Submarine Fleet Performance – ASC’s Collins Experience

Martin Edwards – ASC Pty Ltd
Outline

1. ASC Overview
2. Collins Class Submarines
3. Transition to Sustainment
   - Submarine availability
   - Key findings
5. Implementation of the Key Findings
6. Outcome
ASC Overview

- **Australian Submarine Corporation Pty Ltd** founded 1985
- **Owner**
  - Commonwealth of Australia
  - Government owned Business Enterprise (GBE)
- 1,400 employees
- Operations in South Australia and Western Australia
- Annual Revenue – A$765m
ASC – Corporate Timeline

1985: ASC Established

Shareholder History

<table>
<thead>
<tr>
<th>Year</th>
<th>Kockums AB</th>
<th>CBI</th>
<th>Wormald</th>
<th>ADC</th>
<th>James Hardie</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>20%</td>
<td>20%</td>
<td>30%</td>
<td>30%</td>
<td>-</td>
</tr>
<tr>
<td>1987</td>
<td>30%</td>
<td>20%</td>
<td>25%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1990</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>-</td>
<td>2.5%</td>
</tr>
<tr>
<td>1991</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2000</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

1993: Collins Class Launch
1996: HMAS Collins
1997: HMAS Farncomb
1999: HMAS Waller
2000: HMAS Dechaineux
2000: HMAS Sheean
2003: HMAS Rankin
2010: ISSC Performance Based Support contract signed.
2012: Collins Through-Life support contract signed.
2012: ASC transitions to Submarine Designer
2015: Ship I HMAS Hobart Launched
2016: Ship II HMAS Brisbane Launched
2018: Ship III HMAS Sydney Launched
2018: Construction commence Arafura Class OPV
2021 and 2022: Delivery Arafura Class OPV
2016: Collins Sustainment described as an exemplar project in the Coles Beyond Benchmark Report
2016: ASC became part of ABD
2014: FCD commence 2 year cycle.
2014: ASC supports SEA1000 CEP
2015: ASC supports SEA1000 CEP
2018: Construction commence Arafura Class OPV
2021 and 2022: Delivery Arafura Class OPV

BUILD

Transition to Sustainment

COLES

Transition to Multi Class Fleet
The Collins Class Submarine

- One of the first modern era, long range conventional submarines
- 3,100 tonne surface displacement
- Construction by ASC in 16 years (1987 to 2003)
- SAAB Kockums AB design – based on the Västergötland-class
Transition to Sustainment

- Sustainment activities began upon the delivery of HMAS Collins in 1996.
- Industrial arrangements based on purchase orders for individual maintenance activities.
- A decade later saw the establishment of long term strategic industrial arrangements.
- Once the Fleet had been delivered, the Full Cycle Dockings (FCD) programme commenced.
- More comprehensive maintenance contracting arrangements were established however, factors progressively emerged that impacted submarine availability & the cost of ownership.
Coles Review - 2011 to 2016

- Australian Government commissioned a study lead by John Coles into the end-to-end business of the submarine fleet sustainment.
- The team reviewed the period from 2006 to 2010 which was characterised by declining submarine availability compared to international benchmarks.
- According to Coles, the decline in availability was a result of a combination of factors related to alignment of organisational responsibility and lack of clear performance objectives, ultimately impacting submarine reliability and availability.
The review concluded that the factors driving the availability deterioration included:

- Growing Urgent Defects
- Unclear requirements
- Unclear lines of responsibility
- Lack of clearly stated strategic plan
- Lack of performance based ethos

*Study Into The Business Of Sustaining Australia's Strategic Collins Class Submarine Capability, November 2012*
Relative Impacts on Material Ready Days*

Low levels of submarine availability against the benchmark were driven by 3 key factors:

1. Long planned maintenance periods (28%)
2. Overruns to planned maintenance periods (10%)
3. Defects outside of maintenance periods (6%)

**Conclusion**

Changing the Usage Upkeep Cycle, shortening maintenance periods & managing in a way that reduces overruns yields the biggest contribution to improving available Material Ready Days.

*Study Into The Business Of Sustaining Australia’s Strategic Collins Class Submarine Capability, November 2012*
Coles Review*: Key Findings

1. Establish a Submarine Enterprise oversight group comprising Navy, Department of Defence - Capability Acquisition & Sustainment Group (CASG) and ASC with a clear and aligned set of submarine performance requirements.

2. Clarify and re-align the key roles within the Value Chain.

3. Establish a 10+2 year Usage Upkeep Cycle (from 8+3) and a new whole-of-life Integrated Master Schedule while minimising schedule overrun for maintenance activities and reducing in-service defects.

