OFFICE OF THE PARLIAMENTARY BUDGET OFFICER

BUREAU DU DIRECTEUR PARLEMENTAIRE DU BUDGET

Sailing Blind
Canada's Joint Support Ship Project Case Study

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Before we begin, a little about the Parliamentary Budget Office…

- The Parliamentary Budget Office (PBO) is similar to the Congressional Budget Office, with a few notable differences:
  - Our budget is smaller ($2.8 million CDN)
  - Out staff is smaller (19 including interns)
  - We have only existed since 2008
  - All of our work is made public

Will the $2.6 billion set aside be enough to replace the two existing Protecteur?

Provide independent cost assessment of JSS project, evaluating the feasibility of budget.

Source: Member for St John's East and Member from Scarborough-Guilwood

Why the JSS?

Canada First Defence Strategy

Army	Air Force	Navy

Agenda for today

United States Government Accountability Office

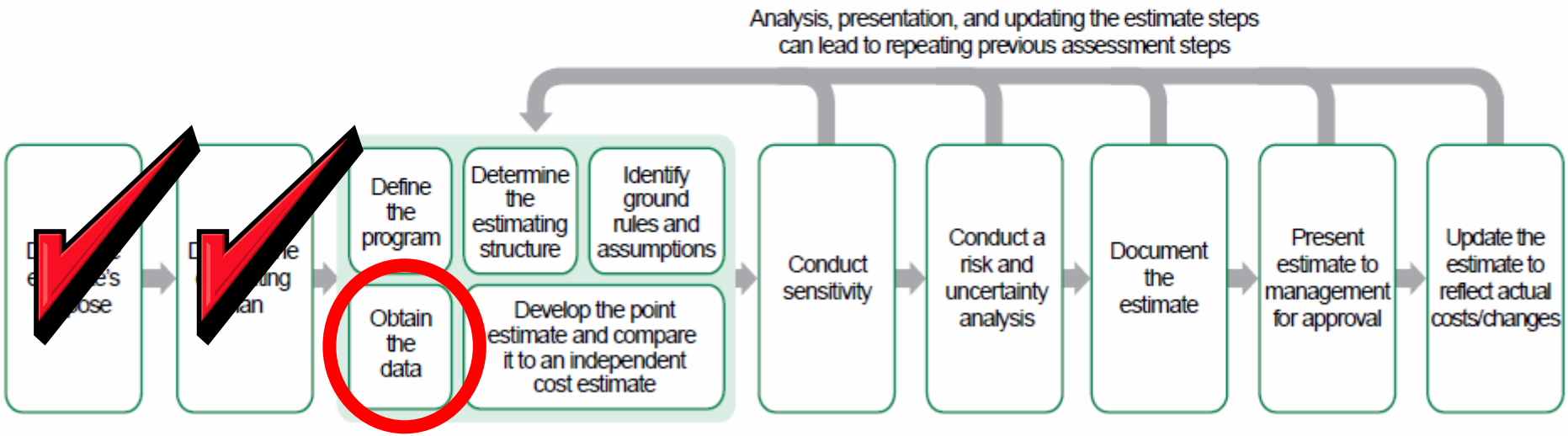
Figure 1: The Cost Estimating Process

Initiation and research
Your audience, what you are estimating, and why you are estimating it are of the utmost importance

Assessment
Cost assessment steps are iterative and can be accomplished in varying order or concurrently

Analysis
The confidence in the point or range of the estimate is crucial to the decision maker

Presentation
Documentation and presentation make or break a cost estimating decision outcome



Source: GAO.

