# St. George Basin Play 2: South Platform Play

# **Geological Assessment**

<u>GRASP UAI</u>: AAAAAJAC <u>Play Area</u>: 7,950 square miles <u>Play Water Depth Range</u>: 320-535 feet <u>Play Depth Range</u>: 4,125-6,875 feet <u>Play Exploration Chance</u>: 0.125

Play 2, South Platform, St. George Basin OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil & Gas											
Assessment Results as of November 2005											
Resource	Resource Resources *										
(Units)	F95	Mean	F05								
BOE (Mmboe)	0	194	870								
Total Gas (Tcfg)	0.000	0.885	4.086								
Total Liquids (Mmbo)	0	36	143								
Free Gas** (Tcfg)	0.000	0.880	4.074								
Solution Gas 0.000 0.005 0.013											
Oil (Mmbo)	0	14	39								
Condensate (Mmbc)	0	22	104								
* 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 harrels-of-oil-											
equivalent, where 1 b gas	arrel of oil = 5,	620 cubic fee	t of natural								
Mmb = millions of bar Tcf = trillions of cubic	rrels feet										

Table 1

Play 2, the "South Platform" play, is the second most important play (of four plays) in the St. George Basin OCS Planning Area, with 27% (194 Mmboe) of the Planning Area energy endowment (712 Mmboe). The overall assessment results for play 2 are shown in table 1. Oil and gas-condensate liquids form 19% of the hydrocarbon energy endowment of play 2. Table 5 reports the detailed assessment results by commodity for play 2.

Table 3 summarizes the volumetric input data developed for the *GRASP* computer model of St. George basin play 2. Table 4 reports the risk model used for play 2. The location of play 2 is shown in figure 1.

The south platform includes the area south of the St. George graben to the continental slope and east of Pribilof Canyon. This stable platform area generally contains less than 10,000 feet of nearly flat-lying strata, separated from acoustic basement by an angular unconformity. The overlying strata range in age from middle Eocene to Pleistocene and were mostly deposited in a marine-shelf environment. The basement at the COST No. 1 well consists of basaltic igneous rocks, but Mesozoic and lower Tertiary sedimentary rocks occur below the acoustic basement unconformity elsewhere.

Potential traps in play 2 include anticlinal structures within the acoustic basement, drape of Tertiary sands over basement highs, fault-bounded traps, and stratigraphic onlap onto basement highs. Five exploratory wells and one COST well were drilled in the south platform play area, all of which were plugged and abandoned with only minor gas shows encountered.

The best reservoir-rock potential is in the Oligocene section. The COST No. 1 well contained individual sandstone beds greater than 150 feet thick, with an aggregate total of 1,200 feet. Porosities were as high as 25 percent and permeabilities were as high as 37 millidarcies (Turner and others, 1984a). Permeabilities were as high as 300 to 400 millidarcies in Oligocene sandstones in the Shell Y-0454 well.

Source-rock potential in the south platform area appears to be poor. The sediments were deposited under oxidizing conditions and are low in TOC. Only gas-prone kerogen types were present in samples from the COST No. 1 well, and the rocks were thermally immature. The oil window occurs at approximately 12,000 feet, so any hypothesized thermally mature hydrocarbon source must involve rocks that lie below the acoustic basement unconformity, the latter generally shallower than 10,000 feet in this play area.

Play 2, South Platform, St. George Basin OCS Planning Area, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools											
Assessment Results as of November 2005											
BOE Resources *											
	F95	Mean	F05								
1	19	268	869								
2	7	84	269								
3	4	43	129								
<b>4</b> 2.4 <b>26</b> 78											
<b>5</b> 1.8 <b>18</b> 54											
<b>6</b> 1.45 <b>14</b> 40											
7	1.22	11	31								
8	1.07	9	25								
9	0.96	8	21								
10	0.83	7	18								
* 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											



A maximum of 18 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 2. These 18 pools range in mean conditional (un-risked) recoverable volumes from 2.7 Mmboe (pool rank 18) to 268 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 19 Mmboe (F95) to 869 Mmboe (F05), or in a gas case from 0.107 Tcfge (F95) to 4.884 Tcfge (F05). Table 2 shows the conditional sizes of the 10 largest pools in play 2.

In the computer simulation for play 2 a total of 22,836 "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 10 contains the largest share (4,250, or 18.6%) of simulation pools (conditional, technically recoverable BOE resources) for play 2. Pool size class 10 ranges from 16 to 32 Mmboe. The largest simulation pool for play 2 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 2.

