ALEUTIAN ISLANDS RISK ASSESSMENT PHASE B

Best Available Technology

PREPARED FOR: Nuka Research & Planning Group Seldovia, Alaska	BY: Garth Wilcox, PE PROJECT MANAGER CHECKED: David W. Larsen, PE PRINCIPAL-IN-CHARGE	 Digitally Signed 20-Sep-2013
THE GLOSTEN ASSOCIATES 1201 Western Avenue, Suite 200, Seattle, WA 98101-2921 TEL 206.624.7850 FAX 206.682.9117 www.glosten.com	APPROVED: David L. Gray, PE PRINCIPAL-IN-CHARGE	
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References

1. *Aleutian Islands Risk Assessment – Phase B Work Plan*, Nuka Research & Planning Group, LLC and Pearson Consulting, LLC, 29 November 2012.
2. *Minimum Required Tugs*, The Glosten Associates, Inc., File No. 12127.02, Report No. 12127.02.1-2b, Rev. A, 14 January 2013.
3. *Environmental Data Tables*, Nuka Research & Planning Group, LLC, March 2013.

Introduction

As part of the Aleutian Islands Risk Assessment Phase 2 Work Plan (Reference 1), it is required to select the best available vessel that can perform the emergency towing role. It was expected that a European design would be the most suitable for the emergency towing task, but that a domestic design would be less expensive and possibly meet all the requirements. Both the best foreign and the best domestic vessels were identified in this task. The second part of this task was to estimate the cost to construct each vessel in the United States.

Weather

Reference 2 defined the required towing performance for a range of typical wave heights, periods, and wind speeds. For this task, it was decided to identify a design condition based on buoy data specific to the Aleutian Islands.

Four weather buoys were chosen: North Pacific, Northeast Pacific, Southeast Bering Sea, and Southwest Bering Sea. Joint probability plots were made relating wind speed to wave height and wave period for each of four wind quadrants for each buoy. The quadrant with the most severe weather was selected for each buoy. The 98-percentile wind speed for each buoy was selected from the data tables (Reference 3), and the corresponding wave height and period were calculated. Finally, the worst-case combination of wind and wave was selected as the design condition. The resultant condition is: 42 knots of wind, 6.6 m height at a 14.5 second modal period.

This design condition was run through the same calculations discussed in Reference 2. A tug capable of applying 110 MT of bollard pull is required to produce an adequate force.

Vessels

A literature search was conducted to identify towing vessels with bollard pulls above 80 MT. Fifty-nine vessels were selected for the study: twenty-eight foreign and thirty-one domestic. A purpose-designed emergency towing vessel labeled “fast tug” was included for comparison. Information in a wide array of categories was collected and entered into the spreadsheet. Appendix A shows all the vessels and their information. A rating system was developed to assist in ranking the vessels.

Scoring System

The best available technology is a measure of suitability for the mission balanced with affordability and availability. All of the vessels are available in the sense that new copies of them can be built. The domestic vessels are potentially available for charter or purchase; however, no attempt was made to predict their availability on the market. The goal of the scoring system is to identify which vessels are the most suitable for the emergency towing task without their being overly complex and expensive. The scoring system is described below.

Bollard Pull

The bollard pull requirement as calculated for the design condition is 110 MT. The vessels were collected with a lower limit of 70 MT. All vessels with bollard pulls below 100 MT were given scores of zero and effectively dropped from further study.

Propulsion Power

The propulsion power of the vessel was used as a stand-in for cost and complexity. The lowest power received the highest scores. The range of power was 6,000 kW to 24,000 kw with scores ranging from five to zero (see Table 1).

Table 1 Propulsion power matrix

Propulsion Power Range	Score
< 7,000	5
> 7,000 and < 8,750	4
> 8,750 and < 10,900	3
< 10,900 and < 13,650	2
< 13,650 and < 17,100	1
> 17,100	0

Speed

Speed was considered very important for the Aleutian Islands due to the very long distances involved in getting to an incident site. The lowest speeds received the lowest scores. The range of speeds was 10 kt to 20 kt with scores ranging from zero to five (see Table 2).

Table 2 Speed matrix

Speed (kt)	Score
< 10	0
> 10 and < 12	1
> 12 and < 13	2
> 13 and < 15	3
> 15 and < 17	4
> 17	5

Crew Protection

Because of the severity of the weather in the Aleutians and the mission of the vessel, which will require operation in the worst of the weather, crew protection was considered vital. Two factors were used to evaluate crew protection: (1) whether or not the vessel had a foc'sle, and (2) whether the main deck bulwark was intact around the stern.

Most of the vessels had foc'sles except for some of the domestic tug boats designed for conditions that are more benign than the mission operational parameters. Having a foc'sle will shelter the crew in head seas and facilitate towing gear preparation. One point was given to vessels with foc'sles.

There is a modern trend of cutting out the aft bulwark and lowering the stern roller to deck level. This allows easier handling of heavy shackles and chain but leaves the crew exposed to following seas. This will be a particular problem if the rescue vessel must approach stern first from downwind. The deck level roller is found on all anchor handlers, at least half of the European emergency towing vessels, and on most of the newer tugboats. While considered of large importance, it was judged relatively simple to modify. One point was awarded for vessels with intact bulwarks.

Winch

The tow gear being vital to the role of emergency towing, a fully redundant system instantly available was considered important and this is best accomplished with a double drum winch. Constant tension render-recover functionality in the winch will allow tension to be applied with a shorter tow line and therefore be advantages in shallow water and in extreme conditions. Like the open aft bulwark, a winch was judged relatively easy to change. One point was awarded for vessels with double drum winches.

Maneuverability

The emergency towing vessel will be called upon to operate close to a stricken vessel in high sea states. Maneuverability was considered important, with more maneuverability always being better even if not absolutely required (see Table 3).

Table 3 Maneuverability score

Propulsion Type	Score
Twin screws with bow thruster	1
Z-drives	2
Voith Schneider	3

Results

The striking difference between the collection of vessels is that the European vessels are designed as coast guard or navy patrol vessels with rescue towing as one of their missions, while the US vessels are a combination of large ocean towing tugs and anchor handling vessels.

