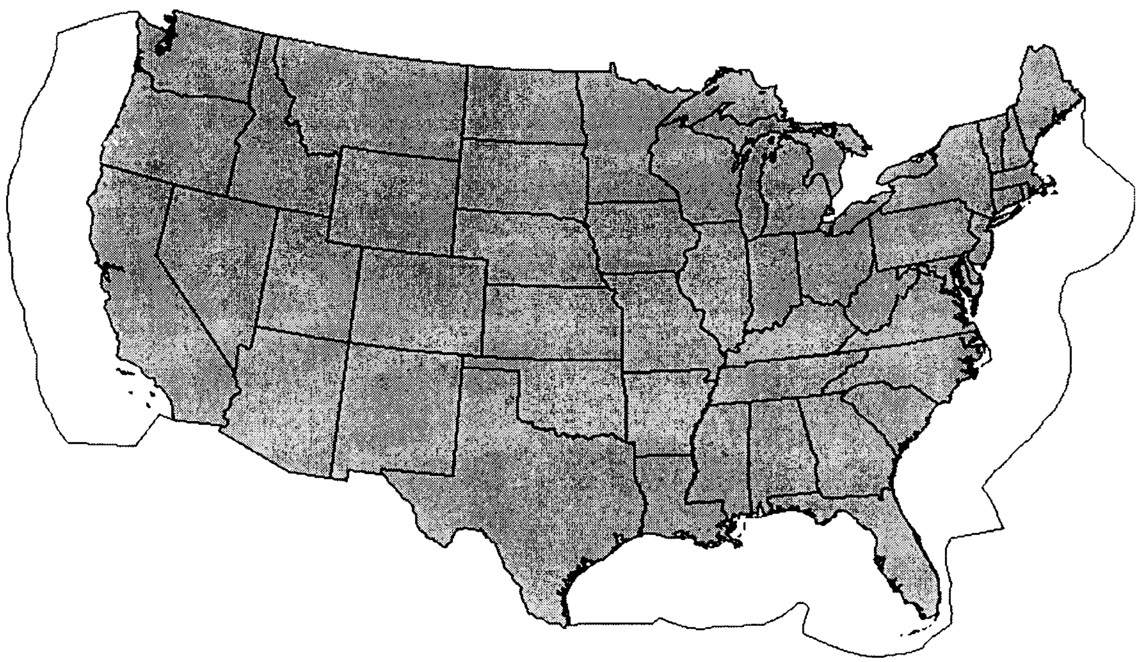
OCS Report
MMS 99-0006

Boundary Development on the Outer Continental Shelf



MMS

U.S. Department of the Interior
Minerals Management Service
Mapping and Boundary Branch

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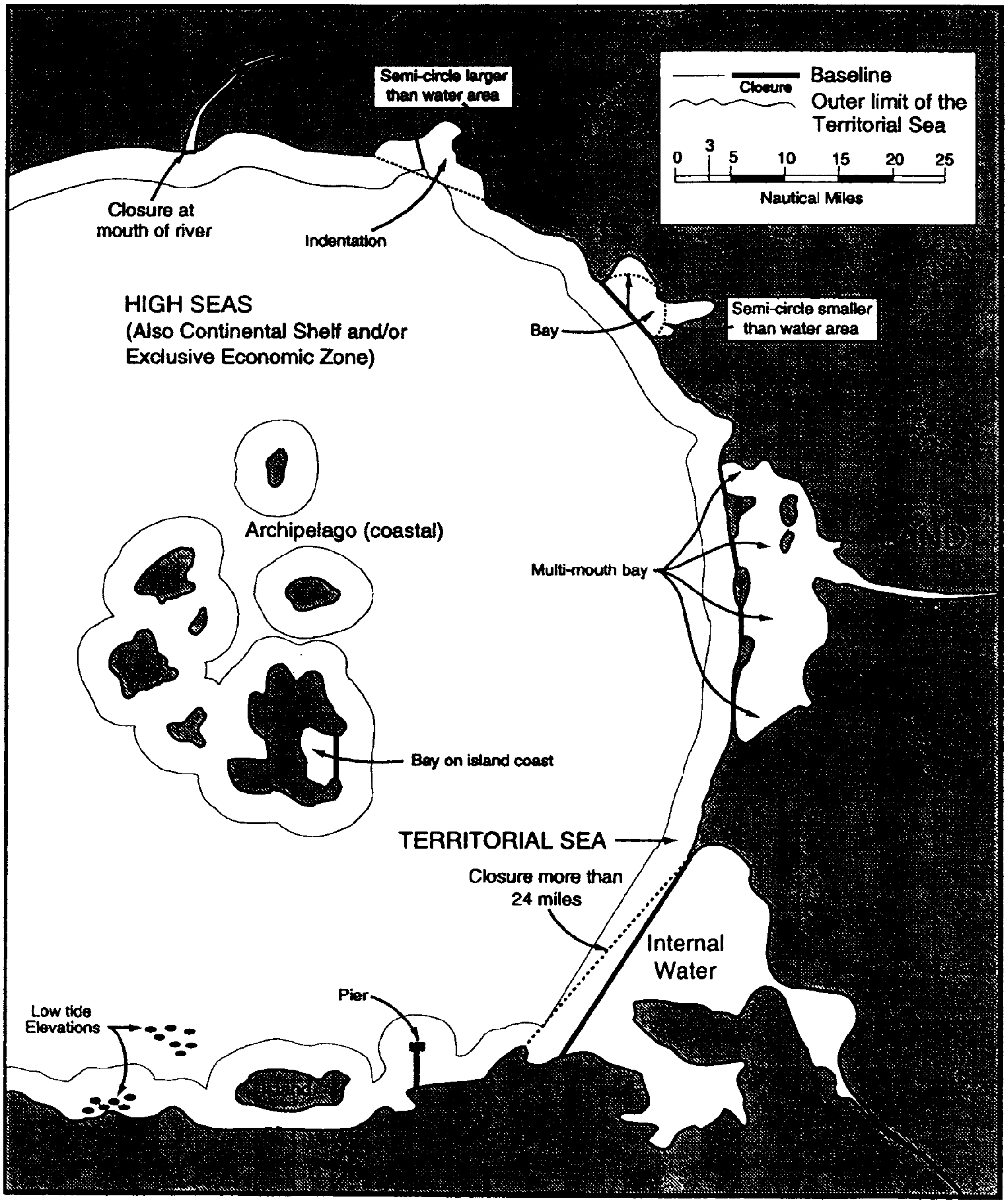

U.S. Department of the Interior
Minerals Management Service
Mapping and Boundary Branch

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United States Department of the Interior
Minerals Management Service

BOUNDARY DEVELOPMENT ON THE OUTER CONTINENTAL SHELF

Abstract: The United States Department of the Interior, Minerals Management Service (MMS), is the agency within the Federal Government tasked with the responsibility for managing the Federal Government's offshore leasing program under 43 U.S.C. Section 1344. In support of this effort the MMS performs mathematical offshore boundary location computations and prepares Outer Continental Shelf (OCS) Leasing Maps, OCS Official Protraction Diagrams, and Supplemental Official OCS Block Diagrams depicting OCS Block information, the State Seaward Boundary, Limit of "8(g) Zone", the 200 nautical mile Exclusive Economic Zone (EEZ Boundary), and corresponding areal measurements. The analytical procedures employed and the computer programs utilized to perform various offshore boundary geometric computations are briefly described. Included are the methods employed by the MMS for determining locations of various offshore boundaries, points of intersection between boundaries and OCS Block lines, and areas of fractional blocks.

INTRODUCTION

The Secretary of the Interior is charged by law with the administration of the offshore submerged lands of the Outer Continental Shelf for minerals leasing purposes. The MMS of the Department of the Interior is responsible for administering these resources by Secretarial Order No. 3071, dated May 10, 1982, as amended. The exercise of this responsibility requires that the area of the offshore submerged lands of the OCS be subdivided into parcels referred to as OCS Blocks, that no submerged lands be offered for lease that are not owned by the Federal Government, and that no submerged lands owned by the Federal Government be offered for lease or sale by either a foreign country or a coastal state of the United States.

The location of offshore submerged land boundaries between the various states and the Federal Government has been a matter of continuing litigation based upon different interpretations of the meaning of various treaties and international and domestic laws.

Before any offshore computations can be made, a series of baseline points representing the mean lower low water (MLLW) line in direct contact with the open sea must be marked on the appropriate nautical charts or hydrographic and topographic survey sheets. From these base materials, Cartographers from the MMS select isolated points and straight line segments along the shoreline where the baseline can be assumed to be a straight line in order to secure a mathematically describable line. Points along straight line segments are selected in such a manner that lines between them do not depart more than fifty feet from the MLLW line (with minor exceptions) except where they constitute appropriate lines marking the outer limits of inland waters; i.e., bay closing lines. These points are then submitted to the appropriate state(s) for verification and concurrence. If agreement can not be reached, alternate points may be selected that best represents the position(s) of the parties. The resolution of differences is normally a juridical matter which is potentially very costly and time consuming. Generally, the preferred method of conducting business is to involve all affected parties in the entire process.

