Research Vessel Design and Construction: Is There A Better Way?

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The Usual Caveats and Disclaimers

- I'm not an authority and so...
- Based on what I've seen and heard and not...
- Any misrepresentations are on me and not...
- Views and opinions are my own and do not...

Current Processes – 1
(Very) General Overview

- NAVY/NAVSEA/PEO-Ships
  - Based on common SOR
  - Competitive
  - Design Agent + Shipyard Teams
  - Solicitation released to successful Team for construction with Navy oversight.
  - Closed Process once SOR complete
  - Evaluation against SOR
  - Funding identified in advance
  - Incorporates cost caps
  - Built for speed and multiple copies
  - Design "solidified" early
  - Not necessarily a classic design spiral
- NSF/UNOLS
  - Based on SMR
  - Design generally non-competitive
  - Shipyard not involved
  - Open process
  - Solicitations are Refresh/Build, and released to academic institution for management with Agency oversight.
  - Evaluation against SMR and subsequent reviews
  - Funding not always identified
  - Built for one-offs
  - Design "solidified" late
  - More of a classic design-spiral
  - Some detailed design is incoporated into the contract design

Current Processes - 2 Strengths

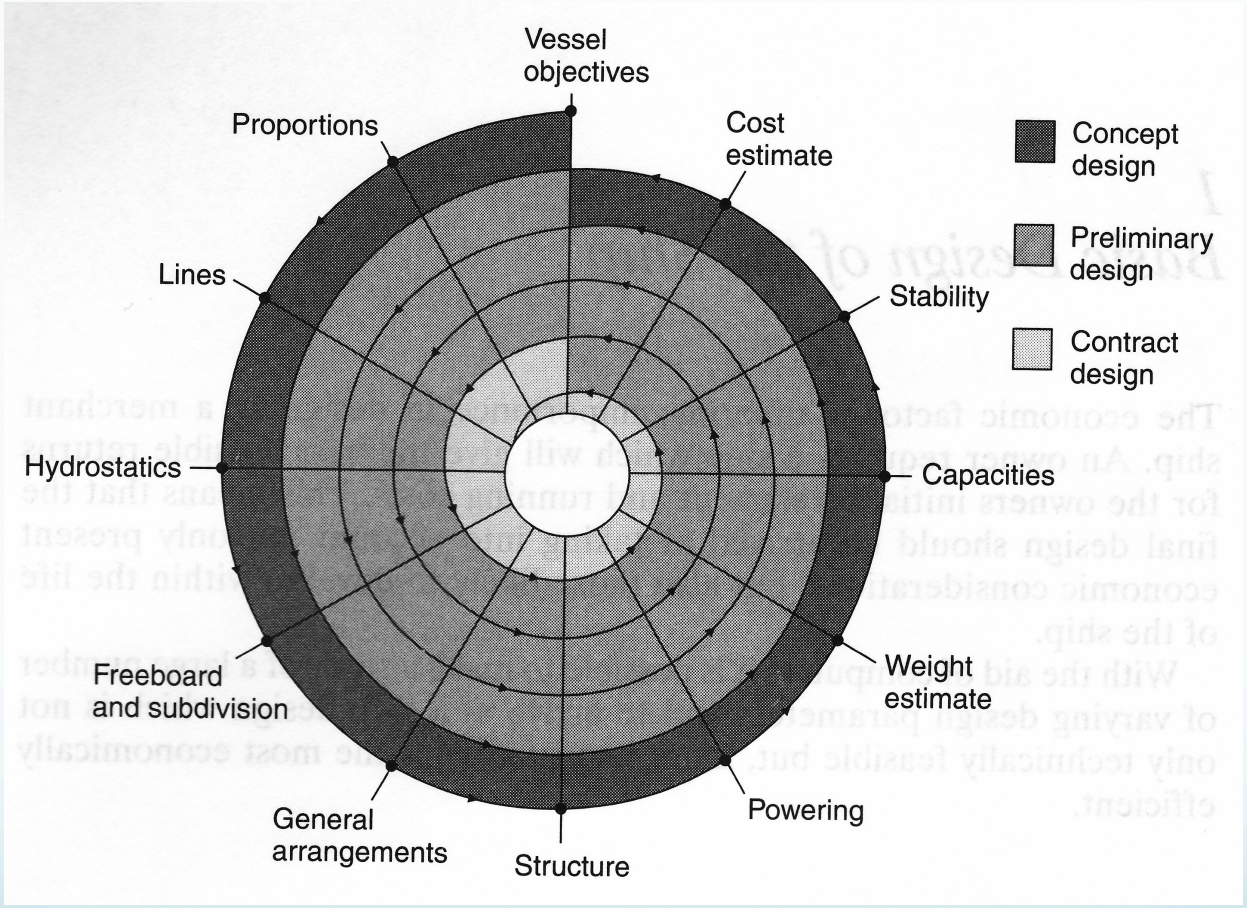
- NAVY/NAVSEA/PEO-Ships
  - Requirements are detailed, and consistent throughout
  - Design Agent + Shipyard Teams
  - Competitive design process
  - Moves forward “quickly”
  - Designs are more objectively evaluated against Requirements
- NSF/UNOLS
  - Lots of community input
  - Flexibility in requirements
  - Design is refined over a long period with multiple reviews
  - Maximizes vessel customization