Our data set was deficient – even for a concept phase project

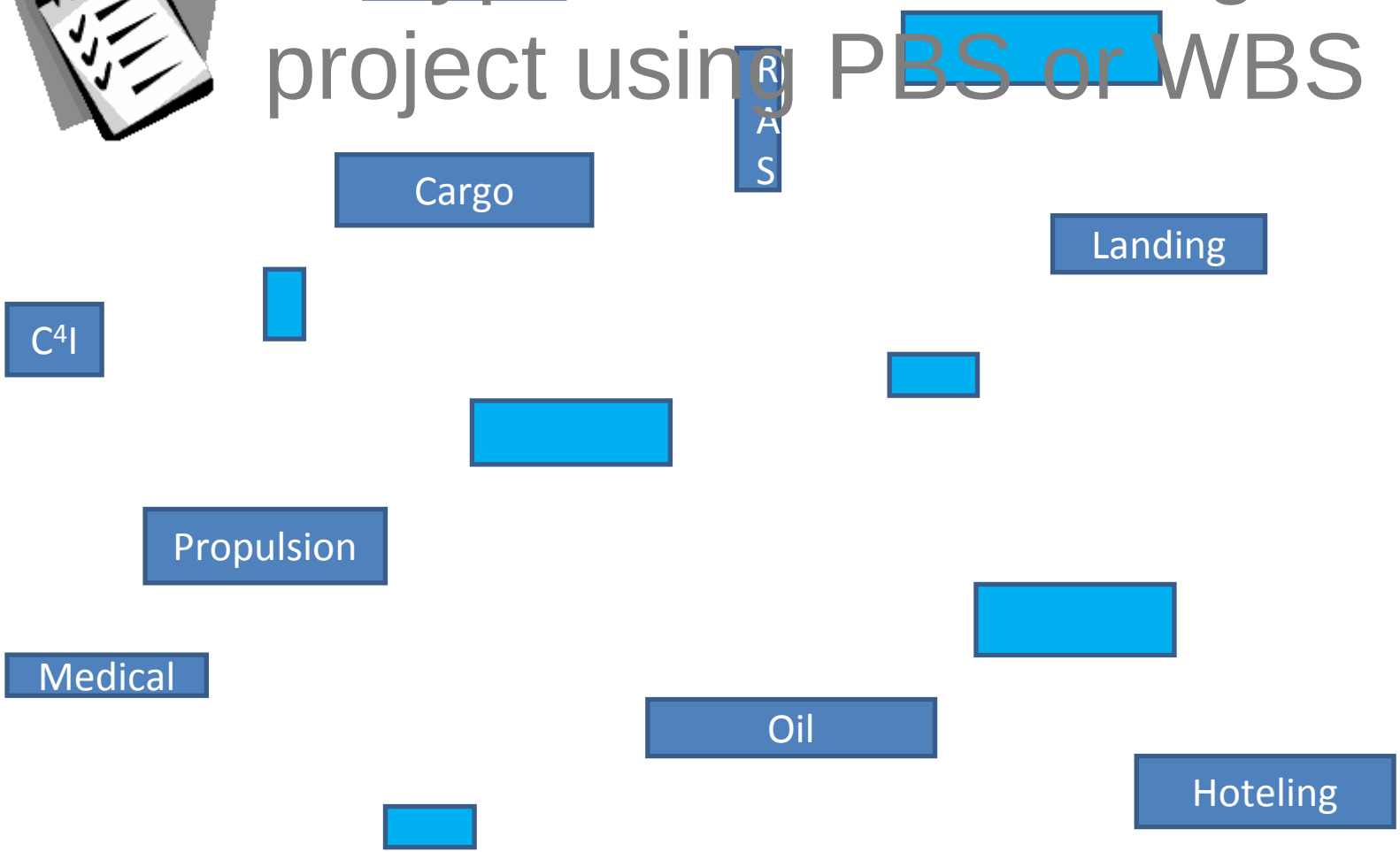
- Canadian legislation governing defence[1] procurement not the same as in the USA
- Canada has not built a navy ship in about 20 years
- There are two incomplete designs competing for the final design contract

[1] We spell defence with a “c”, pronounce Z “zed”, but it is an urban myth that we say “oot and aboot”.