The European vessels tend to be outfitted for multiple missions such as fisheries enforcement, search and rescue, and customs enforcement, in addition to emergency towing. They tend to have larger crews, much greater speed and bollard pull, and more complex propulsion plants designed for efficient operation during high speed, bollard pull, and low speed patrol conditions. Many are armed.

The domestic vessels are typically designed for simpler missions such as line haul towing or anchor handling requiring bollard pull and endurance. They have smaller crews, less complex propulsion systems, and little focus on speed. There were fewer vessels found with the required bollard pull.

The scores as applied are shown in Table 4 and Table 5. The scores were used to identify the most suitable vessels. Engineering judgment was used to make the final selections.

Table 4 Foreign towing vessel scores

Name	Bollard Pull (MT)	Propulsion (kW)		Bwk Aft	Foc'sle	Speed		Winch	Maneuver-ability	Score
Poseidon	100	6,600	5	0	1	16.0	4	1	2	13
ICGV Thor	120	9,000	3	0	1	19.5	5	1	2	12
Barentshav	110	7,237	4	0	1	20.0	5	1	1	12
Baltic	127	8,479	4	1	1	17.0	4	1	1	12
Anglian Monarch	152	8,501	4	1	1	17.0	4	1	1	12
Luz de Mar	128	7,680	4	1	1	16.4	4	1	1	12
ESVAGT Aurora	100	6,600	5	0	1	16.5	4	0	2	12
Abeille Languedoc	160	9,400	3	1	1	16.0	4	1	1	11
Alonso de Chaves	105	6,443	5	0	1	15.0	3	1	1	11
El Moundjid	200	16,208	1	1	1	20.0	5	1	1	10
Abeille Bourbon	209	16,000	1	1	1	20.1	5	1	1	10
Smit Amandla	181	14,317	1	1	1	20.0	5	1	1	10

Name	Bollard Pull (MT)	Propulsion (kW)		Bwk Aft	Foc'sle	Speed		Winch	Maneuver-ability	Score
Anglian Earl	135	8,948	3	1	1	14.0	3	1	1	10
President Hubert	157	9,000	3	0	1	16.0	4	0	2	10
Nordic	201	17,200	1	1	1	19.9	5	1	1	10
Atlantic Eagle	162	10,738	3	0	1	16.0	4	0	2	10
Argonaute	132	7,950	4	0	1	13.6	3	1	1	10
Levoli Black	120	7,500	4	0	1	13.5	3	1	1	10
Jason	120	8,210	4	0	1	12.8	2	1	2	10
Skandi Rio	180	12,370	2	0	1	17.0	4	0	2	9
Herakles	170	16,823	1	1	1	17.0	4	1	1	9
Skandi Stord	184	11,196	2	0	1	17.0	4	0	2	9
Skandi Ipanama	145	9,000	3	0	1	15.0	3	0	2	9
Atlantic Kingfisher	186	12,000	2	0	1	16.0	4	0	2	9
Skandi Saigon	196	12,000	2	0	1	16.0	4	0	2	9
Union Princess	180	24,000	1	1	1	13.0	2	1	1	7

Table 5 Domestic towing vessel scores

Name	Bollard Pull (MT)	Propulsion (kW)		Bwk Aft	Foc'sle	Speed (kt)		Winch	Maneuver-ability	Score
Alert	136	7,600	4	1	1	16.0	4	0	2	12
Seacor Relentless	120	5,420	5	0	1	14.0	3	0	2	11
Devin Candies	117	6,860	5	0	1	12.0	2	0	2	10
Keith Cowan	121	9,425	3	0	1	14.0	3	1	1	9
Forte	103	8,120	4	0	1	11.0	1	0	3	9
Harvey Provider	102	6,061	5	0	1	13.0	2	0	1	9
John Coghill	125	8,000	4	0	1	14.3	3	0	1	9
Harvey War Horse II	170	12,304	2	0	1	16.0	4	0	1	8
Seacor Vantage	129	9,157	3	0	1	14.0	3	0	1	8

Name	Bollard Pull (MT)	Propulsion (kW)		Bwk Aft	Foc'sle	Speed (kt)		Winch	Maneuver-ability	Score
42 m Line Haul Tug	100-110	2,700	5	0	1	10.0	0	0	2	8
Gerard Jordan	163	10,738	3	0	1	14.6	3	0	1	8
Ocean Wave	150	16,226	1	0	1	16.0	4	0	1	7
Ocean Sky	150	16,226	1	0	1	16.0	4	0	1	7
Seacor Valor	108	10,728	3	0	1	13.0	2	0	1	7
Seacor Venture	104	10,728	3	0	1	13.0	2	0	1	7
Foss Arctic Tug	116	7,268	4	0	0	14.5	3	0	0	7
Damon Chouest	135	14,483	1	0	1	13.0	2	0	1	5

Vessel Selection

Two vessels were selected for further study. Among the domestic vessels, the *Alert* stood out. It was one of the faster domestic vessels at 16 kt, had a foc'sle, stern bulwarks, and Z-drives. The *Alert* is well known in Alaska, and has performed some rescue-towing missions. It is only lacking in having a single drum non-motion compensated winch. See Table 6 and Figure 1.

Among the foreign vessels, the choice was more difficult. The *Poseidon* scored the highest, being the smallest and least powerful vessel that was suitable for the task. The bollard pull is on the low side but is considered acceptable.

Because the next part of the study involves cost and performance, and because the speed of the *Poseidon* is the same as the *Alert* with a higher expected construction cost, it was decided to select the fastest of the top-scoring vessels, the *Barentshav*. See Table 6 and Figure 2.

Table 6 Selected vessels – main particulars

	Alert		***Barentshav***	
Length, Overall	140	ft	305	ft
Length, Waterline	130	ft	270	ft
Breadth	42	ft	54	ft
Depth, Main Deck	20	ft	28	ft
Draft	16	ft	19	ft
Displacement	1,534	LT	3,251	LT
Propulsion BHP	10,192	hp	8,660	hp
Propeller Diameter	(2) 11	ft	(1) 13	ft
Propulsion Type	Z-drives		fixed prop with thrusters	
Bollard Pull	136	MT	110	MT
Electrical kW	380	kW	1,035	kW

	Alert		*Barentshav*	
Crew Capacity	16	persons	40	persons
Fuel Capacity at 100%	129,500	gal	238,100	gal
Ballast Capacity	51,500	gal	434,540	gal
Freshwater Capacity	9,250	gal	95,800	gal
External Fire Fighting	FiFi – Class 1		FiFi – Class 1	

Figure 1 ***Alert***

Figure 2 ***Barentshav***

Vessel Design Modifications

The design of the vessels would be modified to make the vessels better suited to and less expensive for the Aleutian towing mission. The cost estimate reflects these modifications as listed below:

Alert

- The addition of a motion-compensated double drum winch.

