The Future of Naval Architecture, Marine and Ocean Engineering

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Planet Earth or Planet Ocean?

Importance of Naval Architects

- Since the planet we live on is largely covered by water and since humankind exists and thrives because of our capability to successfully harness the resources which the world provides , those who are trained to create solutions for issues associated with the ocean, ***Naval Architects***, must, a priori, be amongst the most important class of persons on our little globe.

What the Oceans Mean to Us

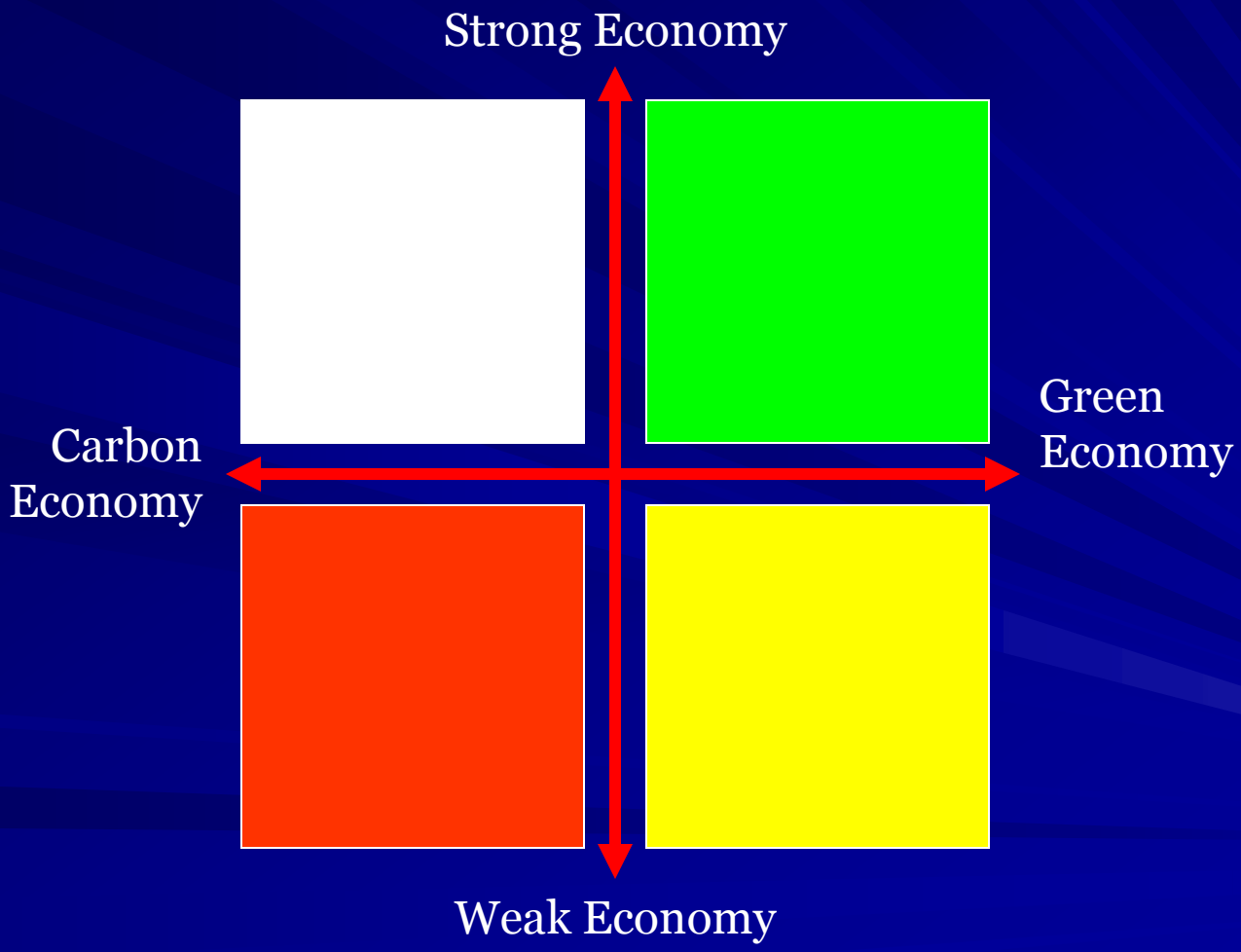
- Approximately 70% of the earth's surface is covered by water
- Over 95% of the world's inter-continental trade moves by sea
- A significant portion of the world's food comes from the sea ~ 16% of world animal protein consumption by humans comes from fish.
- Around 40% of the world's population lives within 100 km of the coasts and this percentage is rising rapidly
- A large part of the world's oil lies the under the sea – in the US there are ~21 billion barrels of proven reserves of conventional oil (including 4 billion offshore) and "technically recoverable undiscovered" offshore oil in the US is in the range of 59 billion barrels

What Does the Future Look Like?

