Reviewing the Affordability of the Canadian Joint Supply Ship (JSS) Programme

Craig Clark and Sandra Lewis

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Agenda

- Background
  - Programme background and requirement
  - Parliamentary Budget Office Affordability Analysis
- DAS Task
  - Approach/Methodology
  - Schedule Analysis
  - Cost and Budget Analysis
  - Conclusions
- Questions

Programme Background

- Background
  - 2004: Government of Canada announced it would replace Protecteur-class Auxiliary Oiler Replenishment (AOR) ships with three Joint Support Ships (JSS). Ships to be delivered between 2012 and 2016 for budget of $2.1Bn.
  - 2009: Number of ships reduced to two, delivery dates pushed out and requirements changed to include National Shipbuilding Procurement Strategy (NSPS)'s 'Build in Canada' requirement for new budget of $2.6Bn.

- Canadian Parliamentary Budget Office (PBO) asked to assess the sufficiency of the $2.6Bn budget
  - PBO analysed the budget by developing a parametric cost model
  - Tasked DAS to provide independent assurance of their analysis and an independent estimate/assessment of the DND budget

PBO Parametric Analysis

- Summary published in 'Journal of Cost Analysis and Parametrics', Volume 6, Number 2, July-December 2013.
- Key Points
  - PBO used PRICE Systems' True Planning for its cost modelling
  - Main cost drivers were weight (ship's displacement) and technology (how complicated construction of the platform is)
  - Report suggested $2.6Bn would be insufficient
    - PBO estimated cost to be about $3.28Bn
  - Report also suggested the DND schedule of 48 months would be inadequate
    - PBO model estimated 90 months when optimized on cost.

DAS Task and Methodology

- Task
  - Provide an independent assurance of PBO analysis
  - Provide an independent estimate/assessment of the DND budget
- Methodology
  - Independent Assurance
    - Use of subject matter experts (SME's) to review PBO analysis
  - Schedule Analysis
    - Historical Trend Analysis (HTA) approach
    - Feasibility of timescale assessed based on similar projects
  - Cost and Budget Analysis
    - Parametric cost model used to provide an independent estimate of the acquisition costs
    - Results reviewed using HTA
    - Investigate and estimate all elements of the budget
    - Review adequacy of the DND budget

Schedule Analysis

Schedule Analysis: Review of Analogous Systems

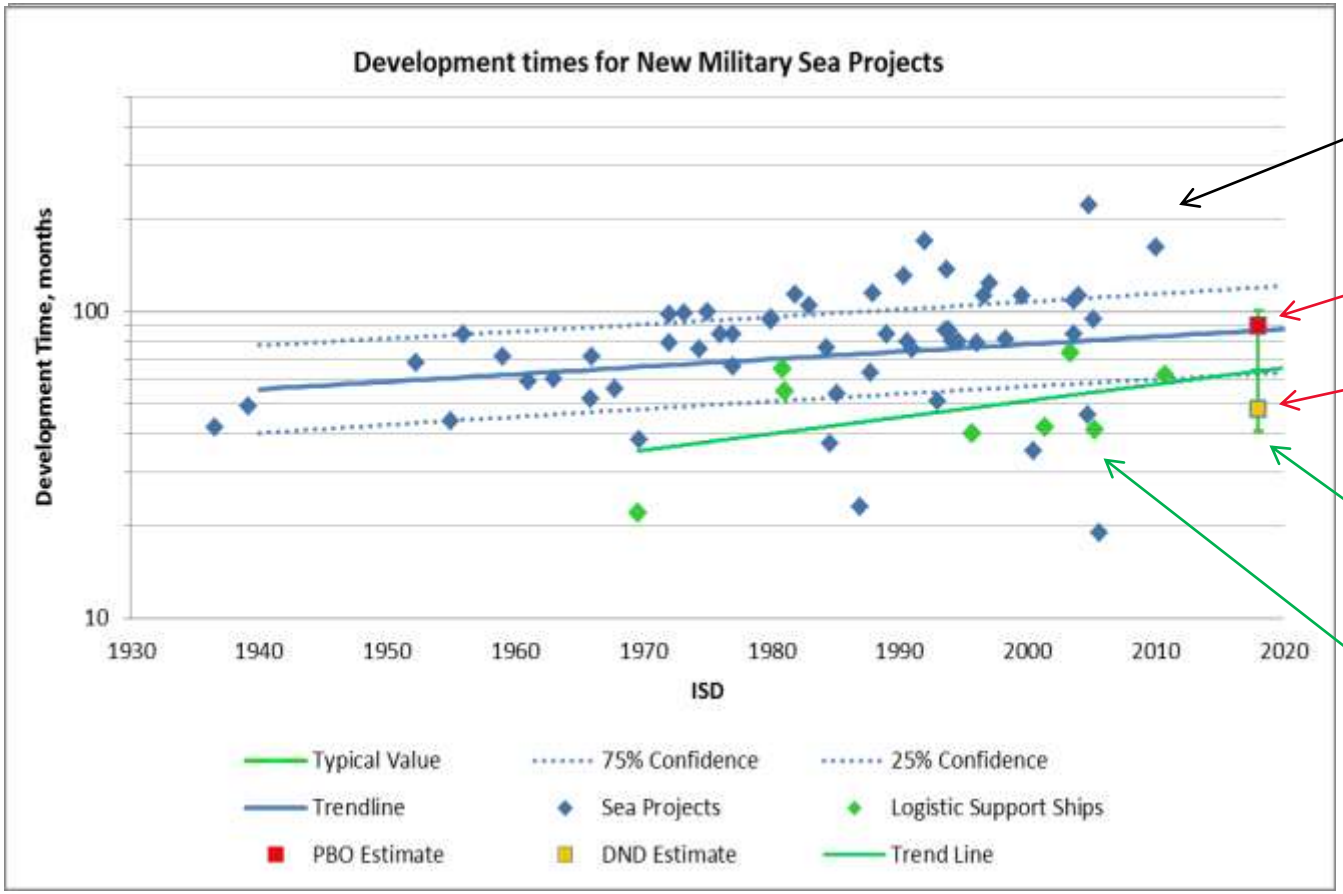
- The following table contains historical development time data for analogous systems (sourced from Jane's).