Barentshav

- Redesign from a combination diesel and LNG fuel to a fully diesel-fueled vessel.
- Removal of the 40 mm gun.
- Reduction in crewing level from 40 to 16.
- Raising the roller to provide a complete bulwark aft.
- The addition of a motion-compensated double drum winch.

Cost Estimates

The estimated costs are shown in Table 7 and Table 8.

Table 7 *Alert* Cost Estimate

SWBS Number	Description	Labor (Hours)	Materials ($)	Subtotal ($)
000	Shipyard Engineering and Services	20,618	965,495	2,408,733
100	Structure	31,914	786,376	3,020,326
200	Propulsion	8,977	7,940,313	8,756,522
300	Electric Plant	9,836	511,035	1,199,555
400	Command and Surveillance	1,250	486,990	574,490
500	Auxiliary Systems	20,748	4,167,101	5,619,471
600	Outfit and Furnishings	9,746	961,948	1,650,262
	Subtotal	103,088	15,819,258	23,229,000
	Labor Rate	$70	Per Hour	
	Material Markup	15%		2,228,000
	Estimate Contingency	15%		3,484,000
	Construction Cost Subtotal			28,941,000
	Builder's Risk Insurance	0.5% APR	18 Months	103,000
	Design License Fee	1.00%		289,410
	Design Modifications			100,000
	Regulatory Review and Inspection			240,000
	Cost Subtotal			29,673,410
	Project Financing	3% APR	18 Months	640,000
	TOTAL COST ESTIMATE			**$30,313,410**

Table 8 ***Barentshav*** **Cost Estimate**

SWBS Number	Description	Labor (Hours)	Materials ($)	Subtotal ($)
000	Shipyard Engineering and Services	69,162	1,693,563	6,534,908
100	Structure	112,654	2,825,511	10,711,304
200	Propulsion	9,544	9,566,719	10,362,267
300	Electric Plant	51,388	2,767,877	6,365,036
400	Command and Surveillance	2,500	973,980	1,148,980
500	Auxiliary Systems	69,659	7,103,263	11,979,422
600	Outfit and Furnishings	30,903	2,817,468	4,998,319
	Subtotal	345,810	15,819,258	52,100,000
	Labor Rate	$70	Per Hour	
	Material Markup	15%		3,908,000
	Estimate Contingency	15%		7,815,000
	Construction Cost Subtotal			63,823,000
	Builder's Risk Insurance	0.5% APR	18 months	227,000
	Design License Fee	1.00%		638,230
	Design Modifications			200,000
	Regulatory Review and Inspection			240,000
	Cost Subtotal			65,128,230
	Project Financing	3% APR	18 months	1,403,000
	TOTAL COST ESTIMATE			**$66,531,230**

Conclusions

The design weather condition was calculated from buoy data. This resulted in a required bollard pull of 110 MT. A literature search identified 59 vessels, foreign and domestic designed for towing with bollard pulls above 70 MT. Information about each vessel was gathered and presented in Appendix A. A scoring system was developed to rank the vessels to find the best available technology. Two vessels were chosen for further study: the *Alert* and the *Barentshav*. Required design modifications were identified based on the gathered information and a new building cost for each vessel was estimated.

