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of Energy and Management's 1977 fiscal budget calls for $40,000 for acquisition of geophysical information, and $110,000 for Fiscal '78.

In summary, the present bonus bid leasing system used by Alaska takes the fewest state personnel to administer. It is the easiest to administer because most all evaluative decisions are left to the operators. As one moves away from this system, administrative costs will likely rise.

They will rise significantly as the need for additional petroleum appraisers and reservoir engineers grows, and will go even higher if the State asks to participate in the knowledge of costs and profits of the oil and gas operators. (The ultimate would appear to be the need for information to protect an equity interest.)

Auditors, similar but, perhaps, even more expert than income tax inspectors, would be necessary in a true "net profits" system. The incentives for the operator are all toward increasing the costs allowable. The level of monitoring depends to some extent on the level of confidence the State and operators have in each other.

Lastly, the amount of physical information required by the State before and after a discovery of petroleum needs to be addressed. It is costly and it is available. How it is used and for what purpose is critical to the health of the State's role in exploration.

And finally, no system will work well unless there are qualified people making the decisions. The administrator, located between the elected official and the public, traditionally has tended to lay back. Judgments made in the oil and gas exploration business inevitably results in being proved "right" or "wrong". There's either oil and/or gas there in paying quantities, or there is not.

This is not the traditional role of government administrators, but they have been and can be attracted to government service.

SEISMIC DATA ACQUISITION AND COST MODELING

for a

PETROLEUM RESOURCE ANALYSIS

By

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SEISMIC DATA ACQUISITION AND COST MODELING FOR A PETROLEUM RESOURCE ANALYSIS

INTRODUCTION

In order to have controlled development of its petroleum reserves, the State of Alaska must be able to determine the location and the potential quantity of this valuable resource. Exploration seismology is the primary method available to achieve this objective. The following text discusses the various methods by which the State can acquire seismic exploration data and, through a model study, the approximate cost of data acquisition.

CONCLUSIONS

The procuring and interpretation of geophysical data in order to determine Alaska's petroleum reserves is an integral part of having an intelligently managed energy evaluation and development plan. The cost of acquiring the data could vary from negligible, if picked up by regulation, to considerable, if the State must contract proprietary data. Currently, the least cost route to obtain reconnaissance data would be through obtaining USGS Open File Reports, purchasing old data and being an original participant in group industry seismic programs. Structural detail information could possibly come from group shoots but would probably have to be gathered as contract proprietary work.

In order to determine some approximate costs for geophysical data that would be needed to evaluate an area considered for leasing 100 by 15 miles containing at least one major structure, an exploration model was developed. Results

indicate that costs can range from around 70 thousand dollars to 2.5 million dollars depending on a variety of factors.

METHODS OF ACQUIRING SEISMIC DATA

There are several routes the State can take to acquire geophysical and specifically seismic data. Given an area of interest the State can (1) obtain United States Geological Survey open file data, (2) participate as a partner in a group industry seismic program, or (3) contract original work. A fourth method would be to require copies of seismic data as a stipulation of exploration permits on state lands. This fourth method would be following the precedent set by the Federal government and its implementation would probably be similar to the Federal method. For each of these data acquisition methods the cost of acquisition, location, grid spacing, data quality and time of acquisition must be considered. Each method now will be discussed in detail.

Federal and Public Data. The primary concerns of the USGS in obtaining seismic data in Federal waters are to evaluate the energy potential of the area, to determine the potential environmental hazards, and to perform basic geological research. Many of its older surveys extend into state waters and this data can be obtained for the cost of reproduction of its Open File Reports. Through the State's personnel participation and sharing of expenses with the USGS, there is the possibility of the USGS extending its Federal Water Surveys into Alaskan State waters. Such a cooperative effort in the acquisition and interpretation of the USGS Exploration data would be to the advantage of both parties. The data's location grid spacing, and time of acquisition would not be completely controllable, but it would provide a low cost addition to the State's data base. Data is also available

from public sources such as universities and other Federal agencies.

Industry Group and Speculative Seismic Surveys. The least costly method of obtaining technologically up-to-date seismic data in current areas of exploration interest is through the State's participation in the petroleum industries group seismic survey. An original participant in a group seismic survey has the advantage of influencing the decision on line location and grid spacing. To buy into a group after the original participant closing date, generally costs up to twice the original amount thereby making it advisable to be an original participant. Also, the late participant cannot influence the group's decisions. Old group survey and contractor speculative survey data is available to the State at varying costs depending upon location and age. This old data would give the State an original data base to expand upon. Group surveys are the least expensive way to obtain good quality reconnaissance data in a current area of interest.

Original Contract Data. The greatest control over all but the cost factor is obtained by the contracting of original seismic programs. The line location, grid spacing, and acquisition time would all be dictated by the State. This kind of control is necessary when one desires to perform a detailed structural investigation. Although original contract work is very expensive, relative to the other methods, the cost can be held down by sufficient planning and foresight. By keeping informed of crew location and contracting for small amounts of structural detail data the major expense of crew mobilization can be avoided. The amount of detail data contracted would depend upon whether the State had acquired copies of industry data, permit stipulations and other factors.

Regulative Requirements. By requiring that a copy of all geophysical data taken in the State be turned over to the State as part of leasing State land or obtaining a geophysical operations permit, Alaska would be guaranteed obtaining both reconnaissance and structural detail data. This data, of course, would be in current areas of interest and may not be timely with respect to long range planning. But it would allow detailed structural analyses after a lease sale. The cost of acquisition would be, at most, the cost of reproduction. For structures that lie wholly in State waters a complete structural evaluation would be possible. For structures which lie partially in Federal waters, a total evaluation would not be possible if the State only receives the data covering the position of the structure in state waters. Planning for future lease sales should include a seismic analysis to identify structural areas that lie both on State and other lands. Cooperative leasing ventures can then avoid drainage of State resources.

EXPLORATION COST PREDICTION

The actual cost of obtaining seismic data varies considerably and depends not only on the source of the data, as discussed previously, but also on the area of the State being evaluated. For the purpose of this cost analysis, the State has been divided into three cost of exploration areas. The areas are the Arctic Submerged Lands, the other submerged lands, and the State uplands. Assuming good data quality, the probability of finding a particular size field in the above mentioned areas is strictly dependent upon the seismic line grid spacing. (See Appendix A-A.)

Probabilities of Finding a Structure. Table 1 shows the probabilities of finding a structure of a specific size given a particular size seismic line

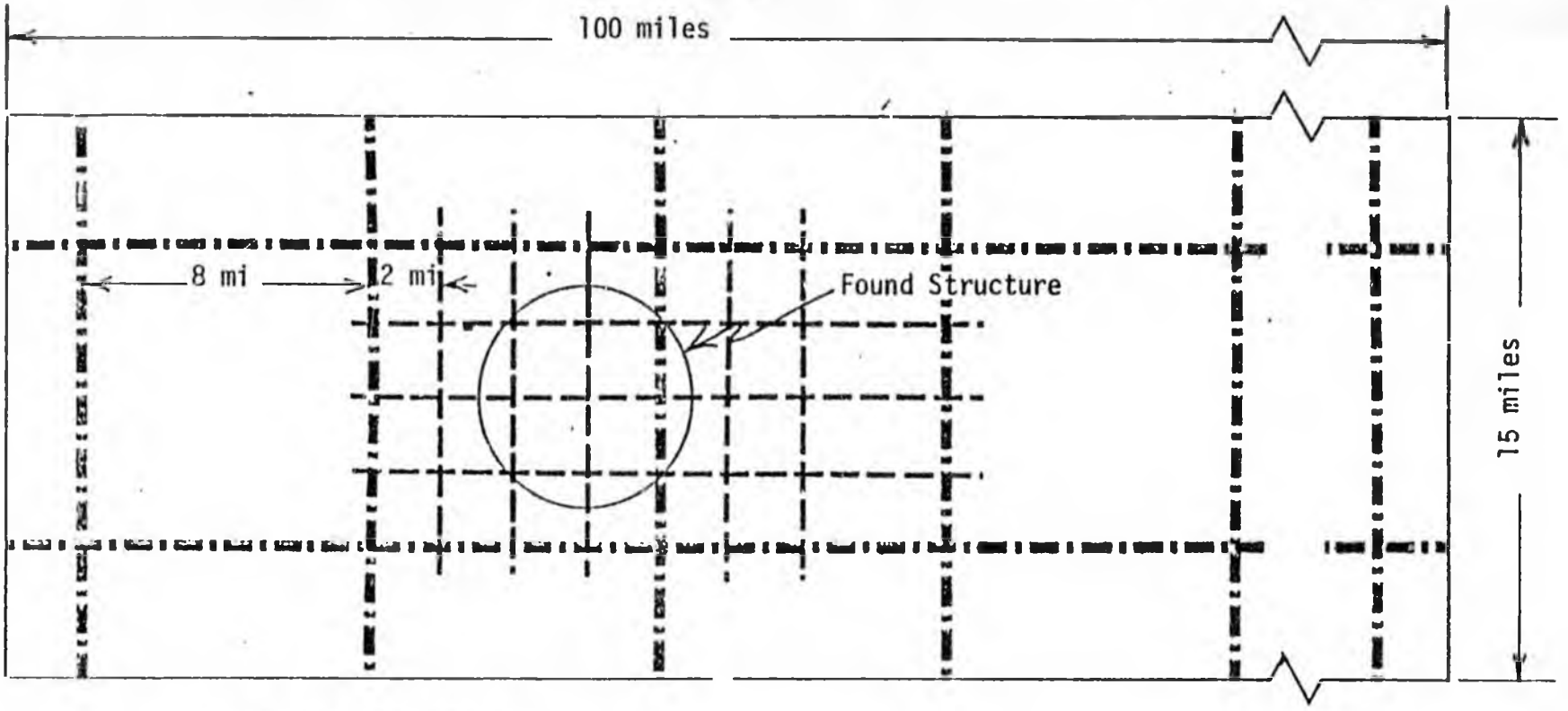
grid spacing. Four oil fields were chosen to represent a range of structures over the State's current structure size range of interest. The MacArthur River field was chosen as the target size field for this cost study. It is a 500,000 BBL field with an approximate structural area of 28 square miles, which gives a structural equivalent diameter of 5.9 miles. Table 1 presents the various probabilities of finding a structure of this size given a seismic grid spacing of twenty, ten, eight, and five miles. They are respectively 0.35, 0.63, 0.74 and 0.96. Also, if the grid spacing is 8 miles, the probability of finding a Prudhoe Bay size field is 1.0 (100%), of finding a MacArthur size field is 0.74, a Granite Point size field 0.52 and a Trading Bay size field 0.41.

Model Lease Area and Costs. Figure 1 displays a portion of a fifteen by one hundred mile area chosen as the model reconnaissance area. An eight mile reconnaissance seismic grid and a two mile structural detail seismic grid are displayed in the figure. These grid spacings were used in the cost determinations. Three hundred and ninety-five (395) miles of reconnaissance data and one hundred and three (103) miles of detail data were needed to find and adequately describe the MacArthur River field size structure.

The actual costs to explore the size area defined by the model in each of the cost regions is given in Table 2. The cost per mile of the seismic data, the cost to acquire 395 miles of reconnaissance data, and the cost to acquire 103 miles of detail seismic work are arranged by cost region and data source. The total cost is the sum of the original group shoot reconnaissance costs and the original contract detail data costs. The cost figures for the original contract work are only close approximations from a telephone survey and are not actual bid figures. The cost figures can be considered accurate within 15%.

If more than one structure is found in the model area then the cost of the reconnaissance data is distributed to each structure and thereby reduces the structure finding cost.

For the model, the lease area is considered to be the 154 square miles that were detailed by the contracted proprietary data.



