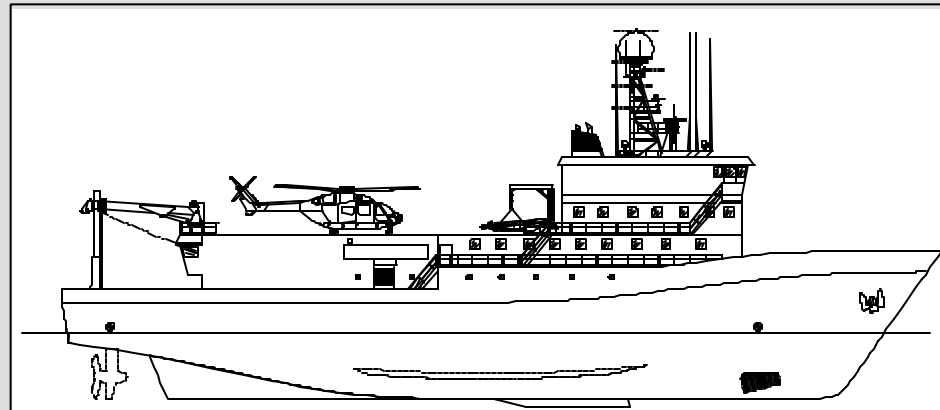
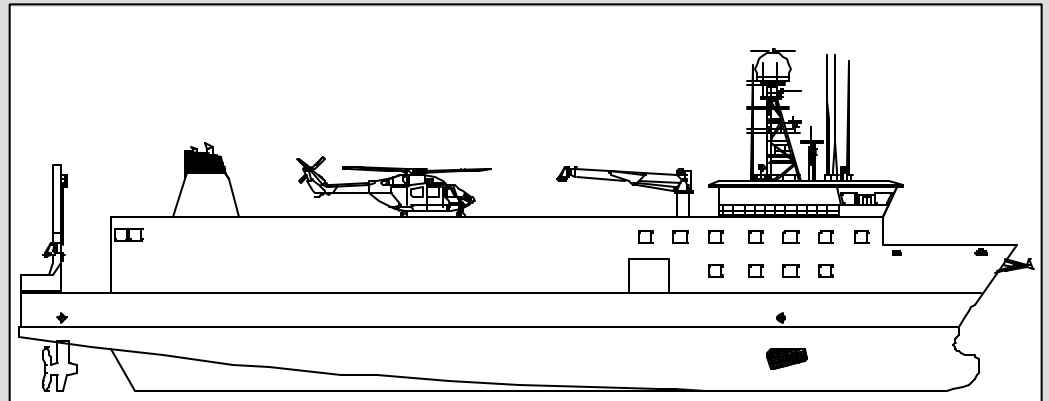
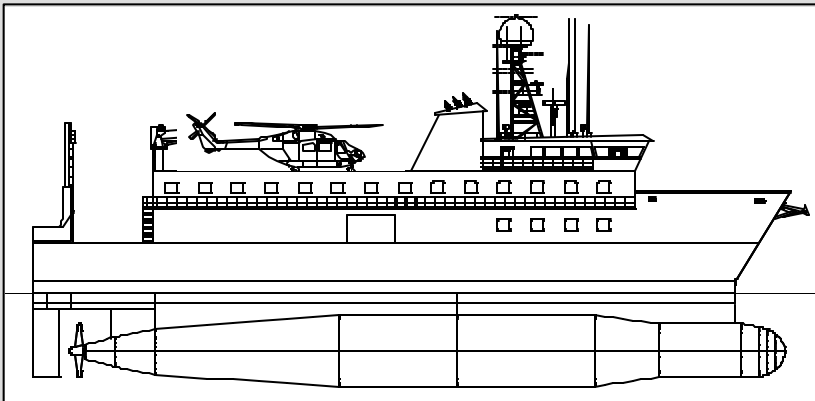