Appendix A Emergency Towing Vessel Information

Name	Flag	Owner	Builder	Designer	Year Built	DWT	Design Mission/Tug Type
Poseidon	Sweden	Swedish Coast Guard	Damen Shipyard	Damen	2009	700	Rescue/Salvage Tug & Surveillance
ICGV Þór (Thor)	Iceland	Icelandic Coast Guard	ASMAR Naval Shipyard	Rolls-Royce	2011		Offshore Patrol Vessel
Barentshav	Norway	Remoy Management AS	Myklebust Verft	Vik-Sandvik / Wärtsilä Ship Design	2009		Offshore Patrol Vessel
Baltic	Germany	Arbeitsgemeinschaft Küstenschutz	Astilleros Armon	Astilleros Armon Vigo S.A. (Class Luz de Mar)	2010	904	Emergency Towing Vessel
Anglian Monarch	UK	JP Knight	Matsuura TZ	Rolls-Royce	1999	1800	ETV
Luz de Mar	Spain	Spanish Maritime Safety Agency	Astilleros Armon Vigo S.A.	Astilleros Armon Vigo S.A.	2005	1190	Rescue/Salvage Tug
ESVAGT Aurora	Denmark	ESVAGT AS	Zamakona Yards	Ulstein	2012		Offshore Standby Vessel
Abeille Languedoc	France	Abeilles International	Ulstein	Rolls-Royce	1979	1550	Assistance & Salvage Tug
Alonso de Chaves	Spain	Spanish Maritime Safety Agency	Astander Shipyards		1987	1134	Rescue/Salvage Tug
El Moundjid	Algeria	Algeria Govt.	STX OSV Brattvaag	Rolls-Royce	2011	1900	Assistance & Salvage Tug
Abeille Bourbon	France	Abeilles International	Myklebust Verft	Rolls-Royce	2005		Assistance & Salvage Tug
Smit Amandla	South Africa	Smit Amandla Marine			1976	2055	Tug
Anglian Earl	Barbados	JP Knight	Patje	Maersk?	1987	2500	Anchor Handling Vessel
President Hubert	Belgium	SMIT (Royal Boskalis Westminster)	Royal Niestern Sander	Royal Niestern Sander	1982		Tug Operations
Nordic	Germany	NORTUG Bereederungs GmbH & Co.	P&S Werften	Skipskonsulent of Bergen (Wartsila)	2010	2115	Emergency Towing Vessel
Atlantic Eagle	Canada	Atlantic Towing Limited	Halifax Shipyard	Rolls-Royce	1999		Offshore Support
Argonaute	France	Abeilles International	Brevik Construction A/S	Rolls-Royce	2003	2370	Rescue/Salvage Tug
Ievoli Black	Netherlands	Marnavi spa	Remontowa Shipyard	Remontowa Marine Design & Consulting Ltd	2011	2064	Anchor Handling Vessel
Jason	France	Abeilles International	Keppel Singmarine		2005	2100	Anchor Handling Tug
Skandi Rio	Brazil	NorSkan Offshore/DOF ASA	Aker Yards Promar, Brazil	Rolls-Royce	2007		Offshore Support/ Anchor Handling Vessel
Herakles	Maltese	Rederi AB Nestor	Chung Wah Shipyards		1980	1479	Salvage Tug
Skandi Stord	Norway	DOF Rederi AS	Astilleros y Servicos Navales S.A.	Moss Maritime	1999		Anchor Handling Towing Supply
Skandi Ipanama	Brazil	DOF Navigacao Ltda	STX OSV Niterói	STX OSV	2010		Anchor Handling Towing Supply
Atlantic Kingfisher	Canada	Atlantic Towing Limited	Halifax Shipyard	Rolls-Royce	2002		Offshore Support
Skandi Saigon	Norway	Aker DOF Deepwater AS	STX Vung Tau	STX OSV	2011		Anchor Handling Towing Supply
Union Princess	Belgium	SMIT (Royal Boskalis Westminster)	Yantai Raffles Shipyard	Rolls-Royce	2002		Anchor Handling Towing Supply
Seaspan Royal	CA	Seaspan ULC	Vancouver Shipyards	Talbot, Jackson & Associates	1981		General Tug Operations
Seaspan Kestrel	CA	Seaspan ULC	Sanmar Shipyard	Robert Allan, Ltd.	2011		General Tug Operations
Alert	US	Crowley Maritime Corporation	Dakota Creek Industries	Guido Perla and Associates	2000		Ship Assist Wk, Escorting, Em. Response, Firefighting, Oil Spill Recovery
Seacor Relentless	US	SEACOR Marine	North American Shipbuilding		2000		Offshore Towing Service
Devin Candies	US	Otto Candies	Bender Shipbuilding	Guido Perla and Associates	2000		General Tug Operations
Keith Cowan	US	Seacor Marine	Eastern Shipbuilding Grp.		2012		Anchor Handling
Forte	US	Edison Chouest Offshore	North American Shipbuilding	North American Shipbuilding	2010		Tractor Tug
Harvey Provider	US	Harvey Gulf International Marine	Eastern Shipbuilding Grp.		2003		Multi-purpose Vessel
John Coghill	US	SEACOR Marine	Bender Shipbuilding	STX US Marine	2007		Offshore Towing Service
Harvey War Horse II	US	Harvey Gulf International Marine	Eastern Shipbuilding Grp.	Gilbert Associates	2002		Anchor Handling
Seacor Vantage	US	Seacor Marine	Halter Marine		1998		Anchor Handling
42m Line Haul Tug	US			Jenson Maritime			Tug Operations
Gerard Jordan	US	SEACOR Marine	Halter Marine		1998		Offshore Towing Service
Ocean Wave	US	Crowley	Bollinger Shipyards	Jensen	2011		General Tug Operations
Ocean Sky	US	Crowley	Bollinger Shipyards	Jensen	2013		General Tug Operations
Seacor Valor	US	Seacor Marine	Halter Marine		1999		Anchor Handling
Seacor Venture	US	Seacor Marine	Halter Marine		2000		Anchor Handling
"Arctic Tug"	US	Foss	Foss' Rainier, OR	Glosten Associates	2014		Arctic Tug
Damon Chouest	US	Edison Chouest Offshore	North American Shipbuilding	North American Shipbuilding	1986		Anchor Handling
Harvey Intruder	US	Harvey Gulf International Marine	Eastern Shipbuilding Grp.	Gilbert Associates	2002		Anchor Handling
Gulf Service	US	Hornsbeck Offshore Service	McDermott Shipyard		1979		General Tug Operations
Lauren Foss	US	Foss	Marine Pwr & Eqpt/Gulf Coast Industries Inc.	Paul Zankich	2002		Ocean Going Tug
Nanuq	US	Vessel Mgt. Services, Inc.	Dakota Crk Industries	Guido Perla & Associates	1999		General Tug Operations
Robert Franco	US	Harley Marine Services	Nichols Bros. Boat Bldrs	Jensen Maritime Consultants	2013		General Tug Operations
Delta Lindsey	US	Bay Delta Navigation	Nichols Bros. Boat Bldrs	Jensen Maritime Consultants	2010		Tractor Tug
Freedom Service	US	Hornbeck Offshore Service	McDermott Shipyard		1983		Offshore Tug
Seaspan Resolution	US	Seaspan ULC	J.M. Martinac Shipbuilders	Robert Allan, Ltd.	2008		Ocean Going Tug
America	US	Signet Maritime Corporation	J.M. Martinac Shipbuilders	Robert Allan, Ltd.	2008		Ship Escort-ASD Tug
Signet Constellation	US	Signet Maritime Corporation	Trinity Offshore	Robert Allan, Ltd.	2011		LNG Terminal Escort-ASD Tug
Tristan K	US	Bay-Houston Towing Co.	Washburn and Doughty Associates	Robert Allan, Ltd.	2011		LNG Terminal Escort-ASD Tug
Resolve Pioneer	US	Resolve Marine Group	Campbell Industries		1978		Anchor Handling
Atlantic Salvor	US	Donjon	Halter Marine		1977		General Tug Operations

