Gulf of Alaska Play 1: Middleton Fold and Thrust Belt Play

Geological Assessment

GRASP UAI: AAAAA EAB
Play Area: 6,350 square miles
Play Water Depth Range: 100-700 feet
Play Depth Range: 3,000-15,000 feet
Play Exploration Chance: 0.0864

Play 1, Middleton Fold and Thrust Belt, Gulf of Alaska 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	87	367
Total Gas (Tcfg)	0.000	0.412	1.750
Total Liquids (Mmbo)	0	13	55
Free Gas** (Tcfg)	0.000	0.411	1.743
Solution Gas (Tcfg)	0.000	0.002	0.007
Oil (Mmbo)	0	1	6
Condensate (Mmbc)	0	12	50

** 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 1, the "Middleton Fold and Thrust Belt" play, is the least significant play (of six plays), in the Gulf of Alaska OCS Planning Area, with 6% (87 Mmboe) of the Planning Area energy endowment (1,454 Mmboe). The overall assessment results for play 1 are shown in table 1. Oil and gas-condensate liquids form 15% of the hydrocarbon energy endowment of the play. Table 5 reports the detailed assessment results by commodity for play 1.

Table 3 summarizes the volumetric input data developed for the *GRASP* computer model of Gulf of Alaska play 1. Table 4 reports the risk model used for play 1. The location of play 1 is shown in figure 1.

Play 1 encompasses the offshore area extending west from the Kayak zone to approximately 149 degrees W. longitude. Traps are primarily asymmetric anticlinal closures formed on the upthrown sides of high-angle thrust or reverse faults during the late Neogene to Pleistocene. Reservoir objectives consist of: 1) sandstones in the lower part of the glaciomarine, late Miocene to Pleistocene Yakataga Formation; and 2) sandstones locally developed in the underlying Oligocene to early Miocene Sitkinak Formation equivalent.

There are two potential source rock sequences in this play: 1) marginally-mature to thermally-immature Oligocene to Miocene strata equivalent to the Sitkinak Formation of Kodiak Island; and 2) thermally mature Eocene strata equivalent to the Sitkalidak Formation of Kodiak Island. Both formations consist of deltaic to nonmarine sequences characterized by poor to marginal organic richness and gas-prone kerogen. The Tenneco Middleton Island State No. 1 well tested a structure in this play without recovering producible hydrocarbons.

A maximum of 26 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 1.

These 26 pools range in mean conditional (un-risked) recoverable volumes from 0.43 Mmboe (pool rank 26) to 148 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 9 Mmboe (F95) to 526 Mmboe (F05), or in a gas case from 0.05 (F95) to 2.956 Tcfge (F05). Table 2 shows the conditional sizes of the 10 largest pools in play 1.

Play 1, Middleton Fold and Thrust Belt, Gulf of Alaska 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	9	148	526
2	3.7	35	100
3	1.73	17	51
4	0.96	11	31
5	0.62	7	21
6	0.45	5	15
7	0.35	3.9	11
8	0.29	3.1	9
9	0.25	2.5	7
10	0.22	2.1	6

** 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 1 a total of 33,128 "simulation pools" were sampled 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 8 contains the largest share (5,776, or 17%) of simulation pools (conditional, technically recoverable BOE resources) for play 1. Pool size class 8 ranges from 4 to 8 Mmboe. The largest simulation pool for play 1 falls within pool size class 18, which ranges in size from 4,096 to 8,192 Mmboe (or 23 to 46 Tcfge). Table 6 reports statistics for the simulation pools developed in the *GRASP* computer model for play 1.

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

Basin: Gulf of Alaska
Play Number: 1
Play UAI Number: AAAAAEAB

Assessor: Comer / Larson
Play Name: Middleton Fold and Thrust Belt

Date: March, 2005

Play Area (mi^2; millions of acres): 6,350 mi^2, 4.064 million acres
Reservoir Thermal Maturity, % Ro: 0.3 - 0.7

Play Depth Range, feet: 3,000 - 8,000 - 15,000
Expected Oil Gravity, ^{o} API: 35
Play Water Depth Range, feet: 100 - 300 - 700
Prospect Distance from shore, miles: 16 - 28 - 42

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	0				7290	~~~					64400		~
Prospect Area (acres)-Model Output	140	1273	1872	3564	7290	12796 / 18460	14910	21888	28388	41736	64400	85995	96000
Fill Fraction (Fraction of Area Filled)	0.03	0.06	0.08	0.1	0.15	.17307 / .099617	0.22	0.26	0.3	0.36	0.45	0.52	0.7
Productive Area of Pool (acres)	11	143	224	478	1110	2478.34 / 4678.33	2576	4046	5494	8645	14400	20235	57600
Pay Thickness (feet)	5	28	37	59	100	137.301 / 131.204	170	225	273	363	500	619	1844

