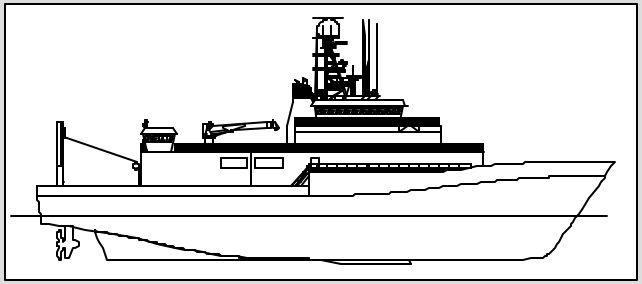
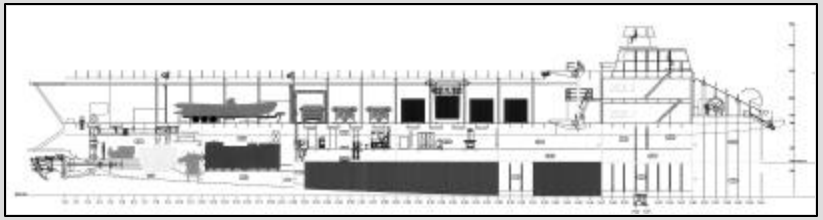
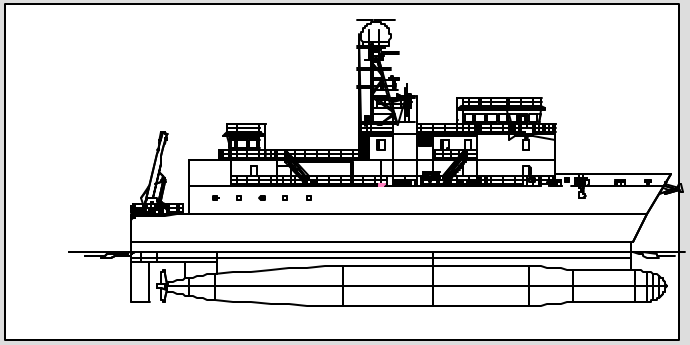
OCEAN Class AGOR
Concept Definition Task







5th Web Meeting

7 July 2004

OCEAN Class AGOR

Concept Definition

Status of OCEAN Class Concept Design Effort

Meeting Date	Monohull	SWATH	X Craft
02-Apr-04	Initial Concept Design - Hull Form - Arrangement - Seakeeping - Propulsion		Initial Concept Design - Hull Form - Arrangement - Propulsion
27-Apr-04	Revised Concept Design - Arrangement Revised to Reflect - PH Location sketch - fwd vs. - Fuel endurance calc revised	Initial Concept Design - Hull Form - Arrangement - Propulsion	Revised Concept Design - Z Drive Variant - Waterjet Variant
20-May-04	Revised Design IAW Comments Op Cost Calcs	Revised Design IAW Comments Op Cost Calcs Seakeeping Analysis	Revised Design IAW Comments Op Cost Calcs Additional ONR Investigation
10-Jun-04	Rev Op Cost Calcs	Rev Op Cost Calcs Seakeeping Analysis	Rev Op Cost Calcs Seakeeping Analysis Weight Impact Analysis
7-Jul-04	Const. Cost Analysis Further refinement of design	Const. Cost Analysis Further refinement of design	Const. Cost Analysis Further refinement of design
	Seakeeping Analysis		
	Technology and Van Lab Study		
In Progress	Refine Const. Cost Analysis	Refine Const. Cost Analysis	Refine Const. Cost Analysis
	Technology and Van Lab Study		

OCEAN Class AGOR
Concept Definition

Operating Cost Analysis

	Large AGOR Averages					OCEAN Class Feasibility Designs				
Year	2001	2002	2003	2004	Ratio	Monohull	SWATH	X Craft - Z drive	X Craft - WJ	ARRV
Salaries & Wages										
A. Ship's company										
1. Salaries	$968,474	$1,006,119	$1,005,830	$1,010,798						
2. Overtime	$586,163	$677,495	$553,898	$514,210						
3. Shore Leave	$147,653	$177,615	$247,872	$451,044						
4. Fringe Benefits	$283,241	$307,706	$321,329	$459,089						
TOTAL	$1,985,532	$2,168,936	$2,128,929	$2,435,141	Use 2004	$2,435,141	$2,435,141	$2,435,141	$2,435,141	1,295,000
B. Marine Operations Staff										
1. Salaries	$226,602	$243,280	$248,220	$232,179						
2. Overtime	$648	$877	$2,821	$0						
3. Benefits	$56,051	$63,798	$71,597	$88,990						
TOTAL	$283,301	$307,955	$322,637	$321,169	Use 2004	$321,169	$321,169	$321,169	$321,169	246,000
Repairs & Maintenance										
A. Normal Maint. & Repair	$261,787	$363,632	$260,971	$200,000	4 yr avg ratioed by disp	$227,438	$271,598	$271,598	$271,598	
B. MOSA	$423,232	$555,250	$442,448	$589,600	2004 ratioed by disp	$493,736	$589,600	$589,600	$589,600	
TOTAL	$685,019	$918,882	$703,419	$789,600		$721,174	$861,198	$861,198	$861,198	300,000
Other Expenses										
A. Fuel & Lube Oil	$674,312	$643,821	$692,627	$833,741	Calculated	$692,995	$883,208	$1,099,200	$1,568,039	981,750
B. Food	$122,728	$182,921	$162,179	$196,864	2004 ratioed by compl	$161,710	$161,710	$161,710	$161,710	
C. Insurance	$61,717	$75,796	$84,777	$107,148	Use 2004	$107,148	$107,148	$107,148	$107,148	
D. Stores Minor Equip., & Supplies	$140,192	$177,756	$155,344	$137,440	4 yr avg ratioed by compl	$125,418	$125,418	$125,418	$125,418	
E. Travel										
Domestic	$29,770	$44,778	$52,615	$58,494	4 yr avg ratioed by crew	$46,414	$46,414	$46,414	$46,414	
Foreign	$134,414	$117,258	$77,486	$27,131	4 yr avg ratioed by crew	$106,038	$106,038	$106,038	$106,038	
F. Shore Facilities Support	$94,579	$109,355	$139,566	$168,652	Use 2004	$168,652	$168,652	$168,652	$168,652	
G. Miscellaneous	$229,409	$297,513	$195,684	$180,780	4 yr avg ratioed by disp	$189,126	$196,691	$181,561	$196,691	
H. Amortization										
Total	$1,487,121	$1,649,197	$1,560,277	$1,710,250		$1,597,501	$1,795,279	$1,996,141	$2,480,110	1,487,750
Total Direct Costs	$3,755,954	$4,126,089	$4,011,843	$5,256,160		$5,074,985	$5,412,787	$5,613,649	$6,097,618	
Indirect Costs	$596,378	$625,818	$606,888	$676,311	13% of direct	$659,748	$703,662	$729,774	$792,690	106,063
Total Operating Costs	$4,352,332	$4,751,907	$4,618,731	$5,932,471		$5,734,734	$6,116,449	$6,343,423	$6,890,308	4,388,813
Miscellaneous Data										
A. Number of Cruises/Legs	15	18	16	18						
B. Operating Days	283	297	266	293	Avg	285	285	285	285	275
C. Days at Sea	247	268	242	268						
D. Maintenance Days	48	45	40	23						
E. Days Out of Service	26	0	24	6						
F. Daily Rate	$17,722	$19,193	$20,108	$20,282		$20,145	$21,486	$22,283	$24,204	15,959
Ship Particulars:										
Displacement, LT				2,985		2500	2600	2400	2600	
Crew				21		21	21	21	21	
Sci				35		25	25	25	25	
Total Comp				56		46	46	46	46	

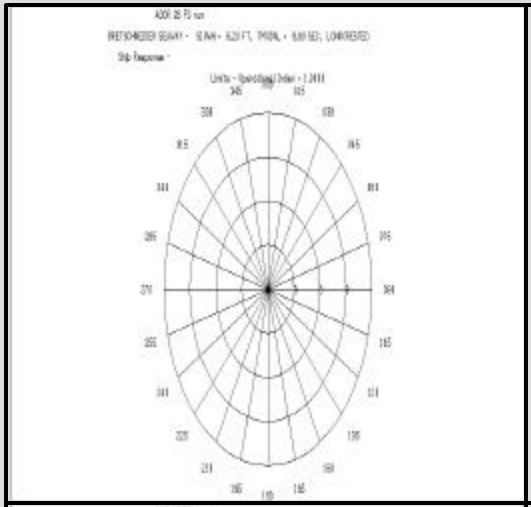
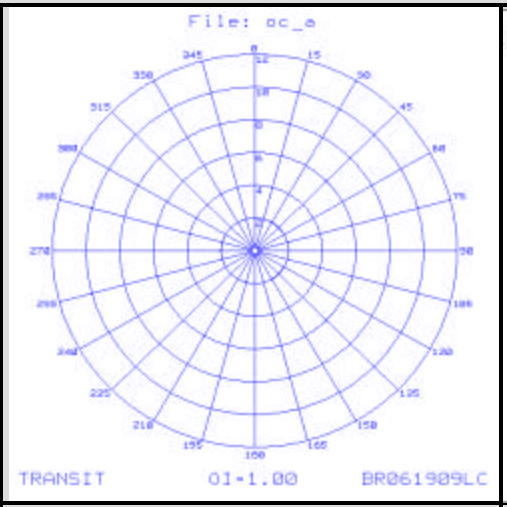
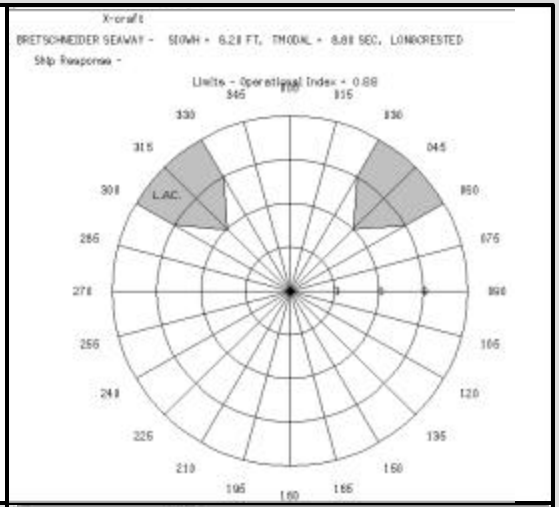
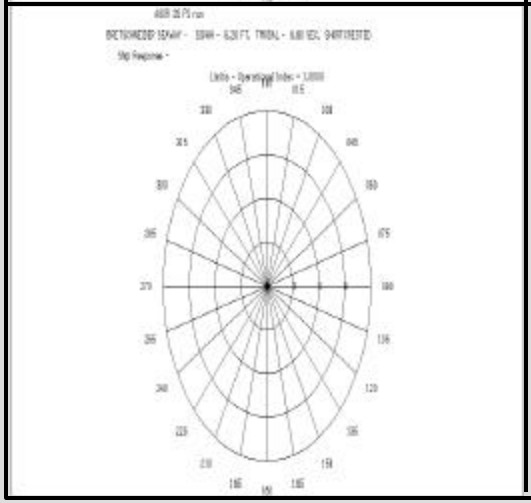
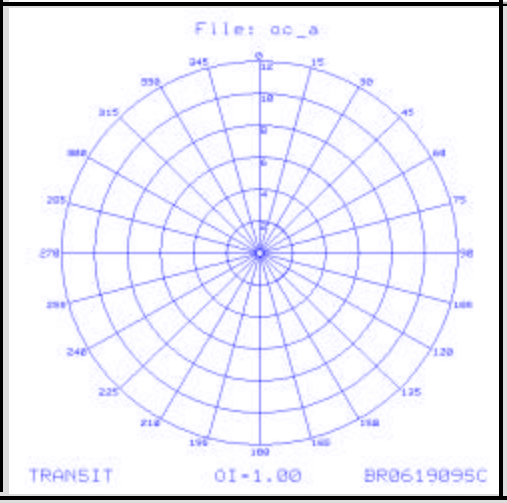
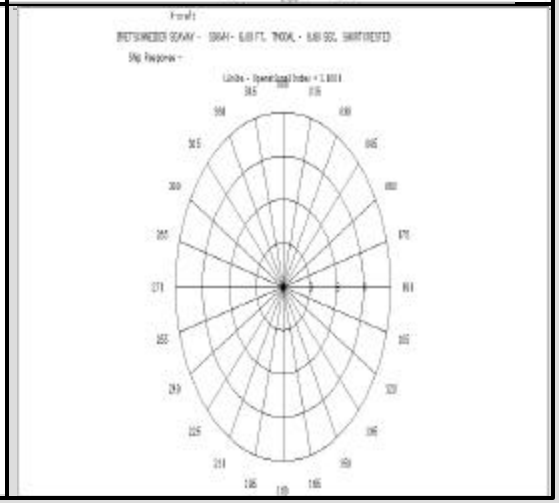
Seakeeping Analysis

