

“Proven” vs Bespoke: The Hull Design Conundrum

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Introduction



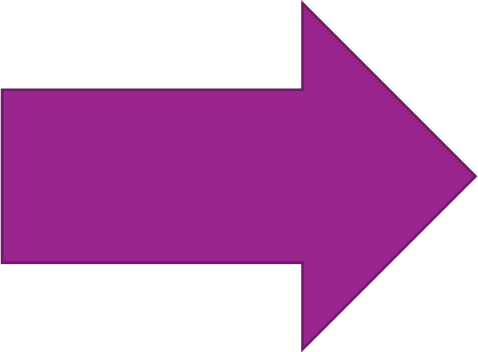
- What is a “proven” design?
- Areas covered;
 - Claimed benefits
 - New design risk
 - Cost of Change
 - Capability implications
 - Skills
 - Decision making process
- When to go bespoke or “proven”

This presentation is an opinion piece, based on the personal experiences of the authors, who have a combined experience in warship acquisition programmes in excess of 50 years. As such, the views expressed herein are solely those of the authors and do not necessarily represent those of any organisation to which they may be affiliated.

Example of Adoption of “Proven” Design



Franco / Italian FREMM modular frigate
First ship commissioned 2013



US Navy FFG-62 Constellation Class
Expected in Service 2029

Perceived advantages of “proven” design

“Using the parent-design approach can reduce design time, design cost, and cost, schedule, and technical risk in building the ship.”

Congressional Research Service, 2020, Navy Frigate (FFG[X]) Program: Background and Issues for Congress, June 8, 2020

	FREMM	FFG-62
Schedule – Contract Award to Commissioning	7 years, 2005-2012	9 years, 2020-2029
Unit Purchase Cost	\$750-800M	\$940M

Sources: Congressional Research Service, 2020, Navy Frigate (FFG[X]) Program: Background and Issues for Congress, June 8, 2020
Basundoro, A., 2021, Comparing FREMM and Iver Huitfeldt: Two Contenders of Indonesian Navy’s Latest Hardware, 25th June 2021



Perceived risk of bespoke design

Hullform Design Affects:

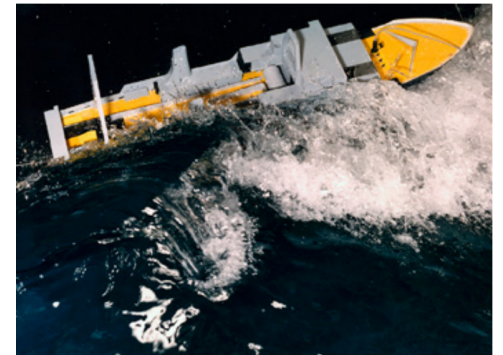
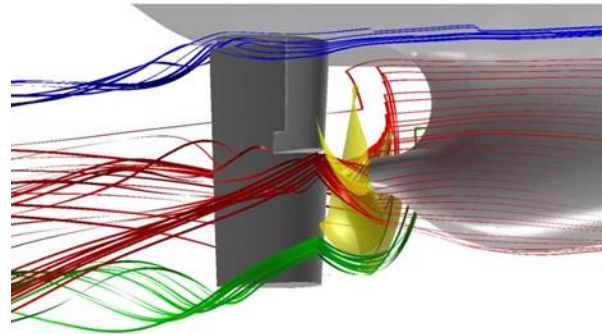
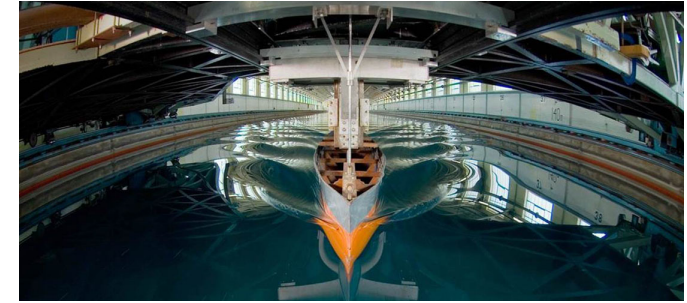
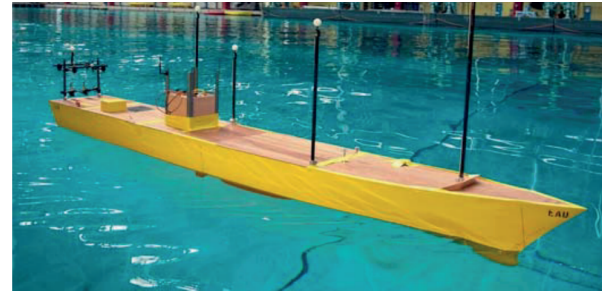
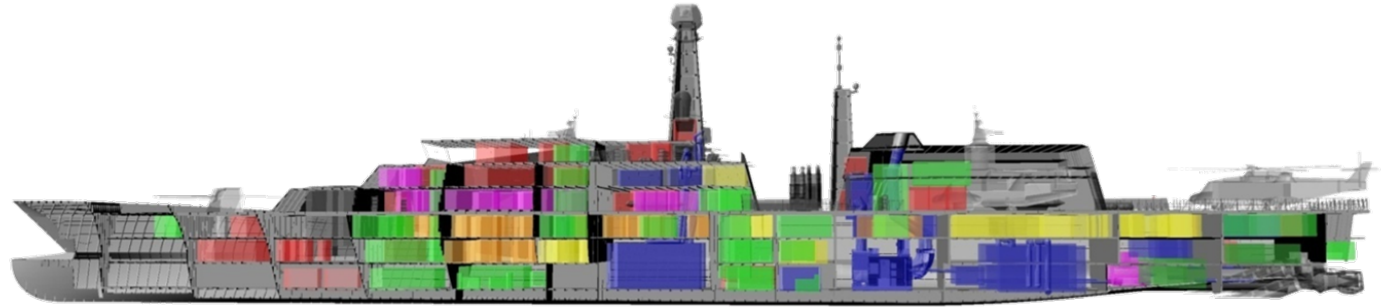
- Stability;
- Resistance;
- Seakeeping; and
- Internal Arrangement.

