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THE ROLE OF MAJOR OIL COMPANIES AND INDEPENDENT PRODUCERS IN DOMESTIC EXPLORATION ACTIVITIES

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EXECUTIVE SUMMARY

As part of the ongoing review of U.S. energy policy, increasing attention is being focused on the relative contributions of different segments of the U.S. petroleum industry in locating new domestic oil and gas reserves. Our study examines the roles of the Majors (large integrated companies) and Independents (relatively smaller producers with little or no refining or marketing investment) in U.S. oil and gas exploration activities.

The most frequently quoted data on the exploration activities of these two groups use a "well-counting" approach, measuring the relative share of each in drilling exploratory wells. On this basis, Independents drill 85% of all exploratory wells and 73% of the successful new field wildcat wells.

In our study, we have considered several other aspects of exploration activities, in addition to drilling. We used primarily data gathered from questionnaires sent to the 23 major integrated oil companies with assets in excess of $1 billion. Fifteen companies responded with the information requested, which covered the eight-year period from 1967 to 1974. In addition, we analyzed pertinent published government and industry data.

The key findings of our study are that the Majors, as a group, have discovered the bulk of U.S. oil and gas reserves and have

provided well over half of the capital used for exploration activities by the entire industry.

The major points of our study are summarized below.

--Exploration expenditures. Our group of 15 major companies spent 48% of the industry's total exploration expenditures between 1967 and 1974 but drilled only 10% of all exploratory wells. There are several reasons for this high ratio of expenditures to wells drilled. Drilling accounted for only 25% of total industry expenditures, with most of the remainder of expenditures used for lease acquisitions and gathering geological and geophysical data. Majors often acquire and survey leases and then farm out the actual drilling to Independents. In addition, Majors drill a relatively higher share of the wells in less-accessible areas, where costs are generally higher Our data on relative exploration expenditures are similar to those published in a Department of Commerce survey which showed that the largest 24 U.S. oil companies out of 5,650 surveyed expended 70% of total exploration funds.

--Crude oil reserves. The 15 Majors in our group accounted for 79% of the gross additions to U.S. crude oil reserves through exploratory drilling in the period 1967-1974, exclusive of Prudhoe Bay. This approximates the findings of a somewhat similar study made by the American Association of Petroleum Geologists for the period 1969-74.

In addition to our questionnaire information we attempted to trace whether the discoverer of each of the 100 largest U.S. oil

fields (as listed by the American Petroleum Institute) was a Major or an Independent. Since these fields were discovered over roughly 70 years, we used ultimate reserve rather than proved reserve data. Ultimate reserves are the total reserves recoverable from a field over its producing life, while proved reserves denote the remaining recoverable reserves at a given moment. We found that fourteen Majors (and their corporate predecessors) discovered 60 of the 100 largest oil fields, while Independents discovered the balance. The 60 fields discovered by the Majors account for 54% of the total ultimate reserves of the 100 fields.

--Natural gas reserves. Our survey group of 15 Majors made 50% of the gross additions to U.S. gas reserves through exploratory drilling between 1967 and 1974 (exclusive of Prudhoe Bay).

As in the case of oil, we traced the original discoverer of the 50 largest U.S. gas fields. Once again using ultimate reserves, we found that fourteen Majors (all but one of which had also discovered at least one of the 100 largest oil fields) had discovered 36 of the 50 fields, accounting for 66% of the total ultimate reserves.

Both our survey and the supplementary data lead to the general conclusion that a relatively small number of major companies have found a relatively large share of the oil and gas reserves in the U.S.

It is important to note, however, that the Majors and Independents both fulfill distinct and necessary roles in exploration activities.

In some areas the Majors, for instance, fund much of the preliminary work which must be completed before drilling, with Independents taking over the actual drilling phase. Thus, both segments are required in order to maximize the exploration for domestic hydrocarbons.

In the future the role of the Majors as discoverers of new reserves is likely to increase since most of the remaining U.S. oil and gas reserves will probably be found in "frontier" areas, requiring the Majors' technical and capital resources to locate and develop. The Independents may participate in "frontier" activities, mostly in conjunction with Majors. But their primary function as discoverers will be to locate the many remaining reservoirs in the historic on-shore and off-shore areas. Cumulatively these could be quite substantial and thus contribute significantly to future U.S. oil supplies.

Introduction

As domestic production and reserves of oil and gas continue to decline, actually and relative to demand, the question of which segment of the industry -- Majors or Independents -- locates what shares of new reserves takes on growing importance. Any rational national policy designed to reverse the current downward trend, or at least to slow its pace, must take into account how much oil and gas each segment of the industry adds to our gross proved reserves* annually.