OCEAN Class AGOR
Concept Definition

Seakeeping - 3 Feasibility Designs

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS4, Tm=8.8s

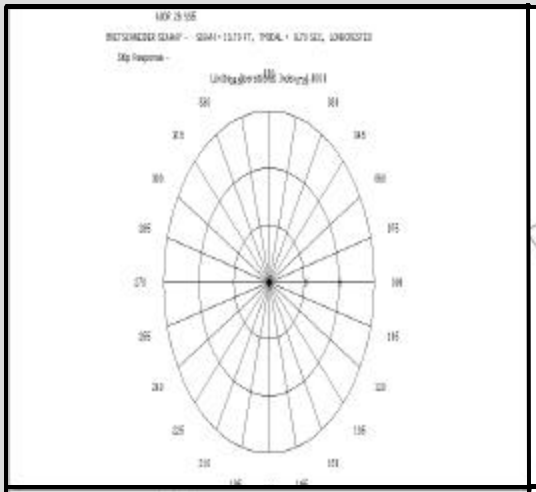
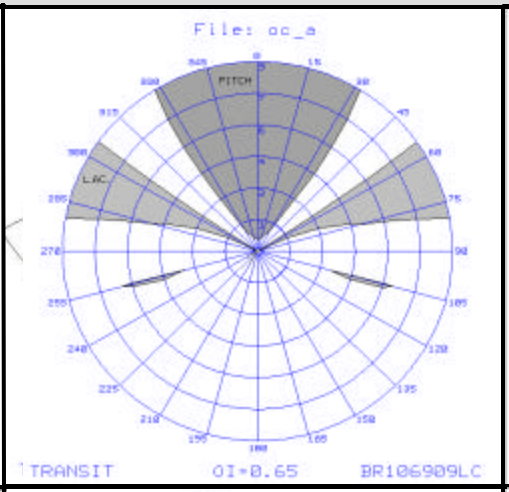
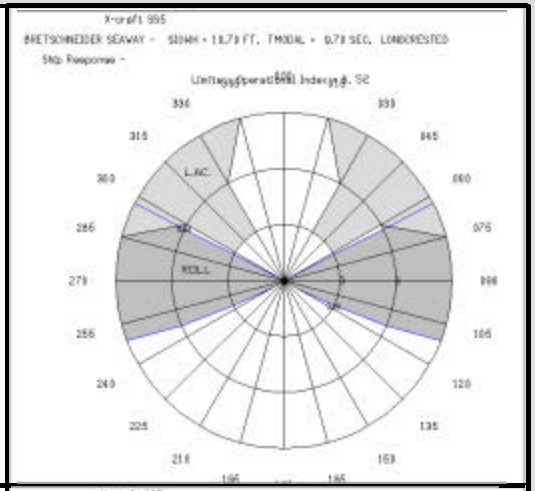
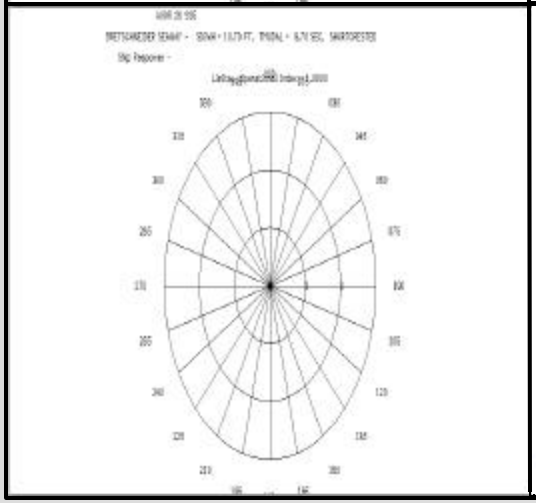
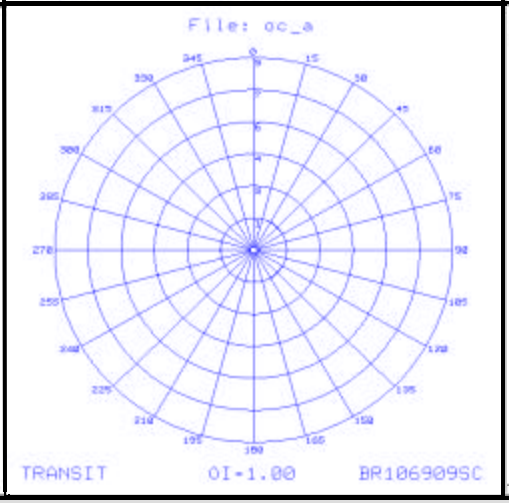
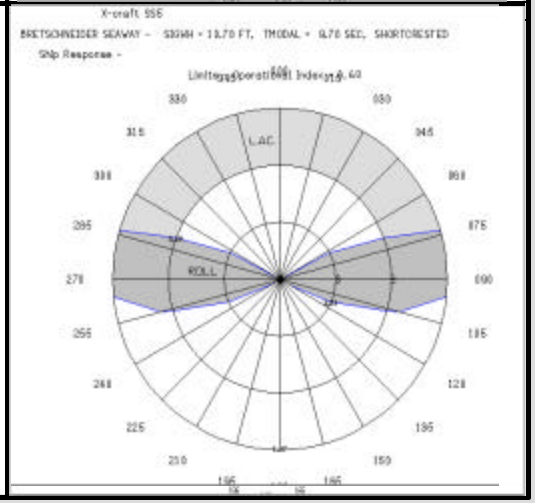
	SWATH	*Monohull*	*X-Craft (1,400 ton)*
Long-Crested Seas			
Short-Crested Seas			

OCEAN Class AGOR
Concept Definition

Seakeeping - 3 Feasibility Designs

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS5, Tm=9.7s

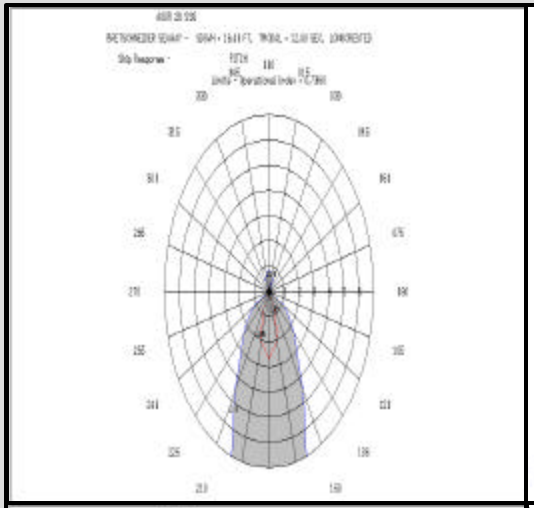
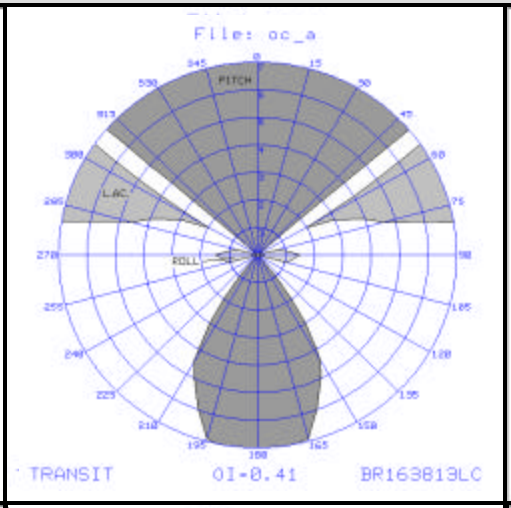
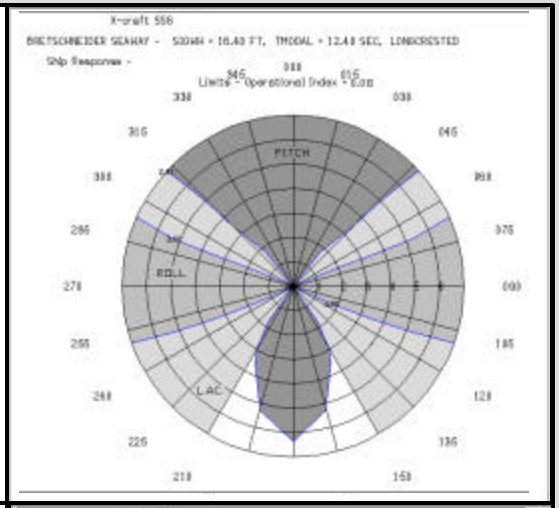
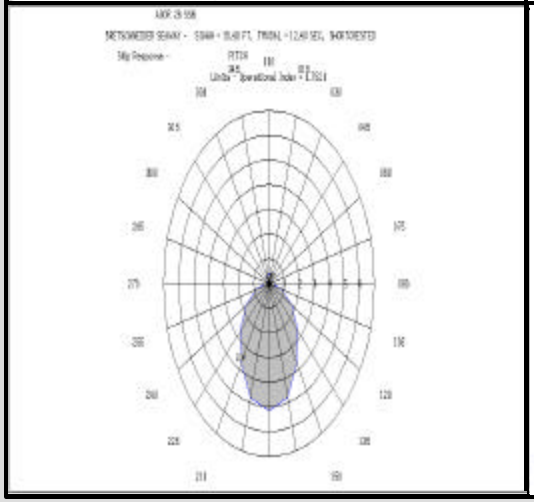
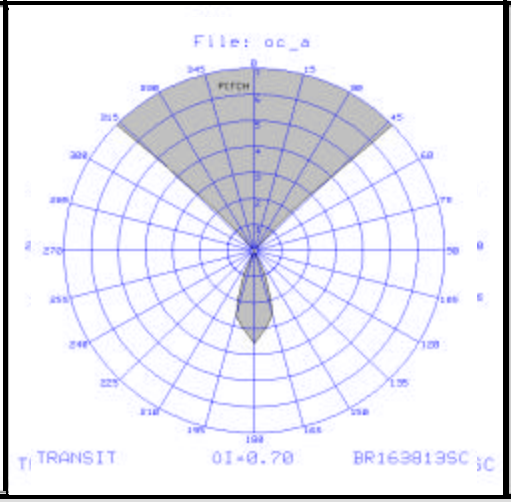
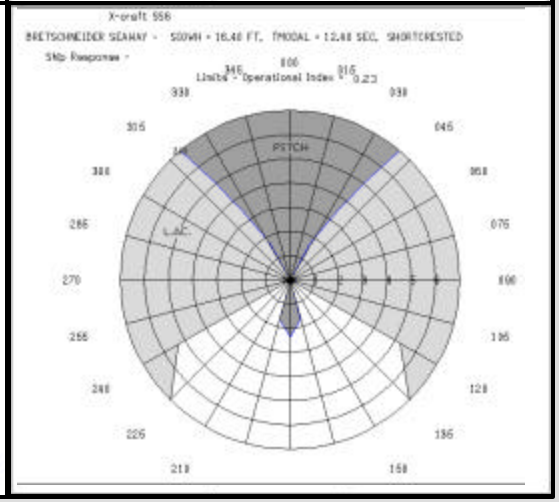
	SWATH	*Monohull*	*X-Craft (1,400 ton)*
Long-Crested Seas			
Short-Crested Seas			

