

VAMOSOC VIEWS: Developing & Assessing O&S Cost Estimates

41st Annual DoDCAS
Williamsburg, VA
20 – 22 February 2008

Paul Hardin

Sponsor: Naval Center For Cost Analysis



Outline

- What are VAMOSOC VIEWS?
- What is the purpose of VAMOSOC VIEWS?
- Data Sources
- Categories of VIEWS for Ships
- List of VIEWS – Ship example
- Sample VIEWS for Amphibious Ships
- Real Applications

What are VAMOSC VIEWS?

- VAMOSC VIEWS are a set of graphical views designed to facilitate user understanding and application of VAMOSC Ships and Aircraft data
- Separate VAMOSC VIEWS have been developed for:
 - Ships
 - Combatants
 - Amphibious ships
 - Carriers
 - Submarines
 - Support Ships
 - Aircraft
 - Fighter/Attack
 - Rotary Wing
 - Surveillance
 - Transport
 - Trainer
- VAMOSC VIEWS are accessible from the VAMOSC Website, in the corporate documents section
- VIEWS provided in pdf files
- Source data provided in excel files

What is the purpose of VAMOSOC VIEWS?

- Provide users with information that can be used for making real-time assessments and decisions regarding operating and support costs
- Explain data anomalies and highlight accounting changes in VAMOSOC reporting that should be considered in conducting analyses of the data
- Provide ideas for developing cost estimating relationships by highlighting cost influences that should be considered when using VAMOSOC data to project future costs

Data Sources

- With the exception of weight data, all data used in constructing the VAMOSC VIEWS are extracted from the VAMOSC Ship and Aircraft Universes
- Ship displacement and Aircraft weight data are collected from various technical data sources (i.e., Naval Vessel Register, Jane's, etc.)

Categories of VIEWS for Ships

- Total
- Personnel
- OPTEMPO
- Fuel
- Supplies and Expendables
- Purchased Services
- Maintenance and Modernization

List of VIEWS for Ships

<u>Category</u>	<u>View ID</u>	<u>X</u>	<u>Y1</u>	<u>Y2</u>	<u>Type</u>	<u>Data</u>	<u>FY</u>	<u>Elements</u>
Total	T1	Allocation			Total	HA	01-06	All
Total	T2	FY	Total Costs per Ship Ton	Total Costs per Ship	Composite	FY	84-06	1.0, 2.0, 3.0, 4.0, A.0, Weight
Total	T3	FY	Number of Ships	Number of Personnel	Total	FY	84-06	A.0, C1.0
Personnel	P1	FY	Enlisted per Ton	Officers per Enlisted	Composite	FY	84-06	C.1.1, C.1.2, Weight
Personnel	P2	Weight	Enlisted	NA	Class	HA	84-06	C.1.2, Weight
Personnel	P3	Weight	Enlisted	NA	Class	MRY	06	C.1.2, Weight
Personnel	P4	Enlisted	Officers	NA	Class	HA	84-06	C.1.1, C.1.2
Personnel	P5	Enlisted	Officers	NA	Class	MRY	06	C.1.1, C.1.2
Personnel	P6	FY	Pay \$ per Enlisted	Pay \$ per Officer	Composite	FY	84-06	C.1.1, C.1.2, 1.1.1.1.1, 1.1.1.1.2, 1.1.4
Personnel	P7	Personnel	TAD + PCS \$	NA	Composite	FY	98-06	C.1.1, C.1.2, 1.1.2, 1.1.3
Personnel	P8	Personnel	TAD + PCS \$	NA	Class	HA	98-06	C.1.1, C.1.2, 1.1.2, 1.1.3
Personnel	P9	Personnel	TAD + PCS \$	NA	Class	MRY	06	C.1.1, C.1.2, 1.1.2, 1.1.3
Personnel	P10	FY	Training \$ per Personnel	Training \$ per Ship	Composite	FY	84-06	4.1, C.1.1, C.1.2, A.0
Personnel	P11	Personnel	Training \$	NA	Class	HA	84-06	4.1, C.1.1, C.1.2
Personnel	P12	Personnel	Training \$	NA	Class	MRY	06	4.1, C.1.1, C.1.2
OPTEMPO	O1	FY	SHU	NA	Composite	FY	84-06	E1
OPTEMPO	O2	Class	SHU	NA	Class	HA	84-06	E1
OPTEMPO	O3	Class	SHU	NA	Class	MRY	06	E1
Fuel	F1	Weight	Bbls per SHU	NA	Class	HA	84-06	F.1.1, F.2.1, E.1
Fuel	F2	Weight	Bbls per SHU	NA	Class	MRY	06	F.1.1, F.2.1, E.1
Fuel	F3	Weight	Bbls per SHNU	NA	Class	HA	84-06	F.1.2, F.2.2, E.2
Fuel	F4	Weight	Bbls per SHNU	NA	Class	MRY	06	F.1.2, F.2.2, E.2
Fuel	F5	FY	Fuel \$ per Bbl	NA	Composite	FY	84-06	1.2.1.1.1, 1.2.1.1.2, 1.2.1.1.2.1, 1.2.1.1.2.2, F.1.1, F.1.2, F.2.1, F.2.2
Fuel	F6	FY	Fuel \$ per Ton	NA	Composite	FY	84-06	1.2.1, Weight
Fuel	F7	Weight	Fuel \$	NA	Class	HA	84-06	1.2.1, Weight
Fuel	F8	Weight	Fuel \$	NA	Class	MRY	06	1.2.1, Weight