Class	Ordered	Commissioned	Time (months)
Protecteur	Oct-67	Aug-69	22
Durance	Jun-75	Nov-80	65
Cimarron	Jun-76	Jan-81	55
Amsterdam	May-92	Sep-95	40
Wave Class	Mar-97	Apr-03	73
Berlin Class	Oct-97	Apr-01	42
T-AKE	Oct-01	Mar-05	41
Cantabria	Jul-05	Sep-10	62

- The data showed a wide variance in project duration, from 22 to 73 months.
- This data was used to review the project development schedule presented in the PBO analysis and the original DND estimate.

Schedule Analysis: Historical Trend Analysis

- The HTA graph below compares the PBO and DND estimates to the historic trend for Major Sea Projects



Wide spread as covers Deep Sea Warships, Auxiliary Warships, Coastal Surface Ships and Submarines

PBO Estimate

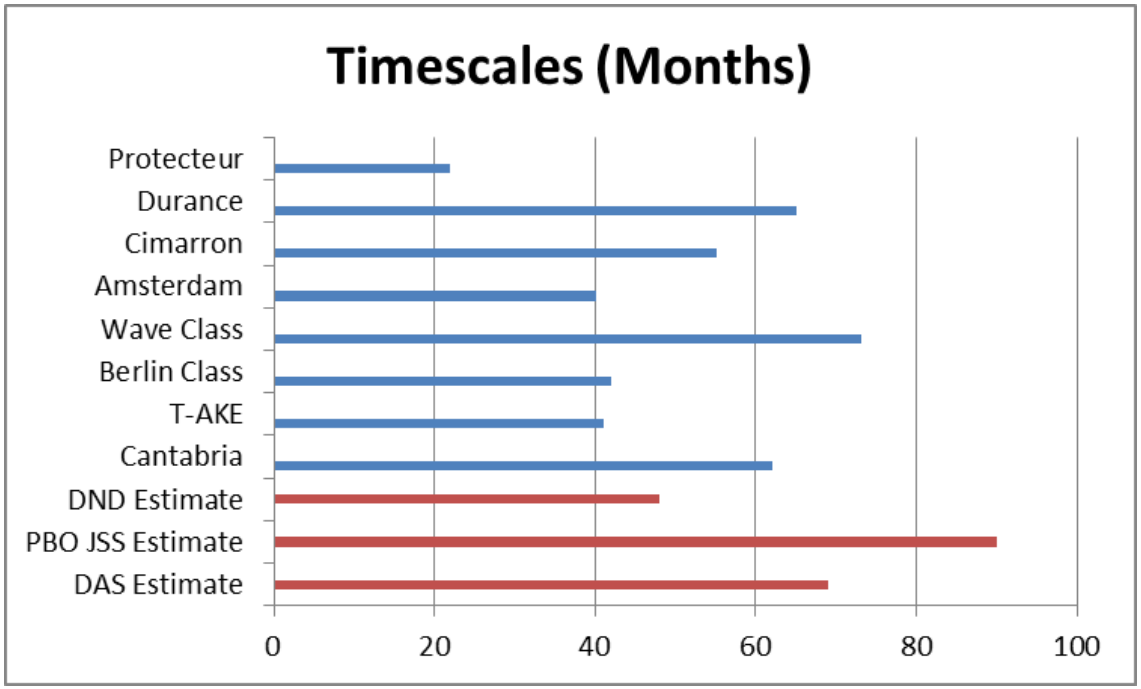
DND Estimate

Trend lines shows PBO estimate at top of range for analogous projects

Logistic Support Ship Projects

- The DAS model provided an estimate of 69 months as the average development time for JSS.

Schedule Analysis: Actual vs Estimated Timescales



- The chart shows the average duration to be about 50 months
- Although HTA indicates schedules increase over time
- DND baseline duration was 48 months
- The PBO analysis suggested a figure of 90 months
- DAS estimated a duration of 69 months

Schedule Analysis: Summary

- Historical trend analysis within the sea domain would show agreement with the PBO estimate of 90 months