Name	Cold Weather / Arctic Rating	Current Status (What's It Doing)	Sea Stories (What Has It Done Re: Emergency Towing)	Length (m)	Beam (m)	Draft (m)	Foc'sle	Bollard Pull (tonnes)	Propulsion Power (kW)
Poseidon	Ice Class 1A	In-Service - Baltic Sea		81.2	16.2	5		100	6,600
ICGV Þór (Thor)	Ice Class 1B			93.6	16	6.5		120	9,000
Barentshav	Ice Class C	In-Service - North Sea		93	16.6	6.1		110	7,237
Baltic	no	In-Service - Baltic Sea		63.36	15	6	27.775	127.2	8,479
Anglian Monarch	no	In-Service - Rotterdam Area		58	14	6.9		152	8,501
Luz de Mar	no	In-Service - Mediterranean		55	15	5.5		128	7,680
ESVAGT Aurora	Ice-1C	In-Service - Arctic Ocean		87.0	17.0	6.0		100	6,600
Abeille Languedoc	no	In-service - English Channel		63.45	14.74	6.9		160	9,400
Alonso de Chaves	-	In-service - Biscay Bay		63.9	13.3	5.5		105	6,443
El Moundjid	no	In-Service - Mediterranean		86	18	5.5		200	16,208
Abeille Bourbon	no	In-service - Biscay Bay	MSC Napoli in Lyme Bay (w/ Liberte) (2007)	80	16.5	6		209	16,000
Smit Amandla	no	In-Service - Southern Atlantic		94.6	15.8	7.52		181	14,317
Anglian Earl	Ice Class C	In-Service - Rotterdam Area	MSC Napoli in Lyme Bay (w/ Liberte) (2007)	69.9	15.9	6.9		135	8,948
President Hubert	Ice Class 3	In-Service, Mediterranean		60.5	15.0	6.3		157	9,000
Nordic	no	In-Service - North Sea		78	16.4	6.6		201	17,200
Atlantic Eagle	ICE-1C	In-Service		75.0	18.0	6.0		162	10,738
Argonaute	no	In-Service - Brest		68.95	15.5	5.95		132	7,950
Ievoli Black	no	In-Service - North Sea		70	15.5	5.5		120	7,500
Jason	no	In-Service - Toulon		67.5	15.4	4.1		120	8,210
Skandi Rio	no	In-Service S. American Atlantic Coast		80.0	18.0	6.6		180	12,370
Herakles	no	In-Service - North Sea (as contracted ETV)	Grounding of sub HMS Astute	69.06	14.22	5.6		170	16,823
Skandi Stord	no	In-Service, Baltic Sea		73.8	16.4	6.9		184	11,196
Skandi Ipanama	no	In-Service S. American Atlantic Coast		74.3	17.0	6.0		145	9,000
Atlantic Kingfisher	ICE-1C	In-service -		80.0	18.0	6.0		186.1	12,000
Skandi Saigon	no	In-Service, North Sea		75.0	17.4	7.0		196	12,000
Union Princess	no	In-Service - North Sea		67.4	15.5	6.2		180	24,000
Seaspan Royal	No	In-Service - Vancouver		40.62	11.89	4.54	93.00	83.8	4,623
Seaspan Kestrel	No	In-Service - N. Pacific		28.20	12.60	5.39	81.00	84.8	4,698
Alert	-	In-service - Alaska	Kulluk rescue	42.7	12.8	4.9	136	120.4	7,600
Seacor Relentless	No	In-Service - Gulf of Mexico		74.5	17.0	2.0	120	93.6	5,420
Devin Candies	-	In-service - Brazil		45.1	15.3	3.7	117	111.3	6,860
Keith Cowan	No	In-Service - Gulf of Mexico		80.80	15.80	4.40	121.00	142.9	9,425
Forte	No	In-Service - Gulf of Mexico		50.00	16.00	7.50	103.00	126.8	8,120
Harvey Provider	No	In-Service - Gulf of Mexico		73.15	17.07	3.05	-	101.5	6,061
John Coghill	No	In-Service - Worldwide		80.8	15.8	4.4	>120	125.4	8,000
Harvey War Horse II	No	In-Service - Gulf of Mexico		45.72	13.72	5.64	170.00	178.3	12,304
Seacor Vantage	No	In-Service - Gulf of Mexico		73.50	15.80	3.00	129.00	139.6	9,157
42m Line Haul Tug	-	Not Built		42.0	13.5	6.8		100-110	2,700
Gerard Jordan	No	In-Service - Gulf of Mexico		78.0	18.0	4.0	163	159.0	10,738
Ocean Wave	No	In-Service - Texas		44.4	14.0	6.4	150	226.5	16,226
Ocean Sky	No	Under Construction		47.5	14.0	6.4	150	226.5	16,226
Seacor Valor	No	In Service - Worldwide		67.00	14.00	2.00	108.00	158.9	10,728
Seacor Venture	No	In-Service - Gulf of Mexico		67.00	15.00	3.00	103.75	158.9	10,728
"Arctic Tug"	Yes	In-Design		132.00			100+	116.4	7,268
Damon Chouest	No	In-Service - Gulf of Mexico		73.00	16.00	4.50	135.00	205.1	14,483
Harvey Intruder	No	In-Service - Gulf of Mexico		41.15	10.97	4.88	-	83.3	4,579
Gulf Service	-	In-Service - Gulf of Mexico		38.40	10.36	4.88	-	62.7	2,908
Lauren Foss	Yes	In-Service - Seattle		45.66	12.19	5.94	98.13	145.7	9,655
Nanuq	Yes	In-Service - Alaska		47.00	14.63	7.32	95.25	195.1	13,668
Robert Franco	Ice plating added	Under Construction - Outfitting		30.48	12.19	5.18	90.00	84.9	4,713
Delta Lindsey	-	In-Service - San Francisco Bay		30.48	12.19	5.18	94.00	139.1	9,119
Freedom Service	No	In-Service - Gulf of Mexico		38.40	11.30	5.60	82.60	83.3	4,579
Seaspan Resolution	No	In-Service - Vancouver		30.00	12.19	5.38	82.00	82.0	4,476
America	No	In Service - Chartered by Foss		29.87	12.19	5.18	81.80	136.0	8,864
Signet Constellation	-	In-Service - Gulf of Mexico		30.48	12.19	5.24	80.00	139.7	9,165
Tristan K	No	In-Service - Gulf of Mexico		30.07	11.99	5.18	73.00	82.1	4,480
Resolve Pioneer	-	In-Service - Caribbean		63.10	12.20	4.90	72.57	79.7	4,288
Atlantic Salvor	-	In service - Hudson River		46.05	12.19	6.20	70.00	86.4	4,832

