Chapter III.—Exploration Alternatives and Underlying Assumptions

A. Identification of Exploration Alternatives

This chapter identifies and describes several alternative methods for separating the decision to explore for oil and gas from the decision to produce any resources that might be found on the Outer Continental Shelves in frontier areas. These methods were chosen because they represent feasible alternatives for separating exploration and production. OTA recognizes that there are other systems which could modify present practices and provide resolution of the significant issues as well, but would not necessarily distinctly separate exploration from production. Modifications are not described in this chapter but certain modifications are suggested for consideration in Chapter IV.

The bonus bid leasing method presently used by the Department of the Interior permits both exploration and production, subject to the lessee meeting certain requirements, such as filing exploratory drilling and field development plans.

Using existing exploratory techniques, it is not possible to determine the presence of oil and gas until a hole is drilled, and it is not possible to determine the quantity of what has been discovered until a number of delineation holes have been drilled. Very little resource evaluation is possible prior to leasing under the present system since exploration is limited to non-drilling techniques.

The exploration alternatives to be described here provide for substantial exploratory drilling prior to leasing (or licensing) and for separate exploration and production decisions by government. These alternatives combine two variables: (1) the level of exploration effort, and (2) who is to conduct the exploration. Three levels of exploration effort-limited, intermediate, and full-and two variations on who conducts the exploration—government or industry-have been selected for analysis by OTA. This results in six exploration alternatives: limited government or industry, intermediate government or industry, and full government or industry.

A limited exploration program is intended to find and delineate the large traps in a given frontier area in an effort to discover major fields, those potentially capable of containing 500 million or more barrels of oil or gas (in equivalent barrels).[1] The second exploration level, intermediate, is intended to find and delineate both large traps (500 million barrel size or greater) and intermediate-sized traps potentially capable of containing over 50 million barrels of oil (or gas). Under a full exploration program, the objective would be to identify and delineate all traps in a given frontier area. As noted earlier,

[1] Wherever "oil" is used in this report it refers to either oil or gas, where quantities of oil are measured in barrels and gas is measured in "equivalent barrels" (i. e., the amount of gas equivalent in the amount of energy available to one barrel of oil).

each succeeding level is essentially an extension of the previous one, simply increasing the intensity of the exploratory effort m order to identify and delineate smaller traps. The exploratory methods and techniques would be essentially the same for all three levels of effort. In each case, the best or largest prospects would be explored first. Choosing a higher level of exploration effort would provide more detailed information about the quantity of resources within the frontier area being explored, but it would also take longer and increase the costs.

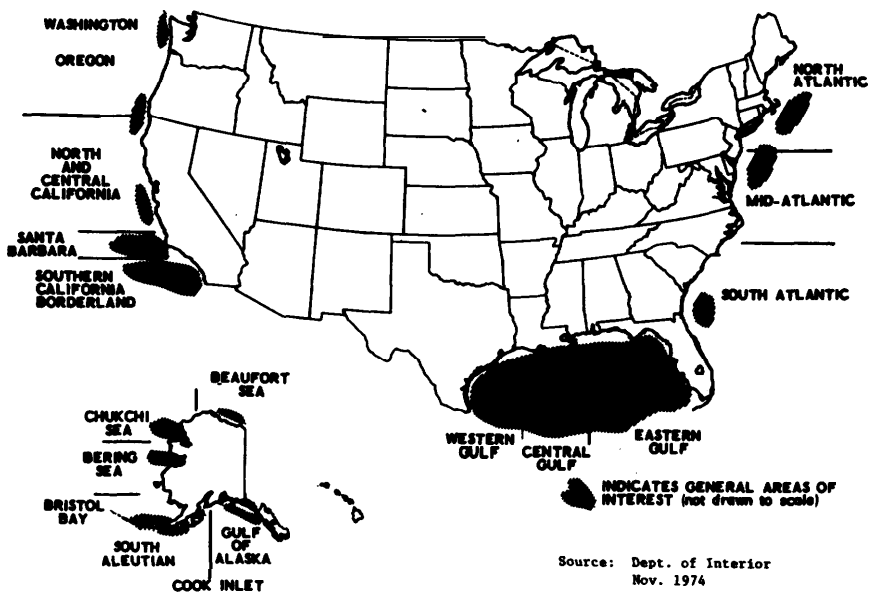
Who conducts the exploration is generally independent of which level of exploration is selected. In fact, all six alternatives (and even the present system) can provide for some degree of participation by both government and industry.

B. Identification of Representative OCS Frontier Areas:

The Department of the Interior has identified 15 OCS areas of interest for oil and gas exploration. (See map, Figure III–1) OTA selected for evaluation three of these as typical and representative of all the OCS frontier areas: (1) Mid-Atlantic; (2) Southern California; and (3) Gulf of Alaska. These three areas are at the top of Interior's priority list of frontier areas to be leased, and they are the regions of the greaest current interest from the viewpoint of coastal state impacts. The following descriptions of these areas have been abstracted from the Department of Interior, Envirormwntal *Impact Statement, "Proposed Increase in Acreage to be Offered for 0il and Gas Leasing on the Outer Continental Shelf.",* released October 18, 1974.

