

Resource Evaluation  
Program Report

# Geological & Geophysical Data Acquisition

Outer Continental Shelf  
Through 2003



U.S. Department of the Interior  
Minerals Management Service  
Resource Evaluation Division

Resource Evaluation  
Program Report

# Geological & Geophysical Data Acquisition

Outer Continental Shelf  
Through 2003

By George Dellagiarino  
Keith Meekins  
David Zinzer



U.S. Department of the Interior  
Minerals Management Service  
Resource Evaluation Division

Herndon, Virginia  
2005

## Contents

<b>Acronyms and Abbreviation</b> .....	v
<b>Introduction</b> .....	1
<b>Permits, Data Acquisition, and Reimbursement</b> .....	3
<b>Geophysical Data Surveys</b> .....	3
Common Depth Point, 3-D, 4-D, AVO, Gravity, and Magnetic Surveys .....	3
<b>Geological Data Collection</b> .....	4
Bottom Sampling and Shallow Coring .....	4
Deep Stratigraphic Tests .....	4
<b>G&amp;G Data Release</b> .....	5
<b>Analysis of Present MMS Data Coverage on the OCS</b> .....	5
Mileage/Blocks .....	5
Geological and/or Geophysical Exploration Permits .....	6
Expenditures .....	6
<b>Comparisons to Industry</b> .....	7
<b>Bibliography</b> .....	16
<b>Appendix</b> .....	17
Alaska Tables for Data Acquisitions, Permits, Expenditures .....	19
Atlantic Tables for Data Acquisitions, Permits, Expenditures .....	23
Gulf of Mexico Tables for Data Acquisitions, Permits, Expenditures .....	27
Pacific Tables for Data Acquisitions, Permits, Expenditures .....	31
<b>Glossary</b> .....	35

## Figure

1. Federal Outer Continental Shelf Planning Areas .....	2
---	---

## Tables

1. Summary of estimates of CDP (2-D) seismic miles in MMS inventory through FY 2003 by planning area .....	9
2. Summary of 2-D seismic data acquisition for FY 1968-2003 .....	10
3. Summary of 3-D seismic data acquisition for FY 1968-2003 .....	10
4. Summary of geological and geophysical data acquisition by data type and region, FY 1968-2003 .....	11
5. Total number of permits issued for geological and geophysical exploration .....	12
6. Summary of total annual expenditures by MMS for geological and geophysical data acquisition by region, FY 1968-2003.....	13
7. Summary of geological and geophysical data acquisition expenditures by data type and region, FY 1968-2003.....	14
8. Summary of average cost per mile by MMS for 2-D seismic data, FY 1968-2003 .....	15

## Abbreviations

AVO	Amplitude Variation with Offset data
CDP	Common depth point seismic data
CFR	Code of Federal Regulations
COST	Continental Offshore Stratigraphic Test
DOI	Department of the Interior
DST	Deep stratigraphic test (well)
FY	Fiscal Year
G&G	Geological and geophysical
GOM	Gulf of Mexico
GRAV	Gravity data
HRD	High-resolution seismic data
MAG	Magnetic data
MMS	Minerals Management Service
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
RE	Resource Evaluation
REP	Resource Evaluation Program
SEG	Society of Exploration Geophysicists
2-D	Two-dimensional seismic data
3-D	Three-dimensional seismic data
4-D	Four-dimensional seismic data



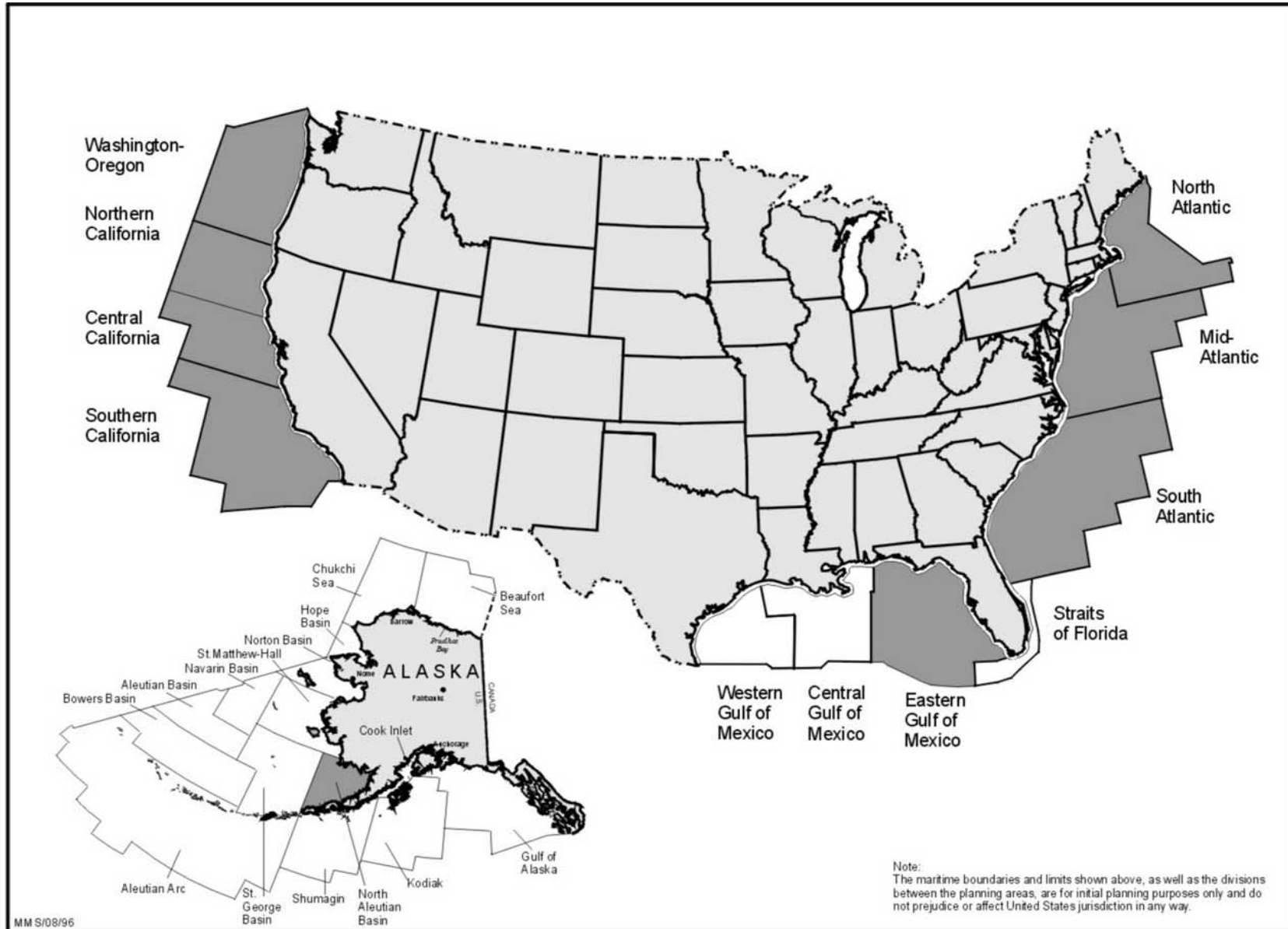
## Introduction

This report addresses the general role of the Minerals Management Service (MMS) Resource Evaluation Program (REP) in geological and geophysical (G&G) data acquisition and permitting activities.

The MMS administers the provisions of the Outer Continental Shelf Lands Act (OCSLA) through regulations found at Title 30 of the Code of Federal Regulations (CFR). The regulations govern permitting, data acquisitions and release, leasing, and postlease operations on the Outer Continental Shelf (OCS). The OCS is divided into planning areas for administrative purposes as shown in figure 1.

With regard to the REP, authority has been vested in the Secretary of the Interior under 30 CFR Part 251 to regulate prelease G&G exploration for oil, gas, and sulphur resources on the OCS. Part 251 applies not only to G&G exploration but to scientific research as well. The purpose of these regulations is to prescribe (1) when a permit or the filing of a notice is required to conduct G&G activities on the OCS and (2) operating procedures for conducting exploration, as well as requirements for disclosing data and information, conditions for reimbursing permittees for certain costs, and other conditions under which exploration shall be conducted. Similar regulations addressing prelease prospecting activities for minerals other than oil, gas, or sulphur can be found in 30 CFR Part 280.