OCEAN Class AGOR Hull Selection Studies

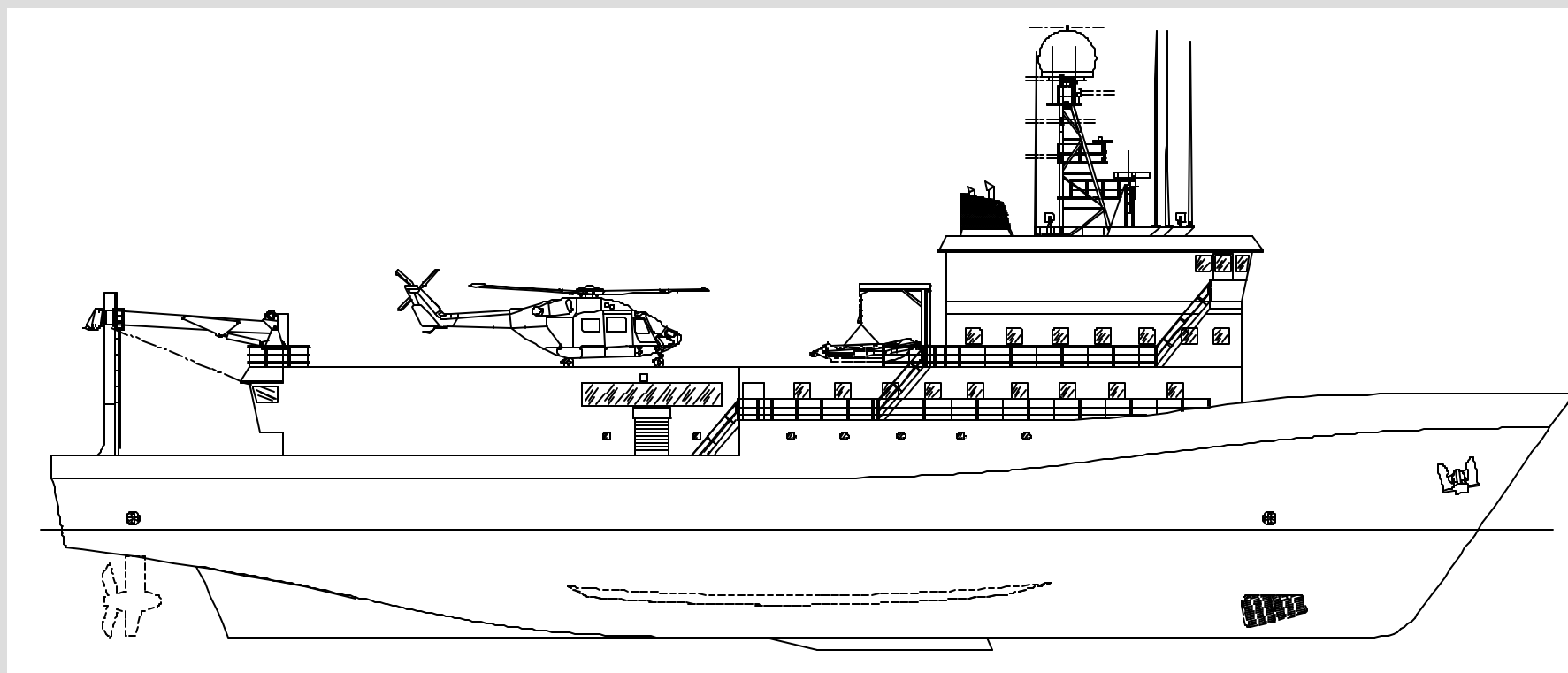


3rd Meeting - 25 January 2005

- New monohull variant - 10 feet longer and optimized beam
- Narrow beam catamaran
- Seakeeping Analyses
 - New monohull variant
 - corrected X craft
 - On station
- Wide beam monohull powering
- Variable draft SWATH
- Construction cost update

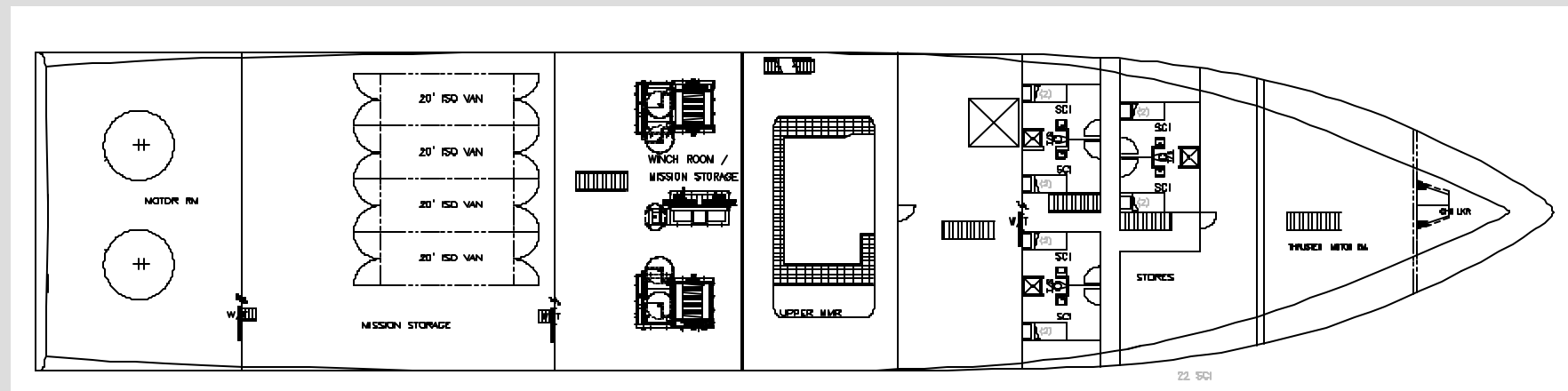
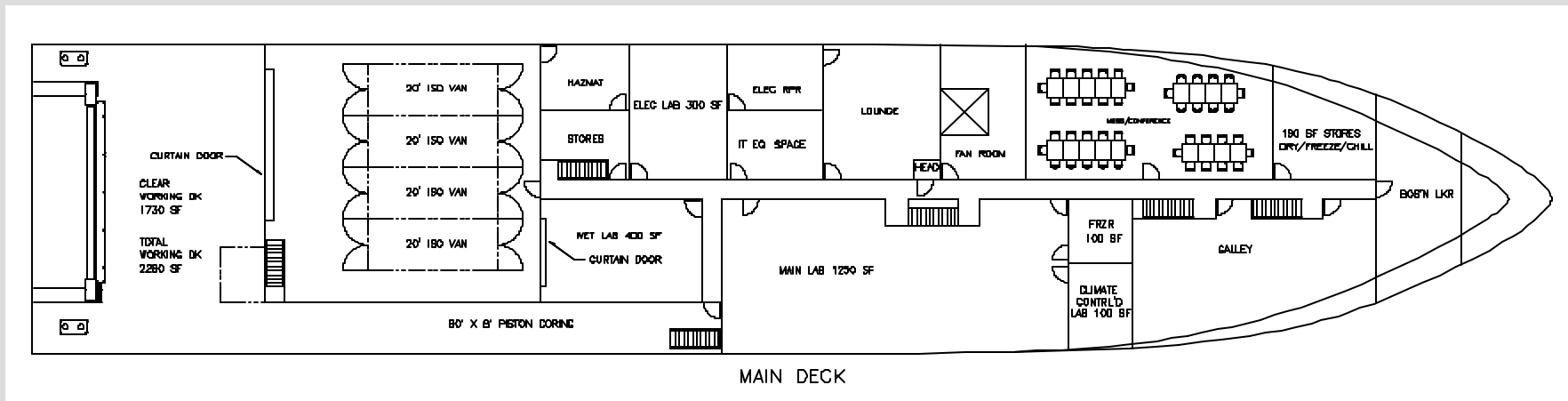
OCEAN Class AGOR Hull Selection Study