Unfortunately, reliable statistics on this subject are rather scant. While there are detailed published data for the entire industry on the number and type of wells drilled each year and the reserves added by various means, there is a lack of similar data for the various groups within the industry. The only readily available data on intra-industry breakdowns are published by the American Association of Petroleum Geologists ("AAPG") and the Petroleum Information Corporation in Denver, Colorado. These data pertain to exploratory wells drilled by independent oil producers and by integrated oil companies. The Independents, sometimes called "wildcatters", are generally engaged only in the exploration for and production of oil and gas, while the integrated companies are also in the refining and marketing business

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*Reported proved reserves prior to withdrawals for marketed production.

and are sometimes referred to as "majors" because of their relatively large size.

The published statistics by the AAPG and the Petroleum Information Corp. show that about 85% of all exploratory wells are drilled by independent producers, with the balance accounted for by the Majors. The same data show that the Independents also account for about 73% of all successful new field wildcat wells, i.e. one which locates commercial quantities of oil or gas in areas where no successful well had previously been drilled.

These data which have been widely quoted have given rise to the impression that most U.S. oil and gas reserves are initially found by Independents but are later sold or otherwise transferred to the control of the Majors, since the latter account for the bulk of U.S. crude oil production.

This impression appears to have influenced some actual and proposed federal energy legislation in the recent past. Thus, while the Congress fully eliminated percentage depletion on oil and gas production for integrated oil companies last year, it retained the provision for the first 2,000 b/d of oil and the first 1,200 million cf/d of gas for independent (non-integrated) producers. Similarly, the initial version of Senate bill S692 which deals with the prices of new and old gas in interstate commerce, would have provided for deregulation of new gas prices for Independents but would have specifically retained such control for major oil and gas companies.

There is little doubt that both pieces of legislation reflect in part the view that since independent producers drill most wildcat and other exploratory wells, they can be assumed to find most new reserves. Hence, it has been argued, statutory tax and price incentives limited to this group will yield almost the same result as if they were given to the entire oil and gas producing industry.

This assumption of a close relationship between exploratory drilling and the volumes of new reserves found is, however, at variance with another, less well known set of data, published by the AAPG.* These data show that for the years 1969-1974 more than 61% of all oil reserves found through the drilling of new field wildcat wells have been found by the Majors. The reason is that the Majors, according to this study, located virtually all new oil fields with proved reserves of 25 million barrels or more, while the Independents found most of the fields between 1 and 25 million barrels.

The AAPG study is the first inquiry into the oil finding efforts of Majors and Independents which goes beyond the well counting approach. However, it still does not show the full differential between the finding activities of the Majors and the Independents since it does not examine the results of well drilling other than new field wildcats, though in the last five years the latter accounted for only

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*AAPG, "Background Paper #2", February, 1975 and update (See Appendix VI).

22% of all new reserves proved by means of exploratory drilling; and since it admittedly understates the reserves of the very large fields by arbitrarily assigning every "major field" a fixed ultimate reserve volume of 100 million barrels.

In order to provide additional and different measures for evaluating the contributions of major oil companies and independent producers in discovering U.S. oil and gas reserves we have undertaken a special study based on a questionnaire sent out to the 23 major integrated oil companies with corporate assets in excess of $1 billion about their exploratory drilling activities, expenditures and annual discoveries of proved reserves for the years 1967 through 1974. A total of fifteen companies provided usable information for our study.* These companies, a list of which is found in Appendix I to this study, accounted in 1974 for 4.22 million b/d of domestic crude oil production, equal to 51% of total U.S. production. Since all U.S. companies generally classified as "majors" account for about 70% of total U.S. oil production, our fifteen company group represents some 2/3 of that category, measured by primary resource output. Hence, while the balance of the oil and gas producing industry includes some Majors, it is overwhelmingly made up of companies that fall into the category of independent producers. A comparison of exploration activities and discoveries of the two segments can

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*The data requested on the questionnaire was received and compiled by the accounting firm Arthur Andersen & Co. in order to assure confidentiality. PIRINC was then given only the aggregate figures.

therefore be assumed to give a reasonably reliable indication of the relative exploration efforts and results of Majors vs. Independents.

Principal Findings

Exploratory Drilling

Our findings tend to confirm both the American Association of Petroleum Geologists and the Petroleum Information Corp. data that most exploratory wells were drilled by Independents. The fifteen company group drilled 10.2% of all U.S. exploratory wells during the eight-year period. The group's success ratio was somewhat higher: it accounted for 11.5% of all successful exploratory oil wells and 17% of all such gas wells. The group's dry hole ratio reflected this fact: 75.8% of its exploratory wells were dry, compared to 82.9% for the remainder of the industry.

A table showing annual and cumulative data for the number of exploratory wells drilled is shown on the following page. The group data are from our questionnaire, the industry data are taken from AAPG statistics.