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

<u>Basin</u>: St. George Basin <u>Play Number</u>: 2 <u>Play UAI Number</u>: AAAAAJAC Assessor: Comer Play Name: South Platform Play Date: March, 2005

 Play Area (mi<sup>2</sup>: millions of acres):
 7,950 (5.088)

 Reservoir Thermal Maturity, % Ro:
 7

<u>Play Depth Range</u>, feet: 4125 - 5500 - 6875 <u>Expected Oil Gravity</u>, <sup>O</sup> API: 35 <u>Play Water Depth Range</u>, feet: 320 - 425 - 535 <u>Prospect Distance from shore</u>, miles: 340

## **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					24450	~~~				105000			~
Prospect Area (acres)-Model Output	906	5693	7855	13451	24450	36202 / 39532	44444	61246	76102	105000	150843	192051	204000
Fill Fraction (Fraction of Area Filled)	0.02	0.06	0.07	0.09	0.12	0.13256 / 0.62222	0.16	0.19	0.21	0.25	0.3	0.34	0.63
Productive Area of Pool (acres)	9	343	562	1286	3227	8018.55 / 14960.02	8096	13262	18526	30404	53099	77007	152000
Pay Thickness (feet)	44	95	104	122	145	149.949 / 39.863	172	189	202	221	246	264	477

### **MPRO** Module (Numbers of Pools)

		-,										
Play Level Chance	0.5		Prospect Level	l Chance		0.25			Exploration	on Chance		0.125
Risk Model	Play C	Chance			Pet	roleum System Facto	rs			Prospec	t Chance	
					[	See Risking Sheet ]						
												1
Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	E15	F10	F05	F02	F01

Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	6	11	12	14	17	18.28 / 4.69	21	23	24	27	28	29	30
Numbers of Pools in Play	1	1	~	F49.46=0	F45 = 2	2.28 / 2.76	4	6	6	7	9	10	18

2.28

Minimum Number of Pools	

Mean Number of Pools

Maximum Number of Pools

18

# POOLS/PSRK/PSUM Module (Play Resources)

0

		<u> </u>	,										
Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	38	90	99	118	143	148.959 / 43.806	173	192	206	228	256	277	532
Gas Recovery Factor (Mcfg/acre-foot)	38	145	170	224	303	336.071 / 162.708	410	483	539	635	763	863	2444
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	64	189	216	269	344	367.931 / 140.682	439	501	548	625	725	800	1856
Condensate Yield ((bbl/Mmcfg)	10	19	20	22	25	25.337 / 4.240	28	30	31	33	35	37	50
Pool Size Distribution Statistics from POO	$\mu$ (mu) = 10.3062926 $\sigma^2$ (sigma squared) = 2.16634879					Random	Number Ge	nerator Se	ed = 7332	40			
		_						-				-	-

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0.05
Probability Any Pool is 100% Oil	0	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.3
Probability Any Pool is 100% Gas	0.95		

Table 3. Input data for St. George basin play 2, 2006 assessment.