Suite of tools available to designers:

- Computational;
- Physical Model Testing.

Technical risk is low!

Major technical risks in systems design, weight growth and integration – tend to be detailed rather than concept design!



Cost Impact & Implications

Saving of design cost is often given as a major reason for adopting a parent design approach.

For FFG-62:

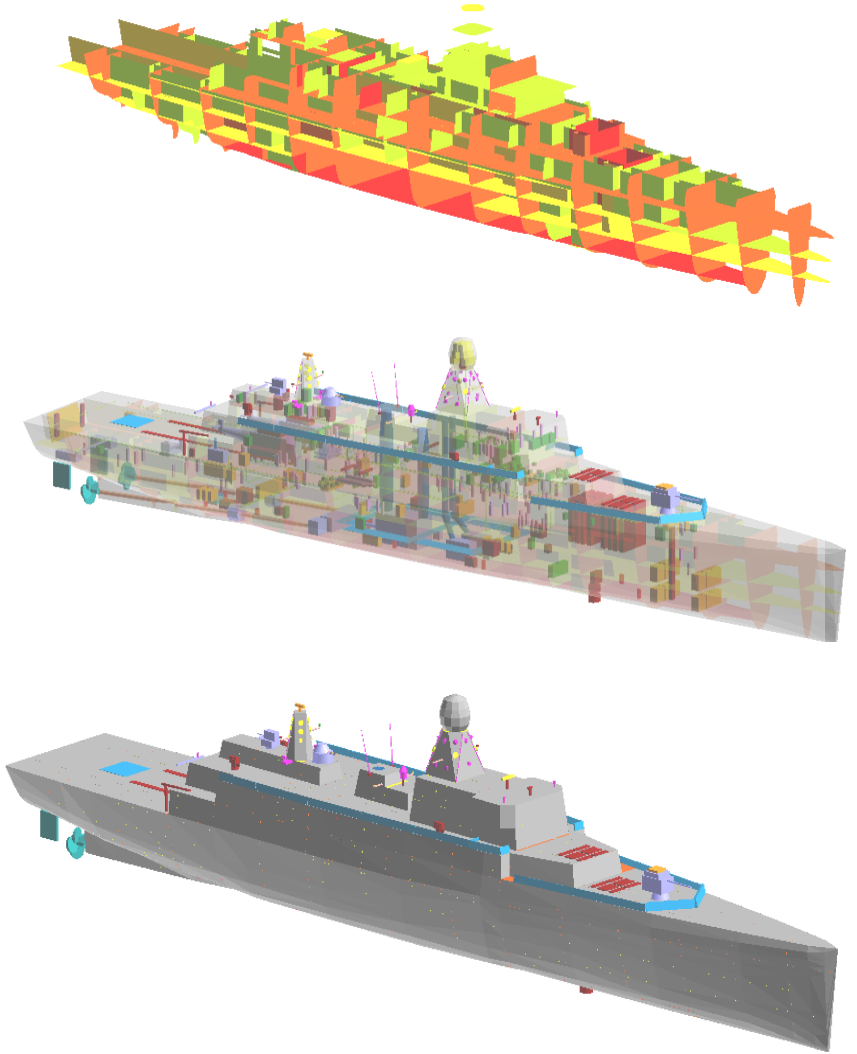
- Purchase Cost Expected to be c.\$940M per unit; and
- Non-Recurring Costs (including design) c.\$228M, c.25% of one vessel UPC.