NUMBER OF EXPLORATORY WELLS DRILLED IN THE U.S.

1967-1974

	Oil	Gas	Dry	Total
1974				
Group	110	144	592	846
Industry	814	1195	6610	8619
Ratio (%)	(13.6)	(12.1)	(9.0)	(9.8)
1973				
Group	64	110	481	655
Industry	619	900	5947	7466
Ratio (%)	(10.4)	(12.2)	(8.1)	(8.8)
1972				
Group	75	83	472	630
Industry	684	601	6254	7539
Ratio (%)	(10.9)	(13.9)	(7.6)	(8.4)
1971				
Group	84	126	524	734
Industry	651	437	5834	6922
Ratio (%)	(12.9)	(28.9)	(9.0)	(10.6)
1970				
Group	93	63	593	749
Industry	790	481	6422	7693
Ratio (%)	(11.8)	(13.1)	(9.2)	(9.7)
1969				
Group	105	77	890	1072
Industry	1236	464	8001	9701
Ratio (%)	(8.5)	(16.6)	(11.1)	(11.1)
1968				
Group	129	104	775	1008
Industry	951	342	7586	8879
Ratio (%)	(13.6)	(30.4)	(10.2)	(11.4)
1967				
Group	139	116	771	1026
Industry	1201	394	7464	9059
Ratio (%)	(11.6)	(29.4)	(10.3)	(11.3)
1967-1974				
Group	800	823	5097	6721
Industry	6946	4814	54118	65878
Ratio (%)	(11.5)	(17.1)	(9.4)	(10.2)

Exploration Expenditures

a) Findings of our study.

The fifteen Majors' share of exploration expenditures was substantially higher than their share of exploratory wells. The $15.3 billion expenditures reported by the group for the eight year period were equal to 48% of total U.S. exploration expenditures, as reported annually by the Joint Association Survey of the U.S. Oil and Gas Producing Industry. One reason why the Majors' share of exploration expenditures is much higher than their share of exploratory wells is that well drilling and equipping accounts for only about 25% of total U.S. exploration expenditures, as reported by the Joint Association Survey. The balance consists of expenditures for acquisition of undeveloped acreage, geological and geophysical surveys, etc. These expenditures are incurred to a much greater extent by the Majors than by independent producers. In fact, many exploratory wells of the Independents are drilled on acreage acquired and surveyed by the Majors and then "farmed out" under various agreements to independent wildcat operators. Thus, the Majors' exploration expenditures relate not only to their own wells but also to some of the wells drilled by Independents.

Another reason is that the Majors drill relatively more of the high-cost wells, such as deep wells, offshore wells and wells in remote areas, than do the Independents. Hence, their average exploratory well costs are higher than those of the Independents.

The table below shows annual and cumulative exploration expenditures for the group and for the industry.

TOTAL EXPLORATION EXPENDITURES
($ Million)

	Group	Industry	% Group
1974	4,428.1	8,901.0	49.7
1973	2,479.1	5,865.0	42.3
1972	1,729.3	3,672.0	47.1
1971	947.6	2,393.0	39.6
1970	1,072.5	2,476.0	43.3
1969	1,413.7	3,106.0	45.5
1968	1,936.7	3,218.0	60.2
1967	1,273.0	2,396.0	53.1
Total 1974-1967	15,280.0	32,027.0	47.7

An interesting development registered by the fifteen Majors in 1974 was a 79% increase in exploration expenditures from the previous year. In fact, the $4.4 billion spent by the fifteen companies in 1974 was about three times their annual average expenditures during the previous eight-year period (1967-1973). The increase is due in large measure to the acceleration of federal offshore leasing, and the effect of substantial cost escalations.

b) Findings of Commerce Department study

The findings of our survey on exploration expenditures are closely supported by the Department of Commerce's Annual Survey of Oil and Gas which was initiated in 1973. The 1974 Survey has recently been released, and includes information on expenditures for domestic exploration, development and production of oil companies grouped by size. By combining several groups it is possible to determine the exploration expenditures for the largest twenty-four oil companies, by value of oil and gas sales from leases. Most of these are the same twenty-three oil companies classified as major integrated firms under our $1 billion asset criterion.

The Survey data show that in 1973 and 1974 these companies accounted for 65% and 70% respectively of the industry's total exploratory expenditures. This is approximately consistent with the shares of 42% and 50% for the fifteen major companies which responded to our questionnaire. In 1974 the twenty-four firms in the Commerce Department Survey registered a 71% increase in exploration expenditures which is fairly close to the 79% increase reported by our fifteen companies. A comparative summary of the Commerce Department's and our own survey is shown in the following table.

