

Chukchi Sea Play 6: Sadlerochit Gp.-Arctic Platform

Geological Assessment

GRASP UAI: AAAAA DAG

Play Area: 9,298 square miles

Play Water Depth Range: 90-165 feet

Play Depth Range: 3,600-14,200 feet

Play Exploration Chance: 0.081

Play 6, Sadlerochit Gp.-Arctic Platform, Chukchi Sea OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil & Gas			
Assessment Results as of November 2005			
Resource Commodity (Units)	Resources *		
	F95	Mean	F05
BOE (Mmboe)	0	1,573	4,933
Total Gas (Tcfg)	0.000	4.672	15.413
Total Liquids (Mmbo)	0	741	2,191
Free Gas** (Tcfg)	0.000	3.719	12.755
Solution Gas (Tcfg)	0.000	0.953	2.658
Oil (Mmbo)	0	539	1,513
Condensate (Mmbc)	0	202	678

* Risked, Technically-Recoverable
 ** Free Gas Includes Gas Cap and Non-Associated Gas
 F95 = 95% chance that resources will equal or exceed the given quantity
 F05 = 5% chance that resources will equal or exceed the given quantity
 BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas
 Mmb = millions of barrels
 Tcf = trillions of cubic feet

Table 1

Play 6, the “Sadlerochit Group-Arctic Platform” play, is the 6th-ranking play (of 29 plays) in the Chukchi Sea OCS Planning Area, with 5.4% (1,573 Mmboe) of the Planning Area energy endowment (29,041 Mmboe). The overall assessment results for play 6 are shown in [table 1](#). Oil and gas-condensate liquids form 47% of the hydrocarbon energy endowment of play 6.

[Table 5](#) reports the detailed assessment results by commodity for play 6.

[Table 3](#) summarizes the volumetric input data developed for the GRASP computer model of Chukchi Sea play 6. [Table 4](#) reports the risk model used for play 6. The location of play 6 is shown in [figure 1](#).

The reservoir objectives of play 6 primarily include marginal to shallow marine sandstones that were deposited on the south-facing shelf that existed on the Arctic platform from Late Permian to Jurassic time.

Triassic sandstones of the Sadlerochit Group are the primary targets, but reservoir sandstones like the Sag River or Simpson sandstones found onshore may also occur in Jurassic strata. Diamond well, offshore on the east flank of Hanna trough, encountered over 500 feet of potential reservoir strata that are correlative to the Permian Echooka Formation at the base of the Sadlerochit Group. Primary trap styles include stratigraphic wedges and fault traps, with hydrocarbons migrating northward into traps from the Hanna trough play charging system to the south. A prospect in play 6 was tested by Diamond well, which encountered trace oil shows in sandstones of the Ivishak and Echooka Formations. At Barrow, gas production is occurring from Lower Jurassic (“Barrow”) sandstones that are apparently unique to the Barrow area.¹ Several wells

¹ *Within the stratigraphic convention used here, the “Barrow” sandstones at the base of the Lower Kingak Formation would be grouped with the Upper Ellesmerian play sequence. In the Beaufort Sea and northern Alaska, the “Barrow” sandstones are grouped with the Rift or “Beaufortian”*

in northwestern Alaska outside the Barrow area penetrated the parts of the play sequence that extend offshore, but encountered no pooled hydrocarbons.

A maximum of 23 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 6. These 23 pools range in mean conditional (un-risked) recoverable volumes from 31 Mmboe (pool rank 23) to 1,276 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 273 Mmboe (F95) to 3,355 Mmboe (F05). [Table 2](#) shows the conditional sizes of the 10 largest pools in play 6.

for size. These simulation pools can be grouped according to the USGS size class system in which sizes double with each successive class. Pool size class 13 contains the largest share (10,876, or 25%) of simulation pools (conditional, technically recoverable BOE resources) for play 6. Pool size class 13 ranges from 512 to 1,024 Mmboe. The largest 9 simulation pools for play 6 fall within pool size class 19, which ranges in size from 8,192 to 16,384 Mmboe. [Table 6](#) reports statistics for the simulation pools developed in the *GRASP* computer model for play 6.

Play 6, Sadlerochit Gp.-Arctic Platform, Chukchi Sea OCS Planning Area, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools			
Assessment Results as of November 2005			
Pool Rank	BOE Resources *		
	F95	Mean	F05
1	273	1276	3355
2	148	553	121
3	89	357	775
4	59	254	555
5	43	191	423
6	34	151	337
7	28	123	275
8	24	104	233
9	21	90	200
10	19	79	175

* Conditional, Technically-Recoverable, Millions of Barrels Energy-Equivalent (Mmboe), from "PSRK.out" file
 F95 = 95% chance that resources will equal or exceed the given quantity
 F05 = 5% chance that resources will equal or exceed the given quantity
 BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas

Table 2

In the computer simulation for play 6 a total of 43,471 “simulation pools” were sampled

sequence

GRASP Play Data Form (Minerals Management Service-Alaska Regional Office)