In this report, the totals for permits issued, mileage acquired, and expenditures reflect the overall trends of oil and gas pricing, limitations of areas due to offshore moratoria, and the shift of industry emphasis to foreign theatres. Also reflected is the trend among the MMS regions with diminished leasing activity to obtain digital tapes of in-house analog data for data release which has commenced with the expiration of proprietary terms beginning in 2001 as discussed by Fulton (1998).



**Figure 1.** Federal Outer Continental Shelf Planning Areas



## Permits, Data Acquisition, and Reimbursement

The permits, issued by the Resource Evaluation (RE) Regional supervisors, set forth the specific requirements for each data-gathering activity, which includes the area where the data are collected, the timing of the data-gathering activity, approved equipment and methods, and other similar detailed information relevant to each specific permit. The primary source of the G&G data used by the REP is the oil and gas industry, which conducts exploration, development, and production activities on OCS lands. While the MMS does not perform any direct data-collection activities, it does issue permits to industry for collecting prelease G&G data. Lessees and operators are also required by regulations to provide data from their leases to the MMS. The MMS has access to the permitted data and information as a condition set forth in the permit. The MMS selectively obtains copies from these activities. Data from prelease permits constitute approximately 90 percent of the MMS database. Reimbursement for data collected by permittees and lessees in their normal conduct of business is for only the cost of data reproduction. However, if industry has collected data in areas not under the MMS jurisdiction, e.g., State waters or adjacent foreign waters, and MMS selects such data, the MMS pays the significantly higher “market price” for obtaining such data.

## Geophysical Data Surveys

### *Common Depth Point, 3-D, 4-D, AVO, Gravity, and Magnetic Surveys*

A large percentage of the geophysical data in the MMS inventory is two-dimensional (2-D) common depth point (CDP) seismic information collected along a survey line. Also known as common midpoint or common reflection point data, it is derived from a common location in the ocean subbottom where sound waves originating from various positions of the seismic (sound) source near the ocean surface are reflected back toward the surface. Estimates of the amount of these data in the MMS inventory by planning area are shown in table 1.

A slightly larger and faster growing percentage of geophysical data and information in the MMS Inventory is three-dimensional (3-D) seismic information. By collecting data along parallel, closely spaced survey lines, spatial relationships are determined in three dimensions. A still newer form of information is AVO data which involves the variation in amplitude of a seismic reflection with the angle of incidence or source-geophone distance. It can be used as a hydrocarbon gas indicator.

Magnetic surveys measure the magnetic field or a component (such as the vertical component) at a series of different locations over an area of interest usually to locate concentrations of magnetic anomalies or to determine depth to basement. Gravity surveys produce measurements of the gravitational field at a series of different locations over an area of interest. The objective in exploration work is to map density differences that may indicate different rock types. Gravity data usually are displayed as anomaly maps.

The evolution of 3-D seismic data and information in conjunction with interactive computer workstations has made it possible to more closely define and assess the potential for oil and gas occurrence on the OCS, especially with regard to subsalt prospects. The 3-D information is used to delineate, in greater detail than that of traditional 2-D information, subsurface geologic conditions associated with the occurrence of oil and gas.

As 3-D seismic technology evolved, the use of 3-D reflection techniques not only portrayed subsurface structure and stratigraphy but revealed information about fluids within the subsurface. Three dimensional seismic surveys that are shot over the same area at different times can detect, where present, changes from one fluid to another, e.g., oil to water, fluid flows, and pressure changes.

Thus, timelapse 3-D seismic surveys, known more commonly as 4-D seismic surveys, have been used to monitor fluid movement in producing reservoirs where changes in fluid content are imaged with seismic techniques over a period of time. Its chief use to date has been reservoir management, e.g., determining where and how long to drain hydrocarbon-bearing areas and to monitor gas injection or steam or water flooding during enhanced recovery operations.

The proprietary term for geophysical information (i.e., seismic sections, etc.) purchased by the MMS is 25 years; for raw geophysical data it is 50 years.

## **Geological Data Collection**

### ***Bottom Sampling and Shallow Coring***

Bottom samples are obtained by dropping a weighted tube to the ocean floor and recovering it with an attached wire line; they can also be obtained from dredging. Shallow coring is performed by conventional rotary drilling equipment to obtain a near-surface sample of the rocks of the seabed. The proprietary term for these kinds of geological information is 10 years.

### ***Deep Stratigraphic Tests***

A deep stratigraphic test, as defined in 30 CFR 251, means, “drilling that involves the penetration into the sea bottom of more than 500 feet (152 meters).” These wells are known as Continental Offshore Stratigraphic Test (COST) wells and are drilled primarily to gather geological information. Conversely, shallow test drilling, as defined in the same regulations, means, “drilling into the sea bottom to depths less than those specified in the definition of a deep stratigraphic test.” Three COST wells have encountered hydrocarbons: the COST B-3 (Atlantic), Point Conception No.1 (California), and the Norton COST No. 2 (Alaska). The proprietary term for a COST well is 25 years or, if a lease sale is held in the area, 60 days after the issuance of a lease within 50 geographic miles of the test. A discussion of the cost well program is described by Dellagiarino (1991).

## **G&G Data Release**

Regulations, promulgated in 1976, require all prelease G&G information be held proprietary for 25 years, and then be released to the public. Hence, the first data sets were released in 2001. These data sets are in southern Alaska, Southern California through Washington/Oregon, the North, Mid, and South Atlantic planning areas, and in Eastern, Central, and Western Gulf of Mexico areas. Notices on the availability of these data may be found at the Regional links to the MMS homepage at <http://www.mms.gov>.

## **Analysis of Present MMS Data Coverage on the OCS**

### *Mileage/Blocks*

A leading indicator of the amount of OCS oil and gas activity is the number and associated mileage of prelease exploration permits that the MMS issues to industry each year. Between 1968 and the early 1990's, industry has shot and recorded approximately 500,000 line miles of CDP data each year on the OCS. Of that data, the MMS has selected and acquired approximately 50,000 line miles of those CDP data each year for the REP.

Since the early 1990s, the MMS, as well as industry, has increased its acquisition of 3-D seismic data in concert with the development and use of interactive workstations. Table 1 shows the CDP (2-D) seismic data coverage, by region and planning area that the MMS has in its inventory. The grid coverage is not uniform over the planning areas. Tables 2, 3, and 4 summarize the MMS data acquisitions through 2003. It should be noted that 3-D seismic information in the MMS inventory is just about equal to the 2-D holdings in that 33,000 blocks of 3-D information equates to about 1.5 million miles of conventional seismic information.

The MMS has not acquired all of the permit data shot and recorded by industry because of budget restrictions on reimbursing the permittees for data reproduction and some processing; the lack of the necessary personnel to manage, interpret, and analyze this large volume of data, as well as the need for media storage capacity; and, primarily, the redundancy of data shot on the OCS by different companies. However, in some areas in which the MMS has previously obtained 2-D or 3-D seismic information, it will acquire new information that is derived from data acquired more recently with state-of-the-art equipment and methods, such as AVO, or from previously acquired data that are reprocessed using more modern techniques.

The Regions formerly spent funds on prelease high-resolution data (HRD), as these data were acquired under exclusive contract rather than under permit. A change in policy in 1982 altered this situation. Under the previous program, the MMS directly acquired prelease, tract-specific, shallow hazards data. Under the areawide leasing program, the detailed shallow hazards analysis function was shifted to the postsale phase, and the responsibility for site-specific hazards data collection was placed on the lessee as a condition to obtain a drilling

permit. If industry chooses to conduct prelease hazards surveys, G&G permits must be obtained from the MMS. Shallow hazards survey data and information are available to the MMS under terms of permit or lease and regulations. This practice has continued under the focused leasing approach adopted in 1984.

### ***Geological and/or Geophysical Exploration Permits***

As mentioned, the number of permits issued by the MMS and the areas for which the permits are issued are leading indicators of oil and gas activity on the OCS. Table 5 presents the statistics of G&G exploration permitting for the OCS since 1960, with a differentiation between geological permits and geophysical permits from 1969 to 2003.