SNAME's Mission

- SNAME's mission is to seek to advance the art, science and practice of naval architecture, marine and ocean engineering by:
  - Affording facilities for the exchange of ideas and information among its members and dissemination of results of relevant research, experience and information.
  - Promoting the professional integrity and status of the members and affording facilities for the advancement in their professional knowledge,
  - Cooperation with educational institutions for the furtherance of education in naval architecture, marine and ocean engineering, and
  - Encouraging and sponsoring such research and other enquiries considered important to the art and science of naval architecture, marine and ocean engineering.

Future World Scenarios
SNAME Planning



Commonalities across Scenarios

SNAME Planning

- SNAME's Strength is in it's grass roots:
  - Individual members working through local Sections, and Technical Panels & Committees. SNAME HQ needs to efficiently support this rather than try to lead or control.

- SNAME Opportunities
  - Additional effort to create, capture and make available technical knowledge needed - How?
    - More and more efficient use of electronic media?
    - More Focus on "knowledge products"
    - New T&R Panels and Committees?
    - More effective use of current T&R structure or re-organize?
  - Improved education required for naval architects, marine and ocean engineers
    - Continuous education – post graduation learning
    - Link Distinguished Practitioner to work community world-wide
  - Increased Internationalization
    - More Collaboration in Asia (China, Singapore, India) and Latin America (Brasil)
  - Increase support to national and international bodies and governments
    - US and Canadian Navies and Coast Guards, Marine Safety Agencies, IMO, OCIMF, TSF, IADC, API etc

How to Influence the Future

- Required :
  - People who are enthusiastic, creative, smart, committed, well educated and well trained.
  - Readily accessible and usable knowledge base
  - Good ideas and the ability to implement them

Education & Training

Why the Education and Training of the next Generation of Naval Architects is too Important to be left to Universities and Professors

The Naval Architect

- *"A naval architect should be able to design, draw, calculate, lay down, cut out, set up, fasten, fit, finish, equip, launch and send to sea a ship out of his own head.*
- *He should be able to tell beforehand at what speed she will go, what freight she will carry, what qualities she will show in a sea, - before it, athwart it, against it, - on a wind, close hauled, going free, - what she will stow, and carry, and earn and expend.*
- *On his word you should be able to rely, that what he says, that his ship will infallibly do."*

  – John Scott Russell's (engineer and naval architect), "The Modern System of Naval Architecture", 1865

Engineering Education

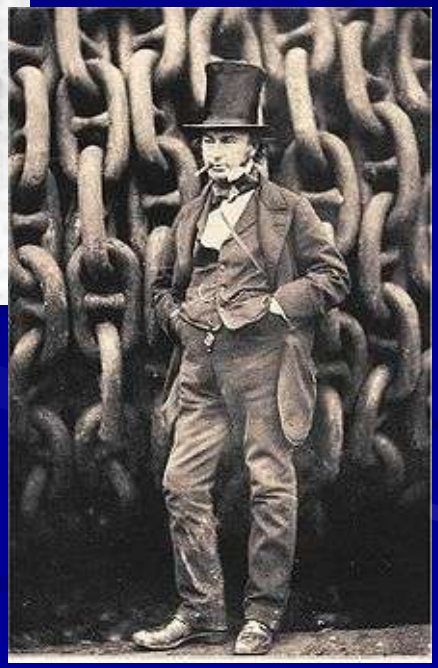
(based primarily on N. American and European models)

- Undergraduate programs do a good job of teaching engineering analysis and a poor job on teaching design synthesis.
- Post-graduate engineering education is focused on producing more professors.
- Most engineering schools put significantly more emphasis on professors being good researcher grant writers, rather than on being good teachers

- William John MacQuorn Rankine, (the Scottish engineer), had a reputation as an excellent teacher, emphasized the ***"mutual dependence and harmony between sound theory and good practice",***