OCEAN Class AGOR
Concept Definition

Seakeeping - 3 Feasibility Designs

Shaded Areas Exceed Motion Criteria

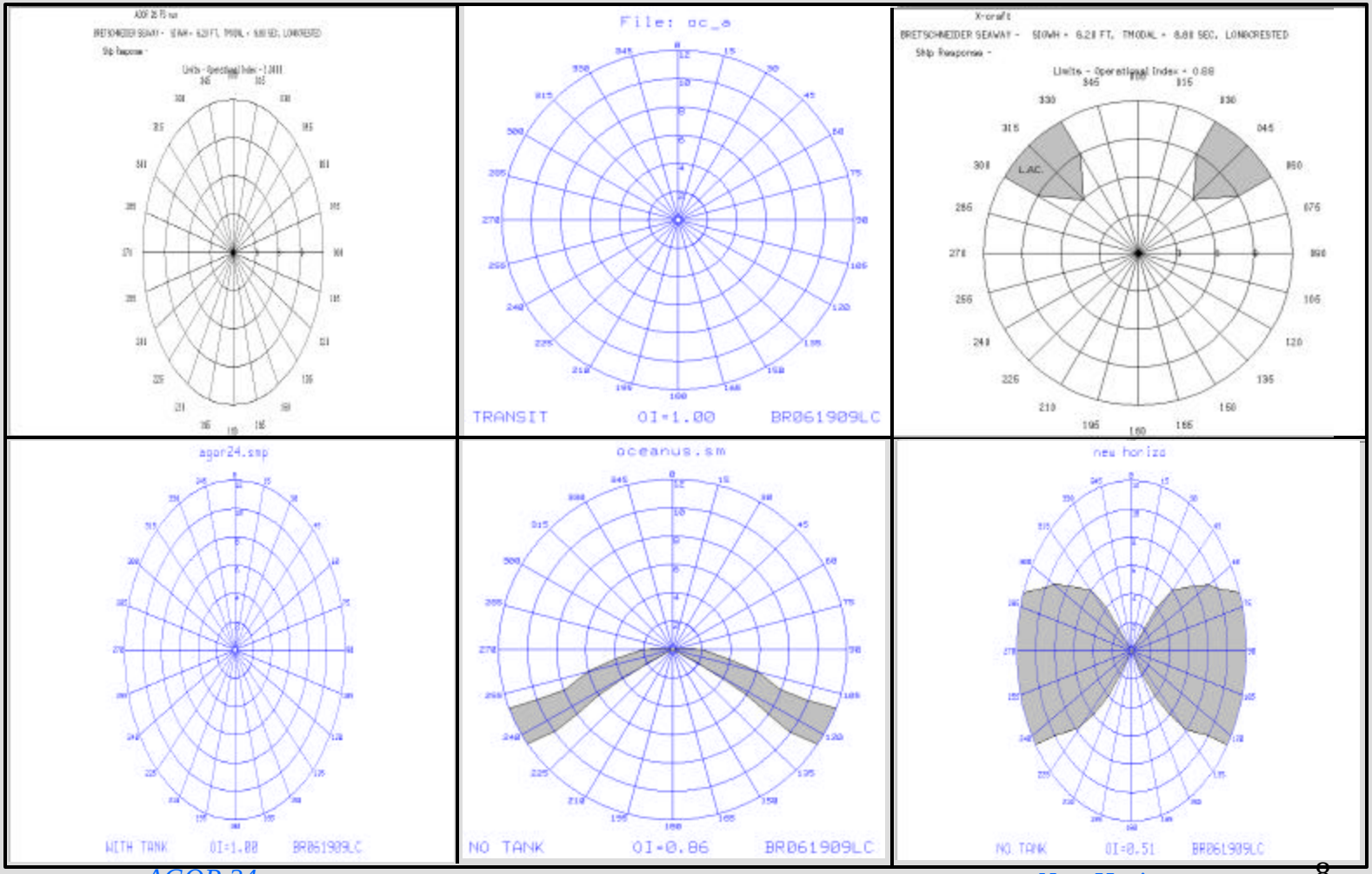
Transit N. Atl., MID SS6, Tm=12.4s

	SWATH	*Monohull*	*X-Craft (1,400 ton)*
Long-Crested Seas			
Short-Crested Seas			

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS4, Tm=8.8s, Long-Crested Seas

SWATH | *Monohull* | *X-Craft (1,400 ton)*



AGOR 24 | *Oceanus* | *New Horizon*

OCEAN Class AGOR
Concept Definition

Seakeeping - Feasibility Designs and Existing RVs

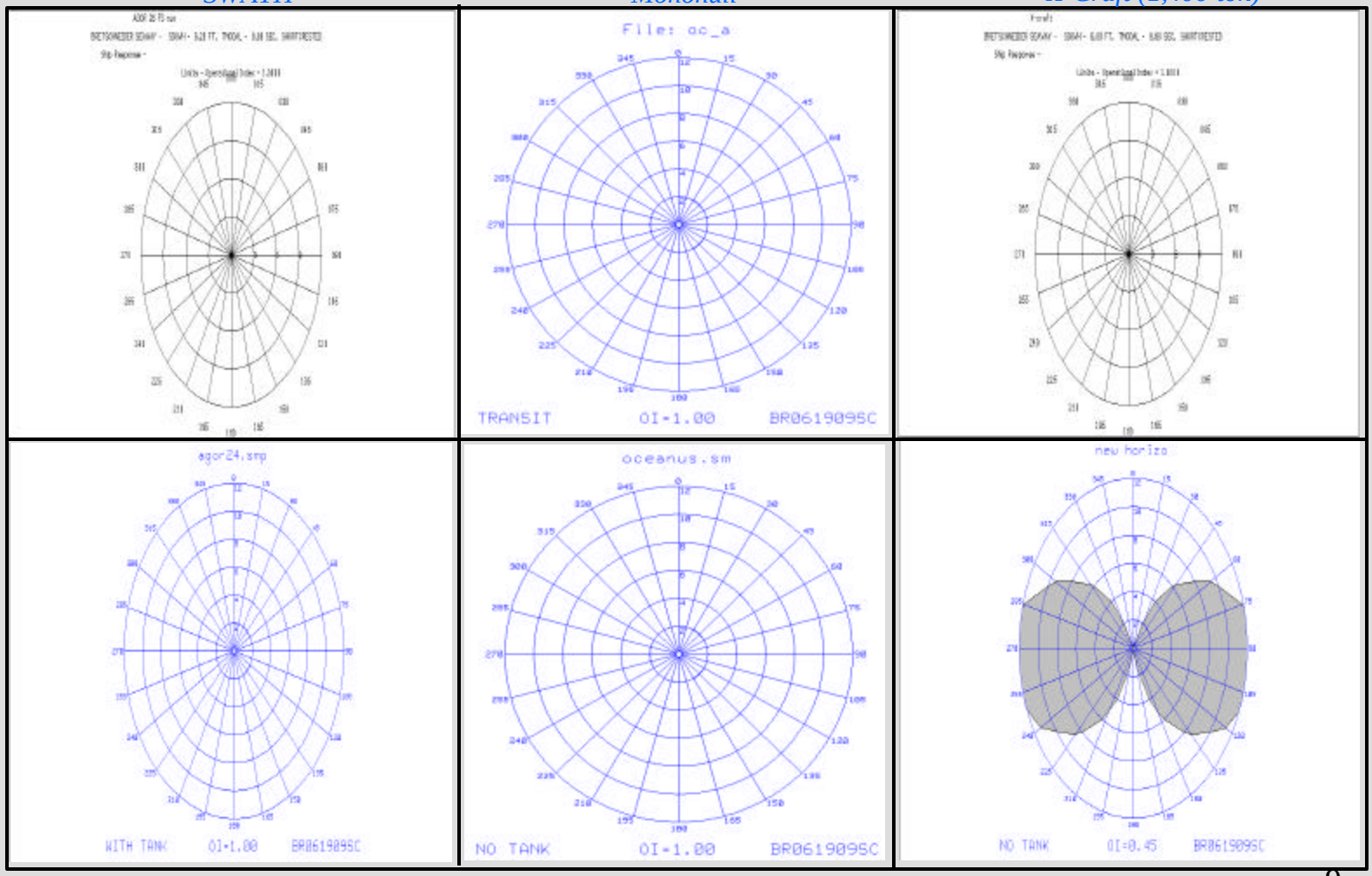
Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS4, Tm=8.8s, Short-Crested Seas

SWATH

Monohull

X-Craft (1,400 ton)