HA - Historical Average
MRY - Most Recent Year

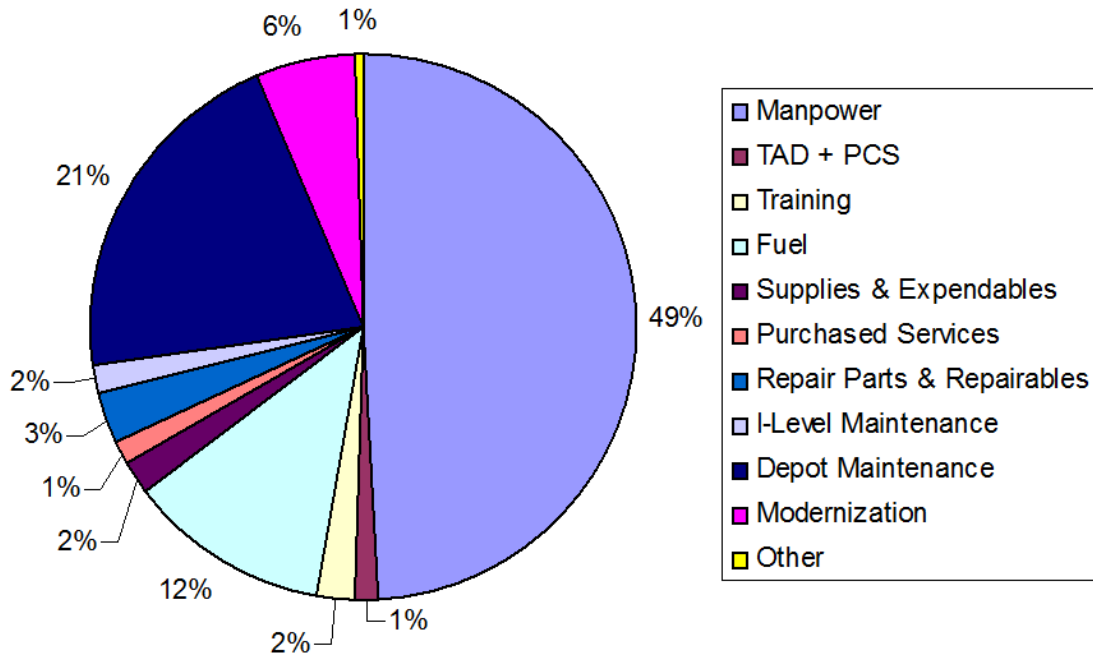
List of VIEWS for Ships (cont.)

<i>Category</i>	<i>View ID</i>	<i>X</i>	<i>Y1</i>	<i>Y2</i>	<i>Type</i>	<i>Data</i>	<i>FY</i>	<i>Elements</i>
Supplies & Expendables	SE1	FY	Supplies \$ per Personnel	NA	Composite	FY	84-06	C.1.1, C.1.2, 1.2.3
Supplies & Expendables	SE2	Personnel	Supplies \$	NA	Class	HA	84-06	C.1.1, C.1.2, 1.2.3
Supplies & Expendables	SE3	Personnel	Supplies \$	NA	Class	MRY	06	C.1.1, C.1.2, 1.2.3
Supplies & Expendables	SE4	FY	Expendables \$ per Ton	Expendables \$ per Ship	Composite	FY	84-06	1.2.4, A.0
Supplies & Expendables	SE5	Weight	Expendables \$	NA	Class	HA	84-06	1.2.4, A.0
Supplies & Expendables	SE6	Weight	Expendables \$	NA	Class	MRY	06	1.2.4, A.0
Purchased Services	PS1	FY	Purchased Services \$ per Personnel	NA	Composite	FY	84-06	C.1.1, C.1.2, 1.3
Purchased Services	PS2	Personnel	Purchased Services \$	NA	Class	HA	84-06	C.1.1, C.1.2, 1.3
Purchased Services	PS3	Personnel	Purchased Services \$	NA	Class	MRY	06	C.1.1, C.1.2, 1.3
Maintenance & Modernization	MM1	FY	Repair Parts + Repairables \$ per Ton	SHU per Ship	Composite	FY	84-06	1.2.2, E.1, Weight
Maintenance & Modernization	MM2	Weight	Repair Parts + Repairables \$	NA	Class	HA	84-06	1.2.2, Weight
Maintenance & Modernization	MM3	Weight	Repair Parts + Repairables \$	NA	Class	MRY	06	1.2.2, Weight
Maintenance & Modernization	MM4	Age	Repair Parts + Repairables \$ per Ton	NA	Class	FY	84-06	1.2.2, Weight, Age
Maintenance & Modernization	MM5	FY	I-Level Maintenance \$ per Ton	NA	Composite	FY	84-06	2.0, Weight
Maintenance & Modernization	MM6	Weight	I-Level Maintenance \$	NA	Class	HA	84-06	2.0, Weight
Maintenance & Modernization	MM7	Weight	I-Level Maintenance \$	NA	Class	MRY	06	2.0, Weight
Maintenance & Modernization	MM8	Age	I-Level Maintenance \$ per Ton	NA	Class	FY	84-06	2.0, Weight, Age
Maintenance & Modernization	MM9	Age	Depot Maintenance \$ per Ton	NA	Class	FY	84-06	3.0 - 3.3, Weight, Age
Maintenance & Modernization	MM10	Age	Modernization \$ per Ton	NA	Class	FY	84-06	3.3, Weight, Age

HA - Historical Average
MRY - Most Recent Year

VIEWS – Total 1 (T1)

