Lamont-Doherty Earth Observatory

of Columbia University

Research Vessel Maurice Ewing in the Gulf of Corinth August 2001

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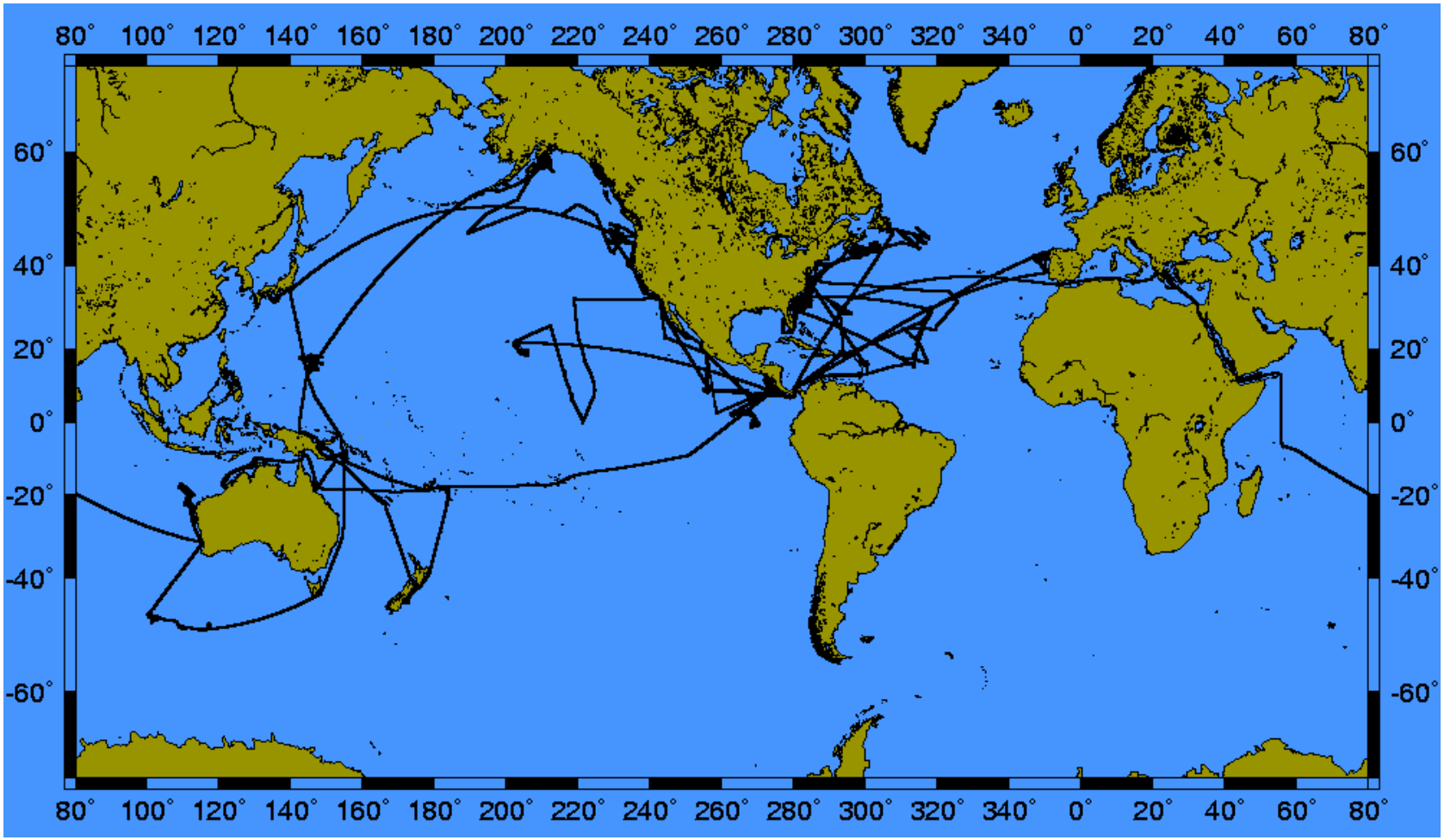
The Research Vessel *Maurice Ewing*

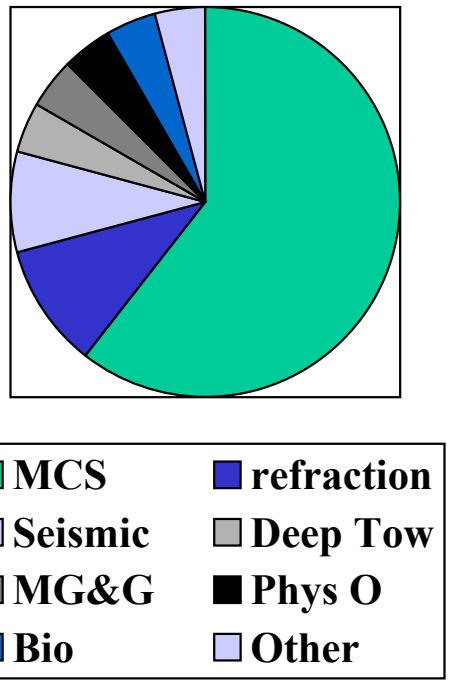
Length:	237 feet
Disp. Tonnage:	2598 long tons
Year Built:	1983 (converted 1989- 1990)
Endurance:	50 days
Science Berths:	29

R/V *EWING* 1997 - 2002



R/V *EWING* use ’97-’02

Principal use, by legs



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The Questions:

How might ***Ewing*** be upgraded to best address the scientific needs of the community?

What additional capabilities should the ship have?

What are the tradeoffs between optimizing seismic capabilities and general-purpose capabilities?

What is practical - reasonable - optimal?

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These questions must be answered in the context of both:

- The evolving science needs of the U.S. community
- The strengths and capabilities of the other vessels within the UNOLS fleet
- The Federal plan for fleet enhancement and replacement over the next 15 years

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The Process

- Solicitation of input from community via EOS ad; direct mailing; requests in community Newsletters
- Establishment of new internal advisory committee
- Establishment of a community-wide steering committee
- Production of extensive set of 'Technical Option Papers'
- Workshop Activity and production of workshop report
- Formulation of set of feasible options for discussion

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Workshop: Overall Summary & Conclusions

Key Statements:

• A refit of ***Ewing*** cannot improve 2-D MCS ***and*** provide an effective multiple streamer capability (for 3D) ***and*** substantially improve general-purpose operations.

• Quality of present ***Ewing*** MCS operations would be substantially improved through increased repeatability of the sound source.

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Key Statements *(continued):*

• In the refit of ***Ewing,*** use of a linear airgun array forces serious compromises in OBS and general purpose operations.

• In the refit of ***Ewing,*** without a linear airgun array, there are excellent options for new lab and deck layouts.

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Workshop Recommendations:

If the goal is to:

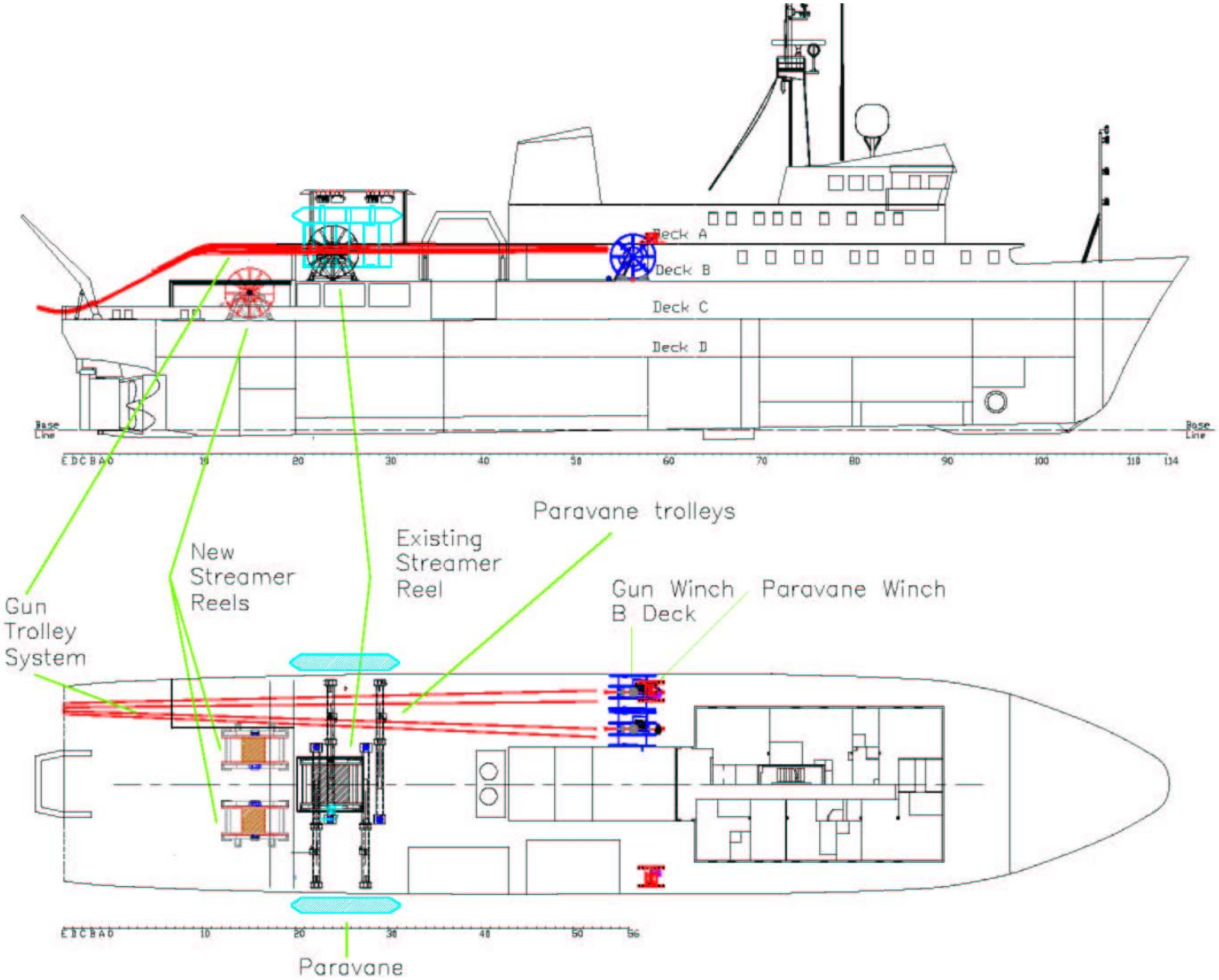
- Tow multiple long streamers
- Improve source repeatability using linear gun arrays