U.S. EXPLORATION EXPENDITURES FOR OIL AND GAS
($ Million)

	1974	(%)	1973	(%)	Change (%)
Commerce Dept. Survey*					
Top 24 Companies	6,103.1	(70)	3,564.0	(65)	71
Total Oil Industry	8,658.5		5,446.2		59
PIRINC Survey					
15 Major Oil Companies	4,428.1	(50)	2,479.1	(42)	79
Total Industry (JAS)**	8,901.0		5,865.0		52

*U.S. Dept. of Commerce, Current Industrial Reports, Annual Survey of Oil and Gas, 1973 and 1974.

**Joint Association Survey of the U.S. Oil & Gas Producing Industry.

A more detailed breakdown of the exploration expenditures in the latest Department of Commerce Survey is shown below. It illustrates that the major oil companies spend a relatively large amount on land acquisition costs and on geophysical and geological activities while the smaller companies -- consisting primarily of independent producers -- spend most of their exploration money on the drilling and equipping of wells. This type of arrangement is to the mutual advantage of both Majors and Independents. However, as the table shows, even in this sector where the Independents are strongest, the twenty-four top companies accounted for 41% of the total expenditures of the 5,650 companies included in the Survey.

U.S. OIL AND GAS EXPENDITURES, 1974*
($ Million)

	Top 24 Companies**	(%)	Remainder Of Survey	(%)	Total
Acquisition of Undeveloped Acreage	4,512.5	(78.2)	1,261.5	(21.8)	5,774.
Land Dept., Leasing & Scouting	51.8	(57.2)	38.8	(42.8)	90.
Rentals	102.1	(57.4)	75.7	(42.6)	177.
Subtotal (Land)	4,666.4	(77.2)	1,376.0	(22.8)	6,042.
Geological/Geophysical	465.7	(82.0)	101.9	(18.0)	567.
Other Exploration Expenditures Including Direct Overhead	314.9	(68.5)	144.6	(31.5)	459.
Subtotal (Prospects)	780.6	(76.0)	246.5	(24.0)	1,027.
Test hole Contributions	6.4	(68.5)	2.8	(31.5)	8.
Drilling & Equipping Exploratory Wells	650.1	(41.1)	930.4	(58.9)	1,580.
Subtotal (Evaluation)	656.5	(41.3)	933.2	(58.7)	1,589.
Total	6,103.5	(70.5)	2,555.7	(29.5)	8,658.

*Data developed from U.S. Dept. of Commerce - Bureau of Census Report, Annual Survey of Oil & Gas, 1974

**By lease revenue.

Crude Oil Reserves

The purpose of all exploration activities is of course to locate new reserves. Hence, the ultimate measure of the Majors' exploration activities is their contribution to total U.S. oil reserves found through exploration. For the industry as a whole reserve additions

through exploratory drilling are published annually by the American Petroleum Institute ("API") which lists them as discoveries of new fields, new reservoirs in old fields and extensions of existing fields.* Reserve additions of individual companies, on the other hand, are either not publicly available or not comparable with each other or with those published by the API. We have eliminated the first two obstacles through our questionnaire. However, the comparability between our sample and the API's nationwide data is limited, because in the final analysis the amount of proved reserves found in a given period is a matter of geological and reservoir engineering judgment. The annual API data are not built up from individual company data but are estimated independently on a reservoir-by-reservoir basis by members of the API Committee on Reserves and Productive Capacity. For a number of reasons, largely judgmental, the committee approach on a reservoir-wide basis may differ from the sum of the reserves estimated by each company active in the reservoir. However, the fact that each of the API's 14 geographic subcommittees on reserves includes geologists and reservoir engineers of the companies with prominent holdings in the subcommittee's area can be assumed to keep the differences between committee estimates and individual company estimates moderate. An independent study by the Federal Energy Administration of U.S. crude oil reserves as of December 31, 1974, on the basis of reports from individual companies

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*In addition, the API also publishes annual revisions of earlier data for proved reserves. These revisions are mostly unrelated to exploratory drilling in any given year.

bears this out.* The study found total company reserves to be 11% above the API estimates for the same date. Nearly half of the discrepancy was due to one single area -- heavy crude oil in California which the companies classified as proved reserves but the API did not.

On the basis of the above,plus discussions with technical personnel in several companies, we believe that despite its limitations, a comparison of the reserve additions reported by our group with those of the API is valid and meaningful.

We are showing two sets of figures for gross reserve additions for newly discovered reserves for both our group and the industry: with and without the Alaskan North Slope field Prudhoe Bay. Since this is the largest field by far ever discovered in North America and since about 80% of its reserves are held by companies in our group, we felt on the one hand that the inclusion of this field could distort the otherwise prevailing relationship between the two sets of data for the period 1967-1974.** On the other hand, we felt that the discovery of a structure the size of Prudhoe Bay should not be treated simply as a non-recurring anomaly, since it really represents the ultimate in exploratory success and, hence,

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*Federal Energy Administration, Initial Report on Oil and Gas Resources, Reserves, and Productive Capacities. Submitted in compliance with PL 93-275 Section 15 (b). June 1975.