**Allocation of VAMOSC Costs
Amphib Ships FY02-06**

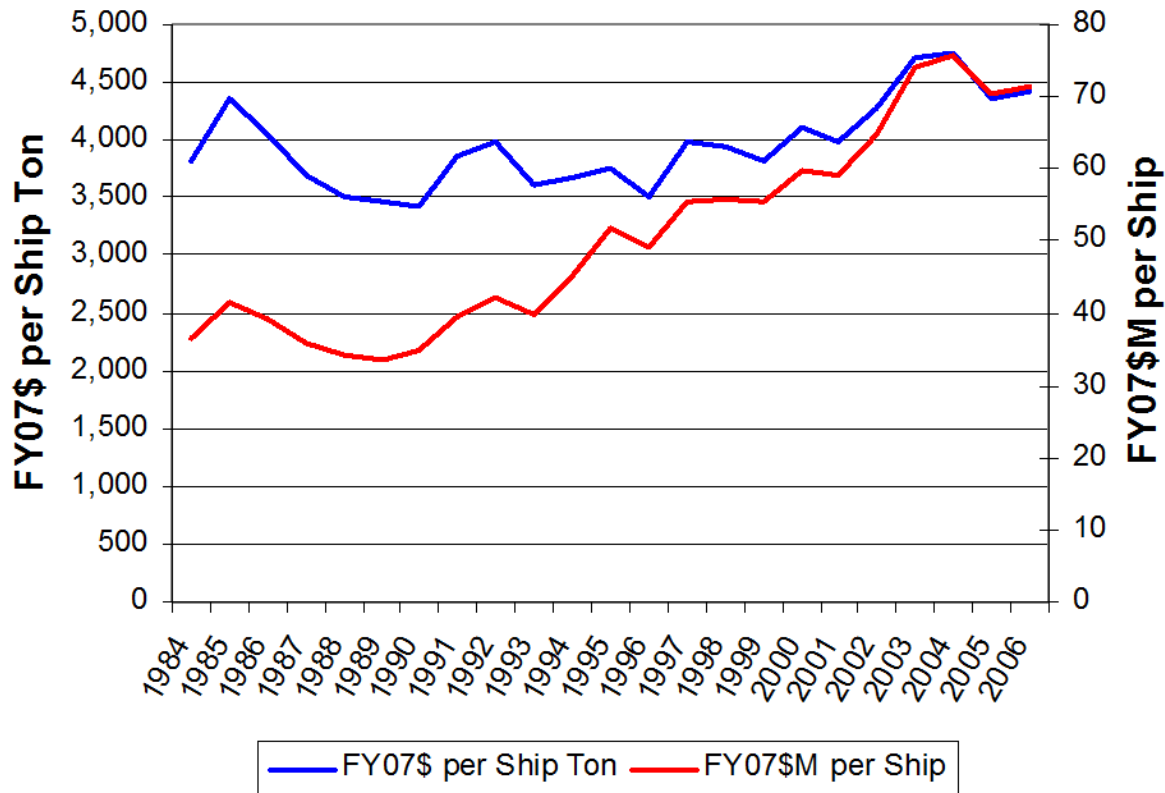


Over half of the cost (52%) is related to personnel when we add PCS, TAD and Training to the pay related cost.

Maintenance and Modernization account for 32% of all costs. Fuel costs account for about 12% of the total, leaving 4%, which is made up of supplies, expendables, purchased services and other costs.

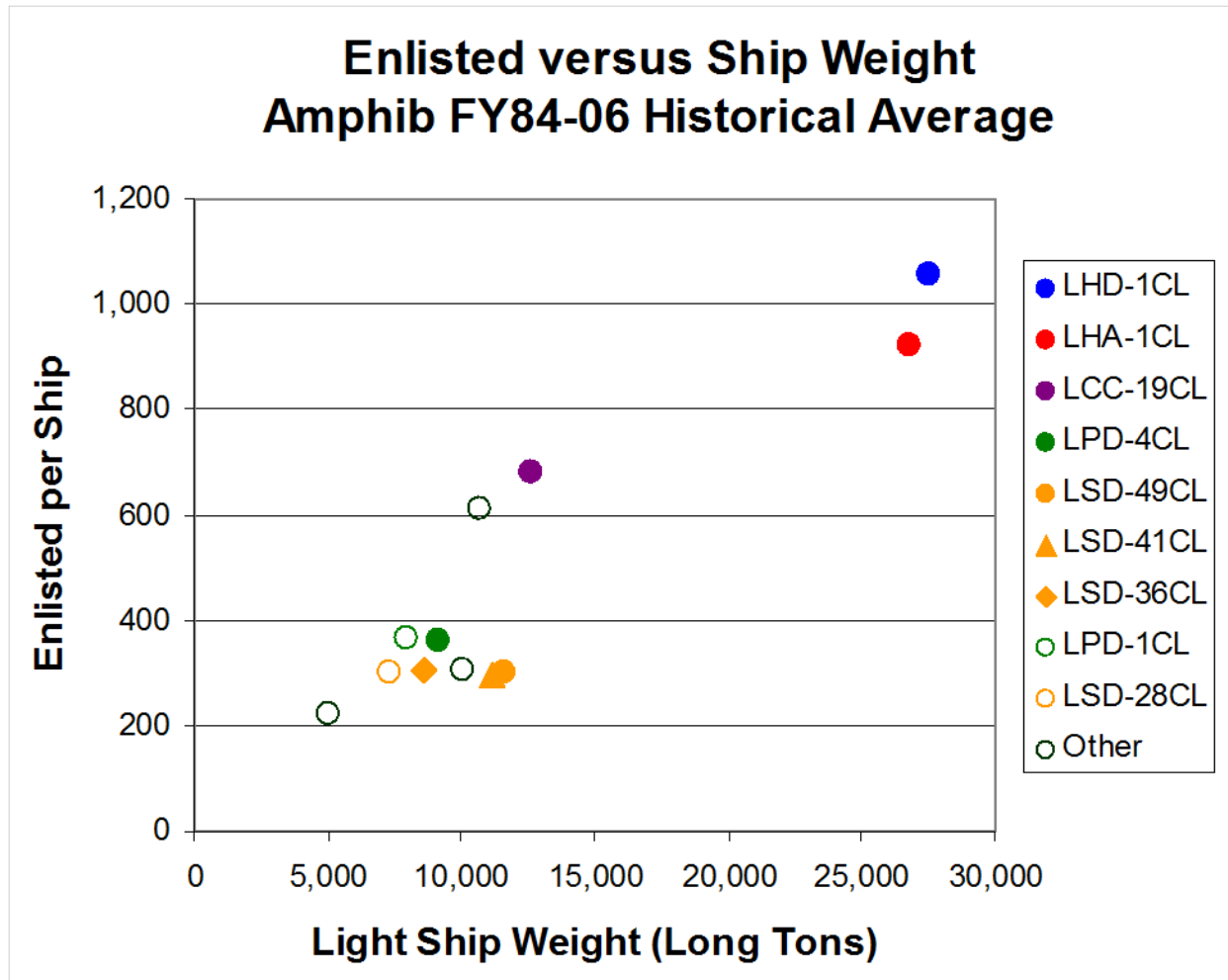
VIEWS – T2

**Total Costs
Amphib Composite**



While the average cost per ship ton has increased slightly since 1990, the average cost per ship has increased significantly, reflecting an overall increase in average ship weight over the reporting period.