and

- Improve general purpose/OBS capabilities

then

- ***Ewing*** cannot satisfy these needs, and the possibility of securing a used industry vessel should be studied


Deck A
Deck B
Deck C
Deck D
Base Line
Base Line
E D C B A 0
10
20
30
40
50
60
70
80
90
100
110
114
Paravane trolleys
New Streamer Reels
Existing Streamer Reel
Gun Winch B Deck
Paravane Winch
Gun Trolley System
E D C B A 0
10
20
30
40
50
56
Paravane

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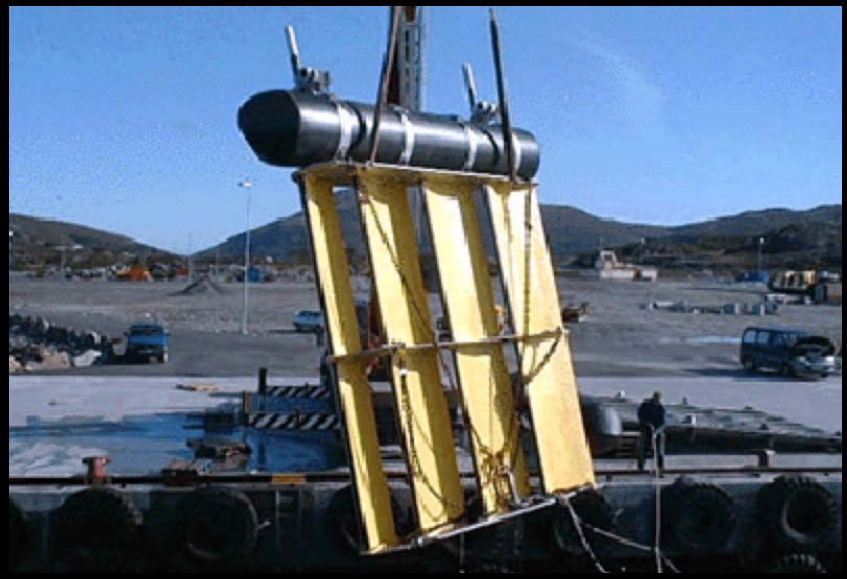

Paravanes

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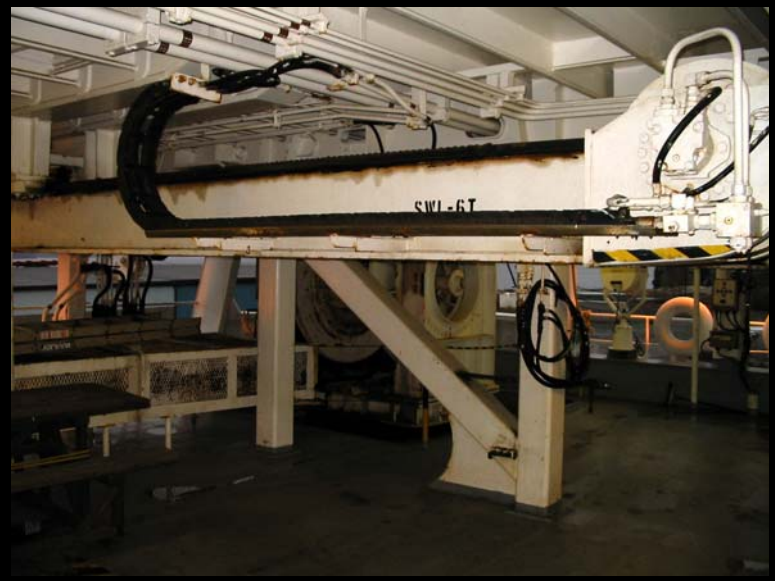

Paravanes

Winch **Handling Equipment**

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Three Options for Discussion:

