OCS Report
BOEM 2019-041

Resource Evaluation Report

2018 Geological & Geophysical Data Inventory

Outer Continental Shelf

By Paul Godfriaux

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

Sterling, Virginia
2019

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A work of this nature requires assistance from numerous sources. The statistics in this report are a result of an agency-wide effort by geoscientists. We would like to thank Chad Vaughn and John Johnson (Gulf of Mexico/Atlantic), Dan Lasco and Louis Niglio (Alaska), and Kevin Smith (Pacific).

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Abbreviations

AVO	Amplitude Variation with Offset
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 Data
IBLA	Interior Board of Land Appeals
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 catalogs the historical and current geological and geophysical (G&G) data permitting activities and purchases of the Bureau of Ocean Energy Management's (BOEM) Resource Evaluation Program (REP).

BOEM's regulations at 30 CFR Part 551 govern the process for prelease G&G exploration for oil, gas, and sulphur resources on the OCS. Part 551 applies not only to G&G exploration but also to scientific research. 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 must be conducted. Similar regulations addressing prelease prospecting activities for minerals other than oil, gas, or sulphur can be found in 30 CFR Part 580.

The focus of this report concentrates mostly on the raw data, such as the totals for permits issued, data acquired, and expenditures for these data. These items are influenced by a number of factors, including overall trends of oil and gas prices, access limitation for OCS acreage due to legislative and presidential moratoria, and the shift of industry investment to international opportunities.

This report tracks all data by fiscal year with the exception of permitting which is tracked by calendar year due to BOEM permit-issuance procedure. This report includes transactions through the end of FY2018; however permitting data is included through December 31, 2018. All dollar amounts are reported in nominal United States dollar values and are not adjusted for inflation.

Permits, Data Acquisition, and Reimbursement

BOEM administers certain provisions of the Outer Continental Shelf Lands Act (OCSLA) through regulations found at Title 30 of the Code of Federal Regulations (CFR). BOEM's regulations govern permitting, data acquisition and release, leasing, and post-lease operations on the OCS.

For administrative and planning purposes, BOEM has established four OCS regions comprised for 26 planning areas. The four regions are Alaska, Pacific, Atlantic and Gulf of Mexico (GOM) as show in Figure 1.

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

BOEM issues permits to industry to allow for the collection of prelease G&G data and approves the collection of post-lease G&G data to inform industry-submitted Exploration and/or Development Plans. These G&G permits, issued by the Resource Evaluation (RE) Regional supervisors, set forth the specific requirements for each data-gathering activity, including the area where the data may be collected, the timing of the activity, approved equipment and methods, environmental mitigations, and other relevant information.

BOEM does not directly acquire G&G seismic data barring a few rare exceptions. Instead, BOEM typically obtains G&G data from lessees and permittees. By regulation BOEM has access to certain permitted seismic data and information (such as processed, analyzed or interpreted data) as soon as the data become available, and lessees and operators are required, upon request, to provide BOEM with data collected on their leases. Data acquired via G&G permits constitute approximately 90 percent of the BOEM seismic database. For OCS data collected in the normal course of business, permittees and lessees are only reimbursed for 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 requests that data, BOEM pays the significantly higher "market price" for obtaining it.

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, the data are derived from a common location in the ocean sub-bottom where sound waves originating from various positions of the seismic (sound) source near the ocean surface are reflected back toward the surface. Table 1 shows estimates of the amount of these data in the BOEM inventory by planning area.

While in the past a majority of data were collected in 2-D, currently the vast majority of geophysical data and information in the BOEM inventory is three-dimensional (3-D) seismic information. This is especially true for Gulf of Mexico (GOM) OCS data. 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). AVO 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 involves the recording of marine seismic data with ocean bottom seismometers (OBS) on the sea floor. 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 of exploration work is to map density differences that may indicate different rock types. Gravity data are usually displayed as anomaly maps.

Controlled Source Electromagnetic (CSEM) surveys are being conducted in areas of the GOM. Although not a new technology, it is a relatively new application for the deeper water OCS provinces. The data gathered from these surveys are often used in conjunction 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. Compared with the results of 2-D surveys, 3-D information provides greater detail and delineation of the subsurface geologic conditions associated with the occurrence of oil and gas.