The MMS tracks G&G permits by calendar year. (tables A-2, A-6, A-10, and A-14 show total permits per Region.) They demonstrate that most OCS oil and gas activity has been in the Gulf of Mexico. The Gulf of Mexico has issued 82 percent of all permits and is followed by the Alaska Region with 9 percent. The Pacific Region has issued 7 percent of the permits, followed by the now defunct Atlantic Region with about 2 percent. However, since 1994 activities in the Atlantic have been assigned to the Gulf of Mexico Region. With the addition of these responsibilities, the percentage of total permits for the Gulf of Mexico Region increases to 85 percent. These statistics correlate extremely well with the dominant position of the Central and Western Gulf of Mexico planning areas in OCS oil and gas activities.

It should be noted that since 1969, approximately 95 percent of the permits issued were for geophysical exploration and that geological exploration permits accounted for only 5 percent. While the total number of 3-D permits compared to all permits issued is rather small (8 percent) when compared with the total geophysical permits issued, over the past 10 years, 3-D permits have averaged 49 percent of all geophysical permits. Permits for deep stratigraphic test wells or COST wells account for about 2 percent of the geological permits.

The overall trends in permitting for all the Regions are similar and reflect fluctuations in the price and supply of petroleum. Some regional differences can be detected that are related to leasing moratoria, operating conditions, and hydrocarbon discoveries. Leasing moratoria and adverse weather conditions decrease exploration activity.

### ***Expenditures***

The MMS records financial and procurement transactions by fiscal year. All figures and tables involving the MMS data acquisition from permittees are based on a fiscal year that begins on October 1 and extends through the following September 30.

Tables 6 and 7 show the total expenditures for G&G data since 1968 for those data presented in table 4. Tables 6 and 7 show the distribution of G&G expenditures by Region. The Gulf of Mexico and Alaska have the largest portion of the expenditures with 39 and 38 percent respectively. Alaska has over twice the offshore area of the other three Regions combined. On the other hand, the Gulf of Mexico, with over 95 percent of OCS production, possesses the largest database.

The Atlantic Region (13 percent of the expenditures) and the Pacific (10 percent) are comparable. The Pacific Region has the smallest slice of the expenditures for G&G data because much of the California OCS and offshore Washington and Oregon have been under moratoria since the 1980s. Much of the Atlantic Region is also under moratoria and there is no new seismic information being collected that MMS would acquire. The main difference between the two Regions, according to table 7 is in the acquisition of high-resolution data in the Atlantic.

The Gulf of Mexico Region's dominant role in establishing the offshore industry is apparent by its acquisition of the majority of the data before 1976 and more so since 1990. Between 1976 and 1989, a significant portion of the MMS geological and geophysical data acquisition budget has been expended by the Alaska Region, which oversees most of the OCS lands. However, since the 1990s and up through the present, most of the MMS geological and geophysical data acquisition budget has been allocated for data in the Gulf of Mexico.

There were large values for the average cost per mile for data in the Alaska Region from the late 1970s into the 1990s and for the Atlantic Region in the 1980s. The Alaska Region purchased a great deal of data shot in State waters, where a Federal permit is not applicable. Thus, the reimbursement did not fall under the provisions of the OCSLA, and the MMS was required to pay full market price for these data. The price varied from \$1,500 to \$6,000 per mile and is reflected in the unusually high average cost per mile shown in table 8.

The Atlantic Region contracted for several sets of exclusive high-resolution data that were used for sales and hazards studies. The high price of exclusive high-resolution data, some well over \$450 per mile, increased the average cost per mile in the Atlantic Region that year.

Overall, the early to mid-1980s saw a dramatic increase in expenditures by the MMS as more reprocessed data were acquired to address areawide leasing and a more aggressively proposed 5-year OCS leasing schedule. However, due to regulatory changes in reimbursement procedures in 1986, the cost per mile has dropped dramatically. With a less aggressive 5-Year Leasing Schedule and new exploration theatres worldwide, total expenditures have decreased from the 1980s to the present.

## **Comparisons to Industry**

Industry has tended to acquire more data than the MMS. However, of the data shot by industry in the Alaska OCS, the MMS has acquired approximately 90 percent. Alaska remains a large frontier area with limited data coverage by industry, a fact that necessitates the MMS to acquire as much of these data as feasible. In recent years, the Gulf of Mexico has acquired most 3-D surveys and most large 2-D surveys. However, the MMS does not acquire the volume that industry obtains to reprocess.

The MMS acquired more data in the Atlantic Region than industry in 1976 and 1983. Before 1976, the MMS database was limited because industry had shown very little interest in leasing this frontier area, although industry had been acquiring geophysical data.

During the period 1976 to 1984, the MMS not only acquired most of the industry data, but purchased much of the pre-1976 data. Since 1985, there has been less activity, reflecting a decrease in industry interest.

Some of the reasons the MMS does not acquire all the data held by industry are as follows:

- Redundancy of data, because industry does not share it,
- Difference in data quality,
- Budgetary constraints,
- Personnel limitations for data reduction and interpretations, and
- Data storage, retrieval and display limitations.

In conclusion, totals for mileage acquired, permits issued, and expenditures reflect the overall trends of oil and gas pricing, limitations of areas due to offshore moratoria, and a shift of industry emphasis to foreign theatres.

**Table 1.** Summary of Estimates of CDP (2-D) Seismic Miles in the MMS Inventory Through Fiscal Year (FY) 2003 by Planning Area (Rounded off to Nearest 1,000 Miles)

<b>Planning Area</b>	<b>Estimated Mileage</b>
<b>Alaska</b>	
Gulf of Alaska	36,000
Cook Inlet	21,000
Kodiak	23,000
Shumagin	10,000
North Aleutian	43,000
St. George Basin	50,000
Aleutian Arc	< 500
Bowers Basin	<1,000
Aleutian Basin	<1,000
St. Matthew-Hall	10,000
Norton Basin	25,000
Navarin Basin	55,000
Hope Basin	9,000
Chukchi Sea	95,000
Beaufort Sea	<u>61,000</u>
Total	440,000
<b>Atlantic</b>	
North Atlantic	92,000
Mid-Atlantic	60,000
South Atlantic	54,000
Straits of Florida	<u>7,000</u>
Total	213,000
<b>Gulf of Mexico</b>	
Eastern GOM	159,000
Central GOM	476,000
Western GOM	<u>363,000</u>
Total	998,000
<b>Pacific</b>	
Southern California	85,000
Central California	21,000
Northern California	19,000
Wash./Oregon	<u>8,000</u>
Total	133,000

Figures may vary by 1-2%.

**Table 2.** Summary of 2-D Seismic Data Acquisition for FY 1968-2003

<b>FY</b>	<b>Total Miles</b>
1968-1975	269,814
1976	108,922
1977	42,808
1978	54,426
1979	31,489
1980	19,400
1981	69,904
1982	79,961
1983	120,743
1984	89,853
1985	71,521
1986	47,287
1987	113,680
1988	78,920
1989	53,494
1990	85,280
1991	40,513
1992	49,191
1993	25,482
1994	7,138
1995	8,930
1996	33,296
1997	39,682
1998	90,981
1999	30,135
2000	64,710
2001	6,668
2002	1,506
2003	48,154
<b>Total</b>	<b>1,783,888</b>

*Figures may vary by 1-2%.*

**Table 3.** Summary of 3-D Seismic Data Acquisition for FY 1968-2003

<b>FY</b>	<b>Total Blocks</b>
1968-1992	0
1993	1,563
1994	1,420
1995	1,826
1996	1,470
1997	3,129
1998	3,460
1999	3,226
2000	6,161
2001	3,602
2002	7,182
2003	6,272
<b>Total</b>	<b>39,311</b>

*Figures may vary by 1-2%.*



**Table 4.** Summary of Geological and Geophysical Data Acquisition by Data Type and Region, FY 1968-2003

<b>Data Type</b>	<b>Region</b>	<b>Mileage *</b>
<b>2-D Seismic</b>	Alaska	440,179
	Atlantic	212,967
	Gulf of Mexico	997,901
	Pacific	<u>132,841</u>
	Total	1,783,888
<b>High Resolution</b>	Alaska	59,855
	Atlantic	49,509
	Gulf of Mexico	145,768
	Pacific	<u>30,582</u>
	Total	285,714
<b>CDP Interpretations</b>	Alaska	84,683
	Atlantic	44,801
	Gulf of Mexico	139,418
	Pacific	<u>42,365</u>
	Total	311,267
<b>Gravity and Magnetics</b>	Alaska	370,849
	Atlantic	15,783
	Gulf of Mexico	590,331
	Pacific	<u>110,150</u>
	Total	1,087,113
<b>3-D Seismic</b>	Alaska	33
	Atlantic	0
	Gulf of Mexico	39,226
	Pacific	<u>52</u>
	Total	39,311
<b>AVO</b>	Alaska	0
	Atlantic	0
	Gulf of Mexico	1,492
	Pacific	<u>0</u>
	Total	1,492
<b>Deep Stratigraphic Tests</b>	Alaska	14
	Atlantic	5
	Gulf of Mexico	3
	Pacific	<u>2</u>
	Total	24

\* 3-D seismic and AVO are measured in blocks and Deep Stratigraphic Test units are wells drilled.

bl = Blocks

Figures may vary 1-2%.