Model Area Outline

Reconnaissance Seismic Lines (395 miles)

Detail Seismic Lines (103 miles)

MODEL FOR FINDING STRUCTURE

Figure 1

		FIELD			
		Prudhoe Bay	McArthur River	Granite Point	Trading Bay
Recoverable Reserves		8.0 mm	500 mm	110 mm	75 mm
Structure Area		500 mi^2	28 mi^2	11 mi^2	6 mi^2
Equivalent Diameter		25 mi	5.9 mi	3.7 mi	2.8 mi
Probability of Finding Structure with Seismic Grid Spacing = L	L = 20 mi	0.97	0.35	0.24	0.19
	L = 10 mi	1.0	0.63	0.42	0.34
	L = 8 mi	1.0	0.74	0.52	0.41
	L = 5 mi	1.0	0.96	0.74	0.61

TABLE OF PROBABILITIES
SEISMIC GRID SPACING
VS
STRUCTURE SIZE

TABLE 1

Data Source	Cost Region		
	Arctic Submerged Lands	Other Submerged Lands	Coastal Uplands
Contracted State Proprietary	$2,200.00/Mile* Recon. $869,000.00* Detail $226,600.00*	$500.00/Mile Recon. $197,500.00 Detail $51,000.00	$5,000/mile Recon. $1,975,000.00 Detail $515,000.00
Original Group Shoot	$400.00/Mile Recon. $158,000.00 Detail $41,200.00	$50.00/Mile Recon. $19,750.00 Detail $5,150.00	$400/Mile Recon. $158,000 Detail $41,200.00
Late Participant Group Shoot	$800/Mile Recon. $316,000.00 Detail $82,400.00	$60.00/Mile Recon. $23,700.00 Detail $6,180.00	$50.00/Mile Recon. (Old data) $19,750.00 Detail No Data
Total Cost Group Recon Contract Detail	$384,600.00*	$70,750.00	$534,750.00

Data: 8 mile reconnaissance seismic grid, 2 mile detail seismic grid, recon. line mile = 395, detail line mile = 103, model field size = 500 MM.BBLs, (McArthur River Field), resultant lease area 154 square miles.

*If crew is not in area there is a mobilization cost of, from $100,000. to $250,000.00, from Kenai to North Slope.

Interior Alaska seismic costs could be very high, but the State owns very little oil potential land in the interior at this time. The shallow Holitna Basin could possible be evaluated using a combination of cheaper methods, such as gravity and shallow refraction seismic.

TABLE OF SEISMIC EXPLORATION COSTS, BY COST REGION

TABLE 2

Seismic Data Grid Size Determination

When performing a seismic reconnaissance survey, the grid spacing of the seismic lines is a major factor in determining the cost of the survey. The two factors which control the grid spacing are the size of the structures being sought and the probability of finding a structure of a particular size. In a specific geologic province knowledge of structural character and orientation will influence the type and orientation of the grid size used.

The development that follows is a generalized probabilistic approach to the problem of what size grid spacing to use when a structure of a particular size is being sought. The basic geometric assumptions are that the structure is circular with a diameter of "D" and the grid is equilateral with a side length of L. The structure is considered found if one of the sides of the square grid passes through the structure a distance less than or equal to "S" from the center of the structure, as displayed in Figure 1a. For the purposes of this discussion "S" is chosen to be one third of "D."

$$S = 1/3\ D$$

Figure 1b displays a portion of a seismic grid. The center of a structure of diameter "D" has an equal probability of being at any point withi. the representative grid. The crosshatched region of width "S" within the grid is the region where the center of the structure must lie in order to be considered found. If the center of the structure lies in the central non-crosshatched region it is considered missed. The ratio of the Find Area to the Total Area enclosed by the grid represents the probability

of finding the structure "P_f." So that:

$$P_f = \frac{\text{Find Area}}{\text{Total Area}}$$

$$P_f = L^2 - (L - 2S)^2$$

$$P_f = 1 - (1 - 2\frac{S}{L})^2$$

Now, since $S = \frac{1}{3} D$,

then $P_f = 1 - (1 - \frac{2}{3}\frac{D}{L})^2$.

The ratio D:L is the ratio of the structural diameter to the seismic grid spacing. The above final equation is plotted as Figure 2. Displayed on Figure 2 is the following example. Given a grid spacing of 5 miles when looking for a structure of 3 miles in diameter, the ratio would be 3/5 or 0.6. The probability of finding a structure of that size with the given grid spacing would be about 0.64. In a similar manner, given the grid is 5 miles and the structural diameter is 5 miles the probability of recognizing that a structure has been found is 0.89.

Figure 2 can therefore be used to determine the probabilities of finding structures of various sizes given a particular size seismic grid spacing. Conversely, it can also provide the answer for the size grid spacing to use to find a particular size structure within a particular probability.