BUT

Most of the design cost is in the detailed phase.

Concept design, including hullform design and testing is trivial (<\$5M) in comparison.

Proportion of overall budget allocated to NRE drops as number of vessels to be procured increases



Impact of Change

“No matter how good a parent design may be, changes are always necessary to build the ship the service wants. That fact raises questions about how much the Navy, or a private shipbuilder, can tweak and tinker with a new vessel before the benefits of modelling of a proven warship begin to erode.”

Katz, J., 2022, For Navy’s new frigate, design changes carry risks and rewards, Breaking Defense, 24th January 2022.

	FREMM	FFG-62	% Change
Length Overall /m	145	151	4
Length BP /m	133	141	6
Waterline Beam /m	17.0	18.1	6
Overall Beam /m	19.7	19.7	0
Draft /m	5.5	5.5	0
Full Load Displacement /te	6,890	7,408	8
Bow Sonar Dome	Yes	No	N/A
Propeller	Controllable Pitch	Fixed Pitch	N/A

Source: Congressional Research Service, 2024, Navy Constellation (FFG-62) Class Frigate Program: Background and Issues for Congress, 4th April 2024.

Modification of a design becomes more costly as design maturity increases.

Perversely this can mean selection of a more mature design can **Increase** risk if amount of change required is not understood.

Equally, the bespoke design can be more efficient if well tailored to the requirements, and most change / rework carried out in early design stages.

Capability Impact

	Parent Design, commencement	First of Class in Service	Time elapsed
FFG-62	FREMM 2005	2029	24 years
Type 31	<i>Iver Huitfeldt</i> 2006	2027	21 years

Sources:

Odense Maritime Technology, 2014, Danish frigate program Setting a new standard for affordable defense procurement, April 2014
 Congressional Research Service, 2020, Navy Frigate (FFG[X]) Program: Background and Issues for Congress, June 8, 2020
 Basundoro, A., 2021, Comparing FREMM and Iver Huitfeldt: Two Contenders of Indonesian Navy’s Latest Hardware, 25th June 2021

Same as time between first flights of Handley Page Heyford and Avro Vulcan



Impact on Design Skills

Only three opportunities for hull design of surface combatants in the UK over the last 30 years:

- Type 45 Destroyer;
- Type 26 Frigate; and
- Type 31 Frigate.

Story in the US is similar:

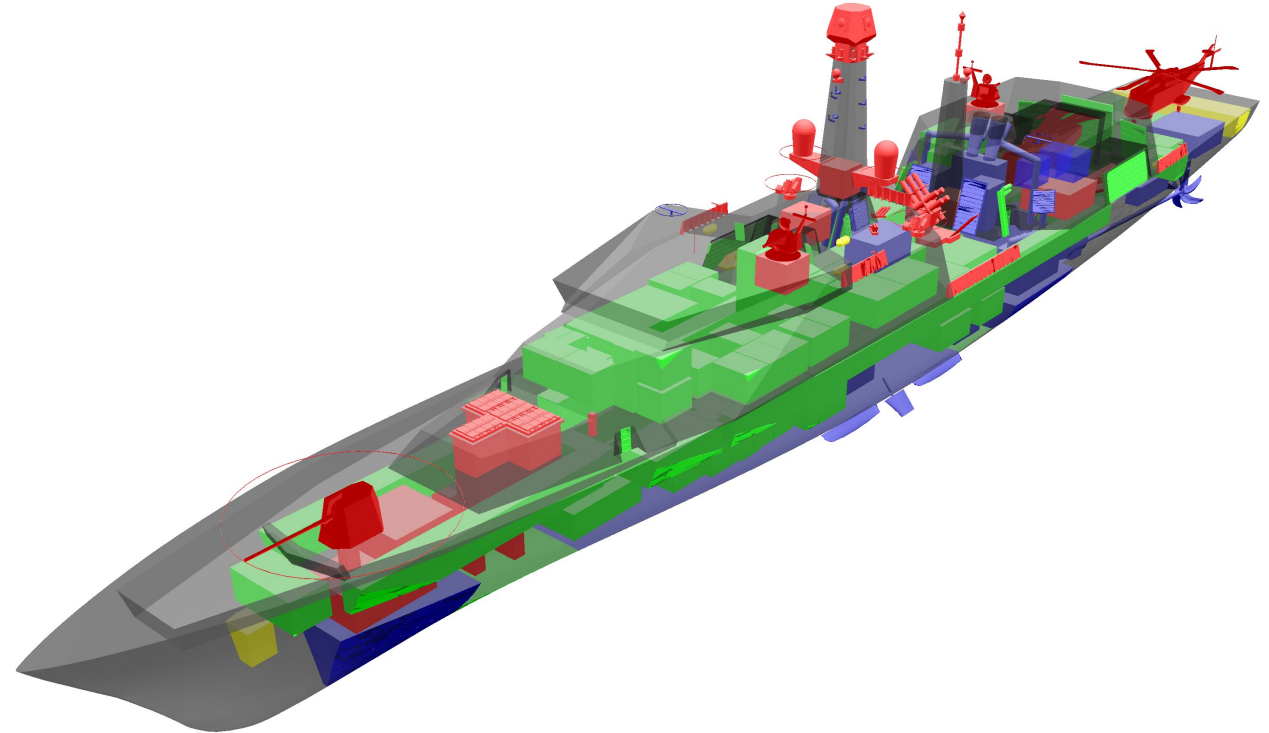
- DDG-1000;
- LCS 1 & 2; and
- FFG-62.