			Risk Analysis Form - 20	005 National Assessn	nent		
As	ses	sment Province:	St. George Basin	Play Number, Name:	2, So	uth Platform	
		Assessor(s):	Comer	Play UAI:	AAAA	AJAC	
		Date:	6-Oct-05				
For cert prot	each ainty abil	n component, a <i>qu</i> ) based on consic ity that the minimu	<i>uantitative</i> probability of success (i.e., between zero a deration of the <i>qualitative</i> assessment of <b>ALL</b> element im geologic parameter assumptions have been met of the superior of the su	and one, where zero indicates nts within the component was or exceeded.	s no con assigne	fidence and one ind ed. This is the asses	icates absolute ssment of the
						Play Chance Factors	Averge Conditional Prospect Chance <sup>1</sup>
1.	Hy	drocarbon Fill	component (1a * 1b * 1c)		1	0.5000	0.5000
	a.	Presence of a C	Quality, Effective, Mature Source Rock		r		
	b.	Probability of effi rock of adequate	cent source rock in terms of the existence of sufficie e quality located in the drainage area of the reservoirs sion and Migration	nt volume of mature source 3.	1a	0.50	1.00
		Probability of efferences	ective expulsion and migration of hydrocarbons from	the source rock to the	1b	1.00	0.50
	C.	Preservation Probability of effe	ective retention of hydrocarbons in the prospects afte	er accumulation.	1c		
2.	Re	servoir compo	nent (2a * 2b)		2	1.0000	0.5000
	a.	Presence of res	ervoir facies	ss and net/gross ratio (as	<b>Г</b>		
		specified in the r	esource assessment).		2a	1.00	1.00
	b.	Reservoir quality Probability of effor permeability (as	ty ectiveness of the reservoir, with respect to minimum e specified in the resource assessment).	effective porosity, and	2b	1.00	0.50
3.	Tra	ip component	(3a * 3b)		3	1.0000	1.0000
	a.	Presence of tra Probability of pre	<b>p</b> ssence of the trap with a minimum rock volume (as sp	pecified in the resource	3a	1.00	1.00
	b.	Effective seal m Probability of effective	nechanism ective seal mechanism for the trap.		3b	1.00	1.00
0.4	rol		(Marginal Drobability of hydrogarbana, MD				
00	fai	(1 * 2 * 3) Produ	ict of All Subjective Play Chance Factors			0.5000	
Ave	eraç	e Conditional (1 * 2 * 3) Produ <sup>1</sup> Assumes that	Prospect Chance <sup>1</sup> ict of All Subjective Conditional Prospect Chance Fac the Play exists (where all play chance factors = 1.	ctors .0)		de	0.2500
Exi	olor	ation Chance	stent with play chance and prospect distribution -	See discussion on Fage 3			4050
		(Product of Over	all Play Chance and Average Conditional Prospect C	Chance)		0.	1250
Co	nm	ents: See guida	nce document for explanation of the Risk Analysis Fo	orm			

 Table 4. Risk model for St. George basin play 2, 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: AAAAAJ	AC	Play No.		2	
World	Level	-	World	Level	Resources	
Country	Level	-	UNITED	STATES	OF	AMERICA
Region	Level	-	MMS	-	ALASKA	REGION
Basin	Level	-	ST.	GEORGE	BASIN	
Play	Level	-	Play		2 South	Platform Play
Geologist	Comer		-			-
Remarks	South	Platform				
Run Date	& Time:	Date	19-Sep-	-05 Time	14:10:	58

#### **Summary of Play Potential**

Product	MEAN	Standard Deviation
BOE (Mboe)	193,880	362,270
Oil (Mbo)	14,104	87,503
Condensate (Mbc)	22,345	42,978
Free (Gas Cap & Nonassociated) Gas (Mmcfg)	879,610	1,657,200
Solution Gas (Mmcfg)	5,150	33,694

10000 (Number of Trials in Sample) 0.4943 (MPhc [Probability] of First Occurrence of Non-Zero Resource) Windowing Feature: used

#### Empirical Probability Distributions of the Products

Greater Than Percentage	Greater Than BOE Percentage (Mboe)		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	47,113	2,873	5,398	217,360	931
40	93,322	4,294	11,066	436,600	1,556
35	140,130	3,389	16,956	672,030	1,180
30	189,340	6,060	23,175	897,670	2,108
25	254,440	11,795	30,185	1,190,100	3,968
20	332,450	17,670	38,363	1,546,800	6,633
15	434,060	26,643	50,255	1,998,400	8,807
10	584,350	39,978	67,518	2,663,100	16,822
8	667,930	44,264	77,503	3,054,200	15,291
6	787,240	49,861	92,726	3,604,900	18,018
5	870,430	39,192	104,170	4,073,600	12,534
4	993,030	82,760	115,960	4,434,000	30,024
2	1,351,100	97,045	154,360	6,149,400	31,135
1	1,746,400	221,060	189,270	7,424,900	83,949
0.1	3,011,800	0	306,450	15,204,000	0
0.01	5,600,100	0	700,510	27,536,000	0
0.001	6,338,200	0	957,100	30,242,000	0

Table 5. Assessment results by commodity for St. George basin play 2, 2006 assessment.