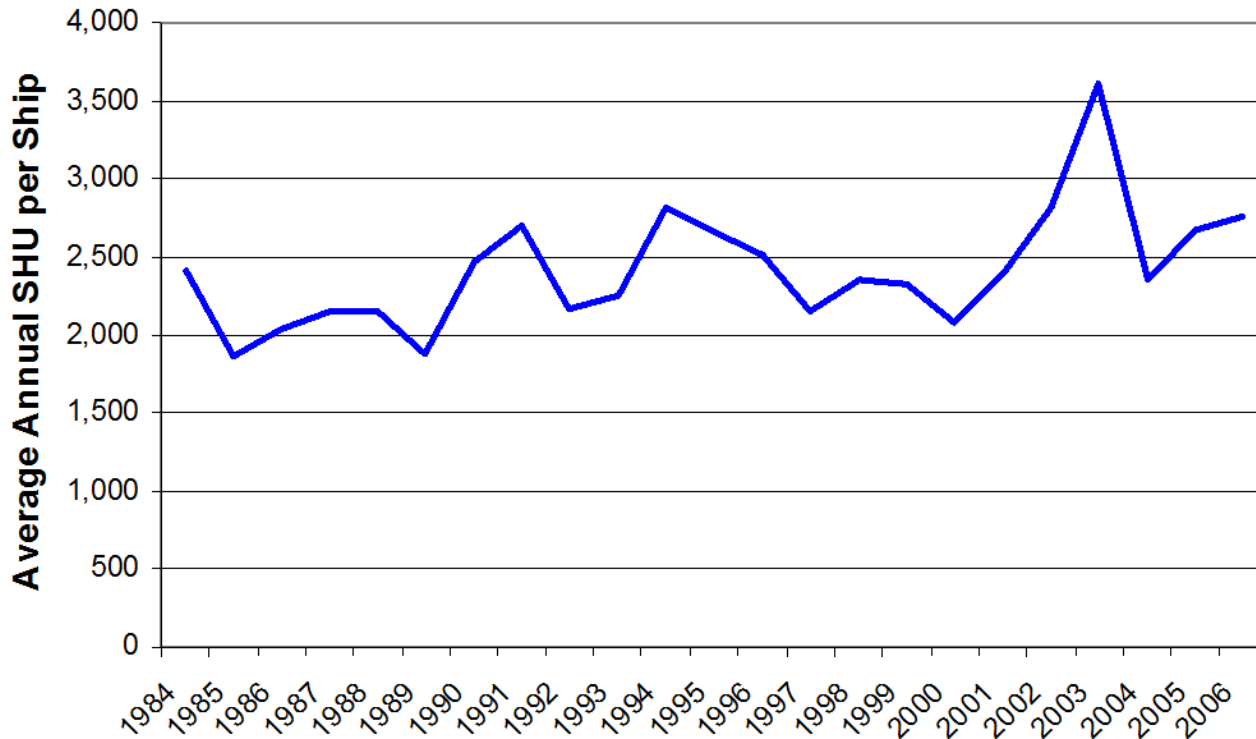
VIEWS – Personnel 2 (P2)



Enlisted per ship is highly correlated to ship weight.

VIEWS – OPTEMPO 1 (O1)

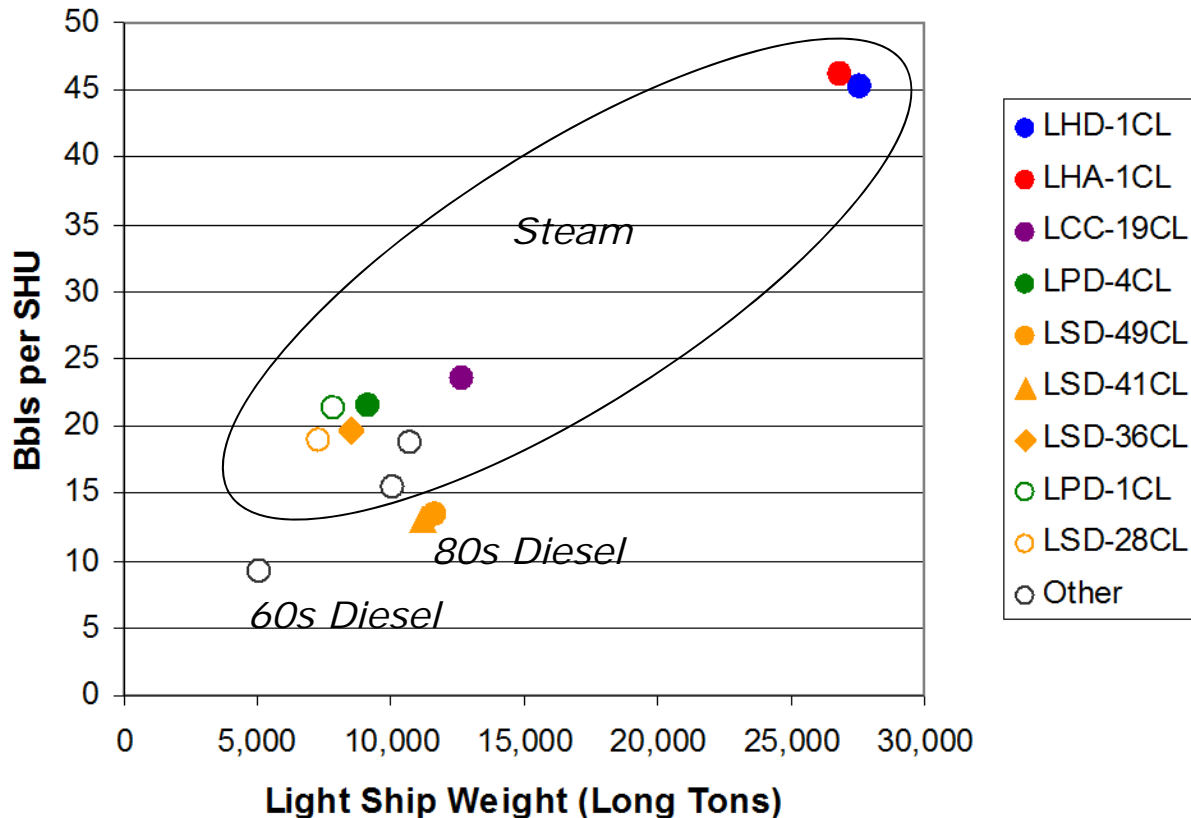
**Annual SHU per Ship
Amphib Composite**



OPTEMPO fluctuates over the reporting period. The significant increase from FY90-92 and FY02-03 most likely relates to the Gulf Wars.

VIEWS – Fuel 1 (F1)