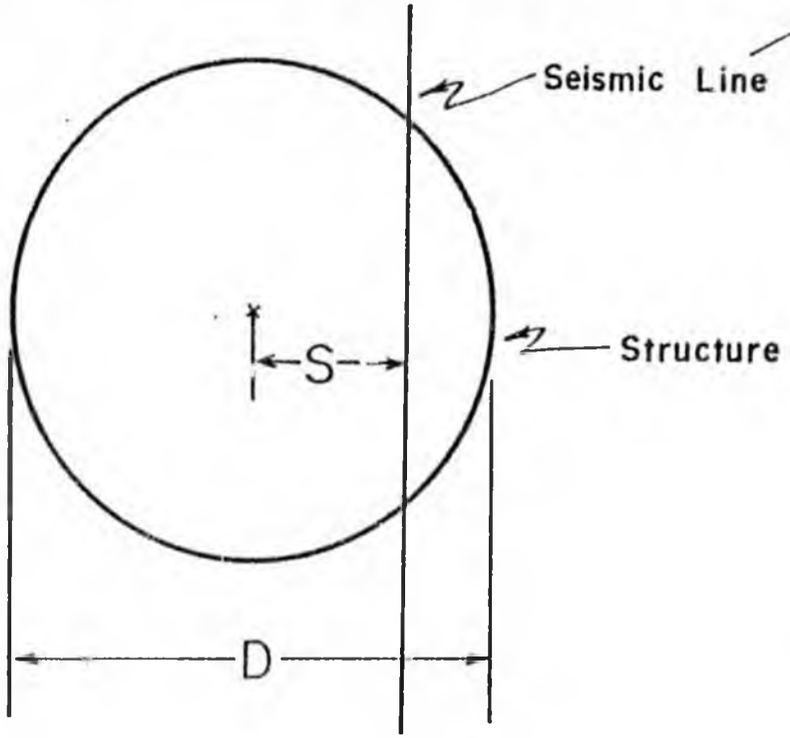


Figure 1a

Structure Find Criteria

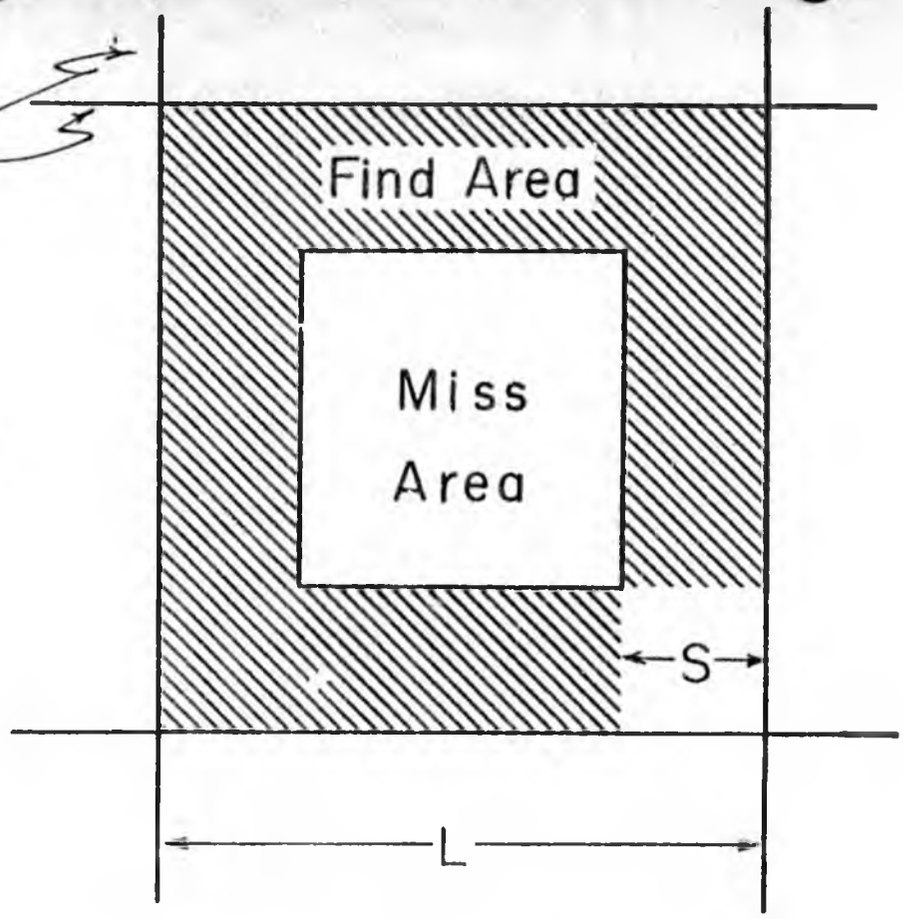


Figure 1b

Seismic Grid, Structure
Find and Miss Areas

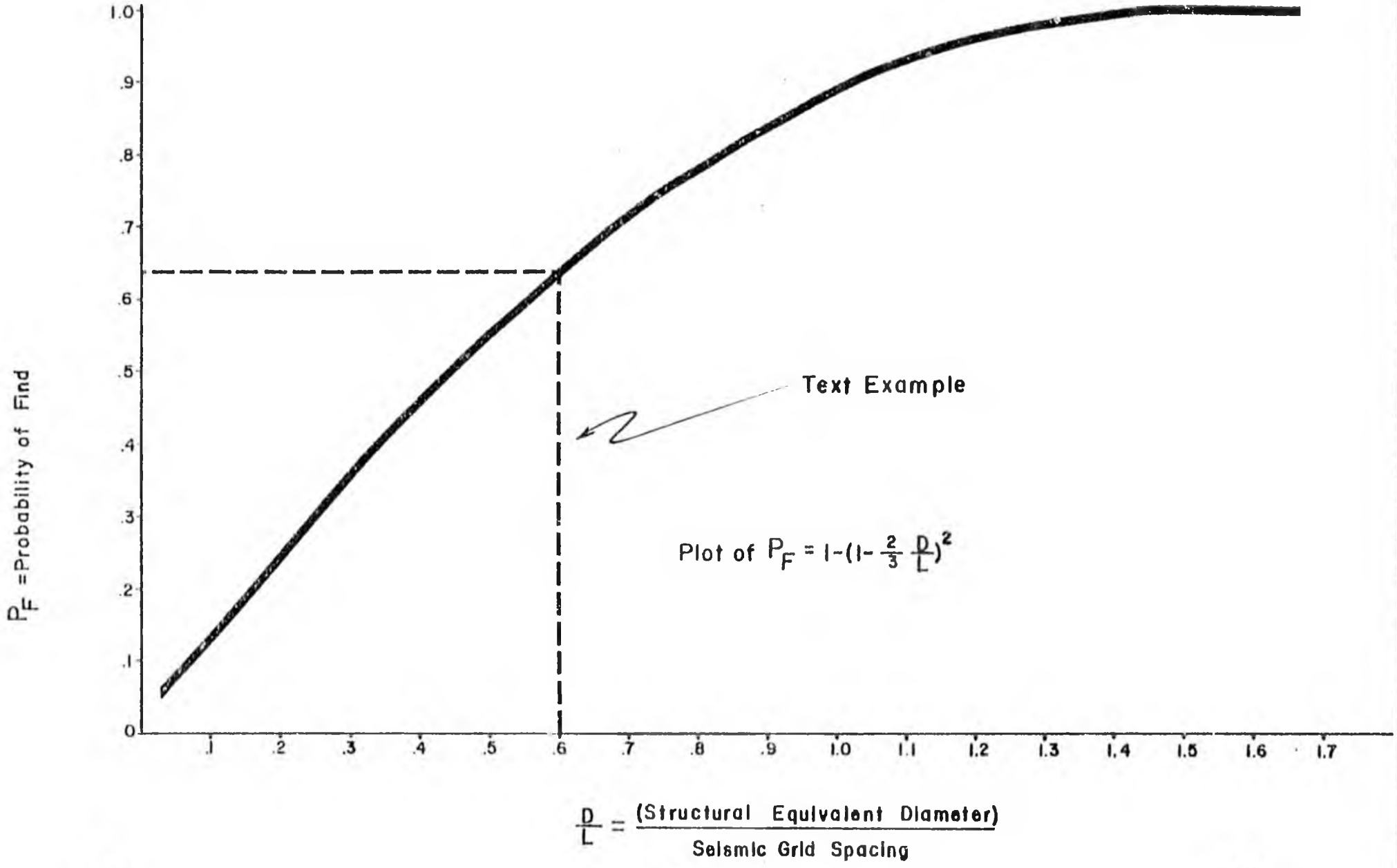

1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
P_F = Probability of Find
Text Example
Plot of $P_F = 1-(1-\frac{2}{3}\frac{D}{L})^2$
.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7
$\frac{D}{L} = \frac{\text{(Structural Equivalent Diameter)}}{\text{Seismic Grid Spacing}}$

Figure 2

SECTION VI

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GLOSSARY

ADVALOREM TAX - the tax derived from the value of oil and gas property.

ALASKA GREAT COMPUTER PROGRAM - projects the cash flow to the State of Alaska resulting from leasing of natural resources, includes bonus, royalty, severance tax, conservation tax, advalorem tax and income tax used to compare various leasing strategies. A commercial program of GARRETT Computer Corporation adapted for the Division of Minerals and Energy Management.

ANALYSIS - an examination in detail, so as to determine the nature or tendencies for the purpose of understanding and/or comparison of parallel systems.

BONUS BID - the amount of money a bidder is willing to pay for the privilege of exploring for petroleum and for the privilege of developing and producing the oil and gas which may be found.

BONUS COMPUTER PROGRAM - determines the expected rate of return to be obtained from a lease as a function of the probability of finding commercial quantities of hydrocarbons, bonus paid, royalty percentage, and/or profit share percentage.

CONSERVATION TAX - tax based on the amount of oil produced.

DISCOUNT RATE - the time value rate of money which is used to evaluate future income and expenditures at present value -- generally equatable to a company interest rate at which the company borrows or lends money, or the average rate of return.

DMEM - Division of Minerals and Energy Management within the Department of Natural Resources, State of Alaska.

ECONOMIC LIMIT - The production rate at which the cost to produce a field is equal to the revenue received.

EXPECTED VALUE - the average value obtained from a number of attempts which include the successes and the failures.

EXPECTED PETROLEUM FIELD SIZE - the average field size obtained from a number of attempts which include the successes and the failures.

FEA - Federal Energy Administration

FIXED BONUS - a predetermined sum of money required by the resource owner to ensure that only earnest bidders participate in the auction. Syn: earnest money.

FRONT END MONEY - cash bonus paid at the time of leasing.

GREAT - Generalized Reserve Estimating, Appraising Tax Computing System, developed and operated by Garrett Computing Services, Inc.

INCOME - the money or other gain received for labor, services, property or investments.

MODEL - a set of estimated parmeters which are assumed to reflect reasonable values as compared to actual fields.

NORMAL DISTRIBUTION - a symmetrical bell-shaped curve, where the relative frequency with which a variable will take on values between two points is the area under the curve between the two points on the horizontal axis.

OIL, LOWER TIER - FEA regulated oil price applicable to all old oil produced on old discoveries.

OIL, UPPER TIER - FEA regulated oil price applicable to a new oil discovery or oil produced above a base level.

PARAMETER - any measurable characteristic of the defined universe.

PRESENT WORTH - the present value of future income or expenditures which is determined by discounting future income and expenditures at an acceptable discount rate.

PROBABILITY - relative frequency of particular events in a very long sequence of trials.

PROBABILITY OF SUCCESS - the chance of finding the expected value resource (field size).

RATE OF RETURN - discount rate which results in the discounted present worth of future net income becoming equal to the discounted investment.

RECOVERABLE RESERVES - the amount of production that can profitably be removed with present technology.

REVENUE - the income, royalties, rentals and fees, collected by government.

RISK - percent chance of success.

SEVERANCE TAX - tax derived from the gross value of production.

STATE INCOME TAX - tax based on taxable income.

TAXABLE INCOME - all company income less operating cost, less depreciation on investment, less amortized pre-leasehold costs (bonus), less conservation and advalorem tax.

SEC. 4

MILTON LIPTON:

The comments that I would like to offer and then open up to your questions are based upon the draft for a bill that amends the leasing policy of the state. To begin with, I call your attention to a rather unique and I think a very progressive statement of the preamble which says that among the purposes of this is to maximize the state's share from profitable oil and gas production while minimizing revenue from unsuccessful exploration wells and from marginal economic oil and gas production. It is a most unusual approach for a state or a government that is leasing property to take....that is...what you are saying in effect is that you are not trying to maximize your revenues come oil or high water, but that you'll take your revenues from successful oil and gas exploration and you are prepared to forego under certain circumstances optimum revenues that you might have gotten from bonuses paid to the state where the venture was unsuccessful. I would think that the industry would look with great favor upon this as a principle of leasing, and as I said before, it's a most unusual thing to see a government proposing this itself.

A major change which is now being proposed in your leasing policy has to do with bidding methods and on page 4 of the proposed draft bill there are actually eight (8) different bidding methods itemized which would be available to the commissioner and from which he could select in any particular lease sale. The eight different bidding methods break down really into four different bid variables. The first is the very familiar front end bonus bid, and there are three (3) different ways this can be done.

The second is royalty bidding and there are two different ways the commissioner can do that. The third is bidding for a net profit interest to the state out of the proceeds of successful oil and gas exploration development and production. The fourth is bidding on the basis of work obligations, how much a company will commit itself to work obligations. As I said, the bonus bidding is the familiar one which as been used most commonly, I think, almost exclusively here in Alaska in which the blocks which are up for competitive bidding will go to that company that offers to the state the highest bonus, and then the terms of the lease specify certain fixed commitments on the part of the leasing company, in the past, it has been almost universally 12 1/2% royalty. Under this proposed legislation, if the commissioner can solicit competitive bidding on the basis of a front-end bonus but with one of three alternative sets of fixed commitments written into the lease. One is a straight royalty which shall not be less than 12 1/2%. Second is a sliding scale royalty, that is beginning initial production at one level and then moving upward. And the third is a combination of a fixed royalty and a net profit interest to the state where the fixed royalty shall not be less than 12 1/2% of the fixed profit, interest shall not be set by the commissioner at less than 30%. So in effect this deviates from your present practice only insofar as it gives the commissioner a choice of three different elements which he can write into the leases when he opens them up for competitive bidding on the basis of the bonus. The royalty bidding is quite different. Here the two alternatives are that the companies would bid competitively; offering, competing on the basis of a sliding scale royalty which cannot begin at less than 12 1/2% and which carries thereafter a fixed bonus. The bonus is fixed by the commissioner, the companies bid on what kind of a sliding scale royalty they are prepared to offer the state or alternatively there's a fixed bonus and they offer a

fixed royalty. They bid competitively on royalty not a sliding scale royalty, but one says I'll offer 12 1/2%, another one says I'll offer 15%, yet another one says I'll offer 18%..... A few words about royalty, competitive royalty bidding, in previous discussions with committees of this legislature we have argued that royalty bidding is not a preferred form of bidding, except under very exceptional circumstances. If, for example, you have semi-proven acreage where the volume of the oil to be found is reasonably calculable, and the risks are not that great, location of the oil in terms of distance from ports or whatever else is pretty well known because other production is close by, under those circumstances you might have royalty bidding. But under most circumstances we would feel that royalty bidding is not a preferred form of bidding. You remember from our discussion of severance tax that the nature of the royalty or of the severance tax is that it becomes a percentage of gross value. Taken off the top of the gross value without regard to what the profitability of the venture is and when companies don't have to pay a very large bonus, the bonus is fixed at a modest rate, everybody pays the same bonus bids, but competitively on the basis of the royalty there may be a tendency for companies in their exuberance to obtain the lease to push the royalty which they offer the state progressively higher, they don't know what their competitors are going to offer, so they stretch their bid in order to win the lease. And then subsequently it may turn out that this royalty to which they commit themselves and which must be paid on every barrel of production over the entire duration of the lease becomes a very burdensome one; it could lead to earlier abandonment. But this is particularly relevant, what I'm saying now in the context of paragraph "D" at the bottom of page 4, which says regulation shall be established for all bidding methods to allow reduction of royalty to compensate for these increasing costs in the later stages of production decline, to prolong the

economic life of the field. And then it goes on, it says that the commissioner cannot really abate the royalty before at least two years of production have transpired. But, I put it to you, that although discretion on the part of the commissioner to abate royalties is something which you had in your lease a long, long time ago in your leasing bill; although this may be good legislative practive and good administrative practice when fields are beginning to reach the end of their natural life and you would like to encourage the maintenance of production even if it means taking a lesser royalty; to have this in the statute at the time when companies are bidding competitively on the royalty and then there is a temptation to say, well, if we bid too high a royalty, we come running back to the commissioner and we ask for abatement of the royalty So, you put the state, you put the commissioner in a very bad hole and and you have perhaps without intending to, you encouraged the companies to bid not the highest royalty that they think they can afford to pay in light of their exploration expectations, but to over bid because when worse comes to worse they will go running back for abatement of royalty. So I would think that if you are going to maintain this feature in the leasing law which says that in order to encourage the continuation of marginal production there will be the possibility of abating royalty then you certainly, I think, want to consider very, very carefully whether you want to have among the options, under which the commissioner can lease, bidding competitively on royalty. The third alternative or the third form of competitive bidding is bidding a percentage of net profit to the state. What this means in effect is that the companies who are bidding competitively to obtain a lease will say to the state, well, your lease requires us to pay a fixed bonus so we all have to do that and in another version your lease requires us to pay a fixed bonus, plus no less than 12 1/2% royalty whatever the commissioner specifies. Now, each company

bids competitively by saying to the state that after we have paid the bonus and after we pay a royalty of 12 1/2% of gross well head value on every dollar of production, thereafter, each year we convey to the state a percentage of our net profits and the companies bid competitively; the company that commits itself to turning back to the state the largest percentage of net profits is the company that wins the lease. Net profits can be defined, they are not defined in the statute, and I think correctly not so. The commissioner before any lease sale where the bidding component or the bidding variable is net profit, tells all companies who are entering the bidding precisely how net profit will be computed. It does not have to be and, hopefully, will not be the same way net profit is computed for income tax purposes. It is a notional concept of net profit which says you start with this gross value or whatever it is and you subtract certain specified costs everyone knows precisely without too great argument or debate how the accounting will be done in the course of the year and relatively simple accounting can be mandated by the commissioner before the lease sale. We have felt for a long time that the net profit bidding variable is a particularly attractive one, both in the standpoint of industry and for the standpoint of whatever government it is that's putting up acreage for lease. Not necessarily to the exclusion to other possibilities, but under certain circumstances a very attractive approach. What it does is, it removes a great deal of the capital available for exploration from the front-end bonuses so that the money thats available goes to productive work instead of just to front-end bonus. Where there is highly successful exploration the lessor, State of Alaska in this case, can expect to have very, very substantial revenues from the lease quite apart from taxation or anything else. Revenue from the