Basin: Play 03 UAI Ke	ST. GEORO 2 - South Play 9: AAAAAJ	GE BASIN atform Pla IAC	у			Model Simulation "Pools" Reported by "Fieldsize.out" GRASP Module																	
	Classification and Size Pool Count Statis					stics		Pool Types Count			Mixed Pool Range		Oil Po	Oil Pool Range		Gas Pool Range		ol 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	Мах	Min	Max	Min	Max		Min	Мах	Total Resource	Average Resource
1	0.0312	0.0625	0	0	0	0		0	0	0	0	0	0	0	C	) (	0	0	)	0.000000	0.000000	0.000000	0.000000
2	0.0625	0.125	3	0.013137	0.0003	0.000607		0	0	3	0	0	0	0	1	1 1	1	1	1	0.089992	0.122856	0.314585	104.861706
3	0.125	0.25	14	0.061307	0.0014	0.002832		0	0	14	0	0	0	0	1	1 1	1	1		0.140666	0.245670	2.774013	198.143780
4	0.25	0.5	56	0.245227	0.0056	0.011327		1	0	55	1	1	0	0	1	1 1	1	1		0.253014	0.498938	22.011980	393.071085
5	0.5	1	187	0.818882	0.0187	0.037824		6	0	181	1	1	0	0 0	1	1 2	1	2	2	0.506842	0.999784	142.567602	762.393594
6	1	2	482	2.110703	0.0482	0.097492		6	0	476	1	1	0	0 0	1	1 3	1	3	3	1.004883	1.997523	742.859326	1.541202
7	2	4	1162	5.088457	0.1162	0.235032		24	0	1138	1	1	0	0 0	1	1 3	1	3	3	2.000762	3.998848	3455.578000	2.973819
8	4	8	2311	10.119986	0.2311	0.467435		62	0	2249	1	1	0	0 0	1	1 6	1	6	6	4.005127	7.996260	13798.229000	5.970675
9	8	16	3450	15.107724	0.345	0.697816		113	0	3337	1	2	0	0	1	1 5	1	5	5	8.003240	15.998968	40412.502000	11.713769
10	16	32	4250	18.610966	0.425	0.859628		175	0	4075	1	2		0 0	1	1 5	1	5	2	16.008567	31.992173	98460.175000	23.167101
11	32	64	3934	17.227184	0.3934	0.795712		202	0	3732	1	3	(	0 0	1	1 5	1	6	5	32.013110	63.985227	179407.607000	45.604374
12	64	128	3235	14.166228	0.3235	0.654328		188	0	3047	1	2		0	1	1 5	1	5	2	64.010550	127.896676	293877.742000	90.843201
13	128	256	2089	9.147837	0.2089	0.422532		1/2	0	1917	1	2		0	1	1 6	1	6	5	128.255074	255.957856	373499.401000	178.793396
14	256	512	1055	4.619898	0.1055	0.21339		103	0	952	1	2		0 0	1		1	3	5	256.213345	511.197011	369916.152000	350.631409
15	512	1024	444	1.944299	0.0444	0.089806		56	0	388	1	1			1			4		513.116506	1021.452000	312229.367000	703.219299
16	1024	2048	146	0.639341	0.0146	0.029531		19	0	127	1	1			1	4				1024.621000	2047.664000	202227.666000	1.385121
17	2048	4096	16	0.070065	0.0016	0.003236		5	0	11	1	1			1				-	2095.894000	3464.331000	39382.332000	2.461396
10	4096	16204		0.006756	0.0002	0.000405		0	0	2	0	0								4617.392000	0402.772000	0.000000	5.610062
19	16294	20760	0	0	0	0		0	0	0	0	0							, ,	0.000000	0.000000	0.000000	0.000000
20	32768	65536	0	0	0	0		0	0	0	0	0			0				,	0.000000	0.000000	0.000000	0.000000
21	65536	131072	0	0	0	0	1	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							2	0.000000	0.000000	0.000000	0.000000
24	262144	524288	0	0	0	0		0	0	0	0	0			0				<u>,</u>	0.000000	0.000000	0.000000	0.000000
25	524288	1048576	0	0	0	0		0	0	0	0	0			0				2	0.000000	0.000000	0.000000	0.000000
Not Clas	sified	1010010	0	0	0	0	Below Class	0	0	0		, v							Below Class	0.000000	0.000000	0.000000	0.000000
Totals 22836			100	2.2836	4.618932	Above Class	0	0	0									Above Class	0.000000	0.000000	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 that occur within any single trial in the simulation.         Number of Trials with Pools: 4944       Min and Max refer to aggregate resources 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 that occur within any single trial in the simulation.													vant size class										

**Table 6**. Statistics for simulation pools created in computer sampling run for St. George basin play 2, 2006 assessment.



Figure 1. Map location of St. George basin play 2, 2006 assessment.