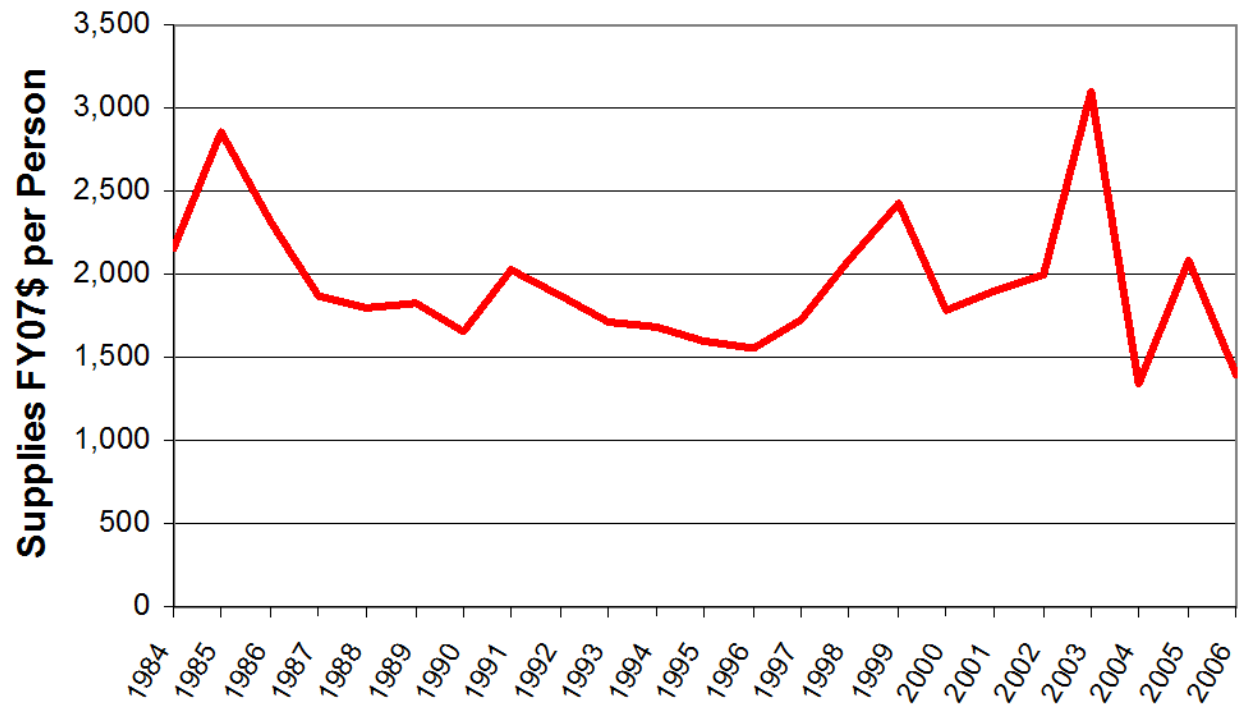
Bbls per SHU versus Ship Weight
Amphib Historical Average FY84-06



Fuel consumption underway is correlated to ship weight. Normalized for weight, fuel consumption underway is less for diesel propulsion ship classes (LSD-41/49) than for ship classes which have steam propulsion.

VIEWS – Supplies & Expendables (SE1)

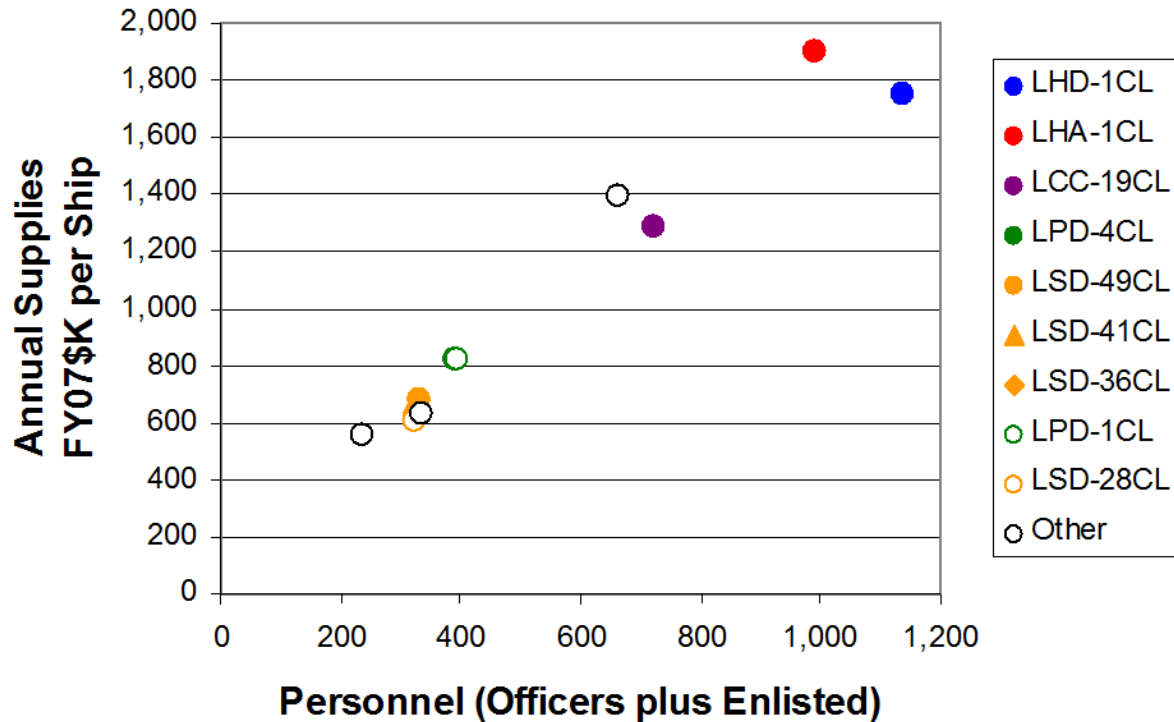
**Supplies (FY07\$) per Person
Amphib Composite**



Supplies cost per person show a noticeable spike in FY03, most likely the result of higher OPTEMPO.