AGOR 24

Oceanus

New Horizon

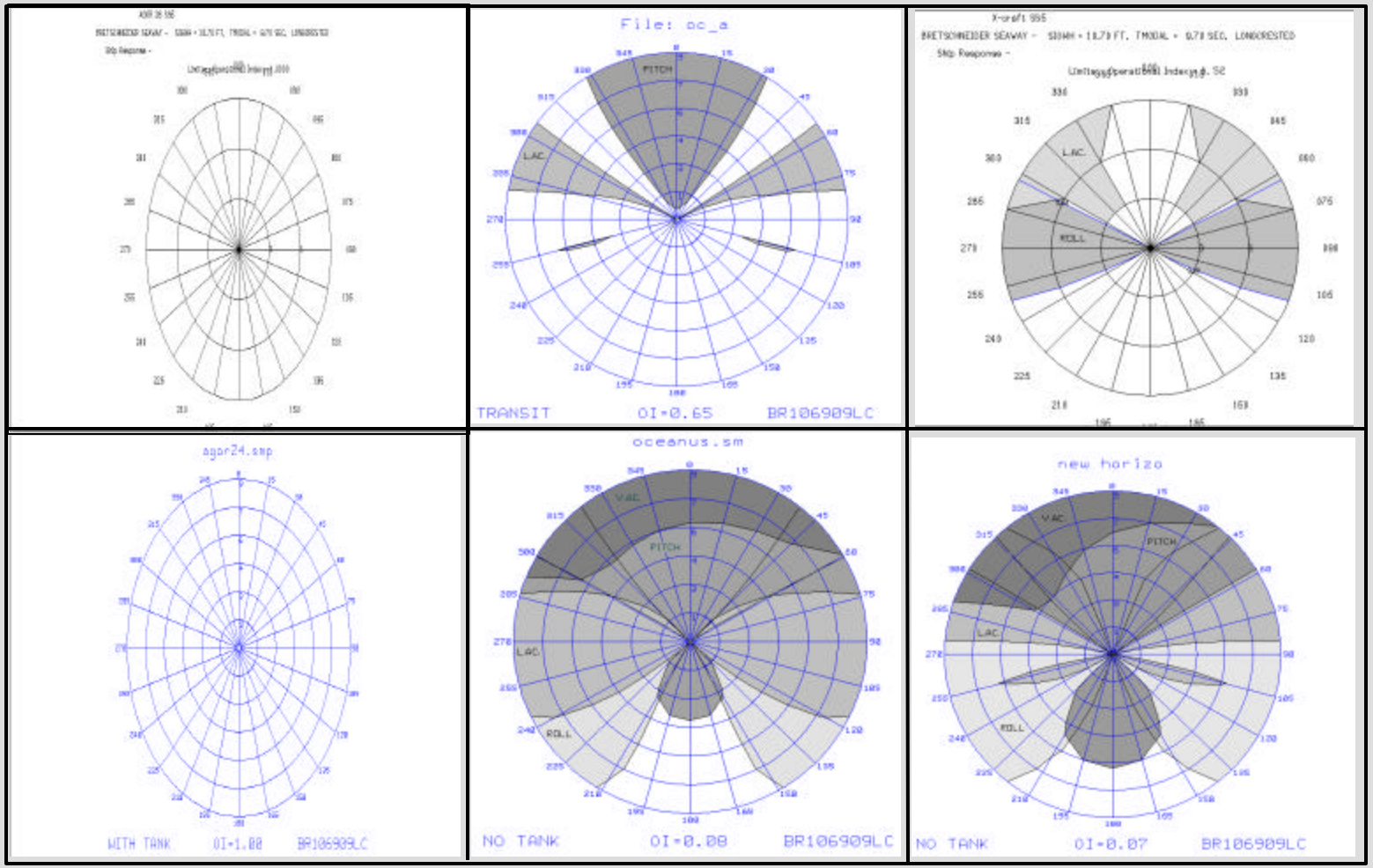
OCEAN Class AGOR
Concept Definition

Seakeeping - Feasibility Designs and Existing RVs

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS5, Tm=9.7s, Long-Crested Seas

SWATH | *Monohull* | *X-Craft (1,400 ton)*

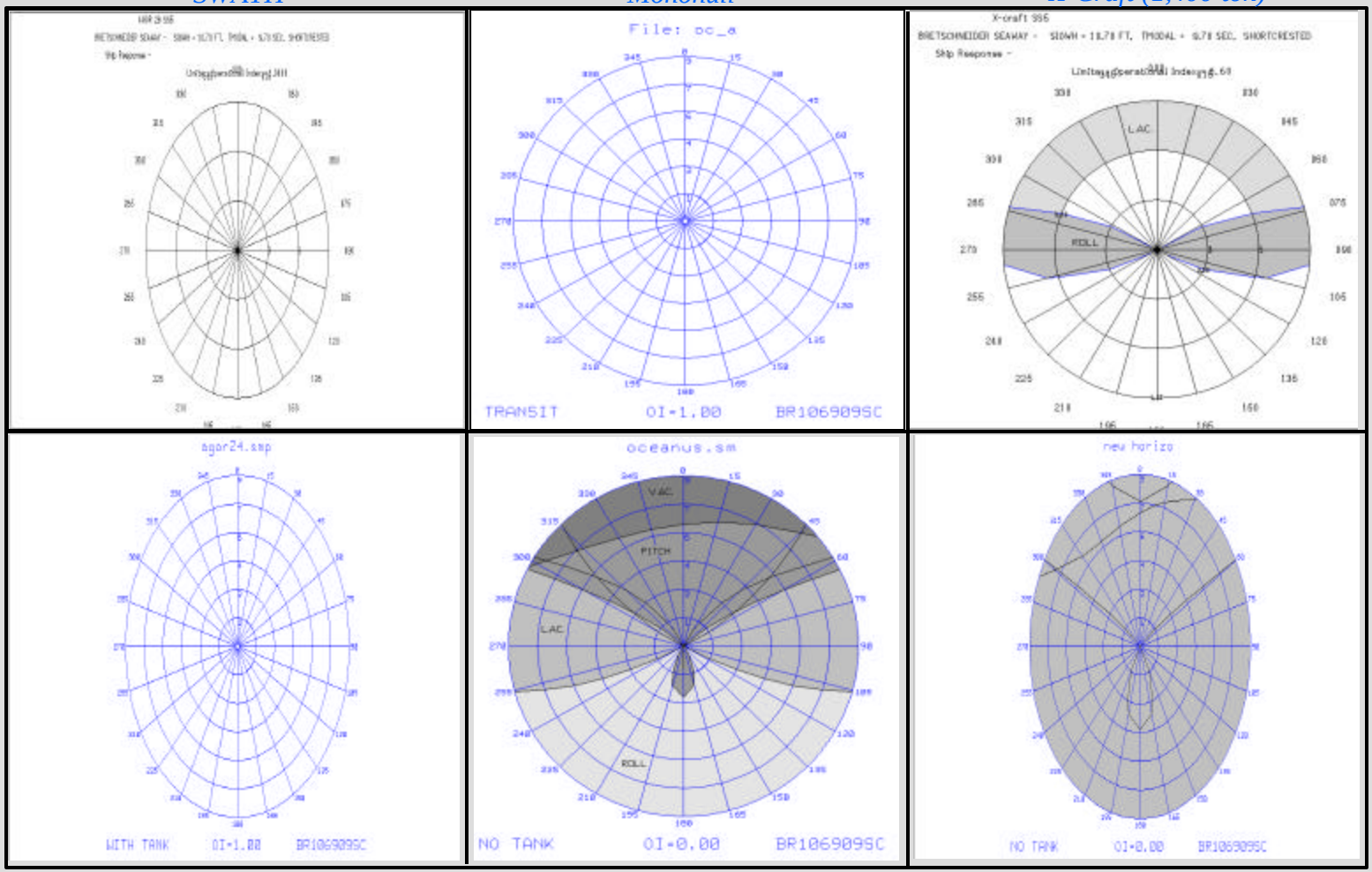


AGOR 24 | *Oceanus* | *New Horizon*

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS5, Tm=9.7s, Short-Crested Seas

SWATH | *Monohull* | *X-Craft (1,400 ton)*



AGOR 24 | *Oceanus* | *New Horizon*

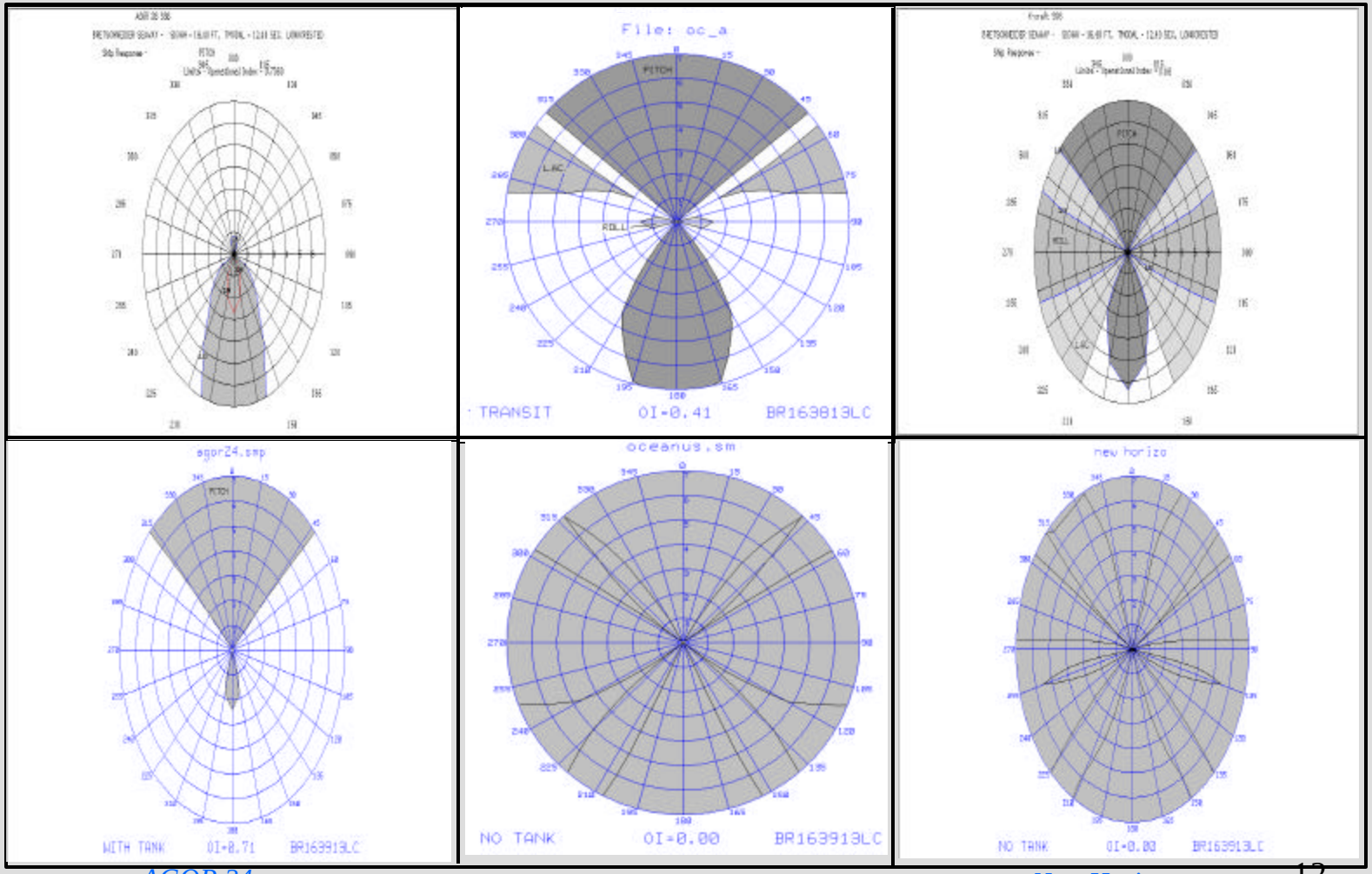
OCEAN Class AGOR
Concept Definition

Seakeeping - Feasibility Designs and Existing RVs

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS6, Tm=12.4s, Long-Crested Seas