**The Prudhoe Bay reserves were included in the API figures for the first time in 1970. Some companies in our sample included them for the first time in their reserve estimates in 1969, others in 1970.

should be credited to those who found it. In the second set of figures below we have therefore included Prudhoe Bay oil reserves. As can be seen, the change is very large in volume but quite small in the share of total reserves discovered. The latter is due to the Group's higher percentage of reserves discovered even without Prudhoe Bay.

CUMULATIVE CRUDE OIL ADDITIONS TO PROVED RESERVES THROUGH EXPLORATORY DRILLING, 1967-74
(000 Bbls)

	EXCL. PRUDHOE BAY	INCL. PRUDHOE BAY
Group	5,366,124	13,066,124
Industry	6,789,309	16,389,309
% Group	79.0	79.7

The percentages in the above table are not very different from those published by the AAPG for oil reserves found through wildcat drilling only, for the period 1969-74 (See Appendix). It can be calculated from the AAPG study that sixteen major oil companies accounted for 62% of total U.S. wildcat oil discoveries. However, since the AAPG for the purpose of their analysis assigns a maximum reserve volume of 100 million barrels to the largest fields, the size of such fields as Prudhoe Bay (with ultimate reserves of 9.6 billion barrels) is substantially understated. Inasmuch as the Majors have discovered most of these largest fields, the adjustment

of AAPG data for actual reserves rather than the arbitrary 100 million barrels would increase the Majors' share of reserves added through wildcat discoveries.

Discovery of the Largest U.S. Oil Fields

In addition to the questionnaire information, we examined one other measure to determine the relative oil reserve discoveries of Majors and Independents over an extended period. We attempted to trace the original discoverer of each of the 100 largest oil fields, by size of proved reserves as of December 31, 1974, as listed by the API.* These fields were found over a very long period of time. One of the latest, Prudhoe Bay, was added in 1970, the earliest probably near the turn of the century. Altogether, these 100 fields accounted for 71.1% of proved U.S. reserves at the end of 1974 and 53% of U.S. production.

In order to determine the full impact of each discovery we used ultimate recoverable reserves rather than the proved reserves shown in the API releases. The estimates of ultimate recoverable reserves were taken from a special study by the Oil & Gas Journal. Ultimate reserves consist of both current proved reserves plus all previous production. Together these make up the total or ultimate volume of oil recoverable from a field. The use of ultimate recoverable reserves gives older fields a relatively larger weight

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*Source: API News Release, April 15, 1975.

than would the use of proved reserves. For example, the ultimate reserves of the East Texas oil field, discovered in 1930, are six billion barrels while its proved reserves at the end of 1974 were only 1.3 billion barrels. Similarly, the Wilmington field has ultimate reserves of 2.4 billion barrels and proved reserves of 705 million barrels. On the other hand, Prudhoe Bay's proved and ultimate reserves are virtually synonymous, since the field has not started to produce. A summary of our findings is shown in the following table. For more detailed information see Appendix II.

100 LARGEST U.S. OIL FIELDS

	No. of Fields	Ultimate Reserves Billion Barrels	%
Majors	60	31.7	54.3
Others	40	26.8	45.7
	100	58.5	100.0

The Majors in this group consist of fourteen of the 23 major companies including their corporate predecessors and companies with which they merged (See Appendix III). The Independents are all smaller and mostly non-integrated companies.

It should be pointed out that the use of ultimate reserves rather than proved reserves to measure the relative shares of the 100 largest discoveries by the two groups favors the Independents, since most of their finds, including such large fields as East Texas and Wilmington,

were made at an earlier period.

If the shares of both groups were measured on the basis of end-1974 proved reserves, the fourteen Majors would account for 67% of all reserves in these fields. Either measure -- proved or ultimate reserves -- indicates that the Majors account for a disproportionately large share of the biggest oil fields found in the U.S.

Natural Gas Reserves

The group of fifteen Majors which responded to our questionnaire reported gross additions through exploration* of 44.5 trillion cf to U.S. natural gas reserves for the eight year period 1967-74, exclusive of the Prudhoe Bay field in Alaska. Including Prudhoe Bay, the fifteen companies' estimated gross additions through exploration amounted to 61.3 trillion cf. (For a discussion of the reasons for the inclusion and exclusion of Prudhoe Bay see page 13). A comparison of our group's reserve additions with those of the industry as a whole is shown below.

