

## **Supplementary Submission to the Senate Economics References Committee:**

### **Inquiry into the future of Australia's naval shipbuilding industry – Future Submarine Program**

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#### **Introduction**

As requested by the Senate Economics References Committee during the hearing on 30 September, this supplementary paper is submitted for consideration.

This submission focusses on two points of evidence from 30<sup>th</sup> September 2014 regarding the Future Submarine Program:

- Whether the AWD is a “build to print” ship, and its implications for industry, and
- Whether or not a submarine must be built in Australia to maintain it.

#### **Whether AWD is a Build to Print ship**

##### **Mr King's evidence – p56 of 67**

“Again, what we learned from AWD—and that was what we would call a 'build to print', so probably as simple a start-up activity as you can have in the maritime construction sense, that was building a ship that had effectively already been built four times. On the first ship, just as an example, the amount of labour that you might allow for a ship of that size would be—in a productive yard, building continuously—in the order of three million man-hours. We allowed 4.7 million man-hours for the first ship, and at the current budget we are sitting at 9.3 million man-hours for the first ship. So you have got things like infrastructure development, production design, workforce development and then—it is no reflection on Australian industry; it is simply a reflection on starting up complex projects—you have a very inefficient, understandably inefficient, process for the early ships. You have to learn how to build them. So it is hard to put a figure on it at this point. Even if the design exists, a production design has to be produced, which means the difference between what the thing looks like and how you break it up into parts in order to be able to manufacture it in that particular facility. And that is a big piece of work.”

##### **Comment**

In context, Mr King was continuing his explanation of how difficult it is to build a ship.

The Spanish design is often described as a Military Off-The-Shelf design. However, it is anything but, due to the expansive modifications to the original design for Australia.

While the ship has previously been built four times in Spain, the ship being built in Australia is heavily modified, mainly due to the changes to the combat system. These changes have had a substantial effect on the ship.

With the schedule slippage and cost over-run exposed in the ANAO report earlier in the year, the clear inference is that the shipbuilder is not capable of following a mature design and is therefore not competent to build a Future Submarine. By extension this applies to Australian industry.

The outburst by the Defence Minister recently that he wouldn't trust ASC to build a canoe is evidence of the effect that this inference is having at senior government levels, and implies a very firmly held belief that ASC (and Australian industry) is not competent to build a future submarine, and that schedule slippages and very high cost premiums should be expected for a future submarine program should it be conducted in Australia.

This ignores that Collins was delivered to the Navy nine years (including 18 months of sea trials) after contract signature at less than 5% budget variation, at a construction facility that did not exist at contract award.

The Spanish air warfare destroyer design was described as a Military-Off-The-Shelf (MOTS) and "build to print" option in accordance with the newly introduced 'Mortimer' recommendations at the time. In the competition with an evolved Arleigh Burke design from Gibbs and Cox of the US, the Spanish design was termed MOTS and won this second competition as it was believed to be cheaper and simpler to build and would meet the Navy's requirement.

According to the DMO at the time, the design was not to be changed, even to a minor degree. "Not even the espresso machine in the officers' mess was to be altered," was the catch-cry at the time.

However, Defence required changes to the combat system and these severely affected the hull design including the power cabling, fitting a towed array and moving machinery to new locations. The ship is also designed as an air warfare ship and there is a very high likelihood that it be too noisy for the towed array or indeed any of the sonars to work properly.

Due to the false "build to print" tag, the project office and the AWD Alliance (not a legal entity, but an office organisation) and subsequently the shipbuilder, established their strategies, arrangements and mechanisms which are not compatible with the high volume of design change that ensued.

The ability for the shipbuilder to deal with the volume of design changes is limited.

The belief that the project office novated the design contract to ASC cannot be accurate – the DMO separately contracted the design and construction. While the ASC appointed a design manager who acts as liaison, the shipbuilder does not have a contractual arrangement with the designer and there is no direct mechanism for the builder to quickly and efficiently facilitate design changes.

Further, electronic interrogation by the shipbuilder of the original design to assess the impact of changes and to make design modifications is limited.

The Gibbs and Cox (US) and the Navantia (Spanish) designs were chosen as original candidates for the ship design competition because as ship designers, they had first-hand experience integrating the complicated US Navy Aegis air warfare system. There are some 23 compartments in a US Navy Arleigh Burke destroyer affected by the Aegis system, sufficient to require Lockheed Martin (the US Navy's contractor for the Aegis air warfare system) to employ quite a few naval architects to work with Gibbs and Cox and Bath Iron Works (the US Navy's lead planning yard for the Arleigh Burke) to ensure

proper integration into the ship. The combat system and the ship design are very tightly coupled.

While the core of the combat system for the Spanish ship is the US-supplied *Aegis* air warfare system, nearly everything around it has been highly modified for Australia, including the "Australian Tactical Interface", the electronic warfare system and the sonars. All these have a ripple effect on the design of the hull and machinery and have led to an unsustainably high volume of design changes for the shipbuilder to deal with.