As 3-D seismic technology evolved, 3-D reflection techniques began to not only portray subsurface structure and stratigraphy, but started to reveal information about fluids within the subsurface as well. Three dimensional seismic surveys that are shot over the same area at different times can now detect changes from one fluid/gas to another (where present), e.g., oil to gas.

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. To date, the main purpose of these surveys has been reservoir management, e.g., determining where and how long to drain hydrocarbon-bearing areas, and monitoring gas injection or steam or water flooding during enhanced recovery operations.

Geological Data Collection

Bottom Sampling and Shallow Coring

In general, bottom samples are obtained by dropping a weighted tube to the ocean floor and recovering it with an attached wire line. Shallow coring (no deeper than 500 ft.) is performed by conventional rotary drilling equipment to obtain a near-surface sample of the rocks or sediment of the seabed.

Deep Stratigraphic Tests

A deep stratigraphic test, as defined in 30 CFR 551.1, 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 drilled on the OCS have encountered hydrocarbons: the COST B-3 (Atlantic), Point Conception No.1 (California), and the Norton COST No. 2 (Alaska). A discussion of the deep stratigraphic test program is described by Dellagiarino (1991) in OCS Report # MMS-90-0028.

High Resolution Data

Up until 1982, all of BOEM's regional offices directly acquired pre-lease, tract-specific, shallow hazards data, or, high-resolution data (HRD). After BOEM established the area wide leasing program in 1982, the detailed shallow hazards analysis function was shifted to the post-sale phase, and it is now the responsibility of the lessee to collect site-specific hazards data.

A company must obtain a G&G permit from BOEM to conduct a prelease hazards survey. Shallow hazards survey data and information are available to BOEM and BSEE under terms of permit or lease and regulations and are submitted to BOEM as part of the safety review process.

G&G Data Release

BOEM's regulations at 30 CFR § 551.14(b)(1) and § 550.197 establish the release times of proprietary G&G data and information. Prelease geophysical information will not be released to the public for 25 years; raw geophysical data is held for 50 years before it is released to the public. The proprietary term for geological information is 10 years. The Minerals Management Service (MMS), a BOEM predecessor agency, first released geophysical data sets in 2001, which included data sets from southern Alaska, the Arctic, the Bering Sea, 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/. 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

BOEM has amassed a large inventory of both 2-D and 3-D seismic data. Table 1 shows the coverage of 2-D seismic data, by region and planning area, that BOEM purchased through FY 2018. Tables 2 and 3 summarize the total amount of 2-D and 3-D data purchased by year through FY 2018. Figure 2 illustrates a visual representation of the data listed in tables 2 and 3. Table 4 summarizes BOEM data inventory by type and location through FY 2018. BOEM currently has 323,000 blocks of 3-D seismic information. In comparison, BOEM currently

has 3.2 million line miles of conventional 2-D seismic information. Each block of 3-D data coverage provides much more information than a 2-D seismic line-mile. Both types of data are important and many areas do not have 3-D coverage, especially in frontier zones.

BOEM has not acquired all the permit data shot and recorded by industry primarily because of either the data quality or the redundancy in available data sets. Since the early 1990s, BOEM and the oil and gas industry have increased the inventory of 3-D seismic data in concert with the development and use of interactive computer workstations. For some areas where BOEM previously obtained 2-D or 3-D seismic information, BOEM continues to purchase new information as a result of the use of state-of-the-art acquisition methods and equipment, or the reprocessing of previously acquired data using more modern techniques.