FIGURE III–1

OCS Regions of Interest for Oil/Gas Exploration



Mid-Atlantic

The principal geologic feature of the Mid-Atlantic OCS is the Baltimore Canyon Trough—so named for the defile cut into the subsurface continental slope offshore from Baltimore. The Trough is approximately 80 miles wide, underlies water depths of 60 to 6,000 feet, and extends from a point south of Long Island, New York, to Cape Hatteras over a distance of some 450 miles. The axis of the Trough is approximately 60 miles offshore and is generally at the 200-foot water depth.

In the deeper parts of the Trough, sedimentary rock (the normal host rock of oil and gas) may exceed 40,000 feet in thickness. Sea bottom stability is considered average, and there are no known geologic hazards.

As much as 16 million acres of the Baltimore Canyon Trough may be considered favorable for oil and gas exploration. Like other portions of the Atlantic OCS, the Baltimore Canyon Trough has not been tested, and its petroleum potential is unknown.

Southern California Offshore

The Southern California offshore area extends from Point Conception on the north to the Mexican border on the south, a distance of approximately 260 miles along the coast of Southern California, and reaches seaward about 150 miles.

The area contains several geologic features, the most familiar being the seaward extensions of the Los Angeles and Ventura Basins which are the sources of several prolific fields; e.g., Wilmington, Huntington Beach, Dos Cuadros, and Santa Ynez Unit. Other major prospective areas are the Santa Monica, and San Pedro Basins, the Santa Rosa-Cortes Ridge area, and the Tanner Bank located west of San Clemente Island. Total thickness of sediments ranges from 20,000 to 50,000 feet in the offshore Ventura Basin, but may be less in other southern California basins. Maximum thickness of reservoir rocks probably exceeds 2,000 feet.

Sediments equivalent in age to those producing in the Dos Cuadros field are present in the near-shore areas of Santa Monica Bay and San Pedro Bay, while portions of the seaward basin areas off the Santa Rosa-Cortes Ridge and Tanner Rank are thought to contain older rocks with possible petroleum potential.

Although faults are numerous throughout the area, they are not considered to be a significant hazard since rigs and platforms will not be located over recognized faults. Ocean floor slides could be a problem in these areas; however, old slide areas can be located and avoided.

* Wave conditions in the Santa Barbara Channel and in most southern California waters are relatively calm compared to the Gulf of Mexico.

Oil and gas have been produced for more than fifty years on State-controlled offshore lands in southern California, and by the end of 1973 total cumulative production exceeded 1.4 billion barrels of oil and 540 trillion cubic feet of *gas.* Cumulative production from the Federal (OCS) portion of the California Continental Shelf (all from the Dos Cuadros field) totaled 105 million barrels of oil and 50 billion cubic feet of gas as of December 1973.

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Gulf of Alaska

The Gulf of Alaska Basin includes an offshore area of about 50,000 square miles underlain by thick sediments and extending seaward from the shore to a distance of 50 to 100 miles. Water depths in the basin range from less than 60 feet to more than 6,000 feet.

Structures capable of trapping oil and gas have been identified in an area extending from east of Yakutat Bay to Kodiak Island, a distance of nearly 600 miles, and extending from about the shoreline to as far as 90 miles offshore.

Based on present knowledge, it is believed that the most promising structures in the Gulf of Alaska are located in less than 200 meters of water between Hinchinbrook Island and Yakutat Bay.

C. Underling Assumptions

1. POTENTIAL RESOURCES

Table III–1 presents approximate areas of interest in each of the three OCS frontier regions. It also summarizes estimates that OTA has made on the number of traps and the average drilling depth to be expected in each region. These estimates are the result of discussions among the OTA Task Force experts on this subject.

The potential reserves of each area listed in table III–1 are based on estimates given in the Department of Interior's Final Environmental Impact Statement for the proposed OCS lease sales.

For the percentages of the potential reserves that will be discovered by completing each exploration level of effort, the Task Force has assumed that each step-up in level of exploration will discover an increased portion of whatever potential there is. This assumption is based on an agreement among the Task Force that about 50% of reserves in the U.S. have. typically been found in major traps and 75% in major plus intermediate sized tram.

TABLE III-1.-DATA ASSUMPTIONS RELATED TO POTENTIAL RESOURCES OF REGIONS

	Frontier region		
	Mid-Atlantic	Southern California	Gulf of Alaska
Total area of interest:			
Square miles	25, 000	23, 000	50, 000
Acres (million)	16	15	30
Estimated:			
Number of major structural traps	7	13	13
Number of major stratigraphic traps	0	8	2
Number of intermediate traps	23	15	20
Average depth of well (feet)	16, 000	10, 000	10, 000
Potential reserves (undiscovered):			
Billion barrels oil	0–8	0–4	0–18
Trillion cu. ft.—gas	0–45	0–7	0–90
Percent discoveries assumed by exploration level: [1]			
Limited	50	50	50
Intermediate	75	75	75
Full	100	100	100

[1] Discoveries have been assumed to cover the total of oil and/or gas because no method is available to indicate the occurance of oil versus gas.

2. GEOPIIYSICAL AND DRILLIN G PROCEDURES

It is also necessary to make some basic assumptions about the procedures to be used to accomplish each level of exploration. Except for

time and cost estimates, these procedures are generally independent of who conducts the exploration. OTA Task Force members provided the background on typical practices and these were used to derive the data given in Table III-2.

