OCS Report
BOEM 2015-05

Resource Evaluation
Program Report

Geological & Geophysical Data Acquisition

Outer Continental Shelf
Through 2014

By Kumkum Ray
And Paul Godfriaux

U.S. Department of the Interior
Bureau of Ocean Energy Management
Resource Evaluation Division

Sterling, Virginia
2015

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U.S. Department of the Interior
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Contents

Abbreviations iv

Introduction 1

Permits, Data Acquisition, and Reimbursement 2

Geophysical Data Surveys 3
Common Depth Point, 3-D, 4-D, 4-C, AVO, Gravity, and Magnetic Surveys 3

Geological Data Collection 4
Bottom Sampling and Shallow Coring 4
Deep Stratigraphic 4

G&G Data Release 4

Analysis of Present BOEM Data Coverage on the OCS 5
Mileage/Blocks 5
Geological and/or Geophysical Exploration Permits 5
Expenditures 6

Comparisons to Industry 7

Tables 9

Bibliography 16

Appendix 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

Glossary 35

Figure

Figure 1: Outer Continental Shelf Planning Areas 2

Tables

1. Summary of Estimates of CDP (2-D) Seismic Miles in BOEM Inventory Through FY 2014 by Planning Area 8

2. Summary of 2-D Seismic Data Acquisition for FY 1968-2014 9

3. Summary of 3-D Seismic Data Acquisition for FY 1968-2014 9

4. Summary of Geological and Geophysical Data Acquisition by Data Type and Region, FY 1968-2014 10

5. Total Number of Permits Issued for Geological and Geophysical Exploration 11

6. Summary of Total Annual Expenditures by BOEM for Geological and Geophysical Data Acquisition by Region, FY 1968-2014 12

7. Summary of Geological and Geophysical Data Acquisition Expenditures by Data Type and Region, FY 1968-2014 13

8. Summary of Average Cost Per Mile by BOEM for 2-D Seismic Data, FY 1968-2014 14

Abbreviations

AVO	Amplitude Variation with Offset data
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CDP	Common Depth Point Seismic Data
CFR	Code of Federal Regulations
COST	Continental Offshore Stratigraphic Test
CSEM	Controlled Source Electromagnetic survey
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
OBS	Ocean Bottom Seismometers
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
RE	Resource Evaluation
REP	Resource Evaluation Program
SEG	Society of Exploration Geophysicists
4-C	Four Component Seismic Data
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 Bureau of Ocean Energy Management's (BOEM) Resource Evaluation Program (REP) in geological and geophysical (G&G) data acquisition and permitting activities.

BOEM 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 551 to regulate prelease G&G exploration for oil, gas, and sulphur resources on the OCS. Part 551 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 580.

In this report, the totals for permits issued, mileage acquired, and expenditures may be influenced by 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 BOEM 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).