1. Maximize ***Ewing*** general purpose capabilities, and enhance conventional MCS.

2. Outfit ***Ewing*** with Linear Gun arrays

3. Replacement Vessel

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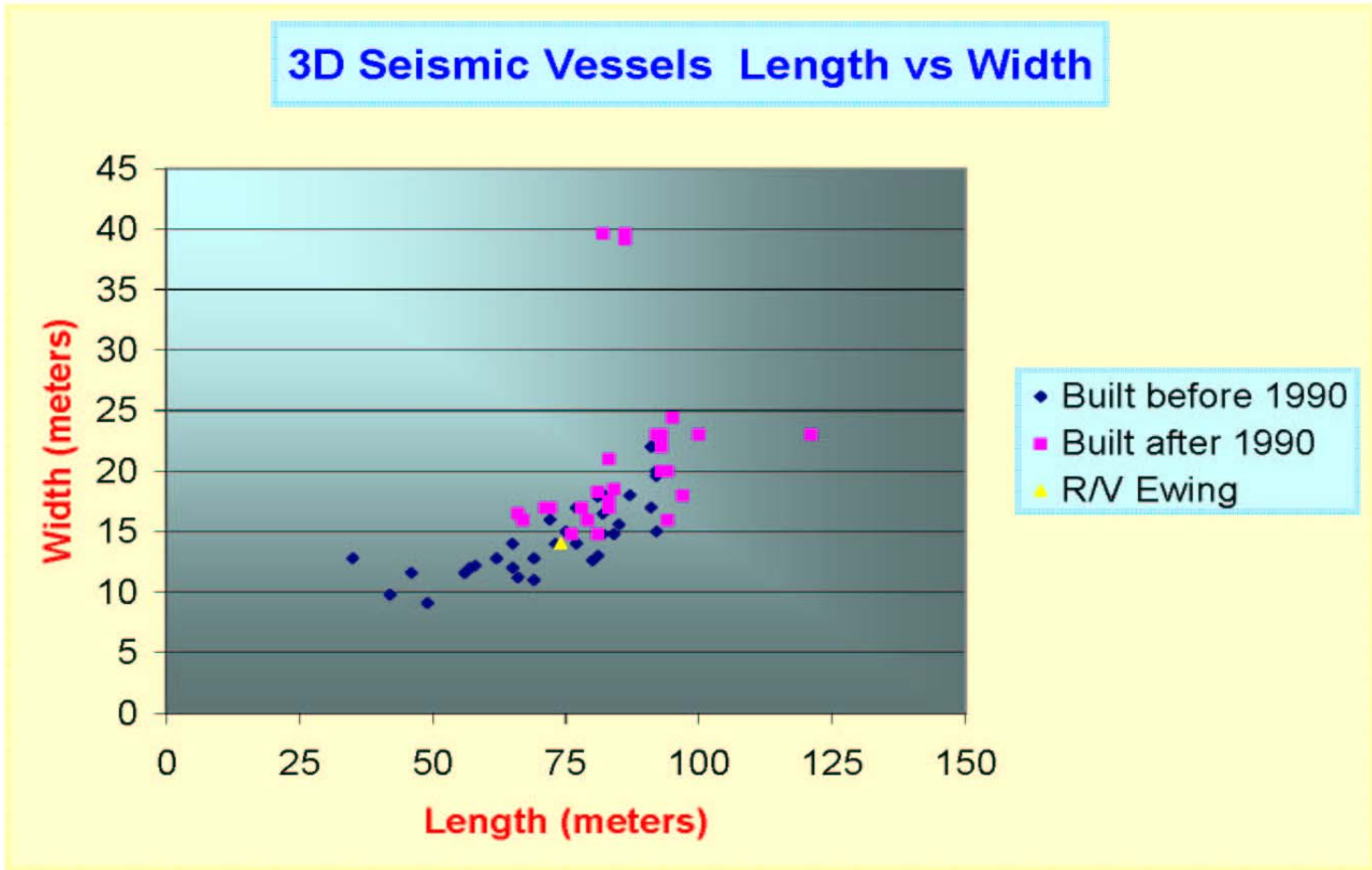
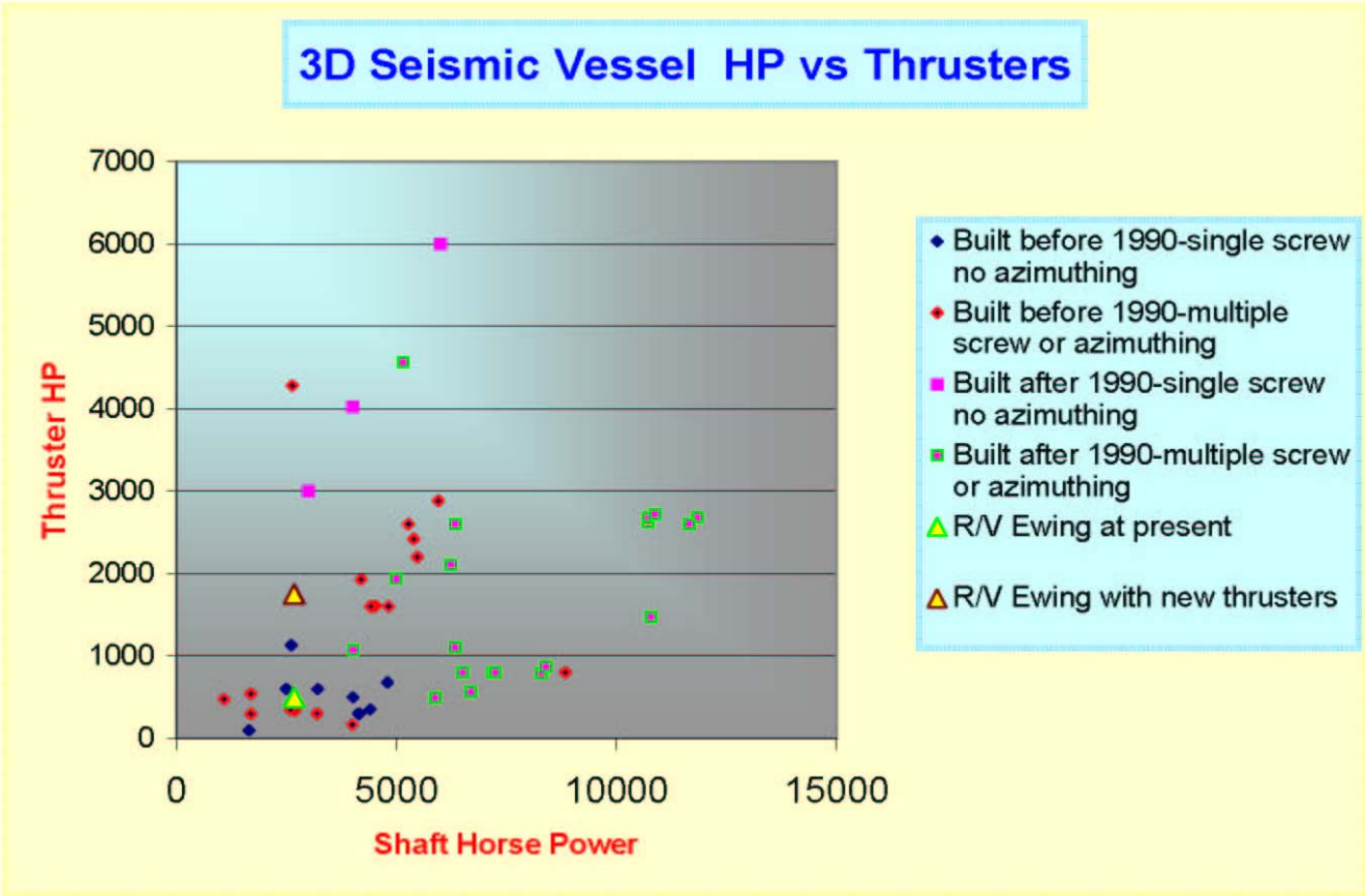
Replacement Vessel Science Capabilities

Streamers:	4 Streamers x 4 km (8 km) with separation up to 100m
Sound Source:	4 Linear Gun Arrays
DP:	Twin Screw with Bow Thruster expandable to include forward azimuthing thruster and stern tunnel thruster
Sonars:	Wide Hull for high resolution Deep Sea Multibeam and high resolution medium depth multibeam and subbottom profiler
Over the Side:	Ability to match or exceed Ewing for over the side handling
Lab Area:	Lab area far exceeds Ewing's capacity
Open Main Deck:	More open deck than Ewing
Portable Vans:	5 Van/Container capacity without effecting other operations

12-20 Streamers Built 1996

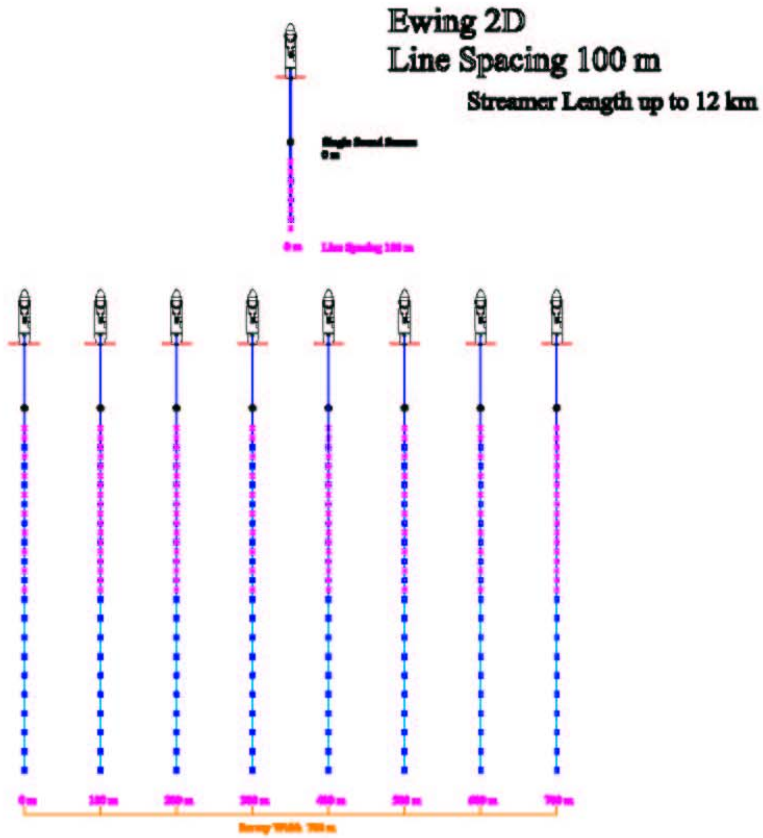

3D Seismic Vessels Length vs Width
Width (meters)
45
40
35
30
25
20
15
10
5
0
0
25
50
75
100
125
150
Length (meters)
Built before 1990
Built after 1990
R/V Ewing

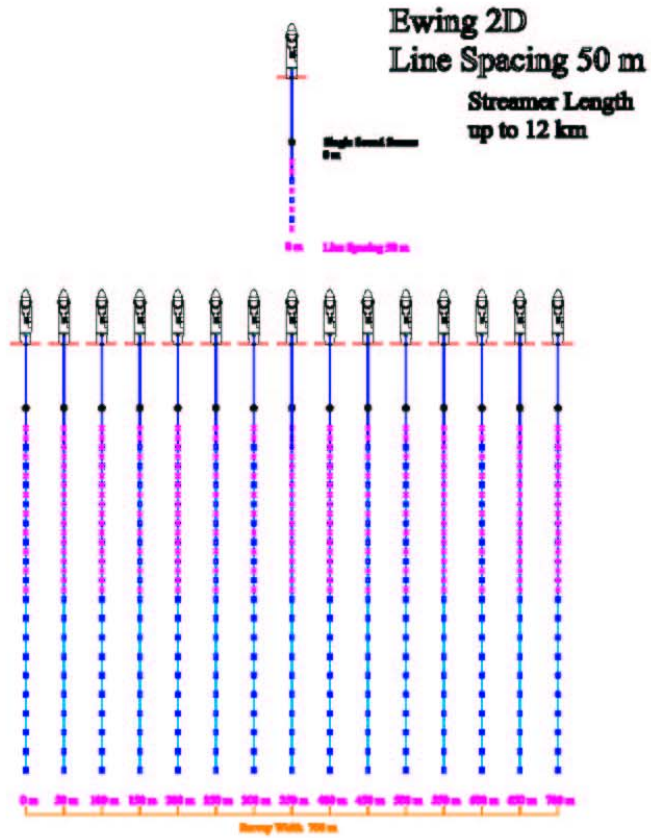

3D Seismic Vessel HP vs Thrusters
Thruster HP
7000
6000
5000
4000
3000
2000
1000
0
0
5000
10000
15000
Shaft Horse Power
Built before 1990-single screw no azimuthing
Built before 1990-multiple screw or azimuthing
Built after 1990-single screw no azimuthing
Built after 1990-multiple screw or azimuthing
R/V Ewing at present
R/V Ewing with new thrusters