Name	Propulsor Type/Number	Engine Type/Number	Thruster Power (kW)
Poseidon	2x Z-drive Thrusters	Diesel Electrics - 3x1940, 2x1362, 1x492	1265
ICGV Þór (Thor)	1xRetractable Azimuth Aquamaster	2xRolls Royce Bergen B32 40L diesels	2233
Barentshav	-	1xBergen Diesel B32 Engine & 3x Mitsubishi GS16R-MPTK, 1x GS12R-MPTK Gas Gen	2355
Baltic	-	2xGE 16V250MDB4	1800
Anglian Monarch	2xCPP in Nozzles	2xNiigata 6MG41HX	1277
Luz de Mar	-	2xMak 8M35	400
ESVAGT Aurora	2xAzimuth CPP	2xDiesel-Electric	2616
Abeille Languedoc	2x LIAAEN AM adj. Blades in Nozzles	MAK 8M 453 AK / 4	~1292
Alonso de Chaves	-	2x Diesels	
El Moundjid	2xFPP in Nozzles	4xMAK Main Engines 8M32C/4	2796
Abeille Bourbon	2xFPP in Nozzles	4xMAK Main Engines 8M32C/4	2796
Smit Amandla	1xCPP in Nozzle	2xMirrlees 16 KVR diesels	597
Anglian Earl	2xKamewa CPP in Nozzles	2xMak 8M35	1342
President Hubert	-	2xMAK-16M453 diesels	600
Nordic	2xCPP	2xMTU 20V8000M71L	2400
Atlantic Eagle	2xUlstein CPP in Kort Nozzles	2xBergen Diesels	2908
Argonaute	2xCPP RR 1500 AGSC	2xBergen BRM9	1770
Ievoli Black	2xCPP in Nozzles	2x Wartsila 12V26	1764
Jason	Schottel SPC100-4XG	2xCaterpillar 3612C	1800
Skandi Rio	1x1120 kW Azimuth Thruster	2x3535 @ 720 RPM, 2x2650 @ 720 RPM	3475
Herakles	2xCPP	4xRuston 12 RK 3A	~1544
Skandi Stord	-	2xTBD	373
Skandi Ipanama	-	2xRolls Royce B32:40L9	2649
Atlantic Kingfisher	2x3.9m Ulstein CPP in Kort Nozzles	4xBergen B32:40L6P	1346
Skandi Saigon	-	2xRolls Royce Bergen	3520
Union Princess	2xCPP in Nozzles	2xWarsilla 16V 32	1836
Seaspan Royal	4 Blade, 304.8cm FP	2xGM EMD 645	-
Seaspan Kestrel	4 Blade CP, 240cm	2xCat 3516C	-
Alert	2xAzimuth Z-Drives	2xCaterpillar 3612B Diesels	
Seacor Relentless	2xRolls Royce, TCN 105 Azimuth Drives, 4 blade FPP in Nozzles	2xCaterpillar 3608	1455
Devin Candies	FPP Center & Z Drives Outboard	1 EMD 20-710-G7B Center & 2 EMD16-645-E6 2100 Outboard	-
Keith Cowan	FPP in nozzles	4xCat 3516C	2146
Forte	2xVoith Schneider Size 36R6	2xCat C280-12	
Harvey Provider	FP High Efficiency 5 Blade	2xCat 3516B Long Stroke	3138
John Coghill	FPP in Nozzles	3xCaterpillar 8516B & 1x3516C	1790
Harvey War Horse II	2xBird Johnson Stainless Steel	2xEMD 20-710 G7B	671
Seacor Vantage	2 Berg 4 Blade CPP	4xEMD 16-645 E7B	1609
42m Line Haul Tug	2xAzumth Stern Drives or Conventional Twin Screw in Nozzles	2xMain Engines	
Gerard Jordan	2xBerg 4 Blade CPP	4xNREC 16-645 F7BZ	3593
Ocean Wave	2x4Blade CuNiAl CPP	2xCaterpillar C-280-12	1007
Ocean Sky	2x4Blade CuNiAl CPP	2xCaterpillar C-280-12	1119
Seacor Valor	2 Berg 4 Blade CPP	2xEMD 16-710-G7B	1354
Seacor Venture	2 Berg 4 Blade CPP	2xEMD 16-710-G7B	1341
"Arctic Tug"	Props in Kort Nozzles	2xCat C280-8	
Damon Chouest	3xMain Props	3xEMD	1609
Harvey Intruder	Bird Johnson Stainless Steel	2xEMD 16-645 E7B	603
Gulf Service	FP High Efficiency 4 Blade	2xEMD 16-645-E6	-
Lauren Foss	2x10.5" Prop in Kort Nozzles	2xAlco 16-cyl Diesels	603
Nanuq	2xVoith Schneider Cycloidal Prop. Units	2xCat 3612	-
Robert Franco	2 RR AQM US 255 Z-Drives	2xCat 3516C	-
Delta Lindsey	Z-drives	2xCat 3516C	-
Freedom Service	4-Bladed, FPP, Ducted	2xEMD 16-645E7B	-
Seaspan Resolution	Z-Pellar, Twin Screw	2xEMD L12710G7C-T2	-
America	2x106 4-Blade NIBRAL in Kort Nozzles	2xMTU Detroit Diesel 16V4000 M71	-
Signet Constellation	2x110" 4-Blade NIBRAL in Kort Nozzles	2xCat C175-16	-
Tristan K	2xRR US255 Z-drive w/ 2.8m Propeller	2xMTU Detroit Diesel 16V4000 M70	-
Resolve Pioneer	2xCP 132" (+Kort)	2xEMD 16-645E7	298
Atlantic Salvor	2xFixed Open 4-Blade	2x25 F 16 MS&MR Alco Engines	224

