings of the open sea should a naval engagement occur

(3) Hinder the maintenance of neutrality

Legal Aspects of Military Security

In its judgment, rendered on 9 March 1917, the Central American Court of Justice in the Gulf of Fonseca case stated that it was an indispensable necessity that the riparian States concerned "should possess the Gulf as fully as required by those primordial interests and the interest of national defense."¹⁰*

Some authors have in part based their opinions on the necessary criteria to be used in judging control over certain waters, on the need for military security. In his dissenting opinion in the North Atlantic Coast Fisheries between Great Britain and the United States, Drago stated that when a "country has asserted its sovereignty over

⁴This gulf is bounded by the territories of Nicaragua, Honduras and El Salvador. By a Treaty of 5 August 1914 the United States granted Nicaragua certain rights over the bay including the right to construct an interoceanic canal. El Salvador disputed the claim. The Central American Court of Justice ruled that it was an historic bay and the exclusive property of El Salvador, Honduras and Nicaragua.
the water, and particular circumstances such as geographical configuration, immemorial usage and above all, the requirements of self-defense, then the claim is justified.

In its reply to the Preparatory Committee of the Codification Conference of 1930 on the subject of historic bays, Portugal stated that "considerations which justify their claim are the security and defense of the land territory and ports, and the well being and even the existence of the State." At various times in history, States have designated several zones of the high seas for special uses or purposes, sometimes to the prohibition of use by other States. Prior and during World War II the United States and the South American Countries designated security zones off their coasts, portions of which extended as far as 1200 miles. In the fifties, the United States designated a 400,000 square mile area in the Pacific Ocean for hydrogen bomb tests. Included within the area were a number of islands held under a strategic Trusteeship Agreement with the United Nations.

Although there has been disagreement as to the legality of such a claim under international law, Professor Carl M. Franklin, occupant of the Naval War College Chair of International Law during part of the year 1959-60, argues that a state has a legal right for such a use and sights McDougal as a basis for his argument. Franklin advanced the thesis that "while the claim of a State to use a designated area of the high seas for nuclear weapons testing is relatively recent and unprecedented, for the obvious reason that science and technology did not create such weapons until 1945,
this new, emergent use of the high seas is a reasonable one. It is reasonable because it is a necessary requisite of self-defense. As McDougal has rightly concluded,

"The claim of the United States is in substance a claim to prepare for self-defense....It has not been possible to establish, under the United Nations or otherwise, either effective international control of armaments or commitments and procedures of global scope which offer reasonable assurance against aggression....The United States has undertaken its program of atomic and thermonuclear weapons development to ensure that these free nations are not lacking either in the retaliatory power which may deter aggression or in the weapons of self-defense if deterrence fails. In this posture of world organization and crisis, which puts so high a premium on self-defense, with authorization of potentially the most drastic interferences with others, it cannot, we suggest, be reasonably concluded that it is unreasonable for the United States to engage in such temporary and limited interferences with navigation and fishing as are involved in the hydrogen bomb tests, in preparation for the defense of itself and its allies and of all the values of a free world society.*

'Certainly the objective of defending all the values of a free world society is as important as, and indeed includes, the traditional uses of the high seas for navigation, fishing, cable laying, etc. Security is the keystone in the arch of all free world values and to be secure the United States and her allies must continue to test and perfect every type of defense weapon even though, it is to be hoped, these weapons never have to be used in defense of the Free world."13

If this be the case then it is not unreasonable for Indonesia to be genuinely interested in her own self-defense.

Indonesia's Problems of Military Security and Control

While continuously submerged, the nuclear-powered submarine Triton, in 1960, passed through the Mindanao Sea and Sulu Strait of the Philippines, through the Celebes Sea and Makassar Strait in Indonesia and passed through the Lombok Strait between Lombok and Bali. This journey carried the Triton through waters claimed by Indonesia as internal and should this claim be recognized then by the rules of international law the passage would have been illegal. This points up a problem of security facing Indonesia with the broad expanses of water between the islands. If the United States submarine can traverse these waters, so can others, be they Russian, British, friendly or enemy. Since the Indonesian claim is not recognized by the United States there was no necessity to get prior permission. A protest by Indonesia on the other hand would have been purely academic.

The Naval theorist, Alfred Thayer Mahan, by his many writings, has had a greater influence on seapower than perhaps anyone else. Among his works are the basic principles which are vital to a nation's security. In outlining these principles he stated:

"When the sea not only borders, or surrounds, but also separates a country into two or more parts, the control of it becomes not only desirable, but virtually necessary." 

*Passage through internal waters is a matter of right even if it is innocent. Even if allowed, submarines are required to travel on the surface and to show their flag. See Keith D. Lawrence, "Military-Legal Considerations in the Extension of Territorial Seas," Military Law Review, July 1965, p. 48.
Experts generally agree that it is largely to Mahan's credit that the United States became a great naval power. Granted it probably would have occurred even if he had not contributed his works toward this effort but it is advanced that it would not have taken place as early and as rapid and remained in the lead so long. Moreover, Russia's Navy is the second largest in the world today and is rapidly growing. She is expanding her naval forces throughout the oceans and exerting influence not envisioned a few years ago. It has been advocated that the architect for Russian seapower is Mahan.

If the thesis advanced by Mahan is taken to be valid, then Indonesia, more than any other country, must necessarily control the waters between her many islands. To be sure, her navy at present is too weak to be effective. A claim of internal waters, however, can serve as a political expedient in assuming some degree of control.

Historically, the territory of another state has remained sovereign only so long as that state could resist foreign influence, imperialism, or aggression. Traditionally, States have relied upon an effective military force to protect this sovereignty. The protection of land areas is inherently easier because of geography than would be the protection of large bodies of water between islands, of which many are extremely remote. It would require an astronomical maritime force to ensure the protection of the rights accruing to the sovereign. Although it may be practical to prevent economic exploitation it is doubtful that the free passage of ships could ever be controlled. To protect all the rights accruing to a sovereign might entail being
a belligerent of the entire world of which no nation is capable.

IMPACT OF CLAIM ON NAVAL FORCES

Right of Peaceful Passage*

The Government Ordinance of 1962 regarding the Peaceful Passage of Foreign Vessels in Indonesian waters permits the peaceful passage of warships through the internal waters of Indonesia as established by the 1960 Act with certain reservations.

1. Sea lanes are to be determined by the Minister/Chief of Staff of the Navy to which foreign warships must adhere.
2. To deviate from these routes requires prior notification.
3. Foreign submarines must sail on the top of the water.
4. Deviation from these provisions will result in a request that the warship depart Indonesian waters.

In explaining the Indonesian position, however, the government has stated that the right of innocent passage may be withdrawn at any time on a unilateral basis. This power of decision to grant the right of innocent passage makes it a convenience to the Indonesian government and a potential barrier to the rest of the world. It is no guarantee whatsoever.

Freedom of the Seas

The rush to make extensive claims is hardly a new one. Historically, during the sixteenth and seventeenth centuries, some nations

*Indonesia used the term Peaceful Passage vice Innocent Passage. For an official explanation of the 1960 Act see Appendix II. Government Ordinance No. 8 of 1962 regarding the Peaceful Passage of Foreign Vessels in Indonesian waters is included as Appendix III. For an official explanation of this ordinance see Appendix IV.
were claiming vast areas of the high seas. For instance, Venice claimed the Adriatic, England the North Sea, Sweden and Denmark the Baltic, Spain the Pacific, and Portugal the Indian Ocean. In 1609, Hugo Grotius, a Dutch scholar, in a brief treatise entitled *Mare Liberum*, first outlined the concept of freedom of the seas. His basic premise was that "every nation is free to travel to every other nation, and to trade with it," and that "nature has made neither sun nor air nor waves private property, they are public gifts....the sea is common to all, because it is limitless it cannot become a possession of anyone, and because it is adapted for the use of all...." As a result, but not without bitter protest, countries came to accept this principle and it developed into common practice supported by international law.

It is evident that a degree of freedom of the seas would be lost should the Indonesian claim be supported by law. The navies of the world would have far less mobility and far fewer rights in these waters than if they were high seas. Freedom of navigation on the high seas is a much greater right than the right of peaceful passage granted by Indonesia. Freedom of navigation on the high seas is hampered only by prudent conduct in respecting the rights of other users. On the other hand innocent passage can be suspended by Indonesia which, in effect, is no right of passage at all.