Geophysical line mile estimates include reconnaissance plus the seismic detailing necessary prior to drilling any trap. It is estimated that reconnaissance requires 10,000 seismic line miles for each 5,000 square miles of area for limited exploration and double that amount for intermediate exploration. Detailing is estimated to require an additional 500 line miles per trap. Most of the limited reconnaissance seismic surveying is already completed for the Mid-Atlantic, some is completed for Southern California, and very little is completed in the Gulf of Alaska. Although most of the Mid-Atlantic data are now proprietary, it is assumed that government could purchase it rather than re-survey.

Table III-2 also presents the number of traps and the number of holes that would be drilled under each alternative program. In the case of both seismics and drilling, OTA did not consider it feasible to make reasonable estimates for a full exploration program. Until such time as exploration is started in a region, no estimates of smaller traps or total extent of potential areas can be made. A full exploration program may extend for 20 years or more in a region if substantial resources are discovered in the early years; the program could easily extend beyond 20 -years if a new technique is developed following no early discoveries. In any case, there are too many uncertainties to make feasible exploration estimates beyond the intermediate level of effort since the extent of a full program depends entirely on the results of a limited or intermediate program.

TABLE III-2.–SUMMARY OF ESTIMATED SEISMICS AND EXPLORATORY DRILLING REQUIRED

		Exploratory drilling			
	Seismic line (miles)	Number traps drilled	Number holes	Number rigs minimum/ maximum	Rig-years total
Mid-Atlantic:					
Limited [1]	4,000	7	100	3/10	25
Intermediate	62,000	30	263	3/15	66
Full	(2)	(2)	(2)	(2)	(2)
Southern California:					
Limited	60,000	21	238	3/15	40
Intermediate	118,000	36	347	3/15	58
Full	(2)	(2)	(2)	(2)	(2)
Gulf of Alaska:					
Limited	108,000	15	272	3/20	56
Intermediate	218,000	35	365	3/20	76
Full	(2)	(2)	(2)	(2)	(2)

[1] Most of the reconnaissance geophysics has been completed in the Mid-At[anfic region and USGS has the data.
2 Unknown.

The number of holes drilled shown in Table III–2 was derived from an estimate of a reasonable number of blocks to be anticipated in each of the major traps found in each area. OTA assumed that at least three dry holes would be drilled on each uninterrupted trap and two dry holes on each block associated with that trap. If any discovery is made, the number of holes drilled would be doubled. Discoveries are arbitrarily assumed to occur in one half of the total traps and one half of the associated blocks. The number of blocks per major trap

are assumed to be 4 in the Mid-Atlantic, 6 in the Gulf of Alaska, and 8 in Southern California. Small traps are assumed to have only one associated block.

The estimated number of rigs required for each program is based on drilling 4 holes per rig per year in the Mid-Atlantic (16,000 ft. average depth), 5 holes per rig per year in the Gulf of Alaska (10,000 ft. average depth), and 6 holes per rig per year in Southern California (10,000 ft. average depth). Assuming total drilling program lengths of 3 years for the Atlantic, 4 years off Southern California, 5 years off Alaska, the minimum and maximum numbers in any year are then estimated. Judgments about the reasonable number of rigs that could be mobilized in a given time period are the basis for OTA'S rig and time projections.

It should be noted that these estimates. as well as estimates of time and cost, are based on very general and broad judgments and represent only the limited knowledge which exists concerning these frontier areas.

In addition to geophysical surveys and drilling programs, it is recognized that a substantial management and analysis group would be required for directing the exploration in each area. This staff, whose composition is shown below, would be needed for each area and would be employed for the duration of any level of exploration program (limited, Intermediate, full).

Exploration program management and analysis 8taff

Job description	*Number of personnel*
Managing officer	1
Managing offiicer assistant	1
Chief civil engineer	1
Chief drilling engineer	1
Chief exploration scientist	1
Senior geophysicist	1
Senior geologist	1
Senior finance officer	1
Legal affairs officer	1
Staff petroleum engineers	12
Staff geologists	12
Staff geophysicists	12
Marine superintendents	4
Operations men (materials)	12
Accounting personnel	6
Secretaries	12
Clerks	12
Typing	12
Drafting	12
Total	115

NOTE: **The foregoing assumes that purchasing, contracts, personnel departments and other support already exist.**

3. TIME REQUIREMENTS

Based on the foregoing assumptions, the required time to complete each phase of an exploration program, and the total time that would be required for each level of effort. are estimated in Table III--3. Differences in the estimates for the limited program are due to a difference in the extent to which geophysical surveys have already been completed in each area and in the number of holes that will have to

be drilled. These and other considerations, tempered by equipment factors, also determine the maximum number of rigs required in any one year. For the intermediate and full programs, there is no significant difference, by geographic area, in time required to complete the programs, so these are not listed in Table III–3. It is assumed that enough rigs would become available, over the longer time periods involved, to eliminate any time differences—in contrast to the limited program for each area.

Government programs have been estimated to need longer start-up times than industry programs. For any new program, some organizational and planning time is required. If government conducts exploration it will be necessary to recruit and train a sizeable management and analysis organization. Such organizations already exist within oil companies but would have to be established within government—and this would take some time. Delays may also be expected with the limited government exploration alternative, since rigs and other major equipment are of limited availability, and almost all major rigs and the available tubular goods production are currently contracted to oil companies for specific programs.

Table 1114 presents some estimates of earliest discovery and production dates based on following the exploration programs described.

Figure III-2 illustrates the relative time schedules and the principal elements of all proposed programs and also compares the alternatives with the existing method, denoting possible separation between exploration and production phases.