Generally, Federal jurisdiction begins at three geographical (nautical) miles from the baseline from which the Territorial Sea is measured. However, there are several special cases that should be noted. Because of claims existing at the dates of statehood, Texas and the Gulf Coast of Florida have a proprietary interest in a submerged belt of land, nine geographic miles wide, extending seaward along the coast. By Public Law, Puerto Rico is also conferred nine geographic miles (three marine leagues). The balance of coastal states and U.S. possessions are limited to three geographic miles.

Texas and the Gulf coast of Florida each have two baselines, a "current" an a "historic". The "current" baseline is the baseline as it exists at the present time, as shown on the most recent edition of the nautical charts. For Texas, the "historic" baseline is that which existed in 1845, the year Texas entered the Union, as per Supreme Court Decision No. 9, Original, October Term 1968. For the Gulf Coast of Florida, for Submerged Lands Act purposes, the "historic" baseline is the baseline determined through the 1977-78 Joint Federal/State Mapping Project, as per Supreme Court Decision No. 52, Original, October Term 1975. Both the "current" and "historic" baselines are used to position the State Seaward Boundary nine geographic miles seaward for both Texas and the Gulf Coast of Florida. This is accomplished with a series of computer programs designed to project and merge both the "current" and "historic" offshore lines and create a new composite offshore line consisting of the most landward portions of the two lines.

In 1997 the United States and the State of Texas filed a Memorandum in support of a joint motion for a supplemental decree immobilizing the federal-state boundary on the basis of fixed coordinates. On October 13, 1998, the joint motion for entry of a supplemental decree was granted by the Supreme Court of the United States. A similar effort to immobilize the federal-state boundary for the Gulf coast of Florida is currently underway between the United State and the State of Florida.

DEFINITIONS

Listed below are definitions of terms which are used extensively in the discussion which follows.

Outer Continental Shelf (OCS) - The sea bed and subsoil of the submarine area adjacent to the coast of the mainland or islands, but seaward of the State Seaward Boundary to a depth of 200 meters, or beyond that limit where the depth of the superjacent waters admit to the exploitation of the natural resources. Also referred to as Federal Area.

Territorial Sea - A belt of sea adjacent to the coast, the outer limits of which is a line, every point of which is at a distance from the nearest point of the baseline equal to the breadth of the territorial sea. A 12 nautical mile U.S. Territorial Sea was established by Presidential Proclamation 5928, December 27, 1988.

Baseline - The normal baseline is the line of mean lower low water (MLLW) along that portion of the coast which is in direct contact with the open sea, and closing lines across the mouths of bays and rivers.

State Seaward Boundary - The limit of states jurisdiction under the Submerged Land Act (P.L. 83-31, 67 stat. 29, March 1953).

Limit of "8(g) Zone" - The limit of a 3 geographic mile zone seaward of the State Seaward Boundary as provided under section 8(g) of the OCS Lands Act Amendments of 1985.

Geographic Mile (also called Nautical Mile) - defined as 6076.103333 American Survey feet approximately or 1852 meters exactly. Louisiana is an exception using an imperial nautical mile which is defined as 6080.2 feet.

Arc and Tan Segments - Arc refers to a circular curved line segment. Tan refers to a straight line segment.

RECTANGULAR GRID SYSTEM

The orderly development of lands has historically been dependent upon a system of surveys, supplemented in recent times with some type of grid system by which the lands could be located, identified, and legally described. Offshore lands are no exception. The Federal Government and coastal state governments have adopted various forms of rectangular grid systems on the basis of which offshore lands can be subdivided into readily identifiable and locatable units referred to as OCS Blocks. These grid systems also provide a base for mapping and a coordinate system for computing offshore boundaries and areal measurements.

Management areas are normally subdivided into a network of square or rectangular blocks approximately nine square statue miles in area bounded by grid lines uniformly spaced in both X and Y directions. The grid system adopted for use on the OCS, when adjacent to areas previously leased by coastal states, is the same as used by the state; generally the State Plane Coordinate System (SPCS) of the coastal area. In all other areas, the Universal Transverse Mercator (UTM) coordinate system has been adopted.

The UTM system is particularly useful along the east coast of the United States where many different State Plane Coordinate Systems are in use.

BASELINE

The MMS researches and develops baseline points for use in determining Federal/State offshore jurisdictions. The "coast line" for determining offshore leasing boundaries is the line of ordinary low water along that portion of the coast that is in direct contact with the open sea and is also the line marking the seaward limit of inland water, 43 U.S.C. 1301(c). This line is interpreted by the MMS to be the same as the mean lower low water (MLLW) line as depicted on the National Ocean Service nautical charts.

The location of a normal baseline is dynamic, that is to say that the baseline ambulates with the normal erosion and accretion of the shoreline. In 1985, the Submerged Lands Act was amended to provide for the "Immobilization of Boundaries" *(Section 8005)*, "...except that any boundary between a State and the United States under this Act which has been or is hereafter fixed by coordinates under a final decree of the United States Supreme Court shall remain immobilized at the coordinates provided under such decree and shall not be ambulatory". Unlike the general property rule, artificial structures such as breakwaters, jetties, groins, beach re-nourishment, and other *solid* structures occurring along the coast have the potential to impact the baseline and associated offshore boundaries. MMS has a responsibility to evaluate Corps of Engineers permits in order to identify and determine if a proposed permitting action has the potential of extending the baseline. If so, MMS has the responsibility to determine the extent of impact and to notify the Solicitor's Office. The Solicitor's Office in turn notifies the Corps of Engineers who requests the affected coastal state to prepare a waiver to any extension of the baseline resulting from the proposed permitting action. Structures such as piers or other *open* structures cannot be used to extend the baseline.

Though points are generally obtained from National Ocean Service large scale nautical charts supplemental source materials can include hydrographic and topographic sheets, photogrammetry, and conventional surveys. All selected points are defined by coordinates.

The baseline is represented by a set of points and lines consisting of subsets of isolated points, and subsets of two or more points connected by lines. Isolated points usually represent rocks, small islands, points along a very irregular stretch of coastline, etc. Points connected by lines represent larger islands, more uniform stretches of coastline, bay closing lines, etc.

LEGAL DESCRIPTION OF BASELINE

The following terminology was adopted by the United States Department of Justice, during the 1968 Supreme Court case, U.S. v Louisiana, No. 9, Original, for describing the baseline. Isolated points are described by the phrase, A POINT AT. The description of a subset of connected points and lines begins with the point described by the phrase, A LINE FROM, includes all points described by the word, THROUGH, and ends with the point described by the word, TO. The description of each point also includes its plane coordinates and geographic coordinates, if appropriate.

LEGAL DESCRIPTION OF BASELINE

COURSE	X	Y	LATITUDE	LONGITUDE
A LINE FROM	1429035	401760	29 45 32.95	-93 7 58.23
THROUGH	1425600	402610	29 45 40.83	-93 8 37.35
THROUGH	1424630	403175	29 45 46.27	-93 8 48.45
THROUGH	1416365	405700	29 46 9.96	-93 10 22.68
THROUGH	1410175	407090	29 46 22.73	-93 11 33.16
THROUGH	1402525	408365	29 46 34.12	-93 13 .19
THROUGH	1397220	408870	29 46 38.25	-93 14 .48
THROUGH	1392000	409180	29 46 40.46	-93 14 59.76
THROUGH	1391954	409243	29 46 41.07	-93 15 .30
THROUGH	1386636	409216	29 46 38.92	-93 16 .63
THROUGH	1380235	408500	29 46 31.76	-93 17 13.12
TO	1372945	406862	29 46 14.31	-93 18 35.51
A POINT AT	1376515	407966	29 46 25.84	-93 17 55.22

STATE SEAWARD BOUNDARY

The offshore line which forms the seaward boundary of the state's submerged lands and the landward boundary of the federally managed OCS lands is defined as a line every point of which is at a distance of 3 geographic miles from the nearest point on the baseline.

The State Seaward Boundary (SSB) is determined by projecting the baseline _n_ geographic miles seaward. It forms an unbroken line consisting of intersecting arc segments and line segments. This line can be described as the envelope of all circular arcs _n_ geographic miles in radius centered at all isolated baseline points, and all line segments projected _n_ geographic miles seaward from and parallel to the lines joining connected baseline points.

To determine the location of the SSB, all baseline points are considered in the mathematical processes. The envelope line formed by all intersecting arc segments and line segments projected from the baseline points are then computed. This line is the SSB and its description is based on the coordinates of the points of intersection.