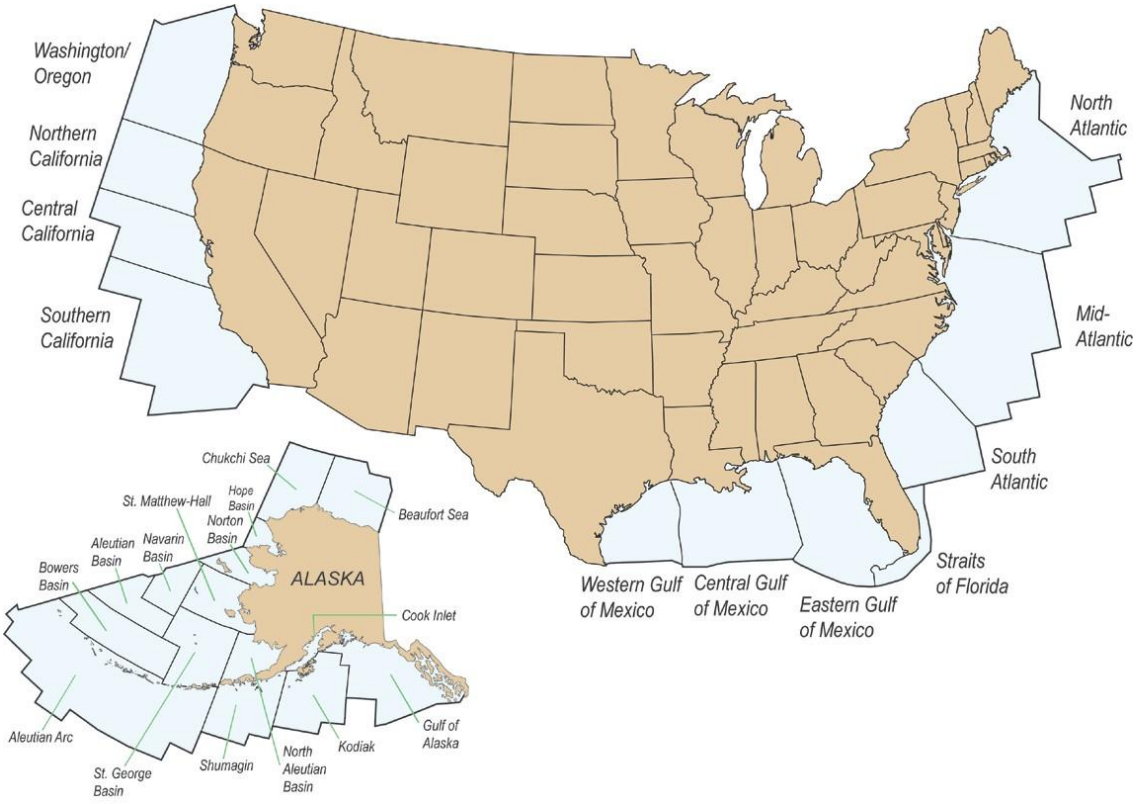

Figure 1: **Outer Continental Shelf Planning Areas**

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, environmental mitigations, and other similar detailed information relevant to each specific permit. The primary sources of the G&G data used by the REP are geophysical acquisition companies that license their acquired data to the oil and gas industry. These data are further processed by oil companies and used for exploration, development, and production activities on OCS lands. While BOEM does not perform any direct data-collection activities, it does issue permits to industry for collecting prelease G&G data and approves the collection of post-lease G&G data for industry submitted Exploration and/or Development Plans. Lessees and operators are also required by regulations to provide data from their leases to BOEM. BOEM has access to the permitted data and information as a condition set forth in the permit. BOEM selectively obtains copies from these activities. Data from prelease permits constitute approximately 90 percent of the BOEM 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 BOEM jurisdiction, e.g., State waters or adjacent foreign waters and BOEM selects such data, BOEM pays the significantly higher "market price" for obtaining such data.

Geophysical Data Surveys

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

The two-dimensional (2-D) geophysical data in the BOEM inventory is 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 BOEM inventory by planning area are shown in Table 1.

While in the past a majority of data was collected in 2-D, currently a vast majority of geophysical data and information in the BOEM inventory is three-dimensional (3-D) seismic information; this is especially true in the GOM OCS. By collecting data along parallel, closely spaced survey lines, spatial relationships are determined in three dimensions.

A specialized processing technique that can be used with both 2-D and 3-D seismic data is Amplitude Variation with Offset (AVO). It involves the variation in amplitude of a seismic reflection with the angle of incidence or source-geophone distance and is processed using the raw data gathered. It can be used as a direct hydrocarbon gas indicator.

Another type of data acquisition is 2-D or 3-D four component (4-C) surveys, which involve the recording of marine seismic data with ocean bottom seismometers (OBS) on the sea floor where each OBS consists of a hydrophone recording pressure changes of passing P-waves and three orthogonal geophones recording movement in three components of direction (x, y, and z axes) of passing shear waves (s-waves). Three dimensional 4-C is a recording of multiple parallel lines of seismometers achieved by recording seismic waves from each line simultaneously or in sequence by recording a line of geophones, moving the line a short distance and parallel to the previous line, etc.

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.

Controlled Source Electromagnetic (CSEM) surveys are being conducted in areas of the GOM. Although not a new technology, it is new for the deeper water provinces. It can be used with seismic data to generate direct recognition of hydrocarbon fluid resistivity in potential subsurface reservoirs.

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, time-lapse 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.

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 (no deeper than 500 ft.) is performed by conventional rotary drilling equipment to obtain a near-surface sample of the rocks of the seabed.

Deep Stratigraphic Tests

A deep stratigraphic test, as defined in 30 CFR 551, 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 deep stratigraphic test program is described by Dellagiarino (1991) in OCS Report # MMS-90-0028.

G&G Data Release

Regulations at § 550.197 provide the release times of proprietary G&G data and information. Prelease geophysical information is held proprietary for 25 years; raw geophysical data is held for 50 years and then is released to the public. The proprietary term for geological information is 10 years. 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 GOM areas. The actual data may be searched for and downloaded at the National Archive of Marine Seismic Surveys (NAMSS) https://walrus.wr.usgs.gov/namss/surveys/search/. Also additional information can be found at the BOEM regional homepage at http://www.boem.gov/BOEM-Regions/.