Basin: Chukchi Sea Planning Area
 Play Number: 06
 Play UAI Number: AAAAA DAG

Assessor: K.W. Sherwood
 Play Name: Sadlerochit Gp.- Arctic Platform

Date: January 2005

Play Area: mi² (million acres) 9,298 (5.951)
 Reservoir Thermal Maturity: % Ro 0.67-1.52

Play Depth Range: feet 3,600 - 14,200 (mean = 10,400)
 Expected Oil Gravity: ° API 30
 Play Water Depth Range: feet 90 - 165 (mean = 140)

POOLS Module (Volumes of Pools, Acre-Feet)

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Prospect Area (acres)-Model Input*	1700		2696		8731	13292/15259			28272				128783
Prospect Area (acres)-Model Output**	1705	2467	3112	5051	9109	13482/13608	16671	23044	28028	39022			125208
Fill Fraction (Fraction of Area Filled)	0.18	0.30	0.32	0.37	0.43	0.44/0.10	0.49	0.54	0.57	0.62			1.00
Productive Area of Pool (acres)***	460	1009	1305	2160	3883	5915/6309	7234	10041	12809	17567	23000	26000	68672
Pay Thickness (feet)	20	122	136	163	200	209/64	245	273	294	327	370	401	700

* model fit to prospect area data in BESTFIT

** output from @RISK after aggregation with fill fraction

*** from @RISK aggregation of probability distributions for prospect area and fill fraction

MPRO Module (Numbers of Pools)

Input Play Level Chance	0.6	Prospect Level Chance	0.135	Exploration Chance	0.081
Output Play Level Chance*	0.5994				

* First Occurrence of Non Zero Pools As Reported in PSUM Module

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		Seal Integrity (stratigraphic traps and down-side fault traps)	0.6
		Chance Porosity > 10%	0.45
0.6		Migration (Diamond well barren of significant hydrocarbons)	
		Reservoir Presence (shale-out into marine facies?)	0.5

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	40	43	45	49	53	53.69/6.40	57	60	62	63	66	69	80
Numbers of Pools in Play					5	4.35/4.10	8	9	10	11	12	13	23

Zero Pools at F59.96

Minimum Number of Pools	4 (F55)	Mean Number of Pools	4.35	Maximum Number of Pools	23
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POOLS/PSRK/PSUM Modules (Play Resources)

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	38	89	103	132	180	211/116	253	314	360	441	520	580	1033
Gas Recovery Factor (Mcf/acre-foot)	229	671	758	940	1203	1320/550	1572	1839	2022	2375	2800	3050	5564
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	450	1250	1350	1550	1750	1762/374	2000	2150	2200	2350	2450	2550	3100
Condensate Yield ((bbl/Mmcf)	13	29	33	40	50	54/19	64	72	79	90	105	120	200

Pool Size Distribution Statistics from POOLS (1,000 BOE): μ (mu)= 12.266 σ^2 (sigma squared)= 1.118 Random Number Generator Seed= 428408

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0.4
Probability Any Pool is 100% Oil	0.2	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.3
Probability Any Pool is 100% Gas	0.4		

Table 3. Input data for Chukchi Sea play 6, 2006 assessment.

GRASP - Geologic and Economic Resource Assessment Model - PSUM Module Results

Minerals Management Service - Alaska OCS Region
 GRASP Model Version: 8.29.2005)
 Computes the Geologic Resource Potential of the Play

Play UAI: AAAAADAG **Play No. 6**

World Level - World Level Resources
 Country Level - UNITED STATES OF AMERICA
 Region Level - MMS - ALASKA REGION
 Basin Level - **CHUKCHI SEA SHELF**
Play Level - Play 6 Sadlerochit Gp. - Arctic Platform
 Geologist Kirk W. Sherwood
 Remarks 2005 Assessment
 Run Date & Time: Date 19-Sep-05 Time 13:52:51

Summary of Play Potential

Product	MEAN	Standard Deviation
BOE (Mboe)	1,572,700	1,808,700
Oil (Mbo)	538,970	743,260
Condensate (Mbc)	202,320	281,570
Free (Gas Cap & Nonassociated) Gas (Mmcf)	3,719,200	4,833,600
Solution Gas (Mmcf)	953,130	1,343,900

10000 (Number of Trials in Sample)
 0.5994 (MPhc [Probability] of First Occurrence of Non-Zero Resource)
 Windowing Feature: used