SWATH | *Monohull* | *X-Craft (1,400 ton)*

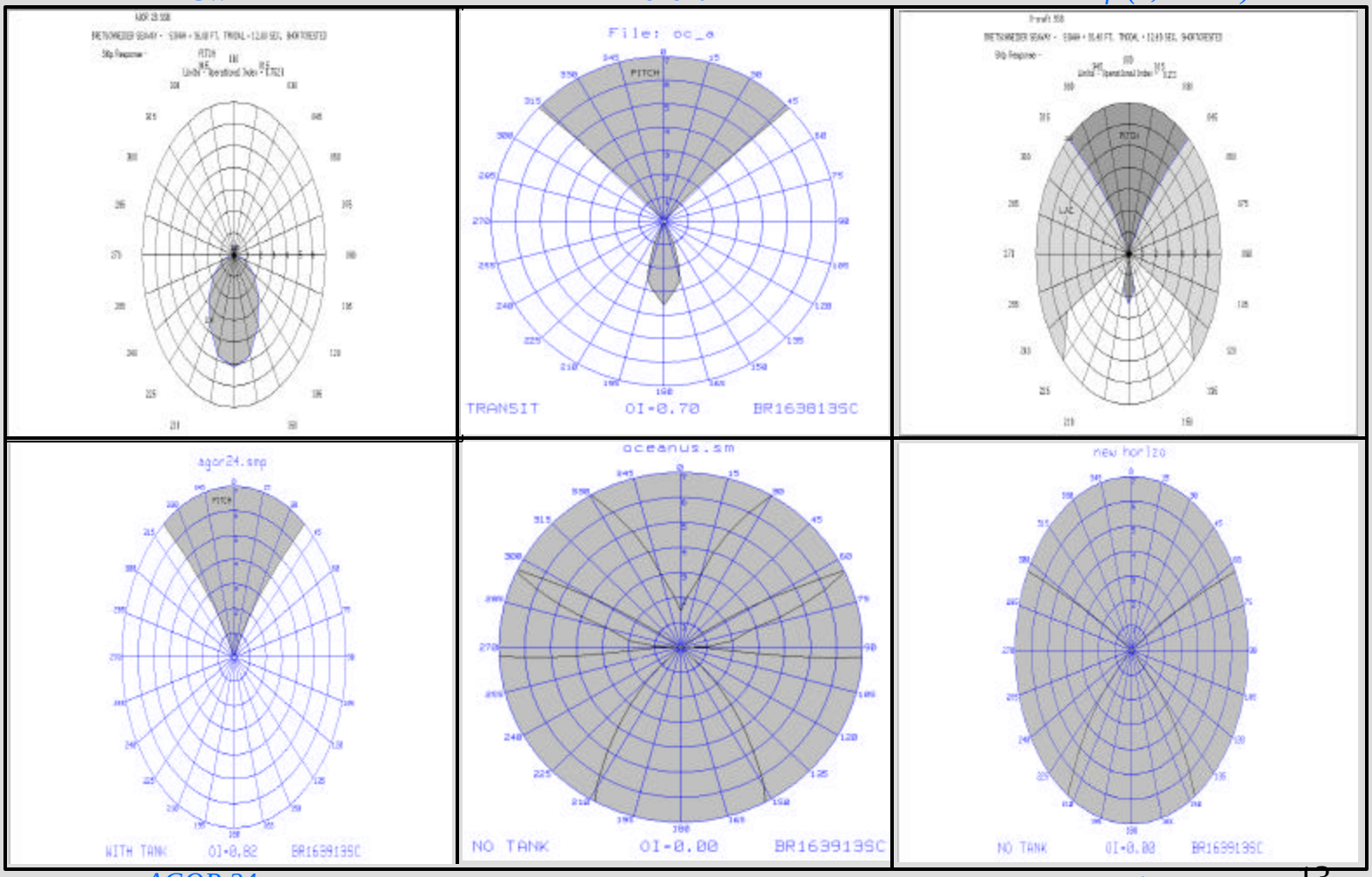


AGOR 24 | *Oceanus* | *New Horizon*

Shaded Areas Exceed Motion Criteria

Transit N. Atl., MID SS6, Tm=12.4s, Short-Crested Seas

SWATH | *Monohull* | *X-Craft (1,400 ton)*



AGOR 24 | *Oceanus* | *New Horizon*

OCEAN AGOR / EXISTING AGOR SEAKEEPING COMPARISON

Operability Index (OI) Summary

	SS4 LC	SS5 LC	SS6 LC	SS4 SC	SS5 SC	SS6 SC
SWATH	1.00	1.00	0.74	1.00	1.00	0.75
MONOHULL	1.00	0.65	0.41	1.00	1.00	0.70
X-CRAFT	0.88	0.52	0.08	1.00	0.60	0.23
AGOR 24	1.00	1.00	0.71	1.00	1.00	0.82
OCEANUS	0.86	0.08	0.00	1.00	0.00	0.00
NEW HORIZON	0.51	0.07	0.00	0.45	0.00	0.00

X Craft Concept Development

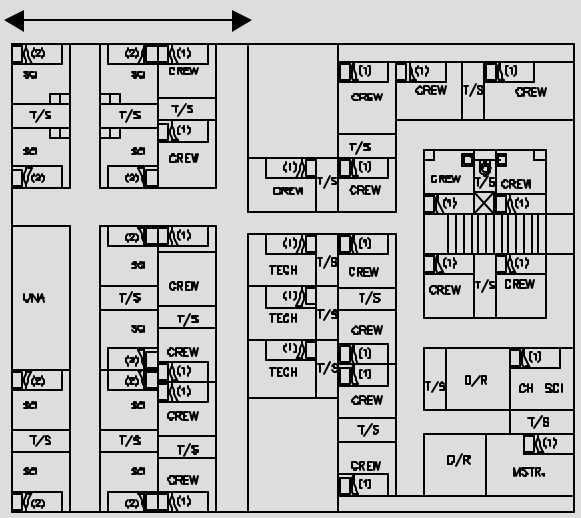
OCEAN Class AGOR
Concept Definition

X-Craft AGOR Variant

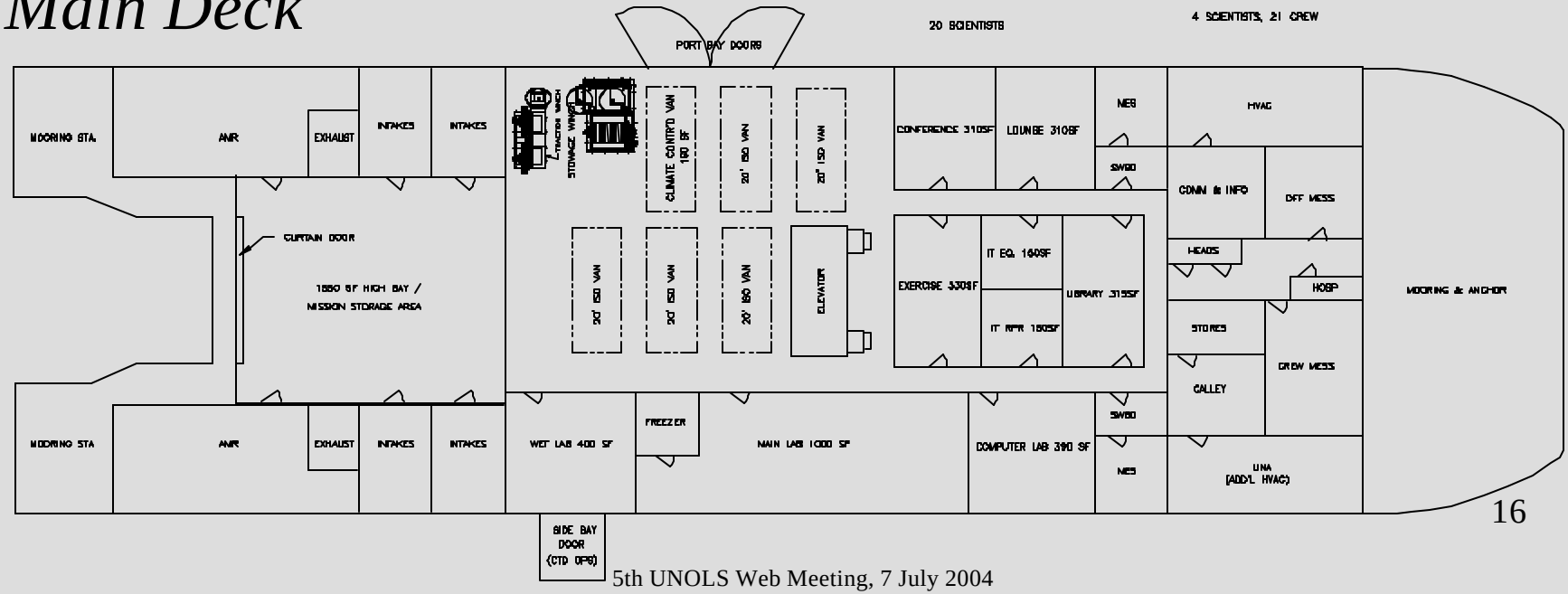
Modifications from baseline X Craft:

- Added HVAC Space, Computer Lab
- Added Library, IT Spaces, Exercise Room
- Elevator moved aft
- Added Main Lab, Freezer & Wet Lab
- Added Winch, High Bay/ Mission Storage
- 01 Deck Extended and Berthing Added