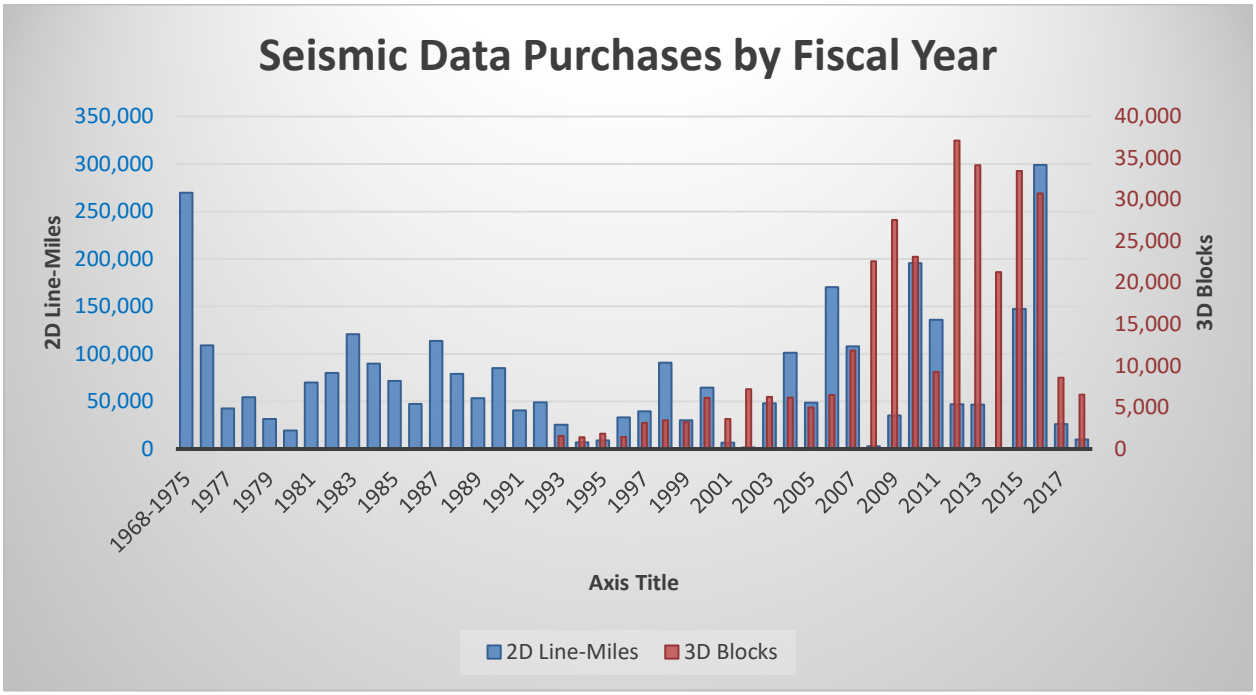

Figure 2: Seismic Data Purchases by Fiscal Year

Geological and/or Geophysical Exploration Permits

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 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 2018. Figure 3 displays the permitting data by calendar year. Since 1960, BOEM has, on average, issued approximately 215 permits per year (Tables A-2, A-6, A-10, and A-14 show total permits per Region.). The greatest number for one year was 574 in 1983.

The figures below highlight the fact that most OCS oil and gas activity has been in the GOM. The GOM has granted 84 percent of all BOEM permits issued, followed by the Alaska Region with eight percent. The Pacific Region has granted six percent of permits issued,

followed by the Atlantic Region with about two percent.

It should be noted that since 1969, approximately 94 percent of the permits issued have been for geophysical exploration, while geological exploration permits have accounted for only five percent. While the total number of 3-D permits issued compared to all permits issued is rather small (10 percent), when compared with the total geophysical permits issued over the past 10 years, 3-D permits (including 4D) have comprised 39 percent of geophysical permits during that period. Permits for deep stratigraphic test wells or COST wells make up about six percent of all geological permits.

Permitting for all regions has declined since the number of permits issued peaked in 1983. The regional differences can be attributed to factors such as leasing moratoria, operating conditions such as hurricanes/arctic ice, and the discovery of new hydrocarbon plays.