**INTENSITY OF CONFLICT SITUATIONS**

It is axiomatic that unilateral claims to areas of the sea that heretofore were considered high seas can lead to conflict situations.
In recent years a number of these have occurred.

Shortly after World War II, Iceland unilaterally proclaimed exclusive rights to fish in the superjacent waters of her shelf extending far out into international waters. Britain responded by deploying warships to defend her fishing fleet.

A number of United States tuna boats, fishing off the west coast of South America in defiance of the Latin American claims of 200 miles of territorial sea have been seized by warships of Peru and Ecuador. To secure their release the U.S. paid fines. Reflecting the mood of the public, many newspaper editorials advocated the use of warships to defend the fishing vessels outside of twelve miles from the coast.

By far the most well known and hotly contested dispute in recent years was the case of the USS Pueblo. This Navy Intelligence Collection Auxiliary Ship was captured by North Korea on January 23, 1968. North Korea claims a 12 mile territorial sea limit which the U.S. does not recognize. Although considerable controversy concerning the ship's position has raged, the United States signed an apology in order to secure the release of the crew. It was an established fact, however, that the ship was outside 3 miles which the U.S. recognizes as being the limit of the territorial seas under international law. This apology read in part:

The Government of the United States of America, acknowledging the validity of the confession of the crew of the USS Pueblo and of the documents of evidence produced by the representative of the government of the Democratic People's Republic of Korea to the effect that the ship, which was seized by the self-defense measures of the naval vessels of the Korean People's Army in the territorial waters....

This apology was immediately repudiated as being false and that it
was signed merely to effect the release of the crew. Nevertheless, the fact remains that the document bears the authentic signature of a person duly designated to represent the Government of the United States.

Russia likewise claims a 12 mile territorial sea limit. It is well known that she is extremely sensitive to any violations and effectively maintains control of this area. Apparently, other countries also respect this claim since there are no recorded accounts of any disputes.

Clearly, advocating a claim not recognized by other nations heightens the intensity of conflict situations by way of military confrontation. Furthermore, to effectively control vast areas of the sea requires extensive naval patrolling requiring large fleets.

MAINTAINING A BALANCE OF POWER

If we accept the thesis of a bi-polar world in which the struggle is between the communist ideology and the Free World and non-aligned nations then Indonesia is a strategic political entity. Maintaining a proper balance of power to avoid devastating military confrontation will continue to be vital to the interest of the United States. Moreover, this maintenance of a proper balance of power is of national concern to other Free World and non-aligned nations as well.

There is no doubt that the United States is politically motivated toward this part of the world. President Nixon has stated that "the United States is a Pacific Power. The United States, with its
coast reaching in an arc from Mexico to the Bering straits, is one anchor of a vast Pacific Community. Both our interests and our ideals propel us westward across the Pacific, not as conquerors, but as partners, linked by the sea not only with those oriental nations on Asia's Pacific littoral, but at the same time with occidental Australia and New Zealand, and with the island nations between.\textsuperscript{21}

It is of world interest that Indonesia develop a mature and stable political system. It is of particular interest that Indonesia develop a responsible political system recognizing her strategic location in relation to the rest of the world. Potentially, Indonesia is capable of playing a useful role in the future as a stabilizing factor in the area. A strong Indonesia could oppose politically and diplomatically Chinese attempts to establish hegemony in Southeast Asia and Soviet moves to assert supremacy in the Indian Ocean. She could also make military manpower available to the smaller countries of Southeast Asia in support of a purely regional system of collective security. On the other hand her future strength could lead to a situation inherently detrimental to other nations. Restricting innocent passage through her claimed internal seas and straits could affect world commerce. Should this effort be directed toward a disliked nation it could result in a "potent kind of political blackmail."\textsuperscript{23}

Assuming that the world continues to be bi-polar and that the free world interest is in maintaining a proper balance of power to prevent military confrontation then Indonesia is an important element in military strategy.
The Indian Ocean has long been considered a strategic body of water. For years it occupied the major concern of the colonial powers for it was the control of this important body of water that assured the maritime powers maintenance of their empires in this part of the world. It is this ocean that is the back door to Southeast Asia and the strategic key to India, eastern Africa, and much of the Middle East. One-third of the World's people live along its shores.

Of the key spots that control the vital entrances to the Indian Ocean Indonesia occupies a critical strategic position. Militarily, Indonesia is incapable of policing the waters encompassed by the claim. She is, however, potentially capable of politically controlling the vital shipping lanes throughout Southeast Asia. By controlling the waters and straits in and around the archipelago she could effectively alter the trade between all Asian countries and Africa and Western Europe.

Russia, the opposing power in the bi-polar world has recently set a course toward becoming a great Naval power. Although handicapped by geography and access to the sea, today she ranks second in seapower which is a world recognized achievement. From this fact alone it is obvious that she understands the need for a strong maritime position if she is to exert her influence throughout the world.

With this growing Navy, Russia has been reaching out. Once considered to be a U.S. "lake" the Mediterranean now supports a Russian Naval Force comparable to the U.S. Recently, she has been expanding to the Indian Ocean. Should Great Britain, who earlier announced
withdrawal from the area east of Suez, continue to contract her Naval forces, someone will obviously rush to fill the vacuum. Russia can be considered to be a prime candidate. Considering her new astuteness in the seapower concept it can be expected that she recognizes the strategic importance of Indonesia.

In the years just preceding the Communist takeover of Mainland China the U.S. foreign policy was directed toward peripheral containment. As stated by Dean Acheson, then Secretary of State, in a speech delivered to the National Press Club in Washington on January 12, 1950 the military security of the Pacific area as envisioned by this policy was a perimeter of islands around the Asian mainland. With the retrenchment of foreign military personnel from Southeast Asia the policy of peripheral military containment of China by an island chain around the Asian mainland as the outer limits of America's military presence is again being advocated.

Given these conditions the strategic military position of Indonesia is even more important. On the one hand Indonesia may be increasingly exposed to subversion from her unprotected flank on the North. Therefore, she must be a strong and viable nation capable of militarily controlling the security of her own territory. For any expansionist attitude from the mainland of Asia or a desire for control of this vital gateway to the Indian Ocean could seriously threaten the Freedom of Choice of the Indonesian nation. Moreover, Australia, one of the more peaceful nations of the world Community could be seriously threatened since Indonesia is the bridge between mainland Asia and Australia.
INDONESIA'S EXPANSIONIST ATTITUDE

Among the many factors being considered during the negotiations for Indonesian Independence in 1945 was the question of territorial boundaries. Sukarno, stressing the fact that he was not an imperialist and that in fact he had been fighting against imperialism for 25 years, did not feel that Indonesia should include only the Netherlands East Indies. He championed the cause of "Pan-Indonesia" that not only included Malaya and New Guinea, but also the Philippines. He hastened to add, however, that since the Philippines were already independent that Indonesia would respect her sovereignty. He went on to say that he did not believe Indonesia was under moral or legal obligation to become merely the heirs of the Dutch, and that Indonesia could not be strong and secure unless the Straits of Malacca were Indonesian. As regards New Guinea he believed the area should be included as a part of Indonesia because of historic claims and national security. After gaining independence there was a long period of confrontation with Malaysia. This, however, has subsided since Sukarno stepped down in favor of Suharto in 1966 after the abortive communist coup in 1965. There are, however, indications that Australia still registers some fear of an Indonesian expansionist attitude. As one Australian writer stated:

The new western security arrangements are correctly geared to maintaining the present benign multipolar international structure of the region. Implicitly Australia has given her support to Malaysia and Singapore only to defend against an expansive attitude.

Perhaps, Indonesia today, as did Sukarno in 1945 believes that control
of the Strait of Malacca, and the remaining waterways, are vital to
the security of the nation, as well as contributing to her desire
to be the dominant power in Southeast Asia.

A MODEST SUMMATION

Politically, Indonesia is making a concerted effort to unify the
country and lift it from the depths of economic depression. Unifi-
cation through nationalism and espirit de corps has been a useful
concept in this effort and is likely to play a significant role in
the future. Political stability, a viable administrative structure,
and organizational competence is a necessity for the self-sufficiency
of the nation. Unreasonable behavior on the other hand hardly justi-
fies any claim that would contribute to the establishment of an
irresponsible political entity in this part of the world.