Current Processes – 3 Weaknesses

- NAVY/NAVSEA/PEO-Ships
  - SOR has to be very complete and well-vetted. Flaws in SOR show up in designs.
  - Rigid SOR stifles creativity and innovation – "check the boxes" to win
  - Once SOR established and design contracts released, little opportunity for refinement
  - Closed process does not allow for input while teams are working – teams work in isolation from users
  - Improvements and customization more difficult
- NSF/UNOLS
  - SMRs can be too vague and may not be achievable – moving target
  - Every suggestion becomes a requirement-not well vetted
  - Cost/producibility realism can be missing
  - SMRs take too long to develop and update – "mid-course correction"
  - Advisory bodies are volunteers, and may turn over frequently
  - Design is fixed very late – if all all - late-stage tweaking – "parachuting"
  - Plays out over a very long time
  - Detailed design to address reviews may result in unforeseen problems

Both: Not enough attention is paid early in the process and there is no consistent follow-through from SMR to design

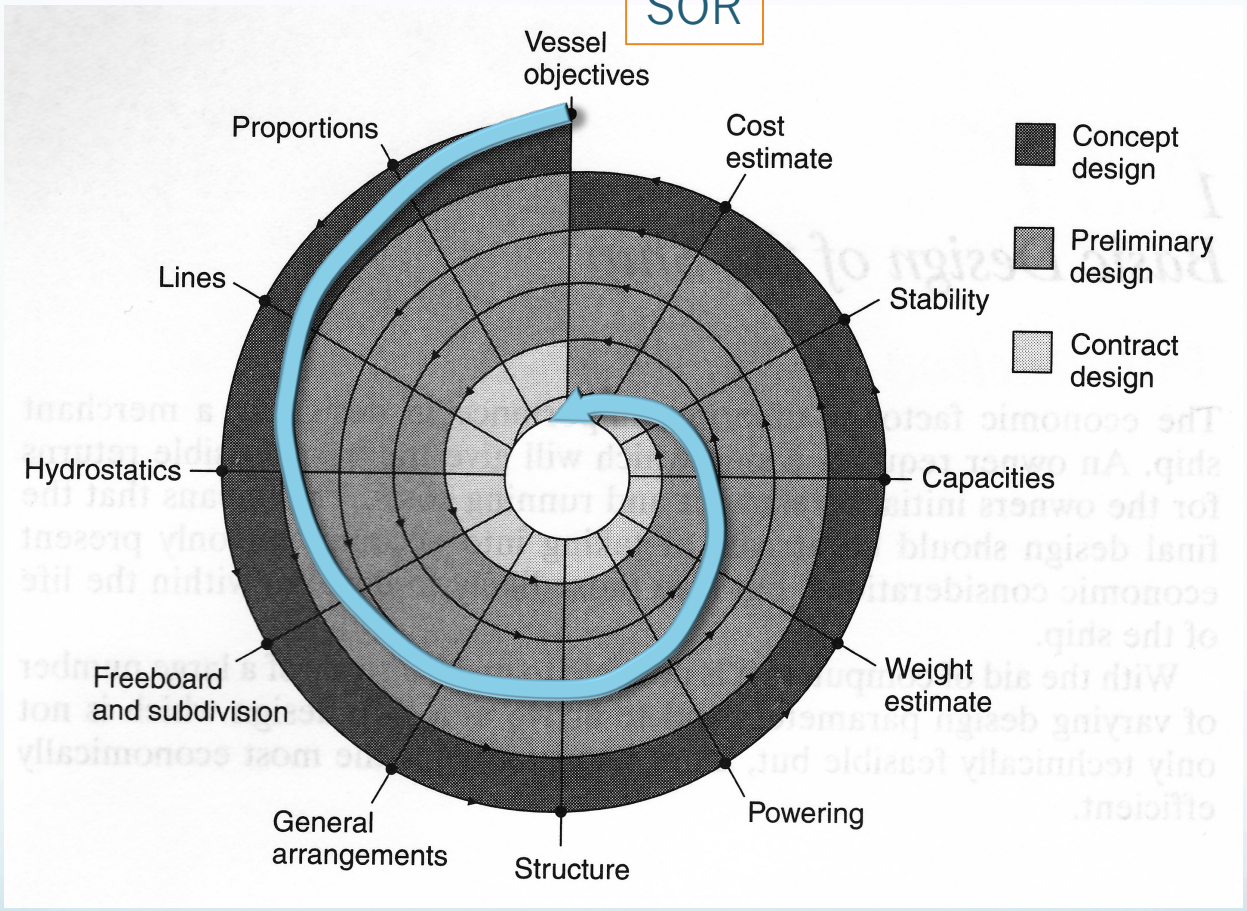
Classic Design Spiral



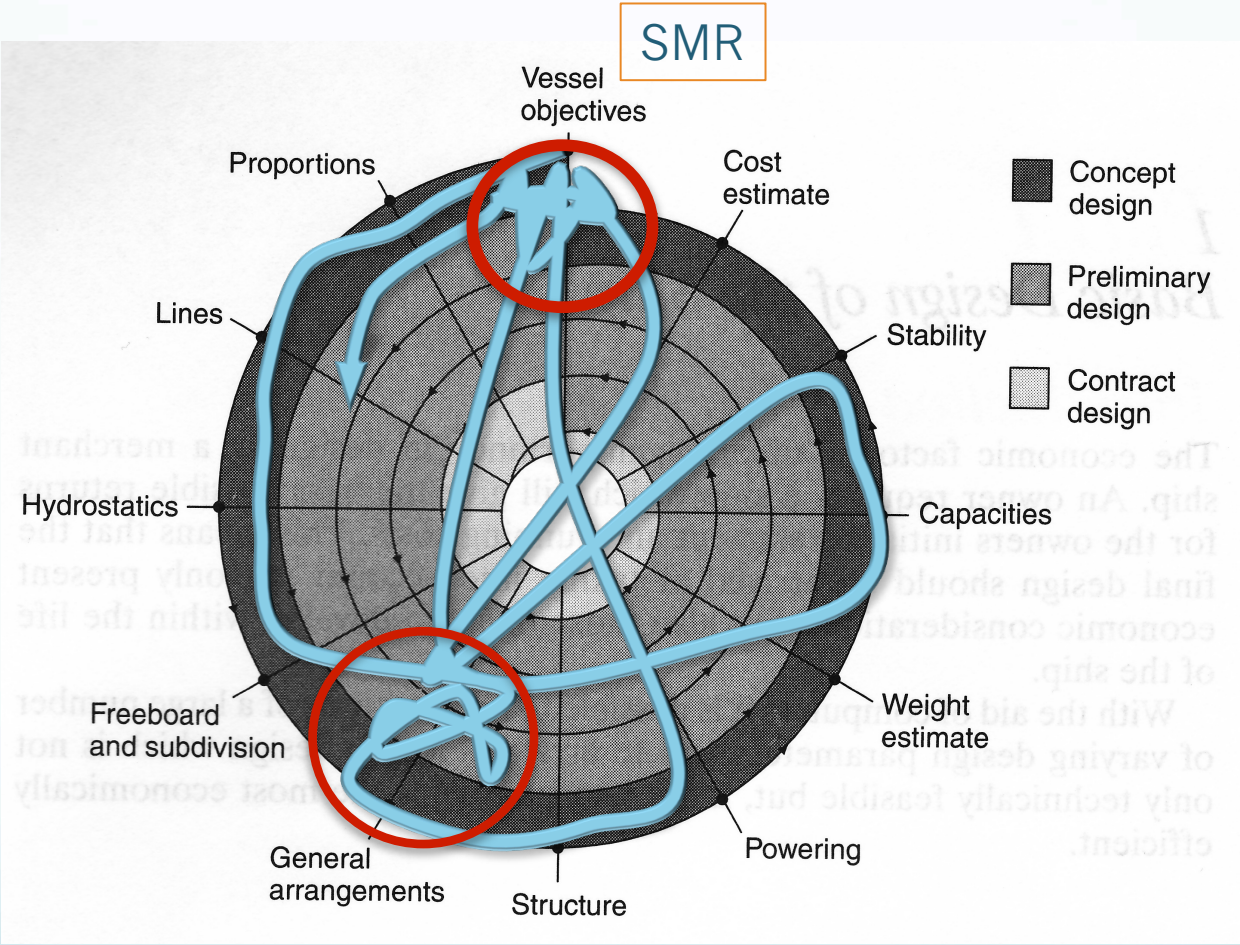
from D.J. Eyres, *Ship Construction*

“Navy” Design Spiral

SOR



“NSF/UNOLS” Design Spiral



RCRV
Process "Worked", Outcome Didn't

- RCRV began as a cooperation between NSF and PEO-Ships
- RCRV followed the PEO-Ships Process with a UNOLS "advisory" committee
  - Two design-build teams with a single advisory body
- The result was a "Navy-type" outcome
  - All boxes checked on SOR – both designs were "successful"
- Expertise was available, but could not be used
  - Advisory committee could not comment on designs
- Unworkable and suboptimal design that still meets the SOR
  - "Lesser of two evils"
- Will require an extensive "refresh" or redesign