CUMULATIVE GROSS ADDITIONS TO PROVED NATURAL GAS RESERVES THROUGH EXPLORATORY DRILLING, 1967-74
(Trillion cf)

	EXCL. PRUDHOE BAY	INCL. PRUDHOE BAY
Group (15 companies)	44.5	61.3
Industry	88.9	114.9
Group's Share of Total	50.1%	53.4%

*See page 12 of this study for an explanation of gross additions through exploration.

The group's 50% and 53% shares respectively of total gross gas reserve additions over the period are smaller than the fifteen companies' share of gross oil reserve discoveries, reported in the previous section but they are still relatively large. By way of corroboration, the AAPG study referred to earlier also shows the Majors' share of wildcat gas discoveries to be smaller than that of wildcat oil discoveries.

Discovery of the Largest U.S. Gas Fields

Just as in the section on oil reserves, we have supplemented our survey findings on gas reserves with an analysis of the discovery of the largest gas fields by Majors and Independents. The Majors consist of fourteen companies (see Appendix) taken from our list of twenty-three Majors. Thirteen of these are the same companies which found the 100 largest oil fields while one -- Tenneco -- is found only among the gas discoverers. The Independents are all smaller and mostly non-integrated companies.

However, in the case of gas we analyzed only the 50 largest fields, because the published listing of the largest U.S. gas fields -- by the American Gas Association ("AGA")* -- contains only 50 in number.

As the following table shows, the fourteen Majors discovered 36 of the 50 largest fields and accounted for 66% of the proved reserves in these fields (See Appendix IV & V)

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*AGA, 50 Largest Gas Fields in the U.S.

50 LARGEST GAS FIELDS IN THE UNITED STATES
(as of 12/31/74)

A) Number of fields			%
	Majors	36	72
	Independents	14	28
		50	100
B) Proved Reserves		(Billion cf)	
	Majors	64,324	66
	Independents	38,886	34
		97,210	100

Although the AGA does not give the ultimate recoverable reserves of these fields, we were able to determine these from a variety of other sources.* In the following table we have summarized the results.

ULTIMATE RECOVERABLE GAS RESERVES
IN THE 50 LARGEST FIELDS

	ULTIMATE RESERVES (Billion cf)	%
Majors	108,298	58.5
Independents	76,825	41.5
Total	185,123	100.0

*Petroleum Encyclopedia, Oil & Gas Journal, International Scouts Yearbook.

As the table indicates, the fourteen Majors accounted for nearly 59% of the total ultimate recoverable reserves in the 50 fields. Once again, the use of ultimate reserves favors the Independents, as one can see by comparing the two tables on the previous page. The largest gas field in the U.S., the Hugoton field with ultimate recoverable reserves of 37 trillion cf, was found prior to 1930 by an Independent, while the second largest field, Prudhoe Bay, with ultimate and proved reserves of 26 trillion cf was found in the late 1960's by a Major. If both these fields are excluded the Majors' share of ultimate recoverable reserves of the 48 remaining largest fields rises to 68%.

Conclusions

Using the relationship between wells drilled and reserves found as a criterion, the obvious conclusion of our study would be that the major oil companies drill fewer wells but find proportionately more oil and gas than the rest of the industry -- primarily the independent oil and gas producers. This would indicate that the Majors are more efficient in finding reserves than the Independents.

On the other hand, the Majors also spend considerably more money for exploration than the Independents. As we have seen, the fifteen companies in our sample accounted for nearly half of total U.S. exploration expenditures for the eight-year period while the twenty-four largest companies accounted for about 2/3 of the total of such

expenditures in 1973-74, according to the Department of Commerce Survey.

Thus, the question of relative efficiency is really more complex than it might seem. As pointed out, a significant part of the Majors' exploration expenditures should really be applied to wells drilled by Independents, for the Majors provide the Independents with the necessary acreage and geological information without which they would not drill these wells. If the Independents did not drill them, the oil and gas in these formations would either remain undiscovered or the Majors would eventually have to drill the wells themselves which, in turn, would reduce their efficiency, measured by the ratio of wells to discoveries.

This leaves us with the conclusion that major oil companies and independent producers each have historically fulfilled different functions in the discovery of oil and gas reserves in the U.S. but that both functions were required to maximize discovery rates. In fact, their historic relationship may be termed synergistic in that their joint efforts probably led to the finding of more hydrocarbons than each of the two groups would have discovered on its own methods alone.

In the future the significant role of the Majors as discoverers of new reserves is likely to continue as there is a change in the

location of our remaining oil and gas resources. Most future reserves are likely to be found in "frontier" areas, that is in the less accessible unexplored parts of the Outer Continental Shelf, in deeper and tighter reservoirs onshore in the Lower 48 states and in the Arctic region. The technical and capital requirements to locate and develop these resources will be such that the larger companies must play an increasingly important role in these areas. The Independents may also participate on a small scale in "frontier" activities, but mostly in conjunction with Majors. But their primary function as discoverers will be to locate the many remaining reservoirs in the historic on-shore and off-shore areas. Cumulatively these could be quite substantial.