Also noting that the DDG-51 production run will be in excess of 40 years...

(source: Miller, S., 2022, DDG 51 Program Update, 12th January 2022)

Leading to loss of warship hull design skills within national ship building prime contractors.

Potential loss of strategic capability for the Future.



Decision making?

Decision whether to take the parent or bespoke hull design approach is not purely technical in nature:

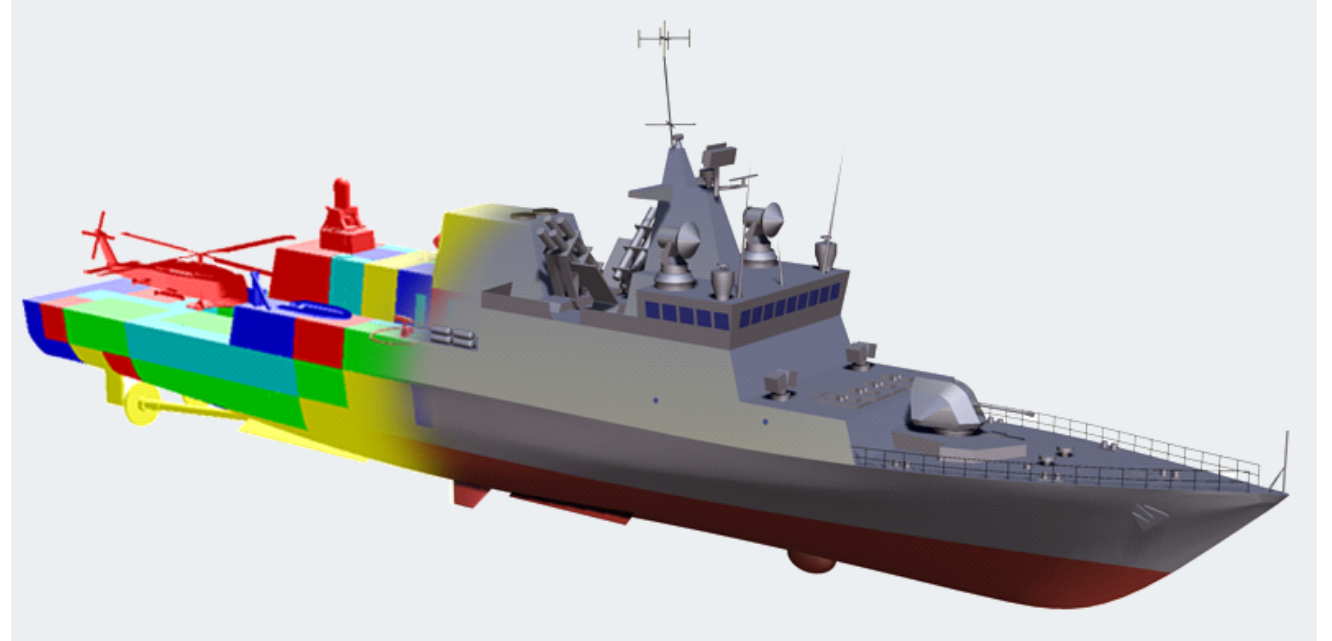
- Commercial;
- Marketing;
- Political;
- Social Value etc.

BUT

Do the technical community communicate concerns well enough?

Is the customer community SQEP enough to understand potential technical issues and see through spin?

Do we need a stronger technical voice in these decisions?



Conclusions

Parent design approach can be worthwhile.

The approach is suited to small production runs and limited change.

Risk and cost of new hull design is often overstated and / or misunderstood by decision makers.

Early stage warship hull design skills are perishable and wholesale adoption of the parent design approach threatens future national capability.

The technical voice often has too little influence over decision making.



QUESTIONS?