**Table 5.** Total Number of Permits Issued for Geological and Geophysical Exploration

<b>Year</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>
1960-1968	2,353	---	---	---	---	---	---
1969	258	249	9	0	0	0	0
1970							
1971	213	203	10	0	0	0	0
1972	210	205	5	0	0	0	0
1973	220	210	10	0	0	0	0
1974	339	321	18	0	0	0	0
1975	357	345	12	2	0	0	0
1976	510	487	23	3	0	0	0
1977	420	400	20	7	0	0	0
1978	452	436	16	4	0	0	0
1979	342	329	13	2	0	0	0
	276	265	11	0	0	0	0
1980							
1981	318	302	16	1	0	0	0
1982	394	383	11	0	0	0	0
1983	502	490	12	3	0	0	0
1984	574	542	32	1	16	0	0
1985	543	518	25	0	18	0	0
1986	398	382	16	0	38	0	0
1987	211	207	4	0	32	0	0
1988	298	282	16	0	42	0	0
1989	313	289	24	0	45	0	0
	249	237	12	1	47	0	0
1990							
1991	251	241	9	0	57	1	0
1992	170	156	12	0	45	2	0
1993	141	137	3	0	53	1	0
1994	147	135	11	0	70	1	0
1995	133	117	16	0	53	0	0
1996	104	92	11	0	50	1	0
1997	136	120	16	0	59	0	0
1998	159	139	20	0	69	0	1
1999	157	143	14	0	59	0	1
	111	98	13	0	44	0	0
2000							
2001	80	73	5	0	32	2	0
2002	110	103	7	0	33	0	0
2003	80	75	5	0	20	0	3
Total	<u>107</u>	<u>100</u>	<u>3</u>	<u>0</u>	<u>29</u>	<u>4</u>	<u>2</u>
	11,636	8,811	460	24	911	12	7

Dashed lines = Individual breakouts not established

A=Total Number of Geological, Geophysical, and Strategic Minerals Permits

B=Number of Geophysical Permits

C=Number of Geological Permits

D=Number of Geological Permits Issued for Deep Stratigraphic Tests

E=Number of Geophysical Permits Issued for 3-D Seismic Data

F=Number of Permits Issued for Strategic (Nonenergy) Minerals

G=Number of Permits Issued for 4-D Seismic Data

Figures may vary 1-2%.

**Table 6.** Summary of Total Annual Expenditures by the MMS for Geological and Geophysical Data Acquisition by Region, FY 1968-2003 (in dollars)

<b>FY</b>	<b>Alaska</b>	<b>Atlantic</b>	<b>Gulf of Mexico</b>	<b>Pacific</b>	<b>Total</b>
1968-1975	3,162,548	361,686	9,414,042	1,443,987	14,891,780*
1976	3,496,607	2,504,710	3,281,698	581,670	9,914,882*
1977	450,161	2,287,390	3,764,678	1,147,968	7,719,974*
1978	3,421,269	906,989	1,842,701	416,463	6,587,422
1979	6,240,687	232,085	1,573,094	2,272,407	11,020,298*
1980	6,972,885	4,469,762	4,388,508	1,412,062	17,243,217
1981	6,842,045	1,530,898	1,168,618	866,656	10,408,217
1982	1,864,661	1,945,270	2,943,602	1,996,271	8,749,804
1983	5,673,514	1,738,427	3,802,409	1,312,596	12,526,946
1984	4,751,354	1,580,008	4,246,742	1,286,598	11,864,702
1985	3,676,375	318,261	2,959,989	861,687	7,816,312
1986	2,904,246	87,307	1,834,553	363,564	5,189,670
1987	2,579,190	438,792	1,840,609	939,558	5,798,149
1988	1,382,560	71,510	1,078,713	114,168	2,646,951
1989	389,960	259,629	913,481	96,354	1,659,424
1990	886,402	150	865,083	0	1,751,635
1991	539,986	2,790	1,003,066	31,000	1,576,842
1992	99,797	1,932	794,104	0	1,490,798**
1993	322,410	0	1,014,853	26,700	1,363,963
1994	582,132	0	760,245	11,806	1,454,183**
1995	379,395	0	628,752	21,125	1,142,817**
1996	283,764	0	1,697,494	40,867	2,022,125
1997	204,655	0	1,180,893	19,594	1,471,967**
1998	278,606	0	1,804,694	10,264	2,094,400**
1999	543,775	0	1,400,781	13,350	1,957,906
2000	354,448	0	2,053,285	7,148	2,414,881***
2001	67,324	0	1,283,496	0	1,350,820***
2002	762,911	0	944,923	0	1,707,834**
2003	<u>0</u>	<u>1,080,000</u>	<u>445,868</u>	<u>0</u>	<u>1,525,868</u>
Total	59,113,667	19,817,596	60,930,974	15,293,863	157,363,788

\* Included in the budget for these years were General Account funds that were transferred to the U.S. Geological Survey, Branch of Marine Geology, for G&G data acquisition. These accounts included \$509,517 in the interval between FY 1968-1975, \$50,197 in FY 1976, \$69,777 in FY 1977, and \$702,025 in FY 1979.

\*\*Included in the budget for these years were funds that were used for special projects related to G&G activities. In FY 1992, \$494,965 was obligated toward the purchase of geologic interpretive workstations and \$100,000 was obligated toward the initiation of the Offshore Northern Gulf of Mexico Oil and Gas Atlas Series. In FY 1994, \$100,000 was again obligated toward the preparation of the Offshore Northern Gulf of Mexico Oil and Gas Atlas and in FY 1995, \$100,000 was obligated toward the completion of the Atlas, and \$13,545 was obligated toward finalization of a well log data conversion contract in the Gulf of Mexico. In FY 1997, \$5,000 was obligated towards the curation of Atlantic well samples. In FY 1998, \$836 was obligated toward updating the MMS AAPG CD-ROM investment. In FY2002, funds were obligated towards a T-3 Data Access Line, Gravity/Magnetics Interpretations, JIP hydrates participation, and the Earth Model Project.

\*\*\*Includes \$353,111 carried over by the Gulf of Mexico from 1999 and \$228,496 carried over from 2000.

Figures are rounded and may vary by 1-2%.

**Table 7.** Summary of Geological and Geophysical Data Acquisition Expenditures by Data Type and Region, FY 1968-2003

<b>Data Type</b>	<b>Region</b>	<b>Expenditures (\$)*</b>
<b>Alaska</b>		
2-D Seismic		40,944,258
High Resolution		11,125,798
CDP Interpretations		439,793
Gravity and Magnetics		1,026,956
3-D Seismic		1,469,139
AVO		0
Total		<u>55,005,944</u>
<b>Atlantic</b>		
2-D Seismic		8,871,438
High Resolution		9,751,232
CDP Interpretations		55,274
Gravity and Magnetics		2,902
3-D Seismic		0
AVO		0
Total		<u>18,680,846</u>
<b>Gulf of Mexico</b>		
2-D Seismic		31,749,143
High Resolution		12,729,139
CDP Interpretations		856,526
Gravity and Magnetics		539,804
3-D Seismic		8,785,584
AVO		61,453
Total		<u>54,721,649</u>
<b>Pacific</b>		
2-D Seismic		9,553,194
High Resolution		3,696,394
CDP Interpretations		72,175
Gravity and Magnetics		534,363
3-D Seismic		27,925
AVO		0
Total		<u>13,884,051</u>

\*MMS has had additional expenditures through its G&G data acquisition budget for other general purchases such as field tapes, special processing, navigation tapes, interpretive hardware and software for evaluation purposes, geological studies, scanning, and acquisition of digital tapes of in-house analog data.