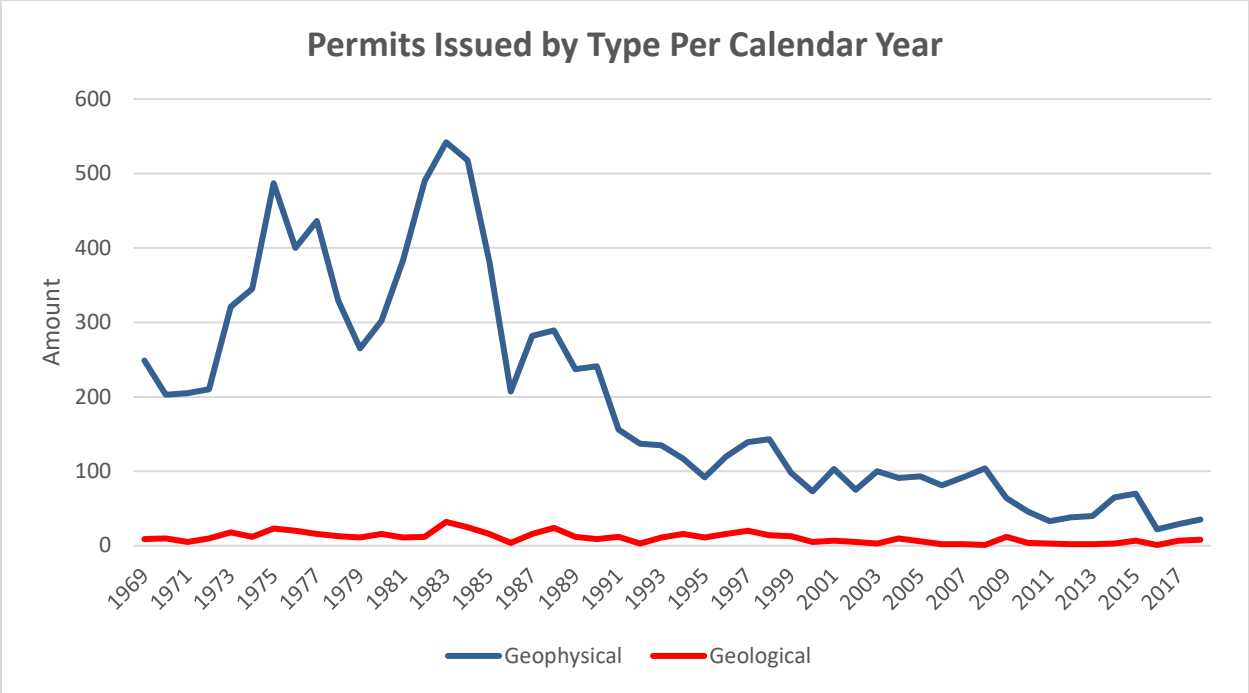

Figure 3: Permits Issued by Type per Calendar Year

Expenditures

Under 30 CFR § 551.13(a), BOEM can purchase G&G data for the cost of data reproduction. As a result, BOEM purchases large amounts of data at costs much lower than market price. This only extends to data in OCS waters, and does not apply to data acquired in foreign countries.

Tables 6 and 7 show the total expenditures for G&G data since 1968 for those data presented in Table 4, including the distribution of G&G expenditures by Region[1]. The GOM and

[1] All dollar values in this report are nominal, and have not been adjusted for inflation.

Alaska have the largest portion of the expenditures with 41 and 36 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 OCS offshore California, Washington and Oregon was under moratoria from the 1980s to 2008. The main difference between the Atlantic and Pacific regions is the purchase of high-resolution data in the Atlantic (see Table 7).

The average cost per mile for data (Table 8) was high 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 (1979 to 1990), and BOEM was required to pay full market price for this non-OCS dataset. 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. It is important to note that these prices are presented in nominal terms.

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

BSEE's Acquisition Operations conducted a market survey in December 2015 to establish current industry pricing. Industry responses to the survey and an analysis of occupational categories and associated labor rates indicated that the $20.48/gigabyte rate was no longer a fair reimbursement rate for G&G data. BSEE recommended a new reimbursement rate of $2/gigabyte for all G&G data which led to the change.

Comparisons to Industry

While BOEM does not purchase all data that industry acquires, it does purchase a vast majority of it. For example, BOEM has purchased approximately 90 percent of the data collected by industry on the Alaska OCS. BOEM may choose not to purchase data if it already has coverage over an area with superior data quality. Alaska remains a large frontier area with limited data coverage by industry, a fact that necessitates that BOEM acquire as much of these data as feasible. In recent years, while BOEM has purchased the data from most 3-D surveys and large 2-D surveys shot in the GOM, it has not needed to 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.