- However, further analysis of Logistic Support Ships would suggest this estimate to be at the top end for ships of this type
  - This could be justified given the unexperienced ship yard selected for the project and the 'build in Canada' requirement
- The original DND estimate of 48 months may be too optimistic.
  - This duration may reflect a schedule that could be expected for a mature ship yard with experience of building similar ships (not the case for this project)
- DAS analysis supported the PBO view that the planned DND duration would be inadequate for the JSS programme following the required procurement strategy

Cost and Budget Analysis

Cost and Budget Analysis: Task and Approach

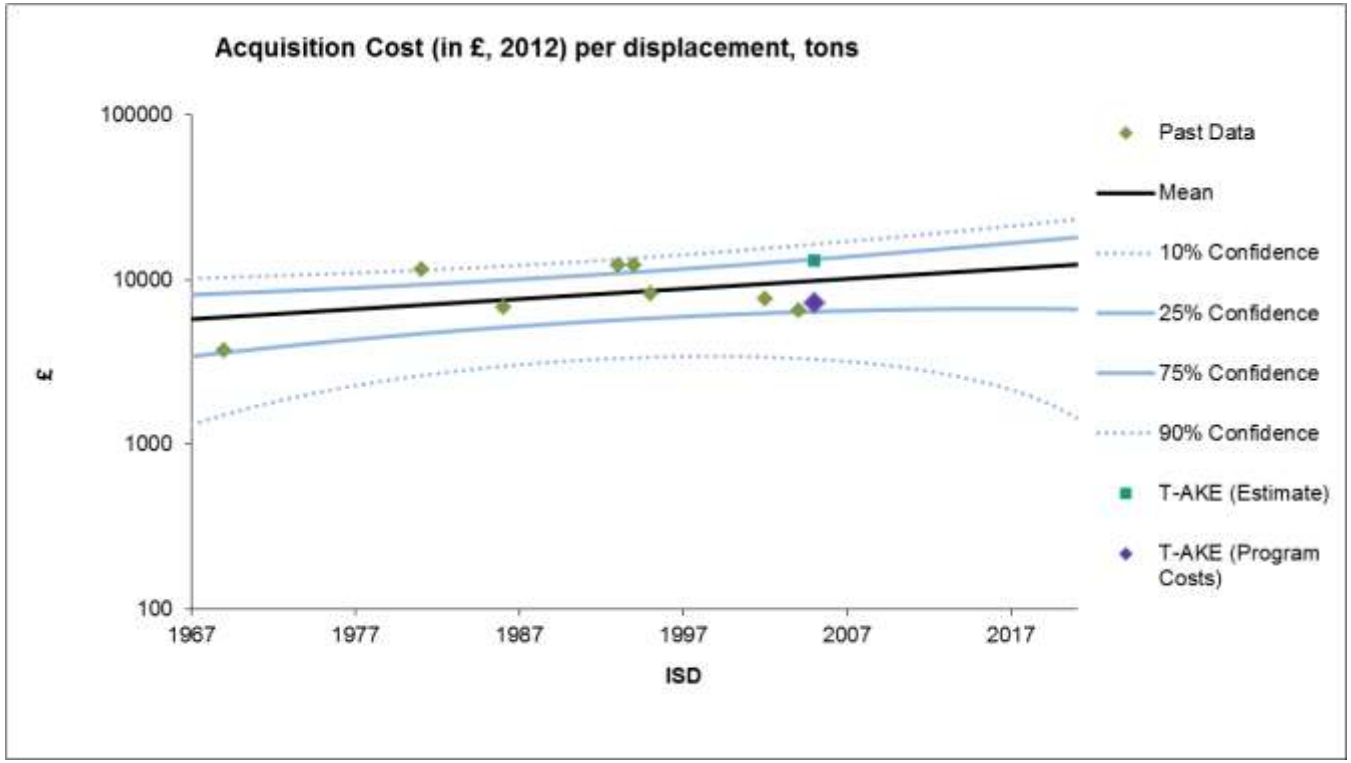
- Task
  - Provide an independent assurance of PBO analysis
  - Provide an independent estimate
  - Provide an assessment of the DND budget
- Approach
  - Estimate Acquisition Cost
    - Select appropriate cost model to estimate acquisition cost
    - Use Lewis and Clark T-AKE Dry Cargo and Ammunition Ship to provide a benchmark and validate model selection
    - Use selected model to produce an acquisition cost estimate for JSS
    - Review estimate using HTA
  - Estimate and Review Budget
    - Investigate and estimate all elements of the budget
    - Provide a total budget estimate
    - Assess adequacy of the DND budget