Analysis of Present BOEM 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 BOEM issues to industry each year. Table 1 shows the 2-D seismic data coverage, by region and planning area that BOEM has in its inventory. The grid coverage is not uniform over the planning areas. Tables 2, 3, and 4 summarize BOEM data acquisitions through 2011. It should be noted that 3-D seismic information, which is reported as coverage of OCS blocks, in the BOEM inventory is comparable to the 2-D holdings in that 151,000 blocks of 3-D information compares favorably to about 2.5 million line miles of conventional 2-D seismic information.

BOEM has not acquired all of the permit data shot and recorded by industry primarily because of the data quality or the redundancy of data shot on the OCS by different companies. Since the early 1990s, BOEM, as well as industry, have increased its acquisition of 3-D seismic data in concert with the development and use of interactive workstations. In some areas in which BOEM has previously obtained 2-D or 3-D seismic information, it continues to acquire new information that is derived from state-of-the-art acquisition methods and equipment or from previously acquired data that are reprocessed using more modern techniques.

The OCS Regions (GOM, Pacific, Alaska and Atlantic) 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, BOEM directly acquired prelease, tract-specific, shallow hazards data. Under the area wide leasing program, the detailed shallow hazards analysis function was shifted to the post sale phase, and the responsibility for site-specific hazards data collection was placed on the lessee as a condition to obtain an approved Exploration or Development Production Plan from BOEM and a drilling permit through the Bureau of Safety and Environmental Enforcement (BSEE). If industry continues to conduct prelease hazards surveys, G&G permits must be obtained from BOEM. Shallow hazards survey data and information are available to BOEM and BSEE under terms of permit or lease and regulations.

Geological and/or Geophysical Exploration Permits

The number of permits issued by BOEM and the areas for which the permits are issued can be leading indicators of oil and gas activity on the OCS. On average, BOEM has issued approximately 280 permits per year. The greatest number for one year was 574 in 1983.

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 2014.

BOEM 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 GOM. The GOM has issued 83 percent of all permits and is followed by the Alaska Region with 9 percent. The Pacific Region has issued 6 percent of the permits, followed by the Atlantic Region with about 2 percent.

It should be noted that since 1969, approximately 94 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 (12 percent) when compared with the total geophysical permits issued, over the past 10 years, 197 3-D permits have averaged 30 percent of geophysical permits during that period. Permits for deep stratigraphic test wells or COST wells make up about 5 percent of all geological permits.

General trends in permitting for all the Regions have been lower since the number of permits peaked in 1983. Some regional differences can be detected that are related to leasing moratoria, operating conditions such as hurricanes/artic ice, and the discovery of new hydrocarbon plays.

Expenditures

BOEM records financial and procurement transactions by fiscal year (FY). All figures and tables involving the BOEM 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 GOM and Alaska have the largest portion of the expenditures with 41 and 37 percent respectively. Alaska has over twice the offshore area of the other three Regions combined. On the other hand, the GOM, with over 95 percent of OCS production, possesses the largest database.

The Atlantic Region (13 percent of the expenditures) and the Pacific (9 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. The moratoria expired on September 30, 2008. The main difference between the Atlantic and Pacific Regions, according to Table 7 is in the acquisition of high-resolution data in the Atlantic.

The GOM 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 BOEM G&G data acquisition budget has been expended by the Alaska Region. However, since the 1990s and up through the present as the level of

activity dropped in Alaska, most of the BOEM G&G data acquisition budget has been allocated for data in the GOM.

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 large amount of data collected in State waters, where a Federal permit is not applicable. Thus, the reimbursement did not fall under the provisions of the OCSLA, and BOEM 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.

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

Comparisons to Industry

While BOEM does not acquire all industry data, it does acquire a vast majority of it. In the Alaska OCS, BOEM has acquired approximately 90 percent of the data collected by industry. Alaska remains a large frontier area with limited data coverage by industry, a fact that necessitates BOEM to acquire as much of these data as feasible. In recent years, the GOM has acquired most 3-D surveys and most large 2-D surveys. However, BOEM does not acquire the volume that industry obtains to reprocess. This is partly due to industry frequently reprocessing portions of the seismic surveys, particularly around their prospective targets.

BOEM acquired more data in the Atlantic Region than industry in 1976 and 1983. Before 1976, the BOEM limited their acquisition of new data 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, BOEM not only acquired most of the industry data, but purchased much of the pre-1976 data.