Figures may vary 1-2%.

**Table 8.** Summary of Average Cost Per Mile by the MMS for 2-D Seismic Data, FY 1968-2003

<b>FY</b>	<b>Average Cost (\$/Mile)</b>
1968-1975	33.60
1976	34.90
1977	30.00
1978	73.60
1979	99.70
1980	91.50
1981	100.70
1982	107.00
1983	102.50
1984	121.10
1985	105.90
1986	102.00
1987	48.30
1988	32.70
1989	26.10
1990	18.00
1991	19.86
1992	7.49
1993	13.33
1994	75.84
1995	22.02
1996	39.04
1997	5.45
1998	3.18
1999	1.40
2000	1.29
2001	68.61/1.34*
2002	2.11*
2003	470.81/0.99*

Note: Summaries reflect average cost per mile for all CDP Information acquired, both State and Federal. Average costs reflect only those dollars assigned to the bureauwide G&G budget and do not reflect monies allocated from Regional funds.

\* The \$68.61 total includes the cost for data in Cuban waters at the market price. The average cost per line mile for data in Federal waters is \$1.34. Likewise, \$470.81 represents the market costs to acquire offshore Canadian data and the average cost per line mile for data in Federal waters is \$3.79. The \$2.11 total includes velocity models for depth data.

*Figures may vary 1-2%.*

## Bibliography

- Dellagiarino, George, 1991, The Offshore Deep Stratigraphic Test Well Program, U.S. Department of the Interior, Minerals Management Service, OCS Report MMS 90-0028, 36 p.
- Dellagiarino, George, Fulton, Patricia, Meekins, Keith, and Zinzer, David, 2002, Geological and Geophysical Data Acquisition, A 25-Year Retrospective, 1976-2001, U.S. Department of the Interior, Minerals Management Service, OCS Report MMS 2002-079, 46 p.
- Dellagiarino, George, and Meekins, Keith, 1998, The Resource Evaluation Program: Structure and Mission on the Outer Continental Shelf, U.S. Department of the Interior, Minerals Management Service, OCS Report MMS 98-0028, 43 p.
- Fulton, Patricia, 1998, Prelease Permits for Oil, Gas, and Sulphur on the Outer Continental Shelf, U.S. Department of the Interior, Minerals Management Service, OCS Report MMS 98-0009, 119 p.
- Geophysics*, Society of Exploration Geophysicists, Tulsa, Oklahoma.
- Geophysics: The Leading Edge of Exploration*, Society of Exploration Geophysicists, Tulsa, Oklahoma.
- Robinson, E.S., and Coruh, C., 1988, Basic Exploration Geophysics, John Wiley and Sons, 562 p.
- Sheriff, Robert E., 2002, "Encyclopedic Dictionary of Applied Geophysics, Fourth Edition", Society of Exploration Geophysicists, 428 p.
- Wood, Larry C., 1982, "Imaging the Subsurface" *in* Concepts and Techniques in Oil and Gas Exploration, Society of Exploration Geophysicists, Tulsa, Oklahoma, pgs. 45-90.

## Appendix

### Alaska

A-1	Summary of geological and geophysical data acquisition by FY for Alaska.....	19
A-2	Number of permits issued for geological and geophysical exploration in Alaska .....	20
A-3	Summary of expenditures by the MMS for geological and geophysical data acquisition by FY for Alaska .....	21
A-4	Summary of average cost per mile by the MMS for 2-D seismic data by FY for Alaska.....	22

### Atlantic

A-5	Summary of geological and geophysical data acquisition by FY for the Atlantic.....	23
A-6	Number of permits issued for geological and geophysical exploration in the Atlantic .....	24
A-7	Summary of expenditures by the MMS for geological and geophysical data acquisition by FY for the Atlantic.....	25
A-8	Summary of average cost per mile by the MMS for 2-D seismic data by FY for the Atlantic .....	26

### Gulf of Mexico

A-9	Summary of geological and geophysical data acquisition by FY for the Gulf of Mexico.....	27
A-10	Number of permits issued for geological and geophysical exploration in the Gulf of Mexico .....	28
A-11	Summary of expenditures by the MMS for geological and geophysical data acquisition by FY for the Gulf of Mexico.....	29
A-12	Summary of average cost per mile by the MMS for 2-D seismic data by FY for the Gulf of Mexico.....	30

**Pacific**

A-13 Summary of geological and geophysical data acquisition  
by FY for the Pacific.....31

A-14 Number of permits issued for geological and geophysical  
exploration in the Pacific .....32

A-15 Summary of expenditures by the MMS for geological and  
geophysical data acquisition by FY for the Pacific (in dollars).....33

A-16 Summary of average cost per mile by the MMS for 2-D seismic  
data by FY for the Pacific (in dollars) .....34



## Alaska Tables

**Table A-1.** Summary of Geological and Geophysical Data Acquisition by FY for Alaska

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	70,306	5,500	32,819	55,710	0	1
1976	37,785	19,163	30,164	0	0	4
1977	11,952	5,606	21,700	23,470	0	4
1978	28,524	0	0	36,625	0	0
1979	8,538	5,412	0	25,465	0	0
1980	10,109	7,703	0	0	0	1
1981	35,430	4,590	0	14,969	0	0
1982	16,624	0	0	0	0	2
1983	51,903	0	0	0	0	2
1984	30,961	7,904	0	5,850	0	0
1985	30,270	0	0	0	0	0
1986	21,603	1,600	0	0	0	0
1987	49,532	470	0	80,826	0	0
1988	14,963	1,741	0	0	0	0
1989	3,136	166	0	9,543	0	0
1990	8,557	0	0	11,046	0	0
1991	3,964	0	0	1,500	0	0
1992	0	0	0	0	0	0
1993	1,893	0	0	0	0	0
1994	2,422	0	0	102,845	0	0
1995	737	0	0	3,000	0	0
1996	315	0	0	0	0	0
1997	382	0	0	0	3*	0
1998	273	0	0	0	0	0
1999	0	0	0	0	7*	0
2000	0	0	0	0	12*	0
2001	0	0	0	0	0	0
2002	0	0	0	0	11*	0
2003	0	0	0	0	0	0
Total	440,179	59,855	84,683	370,849	33*	14

\* Acquisition for 3-D seismic data are measured in blocks; all other acquisitions in this table are measured in miles. The DST dates are assigned based upon completion dates and are measured in terms of wells completed. All other data are measured in terms of miles.

**Table A-2.** Number of Permits Issued for Geological and Geophysical Exploration in Alaska

Year	A	B	C	D	E	F
1960-1968	75	---	---	---	---	---
1969	31	28	3	0	0	0
1970	40	36	4	0	0	0
1971	27	26	1	0	0	0
1972	17	17	0	0	0	0
1973	33	32	1	0	0	0
1974	47	44	3	0	0	0
1975	82	74	8	1	0	0
1976	69	61	8	4	0	0
1977	33	29	4	4	0	0
1978	9	8	1	0	0	0
1979	32	30	2	0	0	0
1980	41	36	5	1	0	0
1981	54	49	5	0	0	0
1982	85	79	6	3	0	0
1983	103	80	23	1	0	0
1984	70	62	8	0	0	0
1985	63	56	7	0	0	0
1986	18	17	1	0	0	0
1987	18	14	4	0	0	0
1988	13	9	4	0	0	0
1989	17	14	3	0	0	0
1990	19	15	3	0	0	1
1991	7	4	1	0	0	2
1992	7	6	0	0	0	1
1993	11	10	0	0	2	1
1994	3	3	0	0	1	0
1995	1	1	0	0	1	0
1996	6	6	0	0	5	0
1997	5	4	1	0	0	0
1998	2	2	0	0	2	0
1999	2	2	0	0	2	0
2000	1	1	0	0	1	0
2001	0	0	0	0	0	0
2002	1	1	0	0	0	0
2003	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	1,043	857	106	14	14	5