Thus, while the Independents are far less likely to discover another East Texas or Hugoton field than the Majors are to find another Prudhoe Bay, both will be vitally needed if our hydrocarbon resources are to be developed to their maximum economic availability.

A P P E N D I X

APPENDIX I

INTEGRATED COMPANIES WITH ASSETS IN EXCESS OF $1 BILLION

Included in Survey Data

Ashland Oil Inc.

Cities Service Company

Continental Oil Company

Exxon Corporation

Gulf Oil Corporation

Marathon Oil Company

Mobil Oil Corporation

Murphy Oil Corporation

Phillips Petroleum Company

Shell Oil Company

Standard Oil Co. of California

Standard Oil Co. (Indiana)

Standard Oil Co. (Ohio)

Sun Oil Company

Texaco Inc.

Not Included in Survey

Amerada Hess Corporation

Atlantic Richfield Company

Burmah Oil and Gas Company

Getty Oil Company

Kerr McGee Corporation

Pennzoil Company

Union Oil Co. of California

Tenneco Oil Company

APPENDIX II

CLASSIFICATION OF THE 100 LARGEST OIL FIELDS IN U.S. BY DISCOVERER
(Million Barrels)

Majors	Ultimate Reserves
Prudhoe Bay	9,600
Elk Hills	1,320
Kelly Snyder	1,108
Sho-Vel-Tum	1,250
Jay	313
Hastings, West	675
McArthur River	390
Webster	575
Caillou Island	700
Rangely	672
Cowden, North	325
Delta, West, Block 58	150
Bay Marchand, Block 2	650
Panhandle	1,415
Huntington Beach	1,043
Grand Isle, Block 43	370
Delta, West, Block 30	450
Cote Blanch Bay, West	250
San Ardo	378
Middle Ground Shoal	185
South Pass, Block 27	385
West Ranch	375
Garden Island Bay	256
Hondo	100*
Thompson	500
Empire	200
Van	549
South Pass, Block 24	489
Vacuum	400
Howard Glasscock	375
Midland Farms	225
South Pass, Block 61	100*
Main Pass, Block 41	280
Dos Cuadras	175
Lafitte	259
Swanson River	205
Main Pass Block 306	150
Sooner Trend	250
Andector	185
Eunice	158
Neches	100
Lake Washington	275
Altamont	274
Tule Elk	100*
Anahuac	355
Bay St. Elaine	200
Oyster Bayou	147
Bluebell	100*
Granite Point	100*
Timbalier Bay, Block 21	260
Venice	205
Cote Blanche Island	130
Delta, West, Block 73	275
Grande Isle, Block 16	350
McKittrick	249
McElroy	360
Ship Shoal, Block 208	225
Bay de Chene	127
Main Pass Block 69	260
Lake Barre	220
	31,747

Independents	Ultimate Reserves
Yates	1,600
East Texas	5,970
Wilmington	2,380
Wasson	1,333
Slaughter	790
Tom O'Connor	700
Hawkins	825
Midway-Sunset	1,617
Kern River	1,486
Conroe	675
Seminole Delta West	315
Fullerton	300
Levelland	325
Eugene Island, Block 330	231
Delhi	210
Ventura	882
Goldsmith	675
Fairway	200
Salt Creek Light Oil Unit	625
Belridge South	273
Ship Shoal, Block 207	175
Cogdell	320
Diamond M	275
Coalinga	699
Elk Basin	518
Golden Trend	500
Lake Pasture	110
Oregon Basin	320
Healdton	320
Foster	100*
Talco	270
Salt Creek	230
Bell Creek	116
Hobbs	255
Sprayberry Trend	510
Postle	131
Prentice	140
Lost Soldier	165
Beaver Lodge	100
Teapot Dome	100*
	26,766

*Assumed minimum ultimate reserves of 100 MM/bbls.

APPENDIX III

MAJOR OIL COMPANIES IDENTIFIED AS DISCOVERERS OF ONE OR MORE OF THE 100 LARGEST OIL FIELDS

Atlantic Richfield Company

Continental Oil Company

Exxon Corporation

Getty Oil Company

Gulf Oil Corporation

Marathon Oil Company

Mobil Oil Corporation

Phillips Petroleum Company

Shell Oil Company

Standard Oil Co. of California

Standard Oil Co. (Indiana)

Sun Oil Company

Texaco Inc.

Union Oil Co. of California

APPENDIX IV

MAJOR OIL COMPANIES IDENTIFIED AS DISCOVERERS OF ONE OR MORE OF THE 50 LARGEST GAS FIELDS

Atlantic Richfield Company

Continental Oil Company

Exxon Corporation

Gulf Oil Corporation

Marathon Oil Company

Mobil Oil Corporation

Phillips Petroleum Company

Shell Oil Company

Standard Oil Co. of California

Standard Oil Co. (Indiana)

Sun Oil Company

Tenneco Oil Company

Texaco Inc.