There is now a resurgence of G&G oil and gas permit applications in the Atlantic OCS (see http://www.boem.gov/Currently-submitted-Atlantic-OCS-Region-Permits/http://www.boem.gov/Currently-submitted-Atlantic-OCS-Region-Permits). This is due to the release of the Atlantic G&G Activities Programmatic Environmental Impact Statement (PEIS) in 2014, and a proposed Atlantic lease sale in 2021 under the 2017-2022 Draft-Proposed-Five-Year Program. As of May 2015, the only approved permits in the Atlantic are shallow hazard surveys conducted for proposed offshore renewable energy installations and for marine minerals.

In conclusion, totals for mileage acquired, permits issued, and expenditures can be influenced by trends of oil and gas pricing, limitations of areas due to offshore moratoria or lack of industry interest, and a shift of industry emphasis to foreign theatres to be lower in

general, though higher in specific arenas (such as deepwater GOM, and frontier Atlantic and Alaska).

Table 1. Summary of Estimates of CDP (2-D) Seismic Miles in the BOEM Inventory Through FY 2014 by Planning Area (Rounded off to Nearest 1,000 Miles)

Planning Area	Estimated Mileage
Alaska	
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	111,000
Beaufort Sea	77,000
Total	**472,000**
Atlantic	
North Atlantic	93,000
Mid-Atlantic	60,000
South Atlantic	54,000
Straits of Florida	7,000
Total	**214,000**
Gulf of Mexico	
Eastern GOM	210,000
Central GOM	1,088,000
Western GOM	558,000
Total	**1,856,000**
Pacific	
Southern California	85,000
Central California	21,000
Northern California	19,000
Wash./Oregon	8,000
Total	**133,000**

Figures may vary by 1-2%.

Table 2. Summary of 2-D Seismic Data Acquisition for FY 1968-2014

FY	Total Miles
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
2004	101,282
2005	48,829
2006	170,379
2007	108,080
2008	1,984
2009	35,130
2010	195,487
2011	135,884
2012	46,923
2013	46,694
2014	248
Total	**2,674,808**

Figures may vary by 1-2%.

Table 3. Summary of 3-D Seismic Data Acquisition for FY 1968-2014

FY	Total Blocks
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
2004	6,193
2005	4,996
2006	6,495
2007	11,855
2008	22,606
2009	27,547
2010	23,137
2011	9,259
2012	37,092
2013	34,132
2014	21,294
Total	**243,917**

Figures may vary by 1-2%.

Table 4. Summary of Geological and Geophysical Data Acquisition by Data Type and Region, FY 1968-2014

Data Type	Region	Mileage*
2-D Seismic	Alaska	472,946
	Atlantic	213,936
	Gulf of Mexico	1,856,054
	Pacific	132,841
	Total	**2,675,777**
High Resolution	Alaska	59,855
	Atlantic	49,509
	Gulf of Mexico	145,768
	Pacific	30,582
	Total	**285,714**
CDP Interpretations	Alaska	84,683
	Atlantic	44,801
	Gulf of Mexico	139,418
	Pacific	42,365
	Total	**311,267**
Gravity and Magnetics	Alaska	372,764
	Atlantic	15,783
	Gulf of Mexico	669,413
	Pacific	110,150
	Total	**1,168,110**
3-D Seismic	Alaska	853
	Atlantic	0
	Gulf of Mexico	243,012
	Pacific	52
	Total	**243,917**
3-D/4-C	Alaska	0
	Atlantic	0
	Gulf of Mexico	37
	Pacific	0
	Total	**37**
AVO	Alaska	81
	Atlantic	0
	Gulf of Mexico	3,455
	Pacific	0
	Total	**3,536**
Deep Stratigraphic Tests	Alaska	14
	Atlantic	5
	Gulf of Mexico	6
	Pacific	2
	Total	**27**

*3-D seismic, 3-D/4-C data, and AVO are measured in blocks and Deep Stratigraphic Test units are wells drilled.

Figures may vary 1-2%.