MPRO Module (Numbers of Pools)

Play Level Chance	0.48	Prospect Level Chance	0.18	Exploration Chance	0.0864

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		[See Risking Sheet]	

Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	17	26	28	32	37	38.34 / 8.36	43	46	49	53	58	61	88
Numbers of Pools in Play	~	~	F47.93 = 0	F45 = 3	F35 = 5	3.31 / 3.96	7	8	9	11	12	13	26

Minimum Number of Pools	0	Mean Number of Pools	3.31	Maximum Number of Pools	26

POOLS/PSRK/PSUM Module (Play Resources)

Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	29	61	69	86	110	117.649 / 44.929	141	160	175	200	232	256	425
Gas Recovery Factor (Mcfg/acre-foot)	46	137	165	227	322	369.939 / 211.075	457	552	627	758	937	1080	2230
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	380	573	650	801	1010	1071.547 / 379.550	1274	1443	1570	1779	2048	2250	2760
Condensate Yield ((bbl/Mmcfg)	11	20	22	25	28	28.534 / 5.669	32	34	36	39	42	44	55

Pool Size Distribution Statistics from *POOLS* (1,000 BOE): **μ (mu) =** 8.92234722 **σ^2 (sigma squared) =** 2.48216030 **Random Number Generator Seed =** 721426

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0.1
Probability Any Pool is 100% Oil	0	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.9
Probability Any Pool is 100% Gas	0.9		

Table 3. Input data for Gulf of Alaska play 1, 2006 assessment.

Risk Analysis Form - 2005 National Assessment

Assessment Province:	Gulf of Alaska	**Play Number, Name:**	1, Middleton Fold & Thrust Belt
Assessor(s):	Comer & Larson	**Play UAI:**	AAAAAEAB
Date:	13-Oct-05		

For each component, a *quantitative* probability of success (i.e., between zero and one, where zero indicates no confidence and one indicates absolute certainty) based on consideration of the *qualitative* assessment of **ALL** elements within the component was assigned. This is the assessment of the probability that the minimum geologic parameter assumptions have been met or exceeded.

			Play Chance Factors	Averge Conditional Prospect Chance[1]
1.	**Hydrocarbon Fill component** (1a * 1b * 1c)	**1**	***0.6000***	***0.4000***
	a. Presence of a Quality, Effective, Mature Source Rock			
	Probability of efficient source rock in terms of the existence of sufficient volume of mature source rock of adequate quality located in the drainage area of the reservoirs.	1a	0.60	1.00
	b. Effective Expulsion and Migration			
	Probability of effective expulsion and migration of hydrocarbons from the source rock to the reservoirs.	1b	1.00	0.40
	c. Preservation			
	Probability of effective retention of hydrocarbons in the prospects after accumulation.	1c	1.00	1.00
2.	**Reservoir component** (2a * 2b)	**2**	***0.8000***	***0.5000***
	a. Presence of reservoir facies			
	Probability of presence of reservoir facies with a minimum net thickness and net/gross ratio (as specified in the resource assessment).	2a	0.80	1.00
	b. Reservoir quality			
	Probability of effectiveness of the reservoir, with respect to minimum effective porosity, and permeability (as specified in the resource assessment).	2b	1.00	0.50
3.	**Trap component** (3a * 3b)	**3**	***1.0000***	***0.9000***
	a. Presence of trap			
	Probability of presence of the trap with a minimum rock volume (as specified in the resource assessment).	3a	1.00	0.90
	b. Effective seal mechanism			
	Probability of effective seal mechanism for the trap.	3b	1.00	1.00
	Overall Play Chance (Marginal Probability of hydrocarbons, MPhc)		***0.4800***	
	(1 * 2 * 3) *Product of All Subjective Play Chance Factors*			
	Average Conditional Prospect Chance[1]			***0.1800***
	(1 * 2 * 3) *Product of All Subjective Conditional Prospect Chance Factors*			
	[1] Assumes that the Play exists (where all play chance factors = 1.0)			
	Must be consistent with play chance and prospect distribution -- See discussion on Page 3 of Guide			
	Exploration Chance		***0.0864***	
	(Product of Overall Play Chance and Average Conditional Prospect Chance)			