10 ft Longer (and 2 ft wider) Monohull



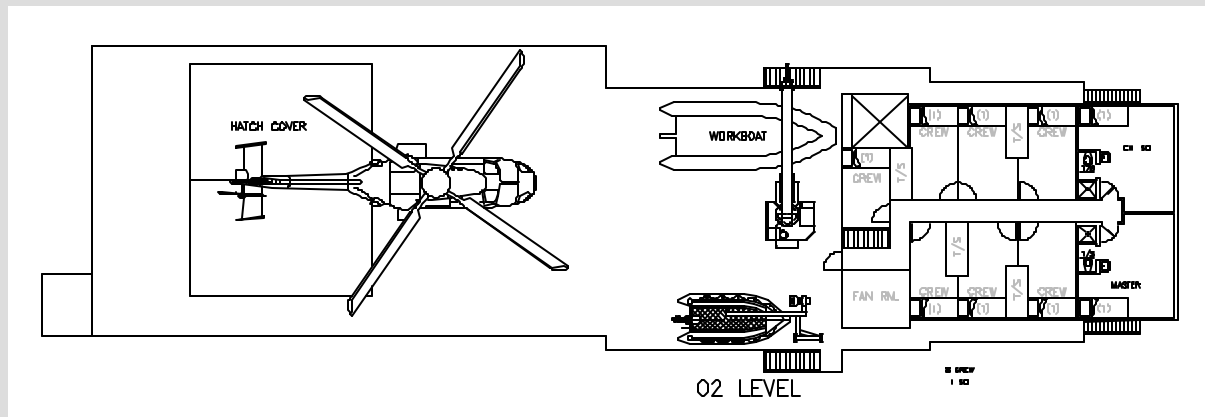
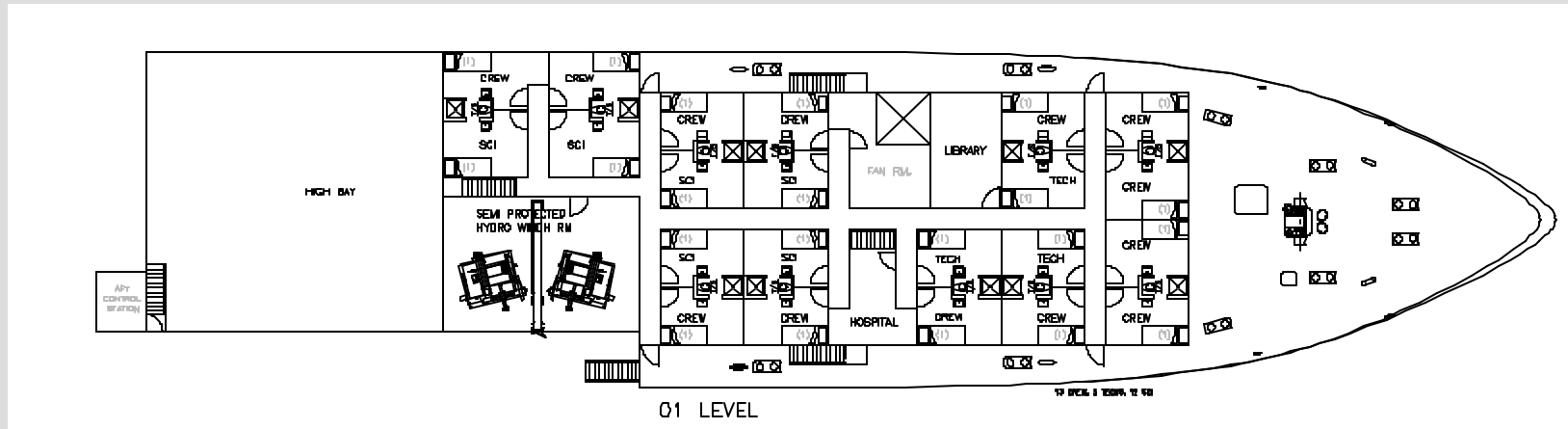
OCEAN Class AGOR Hull Selection Study

10 ft Longer (and 2 ft wider) Monohull



OCEAN Class AGOR Hull Selection Study

10 ft Longer (and 2 ft wider) Monohull



OCEAN Class AGOR

Hull Selection Study

Can X Craft Lateral Accelerations Be Improved ?

- Results from excessively high transverse stability
- No motion control device available
- Only solution is to reduce stability
 - Raise VCG (not practical in required amount)
 - Reduce waterplane inertia
 - Move volume from waterline area to lower hulls (make more SWATH-like)
 - Move hulls closer together (while retaining superstructure width)

OCEAN Class AGOR Hull Selection Study

Narrow Beam X Craft Variant

ONR X Craft

1,400 tons

11.5 ft draft

AGOR Catamaran

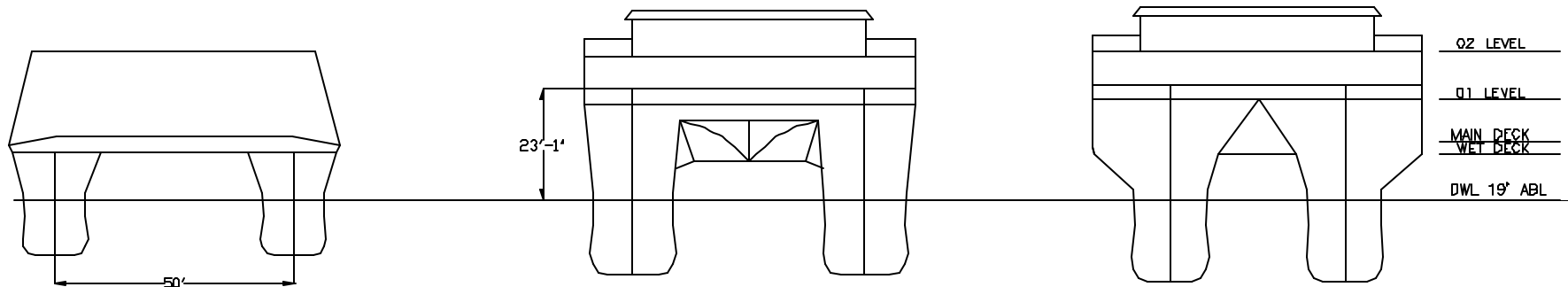
2,400 tons

15.5 ft draft

AGOR Cat with reduced
waterline beam

2,400 tons displacement

17 ft draft



- Draft increased from 15.5 ft to 17 ft to remove volume from waterplane
- Waterplane inertia reduced to approximately that of wide beam monohull
- Powering doesn't appear to be impacted - Speed is slow enough that hull interference not a problem
- Seakeeping analysis not performed
- Roll performance expected to be similar to wide beam monohull
- Lateral accelerations could be improved slightly but roll excesses remain

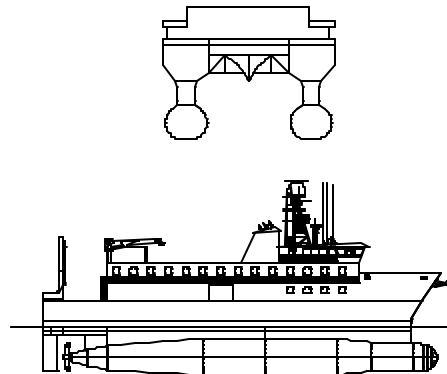
OCEAN Class AGOR

Hull Selection Study

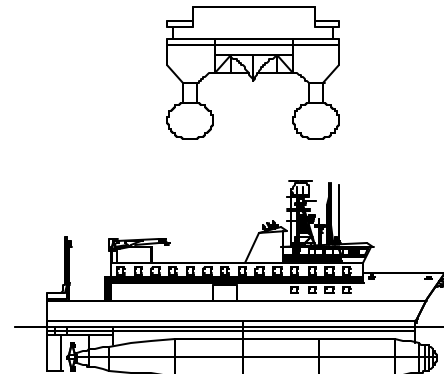
Seakeeping Analysis - Lateral Accelerations for Variants