Elimination of non-contributing coastline points and baseline points *(Figure Nos. 1 & 2)*, or selection of the baseline points which do contribute to the seaward boundary line can be determined mathematically in the following manner.

Beginning at one end of the section of baseline of interest and progressing toward the other, closely

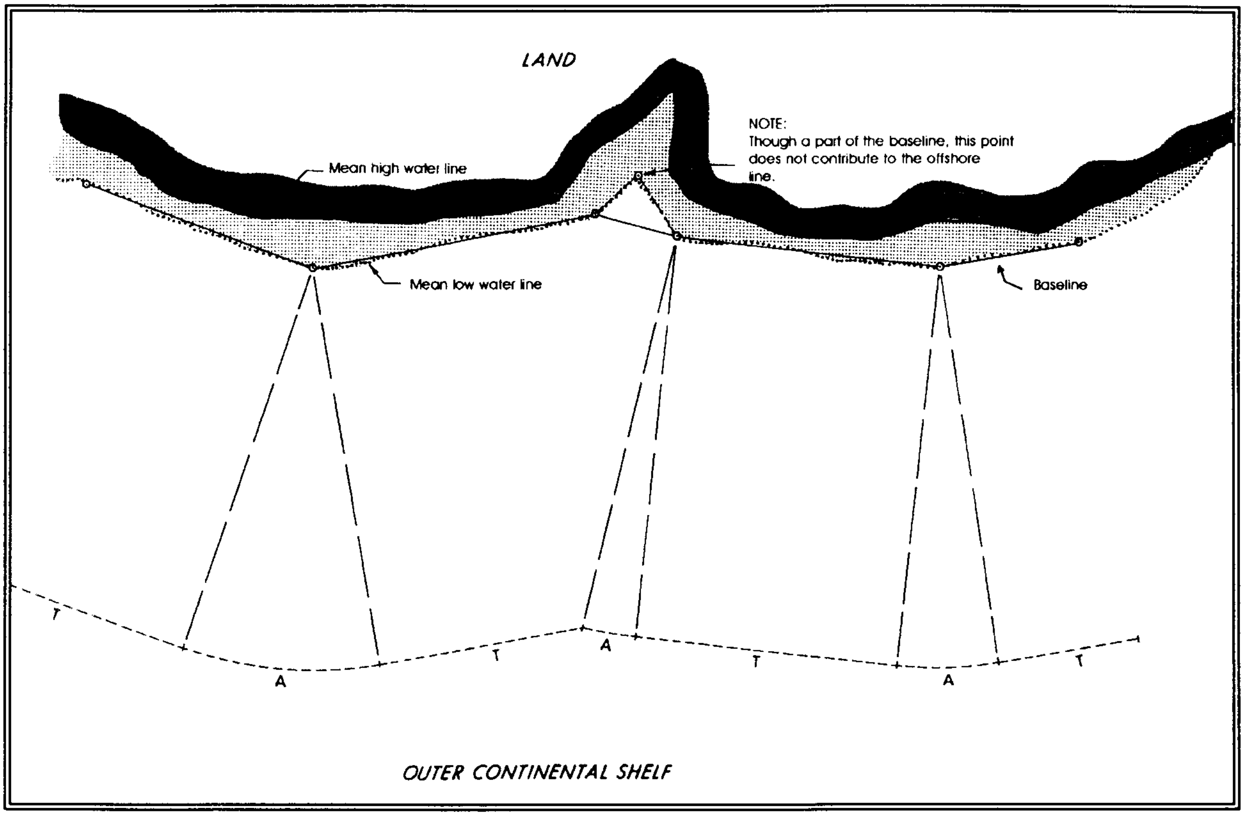

Figure 1 Coastline points eliminated.

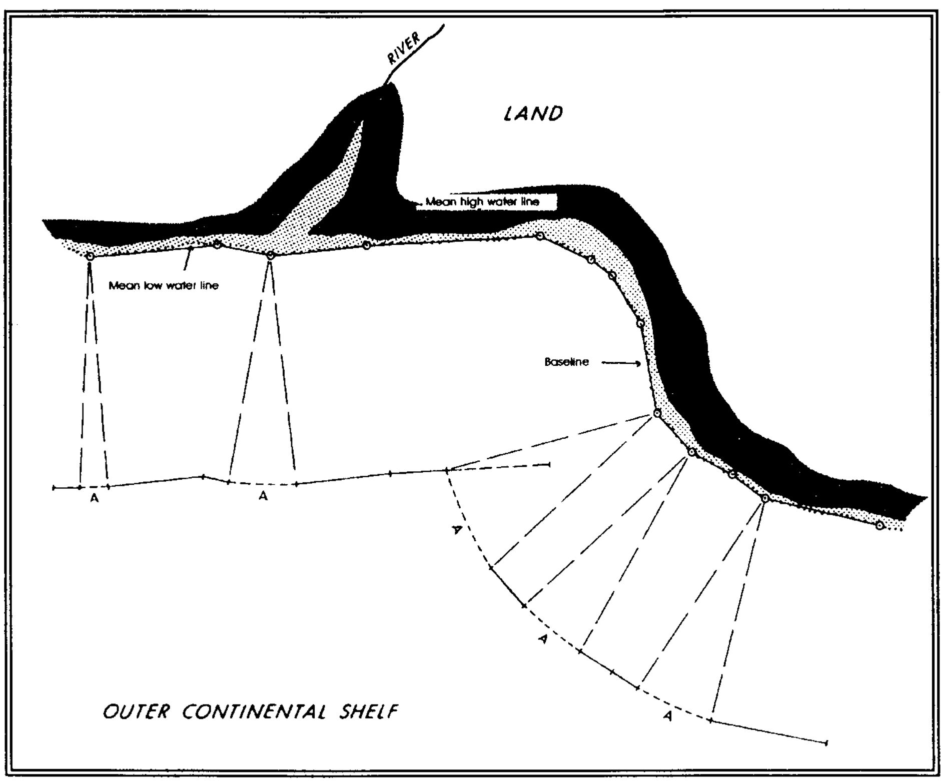

Figure 2 Elimination of non-contributing baseline points.

spaced scan lines parallel to the X axis and/or the Y axis in a generally seaward direction are passed through all of the arc segments and straight line segments which can be projected from all baseline points and lines within n geographic miles distance up or down the coast from the scan line. The most seaward point of intersection is noted and a record is kept of the baseline point or line from which the most seaward arc segment or straight line segment was projected. Ultimately a list is compiled of all arc segments or straight line segments in their proper sequence to form the line. The segments are identified by the baseline points and lines from which they were projected.

After the list of segments forming the SSB has been completed, it is checked for conformance to certain geometric criteria. In this way the existence of very short arc segments and straight line segments which might have been missed by the scanning process can be predicted.

Among the geometric criteria applied, the following are most frequently enforced. Two offshore line segments must be separated by an arc segment if the lines of the baseline from which they were projected intersect in a generally convex-seaward direction. The center of the offshore arc segment is the baseline point common to the two lines. Conversely, an offshore arc segment cannot exist between two straight offshore line segments if the lines of the baseline from which the straight offshore line segments were projected intersect in a concave seaward direction. In addition, two offshore arc segments must be separated by a straight offshore line segment if the center points of the two arc segments on the baseline are connected by a line.

When the list of arc segments and straight line segments in their proper sequence has been completed and checked, the points of intersection of connecting segments are computed. The coordinates of the points of intersection and the types of segments provide sufficient information to completely describe the boundary.

POINTS OF INTERSECTION BETWEEN SEGMENTS

The points of intersection between adjacent arc segments and straight line segments forming the seaward boundary can be computed using the conventional methods of analytical geometry. Three types of intersection problems are encountered; straight lines intersecting straight lines *(Figure No. 3),* circular curves intersecting circular curves *(Figure No. 4)*, and circular curves intersecting straight lines *(Figure No. 5).*

Two points of intersection are normally obtained when circular curves are intersected either by straight lines or by other circular curves. The one point of intersection desired can usually be readily identified. In the case of curves intersecting curves, one point of intersection usually falls on land and the other at sea. When curves are intersected by straight lines, one point usually lies on an extension of the projected line segment, while the other lies on the projected line segment itself. In rare cases both points lie on the projected line segment and both points are desired. This latter situation exists when the baseline is doubly defined, as occurs when an isolated point is defined as a baseline point in addition to an adjacent unbroken straight line stretch of baseline *(Figure No. 6).*

LEGAL DESCRIPTION OF STATE SEAWARD BOUNDARY

The following terminology was adopted by the Department of Justice to describe a computed seaward boundary. The phrase, BEGINNING AT, is used to describe the beginning point of the SSB. Thereafter, when the line is defined by an arc segment, its described by the phrase, BY ARC CENTERED AT, and identified by its center of curvature. The point of intersection with the next segment is indicated by the word, TO. When the boundary is defined by a straight line segment, this is indicated by the phrase, BY STRAIGHT LINE TO, and the point of intersection with the next segment in sequence is identified. Each point of intersection is described by UTM coordinates or state plane coordinates and geographic coordinates. The center point of an arc is also described by coordinates and is the only direct reference to the baseline. A constant radius of curvature is implied.