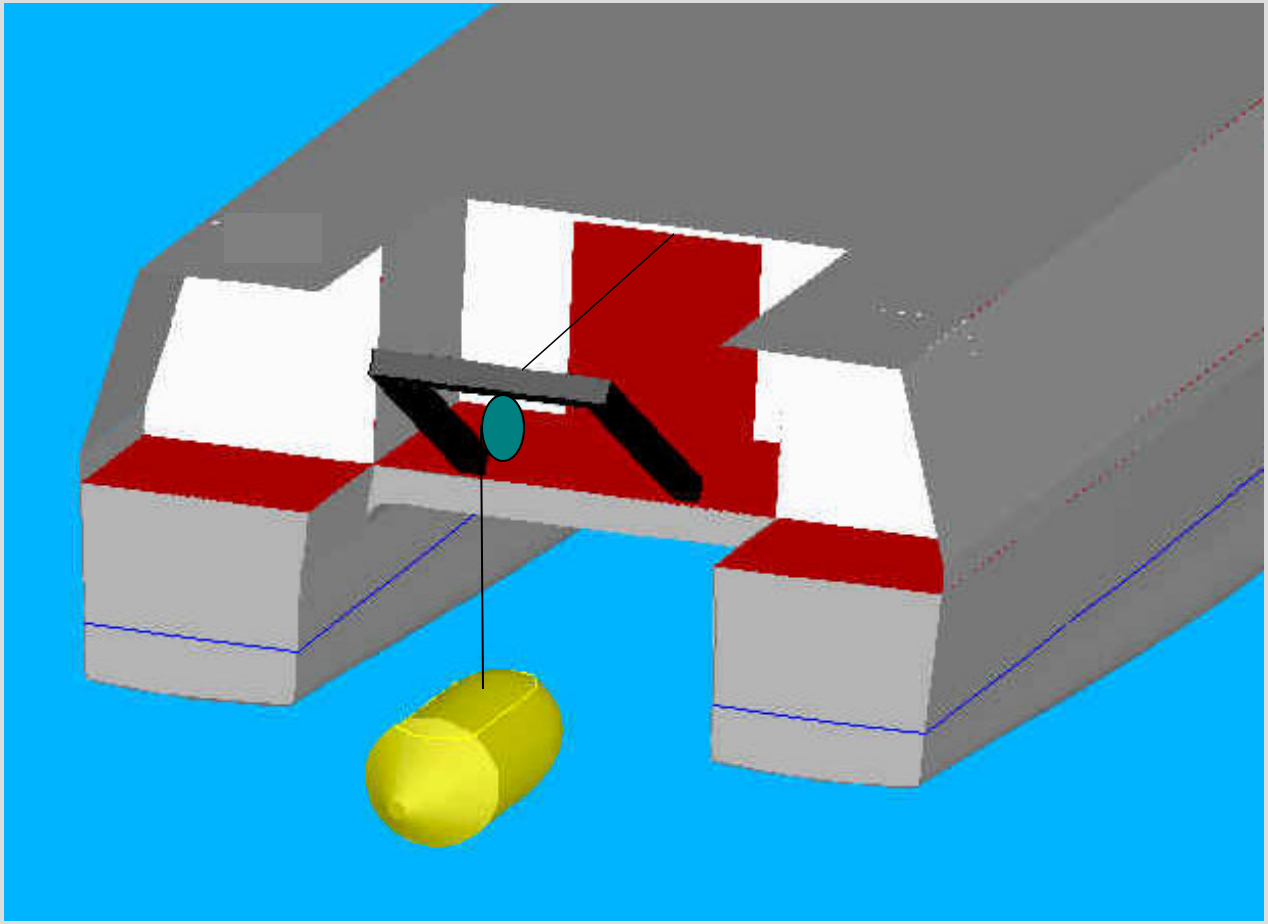
01 Deck



Main Deck



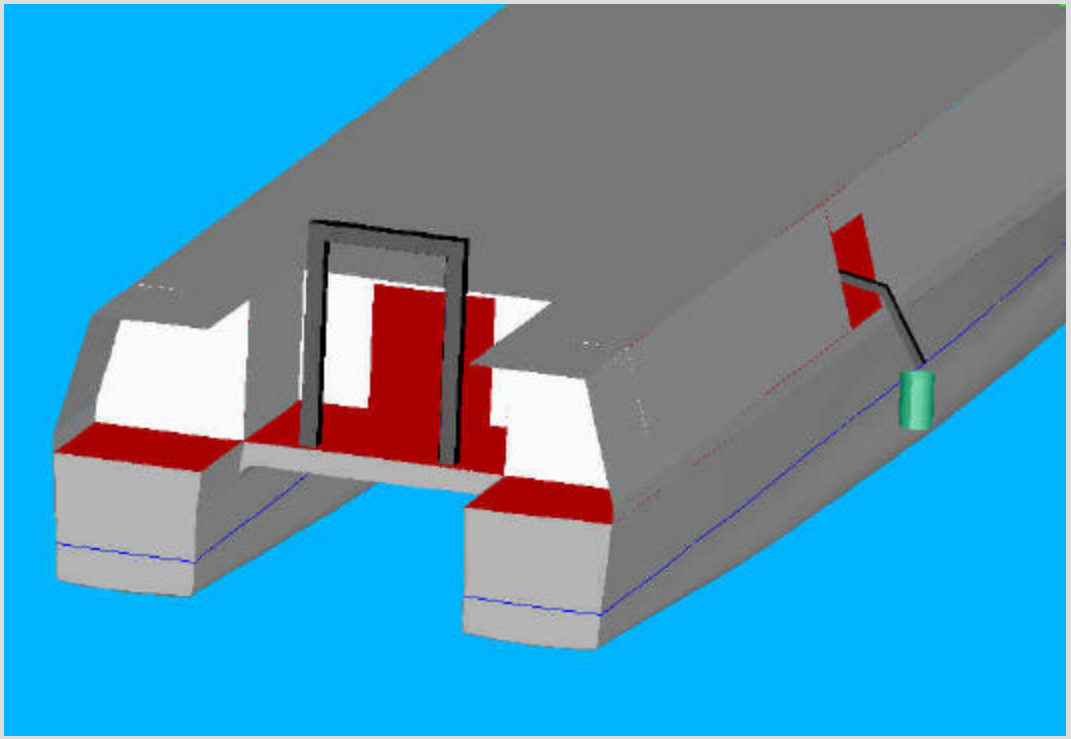
Over Stern Handling - A-Frame Concept



Modifications from ONR Baseline X Craft

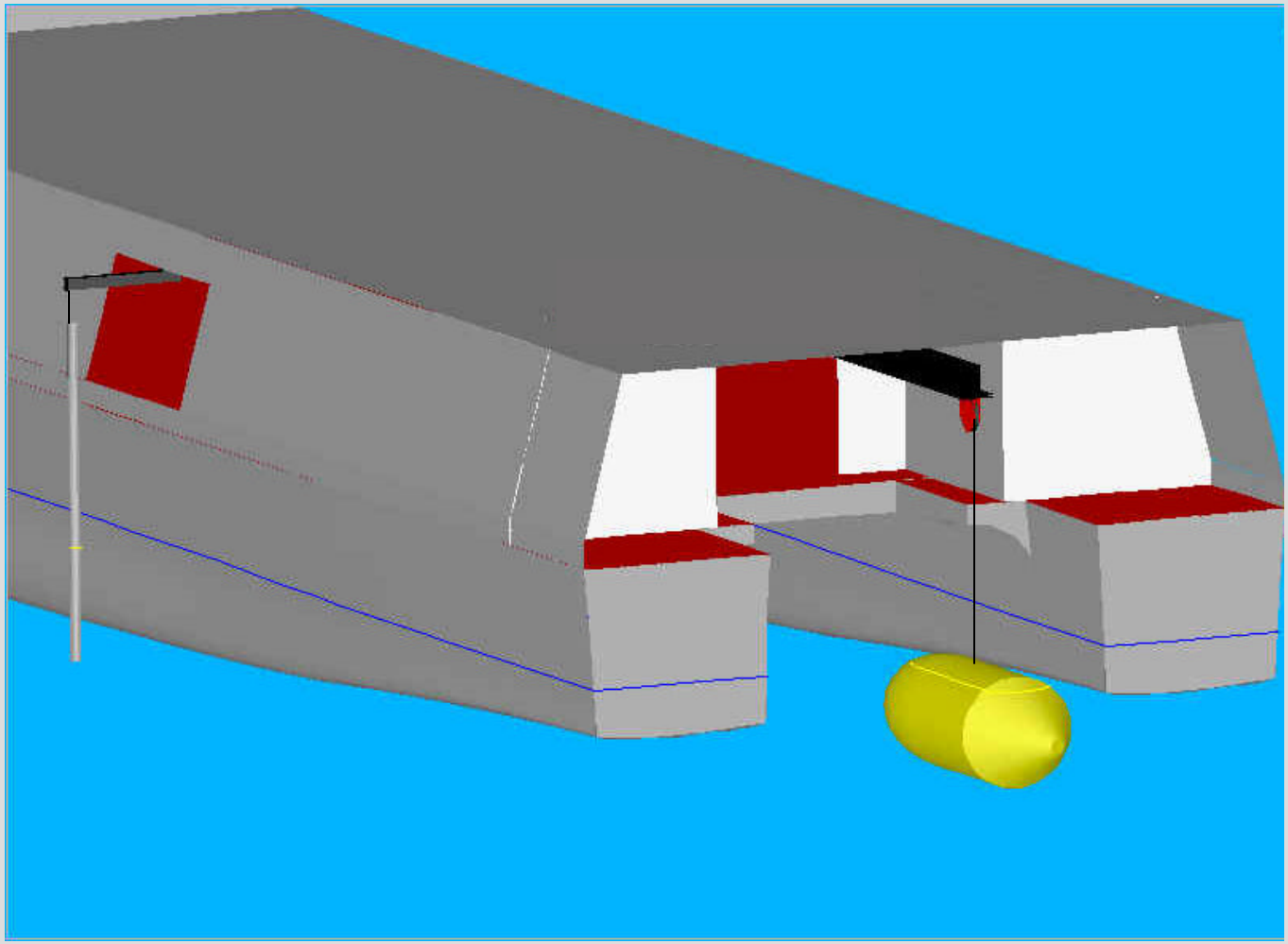
- Boat ramp removed
- Section of deck added aft of hanger door
- Flight deck removed above A-Frame

Side CTD Handling Arrangement



- Sliding Side Bay Door / Sallyport
- CTD winch, crane & rosette within wet lab
- Knuckleboom crane lifts rosette and articulates outboard
- Knuckleboom articulates towards waterline & minimizes pendulum effect

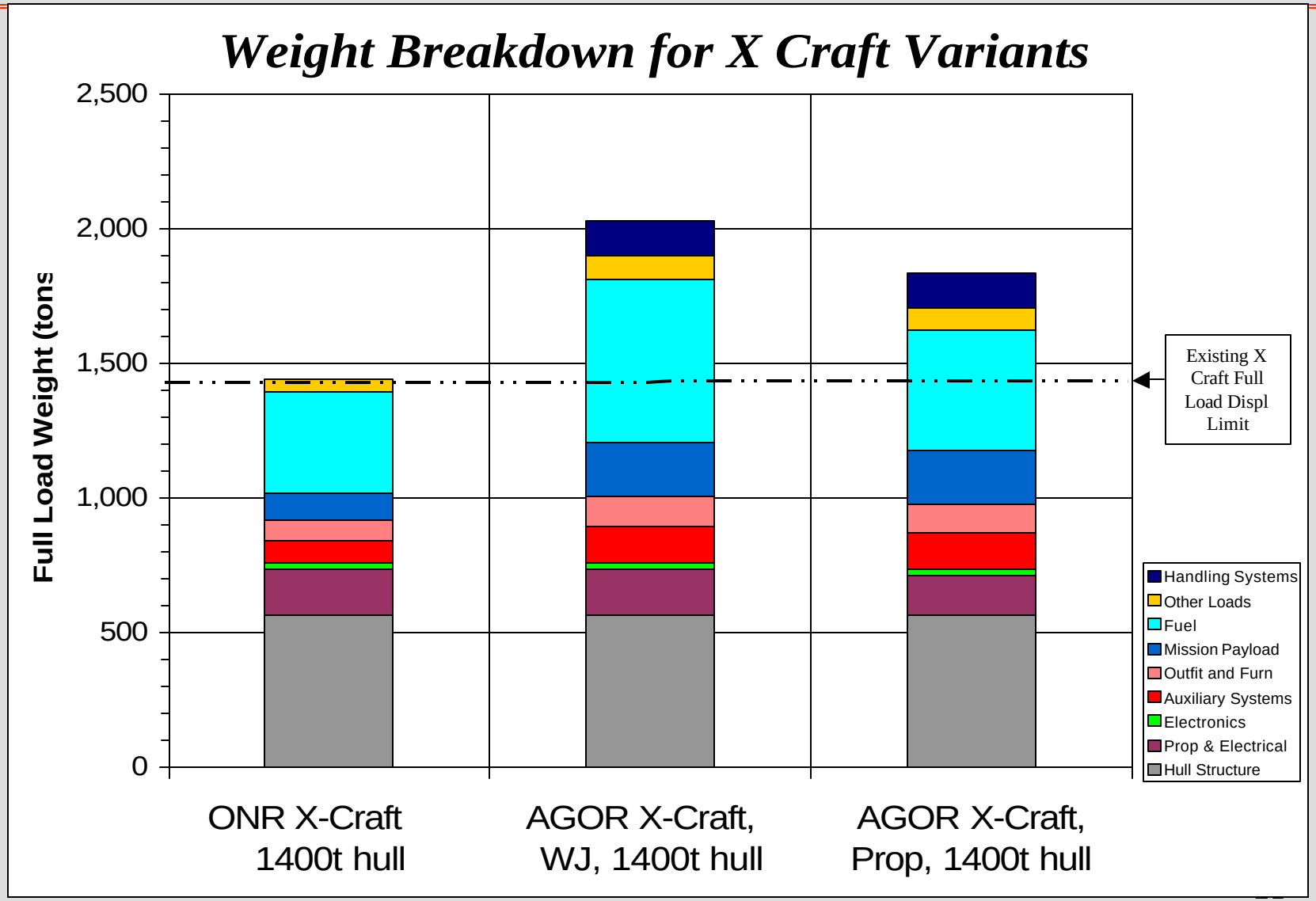
Monorail Stern Handling Concept



- X Craft Has…..
  - » Adequate enclosed volume above the waterline to accommodate AGOR mission functions
  - » But, inadequate displacement to accommodate the weight of the AGOR mission functions without increasing hull volume
- One solution is to fatten hulls for more volume
- To what degree can the existing X craft hull form meet the SMRs without hull modification ?