Looking solely from the standpoint of Indonesia's military
security, the control of the waters separating the country can be
appreciated. It is only natural for a sovereign to be concerned.
Various countries, including the U.S., have at times sealed off for
restricted use large areas of the ocean. Justification has been given
that it was reasonable under the veil of self-defense. However,
Indonesia's veil may not be a ploy considering the events that are
taking place today in that part of the world. Western and European
influence has and continues to diminish, and even though it may be a
good omen, there must be responsible political and military leader-
ship to avoid chaos. And even if the Indonesian military forces
presently lack the capacity or capability to either adequately patrol
or enforce the claim should there be a desire, it does cause nations respecting international law to take political cognizance of the declaration. The U.S. Navy tacitly recognizes the claim by notifying the Indonesian government in advance of any anticipated transit of a U.S. warship through the claimed waters. She, therefore, does get a degree of political recognition. Moreover, as in previous incidents, conflict situations may be produced by Indonesia's exclusion of certain ships which in the future could per chance result in the use of force by the challenged country. In an age when nations are seeking peace and cooperation this would be an unfortunate incident, particularly since reasonable people are coming to consider the ocean to be for the good of mankind.
An Analysis

It is now time to analyze those factors which influenced the decision to make such a claim. In the beginning one is faced with the following questions:

(1) Will Indonesia's claim help unify the land and still be in harmony with the world community?

(2) Does economic dependence justify the claim?

(3) Should political interests and military necessity be considerations in determining territorial waters?

(4) Can the claim be supported by international law? and,

(5) Has the world community accepted the claim with equanimity?

Potentially, Indonesia is a strategic country in the political and military arena. Many would say that she is the pivot in the balance of power equation in Southeast Asia. However, one thing is clear. She is beset by numerous problems, of which densely concentrated population and a divided territory are uppermost.

Indonesia has thousands of islands which are deserted or only sparsely inhabited. They have economic potential, and with modern
transportation systems between the islands and other technological improvements such as cheap power and fresh water from the sea they offer some hope of economic recovery. In an attempt to distribute the people on a more equitable basis a program of transmigration has been initiated but to date this effort has met with very little success. It is perhaps technically feasible to join many of the islands by man-made land transportation structures which would encourage transmigration and contribute to island unity.

For economic viability there must exist, as does between the 50 States of the United States, a great deal of unity and a feeling of identity. To unify thousands of islands with large expanses of water between is a relatively new and unique task in itself and is one of the greatest challenges facing Indonesia. Several problems that must be solved before the situation improves are the economic integration of the widespread islands, a more equitable pattern of population distribution, extension of political influence and establishment of an administrative organization throughout the islands.

It might be argued that it is a streak of luck that a nation has a coastline and more-so for those who have extensive coastlines and that it is unfortunate that some states are landlocked. This is one of those geographical realities which tend to make countries unequal, but this is a fact of nature just as inequality among people is a fact of life. This argument could be extended to archipelagos. It's unfortunate that their land masses are not contiguous which render certain disadvantages but it is fortunate that they have access to
such large parts of the ocean. It seems only natural that a mid-ocean archipelago would want to take advantage of their fortunate features. And perhaps it is these fortunate features that can contribute most to the unity of Indonesia.

Indonesia must look to the sea to aid in economic development. Fish can be a major food product and mineral resources in the sea can make a significant contribution to export trade in acquiring foreign currency. To cope with her many problems it is important to make the small islands habitable and the surrounding waters productive to accommodate her expanding and concentrated population and increase her standard of living. This concept will be of no less importance to other already independent mid-ocean island countries and to those that may gain independence in the future. Any method that can be devised to reduce welfare dependence is for the good of all nations.

On the other hand it is important to the world and more specifically to South Asia, Southeast Asia, North Asia and Australia that the oceanways traversing the Indonesian waters remain free to world trade. Traditionally, the waterways have served as economic lifelines. And even though it is often hinted that the development of large ships which are unable to transit the shallow straits has diminished the importance of these oceanways, in the foreseeable future they will remain extremely critical to economic viability. It is feasible, and Japan is now exploring the possibility to dredge the straits to accommodate the larger ships.

Admittedly, the legal aspects of economic dependence is based upon the principle of "historic" through evidence of long usage. But
in a modern and rapidly changing world is this the overriding consideration? With the independent and largely Lesser Developed Countries just gaining composure from a long period of colonialism this test today may be outmoded and inappropriate. Many of these colonies lived in abject poverty and were never afforded the opportunity to develop the wherewithal to exploit the resources at their disposal. As a result it has been impossible for them to establish a history of long usage. Newly acquired independence ill affords the basis for such a record. History for them may be only a few years. Should the world community now hold them accountable for a failure over which they had no control? Perhaps, economic considerations should be based on future expectations of dependence as well as past dependence. It seems that this approach would be more in line with modern times.

A parallel to this view is the plight of the American Negro, who for almost two centuries had very little direction over his destiny. This was true because society did not accept the premise that he should be a part of the governmental decision making process and domestic law was not adequate to insure him that basic right. It was only through revolutionary reforms in legislation that law became a framework capable of assuring the Negro his basic rights. Perhaps too, it is with international law. Reforms may be drastically needed to assure prior colonial territories their basic rights considering their exclusion from the decision making processes for many years.

The United States, and perhaps other countries as well, have
states that must rely on aid from the richer nations for sustenance. And of the nations vieing for freedom of the sea and resisting claims that do not suit their interests are the rich maritime states. If the sea can be used to aid these welfare nations economically then it should be used even at the expense of a degree of so called freedom of the seas.

National foreign policy goals or National interests should be geared to removing potential sources of disputes in an effort to avoid future conflict. It is obvious that unilateral claims to areas of the ocean are at opposite poles to these interests. The vital interests of a country are expressed in terms of its security. Traditionally, and understandably so, the overriding concern of a nation is to exist as a sovereign. To do this requires the protection of its territory, even at the risk of total destruction of its social structure. Therefore, military security plays a major role in determining the actions of a nation. The question becomes, legally what constitutes the territory of another state? In view of the many claims to territorial waters it is this entity that may be the most hotly disputed. In the absence of recognition by international law, armed conflict may arise over this issue.

In establishing agreement on control of the ocean areas, a primary consideration should be the goal to avoid future conflict. In recent years states have to a certain extent refrained from the use of force against the territorial integrity of another nation because of violation of the United Nations Charter. Therefore, rules
should be developed whereby conflict can be managed by international organizations. Moreover, an oceanic policy must recognize that there are national, international and regional elements. A purely national approach is too narrow and could seriously undermine international stability. An approach to the determination of a law of the sea cannot be negotiated from a position of a narrow and parochial view. But it must be considered in the light of all the forces of interaction and predicated upon what is likely to happen in the future. The basic principle should be that any law of the sea is an inclusive interest shared by many and should be for the common good of the world order as a whole.

International law, it has been emphasized, is a primary means of communications between governments. In many cases, however, it has served as a mechanism for use by a nation to justify its acts which, ostensibly, are taken to be in its best interest. Occasionally, justification for a questionable action is framed under the veil of international law causing the action to appear just and moral because it was made within the unilaterally established bounds. That is, international law may be unilaterally adjusted to mean what a government would desire it to mean. And often states will interpret international law to suit their own needs and evaluate other state's interpretation in accordance with their own standards. In the case of Indonesia's claim this would appear to be so.

In reversing this trend there must be an honest and concerted effort by all nations, and especially the major powers, to respect
From a layman's point of view, under existing international law, as now interpreted, there appears to be no legal basis for such an extensive claim as that made by Indonesia. Given prior precedent and evidences of the law, however, there does appear to be legal justification for enclosing certain groups of islands as a unit rather than having each island possess its own territorial waters.

Conversely, it is contended that the 1958 Conference on the Law of the Sea erred when it failed to even approach the problem of island groups. This was probably due to the strong position of the maritime states and the reluctance of the minority archipelagic states to argue the issue based on obvious lack of support. Perhaps too, the minority views were not argued persuasively because of fear of the unfavorable political attitude that might result. Regardless, it is to the world community's interest to recognize the problems of Lessor Developed and Minority View Countries and assist them with international law to accommodate to their problems also. Only through recognizance that international law is being designed with a view of what is best for all will they support and trust international law.

A new conference on the Law of the Sea is scheduled to take place sometime in 1973. Although the agenda is not yet firm it is highly probable that the problem of the territorial sea will be addressed. Included should be the question of the territorial waters of archipelagos which was conveniently side-stepped in both the 1958 and the 1960 Conferences. Eventually, the problem must be faced by the
world community and this seems to be as propitious a time as any.