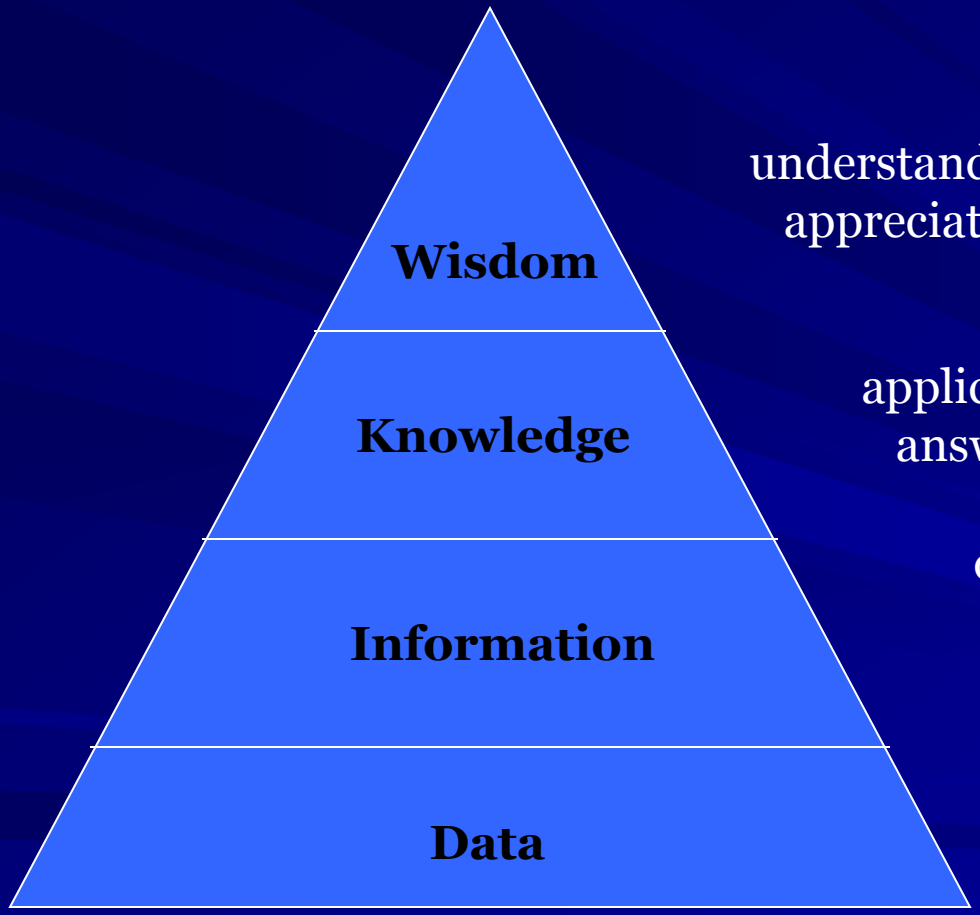
Education and Training

- To expand on the concept the education and training of naval architects (and other engineers) can only be accomplished through strong cooperation between academia and industry professionals
- This is not a new idea – at one of the earliest schools of naval architecture developed by the British Admiralty the teaching staff initially were distinguished practitioners such as William Froude, of Froude Number fame and Isambard Kingdom Brunel, who built the Great Western Railway and the Great Eastern super-ship