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

Year	A	B	C	D	E	F	G
1960-1968	2,353	---	---	---	---	---	---
1969	258	249	9	0	0	0	0
1970	213	203	10	0	0	0	0
1971	210	205	5	0	0	0	0
1972	220	210	10	0	0	0	0
1973	339	321	18	0	0	0	0
1974	357	345	12	2	0	0	0
1975	510	487	23	3	0	0	0
1976	420	400	20	7	0	0	0
1977	452	436	16	4	0	0	0
1978	342	329	13	2	0	0	0
1979	276	265	11	0	0	0	0
1980	318	302	16	1	0	0	0
1981	394	383	11	0	0	0	0
1982	502	490	12	3	0	0	0
1983	574	542	32	1	16	0	0
1984	543	518	25	0	18	0	0
1985	398	382	16	0	38	0	0
1986	211	207	4	0	32	0	0
1987	298	282	16	0	42	0	0
1988	313	289	24	0	45	0	0
1989	249	237	12	1	47	0	0
1990	251	241	9	0	57	1	0
1991	170	156	12	0	45	2	0
1992	141	137	3	0	53	1	0
1993	147	135	11	0	70	1	0
1994	133	117	16	0	53	0	0
1995	104	92	11	0	50	1	0
1996	136	120	16	0	59	0	0
1997	159	139	20	0	69	0	1
1998	157	143	14	0	59	0	1
1999	111	98	13	0	44	0	0
2000	80	73	5	0	32	2	0
2001	110	103	7	0	33	0	0
2002	80	75	5	0	20	0	3
2003	107	100	3	0	29	4	2
2004	103	91	10	0	21	2	0
2005	101	93	6	0	25	2	0
2006	86	81	2	0	24	3	0
2007	95	92	2	0	32	1	0
2008	112	104	1	2	23	7	0
2009	80	64	8	0	9	8	1
2010	55	46	4	0	8	5	1
2011	42	33	3	0	19	6	0
2012	44	38	2	0	20	4	4
2013	47	40	2	0	15	5	4
2014	68	65	3	0	22	0	3
Total	**12,469**	**9,558**	**503**	**26**	**1,129**	**55**	**20**

Dashed lines = Individual breakouts not established
A=Total Number of Geological, Geophysical, and Strategic Minerals Permits Issued
B=Number of Geophysical Permits Issued
C=Number of Geological Permits Issued
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 BOEM for Geological and Geophysical Data Acquisition Only by Region, FY 1968-2014 (in dollars)

FY	Alaska	Atlantic	Gulf of Mexico	Pacific	Total
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	0	1,080,000	445,868	0	1,525,868
2004	0	250,000	739,561	0	989,561
2005	22,000	168,000	507,379	0	697,379
2006	53,826	0	310,403	0	364,229
2007	198,555	0	584,400	0	782,955
2008	44,645	246,500	935,163	0	1,226,308
2009	392	0	950,002	0	950,394
2010	31,154	0	357,260	0	388,414
2011	65	0	170,430	0	170,495
2012	0	0	555,004	0	555,004
2013	0	0	358,790	0	358,790
2014	0	0	682,929	0	682,929
Total	**59,464,304**	**20,482,096**	**67,022,295**	**15,293,863**	**164,530,245**

* 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 1968-2014

Data Type	Region	Expenditures ($)*
	Alaska	
2-D Seismic High Resolution CDP		40,946,589
Interpretations		11,125,798
Gravity and Magnetics		439,793
3-D Seismic		1,027,108
3-D/4-C		1,511,327
AVO		0
Total		28,048
		55,078,663
	Atlantic	
2-D Seismic High Resolution CDP		9,027,538
Interpretations		9,751,232
Gravity and Magnetics		55,274
3-D Seismic		2,902
3-D/4-C		0
AVO		0
Total		0
		18,836,946
	Gulf of Mexico	
2-D Seismic High Resolution CDP		32,262,764
Interpretations		12,729,139
Gravity and Magnetics		856,526
3-D Seismic		774,483
3-D/4-C		12,480,375
AVO		2,787
Total		267,658
		59,373,732
	Pacific	
2-D Seismic High Resolution CDP		9,553,194
Interpretations		3,696,394
Gravity and Magnetics		72,175
3-D Seismic		534,363
3-D/4-C		27,925
AVO		0
Total		0
		13,884,051

*BOEM 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, and 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 BOEM for 2-D Seismic Data, FY 1968-2014

FY	Average Cost ($/Mile)
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*
2004	1.83
2005	0.21
2006	0.17
2007	0.12
2008	161.09/0.49
2009	6.19
2010	0.08
2011	0.11
2012	0.06
2013	0.15
2014	1.21

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 as is the $161.09 and $0.49. The $2.11 total includes velocity models for depth data.

Figures may vary 1-2%.

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.