Any future conferences must accept the thesis that it is a political process and although applying the basic principles of international law it must not be driven by rigid adherence to past practices and prior international law cases. The law must be used as a means of communication to the decision-makers in the political arena. This does not mean that international law should be subservient but that it adequately responds to political negotiations in a determination to find common interests. Generally, United Nations conferences, and specifically, Conventions are a legislative process, albeit fragmented and unstructured.*

Without an accommodation to different conditions it is probably inevitable that a claim such as that by Indonesia will in time be recognized in international law by the very virtue of acquiescence by other states. Although the United States, as well as many other countries, has denounced the claim, the U.S. Navy tacitly recognizes it by giving 24 hours notice prior to transiting the waters. When Dutch ships were denied the right to transit the waters they honored the prohibition, although not without protest, albeit without resistance. The community of nations have not accepted the claim with equanimity and future incidents may not meet with such subservience.

*It is argued that part of the failure of the 1958 and 1960 conferences to reach agreement on many aspects of the territorial seas was the Traditional States strict adherence to long established international law and their failure to recognize that the conference was a political or legislative process rather than a legal or judicial process. See, Robert L. Friedheim, "The 'Satisfied’ and 'Dissatisfied' States Negotiate International Law", World Politics, October 1965, pp. 20-41.
the letter of the law and honestly interpret it so that the less powerful countries of the world clearly understand and refrain from making unilateral declarations which are only claims and are not supported by law. Contrary to popular opinion a great power is not free to do what it wishes to do as regards to the weaker nations. It has the responsibility of setting an example and projecting an image that will gain the respect rather than the condemnation of the weaker states.

Under international law the burden of proof to claim as internal waters certain maritime areas by reason of "historic" rests with the state making the claim. Indonesia's claim as outlined in the 1960 Government Regulation lists factors other than "historic", on which the claim is based. These factors have been established by international law as being criteria to be used by Courts in making Judicial determinations. Again, these are criteria and not rules which implies that they must be applied to specific cases based upon the merits of each. Thus, in addition to proving the claim on historic rights, if they actually exist, it seems that sufficient justification for a claim based on economic, military and political factors as well, must be sufficiently proved to make the claim credible. Indonesia as yet has not proved to the world community that such an extensive claim is warranted.

Unless nations can get together and discuss the problems on a realistic basis and work out compatible solutions free of ill-conceived national interests the oceans may very well be the cause of the next serious armed conflict.

A Proposal

Since present international law does not support Indonesia's position, the unilateral claim is not accepted by the world community, and therefore baselines around the entire group of islands is not a desirable solution to her problems. The method of drawing baselines so as to cause each island to have its own territorial sea likewise is not a practical solution. Admittedly, where the islands are not farther than 24 miles apart the territorial sea is continuous, but there are many islands separated by much greater distances.

A good part of the ocean bed surrounding Indonesia consists of continental shelf with an average depth of 120 feet, therefore, Indonesia already has sovereignty over the majority of the resources on the seabed by reason of the 1958 Convention on the Continental Shelf.

The 1958 Convention on Fishing and Conservation on the Living Resources of the High Seas recognizing the importance of fisheries provided that special interest be given to the coastal state in the maintenance of the productivity of the living resources in any area of the high seas adjacent to its territorial sea. Moreover, it provided that a state whose nationals are engaged in fishing the high
due to Indonesia's economic problems and her need for the living resources of the sea to feed her many impoverished people;

(2) Use of these areas for any type of military activity except for Indonesia's own security should be prohibited. There should be a prohibition on the use of the waters for any type of out-of-country military operations. This would permit Indonesia to maintain a position of neutrality in the event of armed conflict between other nations;

(3) Commercial shipping should be allowed complete freedom and commercial aircraft should be afforded overflight rights in accordance with International Civil Aviation Organization (ICAO) regulations;

(4) Submersibles should not have to surface but should give prior notice before transiting the waters.

The Malacca Strait between Malaysia and Sumatra, the Makassar Strait between Kalimantan and Sulawesi would fall without Indonesia's territorial seas. Likewise would the Molucca Sea and the Ceram Sea leading from the South Pacific Ocean to Northern Australia. The Sunda and Lombok, the two most important straits bordered on both sides by Indonesia, already lie wholly within the territorial waters as now recognized by International Law. Thus, this plan would support Indonesia's reasons for making the claim to territorial waters while leaving the maximum amount of open seas and international waterways free for world commerce.
Conclusion

To conclude is to come to the end. Presumably it should solve the problem or propose a solution. To this end the issues pertinent to the problem which were posed at the beginning are:

(1) Is a uniform and universal rule on the territorial seas practical?

(2) Should international law adjust to varying conditions of a state such as geographic, economic, political and military factors in establishing a method for determining territorial waters? and,

(3) Would a more viable approach to the territorial waters result in more responsible behavior by the many states?

It is doubtful, in fact extremely unlikely, that a universal rule that will be accepted by all nations can ever be devised that will apply worldwide. An approach to international ocean regimes must consider the historical, geographical, political, economic, and military factors which influence the decisions of states and their adherence to the rules of international law. A universal law designed to accommodate only the interests of the maritime nations will result in conflict because the Less Developed Countries and Newly Independent Countries as well as those with special interests in the sea will only insist on making independent decisions. A law of the sea must be developed which will secure the best for every nation regardless of size, geography or political alignment. And more importantly, every nation must be given to understand that this is so. Simply stated, a more viable approach is needed.
Perhaps the real solution for the delimitation of the territorial waters is not devising a uniform and universal rule of law but one of devising a framework within which a solution can be found. In this regard, the following considerations should govern the determination of the territorial waters of mid-ocean archipelagos:

(1) Where a number of islands obviously form a group, geographically and geologically, baselines may be drawn around the outermost islands with the waters in between being internal seas.

(2) Where it is technologically feasible to connect islands by man-made structures for the purpose of inter-island transportation they should be grouped together and have one territorial sea regardless of distance apart.

(3) Where island groups are enclosed by baselines, establish a system of international sea lanes through archipelagos policed by an International Naval Guard.

(4) Base economic dependence not only on "historic" through long usage but expected future dependence as well.

(5) In consonance with the relative interests of the sovereign concerned and the world community, adopt the following criteria:

(a) To reduce the dependence as a welfare nation, special delimitation of the territorial waters of mid-ocean archipelagos should be made where it is determined that a significant contribution to the economy will result.

(b) Make military security a prime consideration to protect the territorial integrity of the state. The use of the waters in,
around, and between for naval warfare between other countries should be prohibited. Likewise, prohibit the placement or the operations of weapons systems on or under the waters during peacetime.

(c) Construct a framework whereby Law of the Sea Conventions become truly living documents that may be readily amended to reflect the realities of the times.

Some Final Thoughts

Popular practice has been to extend concluding remarks to end with a philosophical note. In keeping with the current trend it is now time to finalize this humble work with a dramatization. As the journalist Ernest Gucno expressed it;

Two men looking at an optical illusion puzzle will each see clearly two totally different pictures. In fact, the picture as he sees it will be so utterly clear to each man that it will be inconceivable to him how the other can possibly conceive of it in any other manner. The vexing dilemma is not that either is wrong; it is that both, according to their lights, are absolutely right. If a third man, seated above, could explain both pictures to both men so that each could see the other's picture as well as his own, it is possible that what was the cause for anger would dissolve in a laugh. It is not enough that one see the other's point of view. Each must see the other's simultaneously.

The creation of a global philosophy above the nations of the world would provide for the conscious bloodless evolution of man, whose unconscious evolution is still being effected by war. Such global point of view is as necessary to the world as the United States is to the 50 states which compose it.

It is totally clear that nations are facing a vexing dilemma on what to do with three quarters of the earth's surface. So it is that states are laying claim to large areas of this surface based
on their own optical illusion. This doesn't necessarily make it right. It does, however, make a good many nations wrong for refusing to conceive of the problem because of ill-defined national interests. If the community of countries have recognized Indonesia as a free and independent state, then it is fair to say that the importance of the water areas in and around her many islands should also be recognized. So it may be with other newly developing insular countries.

What does freedom of the seas really mean? As now perceived is it a viable concept? Or does it merely reflect the national interests of each national? In researching for this brief treatise, I have failed to construct a satisfactory answer to the question. It is as unanswerable as the question, "how high is up?". It may well be that the oceans will eventually be divided among the nations of the world, and to accommodate international intercourse there may have to be an international system of oceanways. Man is a territorial animal and unless his instincts and habits drastically change in the future he won't be satisfied until there is some system of political and physical control over the entire globe.