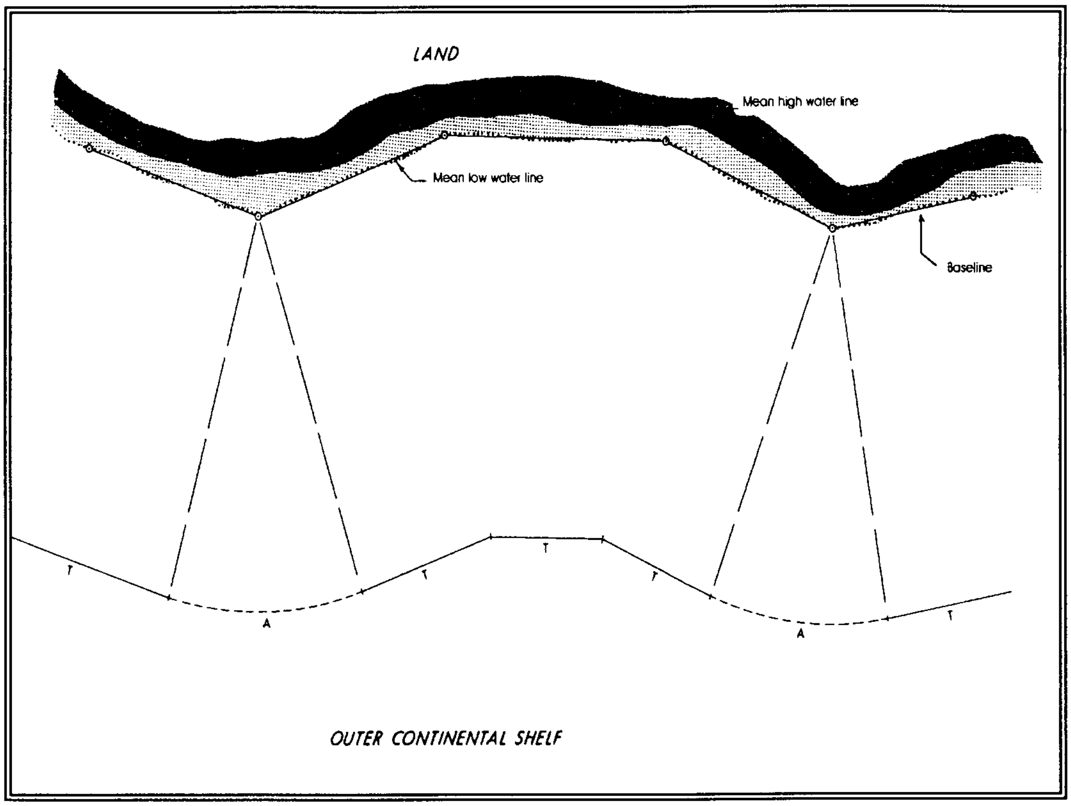

Figure 3 Intersection of adjacent tangents - shoreline concave seaward.

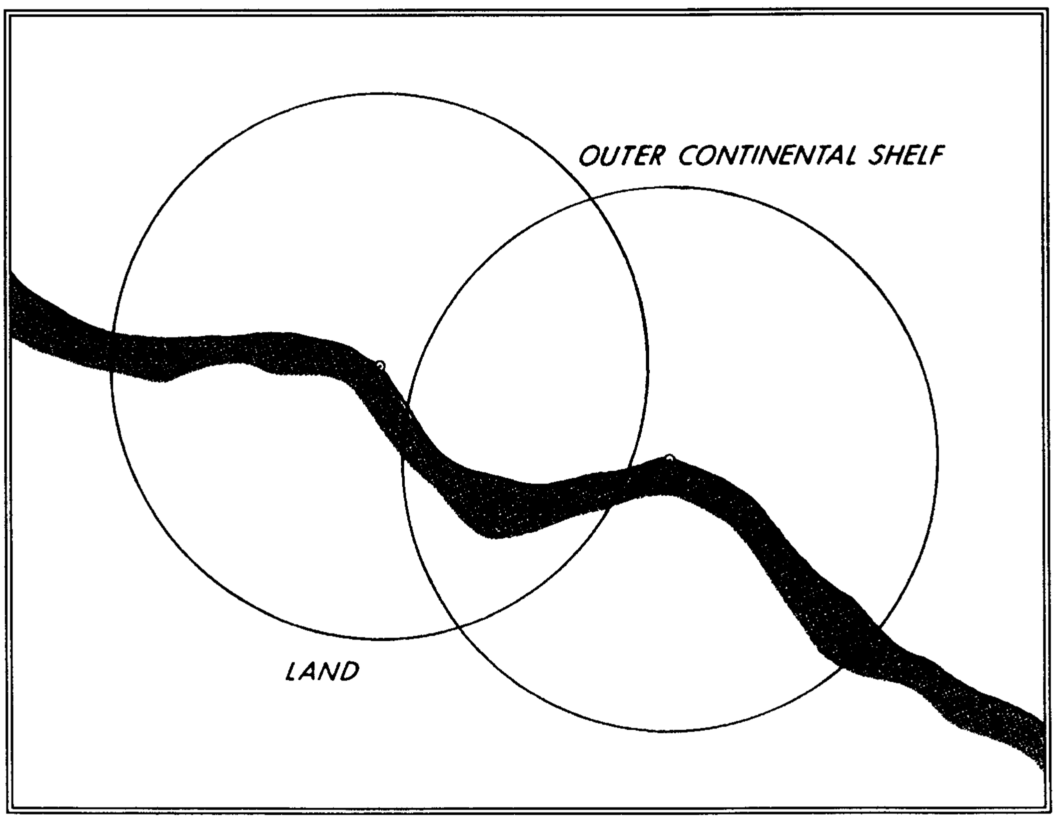

Figure 4 Circular curve intersecting a circular curve.

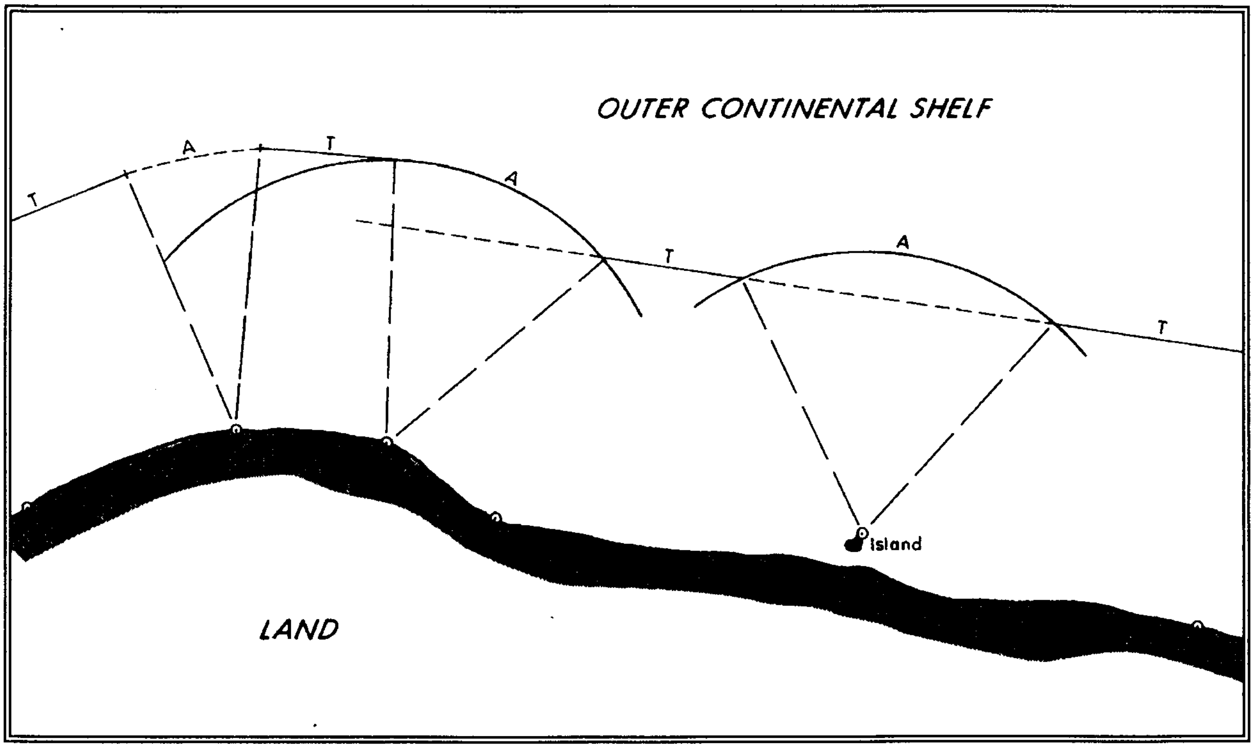

Figure 5 Curve intersecting a straight line.