* Study Into The Business Of Sustaining Australia’s Strategic Collins Class Submarine Capability, November 2012
Implementation: Submarine Enterprise

‘Australian Submarine Enterprise’ established

- Included
  - Royal Australian Navy
  - DOD – Capability Acquisition & Sustainment Group (CASG)
  - Industry - ASC
- Shared long term vision
- Alignment of objectives and outcomes
- Governance & joint management of the Transition Plan
Implementation: Value Chain principles*

- Clarification of roles and responsibilities:
  - An Informed Customer, Owner and Operator
  - Supportive Industry; and
  - An Intelligent Buyer

- Transition to ‘Good Practice’

- Remove duplication/confusion
  - Particularly with suppliers
  - Singular accountability

* Study Into The Business Of Sustaining Australia’s Strategic Collins Class Submarine Capability, November 2012
Implementation: Value Chain roles

Transition from ‘Current Responsibility’ to ‘Good practice’

1. ASC becomes solely responsible for Supply Chain and Engineering
2. Removes opportunity for excuses due to the performance of others
Implementation: Enterprise KPIs

The Navy Requirement

- Deployable Submarines
- Material Readiness Days
- Material Capability Days
- Material Ready Days lost to P1 urgent defects
- Material Ready Days lost to maintenance overruns
- Submarine days spent in planned maintenance
- Submarines available to Fleet Commander

Translated into Enterprise KPIs

* Study Into The Business Of Sustaining Australia’s Strategic Collins Class Submarine Capability, November 2012
**Implementation: ASC Transition Projects**

ASC aggregated transition activities into 7 projects:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Usage Upkeep Cycle redesign</strong></td>
<td>From 8+3 to 10+2 years, realign maintenance baseline.</td>
</tr>
<tr>
<td>2</td>
<td><strong>HMAS Collins Pre FCD</strong></td>
<td>First circumferential hull cut, tank paint &amp; other initiatives.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Supply support</strong></td>
<td>Supply consolidation, inventory of spares, rotatable pool.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Core production change initiatives</strong></td>
<td>Over 14 significant change tasks, Maintenance Support Tower etc.</td>
</tr>
<tr>
<td>5</td>
<td><strong>HMAS Farncomb FCD 225</strong></td>
<td>First 10+2 Full Cycle Docking.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Submarine Engineering development</strong></td>
<td>Evaluation of new maintenance baseline, Authorised Engineering Authority arrangements, Logistics.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Class safety &amp; certification</strong></td>
<td>Assurance of technical integrity, safety after revised Usage Upkeep Cycle and maintenance baseline.</td>
</tr>
</tbody>
</table>
Implementation:
ASC Transition Project 1 - Usage Upkeep Cycle (UUC) redesign

Increase availability by:

- Simultaneous extension of the operational cycle to 10 years while reducing Full Cycle Docking duration from 3 to 2 years
- Ensure no future overlapping of Full Cycle Dockings
- Establishing a new fleet Integrated Master Schedule
- Re-aligning the maintenance baseline

Implemented by:

- Set period codes of over 4,000 Maintenance Requirements (MRRs) were reviewed to understand the viability of moving to the new UUC.
- MRRs were moved to either an earlier or later SPC aligning with the new UUC.
- Mid Cycle and Intermediate Docking durations were extended to accommodate tasks which due to safety or reliability reasons were unable to be moved to FCD.
- Delivering multiple Production efficiency initiatives to shorten the critical path & reduce the production hours by over 300,000 hours to deliver a Full Cycle Docking in a 2 year period.
- Activity was successfully managed across the CCSM fleet which required the individual management and migration of each platform through the process.
Implementation:
ASC Transition Project 2 – HMAS COLLINS Pre Full Cycle Docking

HMAS Collins placed into a pre-FCD activity

• A key enabler to the 10+2 migration.
• Provided the opportunity for organisation to focus upon development of new 2 year FCD execution philosophy.
• Equipment normally refurbished as part of an FCD that impacted critical path was removed for refurbishment, supporting a UXE/rotatable pool philosophy e.g:
  o Main propulsion motor
  o Diesel Generators
  o Induction and Exhaust valves; etc.
• Enabled the early testing and development of new production methods ahead of the first 2 year FCD such as single coat paint scheme.
• Initial pressure hull cut process trialled and proven.
Implementation:
ASC Transition Project 3 – Supply Support

Coles identified
• Split of responsibility between ASC & Defence stores system a target for improvement, material availability issues

Supply Improvement actions included
• Consolidate the supply chain responsibility around ASC, using ASC’s existing supply chain & materials management systems
• Additional material funding provided through the Inventory Investment Program (IIP) enabled the identification and procurement of an optimum spares holding and established purchasing routines to maintain material levels for the new UUC.