TABLE 111-3.–OCS EXPLORATION PROGRAMS–SUMMARY OF TIME ESTIMATES
(YEARS FROM DATE OF ISSUING NEW REGULATIONS)

	Limited program			Intermediate program (all areas)	Full program (all areas)
	Mid-Atlantic	Southern California	Gulf of Alaska		
Start-up time: [1]					
Industry	½	½	½	½	½
Government	1½	1½	1½	1½	1½
Geophysics prior to drill	½	½	1	1	1
Exploratory drilling	3	4	5	7	10–20?
Total program:					
Industry	4	5	6½	8½	20–30?
Government	5	6	7½	9½	20–30?

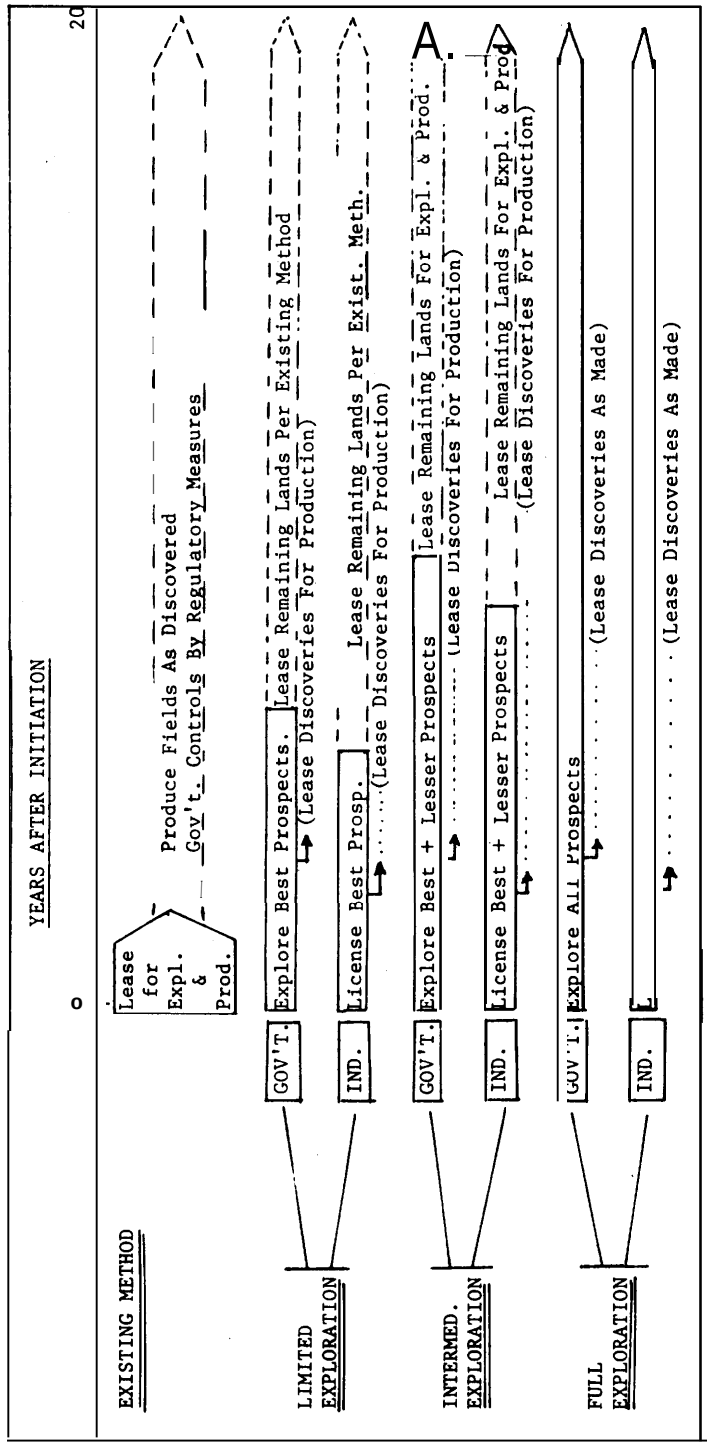
[1] The increased start-up time for Government programs includes time to structure a suitable management and technical organization, time for Government contracting procedures, plus delays due to the lack of availability of equipment which is now under contract to major oil companies.

TABLE III-4.—OCS EXPLORATION PROGRAMS—ESTIMATED DATES FOR EARLIEST DISCOVERY AND PRODUCTION BASED ON MOST REALISTIC ASSUMPTIONS AND STARTING PROGRAM IN ALL REGIONS IN 1975

	First discovery	Earliest date for one field, first production	Peak production
Industry Exploration Program:			
Mid Atlantic	1977	1981	1986
Southern California	1978	1982	1987
Gulf of Alaska	1979	1983	1988
Government Exploration Program:			
Mid Atlantic	1978	1983	1988
Southern California	1979	1984	1989
Gulf of Alaska	1980	1985	1990

Note: All three levels of exploration (limited, intermediate, full) yield the same dates.
Note: The Government program is assumed to require 1 year longer than industry to move to production. This incorporates time not required when the explorer is also the producer.