Dashed lines = Individual breakouts not established

A=Total Number of Geological, Geophysical, and Strategic Minerals Permits

B=Number of Geophysical Permits

C=Number of Geological Permits

D=Number of Geological Permits Issued for Deep Stratigraphic Tests

E=Number of Geophysical Permits Issued for 3-D Seismic Data

F=Number of Permits Issued for Strategic (Nonenergy) Minerals

**Table A-3.** Summary of Expenditures by the MMS for Geological and Geophysical Data Acquisition by FY for Alaska (in dollars)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	2,803,939	119,700	160,832	7,515	0	NA
1976	1,628,153	1,598,789	268,961	0	0	NA
1977	271,035	36,473	10,000	49,450	0	NA
1978	2,956,280	0	0	408,679	0	0
1979	2,180,700	2,019,512	0	125,148	0	0
1980	1,086,423	5,789,936	0	0	0	NA
1981	5,231,130	1,531,458	0	69,286	0	0
1982	1,817,736	0	0	0	0	NA
1983	5,673,514	0	0	0	0	NA
1984	4,118,626	19,238	0	27,072	0	0
1985	3,669,129	0	0	0	0	0
1986	2,780,556	950	0	0	0	0
1987	2,301,780	400	0	249,951	0	0
1988	1,339,007	3,425	0	0	0	0
1989	347,872	5,917	0	21,851	0	0
1990	832,476	0	0	51,681	0	0
1991	518,613	0	0	15,573	0	0
1992*	0	0	0	0	0	0
1993	139,117	0	0	0	0	0
1994	579,129	0	0	0	0	0
1995	167,170	0	0	750	0	0
1996	113,071	0	0	0	0	0
1997	195,855	0	0	0	0	0
1998	192,947	0	0	0	0	0
1999	0	0	0	0	358,155	0
2000	0	0	0	0	348,073	0
2001*	0	0	0	0	0	0
2002	0	0	0	0	762,911	0
2003*	0	0	0	0	0	0
Total	40,944,258	11,125,798	439,793	1,026,956	1,469,139	0

\*In FY 1992 and 2003, the Alaska Region spent funds from the G&G budget and Regional funds to acquire digital copies of data already in their inventory and did not acquire any new or additional data. In FY 2001, the Region spent funds to acquire digital copies of seismic information already in their inventory as well as a paleontological study. In FY 2003, funds were also spent to scan in house data.

Note: NA represents "not applicable" as no G&G funds are used to acquire information from a DST. Where no DST was completed, a zero is entered into the expenditure column.

**Table A-4.** Summary of Average Cost Per Mile by the MMS for 2-D Seismic Data by FY for Alaska (in dollars)

<b>Year</b>	<b>Average Cost (\$/Mile)</b>
1968-1975	39.88
1976	43.09
1977	22.68
1978	103.64
1979	255.41
1980	107.47
1981	147.65
1982	109.34
1983	109.31
1984	133.03
1985	121.21
1986	128.71
1987	46.47
1988	89.49
1989	110.93
1990	97.29
1991	130.85
1992	0
1993	73.48
1994	239.18
1995	475.85
1996	358.96
1997	512.71
1998	706.77
1999	0
2000	0
2001	0
2002	0
2003	0

Note: Summaries reflect average cost per mile for all CDP Information acquired, both State and Federal. Average costs reflect only those dollars assigned to the bureauwide G&G budget and do not reflect monies allocated from Regional funds.

Zero indicates G&G dollars were not spent on CDP information.

## Atlantic Tables

**Table A-5.** Summary of Geological and Geophysical Data Acquisition by FY for the Atlantic

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	41,958	1,740	11,802	14,267	0	0
1976	25,211	23,867	29,822	1,076	0	2
1977	21,032	6,100	3,177	440	0	2
1978	14,281	0	0	0	0	0
1979	6,877	0	0	0	0	1
1980	585	10,660	0	0	0	0
1981	9,950	7,142	0	0	0	0
1982	19,074	0	0	0	0	0
1983	30,077	0	0	0	0	0
1984	9,386	0	0	0	0	0
1985	1,640	0	0	0	0	0
1986	424	0	0	0	0	0
1987	2,356	0	0	0	0	0
1988	827	0	0	0	0	0
1989	2,730	0	0	0	0	0
1990	31	0	0	0	0	0
1991	1,042	0	0	0	0	0
1992	2,377	0	0	0	0	0
1993	0	0	0	0	0	0
1994	0	0	0	0	0	0
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	23,109	0	0	0	0	0
Total	212,967	49,509	44,801	15,783	0	5

Note: The DST dates are assigned based upon completion dates and are measured in terms of wells completed. All other data are measured in terms of miles.

**Table A-6.** Number of Permits Issued for Geological and Geophysical Exploration in the Atlantic

<b>Year</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
1960-1968	45	---	---	---	---	---
1969	7	7	0	0	0	0
1970	4	3	1	0	0	0
1971	4	4	0	0	0	0
1972	4	4	0	0	0	0
1973	4	4	0	0	0	0
1974	2	2	0	0	0	0
1975	29	23	6	1	0	0
1976	35	28	7	3	0	0
1977	20	20	0	0	0	0
1978	17	13	4	1	0	0
1979	9	9	0	0	0	0
1980	15	15	0	0	0	0
1981	17	16	1	0	0	0
1982	11	11	0	0	0	0
1983	10	10	0	0	0	0
1984	6	6	0	0	0	0
1985	2	1	1	0	0	0
1986	3	2	1	0	0	0
1987	2	0	2	0	0	0
1988	4	4	0	0	0	0
1989	0	0	0	0	0	0
1990	1	1	0	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	0	0	0	0	0	0
1995	1	0	0	0	0	1
1996	0	0	0	0	0	0
1997	2	1	1	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	1	0	0	0	0	1
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	255	184	24	5	0	2

Dashed lines = Individual breakouts not established

A=Total Number of Geological, Geophysical, and Strategic Minerals Permits

B=Number of Geophysical Permits

C=Number of Geological Permits

D=Number of Geological Permits Issued for Deep Stratigraphic Tests

E=Number of Geophysical Permits Issued for 3-D Seismic Data

F=Number of Permits Issued for Strategic (Nonenergy) Minerals

**Table A-7.** Summary of Expenditures by the MMS for Geological and Geophysical Data Acquisition by FY for the Atlantic (in dollars)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	309,029	4,900	---	---	0	0
1976	196,687	2,256,167	45,282	2,902	0	NA
1977	242,868	1,968,513	9,992	0	0	NA
1978	581,562	0	0	0	0	0
1979	119,250	0	0	0	0	NA
1980	51,096	4,278,448	0	0	0	0
1981	179,682	1,243,204	0	0	0	0
1982	1,882,723	0	0	0	0	0
1983	1,718,584	0	0	0	0	0
1984	1,500,298	0	0	0	0	0
1985	287,135	0	0	0	0	0
1986	87,307	0	0	0	0	0
1987	438,792	0	0	0	0	0
1988	71,510	0	0	0	0	0
1989	120,042	0	0	0	0	0
1990	150	0	0	0	0	0
1991	2,790	0	0	0	0	0
1992	1,933	0	0	0	0	0
1993	0	0	0	0	0	0
1994	0	0	0	0	0	0
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	<u>1,080,000</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	7,791,438	9,751,232	55,274	2,902	0	0

Note: The abbreviation NA represents "not applicable" as no G&G funds are used to acquire information from a DST. Where no DST was completed, a zero is entered into the expenditure column.

Dashed lines = No expenditures are available for CDP interpretations or gravity and magnetic data for 1968-1975.