lease as the percentage of net profits. You might even think of net profit as a royalty based upon net value instead of a royalty based upon gross value. Sometime it's referred to as a net royalty or a net profit carried interest. What it means in effect is that the State of Alaska takes on a very considerable proportion of the risks in the exploration game. It does get a bonus but the bonus is a small bonus fixed by the commissioner as being appropriate to this bidding variable. And it may get, say, a fixed royalty but after that the larger proportion of the income which the state might expect to receieve it would receive only if the lease proves to be a productive lease and how much the state gets depends upon how much oil or gas is found, what the value the oil or gas is, and how profitable the operation. So the state in a sense becomes a partner with the explorer in both the failures and the successes of the venture. But the state does not become a working partner, the state does not become an active partner, the state is not in the oil and gas business. The decision as to whether or not the exploration should take place, the competitive bidding on what the net profit conveyed to the state is... all of these are private decisions by private industry in a competitive environment. Then the final variable, and it is the eighth item among the alternatives available to the commissioner, is bidding on the basis of work commitments. And there in a sense, the commissioner says when the sale is being advertised, that there is going to be a fixed bonus, and there is going to be a stipulated royalty. Now the winner of this lease who is entitled to do the exploration is the company who commits the largest amount of money to exploration process. This kind of bidding, perhaps, would be utilized in very, very difficult environment areas where the state wants to be sure that all potentials of the acreage are really explored, where the costs of exploration may be very, very high and where in the absence of work commitments the companies may be inclined to back out too quickly in terms of the results of one

unsuccessful well or whatever the case might be and the state would like to get the best possible exploration of the prospects within the area put up for lease and therefore says to the companies, we will reduce your bonus commitments, we won't have a bidding on the basis of royalty, but we will allow you to bid on how much you are prepared to commit to the exploration of this acreage which the state is putting up for lease. Well, just a few comments, I've already indicated that I think, that we think, that gross royalty bidding except in rare circumstances, is not the most attractive form of competitive bidding, and particularly not if you are going to allow abatement of royalty under certain circumstances. Bonus bidding, net profit bidding, work bidding, each one a reasonable approach to competitve bidding depending upon the nature of the area which is up for lease; how the state, the commissioner, and his technical staff regard the potentials. So I think that by providing these alternatives, the state is in effect creating a reasonable basis for a leasing policy within Alaska. I wonder, however, whether it is necessary in legislation to itemize all eight possibilities, that is to say, a bonus bid with not less than a 12 1/2% royalty, or a bonus bid with a sliding scale royalty, or a bonus bid with not less than 12 1/2% royalty and not less than 30% net profit. There are many variations which are itemized here, and for example, a bonus bid with not less than 12 1/2% royalty, and not less than 30% net profit is hardly, I would suspect in most areas, is hardly going to get much competition in terms of the bonus. Why not less than 30% net profit? It seems to me that if you lay out in gross terms what the permissable bid variables are, bonus under certain circumstances royalty, perhaps net profit, work commitments, and then leave it to the commissioner as to the combination of variables and the minima for the fixed items he wants to put in there, how far can one anticipate in legislation itself, what combination of fixed commitments

should underlie the selection of a bid variable, like a bonus variable and I would think that perhaps it might be advisable for the legislature to consider presenting to the commissioner a greater option of more bidding variables and perhaps set certain minima, but not itemize them in the details which appear here. Now there is one other aspect of the bidding that I would like to refer to and it is an item that appears on page 9. It says lands which have been offered for lease within the previous five years, but which received no bids at public auction may at the discretion of the commissioner be immediately offered for lease under regulations promulgated in advance upon terms most advantageous to the state including leasing non-competitively. The commissioner shall utilize a sliding scale of royalty based upon such formuli as he determines to be equitable, but need not adhere to the rental schedule in subsection (k) of this act nor to the 57 (indesc.) acres per lease and so on. What I am calling your attention to is the option here avaiable to the commissioner where a lease that is offered for bidding has not been taken up very quickly, to put it back for lease including under noncompetitive circumstances. I think that this could open up some dangerous precedents. Particularly if it's offered too quickly. I mean that the fact that a lease is not taken up in competitive bidding does not mean that there is no oil and gas there, it does not mean that the prospects are not good for oil or gas, it means that given the state of the knowledge at that moment of time, given the way the industry perceives the attractiveness at the moment of time they have'nt been interested in bidding on it.. They had other things that were more attractive, whatever the case might be. But let some time go by before opening this up for leasing again and particularly under competitive conditions again, what may have been learned about the geology of the state in the interim period. The way in which

company perspectives may have changed for a lot different reasons, I don't know what the case may be, I think may lead to the ability to lease under more favorable terms rather than for the state to conclude that nobody wanted our lease, well, we would like to have it explored anyway, let's get it on the market as quickly as possible, even if under noncompetitive circumstances. I would strongly suggest that you hear from the department, as well as from me, and others about why there is a sense of urgency about leasing noncompetitively just because the lease has not been taken up. I pass to other aspects than the terms of bidding and leasing. On page 5, there is a very pregnant one line clause which says the commissioner is authorized to withhold acreage from leasing in a particular lease sale. Now again, for those of you who remember one of the first reports we made for the legislature on leasing policy many, many years ago, one of the things that was discussed was the advisability, under appropriate circumstances, of the state leasing less than the full acreage in which there might be industry interest. Now enough acreage has to be put up for lease so that the companies that win the leases have a reasonable aggregation of acreage to provide for viable production of oil or gas or whatever is discovered. It doesn't necessarily mean that everything within a particular area of prospective interest has to be put up for lease simultaneously, there is good reason particularly if the purpose is to maximize the states share from profitable oil and gas production and minimize revenue from unsuccessful exploration wells and from marginal production for the state to withhold a certain amount of acreage. Now the acreage which was withheld may be condemned as absolutely sterile if the exploration around it finds nothing, (indesc.) the state may have withheld may turn out to be condemned by the industry you will never be able to lease it in which case you will not have gotten any bonus revenue

or whatever the case may be. But on the other hand, if it is successful you may come up with a subsequent lease sale with a net profit bidding for example, which makes it very attractive to the state in terms of the income that they will receive. So I would think that this thing is that the commissioner is not only authorized, but subject only to circumstances which make it undesireable which in case the commissioner has to exercise his judgement, that he should in fact withhold acreage it should be a more positive thing. I wouldn't want to make it binding under all circumstances. discretion must lie (indesc.) some areas where it may not be feasible where whatever acreage is put up really has to encompass the most of the structure which is in interest. If it can be done, I think it would be advisable to do so. The next feature that I would like to touch on briefly has to do with the period of exploration and on page 6 the appropriate paragraph says that an oil and gas lease shall cover a reasonably compact area and be for a period of five years. And there is no provision here for extension of the exploration period except under specific circumstances if production is eminent or a well has to be completed or the property goes into unitization. What under normal circumstances is a 5 year exploration period. I would suggest that there should be provision for at least some reasonable extension of the exploration period particularly in a country as difficult to operate in as the State of Alaska, where the geology, the environment, the climate, the circumstances all make it impossible to conclude an ongoing exploration period precisely within the five years. A whole exploration season may be lost because of a combination of circumstances; because drilling equipment couldn't get out there, or at the end of one season the

seismic work never got completed and one has to wait for the proper time of the year to go back and finish it and one loses a year of exploration. I would think it would be advisable to allow an extension of the exploration period. If in the view of the commissioner, good faith has been exercised by the leasing company in the previous 5 years. I think it does no violence to the interest of the state. But there is another very interest feature thats introduced here at the bottom of page 9, paragraph v, the state shall have the right to purchase not to exceed 16 2/3% by volume of the oil and gas produced pursuant to a lease, and it goes on. That is to say, the state is assuring itself that if it chooses, it can have as much as 1/6th of the oil or gas produced on the lease. Now included within that would be the states royalty oil and gas and the volume metric equivalent of whatever the state may get on a net profit share. But if those fall short of 2/3rds of the oil and gas the state has the right to buy at the market value at the field price enough to make up 2/3rds. There is no obligation on the state to do it, the state has the right to do it. I see a tremendous advantage of the state in this, I seen no great diadvantage to the industry in this if exercised judiciously. It could be unattractive to the industry if it is arbitrarily applied and particularly out of small production where the lease holder really needs a substantial volume of oil to provide the economics for his export out of the state for example, and taking away 1/6th of the volume of oil starts cutting things too narrow for him, then I would say that this could be a burden to any company who is undertaking the exploration and who successfully is doing the development. So I would think there ought to be at least some proviso where by the lease holder is protected against simply a determination to take 16 2/3rd

no matter what, and in particularly small areas where the increment of the state gets may matter very little to the state but may matter very much to the producing company. I think some kind of clause should be put in to provide the protection.

That's the sum of the remarks that I think I could make about the special features of this proposed bill and if there are any aspects of it that I touched on or things that I have not chosen to talk to that you would like to address yourself to, I'm at your mercy.

SENATOR POLAND I will ask you one question Mr. Lipton, and that is, have you felt for sometime that our leasing policy needed to be updated or overhauled?

MILTON LIPTON Well, I think that if only to broaden increase, the number of options available for leasing, yes, I think so. I think the traditional front end bonus bidding and there is a lot to be said for it under the proper circumstances, and, but for this to be the sole basis of competitive bidding, I think it places a burden in rank wildcat areas upon the industry which is unnecessary, that you have to put so much money that ought to be used constructively, pay out as a bonus and it puts the state in a position where in many rank wildcat areas what the state gets is miniscule in terms of bonuses compared to what may be the profitability. If you add up the sum total of bonuses received by the state from the producing areas of Prudhoe Bay, it is miniscule bonus income because the companies were bidding on rank wildcat areas at a time when even if they were

successful no one ever knew if it could be developed, tremendous volumes of oil had to be found and if prices had ever stayed at $3.00 per barrel it never woud have been produced you see, under those circumstances obviously the bonuses are very very little. Now, I think there is no great virtue in the state having competition on the basis of front end bonuses when the total amount of bonus income you may get, particularly in the less attractive areas of the state. What seemed to be the less atractive areas of the state will be very very little and may prove to be the most attractive producing areas after they are developed. So that if you minimize the front end bonus under certain circumstances and go to a net profit interest then you have a chance of sharing much more considerably in the profitability of successful ventures and without doing great violence to the incentives of the industry. Because no company is going to bid away such a large share of the net profits that it leaves them without the incentive of very very profitable operations on the remaining shares. Now it is something which I think can be equitable both to the state and to the company. So yes, I do think that the leasing warranted amendment if for no other reason than to introduce a greater variety of bidding variables without going mad with you know giving the commissioner so many options that the poor man will never no on what basis he can make a selection. But I think to introduce several other options is a major step forward.

Q: Senator Huber - Milt, can you tell me from industries viewpoint if we would do any harm to this bill, in particular, or good or otherwise, your comments in regards to us putting an Alaska hire clause into the leasing requiring Alaska hire based not upon our regulatory rights but upon our proprietary contract rights?

Lipton: Senator Huber, you know, you ask me from the standpoint of the industry you really should ask that of the industry, not of me, but I would give you a very quick impression and if you put an Alaska hire clause, in, what it

means to the industry depends really on what you intend by Alaska hire. I mean there, if the industry doesn't have sufficient flexibility to obtain competent people, whatever their origin, then I think it does harm to the industry. But if the way in which it is applied is sufficiently flexible then I suspect not only wouldn't the industry object, but the industry would be delighted. You know, I think the industry would like to make the maximum possible contribution to Alaska hire. But it must be a very difficult thing to administer, I suppose.