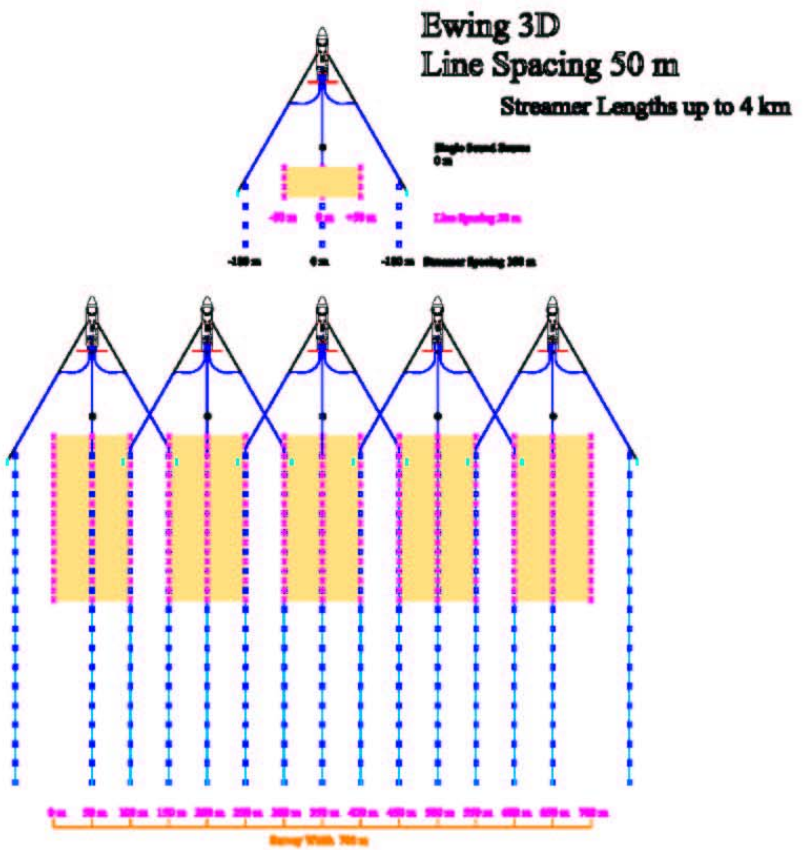
- An extensive search for all appropriately sized, available 3D MCS vessels over the last two and a half years yielded the following:

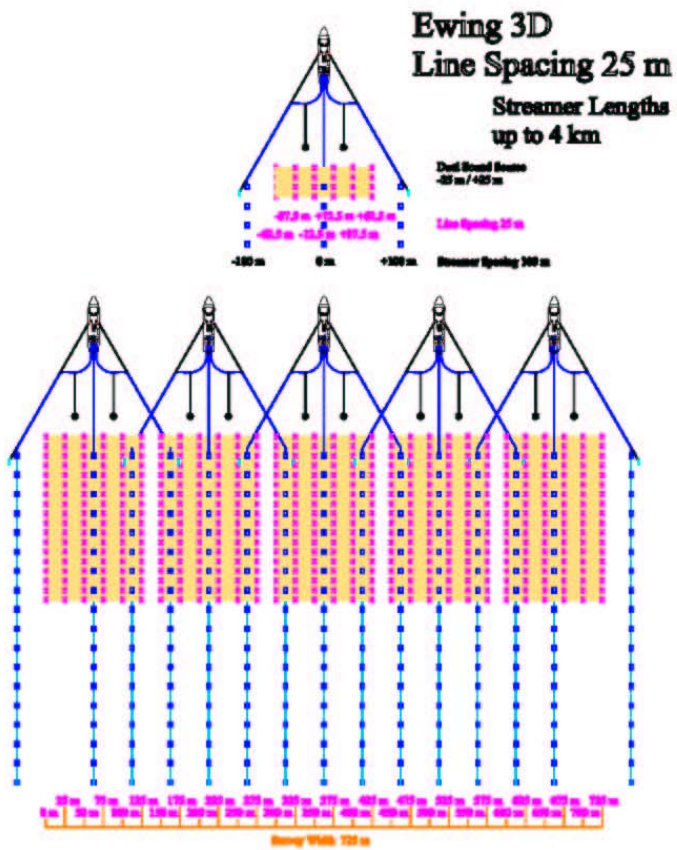
Two older vessels within the target range

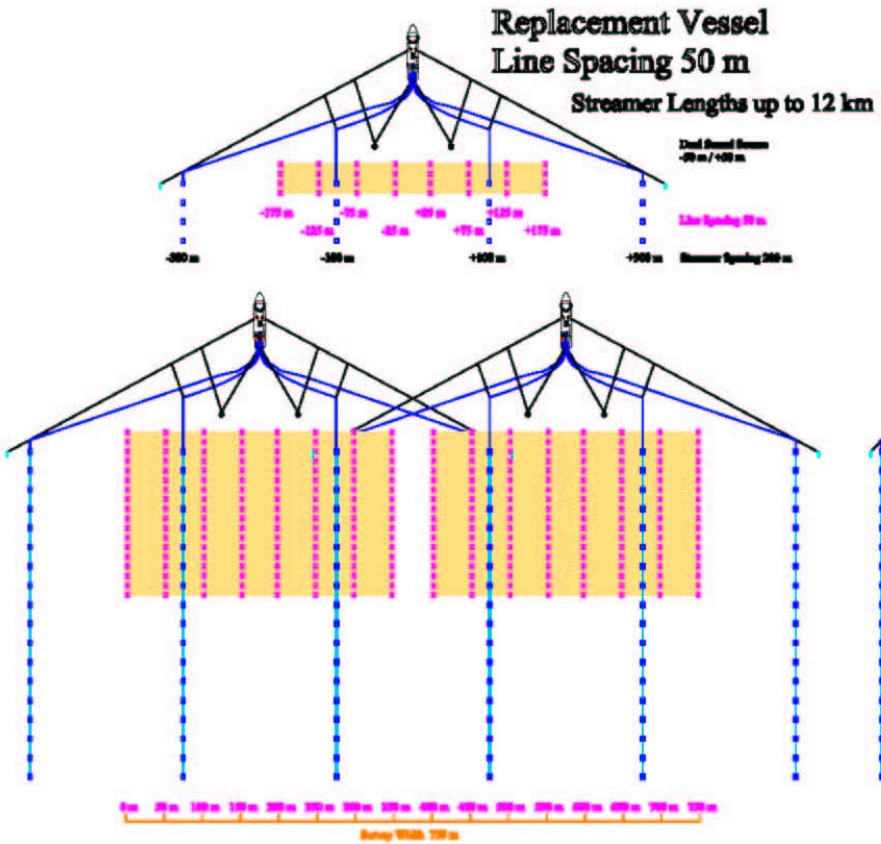
Three post 1990 vessels within the target range