Comments: *See guidance document for explanation of the Risk Analysis Form*

Table 4. Risk model for Gulf of Alaska play 1, 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:	**AAAAAEAB**		**Play No.**		**1**	
World	Level	-	World	Level	Resources	
Country	Level	-	UNITED	STATES	OF	AMERICA
Region	Level	-	MMS	-	ALASKA	REGION
Basin	Level	-	**GULF**	**OF**	**ALASKA**	
Play	**Level**	**-**	**Play**		**1**	**Middleton Fold and Thrust Belt**
Geologist	Larson,	Comer				
Remarks	Play		1 Middleton Shelf Fold & Thrust Belt			
Run Date & Time:		Date	19-Sep-05	Time	14:02:47	

Summary of Play Potential

Product	MEAN	Standard Deviation
BOE (Mboe)	86,522	189,650
Oil (Mbo)	1,430	7,627
Condensate (Mbc)	11,747	26,955
Free (Gas Cap & Nonassociated) Gas (Mmcfg)	410,600	898,460
Solution Gas (Mmcfg)	1,603	10,066

10000 (Number of Trials in Sample)

0.4791 (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 (Mmcfg)	Solution Gas (Mmcfg)
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	0	0	0	0	0
55	0	0	0	0	0
50	0	0	0	0	0
45	21,607	464	2,844	102,320	517
40	44,378	898	6,043	209,350	1,036
35	65,283	1,234	8,824	309,010	1,357
30	86,254	1,788	11,523	408,040	1,896
25	110,790	1,827	14,788	527,530	1,748
20	142,590	2,317	19,393	676,730	2,599
15	184,410	2,836	25,026	876,620	3,159
10	243,510	3,111	33,350	1,160,400	3,203
8	277,100	5,028	37,477	1,313,100	5,304
6	331,080	4,357	45,572	1,575,900	4,154
5	366,610	5,744	49,511	1,742,800	7,004
4	408,130	6,663	55,369	1,936,900	8,172
2	572,750	9,762	77,251	2,717,000	12,878
1	809,090	18,145	107,010	3,822,000	21,720
0.1	2,069,200	0	271,180	10,105,000	0
0.01	3,983,600	0	579,900	19,129,000	0
0.001	5,455,500	0	930,050	25,433,000	0

Table 5. Assessment results by commodity for Gulf of Alaska play 1, 2006 assessment.

Basin: GULF OF ALASKA
Play 01 - Middleton Fold and Thrust Belt
UAI Key: AAAAAEAB

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	27	0.081502	0.0027	0.005634		1	0	26	1	1	0	0	1	1	1	1		0.033367	0.061711	1.299220	48.119269
2	0.0625	0.125	116	0.350157	0.0116	0.024207		5	0	111	1	1	0	0	1	1	1	1		0.063897	0.124767	11.232982	96.836053
3	0.125	0.25	355	1.071601	0.0355	0.074082		25	0	330	1	1	0	0	1	2	1	2		0.125012	0.249670	68.413165	192.713141
4	0.25	0.5	930	2.807293	0.093	0.194073		59	0	871	1	1	0	0	1	3	1	3		0.250200	0.498526	348.027286	374.222875
5	0.5	1	1823	5.502898	0.1823	0.380426		135	0	1688	1	2	0	0	1	4	1	4		0.500059	0.999924	1372.856000	753.075182
6	1	2	3376	10.190775	0.3376	0.704508		333	0	3043	1	2	0	0	1	5	1	5		1.000085	1.999905	4979.093000	1.474850
7	2	4	4772	14.404733	0.4772	0.995826		474	0	4298	1	2	0	0	1	8	1	8		2.000038	3.999939	13975.727000	2.928694
8	4	8	5776	17.435402	0.5776	1.205342		578	0	5198	1	3	0	0	1	7	1	9		4.000564	7.999812	33424.093000	5.786720
9	8	16	5597	16.895073	0.5597	1.167988		572	0	5025	1	3	0	0	1	6	1	6		8.001358	15.998551	64309.769000	11.490043
10	16	32	4454	13.44482	0.4454	0.929466		477	0	3977	1	3	0	0	1	5	1	6		16.001223	31.998999	100597.086000	22.585785
11	32	64	3028	9.140305	0.3028	0.631886		317	0	2711	1	3	0	0	1	5	1	7		32.004564	63.993311	134907.390000	44.553299
12	64	128	1716	5.179908	0.1716	0.358097		186	0	1530	1	2	0	0	1	3	1	4		64.006203	127.950527	153472.512000	89.436195
13	128	256	743	2.242816	0.0743	0.15505		83	0	660	1	2	0	0	1	3	1	3		128.070571	255.120673	129896.918000	174.827621
14	256	512	270	0.815021	0.027	0.056344		40	0	230	1	1	0	0	1	2	1	2		256.081551	508.395371	94601.554000	350.376129
15	512	1024	102	0.307897	0.0102	0.021285		15	0	87	1	1	0	0	1	2	1	2		512.371750	1014.310000	69613.872000	682.488953
16	1024	2048	31	0.093576	0.0031	0.006469		5	0	26	1	1	0	0	1	1	1	2		1030.574000	2004.705000	43206.241000	1.393750
17	2048	4096	5	0.015093	0.0005	0.001043		1	0	4	1	1	0	0	1	1	1	1		2107.029000	3679.420000	14978.645000	2.995729
18	4096	8192	1	0.003019	0.0001	0.000209		0	0	1	0	0	0	0	1	1	1	1		5452.881000	5452.881000	5452.881000	5.452880
19	8192	16384	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
20	16384	32768	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
21	32768	65536	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
22	65536	131072	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
23	131072	262144	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
24	262144	524288	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
25	524288	1048576	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
Not Classified			6	0.018112	0.0006	0.001252	Below Class	0	0	6									Below Class	0.021691	0.026144	0.144855	24.142519
		Totals	**33128**	**99.999992**	**3.3128**	**6.913189**	Above Class	0	0	0									Above Class	0.000000	0.000000	0.000000	0.000000