FIGURE III-2


TYPICAL OIL & GAS EXPLORATION ON THE OCS
PRINCIPAL ELEMENTS OF ALTERNATIVE METHODS
YEARS AFTER INITIATION
0
20
EXISTING METHOD
Lease for Expl. & Prod.
Produce Fields As Discovered
Gov't. Controls By Regulatory Measures
LIMITED EXPLORATION
GOV'T.
Explore Best Prospects.
Lease Remaining Lands Per Existing Method
(Lease Discoveries For Production)
IND.
License Best Prosp.
Lease Remaining Lands Per Exist. Meth.
(Lease Discoveries For Production)
INTERMED. EXPLORATION
GOV'T.
Explore Best + Lesser Prospects
Lease Remaining Lands For Expl. & Prod.
(Lease Discoveries For Production)
IND.
License Best + Lesser Prospects
Lease Remaining Lands For Expl. & Prod.
(Lease Discoveries For Production)
FULL EXPLORATION
GOV'T.
Explore All Prospects
(Lease Discoveries As Made)
IND.
(Lease Discoveries As Made)
Note: Solid lines denote most government control over public lands; dotted lines-least; the methods proposed progress from minimum to maximum control over longer periods of time.

4. ESTIMATED COSTS

Costs have been estimated for limited and intermediate levels of effort in each frontier area. based on the assumptions of the cost of the geophysical, drilling, management, and analysis efforts required to complete each alternative exploratory program. These costs are summarized in Table 111–5. Since it is not feasible at the present time to determine the extent of a full program, no costs are estimated for this alternative. Estimated management and analysis costs for both industry and government are baseed on the 115 staff persons identified in section C-2 at present salary levels. An additional 10% of the total costs shown for each of the government alternatives are to cover top management, planning and contractin, costs. {Geophysics and drilling costs are estimated to be the same for both government and industry. All costs are in constant, current dollars.

Geophysics costs are based on an average present rate of $400 per line-mile for data collection and reduction, and double this for seismic detailing. Geophysical costs are also estimated to be higher by a factor of two for Alaska.

Drilling costs are based on an average rig rate of $30,000 per day plus costs of supply boats, base and logistic support and drilling consumables, such as drilling mud. Costs are also escalated to account for Gulf of Alaska conditions not present in the Mid-Atlantic and California. The per well cost estimates thus range from $3.5 million in Southern California, $4.6 in Mid-Atlantic to $5.0 million in the Gulf of Alaska.

In Table III–6, cost estimates per barrel of oil potentially discovered under the most optimistic assumptions (high level of discovery) are shown. To put these costs in perspective, the per-barrel cost of imported oil is currently on the order of $10–$12.

TABLE 111-5.–OCS EXPLORATION PROGRAMS– SUMMARY OF COST ESTIMATES
(ALL COSTS IN MILLIONS OF CURRENT DOLLARS)

	Industry			Government		
	Mid-Atlantic	Southern California	Gulf of Alaska	Mid-Atlantic	Southern California	Gulf of Alaska
Management and analysis coats:						
Limited	20	25	30	70	115	180
Intermediate	40	40	40	180	170	250
Full	(2)	(2)	(2)	(2)	(1)	(2)
Geophysics costs:						
Limited	25 [1]	30	100	[1] 25	30	100
Intermediate	55	60	170	55	60	170
Full	(2)	(2)	(9)	(2)	(2)	(2)
Drilling costs:						
Limited	500	850	1,400	500	850	1, 400
Intermediate	1, 320	1, 180	1,800	1, 320	1,180	1, 900
Full	(2)	(2)	(2)	(2)	(2)	(2)
Total program costs:						
Limited	545	905	1,530	595	995	1, 680
Intermediate	1, 415	1, 280	2,110	1,555	1, 410	2, 320
Full	(2)	(2)	(2)	(9)	(2)	(2)

1 80 percent of this cost is for purchase of data already collected.
2 Unkown.

Note: These cost estimates are not all inclusive and only include those items indicated. They do not include related costs which are not relevant to the comparison of programs, (i.e., impact studies, energy planning, leasing, etc.)

TABLE 111-6.-OCS EXPLORATION PROGRAMS–EXPLORATION COSTS RELATED TO MOST OPTIMISTIC DISCOVERY ASSUMPTIONS

	Cost—Dollars per barrel 1	
	Industry	Government
Mid-Atlantic:		
Limited.:	0.14	0.15
Intermediate,	0.24	0.26
Southern California:		
Limited-:	0.45	0.50
Intermediate	0.43	0.47
Gulf of Alaska:		
Limtied-,	0.17	0.19
Intermediate	0.16	@.17

I Includes no land acquisition costs.

D. Description of Exploration Alternatives

In this section each of the six exploration alternatives will be described. These descriptions incorporate the assumptions stated and discussed in section C.

1. LIMITED GOVERNMENT EXPLORATION

Limited government exploration would be initiated and managed by the Department of the Interior. Within Interior, the Bureau of Land Management (BLM) and the U.S. Geological Survey (USGS) would jointly plan the exploration program. With the advice of USGS, BLM would contract for seismic and drilling services. USGS would oversee and regulate the conduct of the exploration and interpret the results. BLM would provide both the results and their interpretations to designated federal and state agencies and make both the results and interpretations available to the public.

As noted in Section C, the Department of the Interior would require additional staff to be capable of initiating, managing, and analyzing the results of an exploratory program that includes drilling. OTA estimates that a total of 115 persons would be required for each frontier area under both the limited and intermediate programs (see the list of personnel requirements in section C).