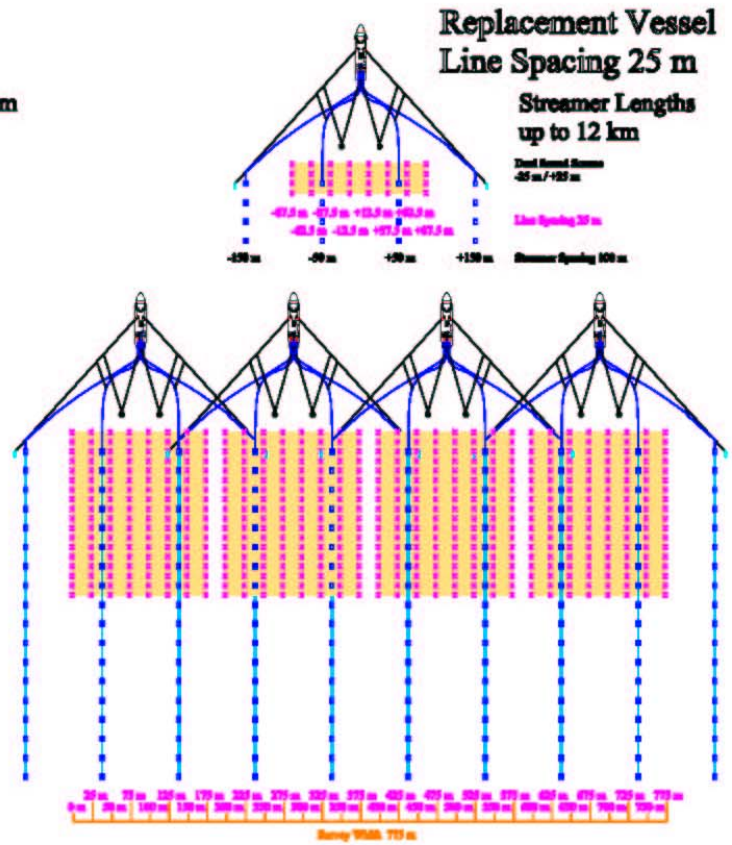

Ewing 2D
Line Spacing 100 m
Streamer Length up to 12 km


Ewing 2D
Line Spacing 50 m
Streamer Length
up to 12 km

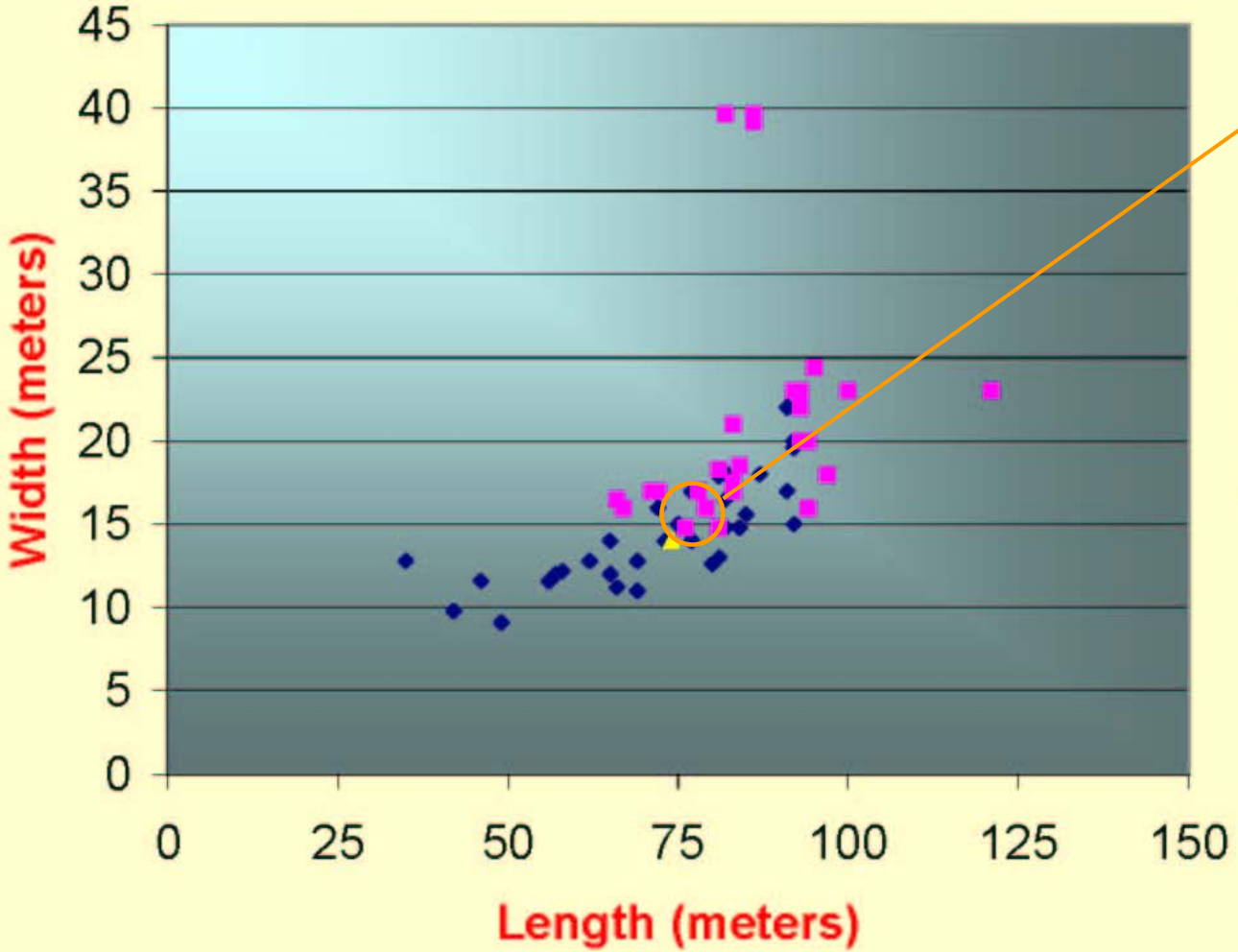

Ewing 3D
Line Spacing 50 m
Streamer Lengths up to 4 km


Ewing 3D
Line Spacing 25 m
Streamer Lengths
up to 4 km


Replacement Vessel
Line Spacing 50 m
Streamer Lengths up to 12 km


Replacement Vessel
Line Spacing 25 m
Streamer Lengths
up to 12 km

3D Seismic Vessels Length vs Width



Target Area
More Space than Ewing
But, not too Big

- Built before 1990
- Built after 1990
- R/V Ewing

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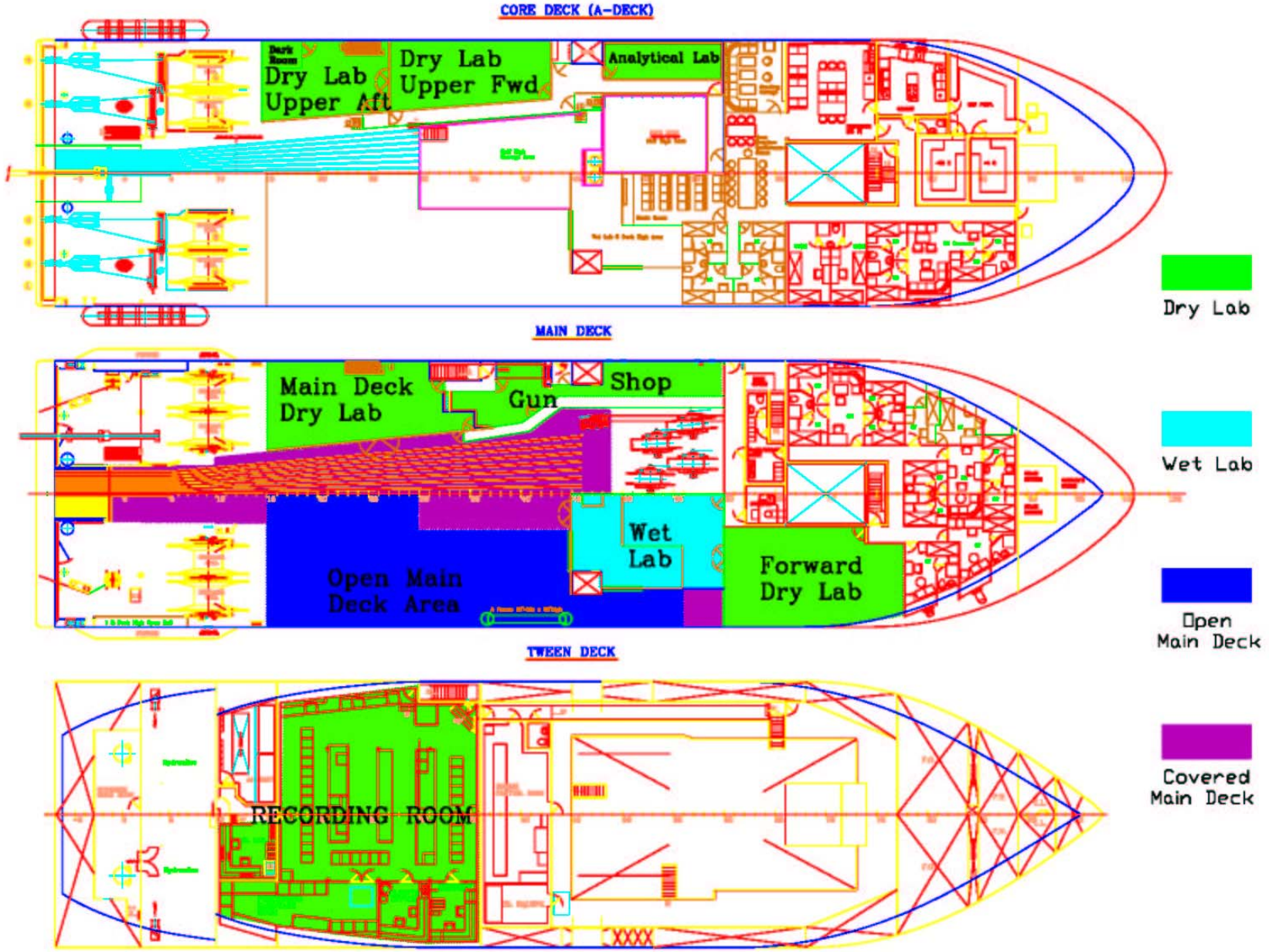
Replacement Vessel

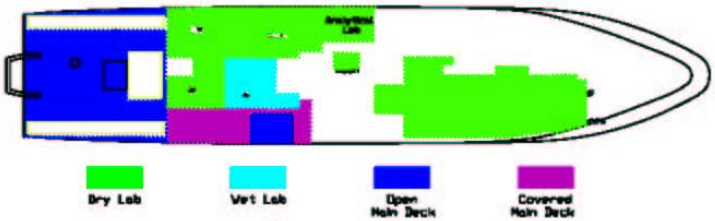
(*EWING* after midlife in parenthesis)