Result
• Material availability improved from mid 60% to mid 90%
• Improved certainty & ability to execute maintenance to plan
• Ability to implement ‘repair by replacement’ strategies
Implementation:
ASC Transition Project 4 – Core Production Change Initiatives

The challenge
Transitioning to a 2 year Full Cycle Docking in one step required the development and implementation of numerous strategies to:

- shorten the critical path,
- reduce the production hours,
- de-conflict critical activities; and
- provide certainty over execution.

Approach
30 complex improvement initiatives targeted significant cost & time reduction.
Implementation:
ASC Transition Project 4 – Core Production Change Initiatives

Hull cuts

• Cutting and reinstating the Pressure Hull without impact on Deep Diving Depth or fatigue life.

• Exploiting the 1, 5 & 8 rule of thumb.

• Enabled critical equipment to be removed from the submarine (3 x DGs & MPM) to be either replaced from the rotable pool or for off boat refurbishment & test.

• Provide improved access for on board activities including metal loss repairs.
Implementation:
ASC Transition Project 4 – Core Production Change Initiatives

Single coat paint system
- Introduction of a single coat paint scheme significantly reducing processing time.
- Careful sequencing of paint zones for optimum execution.
- Implementation of a three shift production routine.

Specialised repair & test facilities
- Establish specialised off boat repair & test facilities.
- Extracting the Main Propulsion Motor & Diesel Generators for repair & test reduce cost and remove main critical path.
Implementation:
ASC Transition Project 4 – Core Production Change Initiatives

Maintenance Support Towers (MST) – a ‘New Way of Working’

• Multi-storey facility which encapsulate the submarine providing workforce direct access to all levels.

• Developed to provide the necessary facilities that surrounds the submarine at all levels; including:
  • Provides workshops,
  • Material stores
  • Canteen and employee services
  • Supervisory support

• Greatly reduces downtime and improved utilisation.

• Designed, built and installed in 9 months

• Return on investment achieved in the first Full Cycle Docking.
Implementation:
ASC Transition Project 5 – HMAS FARNCOMB FCD 225

Overview/Approach

• First attempt at a 2 year FCD employing newly developed methods & maintenance baseline.
• Revolution over Evolution - transition in one step.
• Allowed for a singular focal point for the Enterprise.
• Main motor & diesel generator exchange initiatives met accelerated schedule expectations.
• Improved material availability supported schedule adherence & reduced impact of emergent defects on critical path.

Results:

• First 2 year FCD completed on time (2016)
• Production hours reduced by over 30%
• Integrity of platform performance & safety maintained
Implementation:
ASC Transition Project 6 – Submarine Engineering Development

Overview/Approach

• ASC became accountable for all major platform engineering and technical changes.

• Required the development of further engineering/asset management capability to support the platform through to the Planned withdrawal date.

• Reviewed entire maintenance baseline to support the new UUC and critical assessment of systems to ensure platform and safety.

• WA engineering capability and platform knowledge base grew to support the operational maintenance organisation.

• ASC ultimately established 13 of the 15 level 2 engineers in the Enterprise.
Implementation:
ASC Transition Project 7 – Class safety & certification

Overview/Approach
• Ultimately accountable to the Submarine Enterprise Board and the Chief Naval Engineer for the assurance of technical integrity.
• Ensure entire change program did not undermine the submarine safety case.
• Reviewed the cumulative impact of the entire 10+2 transformation plan across the platform and delivery organisations from a safety perspective and to provide assurance of delivery.
• Included independent validation and verification of hull cut process and solution.

Results:
• Outcome and project deliverables delivered to Chief Naval Engineer for acceptance.
• Executed and delivered in parallel with all other outcomes.
Outcome:

The Coles Review:

- Provided the catalyst for a new phase of improvement across the Submarine Enterprise comprising Navy, CASG and Industry.

Through a strategy of:

- Establishing the ‘Australian Submarine Enterprise’; aligning objectives.
- Moving to Usage Upkeep Cycle optimised for 6 platforms.

Implementation achieved by a program focused on:

- Extending the operational cycle from 8 to 10 years.
- Reducing Full Cycle Docking duration from 3 to 2 years.
- New optimised delivery Infrastructure.
- Consolidating management of the supply chain.
- Establishing ASC as the Engineering Authority for the class.
Outcome:

Results

- Implementing Coles recommendations has seen tremendous improvement in the delivery of Collins Class Submarine sustainment.

- After successfully completing two FCDs under the new UUC, the Enterprise is now delivering submarine maintenance to the Royal Australian Navy’s requirements.

John Coles (May 2016)

- “A program once that was considered a “Project of Concern” should perhaps be now treated as an “Exemplar Project” if such a category existed”.

- In short, the Collins now has a sustainment program arrangement that can deliver the required output with some resilience that as a Strategic System it should have had when it entered service”.

Questions?