Design Considerations

Ship		**Length (m)**	**Displacement** (full load)
Protecteur Built 1969		172	24,700
New Design BMT		TBD	TBD
Berlin TKMSC		173.7	20,240
Cantabria Navantia		174	19,500

Typical TruePlanning project using PBS or WBS



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Hardware Cost Drivers

Technology

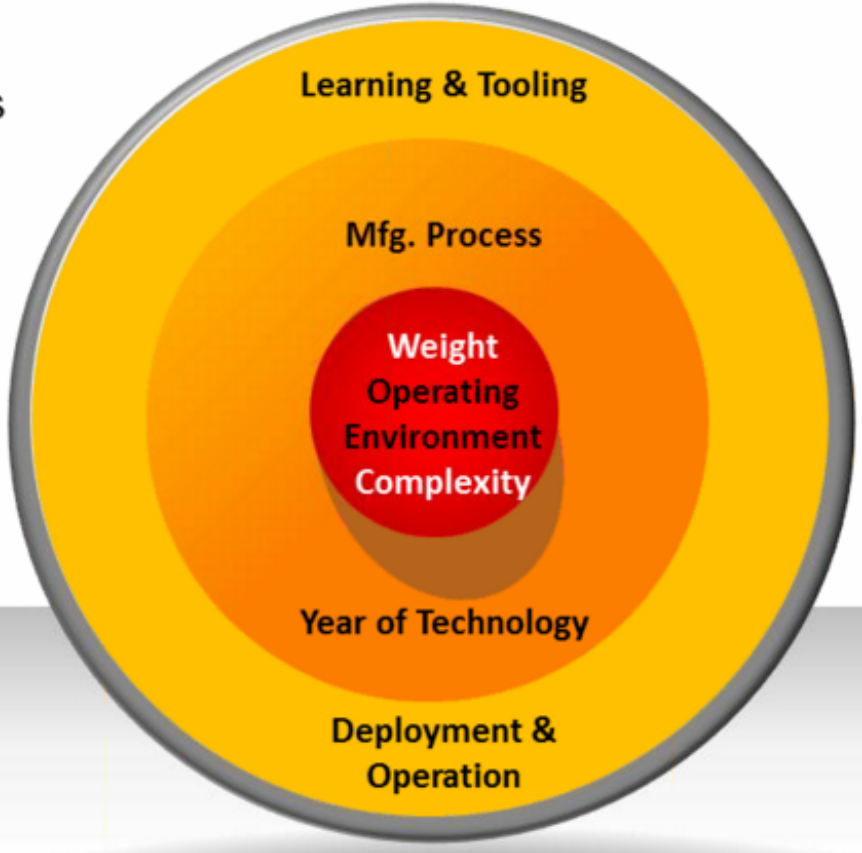
- Manufacturing Complexity for Structure
- Manufacturing Complexity for Electronics