The seismic and drilling services for which Interior would contract include area reconnaissance together with geophysical surveys and exploratory drilling of all major traps. OTA estimates that it would take government a total of 5 years to complete a limited program in the Mid-Atlantic, 6 in Southern California, and $7^{1}/_{2}$ in the Gulf of Alaska. (See Tables III–2 and III–3). Total program costs, including management and analysis, are estimated at $595 million for the Mid-Atlantic, $995 million for Southern California, and $1.68 billion for the Gulf of Alaska. (See Table III–5). Given the most optimistic discovery rate, limited exploration costs per barrel are estimated at $.15 in the Mid-Atlantic, $.19 in the Gulf of Alaska, and $.50 in Southern California. (See Table III–6.)

OTA estimates that a limited exploration program initiated in 1975 could result in an initial discovery of recoverable resources in 1978 in the Mid-Atlantic, in 1979 in Southern California and 1980 in the Gulf of Alaska. At the earliest, production would begin five -years later and peak production reached five years after that. (See Table 1114.)

Under the limited government exploration alternative, OTA assumes that government would decide at the time of discoverv whether recoverable reserves are to be developed and produced or held in reserve. Methods for making recoverable reserves available to industry for development and production are discussed in Chapter IV as a part of the evaluation and comparison of alternatives.

No other exploration would be permitted within the three frontier areas while the limited government exploration program is underway. Once the program is completed, however, unexplored lands and lands rejected during limited exploration would either be held in reserve, made available for exploration by industry under a permit-leasing or licensing system, or explored through extension of the program to the intermediate level.

Under this exploration alternative, government would obtain exploration data and interpretations on the major traps in the Mid-Atlantic, Southern California, and Gulf of Alaska frontier areas. This would include estimates of the recoverable reserves to be discovered. Since these data would be under government's exclusive control, both the data and their interpretations could be publicly disclosed and government would retain full control over whether and when to produce any recoverable reserves that are discovered.

In short, government would exercise full management control and have complete control of the data, but government would also pay the full cost of exploration and, at the completion of the limited program, would have data on only the largest traps in the three representative frontier areas.

The major aspects in the limited government exploration alternative are summarized in Table 111–7.

TABLE III-7.–A SUMMARY OF THE LIMITED GOVERNMENT EXPLORATION ALTERNATIVE

	Mid-Atlantic	Southern California	Gulf of Alaska	Total
Exploration elements:				
Seismic line miles [1]	4,000	60,000	108,000	172,000
Holes drilled [2]	100	238	272	610
Time required (years): [3]				
To complete	5.0	6.0	7.5	NA
To first discovery	3.0	4.0	5.0	NA
To production	8.0	9.0	10.0	NA
To peak production	13.0	14.0	15.0	NA
Costs (millions of dollars): [4]				
Management and analysis [5]	70.0	115.0	100.0	285.0
Geophysical [6]	25.0	30.0	100.0	155.0
Drilling [7]	500.0	850.0	1,400.0	2,750.0
Potential resources: [8]				
Billions of barrels (oil)	0–8	0–4	0–18	0-30
Trillions of cubic feet (gas)	0–45	0–7	0–90	0-142

[2] Based on OTA estimate of 10,000 line miles for each 5,000 square miles plus an additional 500 miles per trap or detailing.

[2] Based on OTA estimate that at least three dry holes would be drilled on each uninterrupted trap and two dry holes in each block associated with that trap. Discoveries are assumed in 50 percent at the traps and 50 percent of the associated blocks. The number of blocks per major trap are assumed to be four in the Mid-Atlantic, six in the Gulf of Alaska, and eight in southern California. When a discovery occurs, the number of holes to be drilled is doubled.

[3] OTA estimate based on the number of seismic line miles and holes to be drilled. This estimate includes the time Government would require to develop its in-house management and analysis capability and the delays Government would be expected to encounter in contracting for drilling services.

[4] Current, constant dollars.

[5] OTA estimate using current salary levels for the 115 staff persons listed in section 111–C. Government cost add an additional 10 percent to cover top management, planning and contract costs.

[6] Based on $400 per line mile for data collection and reduction. Costs are increased by a factor of two for seismic detailing.

[7] Based on an estimated rig rate of $30,000 per day plus the cost for support and consumables. With average well depths of 16,000 feet in the Mid-Atlantic, and 10,000 feet in southern California and the Gulf of Alaska, per well costs are estimated to be $3.5 million in southern California, $4.6 million in the Mid-Atlantic, and $5.0 in the Gulf of Alaska.

[8] USGS estimate, Draft EIS, Vol. 1, p. 676 and Vol. 2, pp. 60–61, and 139–140.

2. LIMITED INDUSTRY EXPLORATION

Limited industry exploration would be initiated by the Department of the Interior under a permit, leasing, or licensing system for specified frontier areas. Industry explorers would be required to report their results to Interior on monthly basis. USGS would regulate the conduct of the exploration and interpret the results. BLM would be responsible for furnishing both the results and their interpretation to designated federal and state agencies and would make both the results and interpretations available to the public.

Unlike government, which would have to develop an in-house capability, 011 companies already possess the management and analysis capabilities needed to plan, manage and analyze the results of a limited exploration program that includes a substantial amount of exploratory drilling.

