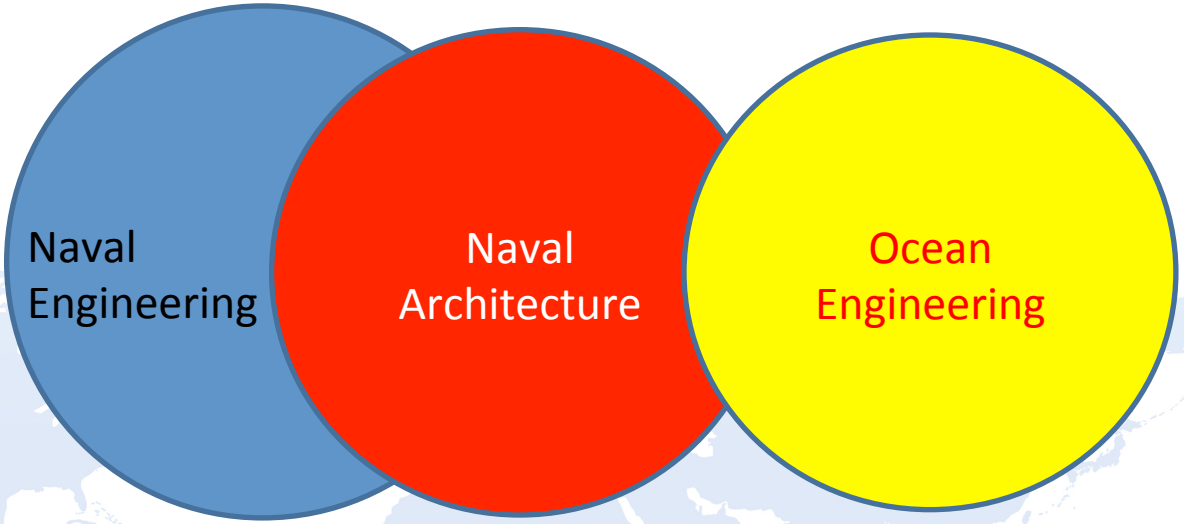


DIFFERENCES AND SIMILARITIES BETWEEN NAVAL ARCHITECTURE NAVAL ENGINEERING AND OCEAN ENGINEERING

UNFORTUNATELY THERE ARE MORE DIFFERENCES THAN THERE ARE SIMILARITIES

However, the difference between Naval Architecture, Naval Engineering and Ocean Engineering is one of involvement of Naval Architecture in the other two.

Naval Engineering incorporates all of Naval Architecture but it is only a relatively small (but important) part of the total discipline.

Ocean Engineering only has a few basic naval architecture parts which form a very small part of the total discipline.

Thus the similarity is the parts of naval architecture used by both which can be seen from the next slide

DEFINTIONS

NAVAL ARCHITECTURE is an engineering discipline dealing with the design, construction, maintenance and operation of marine vessels and structures. Naval architecture involves basic and applied research, design, development, design evaluation and calculations during all stages of the life of a marine vehicle.

NAVAL ENGINEERING includes all arts and sciences as applied in the research, development, design and construction of **naval** surface and subsurface ships.

OCEAN ENGINEERING a mixture of marine, civil and mechanical engineering disciplines dealing with the design, analysis and construction of structures in marine environment. It is closely connected to the offshore oil and gas as well as other material recovery and sustainable or green energy

COMPARISON OF NAVAL ARCHITECTURE IN COMMERCIAL AND NAVAL SHIP DESIGN AND OFFSHORE ENGINEERING

NAVAL ARCHITECTURE
COMMERCIAL

Hull Form
Buoyancy
Weights
Stability
Resistance
Propulsion
Ship Structure
Waves
Seakeeping
Manuevering
Launching
Ship Design