Recent Developments

- **BOEM Initially Denies Atlantic Seismic Permits**: On January 6, 2017, BOEM announced the denial of six pending G&G permit applications to conduct airgun seismic surveys in the Mid- and South Atlantic Planning Areas of the Atlantic Ocean.

- **President Trump Issues Executive Order 13795 (America-First Offshore Energy Strategy):** On April 28, 2017, President Trump issued Executive Order 13795, establishing that it is, "the policy of the United States to encourage energy exploration and production, including on the Outer Continental Shelf, in order to maintain the Nation's position as a global energy leader and foster energy security and resilience for the benefit of the American people, while ensuring that any such activity is safe and environmentally responsible." It directed the Secretary of the Interior to:

  (1) give full consideration to revising the schedule of proposed oil and gas lease sales, so that it includes, but is not limited to, annual lease sales, to the maximum extent permitted by law, in the Western Gulf of Mexico, Central Gulf of Mexico, Chukchi Sea, Beaufort Sea, Cook Inlet, Mid-Atlantic, and South Atlantic Planning Areas; and

  (2) to the maximum extent permitted by law, expedite all stages of consideration of seismic survey permit applications.

  Secretary's Order 3350, issued on May 1, 2017, further implemented Executive Order 13795, and required that BOEM expedite consideration of appealed, new, or resubmitted seismic permitting applications for the Atlantic.

- **BOEM Reconsiders Atlantic Seismic Permits:** On May 10, 2017, the Department of the Interior announced that it would resume its evaluation of applications from six companies seeking permits to conduct G&G activities in the Atlantic Ocean.

- **National OCS Oil and Gas Leasing Program:** On July 3, 2017, BOEM published a Request for Information in the *Federal Register*, initiating the process to develop a new National OCS Oil and Gas Leasing Program. The 2017-2022 National Program will continue to be executed until the new National Program is complete.

- **First of three proposals for the 2019-2024 National OCS Oil and Gas Leasing Program**: On January 4th, 2018, BOEM released the first of three proposals for the National Program –i.e. the Draft Proposed Program. This program proposes a total of 47 lease sales throughout offshore OCS areas including area of the Atlantic and Pacific as early as 2020. This is a major development because previous inactive areas in the Pacific, Atlantic, and Eastern Gulf of Mexico may be opened up to leasing once again. https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/

- **Five IHAs approved in the Atlantic:** On November 30th, 2018, five Incidental Harassment Authorizations (IHA) were approved by NOAA Fisheries for seismic permit applications in the Atlantic.

Table 1. Summary of Estimates of CDP (2-D) Seismic Miles in the BOEM Inventory Through FY 2018 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	115,000
Beaufort Sea	77,000
Total	**477,000**
Atlantic	
North Atlantic	93,000
Mid-Atlantic	67,000
South Atlantic	57,000
Straits of Florida	7,000
Total	**224,000**
Gulf of Mexico	
Eastern GOM	231,000
Central GOM	1,522,000
Western GOM	572,000
Total	**2,325,000**
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 BOEM-Purchased 2-D Seismic Data for FY 1968-2018

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	2,953
2009	35,130
2010	195,487
2011	135,884
2012	46,923
2013	46,694
2014	248
2015	147,555
2016	299,028
2017	26,318
2018	10,061
Total	**3,158,739**

Figures may vary by 1-2%.

Table 3. Summary of BOEM-Purchased 3-D Seismic Data for FY 1968-2018

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
2015	33,427
2016	30,764
2017	8,566
2018	6539
Total	**323,213**

Figures may vary by 1-2%.