Size

- Weight of Structure
- Weight of Electronics

Others

- Engineering Complexity
- Percent of New Structure
- Percent of New Electronics



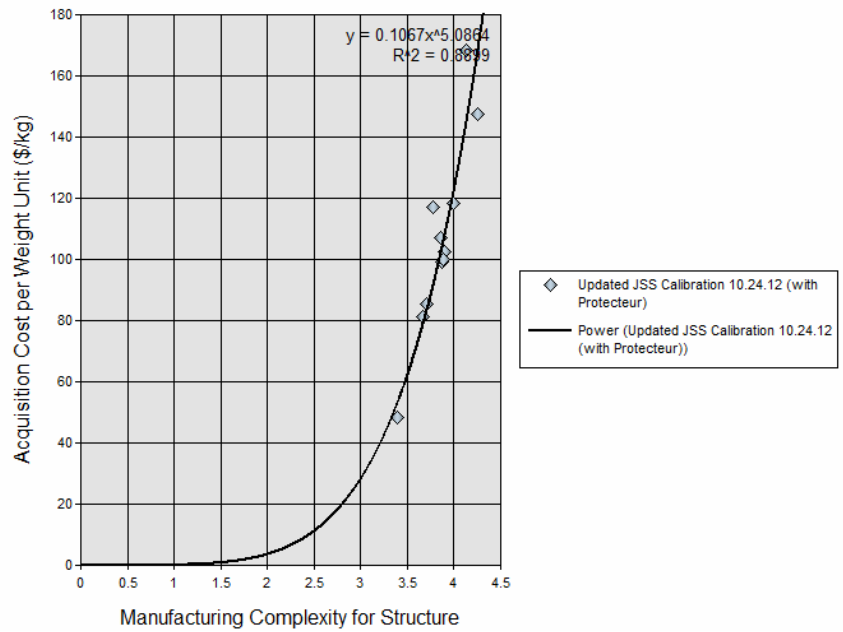
Problem: our data did not differentiate between the structure and the electronics

Can we use complexity if we are missing data?

Calibration exercise

- Normalized production data (common year and currency)
- Calculated Manufacturing Complexity for Structure
- Plotted results, calculated R^2

Yes, the relationship holds.



Which value did we use for MCPLXS?

- That of the Protecteur-class, because:
  1. Requirements: JSS Statement of Requirement's minimum reflects Protecteur;
  2. Policy: CFDS is an upgrade, so JSS will not fall short of Protecteur; and
  3. Validity: Calibration exercise suggests that calculated MCPLXS is on trend with comparable ships.

National Shipbuilding Procurement Strategy (NSPS)

"Build in Canada": fabrication and assembly of hull, decks, superstructure, masts, modules, etc. conducted in Canada and will comply with IRB policy.

Source: Bid Certificate (RFP)

Seaspan's Vancouver Shipyards

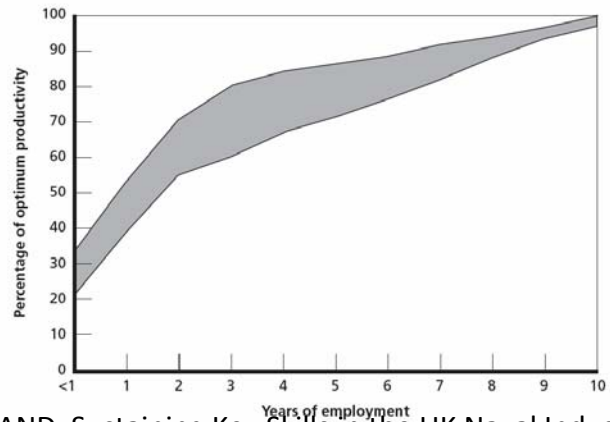
- Extensive experience building barges and ferries (60-80 meters)
- Staffing ramp-up required to support NSPS workload
- Retrofits required to undertake JSS project

Challenge: How to determine model inputs using qualitative information

Finding a link between qualitative data and TruePlanning inputs

Qualitative

1. AOR's have not changed much, but the design will be unique
2. Staffing ramp-up required to support NSPS workload



RAND, Sustaining Key Skills in the UK Naval Industry (2008) (http://www.rand.org/content/dam/rand/pubs/monographs/2008/RAND_MG725.pdf), p. 35

Engineering Complexity

Scope of Design Effort	Experience of Personnel: Extensive, Familiar Product	Normal, Familiar Product	Mixed, Some Product Familiarity	Limited, Unfamiliar Product
Simple Modification, Existing Design	0.2	0.3	0.4	0.5
Extensive Modification, Existing Design	0.6	0.7	0.8	0.9
New Design, Existing Technology	0.9	1	1.1	1.2
New Design, New Product Line	1	1.2	1.4	1.6
New Design, Unfamiliar Technology	1.3	1.6	1.9	2.2
New Design, State of Art Technology	1.9	2.3	2.7	3.1