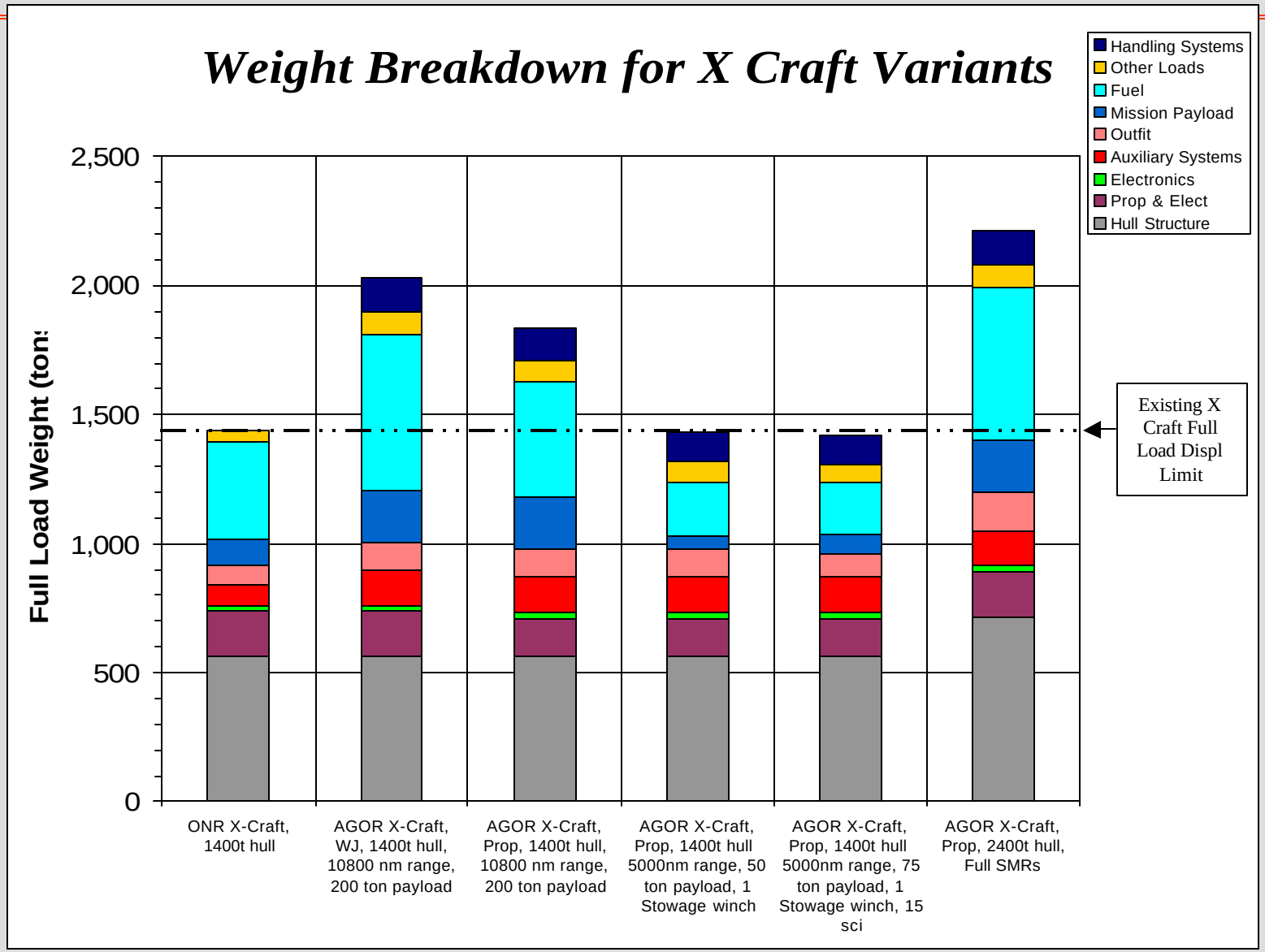
OCEAN Class AGOR

Concept Definition



OCEAN Class AGOR

Concept Definition



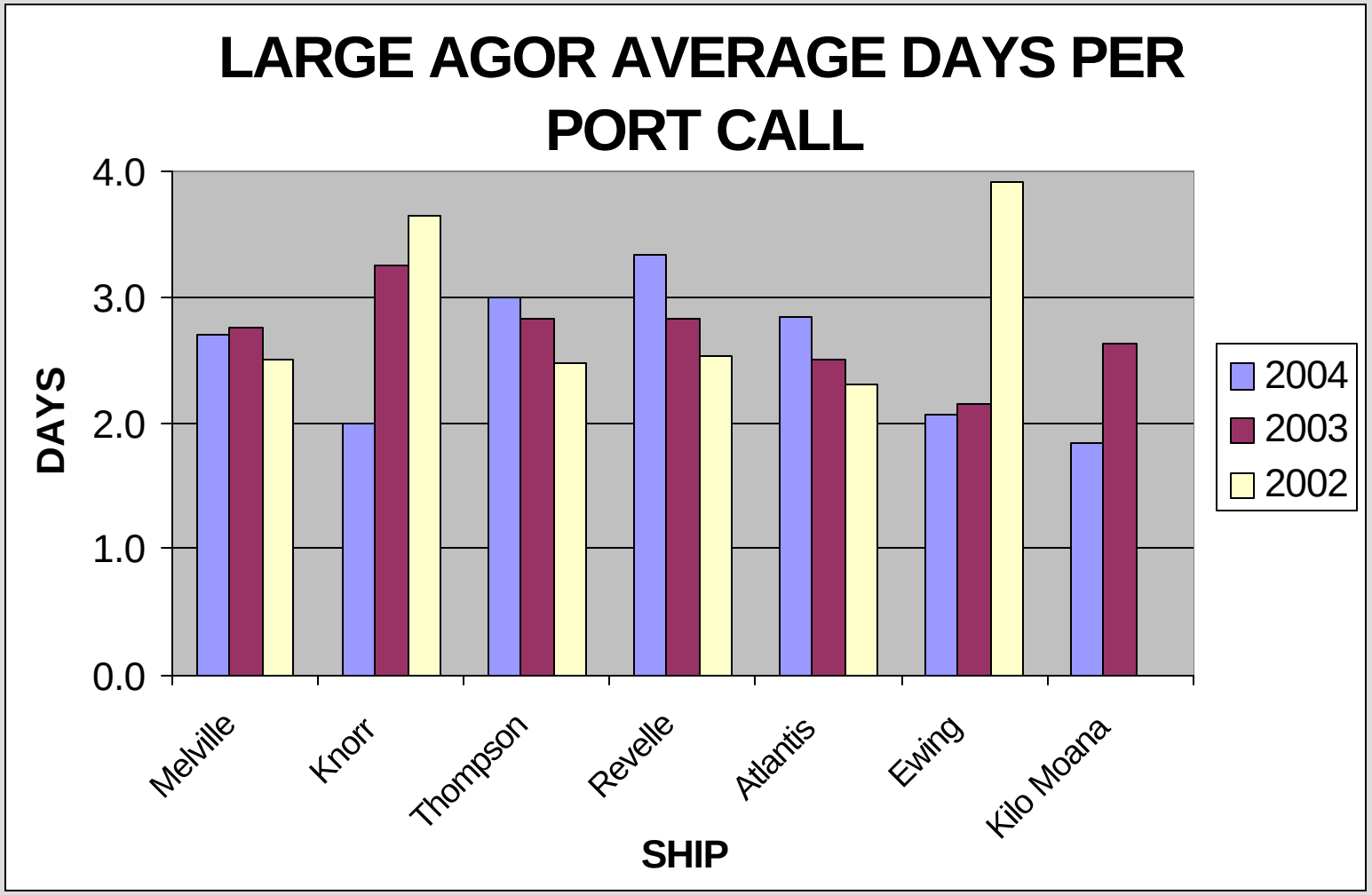
Lab Van Study

Increased Use of Portable Lab Vans Makes Sense If:

- Operating Cost Can Be Reduced Without Significant Negative Impacts on Science and/or Ship

OR

- Science and/or Ship Operations Can Be Improved Without Significant Increase In Cost


LARGE AGOR AVERAGE DAYS PER PORT CALL
DAYS
4.0
3.0
2.0
1.0
0.0
Melville
Knorr
Thompson
Revelle
Atlantis
Ewing
Kilo Moana
SHIP
2004
2003
2002

OCEAN Class AGOR

Concept Definition

Where Did They Go ?

MELVILLE			*KNORR*			*THOMPSON*		
2002	**2003**	**2004**	**2002**	**2003**	**2004**	**2002**	**2003**	**2004**
Cairns	Cape Town	Port	Woods Hole	Woods Hole	Ft. Lauderdale	Easter Island	Apra	Seattle
Honolulu	Cape Town	Lyttelton	Balboa	Norfolk	Ft. Lauderdale	Papeete	Apra	Seattle
Port	Port	Papeete	Balboa	Ancona	Ft. Lauderdale	Suva, Fiji	Apra	Seattle
Honolulu	Cape Town	Lyttelton	Barbados	Ancona	Guadeloupe	Guam	Ancona	Seattle
Moresby	Cape Town	Lyttelton	Woods Hole	Istanbul	Bridgetown	Yokohama	Honolulu	Seattle
Moresby	Walvis Bay	Apia	Bergen	Istanbul	Guadeloupe	Yokohama	Seattle	Seattle
Driscoll	Cape Town	Majuro	Bergen	Istanbul	Reykjavik	Yokosuka	Seattle	Seattle
Moresby	Cocos Keeling	Osaka	Woods Hole	Istanbul	Glasgow	Seattle	Astoria	Seattle
Cairns	Hedlan	Honolulu	Woods Hole	Istanbul	Glasgow	Portland	Astoria	Seattle
Moresby	Darwin	Honolulu	St. Johns	Istanbul	Reykjavik	Portland	Astoria	Seattle
Moresby	Darwin	San Diego	Bergen	Ancona	Reykjavik	Astoria	Victoria	Portland
Cairns	Cairns	San Diego	Reykjavik	Ancona	Woods Hole	Astoria	Seattle	San Diego
Moresby	Moresby	Puerto Cald	Nuuk	Malta	Woods Hole	Seattle	Seattle	Honolulu
Moresby	Moresby	Puerto Cald	Nuuk	Sinop	Woods Hole	Seattle	Seattle	Honolulu
Moresby	Moresby	Arica	Woods Hole	Istanbul			Seattle	Apra
Cairns	Moresby	Valparaiso	Bermuda	Malta			Seattle	
Yokohama	Brisbane	Cap Town	Woods Hole	Woods Hole			Seattle	
San Diego				PortO'Spain				
San Diego				Woods Hole				
San Diego								
San Diego								