**Table A-8.** Summary of Average Cost Per Mile by the MMS for 2-D Seismic Data by FY for the Atlantic (in dollars)

<b>Year</b>	<b>Average Cost (\$/Mile)</b>
1968-1975	7.37
1976	7.80
1977	11.55
1978	40.72
1979	17.34
1980	87.34
1981	18.06
1982	98.70
1983	57.14
1984	159.85
1985	175.08
1986	205.91
1987	186.24
1988	86.47
1989	43.97
1990	4.84
1991	2.68
1992	0.81
1993	---
1994	---
1995	---
1996	---
1997	---
1998	---
1999	---
2000	---
2001	---
2002	---
2003*	470.81

Note: Summaries reflect average cost per mile for all CDP Information acquired, both State and Federal. Average costs reflect only those dollars assigned to the bureauwide G&G budget and do not reflect monies allocated from Regional funds.

\* Data acquired in offshore Canada at market prices.

Dashed lines indicate no funding for that year.



## Gulf of Mexico Tables

**Table A-9.** Summary of Geological and Geophysical Data Acquisition by FY for the Gulf of Mexico

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	143,458	88,549	120,038	19,670	0	2
1976	31,474	9,367	19,380	56,272	0	0
1977	4,485	18,119	0	0	0	0
1978	7,188	8,275	0	0	0	0
1979	11,681	5,018	0	0	0	0
1980	4,758	15,940	0	0	0	0
1981	16,454	500	0	0	0	0
1982	28,700	0	0	0	0	0
1983	26,290	0	0	0	0	0
1984	40,828	0	0	0	0	0
1985	31,430	0	0	0	0	0
1986	22,616	0	0	0	0	0
1987	43,073	0	0	0	0	0
1988	56,265	0	0	0	0	0
1989	43,121	0	0	0	0	1
1990	76,692	0	0	0	0	0
1991	35,507	0	0	0	0	0
1992	46,814	0	0	0	0	0
1993	23,589	0	0	0	1,563*	0
1994	4,416	0	0	0	1,420*	0
1995	8,193	0	0	0	1,826*	0
1996	32,797	0	0	0	1,458*	0
1997	39,300	0	0	0	3,105*	0
1998	90,708	0	0	178,305	3,452*	0
1999	30,135	0	0	52,000	3,219*	0
2000	64,710	0	0	284,084	6,138*	0
2001	6,668	0	0	0	3,602*	0
2002	1,506	0	0	0	7,171*	0
2003	25,045	0	0	0	6,272*	0
Total	997,901	145,768	139,418	590,331	39,266*	3

Note: \*Acquisitions for 3-D seismic and AVO data are measured in blocks; all other acquisitions in this table are measured in miles.

The DST dates are assigned based upon completion dates and are measured in terms of wells completed.

Figures may vary by 1-2%.

**Table A-10.** Number of Permits Issued for Geological and Geophysical Exploration in the Gulf of Mexico

Year	A	B	C	D	E	F	G
1960-1968	2,071	---	---	---	---	---	---
1969	207	204	3	0	0	0	0
1970	166	162	4	0	0	0	0
1971	179	175	4	0	0	0	0
1972	198	188	10	0	0	0	0
1973	272	264	8	0	0	0	0
1974	284	275	9	2	0	0	0
1975	353	348	5	0	0	0	0
1976	292	289	3	0	0	0	0
1977	368	361	7	0	0	0	0
1978	278	278	0	0	0	0	0
1979	211	204	7	0	0	0	0
1980	231	225	6	0	0	0	0
1981	283	280	3	0	0	0	0
1982	344	341	3	0	0	0	0
1983	416	416	0	0	16	0	0
1984	411	408	3	0	18	0	0
1985	300	295	5	0	38	0	0
1986	170	169	1	0	32	0	0
1987	258	252	6	0	42	0	0
1988	263	251	12	0	45	0	0
1989	232	223	9	1	47	0	0
1990	227	222	5	0	57	0	0
1991	163	152	11	0	45	0	0
1992	134	131	3	0	53	0	0
1993	136	125	11	0	68	0	0
1994	130	114	16	0	52	0	0
1995	102	91	11	0	49	0	0
1996	130	114	16	0	54	0	0
1997	152	134	18	0	69	0	1
1998	155	141	14	0	57	0	1
1999	109	96	13	0	42	0	0
2000	78	72	5	0	31	1	0
2001	110	103	7	0	33	0	0
2002	79	74	5	0	20	0	3
2003	<u>106</u>	<u>99</u>	<u>3</u>	<u>0</u>	<u>28</u>	<u>4</u>	<u>2</u>
Total	9,598	7,276	246	3	846	5	7

Dashed lines = Individual breakouts not established

A=Total Number of Geological, Geophysical, and Strategic Minerals Permits

B=Number of Geophysical Permits

C=Number of Geological Permits

D=Number of Geological Permits Issued for Deep Stratigraphic Tests

E=Number of Geophysical Permits Issued for 3-D Seismic Data

F=Number of Permits Issued for Strategic (Nonenergy) Minerals

G=Number of Permits Issued for 4-D Seismic Data

Figures may vary by 1-2%.

**Table A-11.** Summary of Expenditures by the MMS for Geological and Geophysical Data Acquisition by FY for the Gulf of Mexico (in dollars)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	5,255,068	2,795,562	722,442	129,500	0	NA
1976	1,489,665	514,141	134,084	385,234	0	0
1977	579,583	3,072,088	0	0	0	0
1978	330,183	1,438,856	0	0	0	0
1979	492,299	949,697	0	0	0	0
1980	388,329	3,926,990	0	0	0	0
1981	939,506	31,805	0	0	0	0
1982	2,936,727	0	0	0	0	0
1983	3,678,684	0	0	0	0	0
1984	3,999,326	0	0	0	0	0
1985	2,768,574	0	0	0	0	0
1986	1,600,031	0	0	0	0	0
1987	1,824,927	0	0	0	0	0
1988	1,075,515	0	0	0	0	0
1989	885,748	0	0	0	0	NA
1990	704,670	0	0	0	0	0
1991	289,266	0	0	0	0	0
1992	376,893	0	0	0	0	0
1993	200,407	0	0	0	537,908	0
1994	26,946	0	0	0	647,592	0
1995	21,535	0	0	0	592,223	0
1996	1,151,587	0	0	0	526,471	0
1997	44,103	0	0	0	1,150,050	0
1998	96,771	0	0	12,000	1,289,773	0
1999*	42,227	0	0	3,000	1,154,577	0
2000	83,359	0	0	10,070	1,816,038	0
2001	457,463	0	0	0	729,196	0
2002	3,185	0	0	0	341,756	0
2003	24,902	0	0	0	288,443	0
Total	31,767,479	12,729,139	856,526	539,804	9,074,027	---

Note: The abbreviation NA represents “not applicable” as no G&G funds are used to acquire Information from a DST. Where no DST was completed, a zero is entered into the expenditure column.

In FY 1999, the Gulf of Mexico Region also spent funds to acquire digital copies of data and information that were already in their inventory or purchased as two differing displays.

Figures may vary by 1-2%.

**Table A-12.** Summary of Average Cost Per Mile by the MMS for 2-D Seismic Data by FY for the Gulf of Mexico (in dollars)

<b>Year</b>	<b>Average Cost (\$/Mile)</b>
1968-1975	36.63
1976	47.33
1977	129.23
1978	45.94
1979	42.15
1980	81.62
1981	57.10
1982	102.33
1983	139.93
1984	97.96
1985	88.09
1986	70.75
1987	42.37
1988	19.12
1989	20.54
1990	9.19
1991	8.14
1992	8.05
1993	8.49
1994	6.10
1995	2.63
1996	35.11
1997	1.01
1998	1.07
1999	1.40
2000	1.29
2001	68.61/1.34*
2002	2.11*
2003	0.99

Note: Summaries reflect average cost per mile for all CDP Information acquired, both State and Federal. Average costs reflect only those dollars assigned to the bureauwide G&G budget and do not reflect monies allocated from Regional funds.

\*The \$68.61 total includes the cost for data in Cuban waters at the market price. The average cost per line mile for data in Federal waters is \$1.34.

\*The \$2.11 total includes velocity models for depth data.