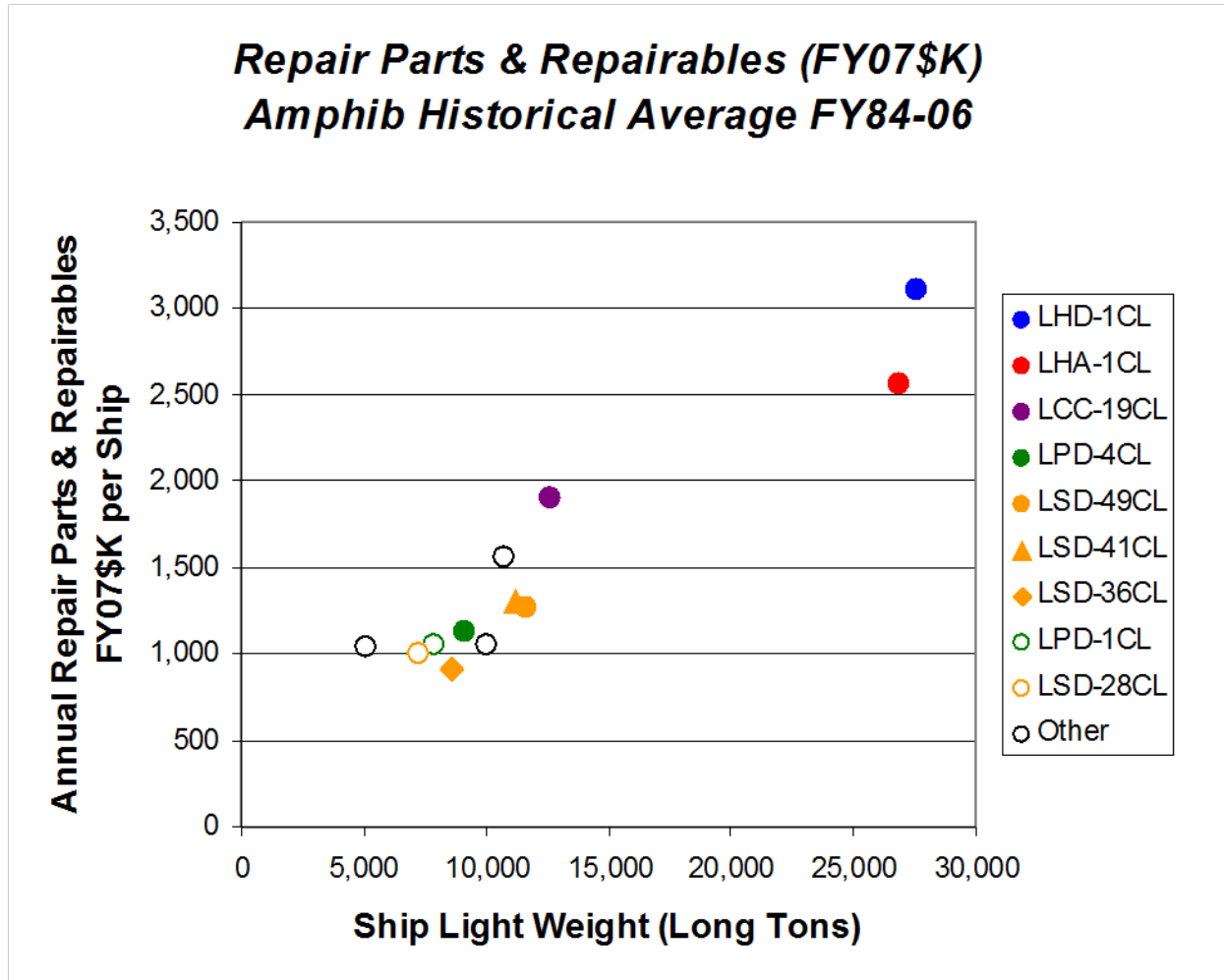
VIEWS – SE2

Supplies (FY07\$K) versus Personnel Amphib Historical Average FY84-06



Supplies cost is highly correlated to the number of people assigned to a ship.

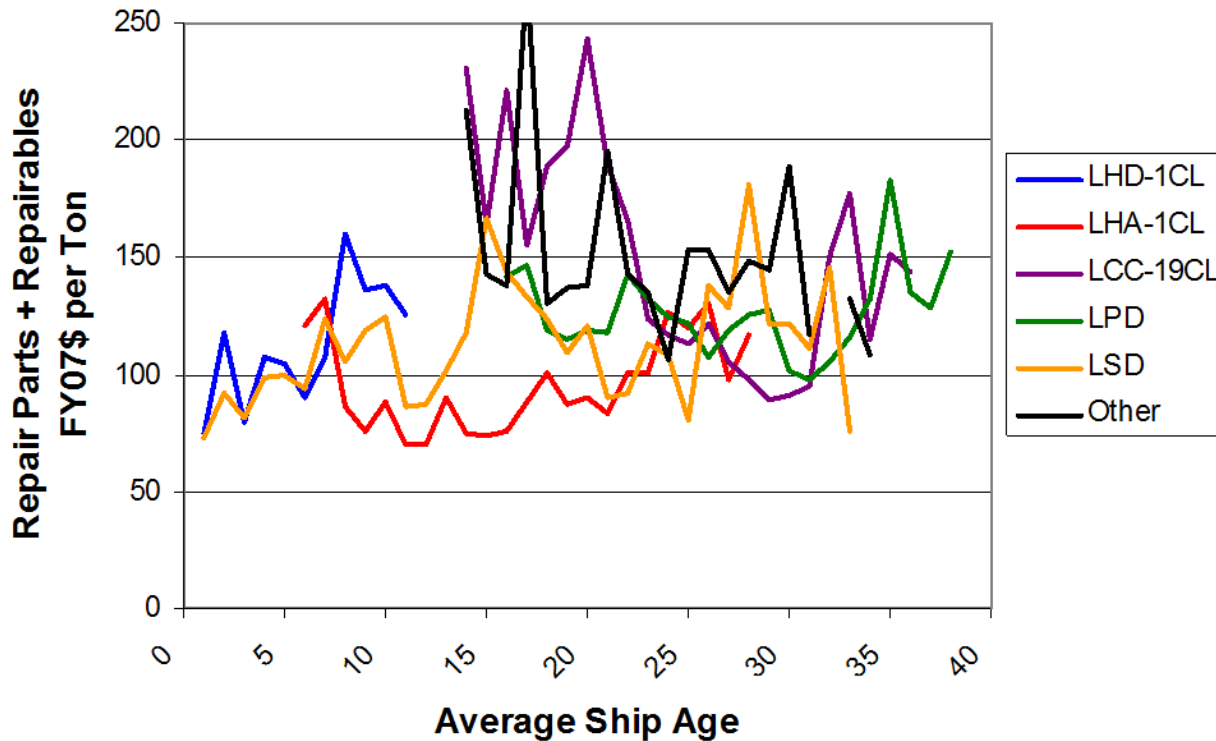
VIEWS – Maintenance & Modernization (MM2)



Repair Parts & Repairables cost is highly correlated to ship weight.