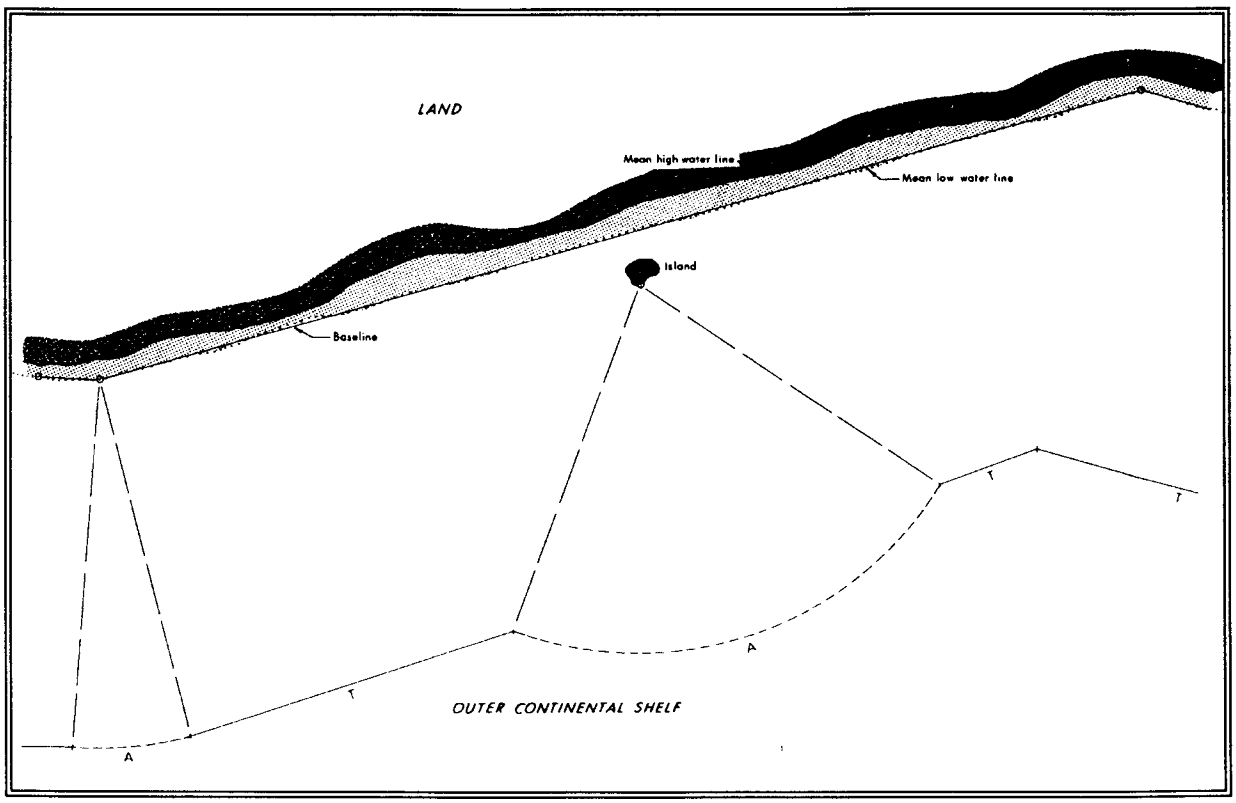

Figure 6 Tangent intersected by a superimposed arc.

LEGAL DESCRIPTION OF STATE SEAWARD BOUNDARY

	COURSE	X	Y	LATITUDE	LONGITUDE
1	BEGINNING AT	2567200	193910	29 11 16.07	-89 33 21.07
2	BY ARC CENTERED AT	2574890	210450	29 13 58.60	-89 31 51.39
	TO	2566472	194268	29 11 19.72	-89 33 29.21
3	BY STRAIGHT LINE TO	2564469	194807	29 11 25.36	-89 33 51.71
4	BY ARC CENTERED AT	2565940	212988	29 14 25.11	-89 33 31.94
	TO	2559750	195830	29 11 36.21	-89 34 44.76
5	BY STRAIGHT LINE TO	2559112	196060	29 11 38.58	-89 34 51.92
6	BY ARC CENTERED AT	2562149	214046	29 14 36.16	-89 34 14.54
	TO	2557272	196470	29 11 42.91	-89 35 12.61
7	BY STRAIGHT LINE TO	2557019	196540	29 11 43.65	-89 35 15.45
8	BY STRAIGHT LINE TO	2552324	197553	29 11 54.38	-89 36 08.24

RELATION BETWEEN SEAWARD BOUNDARY AND OCS BLOCK GRID SYSTEM

The location of the seaward boundary can be determined without regard to the OCS Block grid system. However, the two must be compatible if they are to be related mathematically. A common grid scale factor and plane coordinate system must exist. The position of the seaward boundary on the grid can then be determined by computing the coordinates of the points of intersection of the seaward boundary with all block boundaries. Computations involving rectangular blocks and boundaries present no particular difficulty, of course, and are not discussed.

IRREGULAR CURVES

The offshore cadastre is usually crossed or bounded on one or more sides by non-circular curved lines. This occurs when an area is bounded or divided by a geodetic line, by a grid line chosen to represent the boundary between two plane coordinate systems or zones, by a political boundary, by the boundary of a restricted area, such as a marine sanctuary or military reservation, or by shipping safety fairways and anchorage areas.

When such lines are well defined in terms of a grid coordinate system all necessary computations within the plane coordinate system can be performed using two dimensional analytical geometry or trigonometry. More often, however, these lines are defined geodetically, in which case an equation in terms of grid coordinates must be derived to represent the line in the plane coordinate system.

An n th degree polynomial equation is normally used for this purpose and can be obtained in the following manner. The coordinates of a relatively large number of points spaced at regular intervals along the line are computed as accurately as possible; geodetically when appropriate, and always in the coordinate system in which the actual line is defined. These coordinates are then converted into the plane coordinate system of the subject area. Employing curve fitting procedures, an *n* th degree polynomial equation can then be written using *n* +1 or more of the converted points, which will very closely approximate the curve on the grid. In all subsequent computations the irregular curve is represented by the polynomial.

When the degree of polynomial desired is less than *m* +1 , where *m* equals the number of points having been chosen to represent the line, a least squares curve fitting process is employed.
An area is sometimes bounded by a meridian of longitude or a parallel of latitude which appear as straight lines in some plane coordinate systems and as curves in others. In either case, no computations are required to determine the geographic coordinates of points on the line as they can be chosen at random. These lines can be approximated by polynomials quite easily. A set of *n* +1 or more points evenly distributed along the meridian or parallel are selected to represent the line. The geographic coordinates of the points are then converted into grid coordinates and a polynomial equation of *n* th degree is derived as described above.

A boundary line separating two plane coordinate systems or zones is often chosen to facilitate computations. Frequently, a parallel or meridian is selected, in which case it is treated as described above. A grid line in one or the other system or zone is also commonly chosen. In this case, it is convenient to select, as points to represent the line, the coordinates of the corners of the blocks bounded by the line in one system. The coordinates of these points are then converted into the grid coordinates of the other system or zone and a polynomial equation is written as before.

Rhumb lines (or loxodromic lines) are curves on the surface of the earth which cross all meridians at the same angle. They are probably the most frequently encountered of the irregular curves because of their popularity for navigational purposes. Shipping safety fairways and anchorage areas are bounded by rhumb lines connecting a series of points, each line being defined by two points having geographic coordinates, one at each end of the line. Eleven points, spaced at ten even intervals along the rhumb line, will provide sufficient information to write a ninth degree polynomial equation and will usually closely approximate a line of reasonable length in most plane coordinate systems.

Points selected to represent the rhumb line must be computed geodetically. This can be done by solving the geodetic equation of the rhumb line which joins the two specified end points for values of longitude, substituting into the equation values of latitude, which have been chosen at regular intervals along the line.

INTERSECTIONS INVOLVING THE IRREGULAR CURVES AND BOUNDARY LINES

Whenever an irregular shaped OCS Block is created by nonrectangular boundaries, the points of intersection between the regular OCS Block boundary lines and the irregular boundary lines must be computed in order to properly define the block boundaries.

Similarly, when a block is crossed by a line of any type, the points of intersection between that line and the block boundaries must be computed in order to determine the location of the line within the block.

In addition to the three types of intersection problems solved in forming the SSB, several additional types of intersection are encountered at this time. Included among these are intersections of irregular non-circular curves, represented by polynomials, with straight lines, with circular curves, and with other irregular curves also represented by polynomials.