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Appendix

Alaska

A-1 Summary of geological and geophysical data acquisition by FY for Alaska 18

A-2 Number of permits issued for geological and geophysical exploration in Alaska 19

A-3 Summary of expenditures by BOEM for geological and geophysical data acquisition by FY for Alaska 20

A-4 Summary of average cost per mile by BOEM for 2-D seismic data by FY for Alaska 21

Atlantic

A-5 Summary of geological and geophysical data acquisition by FY for the Atlantic 22

A-6 Number of permits issued for geological and geophysical exploration in the Atlantic 23

A-7 Summary of expenditures by BOEM for geological and geophysical data acquisition by FY for the Atlantic 24

A-8 Summary of average cost per mile by BOEM for 2-D seismic data by FY for the Atlantic 25

Gulf of Mexico

A-9 Summary of geological and geophysical data acquisition by FY for the Gulf of Mexico 26

A-10 Number of permits issued for geological and geophysical exploration in the Gulf of Mexico 27

A-11 Summary of expenditures by BOEM for geological and geophysical data acquisition by FY for the Gulf of Mexico 28

A-12 Summary of average cost per mile by BOEM for 2-D seismic data by FY for the Gulf of Mexico 29

Pacific

A-13 Summary of geological and geophysical data acquisition by FY for the Pacific 30

A-14 Number of permits issued for geological and geophysical exploration in the Pacific 31

A-15 Summary of expenditures by BOEM for geological and geophysical data acquisition by FY for the Pacific (in dollars) 32

A-16 Summary of average cost per mile by BOEM for 2-D seismic data by FY for the Pacific (in dollars) 33

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	AVO	DST
1968-1975	70,306	5,500	32,819	55,710	0	0	1
1976	37,785	19,163	30,164	0	0	0	4
1977	11,952	5,606	21,700	23,470	0	0	4
1978	28,524	0	0	36,625	0	0	0
1979	8,538	5,412	0	25,465	0	0	0
1980	10,109	7,703	0	0	0	0	1
1981	35,430	4,590	0	14,969	0	0	0
1982	16,624	0	0	0	0	0	2
1983	51,903	0	0	0	0	0	2
1984	30,961	7,904	0	5,850	0	0	0
1985	30,270	0	0	0	0	0	0
1986	21,603	1,600	0	0	0	0	0
1987	49,532	470	0	80,826	0	0	0
1988	14,963	1,741	0	0	0	0	0
1989	3,136	166	0	9,543	0	0	0
1990	8,557	0	0	11,046	0	0	0
1991	3,964	0	0	1,500	0	0	0
1992	0	0	0	0	0	0	0
1993	1,893	0	0	0	0	0	0
1994	2,422	0	0	102,845	0	0	0
1995	737	0	0	3,000	0	0	0
1996	315	0	0	0	0	0	0
1997	382	0	0	0	3*	0	0
1998	273	0	0	0	0	0	0
1999	0	0	0	0	7*	0	0
2000	0	0	0	0	12*	0	0
2001	0	0	0	0	0	0	0
2002	0	0	0	0	11*	0	0
2003	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	32,281	0	0	1,915	204	0	0
2008	0	0	0	0	54	0	0
2009	0	0	0	0	20	0	0
2010	0	0	0	0	315	66*	0
2011	486	0	0	0	227	15*	0
2012	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0
Total	**472,946**	**59,855**	**84,683**	**372,764**	**853***	**81***	**14**

*Acquisition 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. 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	1	1	0	0	0	0
2004	1	1	0	0	1	0
2005	1	1	0	0	1	0
2006	4	4	0	0	3	0
2007	5	4	1	0	3	0
2008	4	4	0	0	4	0
2009	1	1	0	0	1	0
2010	2	2	0	0	1	0
2011	0	0	0	0	0	0
2012	2	1	0	0	0	1
2013	1	1	0	0	0	0
2014	3	3	0	0	3	0
Total	**1,067**	**879**	**107**	**14**	**31**	**6**