Grotius espoused his theories more than 300 years ago. To believe they are immutable is to look at life through a rear view mirror or march backwards into the future.
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28. The Far East and Australia, p. 440
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13. Ibid, pp. 161-163


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GOVERNMENT REGULATION IN LIEU OF ACT NO. 4 OF THE YEAR 1960 CONCERNING INDONESIAN WATERS

THE PRESIDENT OF THE REPUBLIC OF INDONESIA,

Considering:

1. That the geographical structure of Indonesia, as an archipelago consisting of thousands of islands, has a specific character;

2. That, according to history, since time immemorial the Indonesian Archipelago has been a unity;

3. That for the wholeness of the territory of the Indonesian State, all islands and seas situated between them shall be considered as a complete unity;

4. That the determination of borders of territorial seas as contained in the "Territoriale Zee en Maritieme Kringen Ordonnatie 1939" (State Gazette 1939 No. 442) Article 1 clause (1) is no longer in conformity with the above considerations since it divides the land territory of Indonesia into parts which separate them from the respective territorial seas;

5. The necessity of promulgating a Government Regulation in Lieu of Act concerning Indonesian waters which is in conformity with the realities referred to above;

With due regard to: Article 5 clause (1) of the Constitution of the Republic of Indonesia:

Having heard: The deliberations of the Kerda Cabinet on 20 January, 1960;

HAS RESOLVED

To enact:

The Government Regulation in Lieu of Act concerning the Indonesian Waters.

Article 1
(1) Indonesian waters are the territorial seas of Indonesia and the inland seas of Indonesia.

(2) The territorial sea of Indonesia is the maritime belt as wide as 12 sea miles, the outer line of which is measured perpendicularly on the baseline, or points on the baseline consisting of straight lines connecting the outermost points at the ebbline of islands or part of islands within the territory of Indonesia with the understanding that if there is a strait with a width not exceeding 24 miles and Indonesia is not the only border state, the borderline of the territorial sea is drawn in the middle of the strait.

(3) The inland seas of Indonesia are all seas situated within the baselines as stipulated in clause (2).

(4) A sea mile is $\frac{1}{60}$ of a degree of longitude (at the equator).

**Article 2**

On the map attached to this Regulation, there are clearly defined the points and the lines, referred to in Article 1 clause (22).

**Article 3**

(1) Innocent passage in the inland seas of Indonesia is open to foreign water transport.

(2) Innocent passaged as referred to in clause (1) can be regulated by a Government Regulation.

**Article 4**

(1) This Government Regulation in Lieu of Act comes into force on the day of its enactment.

(2) Effective the day mentioned in clause (1), Article 1 clause (1) under number 1 through 4 of the "Territoriale Zee en Maritieme Kringen Ordonnantie 1939" (State Gazette 1939 No. 442), ceases to be valid.

In order that people may know of it, we hereby order the promulgation of this Government Regulation in Lieu of Act through its placing in the State Gazette of the Republic of Indonesia.

Sanctioned in Djakarta on 18th February, 1960
The President of the Republic of Indonesia

SUKARNO.

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Enacted in Djakarta on 18th February 1960
Minister of Justice

SAHARDJO.

Source: The Indonesian Revolution: Basic Documents and the Idea of Guided Democracy, The Dept. of Information, Republic of Indonesia, Special Issue 65, Djakarta, 1960
APPENDIX II

EXPLANATORY MEMORANDUM
ON
THE GOVERNMENT REGULATION IN
LIEU OF ACT CONCERNING
INDONESIAN WATERS

I. General Explanation.

Since some time ago the necessity is felt to re-examine the determination of the borders of territorial seas in conformity with the specific nature of our country as an archipelago and with the demands and interests of the Indonesian people, which territorial seas, as part of the State territory comprised of land, sea and air territories, form an important part of the Indonesian State in view of the structure of the Country which consists of thousands of islands.

The determination of the borders of territorial seas as contained in "De Territoriale Zee and Maritieme Kringen Ordonnantie" of the year 1939 (State Gazette 1939 No. 442) which under article 1 clause (1) among other things stipulates that the Indonesian territorial seas are three sea miles wide, measured from the ebb-line of the islands; for islands which are part of the land territories of Indonesia, it is felt that the sea borders are no longer in line with the present situation and need to be re-examined.

The main objection to the way of determining the territorial sea borders as referred to above is that those ways do not take consideration of the specific nature of Indonesia as an archipelago. According to the old way of measuring the territorial sea, namely measured from the baseline which constitutes the ebb-line, theoretically each island in Indonesia has its own territorial sea (the Indonesian Archipelago consists of approximately 13,000 islands of which 3000 are inhabited by people). Although certain islands which are separated from each other by less than 6 sea miles, are considered as one group, by the manner of measuring on the basis of the ebb-line, there are still some hundreds or some tens of islands/group of islands (depending on what width of the respective territorial sea) possessing their own territorial seas.

It can be imagined that such a situation makes it very difficult to implement the task of controlling the sea in a perfect way, since the structure of the territory to be controlled is so complicated. The air territory above a territory with such a structure can of course not be homogenous either. Open sea-enclaves amidst and between
islands within the territory of Indonesia, place the officials assigned to exercise control in a difficult position, as they have to watch all the time whether they are sailing in National waters or in open seas, since their right to act depends on said position.

In a war between two parties, by the moving to and fro of the fleet of both sides in the open sea between the islands of Indonesia, the wholeness of our country would become jeopardized. Communications between one island and the other which forms the backbone to the people's livelihood in view of the transportation of vital daily consumer goods, would be broken, which would cause sufferings to the people living on those islands. The consequence of a sea battle with nuclear weapons amidst the Indonesian islands, would endanger the inhabitants of the islands in the surroundings of the open sea where the battle takes place.

Apart from the risk which the inhabitants would possibly have to suffer, the question also arises as to how we can maintain our neutrality in such a situation. Further, one can imagine the difficulty in exercising control over execution of customs, immigration and health regulations in such a territorial structure.

On the basis of the above considerations, it is necessary to find a solution based on the principle that the Indonesian Archipelago is one unity, and that the seas between the islands are an inseparable part of the islands of our country.

Based on this principle, therefore, the territorial sea must be situated along the lines connecting the outermost points of the Indonesian Archipelago.

To ensure that ships can sail smoothly in and out of the country which is very important for the smooth running of our economy, and in order that we can deny the accusations by other countries as if we are hampering innocent passage, it is necessary to guarantee that "........innocent passage in the inland seas is guaranteed to foreign ships, as long as it is not endangering the sovereignty and security of the Indonesian State".

The determination of territorial seas as wide as twelve sea miles is the maximum width according to what is laid down in the draft articles of the International Law Commission on its 8th session in the year 1957.

The revision of the determination of sea waters in Indonesia as formulated in the present Government Regulation in Lieu of Act has also important consequences in the field of economy. With the new determination of sea borders, Indonesia will have sovereignty over all waters situated within the boundaries of the outerlines of the territorial seas and of the air and sea bottom and the land underneath,
thus including all the natural resources found therein in the form of fauna and flora. And in this way, also other natural resources in the form of minerals, those which have been unearthed as well as those still to be unearthed, can be secured for the welfare of the Indonesian people which year by year increase in number.

To the Indonesian people whose diet does not contain enough protein, -- even the animal protein substance in their food belongs to the lowest standard -- the natural resources in fishery are of incalculable value. Especially when we consider that other methods of meeting the shortage of protein, for instance the development of cattle breeding (live stock), are hard to conduct -- and their financing is moreover too expensive -- it is therefore necessary to keep in reserve and to utilize the potential resources in the seas. The methods of catching fish and exploiting the other sea products by the Indonesian people, is up to the present time still too primitive, and this is another reason for taking measures to the effect of protecting those natural resources.

Natural resources in the form of minerals are of no less importance for the welfare of the Indonesian people. Although it is not yet known precisely how great the quantity is of the wealth hidden underneath the bottom of the sea, it can be said for sure that this wealth must be considerable. If we regard the richness of the Indonesian islands in minerals, such as petroleum and tin which are found in the earth on the land territories of Indonesia, we can safely assume that the land underneath the sea surface which essentially is an extension of the land territories, also contains those richnesses.

II. Seriatim Explanation:

Article 1.

(1) By Indonesian waters is understood that part of the state territory which consists of water. As is known the territory of a state over which it has sovereignty, may cover:

   a. land territory -- b. sea territory -- c. air territory.