1

2

What we brought to our first meeting with PRICE

1. Production costs for a set of auxiliary ships
2. Production costs and high-level specs for the ships being replaced (Protecteur-class)
3. Qualitative information about the shipyard (incomplete)

Insufficient data for a PBS approach

Sensitivity Analysis

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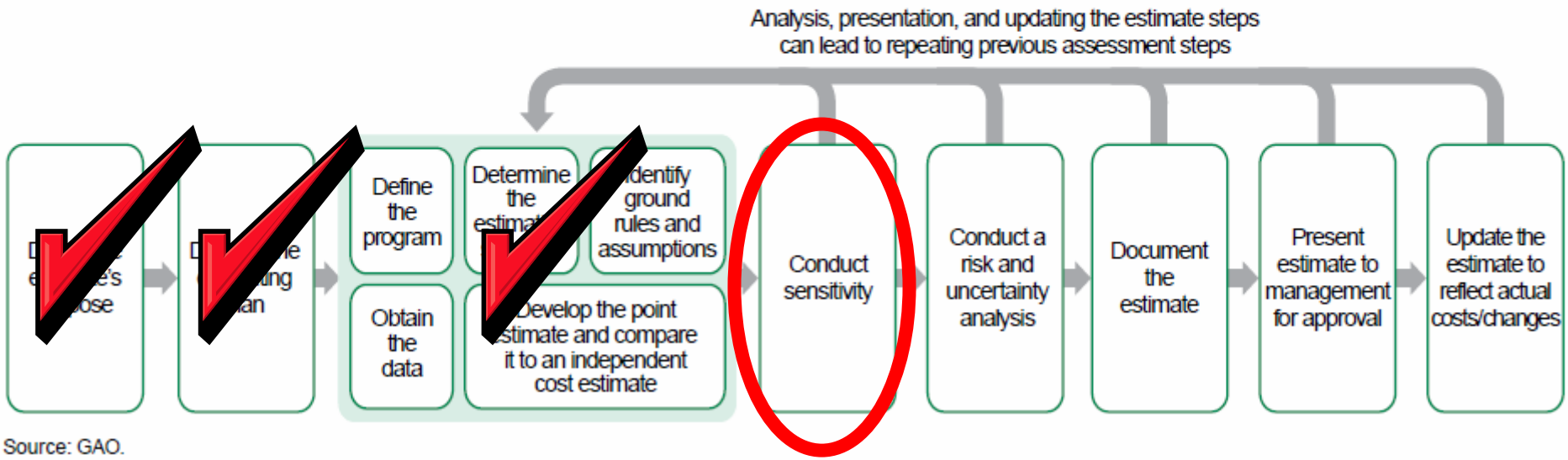

Source: GAO.

Schedule

Schedule Reality

- Project schedule not proportionate of actual schedules of similar projects
- Sensitivity analysis showed that the proposed schedule is sub-optimal

Policy Neutrality

- Non-partisan role means working with the assumption that programs will role-out as planned
- Ideally, the project's schedule should be based on an analysis of historical program data undertaken in the context of the Department of Defence's financial and operational priorities.

Schedule

Schedule Reality

- Project schedule not proportionate of actual schedules of similar projects
- Sensitivity analysis showed that the proposed schedule is sub-optimal

Good Practice

- Identify scheduling considerations (e.g. change in regulations)
- Obtain historical program data to inform analysis
- Establish schedule by balancing operational and fiscal considerations

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Risk and Uncertainty Analysis