Cost Analysis: Tool Selection

- Models Available
  - DAS has a suite of High Level Concept Cost Models which are predictive top-down models and can be used at the earliest stages of a project. We currently have three levels of model to select from, each requiring different amounts of data:
    - L0 : Require equipment type, a measure of size and milestone dates to provide an estimate
    - L1 : Combine design, performance and technical characteristics to provide an estimate
    - L2 : Require more detail and have specialised model capability
- Data Sources Available
  - Statement of Requirement (SoR)
  - Public data for Protecteur (system being replaced)
  - Public data for Berlin (basis of new system)
- Model Selection
  - L2 Auxiliary Warship model was selected for this analysis.
    - This model was designed to cover a range of auxiliary warships used for the transport, supply and fleet replenishment duties including those able to operate and support helicopters not only for replenishment but in secondary combat roles.

Cost Analysis: Benchmarking/Validation

- DAS analysed the T-AKE acquisition costs using both the L2 model and costs published by Data Search Associates.



T-AKE data points:

- Green Square - model estimate
- Purple Diamond - published costs

- Both the estimate and the published costs for T-AKE are within the historical trend brackets giving confidence in the model selected.

- *Note: The T-AKE programme did not form part of the model dataset.*

Cost Analysis: Model Inputs

- The key model inputs are listed below

Model Inputs
Full Load Displacement (tons)
Engine Power (SHP)
Prime Mover Propulsion Type
Wet Cargo (tonnes)
Dry Cargo (tonnes)
Magazine Cargo (tonnes)
Num. Troops carried
Max Speed (knots)
Num. Helicopters Supported
Helo Operational Mass Empty, kg
Num. RAS Stations
Num. Helo Spots
Num. of CIWS
Technology Year Design Frozen

- Model inputs are entered as three point estimates
- Populated from the following sources
  - SoR Essential/Desirable data
  - Berlin data
  - Protecteur data

Cost Analysis: Model Results

- The model produced the following results for the acquisition of 2 new design ships (values in C$M 2012ec):