NAVAL SHIP DESIGN

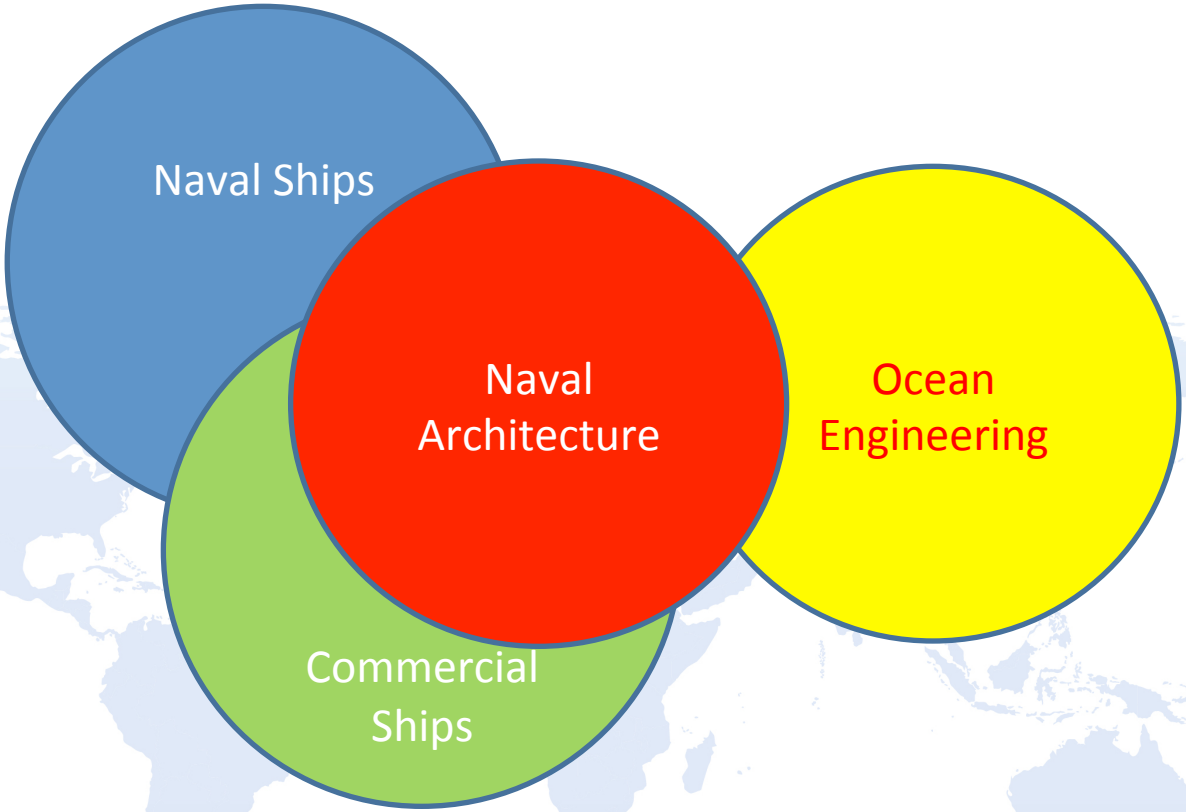
Hull Form
Buoyancy
Weights
Stability
Resistance
Propulsion
Ship Structure
Waves
Seakeeping
Manuevering
Launching
Naval Ship Design
Mission Analysis
Manning
Systems Engineering
Weapons Integration
Systems Integration
Shock Analysis
Signatures
Damage Stability
Survivability
Underwater Systems

OFFSHORE ENGINEERING

Buoyancy
Weights
Stability
Platform Structure
Wind and Waves
Land to Sea Transfer
Sea Loads on Structure
Mooring Systems
Propulsion
Dynamic Positioning
Drilling & Piping Loads
Design in Steel & Concrete
Pipelines
Platform Design
Down-hole Instrumentation
Dynamics and Production
Technology
Offshore Mechanics
Soil Mechanics
Oil and Gas Engineering
Offshore Vehicle Design
UAV Design

Naval Architecture
Naval Engineering
Ocean Engineering

RELATIVE INFLUENCE OF NAVAL ARCHITECTURE ON NAVAL ENGINEERING, OCEAN ENGINEERING AND COMMERCIAL SHIPBUILDING



DIFFERENCES IN UNIVERSITY INVOLVEMENT

The predominance of differences over similarities makes it difficult for a university to offer all levels of programs in all disciplines.

Therefore universities tend to specialize in Naval Architecture or Ocean Engineering.

I know of no university that has complete programs in all disciplines.

There are some that focus on Naval Architecture but offer Master Degrees with specialization in Ocean Engineering (basically an INTRODUCTION TO OCEAN ENGINEERING.

Recently in Europe groups of universities have joined to offer graduate programs in a wide range of maritime disciplines.

There have been attempts by a number of universities offering special graduate programs in Naval Engineering, such as University of Michigan, but these are short lived due to lack of interest/support.

DIFFERENCES IN UNIVERSITY INVOLVEMENT (Continued)

There are many universities that have naval architecture programs.

Most have at least an undergraduate program and some of these have undergraduate, graduate and advanced degree programs.

There are no universities that have a Naval Engineering undergraduate program other than specialist universities such as the US Naval Postgraduate school in Monterey, California and the London University that took over the British Royal Naval Constructor program that once was located at Greenwich.

MIT has a special graduate program specifically for US Naval Officers and civilian engineers that focuses on Naval Ships.

The US Navy still supports the Summer Naval Design Program at MIT'

DIFFERENCES IN UNIVERSITY INVOLVEMENT (Continued)

Some institutions will NOT address Naval Engineering because they are prohibited to include in their curriculum anything to do with war.