HULLFORM	HULL	LWL FT	BWL FT	T FT	L/B	DISPL. LT	KG/T	GM FT	SS4 SC	SS5 SC	SS6 SC
									max lat ac g's SSA	max lat ac g's SSA	max lat ac g's SSA
MONOHULL	2.0	210	46	16.9	4.6	2600	1.15	5.25	0.05	0.09	0.09
MONOHULL	3.0	242	46	16.9	5.3	2900	1.15	5.25	0.05	0.09	0.09
MONOHULL	4.0	211	53	16.9	4.0	2900	1.15	9.81	0.05	0.08	0.08
MONOHULL	5.0	197	56	16.9	3.5	2900	1.15	12.48	0.05	0.08	0.08
MONOHULL	6.0	197	56	14.6	3.5	2600	1.15	17.16	0.05	0.08	0.08
X-CRAFT	Navy SMR	239	22	15.5	-	2400	1.16	37.04	0.11	0.11	0.14
SWATH	Phase II	172	7.3	25	-	2542	1.21	5.51	0.05	0.07	0.08

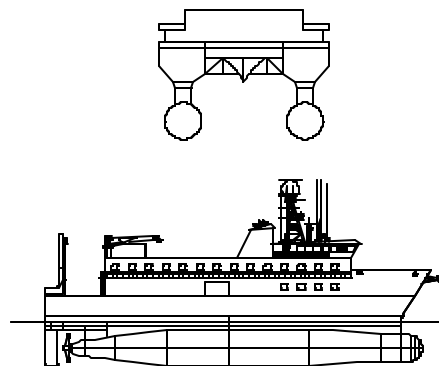
BL NAVY SMR SWATH



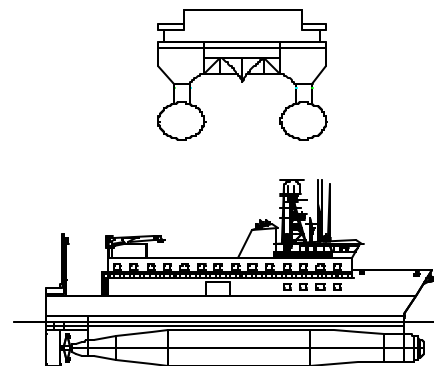
HIGH C_p SWATH



ALUMINUM SWATH



WIDE BEAM SWATH



OCEAN Class AGOR

Hull Selection Study

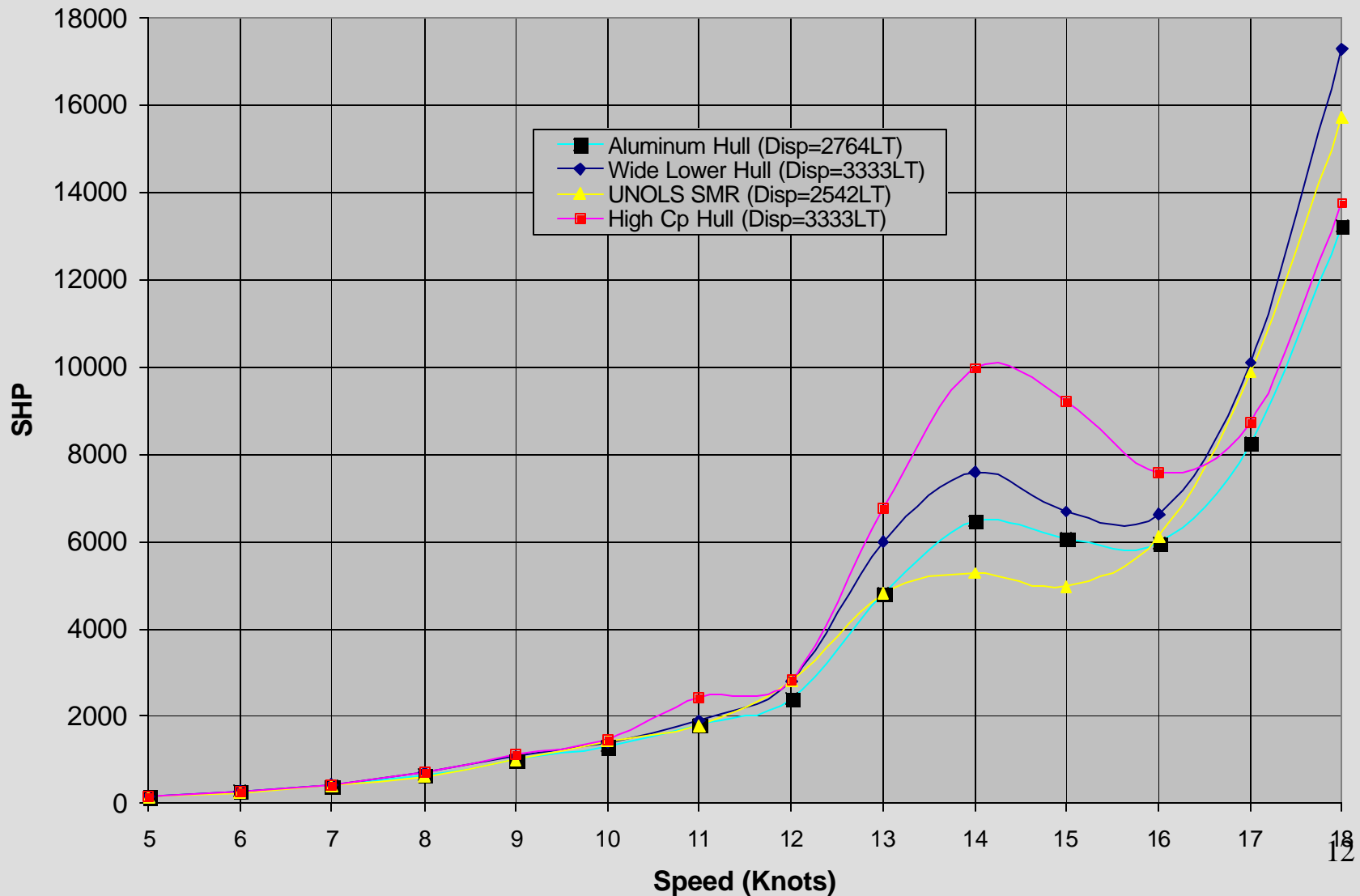
Variable Draft SWATH Options

AGOR 26					LENGTHENED ALUMINUM VARIABLE DRAFT				LENGTHENED STEEL VARIABLE DRAFT			
					OCEAN AGOR SWATH				OCEAN AGOR SWATH			
group		weight	vcg	vm		weight	vcg	vm		weight	vcg	vm
1	hull structure	1225.21	30.99	37969.26	Ratio L - 40%	799.2	30.99	24768.32	Ratio L - 40%	1332.1	30.99	41280.53
	1.5% weld	18.38	30.99	569.54		12.0	30.99	371.52		20.0	30.99	619.21
	1% mill tol	12.25	30.99	379.69		8.0	30.99	247.68		13.3	30.99	412.81
	free flood wt	0.52	1	0.52		0.5	1	0.52		0.5	1	0.52
2	prop plant	97.29	11.65	1133.43	+23% SHP @15	119.7	11.65	1394.12	same as aqor26	97.3	11.65	1133.43
3	elec plant	112.88	41.74	4711.61	+23% SHP @15	138.8	41.74	5795.28	same as aqor26	112.9	41.74	4711.61
4	comm & surv	19.80	45.75	905.85		19.8	45.75	905.85		19.8	45.75	905.85