REVELLE			*ATLANTIS*			*EWING*			*KILO MOANA*	
2002	**2003**	**2004**	**2002**	**2003**	**2004**	**2002**	**2003**	**2004**	**2003**	**2004**
Puerto Cald	San Diego	Lyttelton	San Diego	Miami	Manzanillo	San Juan	Norfolk	Hobart	Honolulu	Honolulu
Mazatlan	San Diego	Lyttelton	San Diego	Jacksonville	San Diego	Curacao	San Juan	Guam	Honolulu	Honolulu
San Diego	San Diego	Lyttelton	Puntarenas	Nassau	San Diego	Curacao	Gulfport	Guam	Honolulu	Honolulu
San Diego	San Diego	Lyttelton	Puntarenas	Barbados	San Diego	San Juan	Galveston	Dutch Harbo	Honolulu	Honolulu
Honolulu	San Diego	Hilo	Manzanillo	Barbados	San Diego	Tampa	Panama	Kodiak	Honolulu	Honolulu
Dutch Harbor	San Diego	Hilo	San Diego	St.Georges	Manzanillo	Tampa	Panama	Astoria	Honolulu	Honolulu
Honolulu	Honolulu	Honolulu	Seattle	St.Georges	Galapagos	San Diego	Bergen	Newport	Honolulu	Kodiak
Honolulu	Honolulu	Honolulu	Seattle	Woods Hole	Galapagos	San Diego	Bergen	Newport	Suva, Fiji	Kodiak
Honolulu	Honolulu	Honolulu	Seattle	Woods Hole	Kodiak	New Port	Bergen	Manzanillo	Suva, Fiji	Seattle
San Diego	Honolulu	San Diego	Seattle		Astoria	Kodiak	Barbados	Panama	Wellington	Seattle
San Diego	Honolulu	San Diego	Seattle		Astoria	Astoria	Bermuda		Wellington	Dutch Harbor
San Diego	Newport	New Port	Astoria		Astoria	San Diego	Newark		Honolulu	Dutch Harbor
	San Diego	New Port	Seattle		Astoria	Puerto Cald	Norfolk		Honolulu	Kodiak
	Puntarenas	New Port	Seattle		New Port	Panama			Honolulu	Kodiak
	Manta	Honolulu	San Diego		New Port				Suva, Fiji	Honolulu
	Arica	Honolulu	San Diego		New Port				Suva, Fiji	Honolulu
	Callao	Honolulu	San Diego		San Diego				Lae, PNG	Honolulu
		San Diego	Manzanillo		Puntarenas				Lae, PNG	Honolulu
		San Diego	San Diego		Puntarenas				Honolulu	Honolulu
					Puntarenas					

Possible Activities During Port Stays

- Interaction With Port Officials
- Loading Consumables
- Science Party- Embark New/Debark Old
- Loading Fuel
- Maintenance and Repair
- Inspections
- Crew Rest

OCEAN Class AGOR

Concept Definition

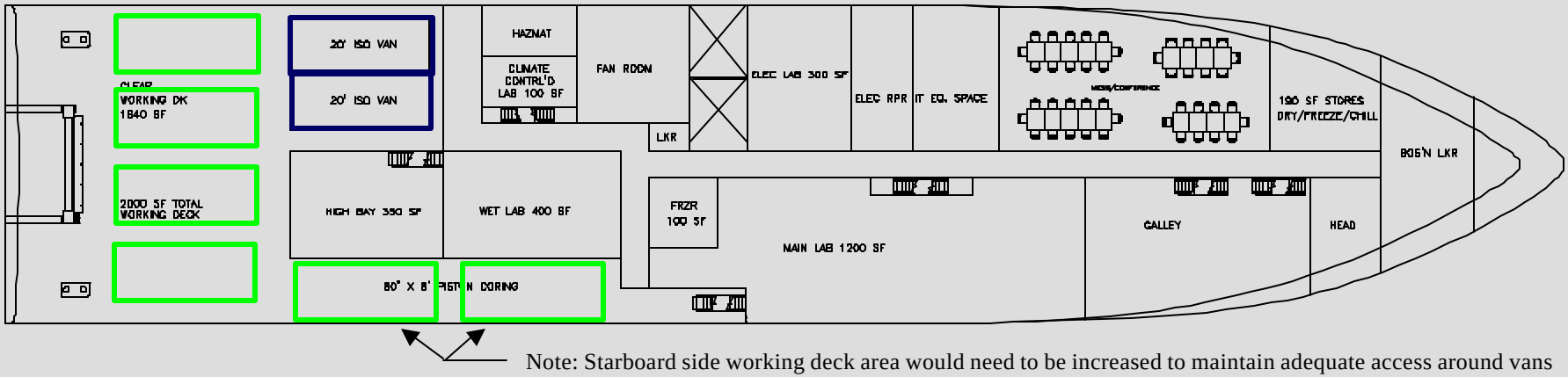
- Large AGORs Generally Designed for 4 vans, but occasionally carry as many as 6
- Lab Van Support Requirements:
  - Overside Handling Cranes
  - Onboard Handling Arrangements (for enclosed areas)
  - Services:
    - Tiedowns
    - Ship's Service Electrical Power (120, 240, 480v)
    - Clean Electrical Power
    - Compressed Air
    - Freshwater
    - Seawater
    - Sewage drain
    - Seawater overboard drain
    - Computer Network
    - Communications - dial telephone, mission intercom

OCEAN Class AGOR Concept Definition

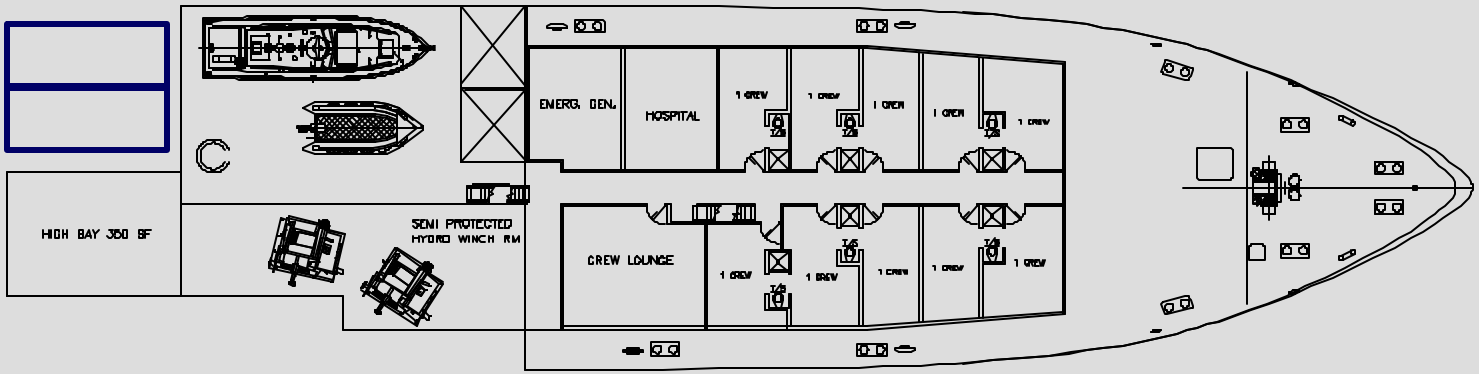
Van Study - Additional Possible Van Locations - Monohull

Vans Required By SMRs

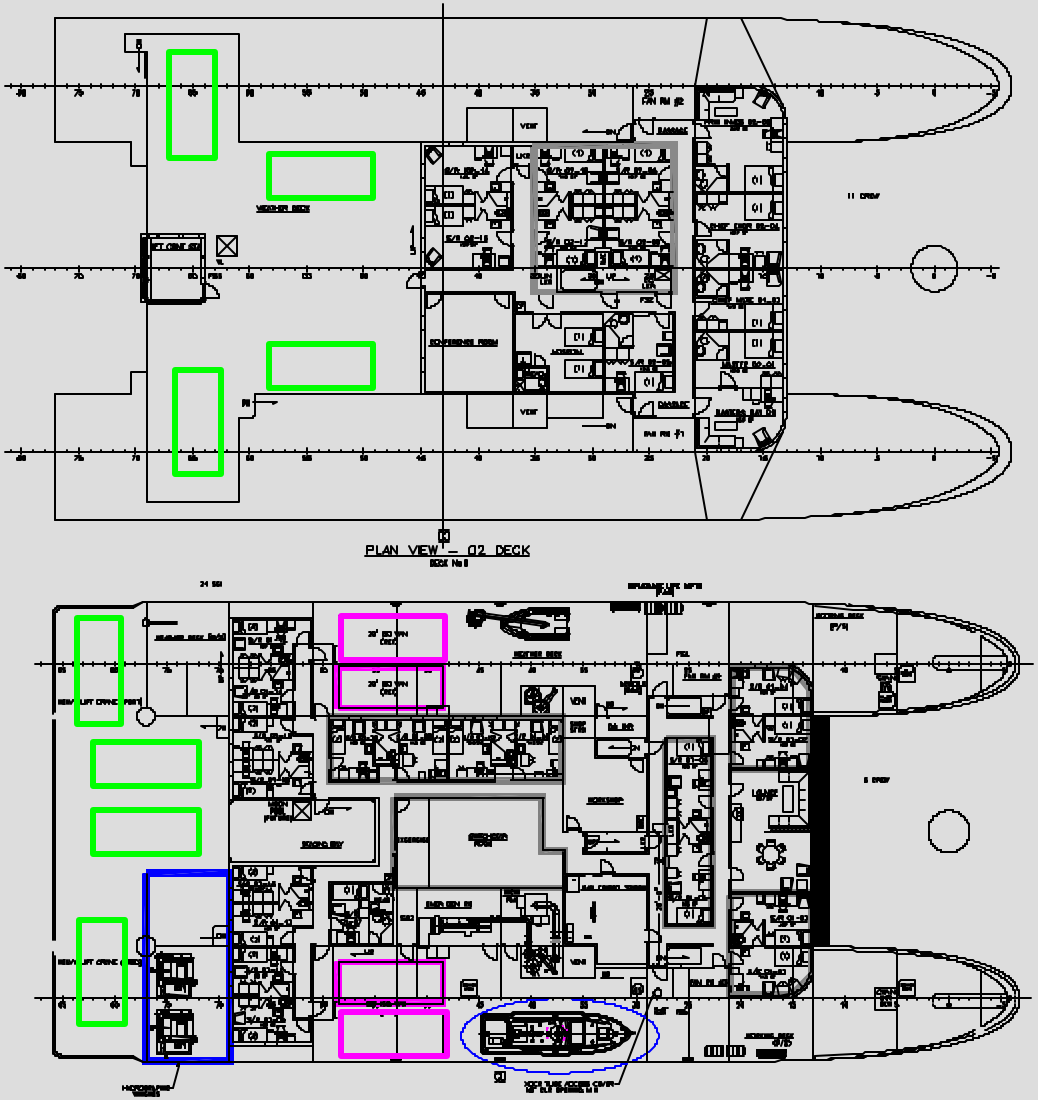
Additional Possible Locations for Vans (depending on stability conditions)



Note: Starboard side working deck area would need to be increased to maintain adequate access around vans



Van Study - Additional Possible Van Locations - SWATH



Vans Required By SMRs

Additional Possible Locations for Vans (depending on stability conditions)

Examples of Specialized Portable Lab Vans

- Radioisotope
- Chemical Storage
- Accommodations
- ROV
- SUS Charges
- Seismic Compressor
- Electrical Generator
- Weather Balloon

Construction Cost Estimate

Construction Cost Estimate

Approach

1) Weight Based Cost Estimate For Each Variant
    - Detailed Weight Estimate Developed For Each
    - Cost Relationships (Mat'l and Labor) Assigned for Each Weight Group
2) Parametric Estimate Based On Existing Similar Ships
    - Scaled By Lightship Weight
    - Inflated To Present Year Dollars