*Figures may vary by 1-2-%.*

## Pacific Tables

**Table A-13.** Summary of Geological and Geophysical Data Acquisition by FY for the Pacific

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	14,092	9,971	15,552	87,637	0	1
1976	14,452	2,429	2,288	1,851	0	0
1977	5,339	5,979	24,525	3,950	0	0
1978	4,433	1,155	0	0	0	1
1979	4,393	6,578	0	0	0	0
1980	3,948	4,470	0	0	0	0
1981	8,070	0	0	3,662	0	0
1982	15,563	0	0	13,050	0	0
1983	12,473	0	0	0	0	0
1984	8,678	0	0	0	0	0
1985	8,181	0	0	0	0	0
1986	2,644	0	0	0	0	0
1987	18,719	0	0	0	0	0
1988	6,865	0	0	0	0	0
1989	4,507	0	0	0	0	0
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	300	0	0	0	0	0
1995	0	0	0	0	0	0
1996	184	0	0	0	12*	0
1997	0	0	0	0	21*	0
1998	0	0	0	0	8*	0
1999	0	0	0	0	0	0
2000	0	0	0	0	11*	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
Total	132,841	30,582	42,365	110,150	52*	2

\*Acquisitions for 3-D seismic data are measured in blocks; all other acquisitions in this table are measured in miles.

The DST dates are assigned based upon completion dates and are measured in terms of wells completed.

**Table A-14.** Number of Permits Issued for Geological and Geophysical Exploration in the Pacific

Year	A	B	C	D	E	F
1960-1968	162	---	---	---	---	---
1969	13	10	3	0	0	0
1970	3	2	1	0	0	0
1971	0	0	0	0	0	0
1972	1	1	0	0	0	0
1973	30	21	9	0	0	0
1974	24	24	0	0	0	0
1975	46	42	4	1	0	0
1976	24	22	2	0	0	0
1977	31	26	5	0	0	0
1978	38	30	8	1	0	0
1979	24	22	2	0	0	0
1980	31	26	5	0	0	0
1981	40	38	2	0	0	0
1982	62	59	3	0	0	0
1983	45	36	9	0	0	0
1984	56	42	14	0	0	0
1985	33	30	3	0	0	0
1986	20	19	1	0	0	0
1987	20	16	4	0	0	0
1988	33	25	8	0	0	0
1989	0	0	0	0	0	0
1990	4	3	1	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	0	0	0	0	0	0
1995	0	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	740	494	84	2	0	0

Dashed lines = Individual breakouts not established

A=Total Number of Geological, Geophysical, and Strategic Minerals Permits

B=Number of Geophysical Permits

C=Number of Geological Permits

D=Number of Geological Permits Issued for Deep Stratigraphic Tests

E=Number of Geophysical Permits Issued for 3-D Seismic Data

F=Number of Permits Issued for Strategic (Nonenergy) Minerals

**Table A-15.** Summary of Expenditures by the MMS for Geological and Geophysical Data Acquisition by FY for the Pacific (in dollars)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	DST
1968-1975	697,733	175,000	49,617	415,913	0	NA
1976	486,139	57,660	20,596	17,275	0	0
1977	188,930	752,400	1,962	11,796	0	0
1978	137,754	23,685	0	0	0	NA
1979	346,612	1,588,695	0	0	0	0
1980	249,048	1,098,954	0	0	0	0
1981	689,372	0	0	20,029	0	0
1982	1,918,891	0	0	69,350	0	0
1983	1,309,608	0	0	0	0	0
1984	1,262,030	0	0	0	0	0
1985	848,777	0	0	0	0	0
1986	356,700	0	0	0	0	0
1987	921,422	0	0	0	0	0
1988	93,748	0	0	0	0	0
1989	44,273	0	0	0	0	0
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	443	0	0	0	0	0
1995	0	0	0	0	0	0
1996	1,714	0	0	0	10,452	0
1997	0	0	0	0	13,479	0
1998	0	0	0	0	3,344	0
1999*	0	0	0	0	0	0
2000	0	0	0	0	650	0
2001	0	0	0	0	0	0
2002*	0	0	0	0	0	0
2003*	0	0	0	0	0	0
Total	9,553,194	3,696,394	72,175	534,363	27,925	0

Note: The abbreviation NA represents "not applicable" as no G&G funds are used to acquire Information from a DST. Where no DST was completed, a zero is entered into the expenditure column.

\* In FY 1999 and 2002, the Pacific Region spent funds to acquire digital copies of data already in their inventory and did not acquire any new or additional data. In FY 2003, funds were allocated for the scanning of in house data.

**Table A-16.** Summary of Average Cost Per Mile by the MMS for 2-D Seismic Data by FY for the Pacific (in dollars)

<b>Year</b>	<b>Average Cost (\$/Mile)</b>
1968-1975	49.51
1976	33.64
1977	35.39
1978	31.08
1979	78.90
1980	63.08
1981	85.42
1982	123.30
1983	105.00
1984	145.43
1985	103.75
1986	134.91
1987	49.22
1988	13.66
1989	9.82
1990	0
1991	0
1992	---
1993	0
1994	1.48
1995	0
1996	9.32
1997	0
1998	0
1999	0
2000	0
2001	---
2002	---
2003	---

Note: Summaries reflect average cost per mile for all CDP information acquired, both State and Federal. Average costs reflect only those dollars assigned to the bureauwide G&G budget and do not reflect monies allocated from Regional funds.

Dashed line indicates no funding for that year. Zero indicates G&G dollars were not spent on CDP information.



## Glossary

**AVO** – The variation in the amplitude of a seismic reflection with the angle of incidence or source geophone distance. It depends on changes in velocity, density, and Poisson’s Ratio.

**Block** - a geographically defined section of the Outer Continental Shelf (OCS) designated by a number on an Official Protraction Diagram or Leasing Map prepared by the Minerals Management Service (MMS). A block normally is a 9-square-mile area (3 miles x 3 miles) consisting of 5,760 acres. A single block is the smallest unit that can be leased for oil and gas exploration on the OCS.

**Common Depth Point** - a common location in the ocean subbottom where sound waves originating from various positions of the seismic (sound) source near the ocean surface are reflected back toward the surface. The traces from different seismic profiles corresponding to the same reflection point are mathematically summed (stacked) for reflection points beneath the survey line. Also known as common midpoint or common reflection point.

**COST Wells** - Continental Offshore Stratigraphic Test Wells - deep stratigraphic wells drilled to determine the geological character or stratigraphy of rock strata. These wells, which may be more than 20,000 feet deep, provide information that can be used by Government and industry to evaluate tracts to be offered in a lease sale.

**Fair Market Value** - the amount in cash, or on terms reasonably equivalent to cash, for which in all probability the property would be sold by a knowledgeable purchaser who desired, but is not obligated, to buy. This market value that is sought is not merely theoretical or hypothetical, but represents, insofar as it is possible to estimate, the actual selling price.

**High-Resolution** - a range of seismic frequencies above the normal range of frequencies used in exploration, with an improvement in resolution in the shallow portions of the subbottom but with less total penetration into the subbottom.

**Lease** - any form of authorization that is used under section 8 or maintained under section 6 of the Outer Continental Shelf Lands Act and that authorizes exploration for and development and production of minerals or the area covered by that authorization, whichever is required of the context.

**Lease Sale** - an MMS proceeding by which leases for certain OCS tracts are offered for sale by competitive bidding and during which bids are received, publicly announced, and recorded.

**Outer Continental Shelf** - all submerged lands lying seaward and outside of the area of lands beneath navigable waters as defined in section 2 of the Submerged Lands Act and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control.

**Outer Continental Shelf Lands Act** - law passed by Congress on August 7, 1953, and amended in 1975, 1978, and 1985.

**Permit** - the contract or agreement, other than a lease, approved for a specified period of not more than 1 year under which a person acquires the right to conduct (1) geological exploration for mineral resources, (2) geophysical exploration for mineral resources, (3) geological scientific research, or (4) geophysical scientific research.

**Planning Area** - a subdivision of an offshore area used as the initial basis for considering blocks to be offered for lease in the DOI's offshore oil and gas leasing program.

**Shallow Hazards** - potential geological and manmade hazards to exploration on the OCS that are in the shallow portion of the subbottom. Examples include seismicity, active faults, shallow gas deposits, steep slopes, unstable soil conditions, pipelines, anchors, and sunken ships. Shallow hazards may occur in shallow or deep waters.

# **MMS** *Securing Ocean Energy & Economic Value for America*



## **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 **Minerals Revenue Management** 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.