5	aux sys	241.37	35.52	8573.46	ratio L	262.4	35.52	9321.15	ratio L	285.3	35.52	10134.04
6	outfit furn	194.04	44.83	8698.81	ratio L	211.0	44.83	9457.43	ratio L	229.4	44.83	10282.21
7	arm	0.00	0	0.00		0.0	0	0.00		0.0	0	0.00
lt ship		1921.74	32.7527	62942.17		1571.4	33.25758	52261.87		2110.5	32.92095	69480.20
margin	design	8.17	43	351.31	10% ltship	157.1	43	6757.14	10% ltship	211.1	43	9075.22
	una	10.68	32.87	351.05		0.0	32.87	0.00		0.0	32.87	0.00
	construction	56.21	43	2417.03		0.0	43	0.00		0.0	43	0.00
lt ship	with margin	1996.80	33.08	66061.57		1728.6	34.14	59019.01		2321.6	33.84	78555.42
loads	ballast resid	2.74	1.65	4.52		2.7	1.65	4.52		2.7	1.65	4.52
	fuel	383.01	12.44	4764.64	-15% SHP @12	325.6	12.44	4049.95	ratio 12 kt SHP	342.7	12.44	4263.18
	lube oil	2.4	43.8	105.12	+23% SHP @15	3.0	43.8	129.30	same as aqor26	2.4	43.8	105.12
	oily waste	0.04	39.25	1.57	+23% SHP @15	0.0	39.25	1.93	same as aqor26	0.0	39.25	1.57
	fresh water	29.63	34.46	1021.05		29.6	34.46	1021.05		29.6	34.46	1021.05
	sewage	3.28	28.77	94.37		3.3	28.77	94.37		3.3	28.77	94.37
	payload	100	43	4300.00	VSL	200.0	43	8600.00	VSL	200.0	43	8600.00
	sci	5.89	40	235.60		5.9	40	235.60		5.9	40	235.60
	crew	1.42	40	56.80		1.4	40	56.80		1.4	40	56.80
	provisions	8.71	34	296.14		8.7	34	296.14		8.7	34	296.14
	general stores	7.39	34	251.26		7.4	34	251.26		7.4	34	251.26
	hydraulic fluid	1.56	30.5	47.58		1.6	30.5	47.58		1.6	30.5	47.58
full load weight		2542.87	30.38	77240.22		2317.8	31.84	73807.51		2927.3	31.95	93532.60
displacement		2542										
variable ballast						446				400		
full load ballasted					ratio L	2764				3327		