Wisdom, Knowledge, Information and Data - WKID

Hierarchy of Knowledge
WKID Pyramid



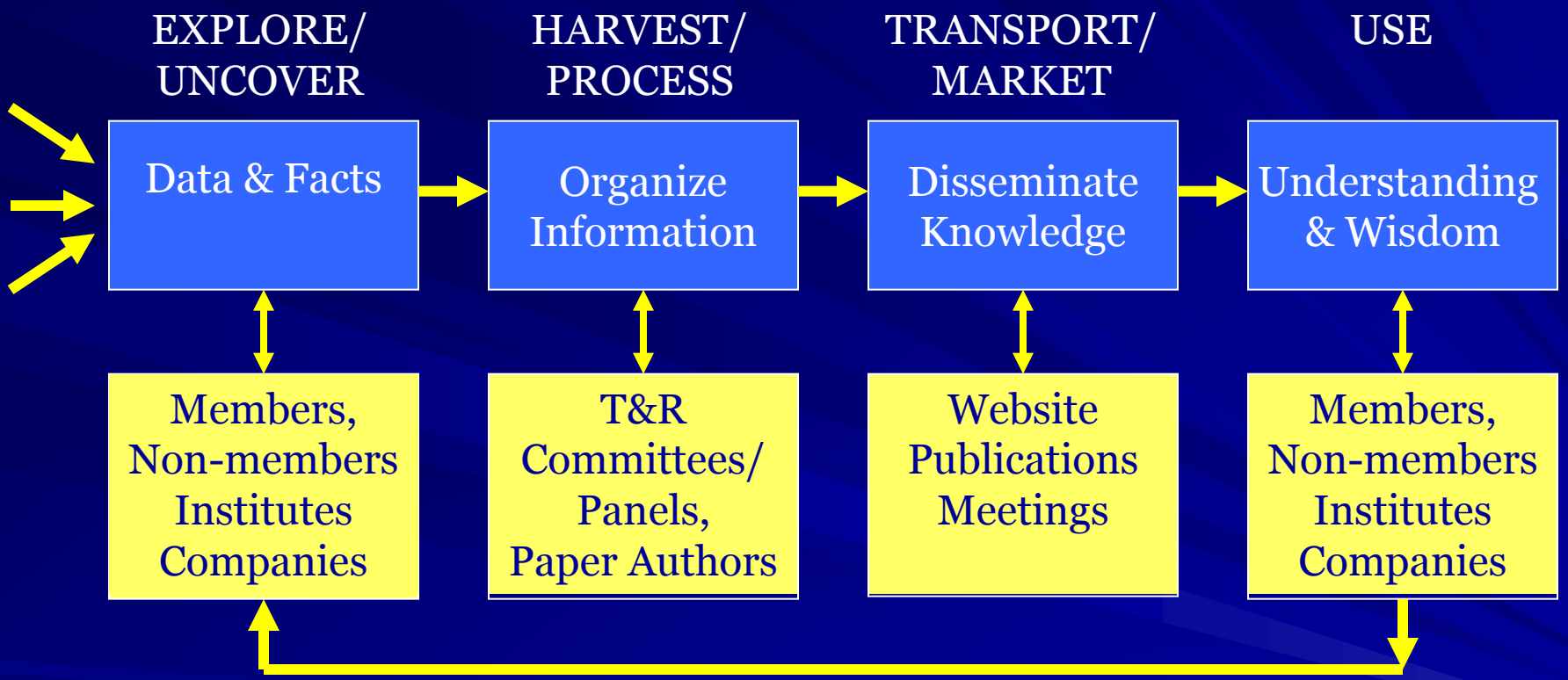
understanding and
appreciation of "why"

application of data and information;
answers "how" questions

data that are processed to be useful;
provides answers to "who",
"what", "where", and "when"

facts, statistics, quantities,
characters, or symbols

SNAME Knowledge Value Chain



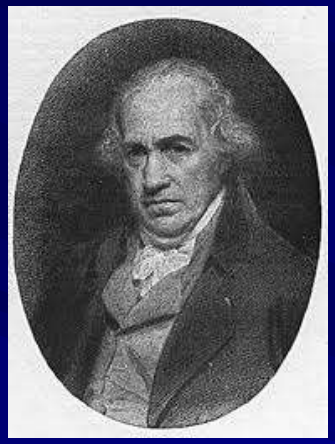
Through use of Knowledge new facts and data may be discovered which will feed-back into the start of the value chain.

Ideas

Scientific Research

- Traditional thinking (at least as conveyed by the media) seems to be that new technological developments emerge from scientific research performed by universities and large government or industry research laboratories.
- While these institutions can do valuable work, there is little evidence to support this premise as there appears to be only a loose coupling between scientific research and technology development

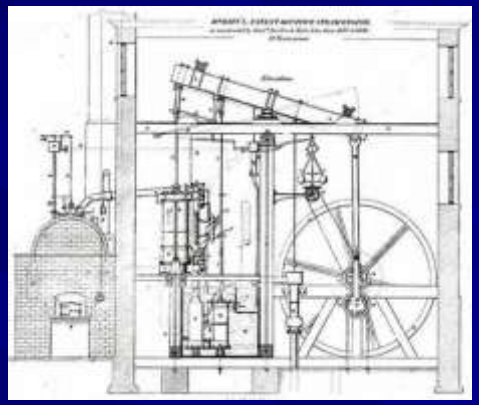
Technology often precedes Science



James Watt 1736-1819

William Thompson,
Baron Kelvin of Largs 1824-1907

Watt Steam Engine - 1775



Kelvin's articulation of
the Second Law of Thermodynamics - 1851

"No process is possible in which the sole result is the absorption of heat from a reservoir and its complete conversion into work."