VIEWS – MM4

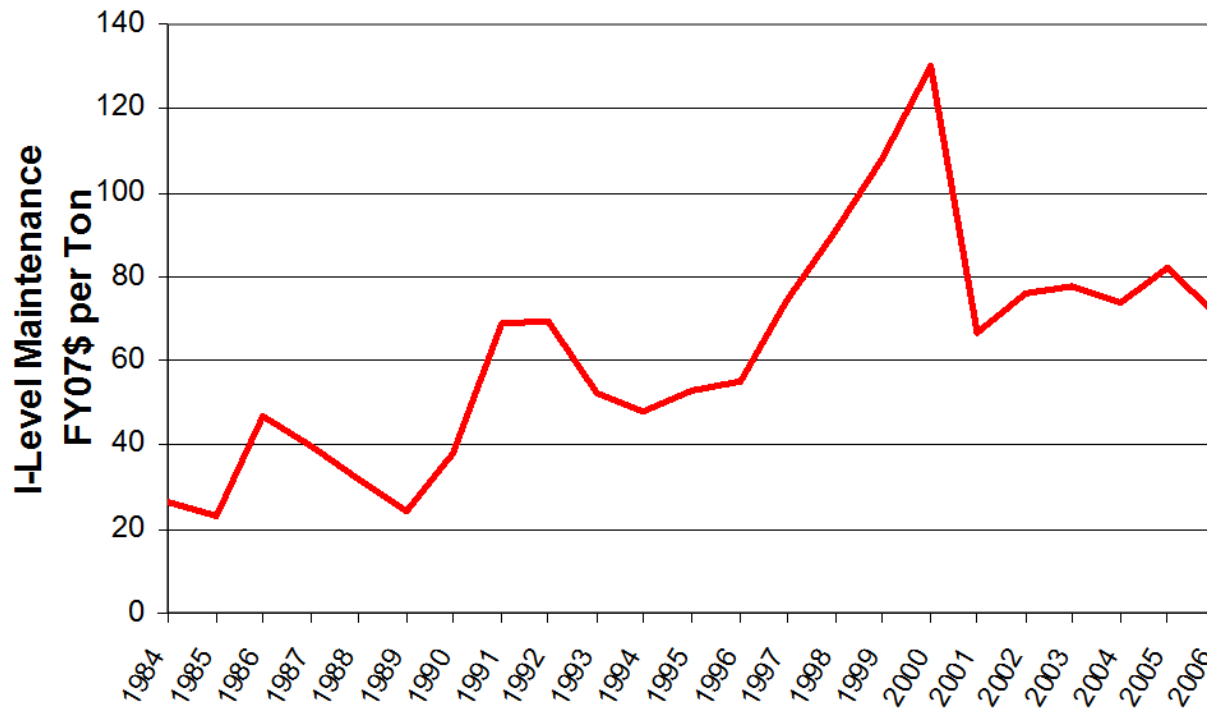
**Repair Parts + Repairables
FY07\$ per Ton
Amphibs FY84-06**



In general, Repair Parts and Repairables cost appears to be more significant starting near mid-life.

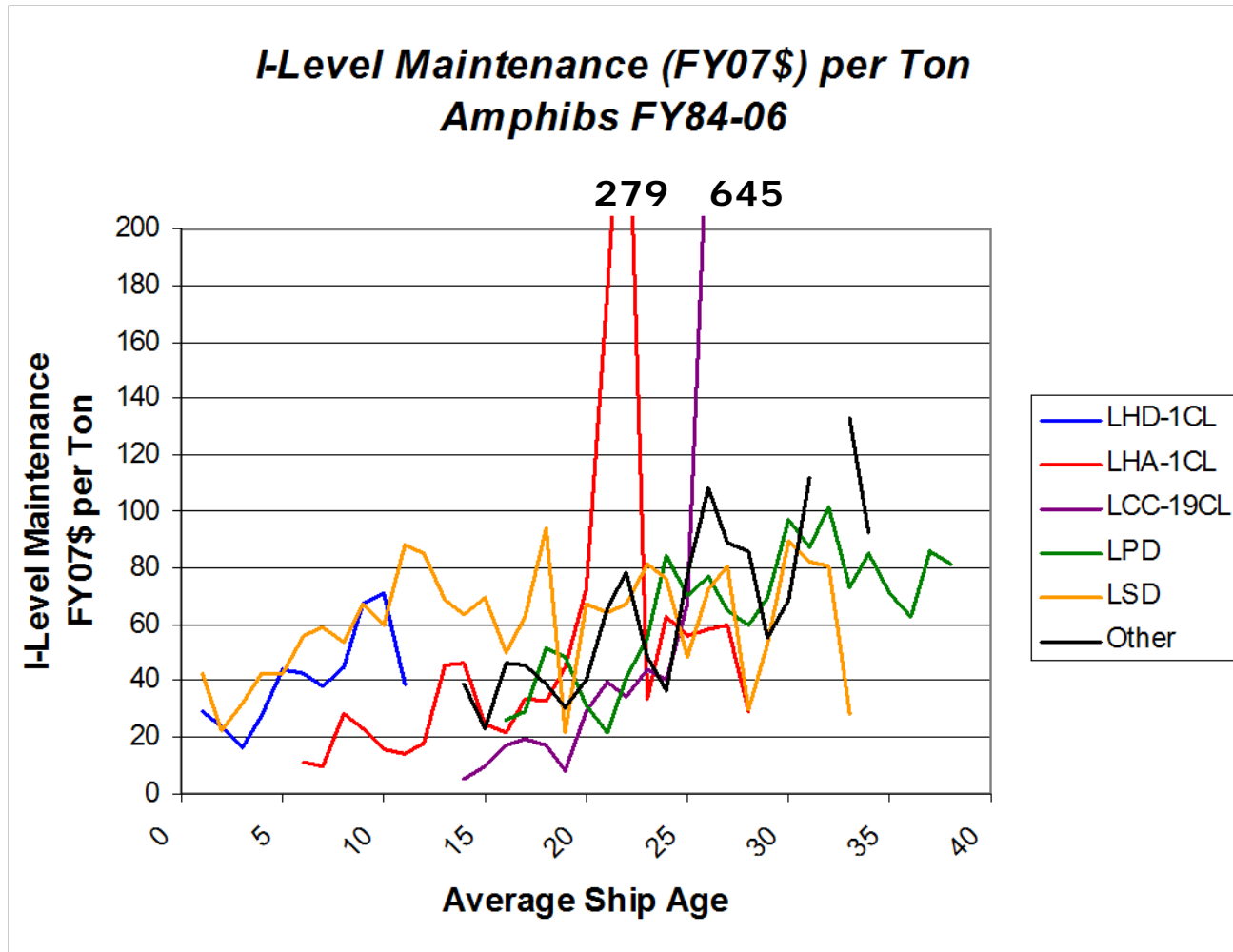
VIEWS – MM5

***I-Level Maintenance (FY07\$) per Ton
Amphib Composite***



I-Level Maintenance cost per ship ton increased from the mid-80s to 2000. Since 2000, costs have decreased and become relatively stable.