Union Oil Co. of California

APPENDIX V

CLASSIFICATION OF THE 50 LARGEST GAS FIELDS IN THE U.S. BY DISCOVERER
(AS OF DECEMBER 31, 1974)

A) DISCOVERED BY MAJORS	Billion Cf PROVED RESERVES	ULTIMATE RESERVES
Prudhoe Bay	26,000	26,000
Rabbit I., Eugene I. Blk 4, Mount Point, Tiger Shoal, So. Marsh Blks 211, 212, 217, 218	4,646*	6,092*
Kenai	2,641	5,400
Katy & North	2,433	7,000
Gomez	2,165	10,000
Borregos	1,751	2,050
Bateman Lake	1,481	2,000
Bastian Bay	1,313	3,600
Vermilion Blks 14, 15, 26, 27, 34, 35, 36	1,242	2,461
Caillou I. S. Timbalier Blks 11, 12	1,216	2,412
Seeligson	1,105	1,572
Puckett	1,065	6,500
Coyanosa	1,000	3 500
North Cook Inlet	979	1,114
Beluga River	972	989
S. Marsh I. Blks 48-51, Eugene I. Blk 179	962	1,413
Vibaros	908	1,803
Lake Pagie	899	1,483
Main Pass Blks 37, 40 41-43, 57-59, Breton Sound Blks 54, 55, 56	884	1,138
LaGloria	852	3,000
Grand Isle Blks 32, 43, 44, 55, West Delta Blks 67-72, 93-96	819	1,171
West Cameron Blks 17, 47, 48	813	1,136
Block 16	785	1,178
Bayou Sale	737	3,600
Ship Shoal Blks 208, 209, 214, 215, 233	728	1,138
West Cameron Blks 144, 145, 172, 173, 174, 179, 180, 181	718	1,108
Eumont	715	1,752
West Delta Blks 22-27	707	1,484
Sheridan	667	815
Magnet Withers	642	1,049
Patterson	640	1,275
Paradis	626	1,476
Laguna Larga	609	661
Alazan, North	604	928
Total	64,324	108,298

*Total of 3 fields, not reported separately.

B) DISCOVERED BY INDEPENDENTS	Billion Cf PROVED RESERVES	ULTIMATE RESERVES
Hugoton	12,538	37,239
Panhandle	5,120	6,284
Blanco	4,610	8,461
Basin	2,130	4,281
Old Ocean	1,223	5,000
Carthage	1,154	7,600
Boonesville	883	893
Panoma Council Grove	877	1,051
Indian Basin	860	1,360
Eugene Blks 295, 296, 305, 306, 307, E/2	833	833
Wasson	700	820
Garden City	679	1,558
Headlee	640	645
Black Lake	639	800
Total	32,886	76,825

Note: Underlined numbers for Louisiana fields denotes the number used for field identification.

Source: Adapted from information released by AGA on April 15, 1975, and subsequently revised by AGA.

APPENDIX VI

RESERVES CLASSIFICATION FOR NEW FIELD WILDCAT SIGNIFICANT DISCOVERIES, 1969-74
(Million Oil Equivalent Barrels*)

Oil Discoveries

Size Classification**	Industry No. Wells	Industry Reserves	Independents No. Wells	Independents Reserves	Independents (%)	Majors (16) No. Wells	Majors (16) Reserves	Majors (16) (%)
A	12	1,200	2	200		10	1,000	
B	7	259	0	-		7	259	
C	15	255	9	153		6	102	
D	261	783	201	603		60	180	
Subtotal	295	2,497	212	956	(38.3)	83	1,541	(61.7)

Gas Discoveries

A	6	600	2	200		4	400	
B	10	375	7	263		3	112	
C	47	822	28	490		19	332	
D	357	1,175	288	950		68	225	
Subtotal	419	2,972	325	1,903	(64.0)	94	1,069	(36.0)
TOTAL	714	5,469	537	2,859	(52.3)	177	2,610	(47.7)

*Gas converted to oil equivalent barrel on basis of 6,000 cubic feet to one barrel of oil.

NOTE: These reserve figures do not portray actual field sizes. For example the reserve size attributed to any major discovery (i.e., Prudhoe Bay) is only 100 million barrels.

SOURCE: AAPG, Strategic Committee on Public Affairs in cooperation with the Committee on Statistics on Drilling.

**SIZE CLASSIFICATION	OIL	GAS
A	100 million bbls	600 Bcf
B	37 million bbls	225 Bcf
C	17 million bbls	105 Bcf
D	3 million bbls	20 Bcf