Number of Pools not Classified: 6
Number of Pools below Class 1: 6
Number of Trials with Pools: 4792

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.

Table 6. Statistics for simulation pools created in computer sampling run for Gulf of Alaska play 1, 2006 assessment.

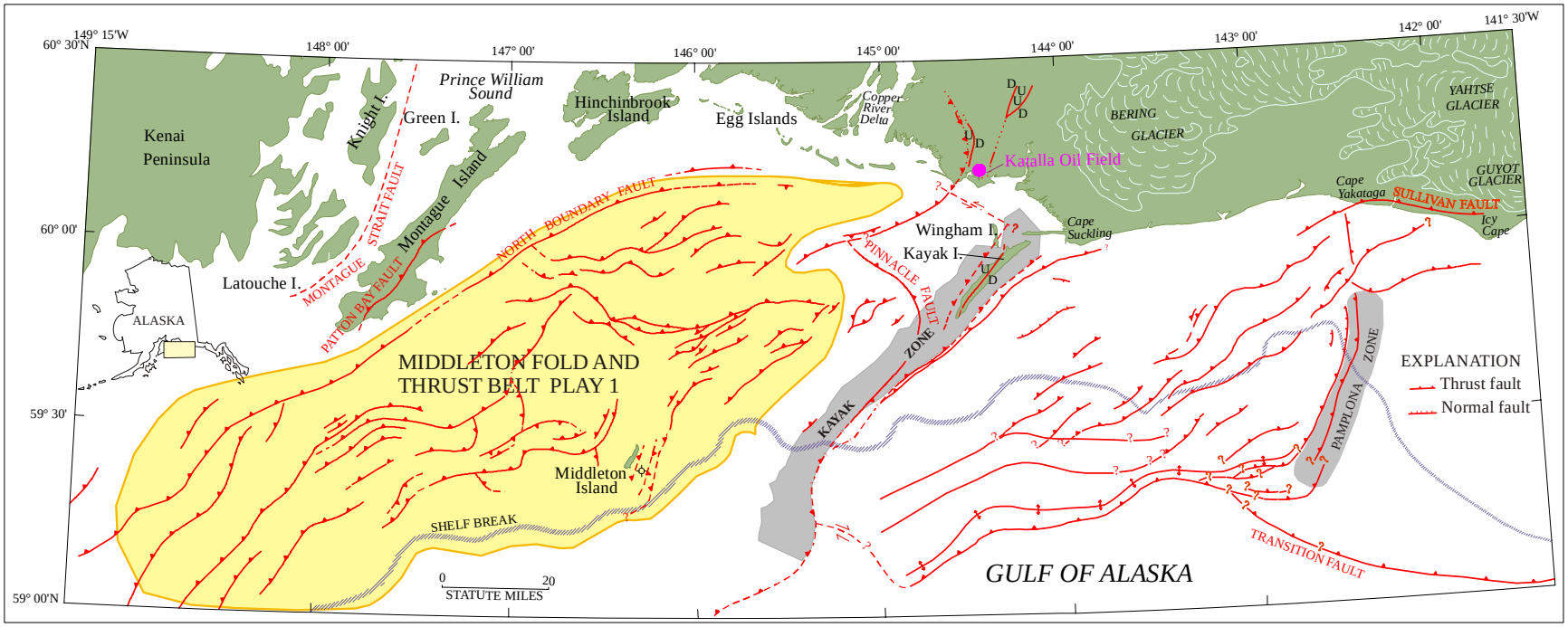

Figure 1. Map location of Gulf of Alaska play 1, 2006 assessment.