Proposal for a New Process

- Combine best features of both:
  - Two competitive Design-Build Teams – Design Agent + Shipyard
    - Achieve better cost realism and reduce producibility issues
    - Reduces design verification period and risks
  - Provide complete guidance – blend SMR and SOR
    - More flexible than SOR, less vague than SMR
    - ?SVR=Summary of Vessel Requirements?
  - Provide a mechanism for input and feedback
    - Regain the benefit of a design spiral involving user experts
- Make the hard decisions during the design period
- Move forward with a production-ready design
- Provide follow-through from SMR to production

Selecting Teams

- Solicitation Issued for design-build teams consisting of a Design Agent and Builder
- Budget for design period set prior to solicitation
- Award to Teams as fixed-price contract for design stage
- Selection criteria based on “RFI + RFP” process
  - Award of design based on qualifications and experience – “RFI”
  - Award of build based on cost modified by RFI – “RFP”
    - Extra cost credit for qualifications and experience
- Design deliverables must be achievable within fixed price
- Agency manages design process independent of academic operator institutions

Build Team(s)

- Select one or more academic institutions to manage the build
  - Similar to MREFC process and oversight
  - Institution assembles management team including some or all of the Design Advisory Panel
- Institutions take the final design and move it through shorter verification process and into production
- Management via a multi-ship contract or a series of single-ship contracts with varying outcomes

Design Advisory Panel:

A New Mechanism for Community Input

- Assemble a list of "Certified," "Qualified," or "Approved" *Advisors* to design teams.
  - "Design Advisory Panel"