A territorial sea is the maritime belt situated on the outerline of the baseline. The baseline is the line from which the territorial sea is measured to the outside. The territorial sea is bounded as its outside by an outer limit which is drawn parallel to the baseline. The distance between the baseline and the outer limit is 12 sea miles.

In this way, what is called territorial sea is the maritime belt which is 12 sea miles wide and limited at its inside by the baseline and at its outside by the outer limit drawn parallel to the baseline.
The Indonesian state has sovereignty over this territorial sea, as regards the maritime belt itself which consists of water, its seabed and its subsoil, as well as the air above it. The only restriction to the sovereignty of Indonesia as a maritime country, is the existence of innocent passage within the territorial sea by foreign ships. Innocent passage within the territorial sea by foreign ships is a right guaranteed by international law.

(3) The inland seas of Indonesia as referred to in this clause are all waters situated in the inside of the baseline consisting of seas, bays, straits, and canals.

Differing from its sovereignty over its territorial seas, the sovereignty of Indonesia over the inland seas is not restricted by the right of innocent passage, though Indonesia itself may make restrictions of its own by providing certain facilities based on certain consideration (see below under article 3 clause (1)).

(4) Sufficiently clear.

Article 2 Sufficiently clear (see map attached)

Article 3

(1) It is necessary to guarantee sea traffic to foreign ships with a view to the importance of traffic by ships in the inland seas for our own interest (we need commercial shipping for our trade) as well as for the interest of the world community.

Differing from innocent passage by foreign ships which is a right recognized by international law, innocent passage in the inland seas is a facility purposely granted by Indonesia. As a consequence of this difference, Indonesia may withdraw the facilities granted in the inland seas, whereas innocent passage in territorial seas basically can not be harmed by a maritime state.

(2) The stipulations in this clause clearly describe the nature of traffic by foreign ships in the inland seas of Indonesia as a facility.

The stipulations in this clause are an operative stipulation of clause (1), which is the definition of a principle.

Article 4

(1) Sufficiently clear.

(2) Sufficiently clear.

Source: The Indonesian Revolution: Basic Documents and the Idea of Guided Democracy, the Dept. of Information, Republic of Indonesia, Special Issue 05, Djakarta, 1960
APPENDIX III

GOVERNMENT ORDINANCE NO. 8 OF 1962

regarding

THE PEACEFUL PASSAGE OF FOREIGN VESSELS
IN INDONESIAN WATERS

THE PRESIDENT OF THE REPUBLIC OF INDONESIA

considering: that it is necessary to introduce further provisions regarding the peaceful passage of foreign vessels in Indonesian waters.

with due regard to: 1. Article 5, paragraph 2, of the Constitution;


having heard: The discussions in the meeting of "Kerdja" Cabinet held on 27th December 1961;

DECIDED:

to establish this: GOVERNMENT ORDINANCE REGARDING THE PEACEFUL PASSAGE OF FOREIGN VESSELS IN INDONESIAN WATERS.

SECTION I

Foreign vessels in general

Article 1

The peaceful passage of foreign vessels in the internal waters of Indonesia, which prior to the coming into force of Law No. 4 Prp of 1960 constituted free seas or the sea territory of Indonesia, is guaranteed; this provision does not apply to bays, inlets and estuaries of which the mouth is less than 24 nautical miles across.

Article 2

(1) The peaceful passage of foreign vessels in this government Ordinance means sailing for peaceful purposes through the sea territory and internal waters of Indonesia.
a. from the free sea to an Indonesian port and vice versa;
b. from one free sea to another free sea.

(2) The peaceful passage (traffic) referred to in paragraph 1 is urged to follow the sea lanes described in the pilotage books for international navigation.

(3) Stopping, dropping anchor and/or cruising about without legitimate reason in Indonesian waters or in free seas adjoining the said waters is not included in the interpretation of peaceful passage as referred to in paragraph 1.

**Article 2**

The passage referred to in article 2 is considered to be peaceful in so far as it does not conflict with the security, general order, interest and/or does not disturb the peace of the State of the Republic of Indonesia.

**Article 4**

(1) In order to safeguard the sovereignty and the safety of the State, the President of the Republic of Indonesia has the authority to prohibit temporarily peaceful passage in certain parts of the Indonesian waters.

(2) The temporary prohibition referred to in paragraph 1 is carried out after an announcement has first been made by means of the customary publicity in the shipping world.

**SECTION II**

**Foreign fishing vessels**

**Article 5**

(1) When sailing from one free sea to another free sea, foreign fishing vessels are required to keep their fishing equipment in a packed state stowed away in the holds while they are in or are crossing the sea territory and internal waters of Indonesia.

(2) When sailing as referred to in paragraph 1, the foreign fishing vessels must sail along the sea lanes which have been or will be determined by the Minister/Chief-of-staff of the Navy.

**SECTION III**

**Foreign vessels for scientific research**
Article 6

Scientific research by foreign vessels in the sea territory or internal waters of Indonesia may only be carried out after permission has been obtained from the President of the Republic of Indonesia.

SECTION IV

Foreign warships and Government vessels that are not merchant ships

Article 7

(1) Before undertaking a peaceful passage in the sea territory or internal waters of Indonesia, the foreign warships and Government vessels that are not merchant ships must first notify the Minister/Chief-of-Staff of the Navy, unless the said passage is along sea lanes which have been or will be determined by the Minister/Chief-of-Staff of the Navy.

(2) When crossing through Indonesian waters, foreign submarines must sail on the surface of the water.

(3) The passage of foreign warships and government vessels that are not merchant ships outside the sea lanes referred to in paragraph 1 without prior notification to the Minister/Chief-of-Staff of the Navy, including foreign submarines which do not sail on the surface of the water when crossing through Indonesian waters, is considered as not being a peaceful passage, and for this reason they may be obliged to leave Indonesian waters forthwith.

SECTION V

Final stipulations

Article 8

This Government Ordinance comes into force on the day of promulgation.

In order that it may be known by all, it is ordered that this Government Ordinance be published in the Statute Book of the Republic of Indonesia.

Promulgated in Djakarta on 28th July 1962

THE STATE SECRETARY,

Established in Djakarta on 25th July 1962

THE PRESIDENT OF THE REPUBLIC OF INDONESIA,

Statute Book 1962 No. 36

Source: General Circular No. 3514, The British Chamber of Commerce in Indonesia, Djakarta, January 11, 1963
APPENDIX IV

OFFICIAL ELUCIDATION to Government Ordinance No. 8 of 1962 regarding
THE PEACEFUL PASSAGE OF FOREIGN VESSELS IN INDONESIAN WATERS.

I. GENERAL

The right to peaceful passage in the territorial seas of a State
is guaranteed by international law, but not in the internal waters
unless those internal waters are the result of new ways of drawing
baselines as points from which to measure the territorial seas. For
this reason the right of peaceful passage is not guaranteed in all
internal waters by international law. However, article 3 of Law No. 4
Prp of 1960 does guarantee this right of peaceful passage in the in­
eternal waters of Indonesia without any further distinction being made
between the former internal waters (i.e. the internal waters prior to
the coming into force of Law No. 4 Prp of 1960 when there was no right
to peaceful passage according to international law) and the new internal
waters resulting from the manner of drawing the baselines according to
article 1, paragraph 2, of Law No. 4 Prp of 1960 in which peaceful
passage is guaranteed.

In view of what is stated in article 3, paragraph 2, of Law
No. 4 Prp of 1960, that the right of peaceful passage will be further
regulated by Government Ordinance, it is proper that the Government
of Indonesia issues an Ordinance which distinguishes the internal
waters of internal seas, where the right of peaceful passage is
guaranteed, and the coastal waters where there is no such right of
peaceful passage.

The Government considers it necessary to issue this Government
Ordinance as the absence of well defined stipulations on the matter
in question will cause difficulties to Government functionaries at
sea. These well defined stipulations are also necessary to ensure
smooth international shipping. It is hoped that with this Government
Ordinance the rights and obligations of Indonesia in Indonesian waters
will become clearer and more definite, and thus eliminate or at least
reduce irregularities at sea by foreign vessels.

II. ARTICLE BY ARTICLE

Article 1

This article clearly states that the right of peaceful passage
of foreign vessels is guaranteed only in the internal waters of
Indonesia which prior to the coming into force of Law No. 4 Prp of 1960,
constituted the territorial seas or free seas. These internal waters are known as the "internal seas". In the former internal seas, i.e. prior to the coming into force of Law No. 4 Prp of 1960, there was no right of peaceful passage. The second kind of internal waters are known as "coastal waters".