Q: Senator Huber - I apologize for asking the industry viewpoint. I was asking basically for the economics of the industries viewpoint.

Lipton - Well, as I said the economics are affected depending upon how this either contributes to, or intereferes with the efficiency of the industries exploration and producing operations.

Q: Senator Huber - I was referring to a particulary in the difference between our regulatory powers as a government and our proprietary rights as a contract maker in this particular case.

Lipton - Well Senator Huber, this suggests to me that if you are doing this as part of a contract rather than by regulation, does that mean it's going to be less flexible, because it is in the contract?

Q: Senator Huber - Madame Chairman, Mr. Lipton, the intention is to make it less flexible because we are presently finding that our leases do not contain this and that hiring is not being done from the North Slope from Alaska where it could be done when there is qualified people sitting on the benches. And we want something to get a handle on this, so that it is not going to be struck down by the Supreme Court saying that you cannot make

such a law we want to work on our proprietary rights being that is our oil that we are selling.

Lipton - Senator Huber, I find it very difficult to give you a responsive answer because if you say that there are qualified people sitting up there who are not being hired, now obviously that is bad and if you had it in the lease they would be hired. On the other hand, if the industry may interpret qualified people differently. I don't know it's very very, it's difficult to say. But if the whole idea is to make it a firmer obligation through the lease that is one thing. But if you make it a firmer obligation and there is no flexiblity then I think it could be very difficult.

Q: Senator Huber - Well Madame Chairman, I won't dwell on it but just one more short thing, so that you understand what I am talking about. When the industry on the North Slope makes a deal, with forinstance, a Hawaiian corporation to supply them with the personnel and to do the hiring for them and then the hiring is done in Houston Texas we become concerned when there is qualified Alaskans sittin on the bench. But if we have a handle, a way that we can get a handle on this, using our proprietary rights we should be doing it, or trying to find a way to do it when we know that we can't do it with our regulatory rights and that is why I wanted to get your expertise on this.

Senator Meland - Madame Chairman, I, has Mr. Lipton spoken to any type of questions about all the legislature or are we just talking about (inaudible). Because I did have some questions that were left over from Wednesday, but we can certainly wait on that and talk about this legislation before us.

Senator Poland - Well what we had though we would do is talk about this and when there are no more questions on this we will go to the royalty oil proposals and then throw it open for all types of questions.

Q: Senator Radar - There are many question Madame Chairman. I had two items that I would like to have Dr. Lipton comment on. One of them is the concept of limiting from 500,000 acres to 200,000 acres the amount that any one entity can hold in leased lands and that concept actually appears in several faces in the bill. I assume it is to prevent or to insure a competitive market here so that we don't end up with one company dominating the field. Comment on this and give us your observations on that and what problems and benefits might flow from that.

Lipton - I think there is great virute in limiting acerage holding by an individual company. On the other hand, I have no feel really, for whether 200,000 acres as an amendment to the 500,000 alternative is too little or not. I would strongly urge that in order to acheive the same purpose, that is, I think that two things are of value. Acerage limitation I think could go in there. I don't think it does violence, providing that it is not so narrow that in a sense very soon you start reducing the number of competitors and a company that is successful in a couple of lease sales and then suddenly finds itself barred from further competitive bidding for acerage. You defeat your own purpose if you do that. But I sense that the purpose of the legislature and certainly the interest of the state is that acerage shall not be held. The purpose of winning acerage under a lease is to get on with the business of exploration. And therefore I would suggest that whether there is competive bidding on work obligations is one of the options or not. I think there should be work obligations in every lease. The commissioner should in every lease stipulate minimum, not maximum work obligations. We are not trying to tell the companies how to conduct their exploration activities. But there should be certain minimum work commitments which the companies have to perform in order to hold that lease. Let them get on with the business of exploration. It does no violence to the purpose of the companies, unless they want to get in that bidding and then sit back and wait for

somebody else to do some work or they wanted to be sure they were represented in the area but they had other fish to fry elsewhere in the state or somewhere else. I think you have a five year duration of the lease and I have already suggested that you might be willing to extend it, if the companies really need it and they have been going about their business. On the other hand, there should be minimum work obligations in every lease there. I think also there is a certain virtue in putting a ceiling on the amount of acerage which a given corporate or individual can hold as a result of leasing from the State of Alaska. I certainly would not want you to cut that down so small that you lose the competitive bidding and the third, fourth and the fifth lease sale because one company has already not exhausted it's interest, not even exhausted it's dollars but has exhausted it's ability to hold acerage in the state.

Q: Senator Radar - Would you comment on the provision as to the lessee or permittee conducting any exploration for development or production of oil and gas, the state shall provide the commissioner access to all data obtained from such activities and shall provide copies of such specific data as the commissioner may request. I don't know whether that is intended to change the public disclosure of that information or whether there is still proprietary interests or not but what is your understanding of that provision and your comment? It is on the top of page ten. It starts on the second line.

Lipton - I assume that your statutes prevent public disclosure of this for some minimum period. What is it two years in Alaska. Two years, I think I believe. Two years by statute.

Q: Senator Radar - Cause I take it that the proposal here does not suggest that we alter that proprietary -

Lipton - I would hope not. I would hope not. I think the right to proprietary information for at least two years. For any company operating here considering the amount of money which goes into

exploration. I think that should be protected.

Q: Senator Radar - Well let me ask you this. Would that be true. I assume the reason for your statement is that a company therefore gets the value of it's own work product. But what if the state, for example, should for reasons unknown, at the time of exploration, should withhold in the leasing for a period of three years. Then under those circumstances we would have deprived the company of the value of it's own work product. I don't know how to avoid that but I can see a problem here and perhaps discretion should be available here. Although I am not certain as to the purpose of this particular section or what the discretion or the thrust of the discretion should be. Whether the purpose here basically is to give the state the right to deprive them of the work product, within two years or what?

Lipton - Well I don't know how you can set the period of confidentiality so that it conforms with the amount of, the lapse of time between one lease sale and another lease sale. I mean that is a pretty difficult thing to do. I don't think, see the point is the state has access to this information. It is just that the competitors don't have access to this information. And in that respect there is a certain value in extending the period of confidentiality to a reasonable period of time because the value of the information is not just for another lease sale in exactly the same area. There is an awful lot of information. It becomes valuable because one correlates it with what one knows from other wells elsewhere. One builds up ones geologic and geophyical knowledge as this stuff becomes public. So there is virtue in keeping it confidential for a reasonable length of time. But I don't know, one can't do it for too long a time or you deprive the industry as a whole of what is really basic knowledge necessary for it to advance. So there is some kind of a compromise has to be struck between the virtue of the confidentiality to the company doing the work and how important it is for the whole industry to know more and more about the State of Alaska.

Q: Senator Radar - Well let me ask you. You have suggested in a number of instances descretion in the commissioner. Do you think that in this particular instance that we should provide administrative descretion in perhaps, write in a minimum or maximum or something of that nature. Or do you think the two year -

Lipton - Senator Radar I don't think this is an area where the commissioner ought to have descretion. This is protection which the legislature is going to give to an exploring company as they are taking the risks in putting it's money in. It depends upon the legislature to know exactly what it's protection is.

Q: Senator Radar - Well what if you wrote in a minimum of two years, an extension of that period of time before it was made public?

Lipton - Senator Radar, I don't know of any place where that exists. That of course doesn't mean that it's a bad idea. I don't know that it exists anywhere else. I am not familiar with it. I think normally two years is pretty ample time. Again I would certainly defer to the judgement of people in the administration you know they have alot more experience with what the circumstances up here in Alaska have been.

Q: Senator Huber - Madame Chairman, I would like to just ask Milton just one thing, one question that was raised here by Senator Radar and I would hope he would concur with me. Milton will you take a look into the matter that Senator Radar brought out to determine in your opinion how our laws stack up on this at this time and give us some kind of a report on it. I think I know and the question I would like to ask you would be if you thought that two years was the best period of time and compare this with our current law and give us another report.

Lipton - Yes. I would be pleased to.

Q: Senator Radar - Madame Chairman, perhaps if I might ask Dr. Lipton, he said he had no particular feel to the 200,000 acre limitation for single holdings. I might ask him if it is possible for you to develop a feel for that. At least give us your best judgementas to whether or not -

Lipton - Yes.

Bristol Bay Native Corporation
445 E. 5TH AVENUE / P.O. BOX 220 / ANCHORAGE, ALASKA 99510 / PH (907) 278-3602

March 10, 1978

The Honorable Alvin Osterback
Chairman
House Resource Committee
Pouch V
Juneau, Alaska 99811

RE: H.B. 854

Dear Mr Chairman:

It is my understanding your committee will be holding hearings on H.B. 854 on March 16th and 17th, 1978. Unfortunately, we will have no representative at the hearings to testify and therefore, we respectfully request this letter be included in the official record of the hearings.

First of all, we object to most sections of this Bill as it is very complex, creates a multiple choice system that is unworkable, discourages exploration on State lands, and above all would have a serious impact on the development of our lands. We strongly urge that no action be taken on H.B. 854 this year.

Previous State selections and proposed selections in our region total several million acres with oil and gas potential in the Nushagak Basin (Bristol Bay Basin). BBNC lands in the onshore portion of this sedimentary basin would total about 1,750,000 acres surrounding 17 villages, several of which the Native lands are not contiguous. In other words, most of our lands with the new proposed State selections would be adjacent to or surrounded by State lands. In many instances, a drilling unit would involve both State and Native lands and in some instances, Federal lands. Therefore, any changes in leasing of State lands will have a direct effect on BBNC lands. Most of the provisions of H.B 854 would change the economics of State and Native lands in a producing unit. The net result will be that the portion of the unit under State leases would become uneconomical and abandoned first and the Native portion of the unit would then become less economical followed by early abandonment and thusly leaving large amounts of oil or gas in the ground. This could hardly be called conservation.

BBNC has had a joint agreement with a major oil company whereby, with commercial production, we will become a producing oil company. We do not lease our lands! Knowing some of our selected lands might not be adequate to cover undefined seismic structures, we anticipated leasing State or Federal lands in order to form drilling units for early development of our lands. About three years ago, we filed the necessary qualifying documents to hold both State and Federal oil and gas leases and have filed offers to lease on several thousand acres of Federal lands.

We have no problem with the present leasing system as it has been tried, tested, proven and above all, is understandable. Such a mixed bag of radical, czarist possibilities as proposed in H.B. 854 is uncomprehensible, unjustified and will no doubt have the opposite effect of the original intent, unless the intent was to retard development of State lands indefinately and in effect retard development of much of our lands.

Again, we strongly urge the postponement of any action on this Bill.

Sincerely,

W. C. Bishop

W. C. Bishop
Manager, Subsurface Resources

SEC. 5

OIL AND GAS LEASING POLICY:

ALTERNATIVES FOR ALASKA IN 1977

A Report to the State of Alaska, Jay S. Hammond, Governor

Department of Natural Resources, Guy R. Martin, Commissioner,

and to the

Alaska State Legislature, Interim Committee on Oil and

Gas Taxation and Leasing Policy, Chancy Croft, Chairman

February 1, 1977

OIL AND GAS LEASING POLICY: ALTERNATIVES FOR ALASKA IN 1977

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Summary

The purpose of this report is to be of service to the Alaska State Legi ture and the Department of Natural Resources in their review of oi gas leasing policy. It is written from the State's viewpoint. It t. he State's interests as being frequently adverse to those of the Sta lessees, without being hostile to them. Where the State's interest verse to the federal interest, we take the State's position. Otherwise, the purpose is to be as objective as possible. The Report lists the pros and cons of alternative policies and indicates what the Legislature needs to do to make each policy work. Recommendations are made in a tentative way.