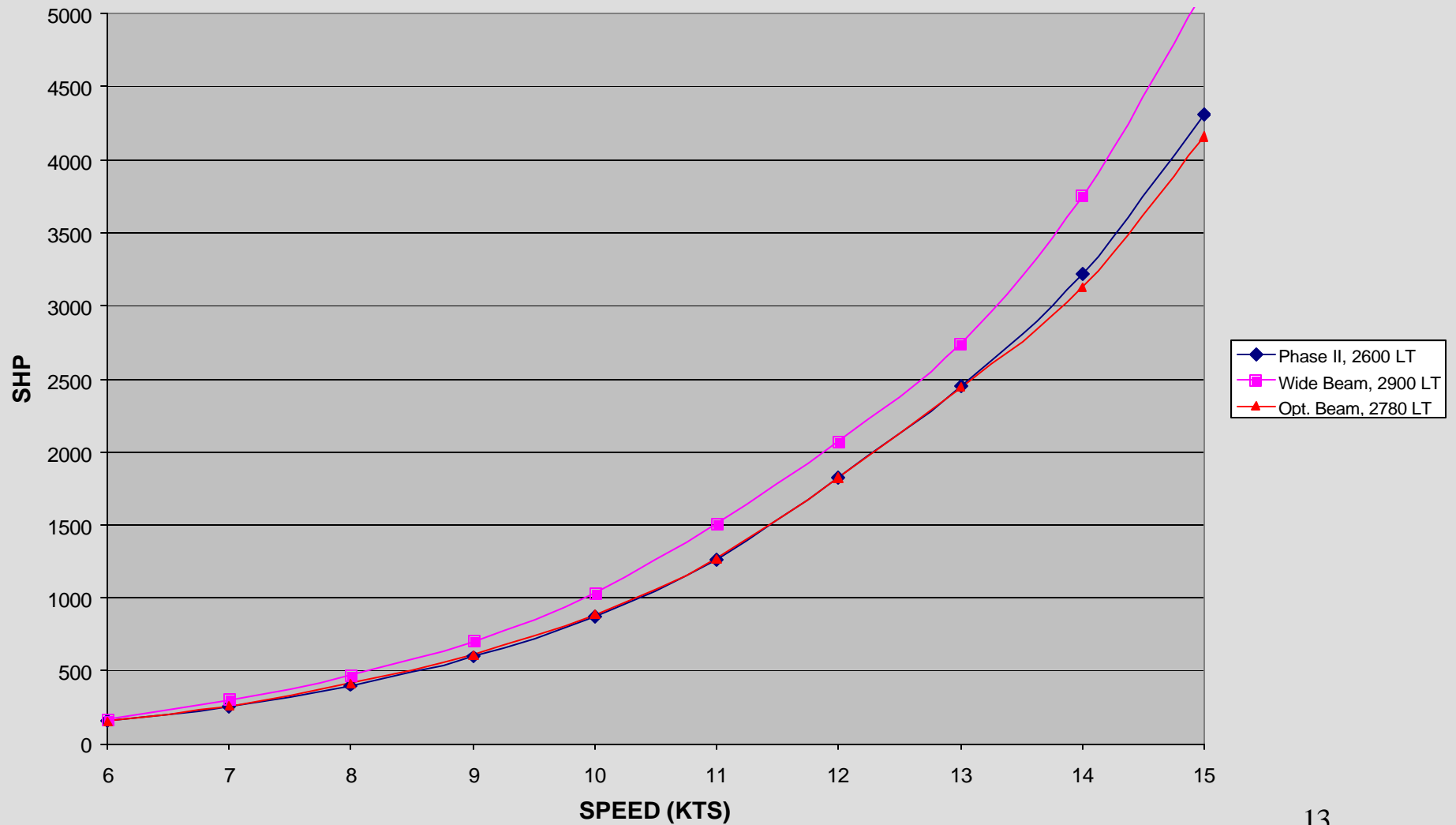
OCEAN Class AGOR Hull Selection Study

Variable Draft SWATH Options - Powering

SWATH Relative Powering Performance
Variable Draft Concepts vs. UNOLS SMR Concept



MONOHULL POWERING COMPARISON



Seakeeping

OCEAN Class AGOR Hull Selection Study

Old Slide - Previous Speed Polar Plots

Note: Shaded Areas Represent Speed and Heading Combinations Where SMR Motion Limits For Operability Are Exceeded

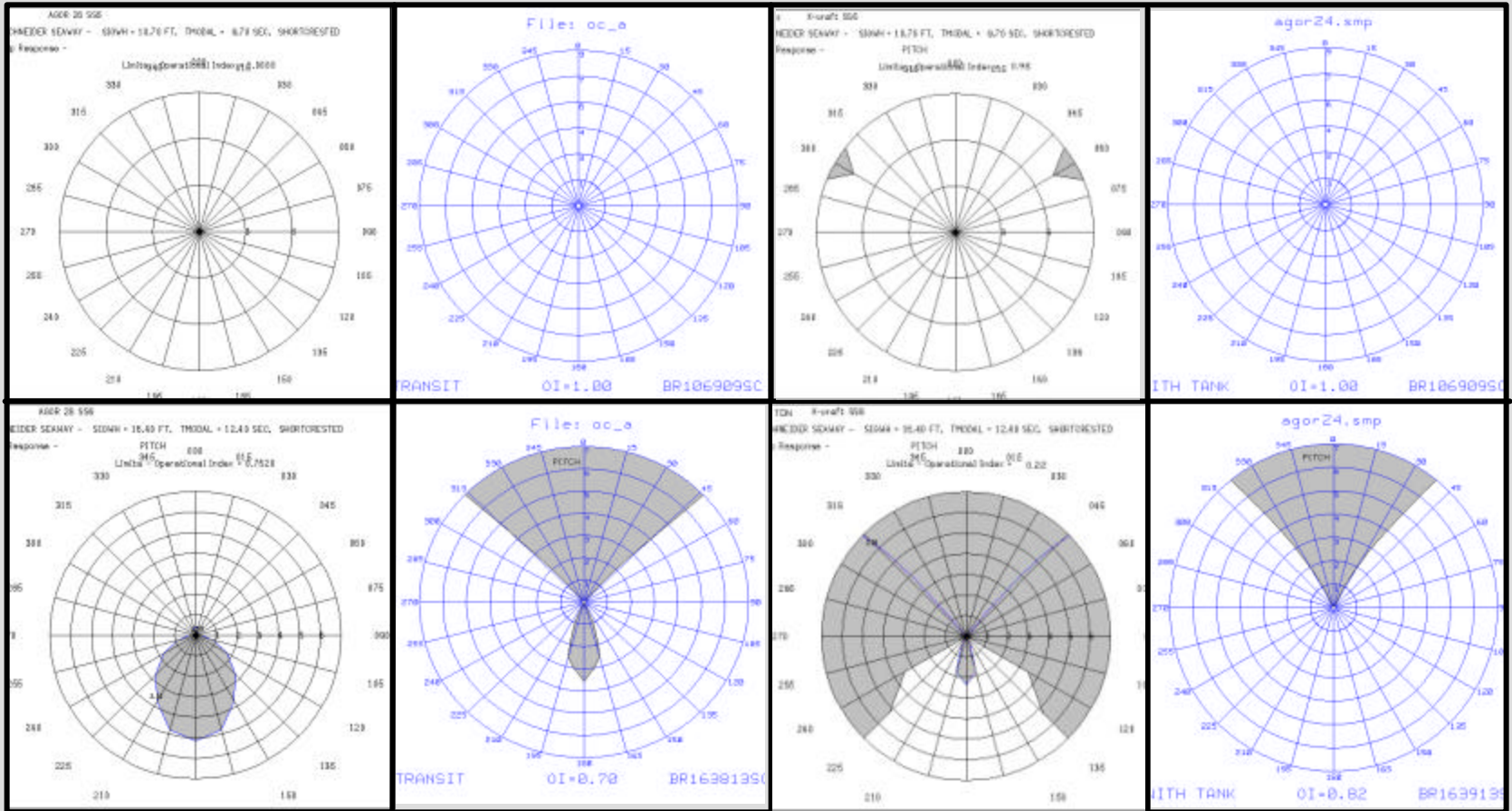
SWATH

Monohull
(Phase II short)

X-Craft
(2,400 ton)

R/V REVELLE
(AGOR 24)

Sea
State
Five



Sea
State
Six

Short Crested Seas

OCEAN Class AGOR Hull Selection Study

New Slide - W/ Revised X Craft Speed Polars

Note: Shaded Areas Represent Speed and Heading Combinations Where SMR Motion Limits For Operability Are Exceeded