Prior to the coming into force of Law No. 4 Prp of 1960 bays, inlets and estuaries were regarded as coastal waters if the line connecting the two points at their mouth did not exceed 10 miles. Since international law has now generally accepted a distance of 24 miles a straight line connecting the two points at the mouth of bays, inlets and estuaries, it is therefore right that bays, inlets and estuaries of which the mouth is not more than 24 nautical miles are likewise considered as Indonesian waters where there is no right of peaceful passage.

This article means also that peaceful passage is open to foreign vessels in the territorial seas of Indonesia as referred to in Law No. 4 Prp of 1960 on the understanding that the provisions in this Government Ordinance are observed.

Article 2

By peaceful passage is understood sailing from a free sea to a port in Indonesia and sailing from a port in Indonesia to a free sea for peaceful purposes, as well as sailing from and to free seas, crossing Indonesian waters. Such sailing must be made without stopping. For this reason stopping, dropping anchor and/or cruising about without a legitimate reason ("hovering unnecessarily") in Indonesian waters or in free seas adjoining Indonesian waters are prohibited, unless this is necessary in the normal interest of navigation or due to force majeure. The term "adjoining" in this article may mean 100 miles from the Indonesian waters if the Indonesian functionaries at sea consider that the stopping, dropping anchor or cruising about without legitimate reason may be harmful to the interests of Indonesia.

Article 3

The passage referred to in article 2 is permitted only in so far as it is of a peaceful nature, namely in so far as it is not against the interests of Indonesia. If the Indonesian Government considers that the passage of foreign vessels in Indonesian waters will endanger peace, security, general order and the interests of the State, the said passage is no longer considered a peaceful passage and for this reason it is no longer guaranteed.

Article 4

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The protection of the sovereignty and safety of the State at sea is the primary task of the Navy of the Republic of Indonesia as this is closely connected with the security and defence of the State. For this reason the President of the Republic of Indonesia has the authority to close temporarily certain parts of the Indonesian waters to foreign vessels if such a closure is considered necessary for the protection of the security and defence of the State. However, this closure must be carried out by means of a proper announcement, e.g. by means of "notices to seamen".

Article 5

The wealth of Indonesia is reserved for the prosperity of the Indonesian nation. For this reason the wealth in Indonesian waters is also reserved for the Indonesian nation. Foreign fishermen are not allowed to take this wealth away, either in the form of fish or in the form of other products, unless with the approval of the Indonesian Government. Consequently, foreign fishing vessels, when availing themselves of the right of peaceful passage, are forbidden to act surreptitiously. They may only cross the waters and may not take away the sources of wealth therefrom while crossing Indonesian waters. In order to see that they observe these provisions, they are required to keep their fishing equipment in a packed condition in their holds during the time that they are in Indonesian waters while sailing from and to free seas.

While sailing from and to free seas, they must observe the regulations which have been and/or will be established for preventing them from taking away the wealth from Indonesian waters. When making a peaceful passage and crossing Indonesian waters to free seas foreign fishing vessels are also obliged to sail along the sea lanes which have been or will be determined by the Minister/Chief-of-Staff of the Navy in order to prevent them from committing irregularities in Indonesian waters. If they do not observe the provisions of this Government Ordinance the sailing of the said foreign vessels is no longer considered to be peaceful.

Article 6

The Government of Indonesia, in this instance the President of the Republic of Indonesia, may issue permits to foreign vessels owned by foreign States or citizens to conduct scientific research in Indonesian waters on condition that such research may not be used to harm the defence and interests of the State. When issuing said permits the President of the Republic of Indonesia may request that a representative of the Indonesian Government joins the research in order to observe that the interests of State are not harmed. This article means also that the Indonesian Government may conclude cooperation agreements with foreign private bodies or governments to carry out scientific research in Indonesian waters.
Article 7

The Minister/Chief-of-Staff of the Navy may establish sea lanes in Indonesian waters for foreign warships and government vessels which are not merchant ships. To sail along these sea lanes does not require prior notification to the Minister/Chief-of-Staff of the Navy. However, if those vessels sail outside the sea lanes which have been or will be established by the Minister/Chief-of-Staff of the Navy prior notification must be given to the Minister/Chief-of-Staff of the Navy. Foreign submarines sailing in Indonesian waters are required to sail on the surface of the water. Should these foreign vessels not observe the provisions of this Government Ordinance, they may be requested to leave Indonesian waters forthwith as they are not considered to be making a peaceful passage.

Article 8

Requires no elucidation.

Supplementary Statute Book No. 2466

Source: General Circular No. 3514, The British Chamber of Commerce in Indonesia, Djakarta, January 11, 1963
APPENDIX V

STATE SECRETARIAT

Pres. Decree
No. 103, Year 1963

The Entire Indonesian Territorial waters Declared
As Maritime Area

I, PRESIDENT OF THE REPUBLIC OF INDONESIA,

Considering:

1. that with the enactment of Act No. 4 Prp year 1960 concerning
the Indonesian waters, the Decrees of the Governor General on the
designation of Maritime Areas (Maritieme Kringen) fail to meet the
requirements any longer, on account of which, it is necessary for
them to be revoked;

2. that for the maintenance of order and security within the
territorial waters of Indonesia, it is necessary to designate the
entire portion of the Indonesian territorial waters, as meant in
Act No. 4 Prp year 1960, as a Maritime Area;

HAVE DECIDED

To Stipulate:

Firstly:
The entire portion of the Indonesian territorial waters, as meant
in Act No. 4 Prp. year 1960, is declared as a Maritime Area.

Secondly:
As of the stipulation of this Decree, all Decrees of the Governor
General concerning Maritime Areas are declared as no longer valid.

Thirdly:
This Decree comes in force as of the day of stipulation.

Stipulated in Djakarta
On 27th May 1963

ACTING PRESIDENT OF THE REPUBLIC OF INDONESIA

(signed)

DJUANDA

Source: Indonesian Publication, WARTA-C.A.F.I.

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CHAPTER VI

CONCLUSION

By examining the results obtained from the analysis, some notable patterns in the choice of projections have emerged. For every maritime interest, be it the preservation of area for fishing rights or mineral exploitation, the shape for visual or psychological purposes, the distance for equitable median line boundary division along strategic straits for shipping, or the direction for navigational purposes, there is an appropriate projection for each purpose in each study area.

In the polar study area, according to the index, the equal-area projections reduced distortion primarily in aeral deformation. The Stereographic and Mercator type, due to their property of conformality, were the most suitable in shape preservation. The Polyconic is the most desireable in keeping the distances closest to the global qualities. The Mercator proved the best in preserving constant lines of compass bearing. The projections that distorted the most, e.g. the Mercator, and others with a combination of high distortion scores, should be disregarded for any maritime use.

Concerning the mid-latitudinal study area, in aeral
preservation, the equal-area projections did the best. The Mercator scored the lowest in shape retention. The Polyconic, because of its property of all the parallels being Standard Parallels, reduced distortion the most in distance measurement. The Mercator was chosen best for navigational purposes by preserving constant compass direction.

In the equatorial study area, again the equal-area group serves the best in aerial distortion. The Mercator projection is best suited to preserve the global qualities of shape. The Polyconic projection had the lowest score in distortion if distance. Finally the Mercator is most suitable for preserving constant compass direction.

As an overview of the process of projection selection, the projection that would create the fairest boundaries for the nations involved in the Polar Study Area and the Mid-Latitudinal Study Area is the Conic; Bonne's Projection. According to the Index of Distortion Tables it generally had the lowest scores. The Mercator projection proved to be the best overall projection for boundary delimitation in the Equatorial Study Area. It consistently scored very low in area and distance distortion and proved to be the best in preserving shape and direction.

This study not only points out the projection best suited for boundary delimitation in selected study areas, but also offers a choice of projections that distort global qualities to varying degrees. The selection of this type of
projection would depend on the needs of the particular country. Depending on which marine interest holds the most importance for a country, certain global qualities will have to be stressed. For instance the maximization of area for purposes of fishing, continental shelf exploitation or other related activities, a projection other than an equal-area would be chosen, the exact selection depending on the degree of maximization desired.

Likewise, shape can be distorted to different degrees. A distortion in the shape of a coastline affects the delimitation of the equidistant boundary. Shape distortion would be desirable for psychological reasons. A distorted visual representation that made a country's boundary area larger than it should may give a certain mental advantage.