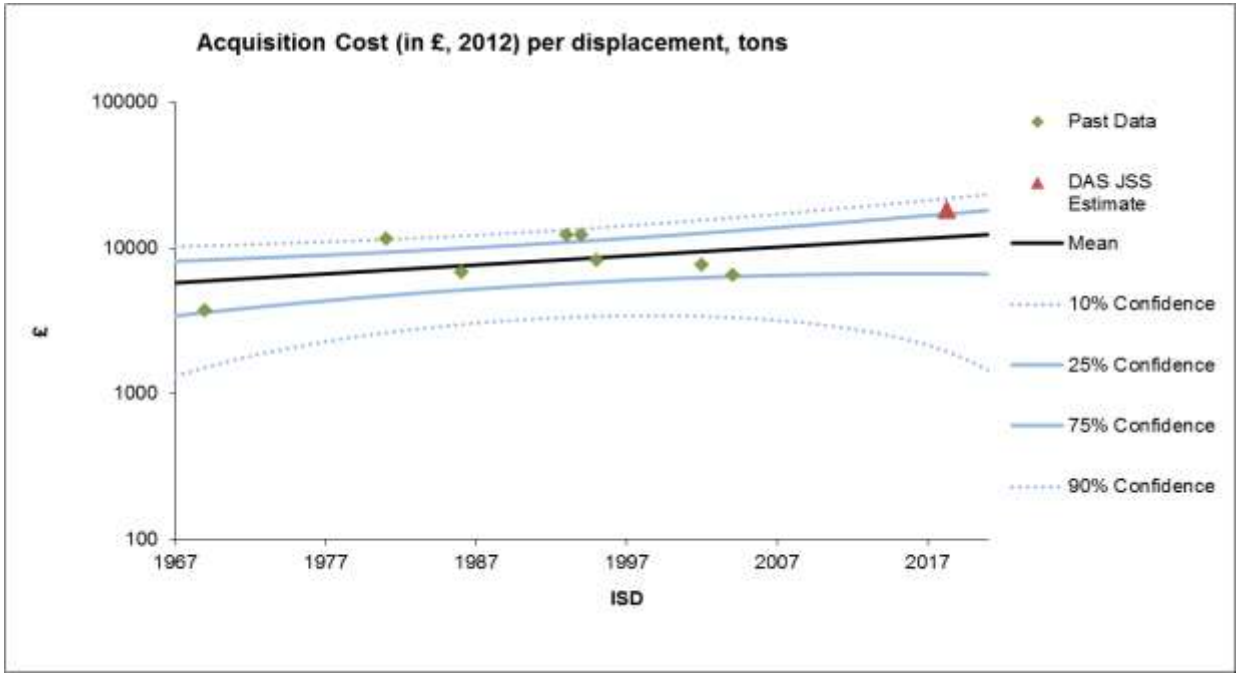
	Mean C$M	SE C$M	%
RDT&E	149.3	41.1	59%
PI	103.3	9.1	41%
Total Development	**252.6**	**42.1**	**100%**
Development	252.6	42.1	21%
Production	928.9	61.9	79%
Total Acquisition	**1,181.5**	**74.80**	**100%**

Sensitivity analysis showed acquisition cost to be only 3% cheaper for a variant acquisition verses a new design

- The total acquisition cost for 2 ships was estimated at C$1,182M
- The development percentage is consistent with analogous systems in the public domain where the percentage increases with complexity

Cost Analysis: Cost HTA

- The following chart shows the DAS estimate (red triangle) in the context of historical cost data for logistic supply ships.



- The acquisition cost estimate sits within the trend lines but to the higher end, which reflects the capability of the desired JSS platform compared with the analogous systems.

Budget Analysis: Consideration of Elements

- We have developed an acquisition estimate for the production of two JSS
- To understand the full budget required it is necessary to add on other cost items
- Canadian acquisition budgets should include
  - Salaries
  - Contributions to employee benefits and pensions
  - Project management
  - Contracts
  - Design fees
  - Licensing fees
  - Industrial and regional benefits management
  - Construction
  - Quality assurance
  - Contingency
- Additional budget items depend on various factors including
  - Specific programme requirements
  - Country of build
  - Acquisition type

Budget Analysis: Additional Cost Items

- An assessment of the Canadian JSS total programme was undertaken
- Total requirement was compared to outputs already generated in acquisition estimate
- Other line items required to make up the full budget were included
- Key items
  - Canadian Premium
    - A requirement to build in country as detailed in National Shipbuilding Strategy
    - The additional cost of required infrastructure to enable building in country
  - Project Management
    - Overhead cost for the Canadian Management of the programme
  - Project Contingency
    - An assessment of project risks
    - Additional funding required to cover risks
- Data sources were determined and costs included

Budget Analysis: Results

- The additional cost lines were included to derive the overall budget required
- This was then compared to
  - The PBO estimate to provide independent assurance and validation
  - The DND estimate to understand if their budget was sufficient for the programme

Source	Budget Estimate (CAN$, Bn)
DND	$2.61
PBO	$3.28
DAS	$3.16

- The DAS budget estimate agreed with the estimate derived by the PBO
- Based on both independent estimates the DND JSS Budget looks to be insufficient for the defined programme

Summary

- DAS were tasked to provide independent assurance of the PBO analysis and help determine if the DND budget was sufficient
- DAS used a parametric approach and Historical Trend Analysis to validate estimates
- Different approaches and toolsets were used by DAS and the PBO
- DAS analysis concurred with the PBO and came to the same conclusions
  - The DND schedule would appear inadequate for development as described by the Statement of Requirement
  - The two Joint Supply Ships would be unaffordable within the budget set aside by the DND

Contact details

Craig Clark
Decision Analysis Services Ltd
craigclark@das-ltd.co.uk
01256 338387
www.das-ltd.co.uk

Sandra Lewis
Decision Analysis Services Ltd
sandralewis@das-ltd.co.uk
01256 338396
www.das-ltd.co.uk