Albert Einstein

'Imagination is more important than knowledge. *For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.'*

Design & Invention versus Science

- *"**Design & Invention** cause things to come into existence from ideas; they **make the world conform to thought**;*

- *whereas **Science**, by deriving ideas from observation and analysis; **makes thought conform to existence**."*

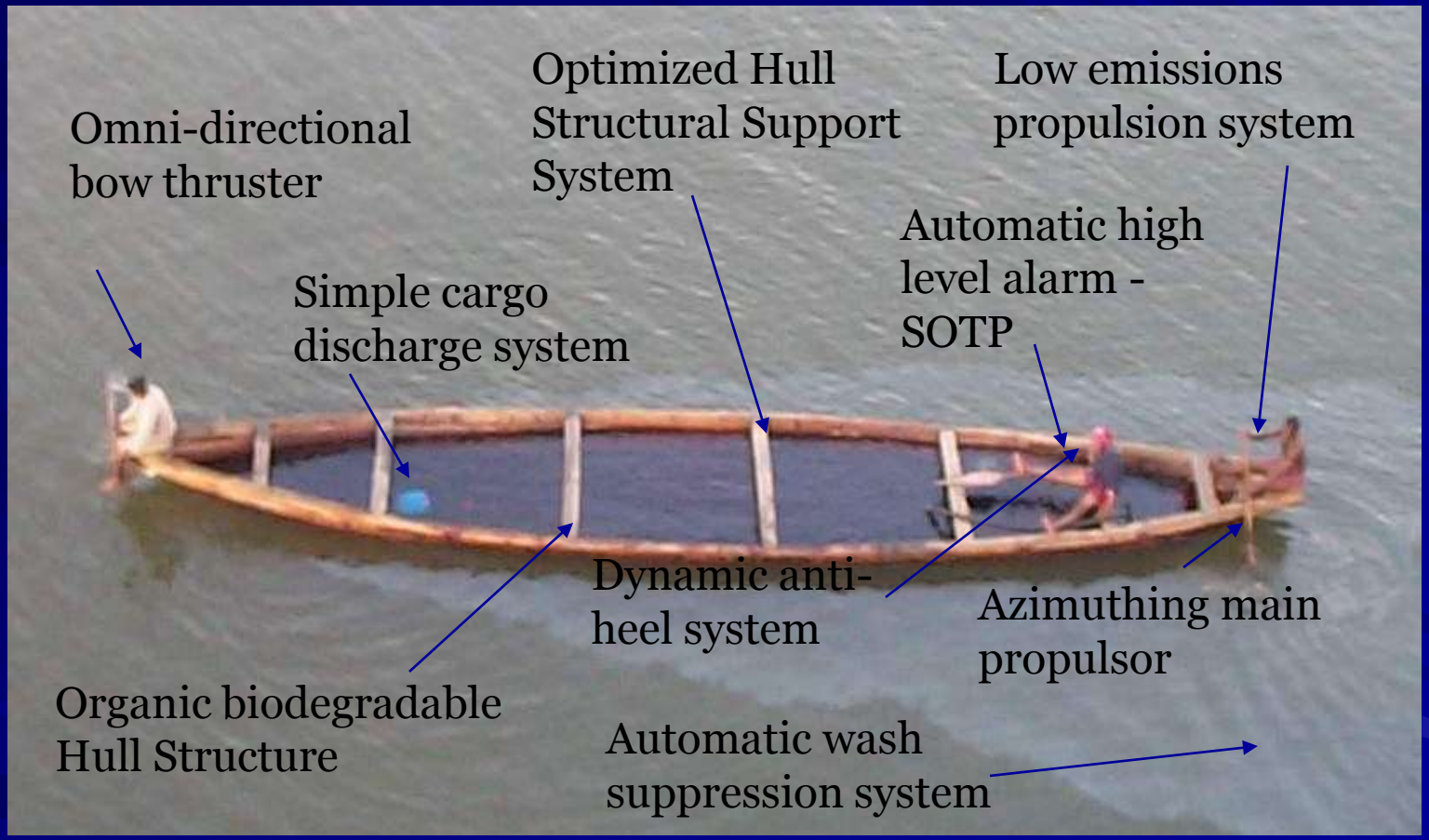
  – Carl Mitcham, Philosopher, Prof of Liberal Arts and International Studies, Colorado School of Mines

Conclusions on Ideas

- **Ideas**
  - don't come from watching television
  - sometimes come from listening to a lecture
  - often come while reading a book
  - occur when dissimilar universes collide
  - often strive to meet expectations. If people expect them to appear, they do
  - fear experts, but they adore beginner's mind. A little awareness is a good thing
  - come from nature
  - don't need a passport, and often cross borders (of all kinds) with impunity
  - good ideas come from bad ideas, but only if there are enough of them

Project ROT-N

Riverine Oil Tanker, Nigeria



Note: SOTP is "seat of the pants" sensor system


The Future Begins Now!