Table 4. Summary of BOEM's G&G Data Inventory, by Data Type and Region, FY 1968-2018

Data Type	Region	Mileage*
2-D Seismic	Alaska	476,608
	Atlantic	223,997
	Gulf of Mexico	2,325,293
	Pacific	132,841
	Total	**3,158,739**
High Resolution	Alaska	59,855
	Atlantic	49,509
	Gulf of Mexico	176,593
	Pacific	30,582
	Total	**316,539**
CDP Interpretations	Alaska	84,683
	Atlantic	44,801
	Gulf of Mexico	293,925
	Pacific	42,365
	Total	**465,774**
Gravity and Magnetics	Alaska	375,017
	Atlantic	15,783
	Gulf of Mexico	672,588
	Pacific	110,150
	Total	**1,173,538**
3-D Seismic	Alaska	853
	Atlantic	0
	Gulf of Mexico	321,455
	Pacific	52
	Total	**322,380**
3-D/4-C	Alaska	0
	Atlantic	0
	Gulf of Mexico	8,659
	Pacific	0
	Total	**8,659**
3D-AVO	Alaska	81
	Atlantic	0
	Gulf of Mexico	20,723
	Pacific	0
	Total	**20,804**
Deep Stratigraphic Tests	Alaska	14
	Atlantic	5
	Gulf of Mexico	14
	Pacific	2
	Total	**35**

(*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 G&G 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	84	64	12	4	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
2015	77	70	7	0	15	0	4
2016	24	22	1	0	22	1	0
2017	37	29	7	1	8	1	1
2018	43	35	8	0	12	0	3
Total	**12,654**	**9,714**	**530**	**31**	**1,186**	**57**	**28**

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 G&G Data by Region, FY 1968-2018 (in nominal 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
2015	1,574	0	436,676	17,600	455,850
2016	23,310	310,000	56,485	89,500	479,295
2017	25,000	0	69,493	25,000	119,493
2018	130	307,629	273,937	0	581,696
Total	**59,514,318**	**21,099,275**	**67,918,886**	**15,425,963**	**166,166,579**

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

Table 7. Summary of G&G Data Expenditures by Data Type and Region, FY 1968-2018 (in nominal dollars)

Data Type	Region	Expenditures ($)*
	Alaska	
2-D Seismic		40,949,737
High Resolution		11,125,798
CDP Interpretations		439,793
Gravity and Magnetics		1,027,238
3-D Seismic		1,511,327
3-D/4-C		0
AVO		28,048
Total		**55,081,941**
	Atlantic	
2-D Seismic		9,335,167
High Resolution		9,751,232
CDP Interpretations		55,274
Gravity and Magnetics		2,902
3-D Seismic		0
3-D/4-C		0
AVO		0
Total		**19,144,575**
	Gulf of Mexico	
2-D Seismic		32,277,913
High Resolution CDP		12,739,926
Interpretations		1,096,580
Gravity and Magnetics		549,483
3-D Seismic		12,726,489
3-D/4-C		2,787
AVO		327,621
Total		**59,945,799**
	Pacific	
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
3-D/4-C		0
AVO		0
Total		**13,884,051**

*BOEM has had additional expenditures through its G&G data purchasing 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 purchases 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 1968-2018 (in nominal dollars)

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
2015	0.05
2016	0.02
2017	0.13
2018	30.58**

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.
** In 2018 2D data was only purchased in the Atlantic and costs vary widely in this area.

Additional Reading

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Appendix

Alaska OCS Region

Atlantic OCS Region

Gulf of Mexico OCS Region

Pacific OCS Region

Table A-1. Summary of G&G Data Inventory for Alaska by FY

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	3D-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
2015	3,662	0	0	0	0	0	0
2016	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0
2018	0	0	0	2,253	0	0	0
Total	**476,608**	**59,855**	**84,683**	**375,017**	**853***	**81***	**14**

*Purchases for 3-D seismic and AVO data are measured in blocks; all other purchases 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 G&G 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
2015	1	1	0	0	1	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	1	1	0	0	0	0
Total	**1,069**	**881**	**107**	**14**	**32**	**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 G&G Data by FY for Alaska (in nominal dollars)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D	3D-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
2015	1,574	0	0	0	0	0	0
2016	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0
2018	0	0	0	130	0	0	0
Total	**$40,948,163**	**$11,125,798**	**$439,793**	**$1,027,238**	**$1,511,327**	**$28,048**	**$0**

Table A-4. Summary of Average Cost Per Mile by BOEM for 2-D Seismic Data by FY for Alaska (in nominal 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	---
1993	73.48
1994	239.18
1995	475.85
1996	358.96
1997	512.71
1998	706.77
1999	---
2000	---
2001	---
2002	---
2003	---
2004	---
2005	---
2006	---
2007	---
2008	0.07
2009	---
2010	---
2011	0.04
2012	---
2013	---
2014	---
2015	0.43
2016	---
2017	---
2018	---

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 lines indicate G&G dollars were not spent on CDP information.