OTA estimates that it would take industry a total of 4 years to complete a limited exploration program in the Mid-Atlantic, 5 years in Southern California, and 6.5 years in the Gulf of Alaska. (See Tables III-2 and III-3.) Total program costs, including management and analysis, are estimated to be $545 million for the Mid-Atlantic, $9o5 million for Southern California, and $1.53 billion for the Gulf of Alaska. (See Table III–5.) Assuming the most optimistic rate of discovery, limited industry exploration costs are estimated to be $.14 per barrel in the Mid Atlantic, $.17 per barrel in the Gulf of Aklaska, and $.45 per barrel in Southern California (See Table III-6).

It is estimated that initiation of limited industry exploration in 1975 would result in an initial discovery in 1977 in the Mid-Atlantic, in 1978 in Southern California, and in 1979 in the Gulf of Alaska. The earliest production could be expected in 1981, 1982 and 1983 respectively; and peak production could be anticipated five years later in each case. (See Table 1114.)

Government would decide at the time of discover-y whether recoverable reserves are to be produced or held in reserve. The evaluation and comparison of exploration alternatives in Chapter IV includes an identification and discussion of alternative means for making recoverable reserves available to industry for production and development.

No exploration other than that being conducted as a part of the limited industry program would be permitted. However, after industry completes its limited program, both unexplored lands and lands rejected as unproductive b-y the limited explorer would either be held in reserve or made available to industry for exploration under a permit, leasing, or licensing system.

The limited industry exploration alternative provides for government to obtain exploration data and interpretation on all major traps (estimated as capable of containing 500 million or more barrels) in areas specified by government. This would include data on any recoverable reserves that are discovered. Government could also publicly disclose the data it obtains from industry and either its own or industry's interpretations of these data. And government could retain control over whether and when discoverable reserves would be produced. However, public disclosure of data and their interpretations and a separate government decision for producing recoverable reserves might

well adversely affect industry's incentive to explore. Consequently, it may be necessary to link the limited industry exploration alternative to a development alternative which overcomes this problem.

Some of the major aspects of limited industry alternative are summarized in Table III–8.

TABLE III-8.–A SUMMARY OF THE LIMITED INDUSTRY EXPLORATION ALTERNATIVE

	Frontier area			
	Mid-Atlantic	Southern California	Gulf of Alaska	Total
Exploration elements:				
Seismic line miles[1]	1,000	30,000	108,000	173000
Holes drilled[2]	100	238	272	610
Time required (years):[3]				
To complete	4.0	5.0	6.5	NA
To first discovery	2.0	3.0	4.0	NA
To production	6.0	7.0	8.0	NA
To peak production	11.0	12.0	13.0	NA
Costs (millions of dollars):[4]				
Management and analysis[5]	*20.0*	25.0	*30.0*	*75.0*
Geophysical[6]	*25.0*	30.0	100.0	*155.0*
Drilling[7]	*500.0*	850.0	1,400.0	*2,750.0*
Potential resources:[8]				
Billions of barrels (oil)	0–8	0–4	0-18	*0-30*
Trillions of cubic feet (gas)	0–45	0–7	&90	*&142*

[1] Based on OTA estimate of 10,000 line miles for each 5,000 square miles plus an additional 500 miles per trap for detailing.

[2] Based on OTA estimate that at least 3 dry holes would be drilled on each uninterrupted trap and 2 dry holes in each block associated with trap. Discoveries are assumed in 50 percent at the traps and 50 percent of the associated blocks. The number of blocks per major trap are assumed to be 4 in the Mid-Atlantic, 6 in the Gulf of Alaska, and 8 in southern California. When a discovery occurs, the number of holes to be drilled is doubled.

[3] OTA estimates based on the number of seismic line miles and holes to be drilled. This estimate includes the time Government would require to develop its in-house management and analysis capability and the delays Government would be expected to encounter in contracting for drilling services.

[4] Current, constant dollars.

[5] OTA estimate using current salary levels for the 115 staff persons listed in sec. III–C. Government costs add an additional 10 percent to cover top management, planning, and contract costs.

[6] Based on $400 per line mile for data collection and reduction. Costs are increased by a factor of 2 for seismic detailing.

[7] Based on an estimated rig rate of $30,000 per day plus the cost for support and consumables. With average well depths of 16,000 feet in the Mid-Atlantic, and 10,000 feet in southern California and the Gulf of Alaska, per well costs are estimated to be $3,500,000 in southern California, $4,600,000 in the Mid-Atlantic, and $5,000,000 in the Gulf of Alaska.

[8] USGS estimate, draft EIS, vol. 1, p. 676 and vol. 2 pp. 60–61, and 139–140.

3. INTERMEDIATE GOVERNMENT EXPLORATION

Intermediate government exploration differs from a limited program only in the level of effort required. This would not change the way in which the program would be initiated and managed by the Department of the Interior. An intermediate program would, of course, take longer, cost more, and be expected to result in the discovery of more recoverable reserves.

The major aspects of the intermediate government alternative are summarized in Table III–9.

TABLE III-9.–A SUMMARY OF THE INTERMEDIATE GOVERNMENT EXPLORATION ALTERNATIVE

	Frontier areas			
	Mid-Atlantic	Southern California	Gulf of Alaska	Total
Exploration Elements:				
Seismic line miles [1]	62,000	118,000	218,000	398,000
Holes drilled [2]	263	347	365	975
Time required (years): [3]				
To complete	9.5	9.5	9.5	NA
To first discovery	3.0	4.0	5.0	NA
To production	8.0	9.0	10.0	NA
To peak production	13.0	14.0	15.0	NA
Costs (Millions of dollars): [4]				
Management and analysis [5]	180.0	170.0	*250.0*	600.0
Geophysical [6]	55.0	60.0	*170.0*	285.0
Drilling [7]	1,320.0	1,180.0	*1,900.0*	4,400.0
Potential Resources: [8]				
Billion of barrels (oil)	0–8	0-4	0-18	*0-30*
Trillions of cubic feet (gas)	0–45	0-7	0-90	*0-142*

[1] Based on OTA estimate of 10,000 line miles for each 5,000 square miles plus an additional 500 miles per trap for detailing.