There are a number of universities which have complete programs (undergraduate, graduate and advanced studies) in Ocean Engineering. They usually do NOT offer degrees in Naval Architecture but include some basic topics that are similar to those in Naval Architecture.

Generally the faculty for Naval Architecture and Ocean Engineering come from far different backgrounds.

DIFFERENCES IN EDUCATION

Naval Architects and Naval Engineers do not study Oceanography. Their knowledge of the oceans and other seas is restricted to wind, waves, current and the influence of shallow water on ship performance.

However Naval Engineers deal with ocean thermoclines and underwater currents in submarine design.

Ocean Engineers are given a broad knowledge of physical oceanography as well as topics such as soil mechanics.

To see the reason for difference in Naval Engineering and Naval Architecture it is necessary to look at difference in the industries they support

DIFFERENCE BETWEEN NAVAL AND COMMERCIAL NAVAL ARCHITECTURE

Naval Engineering involves much more than Naval Architecture.

In Commercial Shipbuilding Naval Architecture is the largest part.

Even today there are commercial shipbuilders where there is only one naval architect who designs all the ships they build.

Naval ship design is many magnitudes more complex and takes 10 times more effort and ten times longer than commercial ship design.

So in commercial ship design the naval architect **LEADS** the team whereas in naval ship design the naval architect(s) is only **PART** of the team.

Major Functional Areas

R&D Cost
Commonality
Reaction Time
Life Cycle Cost
Co-op Engagement
Risk
EMC
Margins
Sensor Fusion
ILS
RMA
Survivability
Margins
O&S Cost
Peacetime Features
Sustainability
Future Growth
Design Integration
Deck Wetness
Strike
Automation
Reaction Time
Computer Architecture
Producibility
Signatures
Maneuverability
Military Effectiveness
Seakeeping
Manning

DIFFERENCE BETWEEN NAVAL AND COMMERCIAL SHIPBUILDING

It is often stated that naval ships are different to commercial ships.

- Yes they are but it depends on the perspective.
- From their use perspective they are certainly different to commercial ships.
- From their contents perspective they have all the ship operating systems but also weapons and much more electronics.
- However, from a shipbuilders point of view the significant differences are more program related and time of design and construction than actual production processes.

DIFFERENCE BETWEEN NAVAL AND COMMERCIAL SHIPBUILDING

The major and obvious differences between naval and commercial ships are:

- Navy more conservative,
- Naval ship damage stability more complex,
- Need for low noise on naval ships,
- Shock requirements for naval ships, and
- Use of lightweight materials

From the shipbuilders perspective naval ships:

- Generally are smaller than commercial ships
- Are more dense with equipment and outfit throughout the whole ship than a typical commercial ship
- Take longer to design (up to 10 times)
- Take longer to build (up to 5 times)

DIFFERENCE BETWEEN NAVAL AND COMMERCIAL SHIPBUILDING

- Another often stated point is that commercial shipbuilding focuses on structure (up to 60% of the lightships weight) but for naval ships structure is not so important as it is only 15% of the lightship weight. Therefore any improvement effort should be focused on machinery, equipment and systems installation.
- While the basic statement is true the conclusion is not.
- A basic misconception that naval ship structure is not as important as for commercial ships is based on following ship cost breakdown:

	Naval	Commercial
Hull	24%	50%
Machinery	10%	15%
Electrical	12%	7%
Command & Commun.	8%	2%
Auxiliary Systems	19%	14%
Outfitting	14%	12%
Weapons	13%	

DIFFERENCE BETWEEN NAVAL AND COMMERCIAL SHIPBUILDING

When you look at actual man hours it can be seen that the effort for naval ship structure is many times commercial (DDG versus 75,000t Bulk Carrier):

	Naval	Commercial
Hull	1,160,000	150,000
Machinery	480,000	45,000
Electrical	600,000	21,000
Command & Commun.	320,000	6,000
Auxiliary Systems	840,000	42,000
Outfitting	600,000	36,000
TOTAL MAN HOURS	4,000,000	300,000

So, although percentage cost reduction may be lower for a naval ship compared to a commercial ship the actual man-hour reduction will be significantly larger.

SUMMARY

Differences between Naval Engineering and Naval Architecture are that naval engineering requires additional needs to be addressed.

Similarity between Naval Engineering and Naval Architecture is that naval engineering incorporates naval architecture completely into its discipline.

Thus it is logical to have Naval Engineering as a Graduate course following on after Undergraduate Degree in Naval Architecture.

Differences between Naval Architecture and Ocean Engineering are significant.

Ocean Engineering should continue as a completely separate program.