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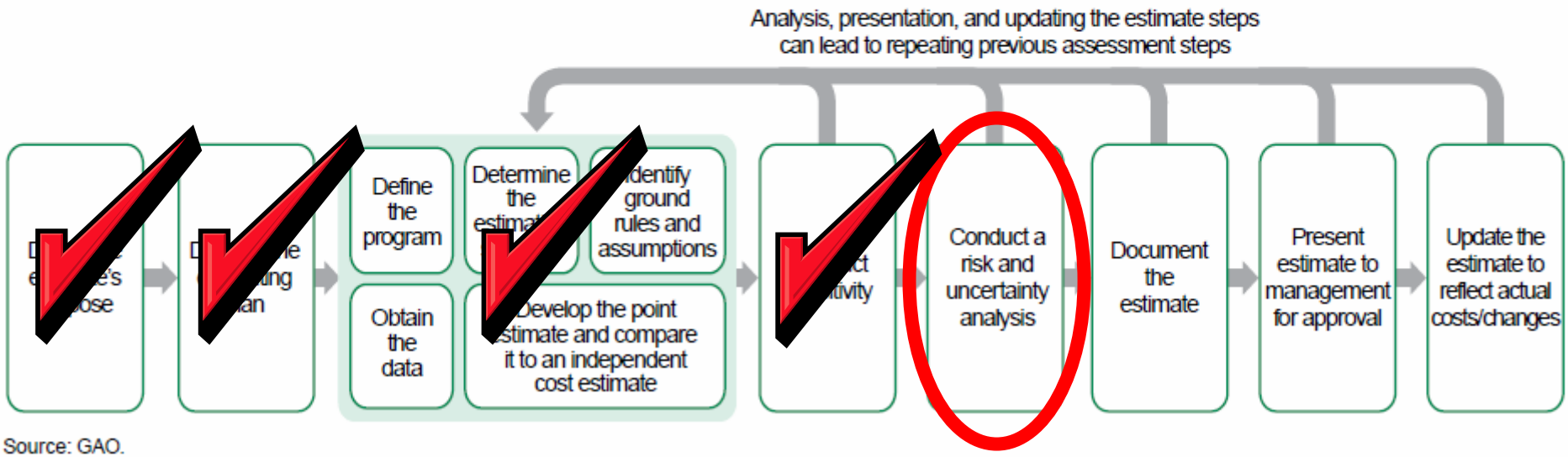
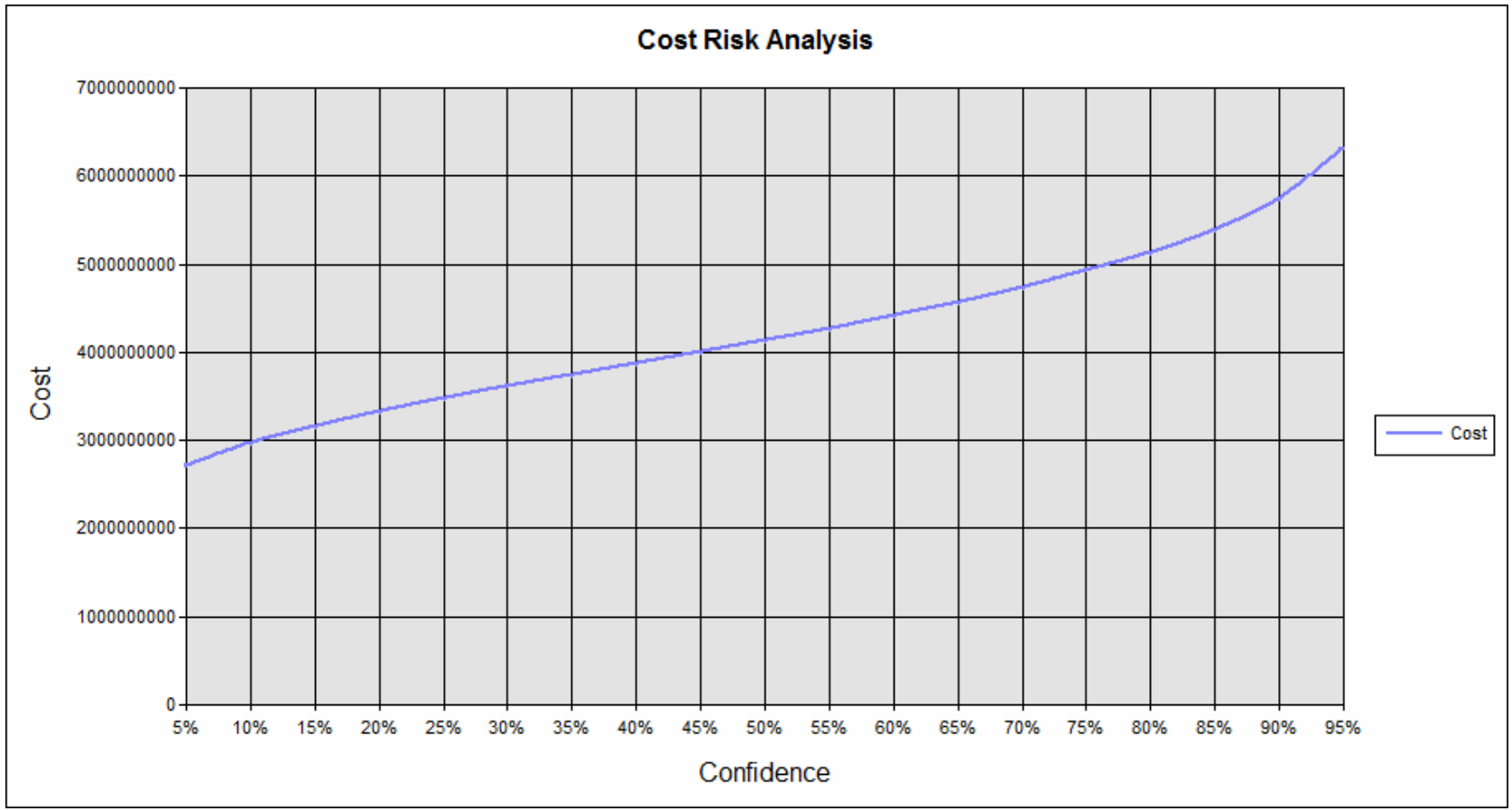