AREAS OF IRREGULAR OCS BLOCKS

The areas of irregular shaped OCS Blocks can readily be computed once the block boundaries have been properly defined. The block is subdivided into simple geometric shaped parcels bounded on all sides by straight lines or bounded on one side by either a circular curve or by an irregular curve which is defined by a polynomial equation. In the first two cases, the areas are easily computed by simple geometry and in the third case, the area between the curved line and an opposite straight side can be determined using integral calculus.

SOURCES OF ERROR

Small differences are occasionally noted if geodetically computed values are compared with information appearing on Leasing Maps and Official Protraction Diagrams. These differences are due in part to a small number of approximations used to simplify map construction. A practice of occasionally approximating irregular curves with straight secant lines, for example, leads to slight discrepancies in the dimensions and areas of blocks bounded by those lines. Also, the common practice of applying a grid scale factor of 1.0 throughout an area results in a few inaccuracies. This approximation greatly simplifies map construction as all blocks bounded by equally spaced grid lines are uniform in area and dimension, but problems arise when ground points are related to grid points or when true distances and areas are compared with grid distances and areas. The largest errors are found along lines chosen to serve as zone boundaries where different scale factors actually exist on opposite sides of the boundary, and a scale factor of 1.0 is used for computations on both sides of the boundary line.

COMPUTER PROGRAMS

Most of the computations required for determining much of the information needed in the construction of OCS maps and diagrams are not particularly difficult, but require a great deal of caution and thought. Other computations are relatively lengthy. For a large area, where much information is required, many hundreds of thousands or sometimes millions of operations may be involved. In such cases, a computer having a minimum of double precision capability is essential.

Mr. William E. Ball, Engineering Analyst (Retired) from the Bureau of Land Management, has written, over the past two decades, a large number of computer programs which perform nearly all the computations required for offshore mapping and boundary determinations.

TECHNICAL INFORMATION MANAGEMENT SYSTEM

The Technical Information Management System (TIMS) is a multi year information management initiative to develop a linked automated information system/corporate database. It is designed to provide the capability to collect, retrieve, store, process, and display information through a suite of standardized hardware, communications equipment, and software.

TIMS uses relational database technology to bring diverse Offshore information into one central database. These various elements are called components and together they include all business, regulatory, scientific, and technical data necessary to support the MMS Offshore mission. It also includes a spatial database with mapping and other graphical portrayal capabilities to present, manipulate, and display Offshore data.

BLOCK AND BOUNDARY

The Block and Boundary Component of TIMS develops and maintains the official Offshore cadastre. The cadastre provides the information of the land management system utilized on the OCS by both MMS and industry to facilitate management and leasing on the OCS. The cadastre provides the means to accurately and legally define these areas by coordinates and calculated areas. It includes OCS Blocks and various offshore submerged lands boundaries which are portrayed on OCS Official Protraction Diagrams, OCS Leasing Maps, and Supplemental Official OCS Block Diagrams.

OUTPUT PRODUCTS

The following is a description of the output products produced by the MMS supporting the foregoing analytical procedures.

OCS LEASING MAP

A brief background must be provided in order to describe the issues associated with the original OCS Leasing Maps (LM's) produced to initiate the offshore leasing program.

In 1954, the Federal Government published its first Leasing Maps as well as issued its first leases on the OCS offshore of Texas and Louisiana. However, prior to the Federal Government publishing Leasing Maps both Texas and Louisiana had produced their own versions of leasing diagrams. Both states utilized their respective SPCS for the development of these diagrams. In order to minimize confusion resulting from the transfer of existing state leases from State jurisdiction to Federal jurisdiction the Federal Government made the decision to use and extend these local SPCS. To compound the problem large amounts of area offshore Louisiana were in dispute resulting in litigation, U.S. v Louisiana, No. 9 Original.

When the OCS grid system was extended seaward using the state plane coordinates, numerous problems were encountered. Offshore of Louisiana the state plane coordinate projection tables did not cover all the areas of interest. We soon found ourselves confronted with areas of negative Y values and problems arising from the use of numerous SPCS.

There are several different "Regular" block sizes associated with these Leasing Maps. In the area of the Mississippi River delta there are four different "Regular" block sizes ranging from 4,560.81 to 5,000 acres. West of the delta area the block sizes were all 5,000 acres. Offshore Louisiana there are 30 Leasing Maps containing a variety of block sizes with less than regular acreage.

Texas blocks on the OCS are 5,760 acres, the maximum allowable under the Outer Continental Shelf Lands Act. The Texas system spans two SPCS zones: south central and south zones. For leasing purposes, the south limit of the south central zone is Y= 7,920 feet. The OCS Blocks having this "Y" value as their south boundary are regular blocks containing 5,760 acres. The OCS Blocks having the south central zone "Y" as their north boundary are fractional blocks and are in the south zone.

Offshore Southern California SPCS were also utilized. A "Regular" block contained 5,760 acres.

Another problem encountered was the use of different OCS Block numbering schemes. In each of the 30 Louisiana Leasing Maps, the blocks were numbered consecutively beginning with the first maps developed along the SSB and continued seaward to the extent of the Leasing Map coverage.

On the existing Texas leasing diagrams the state had initiated a numbering scheme, out to the 200 foot isobath. Texas blocks were numbered consecutively from east to west and then west to east, in a serpentine patten progressing from north to south. When these maps were transferred to the Federal Government the process was picked up from this point and continued seaward for each of the areas including their additions; the new block numbers are prefixed with the alpha designation "A".

Offshore California a grid numbering scheme was derived with the "Y" value beginning with zero at the "Y" origin and "X" value being zero at the central meridian. Each unit being 15,840 feet. Therefore, the west boundary of an OCS Block with an "X" value of 40 would be 40 times 15,840 feet or 633,600 feet, and similarly for the north boundary. On the west coast the agency began movement towards a standardized numbering scheme and block grid dimension.

In the beginning, publication scales were very inconsistent due in part to areas being of several different configurations and sizes and a press size limitation. After publishing and using the various Leasing Maps it was obvious there were going to be problems in the future. An effort was initiated to locate a more uniform system for describing offshore areas. A decision was ultimately made to use the Universal Transverse Mercator Grid System. The UTM system is a world-wide system independent of land and water, thus applicable to all offshore areas of the United States. On June 1, 1988, the Minerals Management Service re-computed and corrected most Leasing Maps offshore Louisiana. Leasing Maps exist only for Texas and Louisiana, to a consistent scale of 1:250,000 *(Figure No. 7).* With the implementation of the North American Datum of 1983 (NAD 83) in the Pacific OCS Region, Leasing Maps offshore California will be superseded by OPD's based on the UTM grid system. This leaves only Texas and Louisiana with Leasing Maps. In addition, a recommendation was made by the Regional Director of the Gulf of Mexico OCS Region to keep the Gulf, for the foreseeable future, on the North American Datum of 1927 (NAD 27). MMS Management is in concurrence with this recommendation.

OCS OFFICIAL PROTRACTION DIAGRAM

In 1974, a decision was made to utilize the UTM Grid System. The UTM grid is designed for world wide use between 84° N. and 80°S. The areas bounded by these latitudes are divided into 60 zones running north-south, each 6° wide and bounded by meridians that are multiples of 6°. Each zone is projected on the transverse Mercator projection and has a central meridian that is an odd multiple of 3°. The zones are numbered consecutively, starting with zone 1 between 180° and 174°W and increasing eastward to zone 60 between 174° and 180°E.

The value of 500,000m east is assigned to the central meridian to avoid negative numbers at the western boundary or the use of plus or minus values to identify west to east. For north-south values in the Northern Hemisphere, the Equator is designated zero north and the northings increase numerically toward the North Pole.

A standard Official Protraction Diagram (OPD) is 1° in latitude by 2° in longitude with the exception of Alaska and northern Washington, which is 1° in latitude by 3° in longitude, and the sheet limits are nearly coincidental with the standard 1:250,000 scale U.S. Geological Survey topographic map series *(Figure No. 8).* We say "nearly coincidental" because the coincidence is exact only for the diagram edges along either side of the 6° UTM zone. The north-south edges are adjusted to agree with the edge of a tier of standard size blocks. This process reduces the number of fractional blocks which simplifies things for all concerned.

The OPDs are numbered using the United Nations International Map of the World Numbering System, which is an alphanumeric system. Sheet names coincide with standard topographic sheet names when diagrams include land areas. Offshore sheet names relate to land features, or to hydrographic features contained within the limits of the diagram. Shoreline planimetric detail is shown when it falls within the limits of a diagram. A series of index maps defining the locations of all OPD's and Leasing Maps on the OCS have been prepared for the Atlantic, Gulf of Mexico, Pacific, Alaska, and Puerto Rico and are available through the MMS Webpage at www.mms.gov, , see *(Figure No. 9).*

SUPPLEMENTAL OFFICIAL OCS BLOCK DIAGRAM

The Supplemental Official OCS Block Diagram (SOBD) represents the final results of the analytical process required to depict graphically a line or lines being projected offshore from the baseline and intersecting a particular block. A separate automated diagram is prepared for each block intersected by an offshore boundary. There are a number of different boundary types depicted on SOBD's including, State Seaward Boundaries, Limit of "8(g) Zones", International Maritime boundaries, Exclusive Economic Zone Limits, and National Marine Sanctuaries, etc.