Length:	235 feet *(237 feet)*
Beam:	56 feet *(46 feet)*
Displacement Lightship Tonnage:	2578 metric tons *(1867 metric tons)*
HP:	7200 HP *(3200 HP)*
Bollard Pull:	86.2 metric tonnes *(20.2 metric tonnes)*
Compressor Capacity:	2x2750cfm *(3x1000cfm)*
Speed Cruising/Max:	12/14 kt *(11/13 kt)*
Ship's Complement/ Minimum Science Party	55/34 people *(50/29 people)*

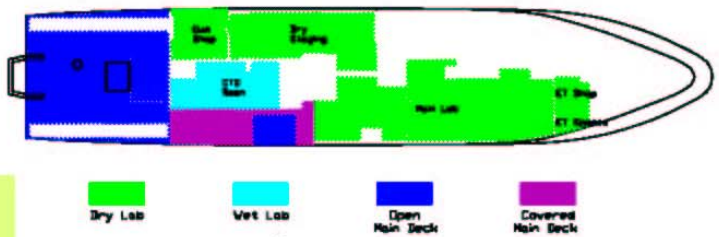

CORE DECK (A-DECK)
Dark Room
Dry Lab Upper Aft
Dry Lab Upper Fwd
Analytical Lab
MAIN DECK
Main Deck Dry Lab
Gun
Shop
Wet Lab
Open Main Deck Area
Forward Dry Lab
TWEEN DECK
RECORDING ROOM
Dry Lab
Wet Lab
Open Main Deck
Covered Main Deck

Scientific Areas

Ewing – Existing

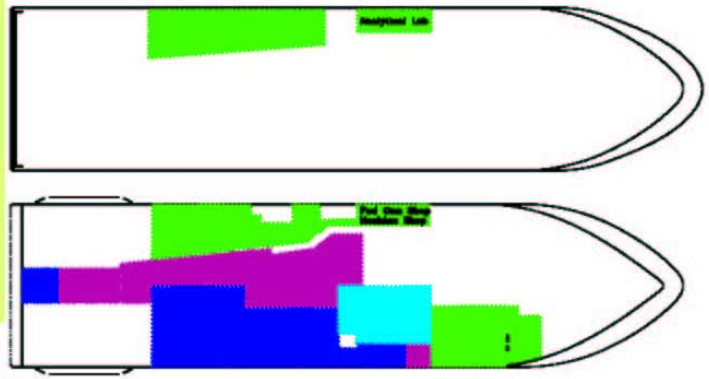


Ewing – Midlife

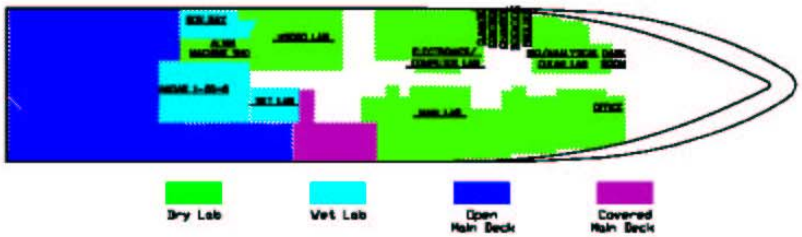


Areas in m2	Ewing Existing	Ewing Midlife	Replacement Vessel	AGOR 23 Atlantis	Ocean Class SMR
Total Laboratory	268	316	522	488	186
Dry Labs	207	264	465	390	149
Wet Labs	61	52	57	98	74
Open Main Deck	150	165	181	294	N/A
Covered Main Deck	40	40	91	30	N/A