The effect would be changes to general arrangements, weight and stability, power loadings and thermal cooling, cable sizes and cable runs, locations, switchboards, signal and control cables, distribution boxes and so on. The consequences of these were either unforeseen by the project office at the time of the design competition or not realised later in the project until the shipbuilder reported slippage.

There are other changes cascaded through the project from Navantia as Spain continued to refine its design.

Because the design had not been finalised and stabilised before the project office ordered construction to commence, there has been an unacceptable level of rework by the builder which has contributed to the cost and schedule over-run.

With the amount of changes to the original Spanish design flowing throughout the construction process, the AWD could not be categorised as "build to print" or "MOTS".

Therefore the implications that the shipbuilder (and by extension Australian industry) is not competent, and that the Future Submarine should be built overseas, are not warranted.

## **Whether or not a submarine must be built in Australia to maintain it**

### **Mr King's evidence – p57 of 67**

"No, I have never believed that, and I am at odds with a lot of people I know. It certainly helps you to do it, but all sorts of other things come into play. If that were true as a principle, we would never have been able to fly the F111s, we would never sustain JSF, we would never sustain Wedgetail. "

### **Comment**

In context, Mr King was answering a question about whether a submarine had to be built in Australia to be able to sustain it.

The key phrase is, "It certainly helps you to do it".

Mr King went on to explain that the Oberon submarines were not built in Australia but were well maintained here. Actually, they were very expensive and difficult to maintain.

Compared with the Collins, the Oberon submarines were relatively 'agricultural'. The systems on Collins are far more complicated than for the Oberons. Yet there were problems with maintaining the Oberons, including a complete lack of support from the UK during the Falklands War and very high maintenance costs– so high that one of the compelling drivers to build Collins in Australia was the strongly held belief by the early New Construction Submarine Project staff was that a local build program would help to reduce costs of maintenance.

This would appear to have borne fruit – the annual maintenance costs for the Oberon ran at about 15% of replacement asset value and the annual maintenance cost (reported DMO costs) for the Collins run at about 7%.

Mr King is correct about cooperation of the original designer and access to the IP. What many do not appreciate is the huge data library developed as a result of the build of a modern submarine including the very exacting SUBSAFE program information required for the Collins.

As the submarines must be maintained to exacting SUBSAFE standards, and the maintenance contractor must certify that the submarine will meet the Designer's Intent, that Design Integrity is assured, and the submarine will be safe to operate until the next maintenance period, this information and how it is used must be held by the maintainer.

The best way to do that is to build the submarines here in Australia. If the submarines are built overseas, Defence will not even know which records to ask for from the builder. This was the case for the early Collins sustainment program (before the first support contract with ASC) and clearly Defence does not appreciate this even now.

Submarines operate in a highly safety regulated environment. The deep maintenance contractor must certify that following a maintenance period, the boat will be safe, fit for purpose, and operate without loss of material ready days until its next planned maintenance period which could be months away. To do this, he needs access to thousands of design and build artefacts, to know them and how to use them.

If constructing the lead submarine in Australia, from the very outset, the design activity – including, most importantly, the production design - requires that the design knowledge and the technology and competencies and skills are developed and applied here. They can then be used later on for modifications and upgrades and diagnosing and remedying difficult faults.

The program would commence with Australian engineers being seconded to the overseas designer before later being repatriated, with the overseas design team, to Australia to complete the detail and production design. This method has been suggested by Thyssen Krupp Marine Systems and the French DCNS at the recent ASPI (Australian Strategic Policy Institute) conference. It is also the method suggested by Saab of Sweden.

Very few people know that this was the method used for Collins. Consequently, the Collins build did not suffer from the inability of the production workers to interpret the design – and delays in modifications for production improvements. The design was managed at the build yard. The design/build transition worked well and the construction was certified by the designer that it had been built to the required specifications and standards.

Second, constructing the lead submarine here means that all the calculations, the standards, specifications, test results, build sequence information, parts specifications including objective quality evidence, design certification and assurance will happen here and will be learnt by Australian engineers from the very beginning. And all organisations, including sub-contractors to be used later for sustainment will benefit from this, not just the builder.

Third, as each submarine is built, the production teams, the engineers, and sub-contractors move along a learning curve with increasing productivity. This will be re-started if the lead boat is built overseas and the following boats built here.

Fourth, if the lead boat is not built here, Australian industry will not have initial access to the thousands of build records required to be able to make certification that following maintenance, the boats are safe to operate and will be free from major defects until the next maintenance period, which could be several months away.

If none of the boats are built here, Defence will be unaware of this vast library of data and the need to keep it updated for safe, efficient and effective maintenance and design certification. In the case of Collins, the Navy and DMO simply did not know the extent of the technical data nor of its existence, until ASC was given a through-life support contract. Even then, it became forgotten amongst the plethora of problems which resulted in the Coles Review.

Without this information, Australia will simply not be able to maintain the submarines properly and to safe standards.

It would certainly be more efficient for sustainment, if the Future Submarines were to be built in Australia. Noting that about 70% of the total life cycle cost is in through-life support, this warrants serious consideration.