Table A-5. Summary of G&G Data Purchases for the Atlantic (by FY)

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
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	10,061	0	0	0	0	0
Total	**223,997**	**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 G&G 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
2015	0	0	0	0	0	0
2016	2	0	1	0	0	1
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
Total	**276**	**184**	**25**	**5**	**0**	**22**

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 G&G Data by FY for the Atlantic (in nominal 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	0
1977	242,868	1,968,513	9,992	0	0	0
1978	581,562	0	0	0	0	0
1979	119,250	0	0	0	0	0
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
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	307,629	0	0	0	0	0
Total	**$9,335,167**	**$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 BOEM for 2-D Seismic Data by FY for the Atlantic (in nominal 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	---
2015	---
2016	---
2017	---
2018	30.58

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.

Table A-9. Summary of G&G Data Purchases for the Gulf of Mexico (by FY)

Year	2-D	HRD	Interpretations	Grav/Mag	3-D*	3-D/4-C*	3D-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	10
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	37,092	3,846	0	0
2013	46,694	0	0	0	34,132	420	0	0
2014	248	0	0	0	21,294	3,651	1,896	0
2015	143,893	0	0	3,175	33,427	541	3,248	0
2016	299,028**	0	0	0	30,764	0	9,095	0
2017	26,318	0	0	0	8,566	0	1,990	1
2018	0	30,825	154,507	0	5,686	164	2,935	0
Total	**2,325,293**	**176,593**	**293,925**	**672,588**	**321,455**	**8,659**	**20,723**	**14**

Note: *Purchases for 3-D seismic, 3-D/4-C data, and AVO data are measured in blocks; all other purchases, in this table are measured in miles. The DST dates are assigned based upon completion dates and are measured in terms of wells completed.
**High figure is due to purchase of reprocessed old data and not due to new seismic acquisitions by industry.
Figures may vary by 1-2%.

Table A-10. Number of Permits Issued for G&G 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	81	63	12	0	8	6	5
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
2015	76	69	7	0	15	0	4
2016	22	22	0	0	22	0	0
2017	37	29	7	0	8	1	1
2018	42	34	8	0	12	0	3
Total	**10,569**	**8,155**	**314**	**5**	**1,148**	**29**	**32**

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 G&G Data by FY for the Gulf of Mexico (in nominal 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
2015	5,935	0	0	0	430,741	0
2016	5,922	0	0	0	56,485	0
2017	3,292	6,092	0	0	60,108	0
2018	0	4,695	240,054	0	29,188	0
Total	**$32,277,913**	**$12,739,926**	**$1,096,580**	**$549,483**	**$13,056,897**	**$0**

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Figures may vary by 1-2%.

Table A-12. Summary of Average Cost Per Mile by BOEM for 2-D Seismic Data by FY for the Gulf of Mexico (in nominal 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
2015	0.04
2016	0.02
2017	0.13
2018	---

*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.

Table A-13. Summary of G&G Data Inventory for the Pacific (by FY)

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
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
Total	**132,841**	**30,582**	**42,365**	**110,150**	**52**	**2**

* Purchases for 3-D seismic data are measured in blocks; all other purchases 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 G&G 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
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	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 G&G Data by FY for the Pacific (in nominal 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
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
Total	**$9,553,194**	**$3,696,394**	**$72,175**	**$534,363**	**$27,925**	**$0**

Table A-16. Summary of Average Cost Per Mile by BOEM for 2-D Seismic Data by FY for the Pacific (in nominal 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	---
1991	---
1992	---
1993	---
1994	1.48
1995	---
1996	9.32
1997	---
1998	---
1999	---
2000	---
2001	---
2002	---
2003	---
2004	---
2005	---
2006	---
2007	---
2008	---
2009	---
2010	---
2011	---
2012	---
2013	---
2014	---
2015	---
2016	---
2017	---
2018	---

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 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.