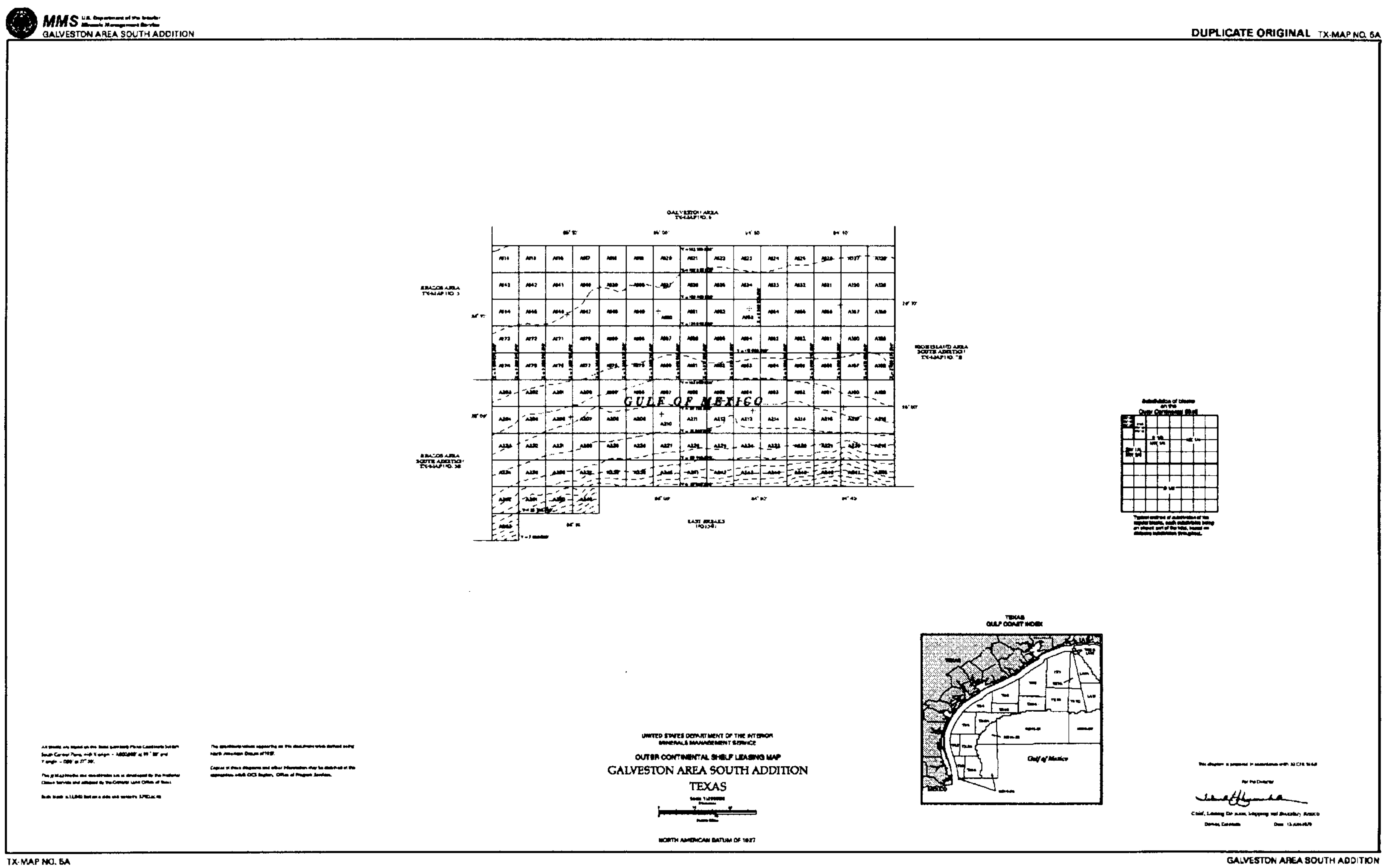

Figure7 Leasing Map

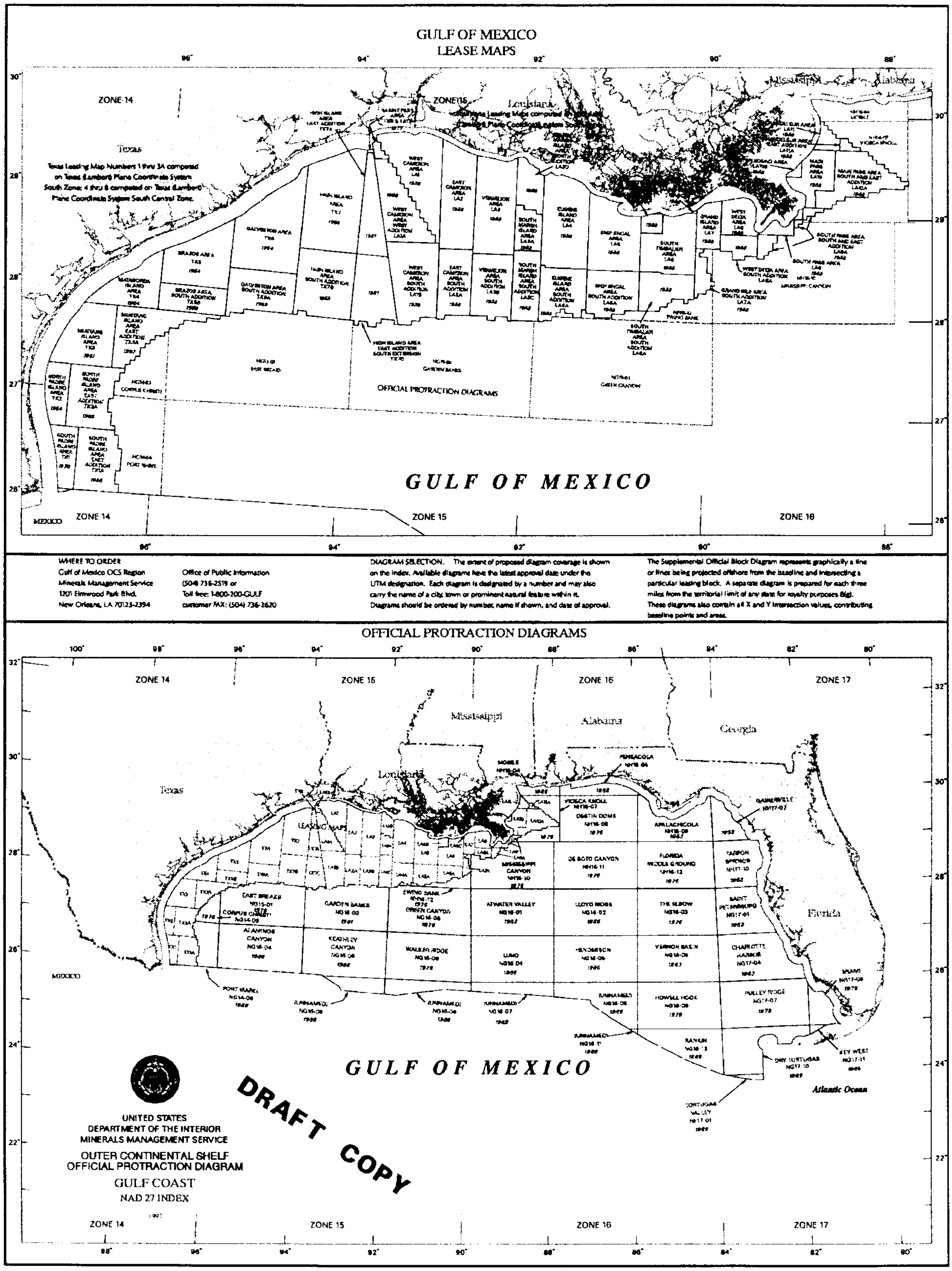

Figure 9 Index (Gulf of Mexico)