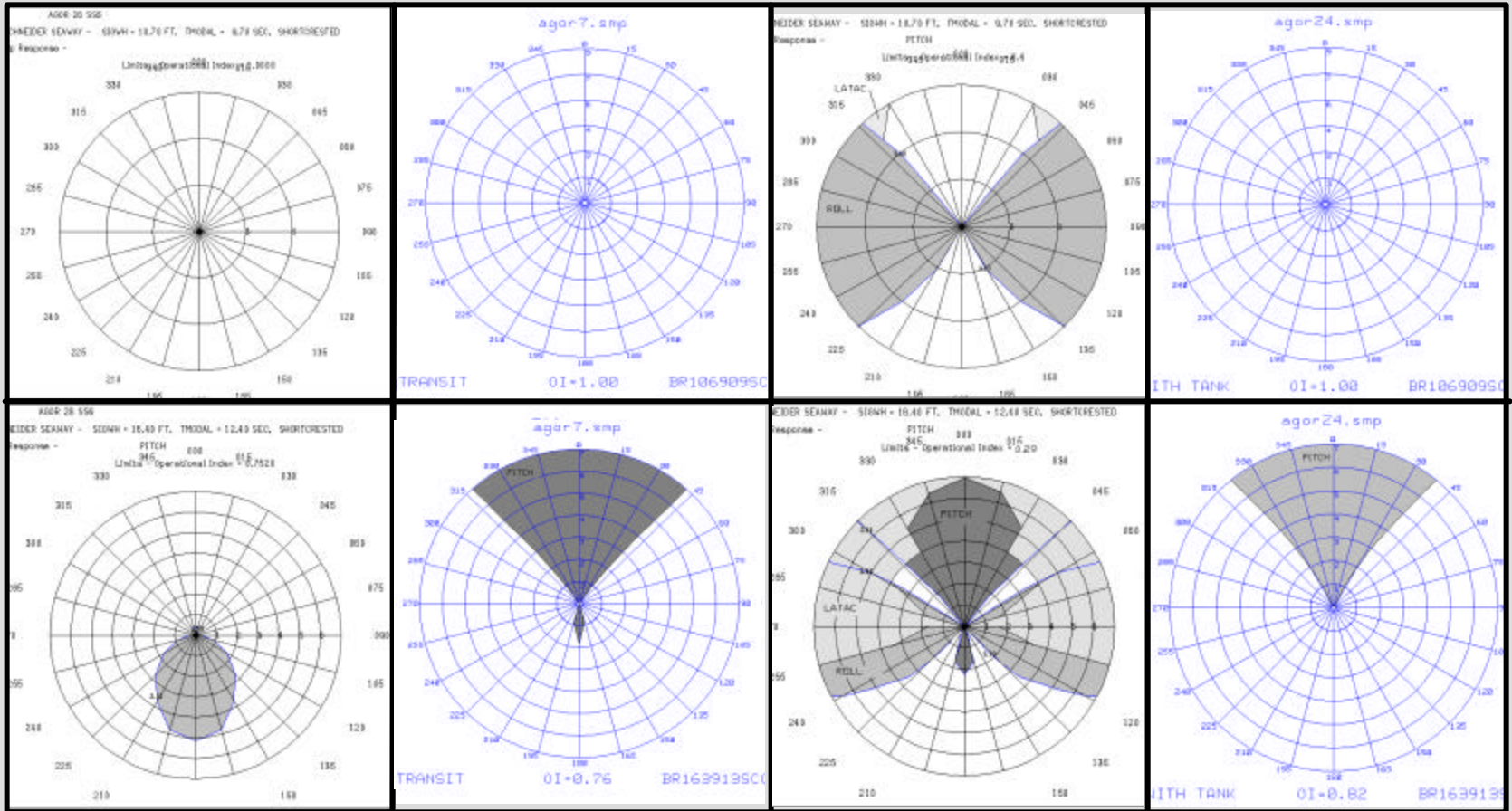
SWATH

Monohull
(Phase II short)

X-Craft
(2,400 ton)

R/V REVELLE
(AGOR 24)

Sea
State
Five



Short Crested Seas

OCEAN Class AGOR

Hull Selection Study

Maximum Roll Angles

2400 TON X-CRAFT AGOR				
	ROLL	ROLL	ROLL	
	MAX SSA	MAX SSA	MAX SSA	
SEA STATE	4	5	6	
LONG CRESTED	6.8	8.8	9.8	DEG
SHORT CRESTED	5.6	10.6	11.8	DEG
REBASELINED MONOHULL WITH ROLL TANK				
	ROLL	ROLL	ROLL	
	MAX SSA	MAX SSA	MAX SSA	
SEA STATE	4	5	6	
LONG CRESTED	3.7	5.6	6.4	DEG
SHORT CRESTED	3.2	5.0	5.6	DEG
2452 TON SWATH				
	ROLL	ROLL	ROLL	
	MAX SSA	MAX SSA	MAX SSA	
SEA STATE	4	5	6	
LONG CRESTED	2.8	2.3	2.6	DEG
SHORT CRESTED	2.0	2.0	2.4	DEG