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 BOEM for Geological and Geophysical Data Acquisition by FY for Alaska (in dollars)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	AVO	DST
1968-1975	2,803,939	119,700	160,832	7,515	0	0	0
1976	1,628,153	1,598,789	268,961	0	0	0	0
1977	271,035	36,473	10,000	49,450	0	0	0
1978	2,956,280	0	0	408,679	0	0	0
1979	2,180,700	2,019,512	0	125,148	0	0	0
1980	1,086,423	5,789,936	0	0	0	0	0
1981	5,231,130	1,531,458	0	69,286	0	0	0
1982	1,817,736	0	0	0	0	0	0
1983	5,673,514	0	0	0	0	0	0
1984	4,118,626	19,238	0	27,072	0	0	0
1985	3,669,129	0	0	0	0	0	0
1986	2,780,556	950	0	0	0	0	0
1987	2,301,780	400	0	249,951	0	0	0
1988	1,339,007	3,425	0	0	0	0	0
1989	347,872	5,917	0	21,851	0	0	0
1990	832,476	0	0	51,681	0	0	0
1991	518,613	0	0	15,573	0	0	0
1992*	0	0	0	0	0	0	0
1993	139,117	0	0	0	0	0	0
1994	579,129	0	0	0	0	0	0
1995	167,170	0	0	750	0	0	0
1996	113,071	0	0	0	0	0	0
1997	195,855	0	0	0	0	0	0
1998	192,947	0	0	0	0	0	0
1999	0	0	0	0	358,155	0	0
2000	0	0	0	0	348,073	0	0
2001*	0	0	0	0	0	0	0
2002	0	0	0	0	762,911	0	0
2003*	0	0	0	0	0	0	0
2004*	0	0	0	0	0	0	0
2005*	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
2007	2,329	0	0	152	29,226	0	0
2008	0	0	0	0	9,401	0	0
2009*	0	0	0	0	392	0	0
2010*	0	0	0	0	3,106	28,048	0
2011*	2	0	0	0	63	0	0
2012	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0
Total	**40,946,589**	**11,125,798**	**439,793**	**1,027,108**	**1,511,327**	**28,048**	**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, 2004, 2005, 2009, 2010, and 2011 funds were also spent to scan in house data. Also, in FY 2004, funds went toward Geoframe support efforts. In FY 2005 funds also went towards a biostratigraphic data base.

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 BOEM for 2-D Seismic Data by FY for Alaska (in dollars)

Year	Average Cost ($/Mile)
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
2004	0
2005	0
2006	0
2007	0
2008	0.07
2009	0
2010	0
2011	0.04
2012	0
2013	0
2014	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
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	0	0	0
2008	969	0	0	0	0	0
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	0	0	0	0	0
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
Total	**213,936**	**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

Year	A	B	C	D	E	F
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	0	0	0	0	0	0
2004	2	0	0	0	0	2
2005	2	0	0	0	0	2
2006	0	0	0	0	0	0
2007	1	0	0	0	0	1
2008	2	0	0	0	0	2
2009	2	0	0	0	0	2
2010	0	0	0	0	0	0
2011	5	0	0	0	0	5
2012	2	0	0	0	0	2
2013	3	0	0	0	0	3
2014	0	0	0	0	0	0
Total	**274**	**184**	**24**	**5**	**0**	**21**

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 BOEM 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	1,080,000	0	0	0	0	0
2004*	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	0	0	0
2008	156,100	0	0	0	0	0
2009**	0	0	0	0	0	0
2010**	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	0	0	0	0	0
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
Total	**7,947,538**	**9,751,232**	**55,274**	**2,902**	**0**	**0**

*In FY 2004, funds were expended to vectorize Atlantic data and a geologic report for offshore Nova Scotia was purchased

**In FY 2009 and 2010, $56,100 and $17,634 respectively was used to purchase reprocessed seismic data that was already owned by BOEM

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 BOEM for 2-D Seismic Data by FY for the Atlantic (in dollars)

Year	Average Cost ($/Mile)
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
2004	---
2005	---
2006	---
2007	---
2008	161.09
2009	---
2010	---
2011	---
2012	---
2013	---
2014	---

*Data acquired in offshore Canada at market prices.
Dashed lines indicate no funding for that year.

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.