Replacement Vessel



AGOR 23 Atlantis



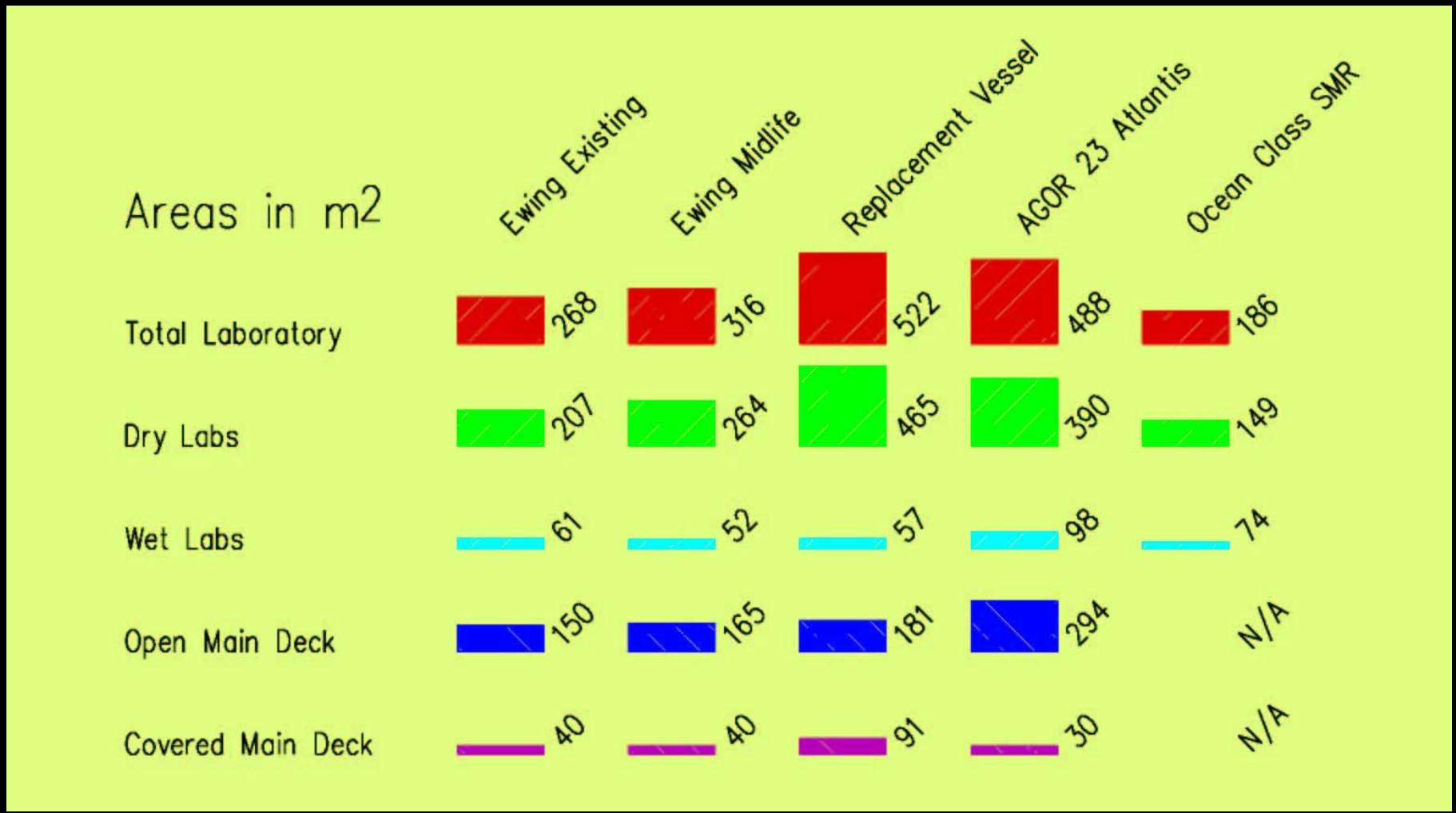
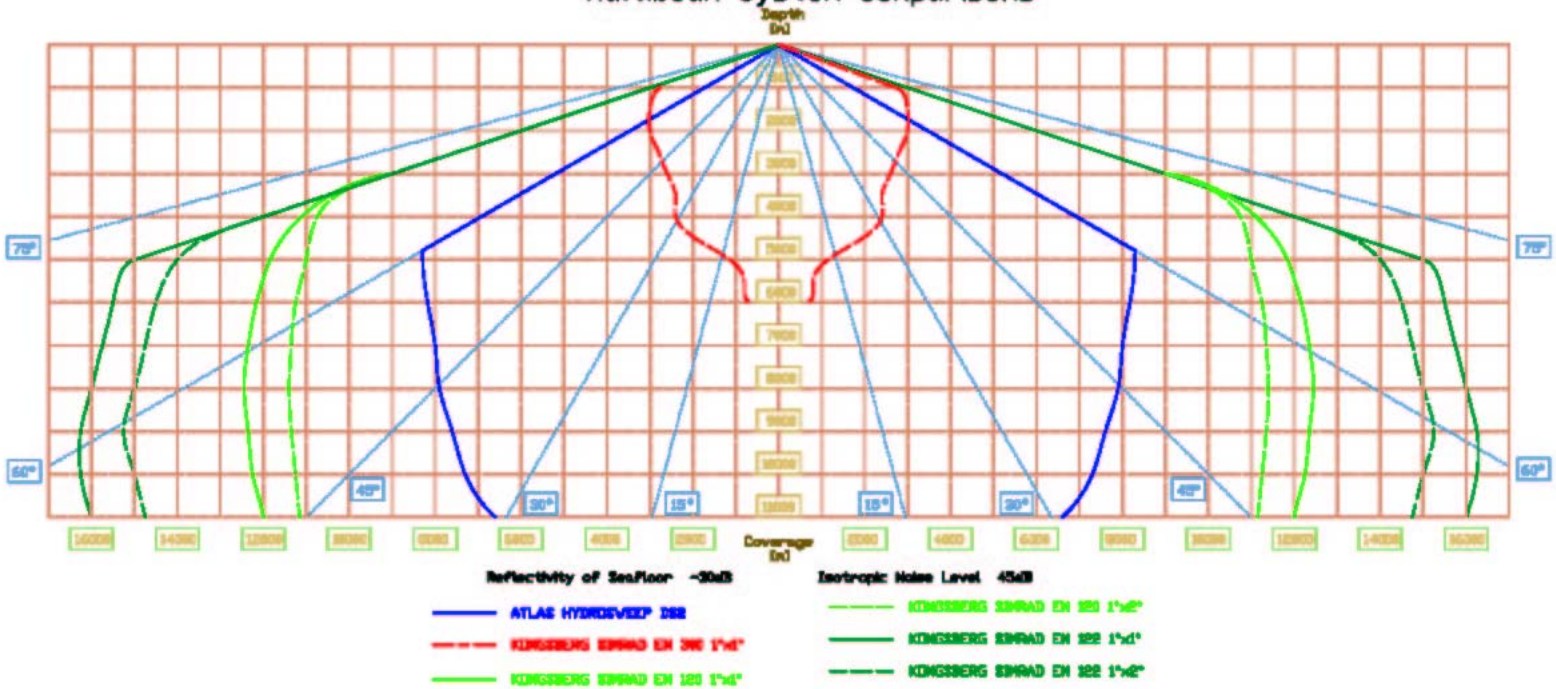
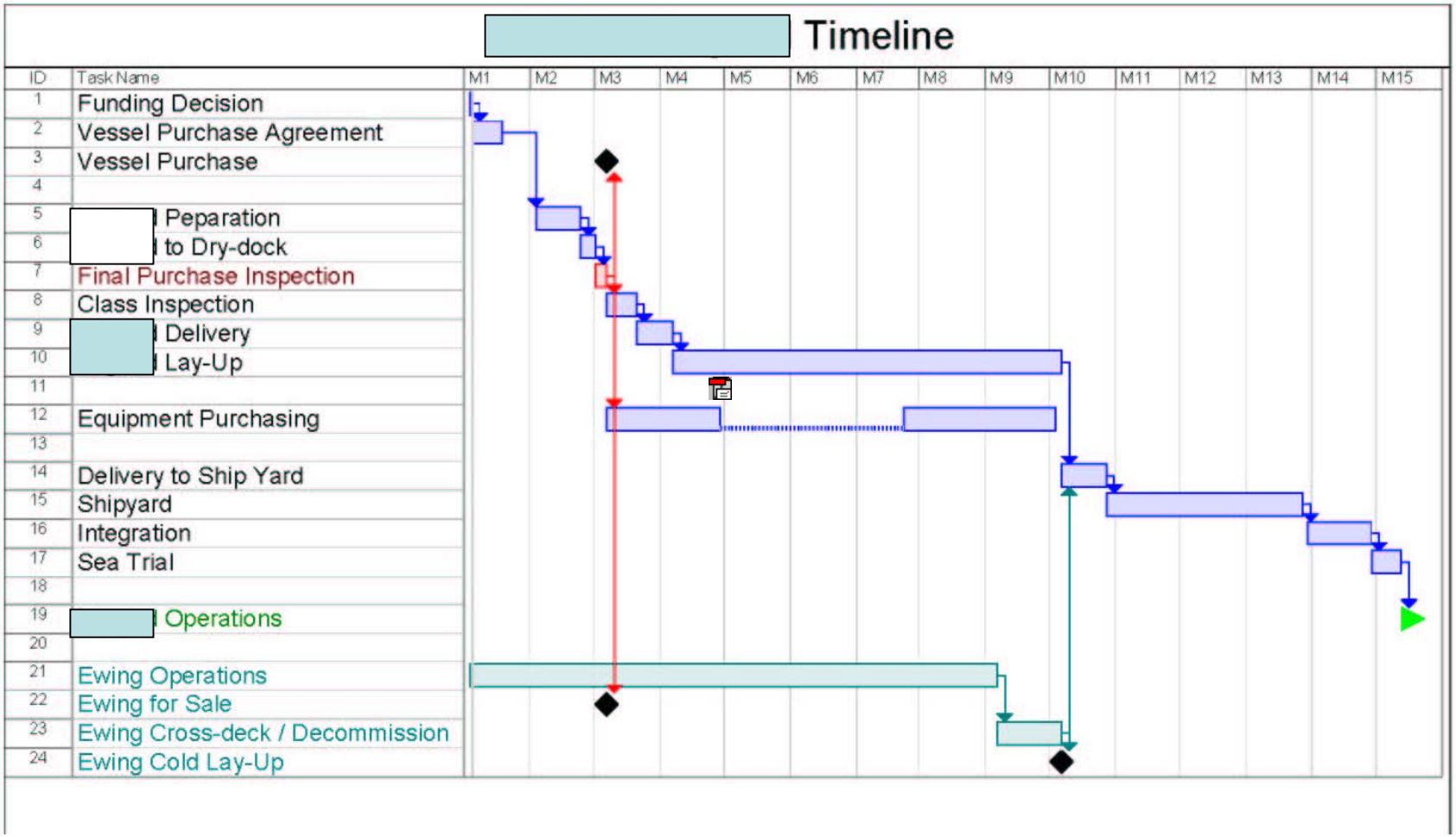

Areas in m2
Ewing Existing
Ewing Midlife
Replacement Vessel
AGOR 23 Atlantis
Ocean Class SMR
Total Laboratory
268
316
522
488
186
Dry Labs
207
264
465
390
149
Wet Labs
61
52
57
98
74
Open Main Deck
150
165
181
294
N/A
Covered Main Deck
40
40
91
30
N/A