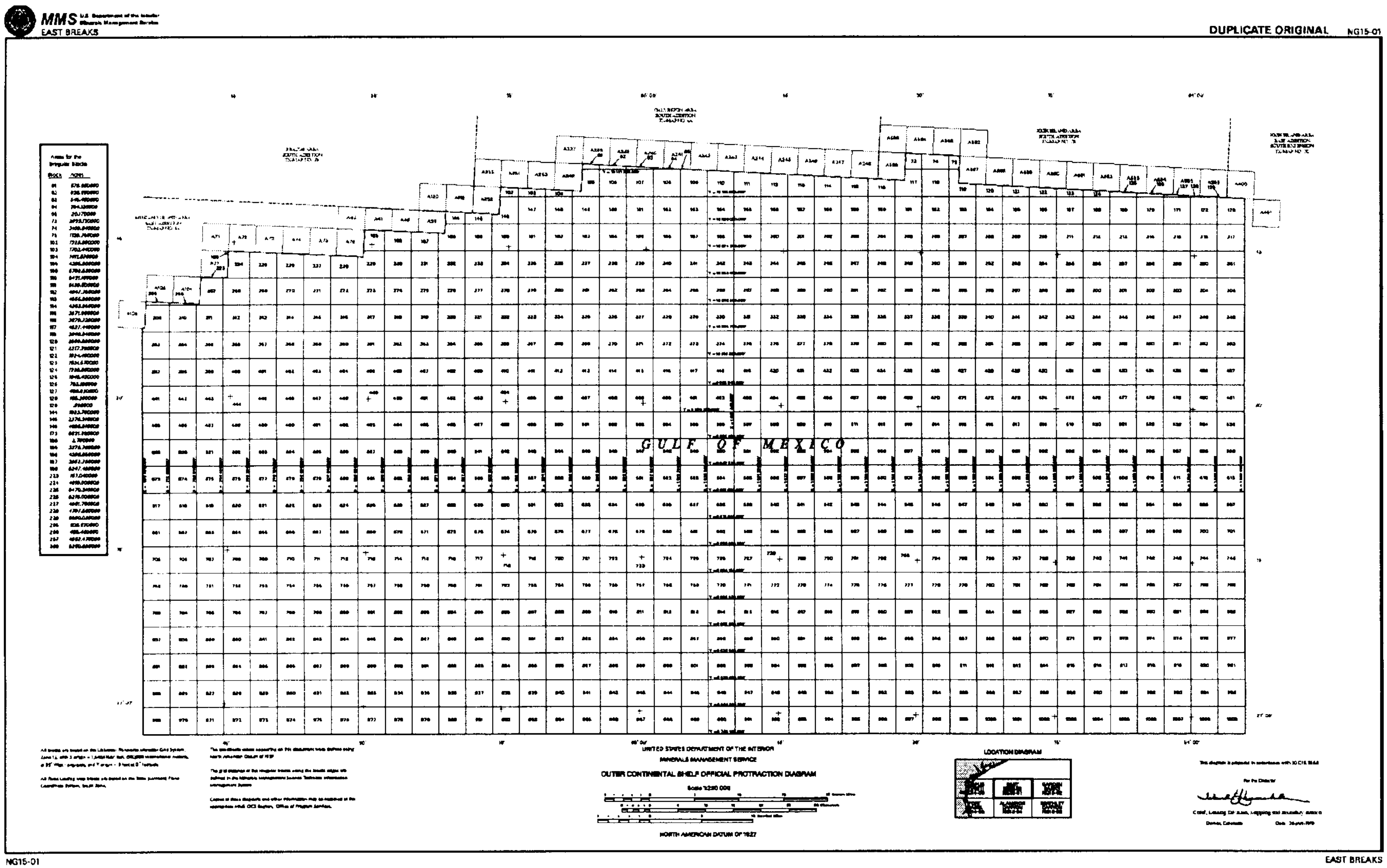

Figure 8 Official Protraction Diagram

The information contained on a SOBD is as follows *(Figure No.10)*:

1. Identification
2. Datum
3. Type of boundary, radius, unit of measure (feet - meters)
4. X and Y values of block
5. Intersection values or arc and tangent segments projected offshore from the baseline.
5a. Graphic, corresponds to the values from 4 and 5
6. Arc centers - contributing baseline points
7. Areas
8. Signature blocks

DIGITAL OFFSHORE CADASTRAL DATA

The Minerals Management Service Mapping and Boundary Branch is currently in the process of developing and placing digital offshore cadastral data on an Internet web site. This data are internally organized by Official Protraction Diagram (OPD) and has been reformatted by subject coverages for an Offshore Region, subregion, or planning area. Metadata will be developed for the various coverages as they are approved and become available. The metadata and coverages are currently available for the Atlantic, Alaska: Cook Inlet/Shelikof Strait, and Pacific: Oregon and Washington. These available coverages include protraction diagram, blocks, federal-state line, limit of "8(g) zone", and coastline. The coastline coverage is provided for general reference purposes. In addition, coverages for maritime boundaries are available for the Atlantic and Pacific as well as national marine sanctuary boundaries in the Pacific. In the near future we anticipate having metadata and coverages available for the Beaufort and Chukchi Sea areas in Alaska and individual Official Protraction Diagrams. The metadata and related information can be obtained from ftp://mmspub.mms.gov/pub/mapping or through links at the Federal Geographic Data Committee (FGDC) metadata clearing house at www.fgdc.gov and http://130.11.52.184/FGDCgateway.html.

CONCLUSIONS

The foregoing is a description of the analytical procedures employed by the Minerals Management Service in performing various geometric computations required for the construction of OCS Leasing Maps, OCS Official Protraction Diagrams, and Supplemental Official OCS Block Diagrams.

With few exceptions, descriptions are limited to two dimensional procedures compatible with existing OCS Leasing Maps and Official Protraction Diagrams, which are based on either State Plane Coordinate Systems or the Universal Transverse Mercator coordinate system.

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MMS U.S. Department of the Interior
Minerals Management Service

Supplemental Official OCS Block Diagram

OCS Planning Area Name: Mid Atlantic
Leasing Map / OPD Name: New York

(1) Leasing Map/ OPD Number: NK18-12
Block Number: 6366

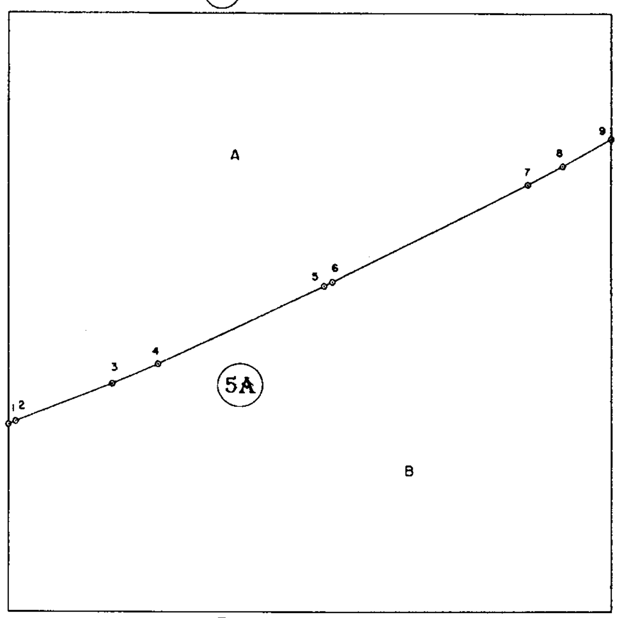
(3) [X] State Seaward Boundary Radius: 5556.000
[ ] Limit of '8(g) Zone' Radius: ______

[ ] Feet
[X] Meters

(2) Datum: NAD 83/WGS 84
[ ] Previous SOBD Date: ______

(4) Y= 4 502 400.000

(4) X= 668 000.000



(4) X= 672 800.000

(4) Y= 4 497 600.000

State Area: A = 1060.064907ha

(7)

Federal 8(g) Area: B = 1243.935093ha

(4) Boundary Disputed: ______

Federal Non-8(g) Area: ______

8(g) Disputed: ______

Federal Withdrawn Area: ______

Federal Deferred Area: ______

Total Area: 2304.000000ha

(5) Offshore Intersections

	X	Y
1	668 000.000	4 499 102.687
2	668 056.530	4 499 128.076
3	668 815.521	4 499 427.842
4	669 175.417	4 499 584.903
5	670 493.002	4 500 216.239
6	670 559.527	4 500 248.662
7	672 131.871	4 501 027.988
8	672 411.656	4 501 176.748
9	672 800.000	4 501 397.657

(6) Contributing Baseline Points

		X	Y
*	1-2	664 617.519	4 503 674.163
*	2-3	665 896.762	4 504 248.707
	3-4	666 774.578	4 504 595.403
*	4-5	666 774.578	4 504 595.403
	5-6	668 092.163	4 505 226.739
*	6-7	668 092.163	4 505 226.739
	7-8	669 664.507	4 506 006.065
*	8-9	669 664.507	4 506 006.065

*Tangent Segment

[signature] 07/02/96 (8)
For the Director, MMS — Date

______ For the State — Date

Figure 10 Supplemental Official OCS Block Diagram

America, Plaintiff v. State of Louisiana, et al.

6. No. 52, Original, In the Supreme Court of the United States, October Term 1975, United States of America, Plaintiff v. State of Florida, Defendant.

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ACKNOWLEDGEMENTS

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U.S. Department of the Interior

1849 • 1999

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.