This is a survey rather than an intensive study of any one alternative. The purpose is to display the full range of alternatives and the full range of issues to be considered regarding each one, so as to keep individual matters in the larger perspective so that no one issue is overweighted. The purpose is to compare, and to show how different leasing elements complement or substitute for each other. The purpose is to serve as a springboard for legislative review and a guide to additional, more selective investigations.

As a unifying theme, the list of alternatives proceeds sequentially, showing how each more complex alternative emerges as an answer to faults perceived in prior ones.

As a set of criteria for judgment the Report seeks to lay on the table assumed goals of the State. These are the following:

-- Business-like ma "his is taken to mean in practice the maximization of discounte

-- Equity. This is take in avoiding giveaways; reducing the lottery element in leasing; hewing to the productivity basis of distribution of income; collecting for the State the rent of its lands; basing industry incentives on productivity rather than acquisition of State assets; and reducing the differential advantage accorded to accumulated wealth.

-- Workability. This means a minimum of arbitrary regulation, achieved by binding the lessor and the lessee in a community of interests when writing the lease.

-- Avoiding economic waste. In addition to physical waste, there are the wastes of producing at excessive cost and doing things at the wrong time. The Report suggests abandoning the criterion of maximizing ultimate recovery in favor of maximizing discounted cash flow; avoiding the dissipation of rent by overspending, particularly on capital. It warns against the twin dangers of using proven resources too slowly and searching out new ones too early.

-- External impacts. These are seen as negative by environmentalists and as positive by developmentalists. The reconciliation lies in a wider distribution of benefits.

-- Coordination with federal and native landowners.

The Report now surveys leasing alternatives in sequence:

-- Noncompetitive leasing is faulted for giving away too much and encouraging premature leasing and production.

-- A high bonus partially cures these problems but creates a serious front-end filter problem. Professor Norgaard's postmortem analysis of bonus bidding i Alaska indicates that too little has been received for leases.

-- A high annual rental cures the problem of the front-end filter by replacing it. It may overaccelerate production, however, unless made to dwindle over time. A rental whose level is set before discovery reduces the buyer's risk since he may drop the lease at will, but does not alleviate the State's risk of selling for too little. A rental based on assessed value avoids this problem and also dwindles over time.

-- High royalty rates solve much of the risk problem. They eliminate the front-end filter and they collect revenue. However, they allow too much speculation. They also put a drag on production, especially marginal production. Premature shutdown turns out to be a minor problem. Others are greater: slow production and future shift; leakage of rent into private hands from better deposits; excessive deferral of State revenues; and lower success ratios for exploration. These problems can be alleviated by imposing specific work terms, by using sliding scales, and by limiting the term of the lease.

-- Specific terms. These must be used with high royalties to compensate for the disincentive effects. Mandatory liability for environmental damage is also suggested.

-- Profit sharing. This means letting lessees write off costs against royalties and also raising the rate to compensate. This lets the State receive more per barrel from the richer deposits, and avoids

sterilizing the marginal ones. It gets us into the same problems as administering an income tax: the rate is high, padding costs is likely, depreciation paths and lives must be determined according to complex and sometimes arbitrary formulas. There remains a loophole for unrealized capital gains.

-- Rent-sharing. In addition to costs the lessee deducts interest on the value of his improvements by one of three methods: by allowing deduction of capital over time with interest at a specified rate; by allowing front-end recovery of capital and by applying an ad valorem charge to the assessed value of the leasehold interest. The first two alternatives engage us in severe auditing problems, and both are biased against exploration on long-shot ventures. The third alternative removes the auditing problem and replaces it with an assessing problem. It also puts a bite on unrealized capital gains. It avoids many faults seen in prior systems: it raises money; it defers payments but not excessively; it puts no drag on production; it requires little direct regulation; it imposes no shift towards the future; there is little opportunity to pad expenses; and there is only a limited bias against long-shot exploration (because what is hard to find is often hard to produce and therefore low-valued). Its problem is discouraging postleasing exploration. Some remedies are suggested.

-- Regulating field operations. Some form of unitization is required. It is suggested that this will work much better if the State accepts the criterion of maximizing discounted cash flow, eliminating a conflict between the State and the operators. A two-tier system is suggested as an alternative to 100 percent unitization.

-- Three alternatives are passed over lightly, although without prejudice. These are: checkerboarding; the sale of undivided interests; and the sale of a fixed volume of oil and gas.

-- Handling information. The Report considers the pros and cons of the State's buying more information on contract as an alternative to relying on industry nomination. The weight of argumentation is in favor of the State's taking a more active role.

-- Direct State intervention in the market is considered, primarily to aid in monitoring prices used as bases of evaluation for royalty and assessment purposes, and to guarantee to all lessees equal access to transportation.

Next a criterion and procedure is developed for timing lease sales. State lands are to be ranked according to maturity or "ripeness." Ripeness is defined as a condition where the percentage growth rate of the DCF of the State's interest slows down. The State's wealth is maximized by selling leases when this anticipated growth rate slows down below the rate of interest. The appropriate rate of interest should be the State's borrowing rate. The question is raised whether the State should set a reservation price when auctioning leases. The Report addresses the question of whether the proposed procedure will cause leases to be sold at a sufficiently even rate.

The Report considers the administrative load and personnel requirements associated with alternative leasing systems. The use of royalties entails ancillary regulation to compensate for the disincentive effects of the royalty on production. The profit share system entails an

auditing staff to avoid the deduction of unjustified expenses. So, also, do the first two rent-sharing systems where capital costs with interest are deductible. The ad valorem charge system entails a staff of valuation engineers or appraisers, whose services are also required to operate a system of timing lease sales optimally.

Leasing is seen as supplementary to taxation, and taxation is not seen as an adequate substitute for leasing policy because taxation is addressed to persons or corporations while leasing policy is addressed to parcels of real estate. The exceptions to this are a net proceeds tax and a property tax, either of which might be used as a substitute for leasing policy.

Recommendations are submitted tentatively in light of the complexity of the subject and the several imponderables involved. I recommend screening out systems based on ex ante forecasts of resource values like the bonus bidding system, because of the front-end filtering out of leaner firms and because so much has to be gambled on so little information. We consider the lease elements whose value depends on actual disclosure of resource values and rank them in the following order: the ad valorem charge, the profit share, the sliding scale royalty, and the front-end recovery. We recommend a vigorous program of State-financed contract exploration with publicity of findings. We recommend scheduling lease sales according to the ripeness criterion described above. We prefer that unitization be administered by an organization of local leaseholders.

Our most immediate and unambiguous recommendation is for a greatly expanded program of information-collecting and valuation, to serve as a necessary base for all other decisions.

A. Reasons for this study and Report

This study was commissioned by Guy R. Martin, Commissioner of Natural Resources, State of Alaska, in cooperation with the Legislative Interim Committee on Oil and Gas Taxation and Leasing Policy, chaired by Senator Chancy Croft. The present Report is part of a larger study being conducted by the Department of Natural Resources, a study described in Commissioner Martin's statement of July 10, 1976, entitled "Alaska Oil and Gas Leasing Study," copies of which have been submitted to the Legislature. The primary focus of the present study is Section 4 of the July 10th memo which reads as follows: "A description and analysis (legal, economic, other as necessary) of all alternative systems which are practically applicable to State use in Alaska, with emphasis on broadening the State capability to employ alternatives rather than making final decisions on which systems to use. This task should consider the practical experience of other states and nations as well as leasing theory and research.

a. Special attention in the analysis should be given the risk element in alternative systems as it relates to public administration of oil and gas resources.

b. The analysis should include, in some form, an overview of this entire leasing issue of use to State officials and legislators."

This Report also responds to Section 5: "An economic/legal analysis of the interrelationship of leasing (ownership interests) alternatives with taxation alternatives. Ongoing coordination with the taxation

segment of the administration/legislative study."

This Report also responds to Section 7: "Design of a system (a criterion) for decision-making by public administrators regarding various leasing alternatives. What information must be available; what factors should be considered; what process should be followed to decide between new alternatives."

In keeping with the spirit of the assignment, the tenor of this Report is expository and not advocatory. The main purpose is to lay out major alternatives in a systematic way to serve as a basis for legislative review, debate and decision. The report does offer its own recommendations at the end and the consultant offers his own judgments from time to time where it seems appropriate, and where they may be identified as such. The overall spirit of the Report, however, is to define and articulate alternatives, to spell them out in a logical sequence, stating the advantages of each, the faults of each, and what the Legislature would have to do to make each one work. Most of them will "work" --sort of-- and are in operation in various jurisdictions around the globe. It is a question of what might work better in light of your own objectives, circumstances, and visions of the future.

In developing alternatives, the Report proceeds from the simple and basic to the more complex and sophisticated, showing how each complexity develops as a logical effort to overcome some fault in the simpler system. Before breaking down in complexities, however, the effort is made to apply Adam Smith's dictum that the evolution of successful inventions is not, in the end, into greater complexity but

greater simplicity -- an observation dramatized by Igor Sikorsky when he exhorted his engineers, "Simplicate, simplicate -- and then add more lightness!"

A purpose is to cut down the seeming number of alternatives without reducing the real number by boiling proposals down to their essentials and showing how few of them there really are. The number of possible combinations is still extremely high because there are so many elements in a lease but the number of reasonable combinations is much smaller because they need to be combined so as to balance each other and countervail each other's faults.

A correlative purpose is to develop commensuration, that is conversion factors among the apples and the oranges. By doing so we develop a common tongue for communication, a common currency for trade-offs, and a unitary standard for decision-making.

Alaska's interest in this topic is timely and in step with a worldwide trend to study and improve leasing systems. This is a natural result of increased valuation of oil and gas resources in the ground. As the retail price rises there is enormous leverage on field prices. The farther the field is from the gas pump the greater the leverage, so that the percentage increase in the field value of Alaska's resources is at a rate so high that few would have credited it a few years ago. Field prices everywhere are rising out of all proportion to other costs. This is reflected in extremely high bonus bids offered for tracts which were previously considered marginal or submarginal. A recent survey indicated that costs of land acquisition

by oil and gas companies increased by nearly 700 percent from 1970 to 1974 (Joint Association Survey, 1976) in comparison with all other costs which increased by considerably less than 100 percent. Clearly, the world is recognizing the high value of remaining oil and gas lands and it behooves any prudent landowner to protect his interests and to economize on the resource with much greater care than ever before.

Most analysts now foresee continued upward pressure on energy prices and this consultant, although forecasting is not his forte, is inclined to agree. This is the more reason to guard our future interests by using care in drawing leases now. The lease contract is binding and irrevocable, unlike tax policies. No legislature can bind or limit the tax power of a future legislature; but neither can a legislature in the United States, with its strong tradition of judicial review, rewrite a lease contract executed by its predecessors. Other nations may force renegotiation of contracts considered unfair in the light of changed circumstances. This is not unknown even in the United States but much rarer and harder than in countries of different traditions.

The result is a growing interest in public landowners' participating in future profits from oil and gas. For generations past, many governments virtually gave away land simply to get it used; while private landowners sold their future rights for a little money up front. Now these attitudes are changing drastically and there is ferment everywhere. The U.S. Congress has entertained several bills in both branches calculated to increase government participation in future profits in spite of

the government's having secured large revenues from bonus bids following the OCS Act of 1953. There has been some support ofor a federal oil and gas corporation to explore in advance of leasing. Equity participation in corporations has been a strong trend, exemplified for example in Norway, in Canada, in Saudi Arabia and elsewhere. Indonesia has pioneered its own interesting leasing system, characterized by rapid capital recovery to the lessee followed by very high royalties. Papua-New Guinea has recently adopted the same principle in more sophisticated form, basing its law on the careful advice of economists Ross Garnaut and Anthony Clunies-Ross. The academic world which ignored this topic for many years past is beginning to spawn several research projects and will soon be awash with reports and articles and proposals and econometric studies and models and new philosophies. The world is moving. Alaska is in step, although perhaps a step behind. The present assignment indicates an intent to catch up or pull ahead.

