Transitioning from 2D to 3D for the Collins Class Submarines

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Chief Technology Officer
Presentation Overview

- Who is ASC?
- ASC’s digital journey
  - 2D CAD and Document Centric
  - 3D CAD and PLM
  - Migration Challenges
  - Benefits
- What does the future hold
- Key message
Who is ASC?

- Australia’s largest specialised naval defence shipbuilding organisation
- We have a number of long-term contracts
  - Collins Class Submarines In-Service Support
  - Collins Class Submarine Training services
Who is ASC?

- Australia’s largest specialised naval defence shipbuilding organisation
- We have a number of long-term contracts
  - Collins Class Submarines In-Service Support
  - Collins Class Submarine Training services
  - Hobart Class Air Warfare Destroyer (AWD) Program
## Submarine Relative Complexity

<table>
<thead>
<tr>
<th>Platform Complexity Metrics</th>
<th>Battle Tank</th>
<th>Boeing 777</th>
<th>Frigate</th>
<th>Collins Class Submarine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (tonnes)</td>
<td>30</td>
<td>250</td>
<td>3,600</td>
<td>3,000</td>
</tr>
<tr>
<td>Length (metres)</td>
<td>7</td>
<td>60</td>
<td>118</td>
<td>78</td>
</tr>
<tr>
<td>Number of systems</td>
<td>25</td>
<td>40</td>
<td>60</td>
<td>108</td>
</tr>
<tr>
<td>Number of suppliers</td>
<td>600</td>
<td>550</td>
<td>600</td>
<td>1,600</td>
</tr>
<tr>
<td>Crew size</td>
<td>4</td>
<td>10</td>
<td>163</td>
<td>43</td>
</tr>
<tr>
<td>Number of parts to assemble</td>
<td>14,000</td>
<td>100,000</td>
<td>170,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Number of person hours to assemble</td>
<td>5,500</td>
<td>50,000</td>
<td>1,200,000</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Construction time (months)</td>
<td>7</td>
<td>14</td>
<td>22</td>
<td>60</td>
</tr>
<tr>
<td>Price (AUD $M)</td>
<td>4</td>
<td>300</td>
<td>600</td>
<td>1,000</td>
</tr>
</tbody>
</table>
The journey (so far …)

**Bespoke Apps**
ASC developed apps for Configuration and Document Management, Logistics, Cost/Schedule Control, etc.

**3D CAD**
- 3D model created from 2D drawings
- 2D drawings still used in production

**Data Integration**
- 3D model integrated with PLM
  - Data Integration Layer
    - improved reporting
    - platform for app development

**1988**
- **2D CAD**
  - Collins Class submarines designed in 2D

**2018**
- **PLM**
  - Embarked on a PLM program in 2006
  - Strategic program to advance ASC capability for sustainment

- **Digital Working**
  - 3D design model trials using Virtual Reality
  - Photo realistic virtual reality used for training
  - 3D Printing for prototyping
2D CAD and Document Centric

2D CAD
- In excess of 25,000 drawings & 25,000 parts lists
- Printed drawings
- Review of product requires mental visualization of 2D data
- No intelligence, just an electronic drawing board
- Boat variations are difficult to maintain

Document Centric
- Record capture focus
- Manual processes and lifecycles
- Product structure inherent in numbering and package system
- Configuration controlled by other systems
- Requires knowledgeable users to find and use information
3D CAD and PLM

3D CAD
- A graphical database
- Integration with other sources – PLM, mechanical CAD tools
- Increased use across the organisation
- Intelligence to aid design
- Multi-purpose – design, planning, maintenance, investigation

PLM
- Object capture in native formats
- Lifecycle management
- Single integrated electronic repository
- IP and security controls
- Single Source of Truth
- Fully searchable
3D CAD Migration – Piping Translation

Optegra/Oracle

CADDS5

LIBRARY/SPEC DATA

ORIENTATION

Scripts
- Perl scripts
- CVDORS
- PML

METADATA

PML scripts
Pipe Metadata

AVEVA Marine

Specifications

Validation Reports

Libraries
3D CAD Migration – STEP Translation

CADDS5 File
- Multi Solid

CADDS5 Files
- Single solids

STEP Files
- Single solids

AVEVA Objects

Assy

Optegra/Oracle

Assembly Positions

Attributes

PML Script
- Implant command line
- Position/Orientation
- Attributes

Vector Validation
3D CAD Benefits – Removal Routes

- Characteristics of maintenance on a submarine
  - Limited and tight spaces
  - Worker occupational health and safety considerations
  - Schedule pressures
  - Bulky and heavy equipment requiring removal for maintenance

- How can 3D CAD help?
  - Plan and simulate activities in 3D before physical access is available
  - Visualise removal routes and optimise options
  - Use Virtual Reality to immerse and understand spatial constraints better
  - Practice and train in a digital environment
What does the future hold?

ASC CLOUD
PROGRAM
SPECIFIC
BUSINESS
ENABLING
CONNECTED
SHIPYARD
RFID
Machinery
Sensors
Biometric
Sensors
Robotics
Industry
4.0
IoT
Advanced Manufacturing

Program Enabling

Digital Twin
Simulation
VR / AR / MR
Scanning

Program Specific

3D Model

User Experience

Tasks
Transparent Data

Information Discovery

Search
Bots
Search Based App

Collaboration

Data Exchange
Suppliers

Business Enabling

Mobility
Self Service

Tasks

Search Based App

Analytics

Sharing

Online Sharing

Data Exchange

IOT

Digitwin

3D Modelling
Visualisation
Digital Simulation
Scanning

3D Modelling
Simulations
VR / AR

3D Modelling

VR / AR

3D Modelling

Commercial in Confidence

Building and maintaining Australia's frontline naval defence capabilities.
Key message

3D CAD MODEL

Asset Data

Commercial-in-Confidence
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