  - Selected/Approved by Funding Agency
    - ?Selection process?
  - A list from which each Team chooses
    - ?Alternatively, assigned to Teams?
  - Each Team has different Advisors
  - **Confidentiality Vital**
  - Advisors to include scientists, operators and technical professionals
  - Advisors are able to comment on designs and make suggestions
  - Advisors participate in design decisions and understand the tradeoffs and compromises
  - **Advisors stay with the project into production**
- **Goal: Two truly unique designs, with a real choice.**

The Missing Element : *Funding*

- A new approach requires an up-front investment
  - Pay for help in formulating “SVR”
    - Naval Architects/Engineers and Subject Matter Experts
    - Community Workshops or Town Meetings
    - Consistency of formulation
    - Shorten the time to complete the “SVR”
  - Pay Design-Build Teams for their work
    - You get what you pay for
  - Pay Advisors for their work
    - Be realistic about the time commitment
  - Pay Advisors to continue with the project as needed
    - This is not a “parachute” process, it requires follow-through
    - “Oversight Committees” of volunteers can only do so much

A Key to Success

- On-Site Representative for scientific/technical issues
  - Full-time member of the on-site management team
  - Day-to-day contact with the realities of the build
  - Review and comment on drawings and submittals
  - Monitor science support and infrastructure
  - Assist shipyard in working out problems with the design and resolve conflicts and interferences
  - Balance requirements against reality

"Every day at the shipyard, there is an insurmountable problem."

Radm David H. Lewis, USN
Program Executive Officer, Ships

"90 percent of success is just showing up"

Woody Allen

If you aren't there, you can't help solve the problem.