OCEAN Class AGOR

Hull Selection Study

On Station Speed Polars

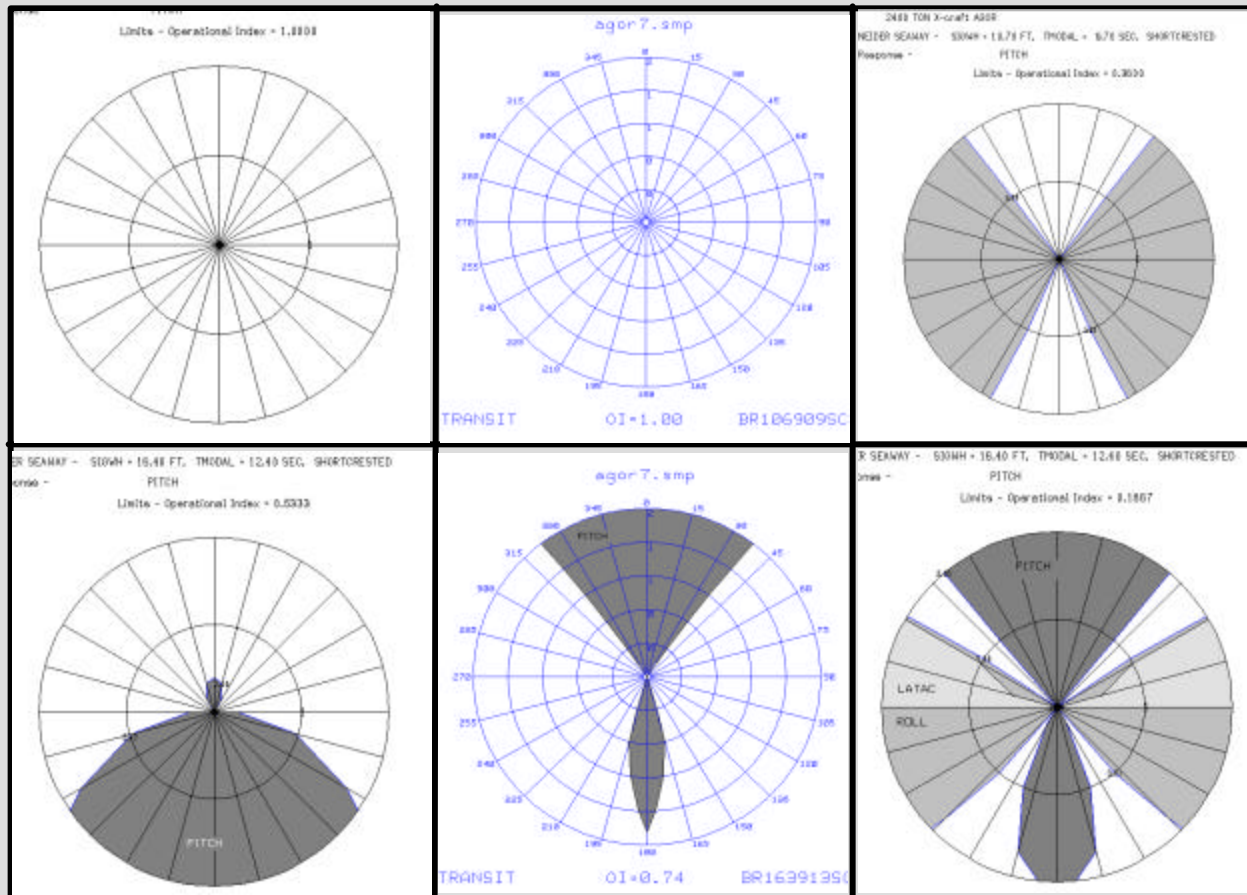
Note: Shaded Areas Represent Speed and Heading Combinations Where SMR Motion Limits For Operability Are Exceeded

SWATH

*Monohull
(Phase II short)*

*X-Craft
(2,400 ton)*

*Sea
State
Five*



Short Crested Seas

OCEAN Class AGOR Hull Selection Study

Construction Cost Based On Similar Ships

	<i>Contract Price</i>	<i>Contract Year</i>	<i>Total in FY07\$</i>	<i>LS Weight</i>	<i>\$/Lightship Ton (FY07 \$)</i>
MONOHULL					
NOAA FRV	\$43,000,000	2000	\$55,344,324	1,810	\$30,570
AGOR 23	\$30,000,000	1988	\$52,605,182	2,226	\$23,632
AGOR 24	\$37,000,000	1992	\$66,579,738	2,226	\$29,910
T-AGS 60	\$49,900,000	1990	\$89,088,487	2,970	\$30,000
T-AGS 63	\$46,984,379	1994	\$85,860,699	2,970	\$28,913
T-AGS 64	\$51,686,293	1996	\$88,449,317	2,970	\$29,784
T-AGS 65	\$53,618,360	1997	\$88,872,123	2,970	\$29,927
Monohull AVG					\$28,962.16
Cost of OCEAN Class				x 1,843 LS tons	\$53,377,268
SWATH					
KILO MOANA	\$46,000,000	1999	\$64,605,274	2,014	\$32,078
Cost of OCEAN Class				x 2,014 LS tons	\$64,605,274
ALUMINUM CATAMARAN					
ONR X Craft	\$59,900,000	2003	\$67,417,978	918	\$73,440
LAKE EXPRESS	\$19,500,000	2003	\$21,947,422	345	\$63,554
FAIRWEATHER	\$34,000,000	2003	\$38,267,300	492	\$77,813
JONATHAN SWIFT	\$57,500,000	2003	\$64,716,757	933	\$69,339
Incat 12F	\$68,000,000	2001	\$81,195,556	1114	\$72,868
Stena HSS	\$120,000,000	1992	\$186,956,090	3500	\$53,416
Hawaii	\$75,000,000	2003	\$84,413,161	1323	\$63,804
Auto Express 86	\$41,500,000	2002	\$48,109,874	705	\$68,241
Spirit of Ontario	\$43,000,000	2002	\$49,848,785	705	\$70,707
Viking High Speed Ferry	\$45,000,000	2002	\$52,167,333	705	\$73,996
Westpac Express/Auto Express 10	\$90,000,000	2002	\$104,334,667	1350	\$77,285
Pacifcat	\$86,000,000	2000	\$105,769,152	1365	\$77,487
Catamaran AVG					\$70,162.59
Cost of 2,400 ton OCEAN Class				x 1,355 LS tons	\$95,070,308

***OCEAN Class AGOR
Hull Selection Study***

Estimated Program Cost - FY07\$

Costs in FY07 M\$

	Based On Similar Ships	NAVSEA 017 Estimate	
	Total Program Cost	Total Program Cost	
<i>Monohull</i>			
Phase II	\$68	\$78 ¹	
Navy SMR (10ft longer x 2 ft wider)	\$74	\$84	
<i>SWATH</i>			
		<i>Low</i>	<i>High</i>
Phase II	\$80	\$87 ¹	\$104 ¹
Navy SMR	\$86	\$94 ¹	\$113 ¹
Steel Variable Draft	\$92	\$100	\$120
Aluminum Variable Draft	\$112		
<i>Catamaran</i>			
2400 ton Aluminum	\$110		

1 - Scaled by lightship weight

- Mooring Recovery
 - Doesn't like stern-to recoveries
 - Can't see well from aft control station
 - Little margin for error - propellers more exposed
 - Side Recoveries
 - Set up bridge wing control station
 - Approach mooring downwind
 - Bring mooring along port side
 - Secure main screws and use bow thruster to pivot stern in or out
 - Throw grapnel from upper deck on port side and walk aft
 - If grapnel misses, last chance at main deck aft

- Seakeeping of KILO MOANA
 - Ship rides well in rough weather
 - Max wave height observed ~ 25 feet
 - Some slamming occurs but doesn't seem to be a problem
 - Occasionally has become too rough for overside work
 - CTD handling difficult because of relative motion of ship/sea surface
 - His experience on catamarans (VICTORIA CLIPPER) is that ride quality is not that good
- Draft - deep draft has occasionally been a concern in some ports