The selection of a projection that distorts distances can greatly affect the equidistant boundary delimitation of a strait. An unequal division would give one country more control than it rightly deserves over the strait involved. The Strait of Malacca between the Island of Sumatra in Indonesia and the Malaya Peninsula in Malaysia is a very strategic area. If, for instance, Indonesia derived its boundary on a projection other than Polyconic, they would receive more control over what occurs in the strait than Malaysia. The amount of control obtained is proportional to the degree of distortion the projection has in distance.

A selection of a projection other than the Mercator in
terms of preserving constant bearing would make navigation in the boundary area very difficult. The patrol and search of violations of the boundary line will best be done by the available Navy or Coast Guard of a country. On the Mercator, the area can be navigated with little difficulty. Any other choice would hinder this process.

Unfortunately, the best one overall projection for all maritime interest for all study areas could not be found, simply because such a projection does not exist. The most ideal representation is the globe. Thus in trying to capture some of the global qualities on a map, it always results in some type of distortion.

Hopefully the findings of this study have some application to delimiting the 200-mile offshore boundary. The study has focused on maritime boundaries because they present unique distortion problems. An equitable median line boundary must be drawn on an appropriate projection to be completely fair, otherwise a non-equitable boundary will result. In most cases, a boundary conflict can be settled with a fair delimitation, agreeable to all concerned. In addition to the suggested projection choice, the author also points out the options that are available in order to achieve an unfair delimitation.

Through recent development of computers, boundaries can be also delimited without the need of projections. By measuring from fixed geographic coordinates of the coastline
to coordinates representing the boundary line, much distortion previously attributed to projections can be minimized. Foreign ships can locate the boundary line through such navigational devices as LORAN A or LORAN C, or by the Doppler Satellite Positioning System. After the boundary lines have been delimited, they may be drawn on the desired projection. The projection selected will inevitably deform the true boundary area according to its distortive properties.

The results of this study show a definite association between the selection of map projections and the division of the offshore boundaries on the earth. A fundamental understanding of this is absolutely necessary. In time, the seaward extent of national claims may grow to encompass all of the oceans. If this is true, the individual nations familiar with the projection properties and deformation problems will have an absolute advantage in coping with the ever more increasing problems of equitably sharing, maintaining, controlling, and exploiting ocean space.

APPENDIX I

DISTORTION IN AREA: POLAR STUDY AREA

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<th>Projection</th>
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<th>U.S.S.R.</th>
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<td>Calculated Global Value</td>
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APPENDIX I

DISTORTION IN AREA: OBLIQUE STUDY AREA

<table>
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<tr>
<th></th>
<th>Albers Equal Area</th>
<th>Bonne's</th>
<th>Conic w/2STPs</th>
<th>Lambert Equal Area</th>
<th>Polyconic</th>
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## APPENDIX I

### DISTORTION IN AREA: OBLIQUE STUDY AREA

<table>
<thead>
<tr>
<th>Country</th>
<th>Simple Conic</th>
<th>Sinusoidal</th>
<th>Cylindrical Equal Area</th>
<th>Mercator</th>
<th>Mollweide</th>
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APPENDIX I

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#### DISTORTION IN AREA: EQUATORIAL STUDY AREA

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DISTORTION IN DISTANCE: EQUATORIAL STUDY AREA

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<td>0°-5° - 1.56888</td>
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<td>0°-5° - 1.53000</td>
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<td>0°-5° - 1.57086</td>
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<td>15° - 1.51722</td>
<td>10°-15° - 1.57086</td>
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<td>0° - 1.57086</td>
<td>0°-5° - 1.56888</td>
</tr>
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<td>15° - 1.57086</td>
<td>10°-15° - 1.53306</td>
</tr>
<tr>
<td>Mercator</td>
<td>0° - 1.57086</td>
<td>0°-5° - 1.57086</td>
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<td>15° - 1.57086</td>
<td>10°-15° - 1.62670</td>
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<td>0°-5° - 1.77660</td>
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<td>15° - 1.38302</td>
<td>10°-15° - 1.74852</td>
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APPENDIX 2

DISTORTION IN DISTANCE: EQUATORIAL STUDY AREA

<table>
<thead>
<tr>
<th>Projection</th>
<th>5 Degrees of Longitude in Inches</th>
<th>5 Degrees of Latitude in Inches</th>
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<tbody>
<tr>
<td>Simple Cylindrical</td>
<td>0° - 1.57086</td>
<td>0°-5° - 1.57086</td>
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<tr>
<td></td>
<td>15° - 1.57086</td>
<td>10°-15° - 1.57086</td>
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## APPENDIX 3
### DISTORTION IN DIRECTION: POLAR STUDY AREA

<table>
<thead>
<tr>
<th>Projection</th>
<th>70°N.-170°E</th>
<th>55°N.-170°W</th>
<th>45°N.-145°W</th>
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<tbody>
<tr>
<td>Azimuthal Equal Area</td>
<td>71.148°</td>
<td>58.836°</td>
<td>51.364°</td>
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<td>Azimuthal Equidistant</td>
<td>67.926°</td>
<td>55.490°</td>
<td>48.128°</td>
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<tr>
<td>Gnomonic</td>
<td>72.317°</td>
<td>63.140°</td>
<td>62.448°</td>
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<td>Orthographic</td>
<td>70.852°</td>
<td>56.399°</td>
<td>47.043°</td>
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<td>Stereographic</td>
<td>71.107°</td>
<td>66.231°</td>
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<td>70.844°</td>
<td>64.766°</td>
<td>53.793°</td>
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<td>Bonne's</td>
<td>71.117°</td>
<td>60.165°</td>
<td>54.735°</td>
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<td>Conic w/2 STPs</td>
<td>71.117°</td>
<td>60.053°</td>
<td>54.754°</td>
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<td>Lambert Equal Area</td>
<td>70.012°</td>
<td>62.690°</td>
<td>53.535°</td>
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<td>Polyconic</td>
<td>71.117°</td>
<td>60.165°</td>
<td>54.735°</td>
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<td>Simple Conic</td>
<td>70.704°</td>
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<td>16.783°</td>
<td>28.244°</td>
<td>34.030°</td>
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<td>Mercator</td>
<td>75.491°</td>
<td>63.441°</td>
<td>57.270°</td>
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<td>Mollweide</td>
<td>57.641°</td>
<td>53.084°</td>
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### APPENDIX 3

**DISTORTION IN DIRECTION: OBLIQUE STUDY AREA**

<table>
<thead>
<tr>
<th>Projection</th>
<th>45°N.-10°W.</th>
<th>35°N.-10°E.</th>
<th>25°N.-35°E.</th>
</tr>
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<tr>
<td>Albers Equal Area</td>
<td>53.678°</td>
<td>50.699°</td>
<td>47.120°</td>
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<td>Bonne's</td>
<td>54.735°</td>
<td>50.680°</td>
<td>47.815°</td>
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<td>Conic w/2 STPs</td>
<td>54.961°</td>
<td>50.667°</td>
<td>47.377°</td>
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<td>Lambert Equal Area</td>
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<td>50.881°</td>
<td>46.804°</td>
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<tr>
<td>Polyconic</td>
<td>54.735°</td>
<td>50.680°</td>
<td>47.815°</td>
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<td>Simple Conic</td>
<td>54.998°</td>
<td>51.045°</td>
<td>46.841°</td>
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<td>Sinusoidal</td>
<td>54.735°</td>
<td>50.680°</td>
<td>47.815°</td>
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<td>Cylindrical Equal Area</td>
<td>34.030°</td>
<td>38.417°</td>
<td>41.563°</td>
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<td>Mercator</td>
<td>57.270°</td>
<td>52.560°</td>
<td>49.107°</td>
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<td>Mollweide</td>
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<td>39.075°</td>
<td>40.027°</td>
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APPENDIX 3

DISTORTION IN DIRECTION: EQUATORIAL STUDY AREA

<table>
<thead>
<tr>
<th>Projection</th>
<th>10°N.-140°E.</th>
<th>5°N.-100°E.</th>
<th>0°-110°E.</th>
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<td>Albers Equal Area</td>
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<td>Conic w/2 STPs</td>
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<td>Polyconic</td>
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<td>Simple Conic</td>
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Central Intelligence Agency, Projection Handbook.


Kellaway, G.P. *Map Projections*, London: Methuen and Co. LTD.