[2] Based on OTA estimate that at least 3 dry holes would be drilled on each uninterrupted trap and 2 dry holes in each block associated with that trap. Discoveries are assumed in 50 percent at the traps and 50 percent of the associated blocks. The number of blocks per major trap are assumed to be 4 in the Mid-Atlantic, 6 in the Gulf of Alaska, and 8 in southern California. When a discovery occurs, the number of holes to be drilled is doubled.

[3] OTA estimates based on the number of seismic line miles and holes to be drilled. This estimate includes the time Government would require to develop its in-house management and analysis capability and the delays Government would be expected to encounter in contracting for drilling services. The time to complete each area is the same due to adjustment in the number of rigs allocated to each (see table III–2).

[4] Current, constant dollars.

[5] OTA estimate using current salary levels or the 115 staff persons listed in sec. III–C. Government costs add an additional 10 percent to cover top management, planning, and contract costs.

[6] Based on $400 per line mile for data collection and reduction. Costs are increased by a factor of 2 for seismic detailing.

[7] Based on an estimated rig rate of $30,000 per day plus the cost for support and consumables. With average well depths of 16,000 feet in the Mid-Atlantic, and 10,000 feet in southern California and the Gulf of Alaska, per well costs are estimated to be $3,500,000 in southern California, $4,600,000 in the Mid-Atlantic, and $5,000,000 in the Gulf of Alaska.

[8] USGS estimate, draft EIS, vol. 1, p. 676 and vol. 2 pp. 60–61, and 139–140.

4. INTERMEDIATE INDUSTRY EXPLORATION

Intermediate industry exploration is basically the same as the limited industry alternative except that it would take longer, cost more, and result in the discovery of a larger quantity of recoverable reserves. Major aspects of this alternative are summarized in Table 111–10.

TABLE III-10.–A SUMMARY OF THE INTERMEDIATE INDUSTRY EXPLORATION ALTERNATIVE

	Frontier area			
	Mid-Atlantic	Southern California	Gulf of Alaska	Total
Exploration elements:				
Seismic line miles [1]	62,000	118,000	218,000	390,000
Holes drilled [2]	263	347	365	975
Time required (years): [3]				
To complete	8.5	8.5	8.5	NA
To first discovery	3.0	4.0	4.0	NA
To production	7.0	8.0	8.0	NA
To peak production	12.0	13.0	13.0	NA
Costs (millions of dollars): [4]				
Management and analysis [5]	40.0	40.0	40.0	120.0
Geophysical [6]	55.0	60.0	170.0	285.0
Drilling [7]	1,320.0	1,180.0	1,900.0	4,400.0
Potential resources: [8]				
Billions of barrels (oil)	0–8	0–4	0–10	0–30
Trillions of cubic feet [3] (gas)	0–45	0–7	0–90	0–142

[1] Based on OTA estimate of 10,000 line miles for each 5,000 square miles plus an additional 500 miles per trap for detailing.
[2] Based on OTA estimate that at least 3 dry holes would be drilled on each uninterrupted trap and 2 dry holes in each block associated with that trap. Discoveries are assumed in 50 percent at the traps and 50 percent of the associated blocks. The number of blocks per major trap are assumed to be 4 in the Mid-Atlantic, 6 in the Gulf of Alaska, and 8 in southern California. When a discovery occurs, the number of holes to be drilled is doubled.
[3] OTA estimates based on the number of seismic line miles and holes to be drilled. This estimate includes the time Government would require to develop its in-house management and analysis capability and the delays Government would be expected to encounter in contracting for drilling services. The time to complete each area is the same due to adjustment in the number of rigs allocated to each (see table III–2).
[4] Current, constant dollars.
[5] OTA estimate using current salary levels for the 115 staff persons listed in sec. III–C. Government costs add an additional 10 percent to cover top management, planning, and contract costs.
[6] Based on $400 per line mile for data collection and reduction. Costs are increased by a factor of 2 for seismic detailing.
[7] Based on an estimated rig rate of $30,000 per day plus the cost for support and consumables. With average well depths of 16,000 feet in the Mid-Atlantic, and 10,000 feet in southern California and the Gulf of Alaska, per well costs are estimated to be $3,500,000 in southern California, $4,600,000 in the Mid-Atlantic, and $5,000,000 in the Gulf of Alaska.
[8] USGS estimate, draft EIS, vol. 1, p. 676 and vol. 2 pp. 60–61, and 139–140.

5. FULL GOVERNMENT EXPLORATION AND FULL INDUSTRY EXPLORATION

Although both full government and full industry programs were identified earlier as possible exploration alternatives, OTA has not been able to make what it considers to be reasonable estimates of the amount of seismic surveying and drilling that a full exploration program would require. However, members of the Task Force were able to agree that an exploration program designed to find all recoverable reserves would be a massive undertaking, Such an effort would probably take at least 20 years and cost some tens of billions of dollars.