Empirical Probability Distributions of the Products

Greater Than Percentage	BOE (Mboe)	Oil (Mbo)	Condensate (Mbc)	Free (Gas Cap & Nonassociated) Gas (Mmcf)	Solution Gas (Mmcf)
100	0	0	0	0	0
99.99	0	0	0	0	0
99	0	0	0	0	0
95	0	0	0	0	0
90	0	0	0	0	0
85	0	0	0	0	0
80	0	0	0	0	0
75	0	0	0	0	0
70	0	0	0	0	0
65	0	0	0	0	0
60	67,698	22,913	8,880	161,480	40,312
55	845,170	281,260	109,800	2,068,600	483,450
50	1,182,700	425,340	143,560	2,706,000	743,680
45	1,462,600	512,180	179,700	3,407,400	923,770
40	1,730,900	617,650	210,650	3,999,300	1,073,300
35	2,007,300	649,730	268,330	4,981,500	1,140,100
30	2,305,900	846,810	262,520	5,231,500	1,493,100
25	2,613,700	838,810	360,160	6,488,300	1,462,400
20	2,976,200	1,144,100	354,450	6,284,200	2,020,000
15	3,394,500	1,159,600	437,160	8,078,600	2,024,900
10	3,964,700	1,306,000	521,110	9,674,800	2,338,100
8	4,274,000	1,498,500	535,250	9,867,100	2,722,900
6	4,684,200	1,621,600	589,820	10,952,000	2,944,900
5	4,933,100	1,513,000	677,640	12,755,000	2,658,000
4	5,222,300	1,832,300	671,420	11,994,000	3,284,600
2	6,261,500	1,944,100	872,170	15,895,000	3,467,400
1	7,388,300	2,585,400	971,500	16,983,000	4,549,400
0.1	11,995,000	7,936,000	278,680	6,565,900	14,678,000
0.01	15,712,000	9,214,800	702,060	10,778,000	21,793,000
0.001	15,830,000	2,501,100	4,135,300	46,425,000	5,244,200

Table 5. Assessment results by commodity for Chukchi Sea play 6, 2006 assessment.

Basin: CHUKCHI SEA SHELF Play 06 - Sadlerochit - Arctic Platform UAI Key: AAAAADAG				Model Simulation "Pools" Reported by "Fieldsize.out" GRASP Module																	
Classification and Size				Pool Count Statistics			Pool Types Count		Mixed Pool Range		Oil Pool Range		Gas Pool Range		Total Pool Range		Pool Resource Statistics (MMBOE)				
Class	Min (MMBOE)	Max (MMBOE)	Pool Count	Percentage	Trial Average	Trials w/Pool Avg	Mixed Pool	Oil Pool	Gas Pool	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Total Resource	Average Resource
1	0.0312	0.0625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
2	0.0625	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
3	0.125	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
4	0.25	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
5	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
6	1	2	1	0.0023	0.0001	0.000167	1	0	0	1	1	0	0	0	0	0	1	1	1	1.938586	1.938586
7	2	4	6	0.013802	0.0006	0.001001	0	4	2	0	0	1	1	1	1	1	1	1	3.225993	3.884508	
8	4	8	63	0.144924	0.0063	0.010509	20	18	25	1	1	1	1	1	1	1	1	1	4.010233	7.975090	
9	8	16	289	0.664811	0.0289	0.048207	105	86	98	1	2	1	1	1	1	1	1	2	8.034994	15.987867	
10	16	32	1352	3.110119	0.1352	0.225521	507	345	500	1	2	1	3	1	2	1	3	2	16.034216	31.979266	
11	32	64	3964	9.118723	0.3964	0.661218	1576	912	1476	1	4	1	4	1	4	1	5	1	32.003757	63.985408	
12	64	128	8368	19.249615	0.8368	1.39583	3380	1761	3227	1	5	1	4	1	5	1	7	1	64.020120	127.995445	
13	128	256	10876	25.018978	1.0876	1.814178	4403	2124	4349	1	5	1	4	1	5	1	10	1	128.010556	255.986460	
14	256	512	9826	22.603575	0.9826	1.639032	4011	1823	3992	1	6	1	4	1	5	1	8	1	256.003283	511.918276	
15	512	1024	5930	13.641278	0.593	0.989158	2282	1143	2505	1	4	1	3	1	5	1	7	1	512.087065	1023.642000	
16	1024	2048	2184	5.024039	0.2184	0.364304	820	373	991	1	3	1	2	1	3	1	5	1	1024.313000	2046.455000	
17	2048	4096	512	1.177797	0.0512	0.085405	194	99	219	1	3	1	2	1	2	1	3	1	2048.735000	4069.599000	
18	4096	8192	91	0.209335	0.0091	0.015179	23	17	51	1	2	1	1	1	1	1	2	1	4102.351000	7462.063000	
19	8192	16384	9	0.020703	0.0009	0.001501	4	2	3	1	1	1	1	1	1	1	1	1	8297.824000	12571.761000	
20	16384	32768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	
21	32768	65536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	
22	65536	131072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	
23	131072	262144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	
24	262144	524288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	
25	524288	1048576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	
Not Classified			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
Totals			43471	100.000008	4.3471	7.251209	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000
Below Class							0	0	0											0.000000	0.000000
Above Class							0	0	0											0.000000	0.000000

Number of Pools not Classified: 0	Min and Max refer to numbers of pools of the relevant size class that occur within any single trial in the simulation.	Min and Max refer to aggregate resources of the relevant size class that occur within any single trial in the simulation.
Number of Pools below Class 1: 0		
Number of Trials with Pools: 5995		

Table 6. Statistics for simulation pools created in computer sampling run for Chukchi Sea play 6, 2006 assessment.