Source: GAO.

Uncertainties

Variable	Optimistic	Pessimistic	Explanation of Range
Weight of structure	18,469,520 lbs	22,833,440 lbs	• Protecteur-class as the optimistic (lightest ship) • Berlin-class (heaviest ship) as the pessimistic value
Manufacturing complexity for structure	3.39	4.25	• 3.39 (corresponding to the Henry J. Kaiser) • 4.25 (corresponding to the Wave)
Percent of new structure	50%	85%	• Design uncertainty • Based on the experience of SMEs, the PBO determined that an acceptable range would be from 50% to 85%.
Percent of design repeat for structure	50%	20%	• Design uncertainty • Assuming perfect symmetry, it is impossible to have a value greater than 50%. • Based on historical naval programs, it is unlikely to have a value of less than 20%.
Engineering complexity	0.9	1.1	• Based on the current capacity of the designers and the shipyard, the experience levels selected for the model is mixed experience. • If the designers and the shipyard are able to procure more experienced professionals, the process may be optimized.

S-Curve


Cost Risk Analysis
7000000000
6000000000
5000000000
4000000000
3000000000
2000000000
1000000000
0
Cost
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
55%
60%
65%
70%
75%
80%
85%
90%
95%
Confidence
Cost

Political Reaction

- Procurement Critic: “With their stated budget are we going to be left with nothing more than two tug boats painted grey?”
- Government Procurement Minister: “If any adjustments need to be made, they will be made with the Navy and the coast guard.”
- Government Defence Minister: “The intention is clearly to match or surpass the (current) capability.”

Informed Discussion

- “The process was worthwhile, even if the outcomes are unwelcome in some quarters and not trusted in others. …it lays down the methodology of the research and the tools used to derive the results. This has not been done before and it serves as a marker for further research.”

"In the valley of the blind, the one-eyed man is king."
August Wilson, *Gem of the Ocean*