B. Objectives of the State

Only individuals, it is said, can have objectives. By "objectives of the State" this Report means the objectives of the effective majority of Alaska's voters as expressed through their political representatives and other leaders. No one thinks that representative government can completely succeed in representing everyone or, perhaps, anyone. But it is what we have, and this report addresses these leaders as though they were the State.

The Report does not presume to say what the State's objectives should be. It, rather, purports to distill what the consultant observes them to be; and to articulate and organize ambient ideas which are often heard but want greater system and organization. This entails the consultant in some interpretation. Those with more data and better interpretation may improve on this statement. The present report only begins the job of laying out our goals on the table.

A further purpose is to begin to define and expand on their specific implications. This inevitably entails even more interpretation and perhaps even some presumption by the consultant. Seeing these implications as he interprets them, one may sometimes recoil and say "no! -- That's not what I really want." So be it -- then we may go back and spell out more realistic objectives we can live with and we are well down the road to our present goal which is to be prepared for decision-making.

The following are what I take to be the State's objectives in framing a leasing policy:

1. Businesslike management of State property

The State holds property in trust for the people of the State and has a duty to manage it prudently for their maximum benefit. This means several things but one is certainly money. The State is a landlord. It wants to secure maximum income. It does not do this by fostering maximal use of resources but optimal use -- that is, it encourages lessees to maximize the bottom line, recognizing that income is net of costs. "Maximum income" is still ambiguous, however, because rival schedules of land use and income differ in their time-distribution: a fast start means a slow finish and vice versa. To resolve this ambiguity we deduct interest on capital between the dates capital is committed and later recovered.

This goes far towards resolving ambiguities but still leaves a large one, the treatment of the investment in withholding unproduced reserves from year to year. The final resolution is achieved by maximizing the Net Present Value of future cash flows. This procedure is also called maximizing wealth; and also called maximizing Discounted Cash Flow (DCF).[1] This report uses the last, which seems to be in common

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[1] There are references in Alaska reports to maximizing the "DCF rate of return." This usage seems ambiguous since the rate of return is held fixed at a rate determined by outside markets when one discounts the cash flow. It is the present value of the cash flow that one maximizes. It is mathematically quite possible and simple to hold the present value fixed and maximize the rate of return instead, using the same mathematical formulae, but treating the interest rate as the unknown to be maximized rather than as a "given." Sometimes this is done when one is out of contact with outside capital markets but there is no need for it here; and it would not affect the findings anyway because, as a rule, maximizing the internal rate of return as it is called will not lead to strikingly different results from maximizing the Discounted Cash Flow, so long as one makes no mistakes in mathematics.

use in Alaska. Businesslike management means adopting the criterion of maximizing DCF.

Maximum DCF is not to be applied rigidly or dogmatically or narrowly as a standard. It does not always comprehend all relevant values and factors. It does, however, comprehend a great many more than critics of the "almighty buck" might realize because it is the net balance arrived at after a long process of adding and balancing all manner of pluses and minuses. In addition, it provides a logical analytical framework within which newly recognized goods and bads may be added to the analysis in carefully measured perspective. One of these, on the minus side, is environmental damage. Some environmental damages are measurable in reduced cash flow. Damage to commercial fisheries is an example. Others are indirectly measurable in the marketplace. For example, the loss of residential and recreational amenities on privately owned land which reduces their service flow is measured in reduced selling prices of titles to the real estate.

Damage to sports fishing reduces an amenity service-flow which is harder to measure than cash flow but no less important on that account. Economists are developing techniques for measuring such service-flows. These techniques are still imperfect, like the rest of this world, but they at least let us set an upper and lower bound on the values and so let us begin to measure them in the same balance with other things.

On the plus side, increased payrolls and commercial sales deriving from oil and gas income will increase residential and

commercial values in some areas. Part of this increase is a "secondary benefit" from oil and gas development and should also be entered into the balance. This obviously gets complicated and extended. It is beyond the scope of this Report to resolve all such issues. The present point is that the use of the crassly materialistic and narrow concept of Discounted Cash Flow does not in any way box us in and preclude us from broadening the scope of the analysis when we have the will and resources to do so. It provides a framework of analysis which is almost indefinitely extensible to comprehend as many variables as we have the ambition to try to consider.

The concept of "discounting the future" disturbs many people but it is only the choice of words which is unfortunate. Discounting does not imply neglecting, abusing or short-changing the future but, rather, charting the most advantageous path into the future. The mechanism discounts poorer paths to the future because there are better ones -- "better" meaning a higher rate of increase of wealth. It is not prodigal to decline a 3 percent path in preference to a 10 percent path.

It is often suspected that discounting the future leads us always in the direction of faster resource use. Not so. We will see that this criterion may well lead the State to retard lease sales and production, so long as the anticipated proceeds to the State are growing faster than money in the bank. On marginal and submarginal lands these net proceeds begin growing from a base near zero. From such a low base they need not grow much in order to grow faster than money in the bank.

Discounting the future requires a discount rate. The State's rate need be no higher than its borrowing rate but it can be a good deal lower when Alaska has surplus funds to invest. There is no suggestion here that the "social" rate of discount is lower than the market, a concept wanting in both precision and rationale. It is, rather, a practical question. If the State cannot invest its surplus for high returns then an investment in the growing value of oil and gas in the ground may be a superior alternative.

Maximizing DCF as a criterion solves two problems for us, problems of timing. One is the optimal rate of production from proven reserves. These timing decisions are largely in the hands of lessees except to the extent that the State interferes with their natural desire to maximize DCF by controlling the rate of production. An equally or more important timing decision is when to begin production. Here the State is in the saddle with its decision of when to sell leases. The DCF criterion says that we should sell leases at that time when we expect that their future value will be growing more slowly than money in the bank. This rationale has been developed in the consultant's previous work, "Extractive Resources and Taxation." The relevant pages are attached as Appendix A.

The State's concern with money is not narrowly centered on lease-hold income but includes tax revenues of course. On the minus side, there will be associated public costs with increased economic activity. An exclusive or unbalanced attention to either the revenues or the costs without the other will always be misleading. It is the

net balance of advantage that we seek to maximize. This should provide a reasonable basis for compromise between the advocates of growth on the one hand and restraint on the other.

While leasing policy should help to protect State revenues, the State has minimal interests in protecting federal revenues from oil and gas. Since the federal rate is much higher than the State rate, especially after the Multistate Tax Compact (MTC) sharing formula is applied, leasing policy may often achieve a net increase of State revenues by being bent to consider the foibles of federal tax law applied to oil and gas, a law which the State follows. Much as we may deplore the peculiar federal tax treatment of income from oil and gas, there seems little reason for the State in its capacity as a landlord to conduct its affairs so as to maximize federal taxation of lessees where that would cut into State revenues from its property.

2. Equity

There is a strong feeling that the distribution of benefits from oil and gas production in Alaska should be equitable. Equitable does not mean equal although there is some suggestion of that in it and it might be more equal than now. There is support for the productivity theory of distribution, however. This means that rewards should be shared in relation to productive contributions rather than other factors like luck of the draw and the weight of superior wealth accumulated in the past.

Tolerance of gambling and the lottery principle has not altogether died. There are residuals of it in the lottery system for allocating noncompetitive leases which are filed on "simultaneously," that is, within one 30-day period, and of course there are lottery elements in the bonus-bidding system. There is a growing interest, however, in shifting from Lady Luck to productivity as a basis for distributing wealth. This is a corollary of a desire for greater equality since productivity is usually more equally distributed than luck, and certainly moreso than accumulated wealth. The Alaska attitude is Jeffersonian: "...there is a natural aristocracy among men. The grounds of this are virtue and talent....There is also an artificial aristocracy, founded on wealth and birth, without either virtue or talent....The natural aristocracy I consider the most precious gift of nature, for the instruction, the trust, and the government of society."

The implication of this is that we should seek to identify and measure that value which belongs to the State, that is the rent of

land, and then collect it. At the same time we leave to lessees all the other values, the ones which they create. Jefferson continued, "What is needed is a wise and frugal government, which shall restrain men from injuring one another, which shall leave them otherwise free to regulate their own pursuits of industry and improvement, and shall not take from the mouth of labor the bread it has earned."

As a happy corollary, if we succeed in this we will protect necessary incentives to the industry and other lessees. A skillful system of discriminating rent collection will leave more incentive to lessees than a blunt instrument such as a royalty accomplishes. A rent-collecting device will take more from the flush deposits in their flush years and less or none from the marginal deposits, leaving incentives unimpaired.

Collecting rent will, to be sure, reduce certain kinds of incentives but these are ones that should be reduced in the interests of efficiency. Resource economists have repeatedly observed that the failure of landlords to collect rent results in overstimulation of resource use by interlopers, resulting in the dissipation of rent, as on the open sea fishery, or an open range. In such a case, reducing incentives is a good thing. It is not enough for incentives to be large; they should motivate people to allocate resources productively.

The prevailing concept of equity also implies that rewards should be related to ability and application more than to the weight of accumulated wealth. In practice this amounts to a suspicion that the present bonus-bidding system with its high requirements for money up

front is filtering out large numbers of potential lessees whose productivity might be high but whose accumulated wealth is low.

A corollary concept here is that reducing the bonus money screen would increase the number of competitive bidders. This, if properly handled, should allow the State to increase its revenues.

3. Practicality

Alaska has traditionally operated with a minimal bureaucracy. While it is increasingly recognized that some additional staff may be very productive, beginning from this low base, there is a presumption against any proposed system that presupposes a large and elaborate and expensive bureaucracy. It is also desirable that there be a low burden of compliance in the form of paper work imposed on lessees and that minimum policing be entailed.

Alaskans have traditionally left considerable latitude of judgment to their higher public officials as well as to technical specialists like reservoir engineers. There is a growing interest in stating objective criteria for these persons to follow, minimizing the burden of judgment and making it easier to evaluate the performance of individuals.

A practical system will be as automatic as possible, minimizing direct regulations and controls which are required when people have to be forced to go against what they perceive to be their economic interests. This is accomplished by drawing leases so as to bind the contracting parties in an identity of interests. The lease should make

the interests of the lessee as nearly as possible identical with those of the State, so he is moved to act in the State's interest by economic incentives rather than orders controlling his rate of production, work commitments, spacing, diligence, and so on.

A very simple system like a royalty system without other features might seem to avoid many problems, but in fact has the shortcoming of involving the lessor in extensive direct regulation in order to offset the disincentive effects of the high royalty rate. A profit share system, allowing for extensive deduction of costs by the lessee, precludes such direct regulations but on the other hand requires extensive audit of expenditures. A rental which is proportional to the appraised value of reserves like the Alaska Reserves Tax avoids the foregoing sets of problems but requires personnel with the ability to place a value on reserves. It is hardly possible to avoid demands for additional personnel under any system designed to protect the interests of the State. It will be a question of determining which system is least costly and most effective to administer.

4. Avoiding economic waste

There is a new and explicit concern with avoiding "economic waste." This is quite a change from and quite an improvement over the prevailing concepts which are limited to preventing "physical waste." The State presently legislates against various kinds of physical waste, for example against flaring and venting gas; against producing from "rate sensitive" reservoirs too fast to maximize "ultimate recovery." In this legislation waste is perceived only in concrete, materialistic terms.