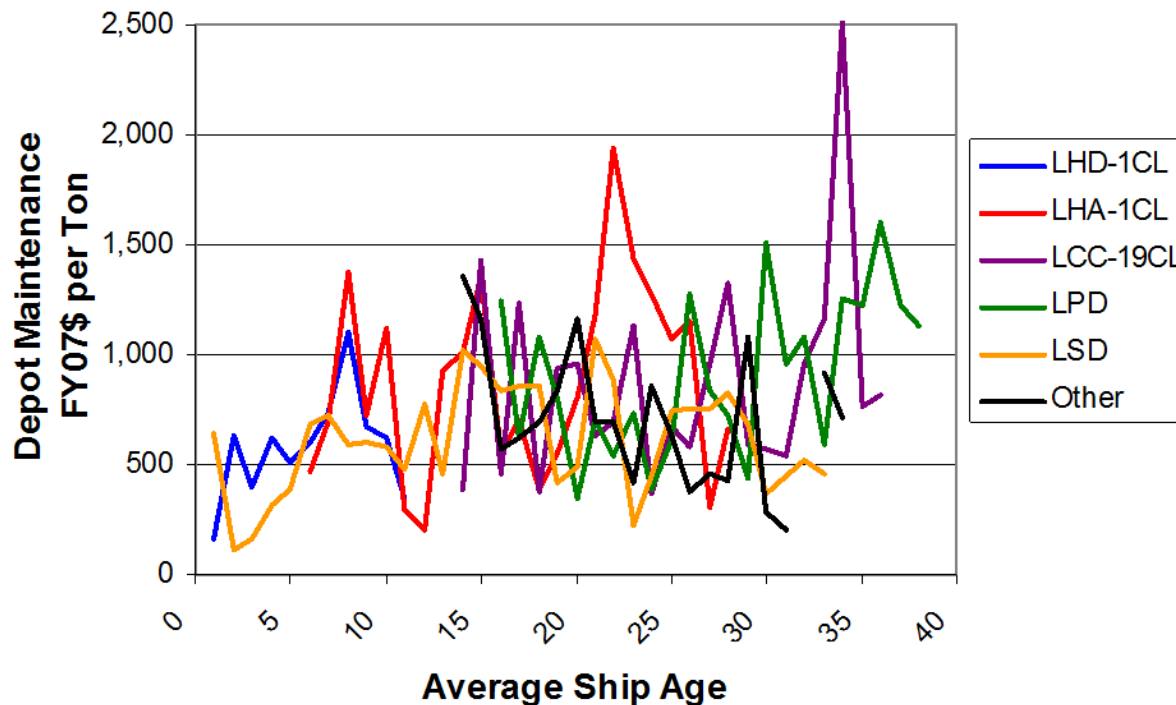
VIEWS – MM8



***I-Level
Maintenance
cost appears
to be highly
correlated to
ship age,
increasing
significantly
after mid-life.***

VIEWS – MM9

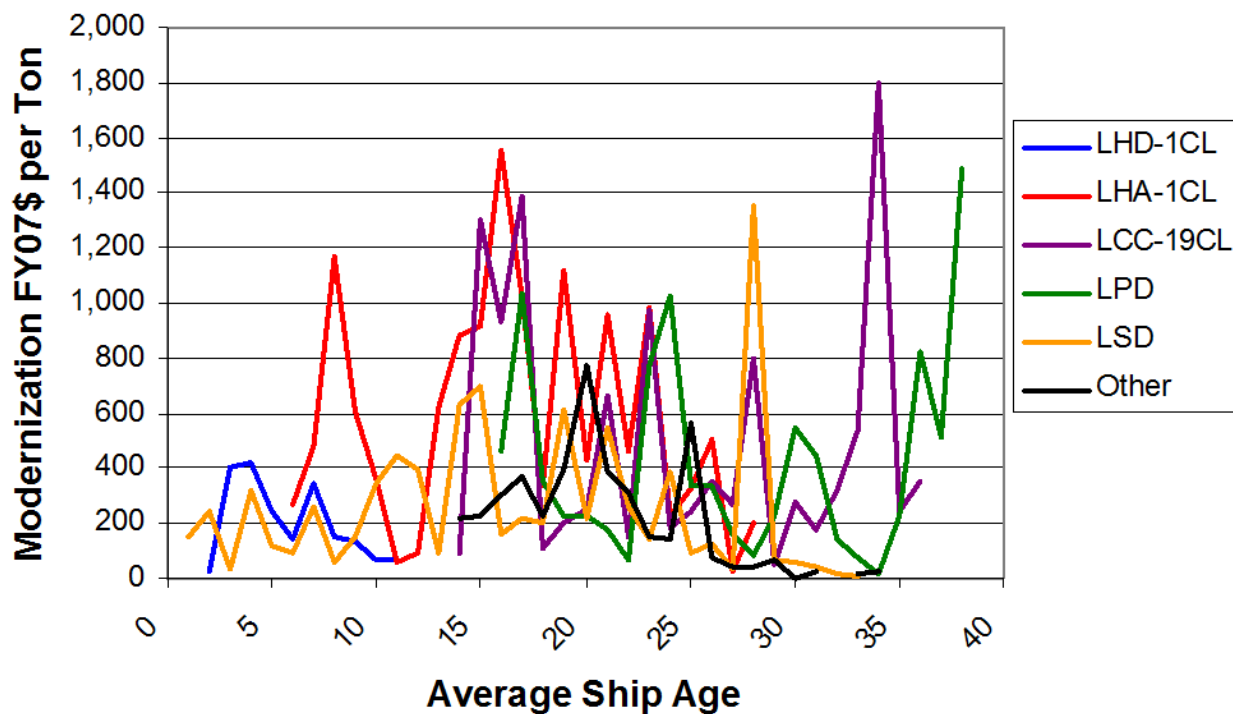
**Depot Maintenance (FY07\$) per Ton
Amphibs FY84-06**



Depot Maintenance cost appears to increase as ships undergo major overhauls approaching mid-life and decrease as ships near a typical 30 year retirement. Increases can be seen when the ship-life is extended beyond 30 years.

VIEWS – MM10

**Modernization (FY07\$) per Ton
Amphibs FY84-06**



Modernization costs appears to increase as ships reach their mid-life. Thereafter, costs appear to decrease. The data shows significant increases when the ship-life is extended beyond a typical 35 year life.

Real Applications

- VAMOSOC VIEWS have been used to assess and develop O&S Cost estimates for:
 - Alternative Ship Propulsion Study
 - USCG Deepwater
 - CG(X)
 - LCS
- For the efforts above, O&S Models have been developed based on VAMOSOC VIEWS and enhanced during each new application

Contacts

- Naval Center for Cost Analysis
 - Mike Carey, Program Manager
Phone: (703) 692-4901
- IBM
 - Pete Bowman, Project Manager
Phone: (703) 653-7195
- Technomics
 - Paul Hardin, Technical Director
Phone: (571) 366-1407