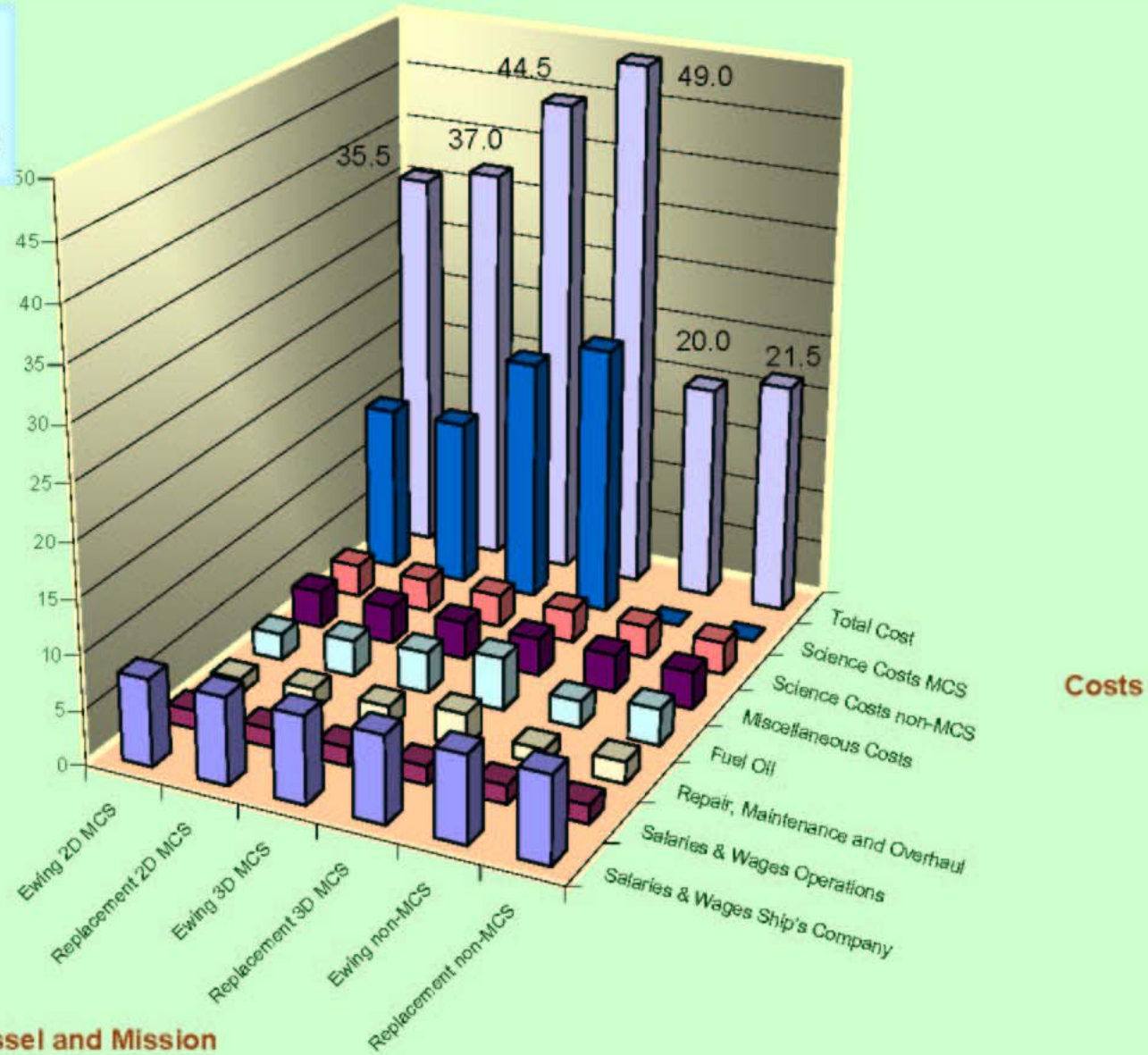
TABLE XX

Multibeam System Comparisons




Timeline
ID
Task Name
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
1 Funding Decision
2 Vessel Purchase Agreement
3 Vessel Purchase
4
5 Peparation
6 to Dry-dock
7 Final Purchase Inspection
8 Class Inspection
9 Delivery
10 Lay-Up
11
12 Equipment Purchasing
13
14 Delivery to Ship Yard
15 Shipyard
16 Integration
17 Sea Trial
18
19 Operations
20
21 Ewing Operations
22 Ewing for Sale
23 Ewing Cross-deck / Decommission
24 Ewing Cold Lay-Up

Comparison of Daily Operating Costs



	2D Ewing 100m Spacing	2D Ewing 50m Spacing	3D Ewing 50m Spacing	Converted Vessel 50m Spacing
3D Survey Nankai	$2.10	$3.87	$1.93	$1.15
Duration	59 days	109 days	43 days	23 days
3D Survey East Pacific Rise	$1.47	$2.75	$1.31	$0.71
Duration	41.5 days	77.5 days	29.5 days	14.5 days
2D MCS	k$35.5 * 90 days	k$35.5 * 90 days	k$35.5 * 90 days	k$37.0 * 90 days
	$3.20	$3.20	$3.20	$3.30
Duration	3 months	3 months	3 months	3 months
High Resolution/ Guns Only	k$25.0 * 30 days	k$25.0 * 30 days	k$25.0 * 30 days	k$27.0 * 30 days
	$0.75	$0.75	$0.75	$0.81
Duration	1 month	1 month	1 month	1 month
Non MCS	k$20.0 * 75 days	k$20.0 * 75 days	k$20.0 * 75 days	k$21.5 * 75 days
	$1.50	$1.50	$1.50	$1.61
Duration	2.5 month	2.5 month	2.5 month	2.5 month
Total for Year	$9.02	$12.07	$8.69	$7.58
	10 months	12 months	9 months	7.75 months
	3.5 months of 3D, 3 months of 2D	5.5 months of 3D, 3 months of 2D	2.5 months of 3D, 3 months of 2D	1.25 month of 3D, 3 months of 2D
	1 month of HR, 2.5 months other	1 month of HR, 2.5 months other	1 month of HR, 2.5 months other	1 month of HR, 2.5 months other
Extra Non MCS for 10 month operating year	-	- 2.0 months @ k$20.0	+ 1 months @ k$20.0	+ 2.25 months @k$21.5
		-$1.20	$0.60	$1.45
Total Time-Equivalent	$9.02	$10.87	$9.29	$9.03
	10 months	10 months	10 months	10 months
	3.5 months of 3D, 3 months of 2D	5.5 months of 3D, 3 months of 2D	2.5 months of 3D, 3 months of 2D	1.25 month of 3D, 3 months of 2D
	1 month of HR, 2.5 months other	1 month of HR, 0.5 months other	1 month of HR, 3.5 months other	1 month of HR, 4.75 months other

Costs in Millions of Dollars Unless Noted

Comparison of 3D Survey Costs

Ship	MCS Mode	# of Streamers	Sound Source	Nankai Survey	East Pacific Rise Survey
Ewing	2D 100m spacing	One	Single	$2,100,000	$1,470,000
Ewing	2D 50m spacing	One	Single	$3,870,000	$2,750,000
Ewing	3D 50m spacing	Three	Single	$1,930,000	$1,360,000
Ewing	3D 25m spacing	Three	Dual	$1,930,000	$1,360,000
Replacement	3D 50m spacing	Four	Dual	$1,150,000	$710,000
Replacement	3D 25m spacing	Four	Dual	$1,760,000	$1,250,000
Industry	3D 50m spacing	-	-	$3,920,000	$3,340,000
Industry	3D 25m spacing	-	-	$4,560,000	$3,790,000

COMMUNITY INVOLVEMENT

22,23 Oct 2002 Dave Hebert of UNOLS FIC attends *EWING* refit and gives presentation on the The Academic Research Fleet Plan. (Tim Cowles, UNOLS Chair and Bob Knox, UNOLS Past Immediate Chair invited to *EWING* Midlife Planning Meeting.)

12 February 2003 Midlife Workshop Report sent to Knox, Cowles, Atkinson

5 March 2003 UNOLS Council meets and *EWING* Midlife Workshop Report is an agenda item

2 June 2003 UNOLS Council meets and *EWING* Midlife is an agenda item. A summary of activity submitted.

28 Jun-2 Jul 2003 Dave Hebert of FIC joins Director LDEO and Marine Office personnel on visit the vessel identified as a potential replacement and upgrade of the *R/V MAURICE EWING*

15 Aug 2003 Submit seismic ship specific SMRs and revised vessel arrangements to FIC

17 Sept 2003 Presentation at FIC Fall Meeting.

18 Sept 2003 Presentation at UNOLS Council Fall Meeting

8 Oct 2003 Presentation at RVOC Annual Meeting

8 Dec 2003 Town Hall Meeting scheduled at AGU entitled “The Enhancement of Marine Seismic Capabilities in the US Academic Research Fleet”

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Acquisition of the *industry vessel to replace the Ewing* offers a unique opportunity to revolutionize the international academic community's capabilities for observational marine geophysics.

Operating Year Cost in $M	Ewing 1 Streamer	Ewing 3 Streamers	Replacement Vessel
1 Month 3D	$1.065	$1.335	$1.470
6 Months 2D/Airguns	$6.390	$6.390	$6.660
3 Months non Seismics	$1.800	$1.800	$1.935
Yearly Total	$9.255	$9.525	$10.065
Assumptions for 3D Month	6 Transit Days 2 Deploy/Recover	6 Transit Days 3 Deploy/Recover	6 Transit Days 4 Deploy/Recover
3D Survey Spacing	100m	50m	50m
3D Survey Area	282 km2	404 km2	1024 km2

Comparison of Yearly Operating Costs - 1 3D Cruise

	2D Ewing 100m Spacing	2D Ewing 50m Spacing	3D Ewing 50m Spacing	Converted Vessel 50m Spacing
3D Survey Nankai	$2.10	$3.87	$1.93	$1.15
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2D MCS	k$35.5 * 90 days	k$35.5 * 90 days	k$35.5 * 90 days	k$37.0 * 90 days
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Duration	3 months	3 months	3 months	3 months
High Resolution/ Guns Only	k$25.0 * 30 days	k$25.0 * 30 days	k$25.0 * 30 days	k$27.0 * 30 days
	$0.75	$0.75	$0.75	$0.81
Duration	1 month	1 month	1 month	1 month
Non MCS	k$20.0 * 120 days	k$20.0 * 120 days	k$20.0 * 120 days	k$21.5 * 120 days
	$2.40	$2.40	$2.40	$2.58
Duration	4 month	4 month	4 month	4 month
Total for Year	$8.45	$10.22	$8.28	$7.84
	10 months	11.5 months	9.5 months	8.6 months
	2 months of 3D, 3 months of 2D	3.5 months of 3D, 3 months of 2D	1.5 months of 3D, 3 months of 2D	2/3 month of 3D, 3 months of 2D
	1 month of HR, 4 months other	1 month of HR, 4 months other	1 month of HR, 4 months other	1 month of HR, 4 months other
Extra Non MCS for 10 month operating year	-	- 1.5 months @ k$20.0	+ 0.5 months @ k$20.0	+ 1.3 months @k$21.5
		$0.90	$0.30	$0.86
Total Time-Equivalent	$8.45	$9.32	$8.58	$8.70
	10 months	10 months	10 months	10 months
	2 months of 3D, 3 months of 2D	3.5 months of 3D, 3 months of 2D	1.5 months of 3D, 3 months of 2D	2/3 month of 3D, 3 months of 2D
	1 month of HR, 4 months other	1 month of HR, 2.5 months other	1 month of HR, 4.5 months other	1 month of HR, 5.3 months other

Costs in Millions of Dollars Unless Noted