Name	Thruster Type/Number (Bow/Rear)	Max Speed (kts)	Speed Cruising (kts)	Crew Capacity/Crew Compliment
Poseidon	1x850 Retractable & 1x415 Tunnel	16.0	12	12 crew / 44 total
ICGV Þór (Thor)	2x Kamewa Ulstein Tunnel Thruster / 1xKamewa Ulstein Tunnel Thruster	19.5	10	14 crew / accom for 48
Barentshav	736 kW FP & 883 kW CP / 736 kW FP	20.0	15	16 crew / accom for 40
Baltic	2xowthruster STT 001 FP / 2x Sternthruster STT FP	17.0	-	8 crew / 14 total
Anglian Monarch	1xKamome Diesel / 1xKamome Diesel	17.0	11	11 crew / 16 total
Luz de Mar	1xSchottel Transverse Thruster STT 330 LK CP	16.4	-	10 total
ESVAGT Aurora	1x850 Elec. Conv CPP Retractile & 2x883 Elec. Conv. CPP	16.5	-	40 total
Abeille Languedoc	2xULSTEIN 90 TV 359	16.0	14.6	12 crew / accom for 24
Alonso de Chaves		15.0	-	17 crew
El Moundjid	2x883 kW Kamewa Ulstein TT2200/ 2x515 kW Kamewa Ulstein TT1650	20.0	-	12 crew / accom for 25
Abeille Bourbon	2x883 kW Kamewa Ulstein TT2200/ 2x515 kW Kamewa Ulstein TT1650	20.1	11.2	12 crew / accom for 25
Smit Amandla	1x Bow Thruster	20.0	-	34 crew & cadets / 38 total
Anglian Earl	2xKamewa / 1xKamewa	14.0	8	12 crew / 26 total
President Hubert	2x300 kW / none	16.0	8.00	26 total
Nordic	2 bow / 1 stern	19.9	6.6	16 crew / accom for 32
Atlantic Eagle	1xAzimuth Thruster & 1xCPP / 1xCPP	16.0	11.5	14 crew max / 38 total
Argonaute	2x Rolls Royce Marine 250 TV/1xRolls-Royce Marine 25 TV	13.6	7.9	accom for 30
Ievoli Black	2x588 kW Electrical / 1x588 kW Electrical	13.5	9	14 crew / accom for 29
Jason	2xBrunvoll FU-63-LTC1550/ 1xBrunvoll FU-63-LTC1550	12.8	10.1	
Skandi Rio	1x1120 kW Tunnel Thrusters / 2x736kW Tunnel Thruster	17.0	-	22 crew / accom for 40
Herakles	2xbow	17.0	12	12 crew / 30 total
Skandi Stord	1xKamewa / 1x Kamewa / 1xAzimuth Aquamaster	17.0	12	9 crew / accom for 24
Skandi Ipanama	1xRR 375 TV / 2x RR 111xF5/4	15.0	10	38 total
Atlantic Kingfisher	1xAzimuth Thruster & 1xCPP / 2xCPP	16.0	12	33 total
Skandi Saigon	2xBrunvoll FU80/2xBrunvollFU80	16.0	10	27 total
Union Princess	2xElectric / 1xRR Ulstein ISOTV 1	13.0	9	12 crew / 20 total
Seaspan Royal	-	11.0	8	-
Seaspan Kestrel	-	13.5	9	-
Alert	Twin Z-Drive Thrusters	16.0	-	16 total
Seacor Relentless	1xRolls Royce TV 150 & 1x Ulstein TCNS 73/50 (both Bow)	14.0	12	12 / 29
Devin Candies	-	12.0	7.5	8 total
Keith Cowan	2xBrunvoll CPP/2xBrunvoll CPP	14.0	12	20/43
Forte		11.0	10	16
Harvey Provider	2xCPP/1xCPP	13.0	11	10 / 26
John Coghill	2xHRP CPP / 1x HRP FPP	14.3	12	30-34/38
Harvey War Horse II	Marprop	16.0	11	14
Seacor Vantage	2xElec Drive Tunnel/1x Elec Drive Tunnel	14.0	11	8/24
42m Line Haul Tug	2 Azimuths	10.0	-	15 total
Gerard Jordan	2xElectric Drive FPP / 2x Electric Drive FPP & 1xElectric Drive CPP	14.6	12.3	12/26 Total
Ocean Wave	1xBerg VFD / 1xBerg	16.0	-	13
Ocean Sky	2xBerg VFD / 1xBerg	16.0	-	13
Seacor Valor	1010 BHP/none	13.0	11	12/20
Seacor Venture	Ship Machinery SMI-FU63-1000HP	13.0	11	14/22
"Arctic Tug"		14.5		11
Damon Chouest	1 Fwd	13.0	9.6	34 total
Harvey Intruder	1xMarprop/none	14.0	11	14
Gulf Service	-	10.0	8.5	10
Lauren Foss	1 Hydraulic Bow	12.3	8.5	15 / 18
Nanuq	-	14.5	-	7
Robert Franco	-			8
Delta Lindsey	-	14.0	7.9	6
Freedom Service		12.0	9	12
Seaspan Resolution	-	13.0	7	3 - Day boat
America	-	-	12	6
Signet Constellation	-			
Tristan K	-	-	13	6
Resolve Pioneer	1x400 BHP Bow	15.6	12	24/12
Atlantic Salvor	1x300 hp Bow Thruster	15.0	13	15