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*	3-D/4-C	AVO	DST
1968-1975	143,458	88,549	120,038	19,670	0	0	0	2
1976	31,474	9,367	19,380	56,272	0	0	0	0
1977	4,485	18,119	0	0	0	0	0	0
1978	7,188	8,275	0	0	0	0	0	0
1979	11,681	5,018	0	0	0	0	0	0
1980	4,758	15,940	0	0	0	0	0	0
1981	16,454	500	0	0	0	0	0	0
1982	28,700	0	0	0	0	0	0	0
1983	26,290	0	0	0	0	0	0	0
1984	40,828	0	0	0	0	0	0	0
1985	31,430	0	0	0	0	0	0	0
1986	22,616	0	0	0	0	0	0	0
1987	43,073	0	0	0	0	0	0	0
1988	56,265	0	0	0	0	0	0	0
1989	43,121	0	0	0	0	0	0	1
1990	76,692	0	0	0	0	0	0	0
1991	35,507	0	0	0	0	0	0	0
1992	46,814	0	0	0	0	0	0	0
1993	23,589	0	0	0	1,563	0	0	0
1994	4,416	0	0	0	1,420	0	0	0
1995	8,193	0	0	0	1,826	0	0	0
1996	32,797	0	0	0	1,458	0	0	0
1997	39,300	0	0	0	3,105	0	0	0
1998	90,708	0	0	178,305	3,452	0	0	0
1999	30,135	0	0	52,000	3,219	0	0	0
2000	64,710	0	0	284,084	6,138	0	0	0
2001	6,668	0	0	0	3,602	0	0	0
2002	1,506	0	0	0	7,171	0	0	0
2003	25,045	0	0	0	6,272	0	1,492*	0
2004	101,282	0	0	0	6,193	37*	67*	0
2005	48,829	0	0	0	4,996	0	0	0
2006	170,379	0	0	0	6,495	0	0	0
2007	75,799	0	0	0	11,651	0	0	0
2008	1,984	0	0	79,082	22,552	0	0	0
2009	35,130	0	0	0	27,527	0	0	3
2010	195,487	0	0	0	22,822	0	0	0
2011	135,398	0	0	0	9,032	0	0	0
2012	46,923	0	0	0	37092	3846	0	0
2013	46,694	0	0	0	34132	420	0	0
2014	248	0	0	0	21294	3651	1896	0
Total	**1,856,054**	**145,768**	**139,418**	**669,413**	**243,012***	**795**	**3,455***	**6**

Note: *Acquisitions for 3-D seismic, 3-D/4-C data, 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	106	99	3	0	28	4	2
2004	100	90	10	0	14	0	0
2005	98	92	6	0	24	0	0
2006	82	77	2	0	21	3	0
2007	89	88	1	0	29	0	0
2008	106	100	1	2	19	5	0
2009	77	63	8	0	8	6	1
2010	53	44	4	0	7	5	1
2011	37	33	3	0	19	1	0
2012	40	37	2	0	20	1	4
2013	43	39	2	0	15	2	4
2014	65	62	3	0	19	0	3
Total	**10,388**	**8,001**	**288**	**5**	**1,091**	**28**	**20**

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 BOEM 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	0
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	0
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
2004	185,470	0	0	0	283,346	0
2005*	10,445	0	0	0	216,934	0
2006	29,071	0	0	0	281,331	0
2007	10,126	0	0	0	429,173	0
2008	965	0	0	9,679	628,018	0
2009*	217,613	0	0	0	507,389	0
2010	16,170	0	0	0	341,090	0
2011	15,307	0	0	0	155,123	0
2012	2,672	0	0	0	134,734	0
2013	7,146	0	0	0	256,756	0
2014	300	0	0	0	172,454	0
Total	**32,262,764**	**12,729,139**	**856,52**	**549,483**	**12,480,375**	**0**

*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. In FY 2005, funds were allocated for scanning of in house data. In Fy 2009, $225,000 was spent on a gravity study.

Figures may vary by 1-2%.

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.

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

Year	Average Cost ($/Mile)
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
2004	1.83
2005	0.21
2006	0.17
2007	0.01
2008	0.49
2009	6.19
2010	0.08
2011	0.11
2012	0.06
2013	0.15
2014	1.21

*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-%.

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.

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
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	0	0	0	0	0
2013	0	0	0	0	0	0
2014	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	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	0	0	0	0	0
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
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 BOEM 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
2004*	0	0	0	0	0	0
2005*	0	0	0	0	0	0
2006*	0	0	0	0	0	0
2007*	0	0	0	0	0	0
2008*	0	0	0	0	0	0
2009*	0	0	0	0	0	0
2010*	0	0	0	0	0	0
2011*	0	0	0	0	0	0
2012	0	0	0	0	0	0
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
Total	**9,553,194**	**3,696,394**	**72,175**	**534,363**	**27,925**	**0**

* 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. From FY 2003 through 2011 funds were allocated for scanning of in-house data. In FY 2009, 2010,and 2011, these totals were $50,000, $25,000, and $25,000 respectively. In addition, in FY 2010, $6,200 were allocated for a GIS-UDRIL mapping tool.

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.

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

Year	Average Cost ($/Mile)
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	---
2004	---
2005	---
2006	---
2007	---
2008	---
2009	---
2010	---
2011	---
2012	---
2013	---
2014	---

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 Bureau of Ocean Energy Management (BOEM). 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.

Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) – Predecessor agency to the Bureau of Ocean Energy Management.

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 (OCSLA) 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 - a BOEM 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.

Minerals Management Service (MMS) – Predecessor agency to the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE).

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 Department of the Interior's (DOI) 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.

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.