Any subsidy to the industry tends to prevent the "physical waste" of not producing submarginal oil and gas. The State has extended a few such subsidies such as a tax holiday to a pipeline in Cook Inlet. Nonuniformity in taxation is a sort of subsidy to those taxed less, and the term "tax subsidy" is commonly applied to it nowadays. Federal income tax law traditionally extends enormous tax subsidies to the oil and gas industry through preferential treatment. The State has followed along by adopting the federal tax law and in addition has joined the Multistate Tax Compact (MTC) whose allocation formulas minimize State tax revenues from oil and gas. The attitude might perhaps by summed up as "as much as possible, as early as possible."

Producing subeconomic reserves entails not only the economic waste of the excess of costs over revenues, there is also the waste of selling the reserves when they are cheap, instead of later when they probably will have become dear. Our initial criterion of maximizing Discounted Cash Flow (DCF) would tell us to hang on to reserves as long as their value was growing faster than money in the bank.

Past policy in administration has been disposed to take an "infant industry" posture towards oil and gas. Raising money or maximizing State wealth has been secondary to attracting activity and capital. Lease sales have occurred at the initiative of industry nominations more than the State's, with the State not much disposed to hold back for the best price. Encouraging and establishing the industry was ipso facto a good thing.

A policy of leasing on demand will undoubtedly stimulate early exploration which will result in locating deposits that might otherwise not be produced, at least for a while. This might be construed as minimizing physical waste -- the waste of not finding something. There has been little concern about the economic waste inherent in premature and duplicative preleasing exploratory investments. In an earlier phase this was carried to even greater extremes when noncompetitive leases were issued. But leasing on demand at the rather low prices that have been received is only a halfway step between noncompetitive leasing of the free entry, first-come first-served, variety and an economical system which would maximize the discounted cash flow of the State.

As to duplication of effort, this is generally rationalized on the grounds that a second explorer might use a different concept from the first and therefore find something overlooked by the first. That is beautiful so long as cost is no object, but it is really no substitute for a benefit cost analysis that would at least purport to tell us how the cost of a second pass at the shot lines relates to its probability of success.

In regulating field production the concept of maximum efficient rate (MER) has been accepted rather uncritically with the thought that itmust be good to maximize ultimate recovery. MER has been accepted not for what might be the legitimate reason that prices are rising or the partly legitimate reason that it requires fewer wells and that saves capital, but rather almost entirely on the grounds that faster flow might cause physical waste. In this case the goal "as early as possible" clashes with the goal "as much as possible" and the latter wins.

The net result of overstimulating preleasing investigation, and decelerating production, is to attract lots of capital into the industry and slow down the rate of recovery. Capital requires to be paid for every year that it is tied up without being recovered. This payment necessarily detracts from the surplus that remains to be captured by the State. This is a kind of economic waste which I believe the State would like to learn to avoid. It dissipates rent.

The traditional conservationist feeling in favor of wide spacing developed at a time when the land surface was subdivided into small private properties, smaller than most oil-bearing structures, so that some offset was needed. The result today is rather one-sided preaching for the benefits of wide spacing without due note of its costs. Such preaching, which is widespread in the literature of this business, also suggests more solicitude for lessees than lessors because the interest of lessors is generally to have lessees apply more capital rather than less, where royalty is being charged. This bias is understandable in an industry where lessees have traditionally dominated lessors by virtue of being larger and fewer; and lessees' agents have written the books.

Where there is a high royalty rate the lessor's interest is to see prompt in-filling at high density. The lessee, on the other hand, might prefer to invest capital by stepping out to someone else's land while dawdling on this.

There is a growing awareness in the State that exclusive preoccupation with physical waste is a one-track goal which lacks adequate

balancing of benefits against the costs of achieving them. There should be an equal awareness that the problem of one-track goals is not peculiar to oil and gas. Specialists in any resource or activity become interested parties and tend to overvalue it and undervalue the costs of promoting it -- since costs represent a sacrifice of the interests of specialists in other resources and activities. This is a universal problem in an over-specialized world.

Legislators are called on to be generalists, arbitrating among the claims of competing specialists. There is no suggestion here that oil and gas interests are better at this game than other specialists, that their technical inside language is more obscure or intimidating than that used in other professions, or that their high "standards" are more unreasonable than those imposed by other groups of whom we could all supply examples. Focusing on "physical waste" is an overpleading technique not peculiar to the oil and gas industry. We bear down on oil and gas here because it is our subject matter and not because it is outstandingly bad. No industry or profession has any monopoly on self-serving, special pleading, and careerism.

Economic waste occurs whenever we prevent physical waste at a cost higher than the value of the oil saved. This would be simple enough to see and correct if all costs were present costs and all production flows occurred right away. The problem is more subtle because it usually involves the factor of time and therefore questions of capital and compound interest. Some major economic wastes of timing are described in what follows. Please note that I speak not only of what has been and

what is but also of what might be if we adopt certain alternative leasing policies that have been proposed.

a. Slow use of proven reserves

Slow production occurs if the State requires it through MER regulation or if it simply fails to build a fire under lessees whose cost of waiting is virtually nil when there is no substantial delay rental, and who might be "stepping out" with other leases which preoccupy them from attending to this one. Not maximizing DCF means ignoring the cost of interest -- first, the cost of drilling wells and equipping the lease and, second, the holding cost of the unproduced reserves. To schedule production this way is the same as assuming that no profit is required on investments, an assumption inconsistent with the idea usually accepted that some very high rate of return is required in order to interest lessees in taking a lease. This paradox is too often resolved by sloughing the cost onto the State in the form of lower bids for leases, from which lower base the lessee can still earn a good rate of return. This clearly is a bad resolution for the State.

The MER standard developed historically as a reaction to the rule of capture and has had at times a useful history therefore, leanding some aura of engineering "authority" to restrictions on production. But it became abused and harnessed to the purpose of helping rationalize price maintenance restrictions; and then it became habitual and traditional, applied in a rote way. It is not appropriate to Alaska today. It can easily become another case of a fixed professional "standard" applied without regard to circumstance or cost, forgetting

that "cost" means more than money. It means an invasion of the standards of other professions and other people who have to make the economic sacrifice.

b. Premature investment

We noted above how a noncompetitive claim-staking system based on priority of claim leads to premature and duplicative investment; and that a system of leasing upon industry demand or nomination halfway resembles a simple claim-staking system. The result is to sink too much capital too soon in the initial phases of exploration, proving up, social infrastructure, equipping leases, mobilizing support facilities, and so on. Money at 10 percent doubles every seven years. Money at 20 percent doubles every four years. To advance investment by a few years, therefore, is the same as doubling the costs.

But as well as neglecting cost-- and often more serious -- premature investment neglects price, the price of the product reflected in the price of the lease. The lessees who buy early aren't neglecting it for they can ride up the escalator, having obtained a lease and being under little pressure to produce quickly. It is the State that is neglecting price when it sells leases too soon at too low a figure. It then plays the lessees' game if it permits or, worse, requires them to produce slowly and at the same time encourages them to go out and acquire more leases.

There should be no implication that the State should hold onto its unsold leases indefinitely, waiting for the top dollar. To everything there is a season and a time for every purpose. The criterion

of maximizing DCF is in keeping with the wisdom of Ecclesiastes for it tells us exactly the best time to sell, namely when the anticipated selling proceeds stop growing faster than money in the bank. Early sale may waste the resource by releasing it for a low price. Later sale may conserve the resource but waste the capital tied up in it. Optimal timing balances the two considerations.

Some things are happening too soon and others are happening too late. Is this just random confusion with no pattern? No, there is a pattern which may be summarized as slow recovery of capital. Capital is put in too soon and taken out too late. The cost of all those extra dollar years of capital time is borne by the State.

A waste imposed by slow turnover is loss of flexibility and adaptability. Each time capital is recovered and replaced it may be brought up to date with new technological developments. The advantage of flexibility is perhaps most obvious in respect to contractual commitments. "Old" gas may be subject to Federal Power Commission (FPC) regulation and tied to a particular pipeline, or it may in any event be under a long-term contract. In an inflationary period there is always an advantage of bringing new supplies on the market at new prices.

There are also more fundamental reasons not dependent on inflation. I have analyzed these in the work already cited and append the relevant pages as Appendix B.

Another route to understating costs is to accept the plea of those with an interest in supplying oil fields that one man's cost is another man's income and therefore to cancel these out. The result of

heeding these arguments is to conceive of benefits in gross rather than net terms. This almost always results in premature development inasmuch as the gross value of a resource is not only greater than the net value but it is positive during that early period when the net value is negative. This kind of argument can be carried even farther by some "economic base" analysts who compute "multipliers" of still more extended benefits proliferating downstream and upstream and sidestream from the resource development, all being dependent on it. If there is much unemployed labor and idle industrial capacity such a case might sometimes be made. In Alaska, which imports labor and oil field materials and steel, there seems little basis for it.

Unfortunately, economic development which is sought after by some and shunned by others is defined by none. This leaves the door open to considerable uncertainty. The extreme prodevelopment posture is that resource discovery creates value and then provides an economic base for mutiple benefits all around. Current thinking seems to be moving away from this. Discovery does not create value all alone. It is a cash-register payoff from the larger development of infrastructure, community support facilities, and so on. All activities are mutually supportive, discovery no more so than others, and the other contributors need support, too. The new emphasis on the problems of community impact is some acknowledgement of this.

It is not surprising that people who see mainly the costs of development and disregard the benefits are disposed to wait a longer time before permitting it to take place. They, too, may get carried

away and overstate their position, becoming like Oscar Wilde's crabbed economist who "knew the cost of everything and the value of nothing." In this Report we will not try to resolve these complex and extended issues, but treat the question of multipliers and extended benefits and costs as something of a standoff, except where very specific external costs or benefits may be identified and measured.

Another economic waste to guard against is "cross-subsidy." This is a generic term for what occurs whenever accounts are consolidated and costs are deductible so that high-cost and losing ventures may be rolled in with low-cost and winning ventures. Cross-subsidy is a hazard in every profit-sharing scheme such as the corporate income tax, and it would be a hazard in any profit-sharing lease resembling the corporate income tax. It is a hazard in any lease that resembles utility rate regulation where a lessee is guaranteed a rate of return. The resulting overinvestment of capital is known in the trade as "goldplating," or more formally as the "Averch-Johnson effect."

Goldplating today might often take the seductive form of an excessive lack of resistence to the claims of some worthy cause like environmentalism. The caribou lobby specialists may overvalue that, the energy specialists may overvalue energy but they can join forces in undervaluing the costs of having both, the costs being shifted to others.

Perhaps the commonest manifestation of cross-subsidy is the overextension of subeconomic feeder lines. This is nearly universal elsewhere and will undoubtedly happen here without vigorous efforts to prevent it.

When we combine this pattern of waste with the pattern of improper timing described earlier, they tend to reinforce each other in a general pattern of overdecentralization. Too much capital is applied too early to expand exploration and allied transportation lines. Too little is applied and too late to more intensive development in and around proven reserves. The overall pattern has much in common with imperialism. All of this can be avoided by hewing faithfully to the concept of businesslike management with maximum DCF. That will be our lodestar.

5. External impacts

To allow for the externalities of oil and gas production both positive and negative the State seems evenly divided between those who perceive more pluses than those who perceive more minuses.[7] This is appropriate since there are both kinds. The issue between the polarized parties is sharper, however, than can be resolved by such devices as measuring the value of the sports fishery, for example, and trading off these values for equivalent energy values because some of the very things seen as positive by some like added payrolls, added spending, and increased property values seem negative to others. Change viewed as progress by some is seen as retrogression by others. To measure and then reconcile these attitudes would be far beyond our scope.

We need not, however, leave the matter completely unresolved. A key to reconciliation is in the distribution of gains and losses. There are probably more gains than losses from general economic development since the actors reinforce one another, but the gains are not equally distributed. One man's windfall is another man's wipeout. Many gains are