Name	Anything Else Re: Shore Facility Requirements	Fuel Capacity (m^3)	Tow Winch Type/Number (Pull Capacity)	DP Rating
Poseidon		1500	1x100t pull	AUT
ICGV Þór (Thor)		268	250t Towing Winch	RRM DP1
Barentshav	LNG-powered	411 FO & 220 LNG	RR Tow Winch 250t cap.	DP-system
Baltic		577	2xIBERCISA MR-H/300/500-70	none given
Anglian Monarch		1309	Dbl Drum Waterfall Winch - 250t pull	none given
Luz de Mar				R
ESVAGT Aurora		1200	1x100t Pull	DP2
Abeille Languedoc		1545	1 Norwich winch	
Alonso de Chaves				
El Moundjid		1645.3	Rauma Brattvagag - 2 drum 250 tonne pull	none given
Abeille Bourbon		1645.3	Rauma Brattvagag - 2 drum 250 tonne pull	
Smit Amandla		1887		
Anglian Earl		1095	4xDrum Winch - 250t pull	none given
President Hubert		1750	2xBrusselle @ 200t	No rating given
Nordic	Hazardous Atmosphere rating	1050	Double drum / 2500 kN	
Atlantic Eagle	Dangerous goods/Noxious Liquids carry approval	991	1xdeclutchable tow drum 270 pull	SDP 21 (Kongsberg)
Argonaute		830	Brattvaag SL300 W / 300 tonne pull	DP1
Ievoli Black		8282	2x 2490 kN Fukushjma Ltd Japan.	DPS-2
Jason		884	Bi-drum Hydraulic Brattvaag - 250 tonne pull	DP1
Skandi Rio		1124.1	2x15ton RRM Brattvaag	none given
Herakles		1474	2xDonkin Towing Winches - 200t pull ea.	none given
Skandi Stord		824	1xBrattvaag Tow Winch	DP2 (Konsberg)
Skandi Ipanama		623	1xAH and Towing Winch	DP2 (Konsberg)
Atlantic Kingfisher		1100	1xUlstein Brattvaag 500 ton	DP2 (Konsberg)
Skandi Saigon		1697	1xBrattvaag Waterfall	DP2 (Konsberg)
Union Princess		1400	Triple Brattvaag 300t	RR POSCON Model P450
Seaspan Royal		536	Burrard Dbl Drum Type HK-D	-
Seaspan Kestrel		99	RR Tw 2000/500 AW 24 U2 H	-
Alert		397	Markey TDS-40	No rating given
Seacor Relentless		790	Rolls Royce Brattvaag / 300	DP2 (Konsberg)
Devin Candies		826	SMATCO 250 t	-
Keith Cowan		521	RR Brattvaag, Electro-Hydraulic Dbl Drum	DP2
Forte				
Harvey Provider		870.6	SMATCO 66 - 140 MT	DP2
John Coghill		530	Rolls Royce Brattvaag, Electro Hydraulic / 300	DP2 (ABS)
Harvey War Horse II		931	Markey Double Drum	DP0
Seacor Vantage		885	Smatco 116-EAW-660W/660W - 494MT	Kongsberg Simrad SDP-01
42m Line Haul Tug		570	TBD	TBD
Gerard Jordan		1136	Smatco 140E/750TW-3200V / 508	DP2 (Konsberg)
Ocean Wave		888.58	Intercon - DW275 / 317.51	DP1
Ocean Sky		973.2	Intercon - DW275 / 317.51	DP2
Seacor Valor		693	SMATCO 96 DAW550K - 206MT	-
Seacor Venture		816	Fritz-Culver FCSL 400W/400W - 363MT	-
"Arctic Tug"			Markey	
Damon Chouest		318	350 MT	-
Harvey Intruder			Markey Dbl Drum - 160 MT	DP0
Gulf Service		505	1xMarkey Single Drum	
Lauren Foss	USS Constellation tow from San Diego to Bremerton, Shell Oil Arctic Drilling Operations; Kulluk tow to Dutch Harbor, AK	848	Intercon Dbl Drum - 300 MT	-
Nanuq		-	Markey DYSDS-62 Dbl Drum	-
Robert Franco		268	JonRie Series 525	-
Delta Lindsey		268	JonRie Series 525	-
Freedom Service		752	1xIntercon DD-225/82155 Dbl Drum (Side-by-side)	
Seaspan Resolution		170	Burrard Iron Works - Electric - 40MT	-
America		178	Markey DEPCF-525	-
Signet Constellation		244	Burrard Iron Works Electric Capstan	
Tristan K		169	Markey DESF-48 200HP - 206.96 line pull	-
Resolve Pioneer	Towed Carnival Triumph to Mobile, AL; Towed 17,324 DWT bulk carrier out of FL keys marine sanctuary;	410	1xSMATCO WF/72 DAW 250 (2 drums) - 136 MT	-
Atlantic Salvor		779	1xInterCon DD 250 Double Drum - 160 tons	-

Name	Sister Vessels
Poseidon	Trion, Amfitrite
ICGV Þór (Thor)	
Barentshav	KV Sortland, KV Bergen
Baltic	
Anglian Monarch	
Luz de Mar	Miguel de Cervantes
ESVAGT Aurora	
Abeille Languedoc	Abeille Flandre
Alonso de Chaves	
El Moundjid	El Moussanid, El Moussif
Abeille Bourbon	Abeille Liberte
Smit Amandla	
Anglian Earl	
President Hubert	
Nordic	
Atlantic Eagle	Atlantic Hawk, Atlantic Ravn
Argonaute	
Ievoli Black	
Jason	
Skandi Rio	Norskan Botafogo, Norskan Fluminence
Herakles	*Formerly ETV Anglian Prince of the HMCG
Skandi Stord	
Skandi Ipanama	A.H. Giorgio P (Finarge de Navagacao)
Atlantic Kingfisher	Atlantic Osprey
Skandi Saigon	Skandi Emerald, Skandi Peregrino, Skandi Pacific, Skandi Atlantic
Union Princess	Union Sovereign *Formerly ETV Anglian Princess of the HMCG
Seaspan Royal	
Seaspan Kestrel	Seaspan Osprey
Alert	Aware, Attentive
Seacor Relentless	Seacor Reliant, Secor Resolve, Seacor Rigorous
Devin Candies	Kelly Candies, Sidney Candies
Keith Cowan	
Forte	
Harvey Provider	Harvey Explorer
John Coghill	Norman F McCall, Seacor Davis, Seacor Grant, Seacor Lee
Harvey War Horse II	Harvey War Horse
Seacor Vantage	
42m Line Haul Tug	
Gerard Jordan	SEACOR VANGUARD
Ocean Wave	Ocean Wind
Ocean Sky	Ocean Sun
Seacor Valor	Seacor Voyager
Seacor Venture	
"Arctic Tug"	2 - No Names
Damon Chouest	
Harvey Intruder	Harvey Trojan, Harvey Thunder, Harvey Titan
Gulf Service	
Lauren Foss	Corbin Foss
Nanuq	Tan'erliq
Robert Franco	Ahbra Franco
Delta Lindsey	Delta Cathryn, Delta Billie
Freedom Service	Liberty Service
Seaspan Resolution	
America	
Signet Constellation	Signet Stars & Stripes
Tristan K	Hercules
Resolve Pioneer	
Atlantic Salvor	