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Master thesis HS 2017
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Can Autonomous Ships revive Domestic Coastal Shipping for Non-Bulk Freight in Australia ?

1 Introduction

Australia being an island with most population concentrated in a few large coastal cities, one might expect coastal shipping to play an important role in the domestic freight task. However, in 2014 road and rail accounted for 78% and 18% of the non-bulk domestic freight task, respectively, leaving coastal shipping with only 4%. Why?

First, "door-to-wharf-to-wharf-to-door" shipping, as with rail, is more complex and time-consuming than "door-to-door" by road. Second, the 2012 cabotage reforms imposed onerous conditions on foreign-flagged ships, decreasing their participation in coastal trades drastically. With the development of new technologies, ships are gaining greater autonomy and current research projects suggest the arrival of unmanned coastal vessels between 2020 and 2025. Compared to their conventional counterparts, autonomous ships have the potential to reduce fixed costs and increase productivity.

2 Autonomous Ships

Autonomous ships, bear the potential to reduce fixed costs of ships through reduced crew, which implies no need for crew-dedicated infrastructure on the ship thus the vessels will be lighter, use less steel and be more cargo-efficient.

The way towards autonomy as the condition of self-government, starts with the automation, which is the use or introduction of automatic equipment in a process. The marine classification society Lloyd's Register introduced the autonomy levels for ships as a guideline, as seen in Figure 1 below. The timeline of the AAWA initiative project, mainly located around the Baltic Sea is illustrated below in Figure 2.

Two concepts emerge from the various research projects, to shape the way towards autonomous ships: *MUNIN* and *NOVIMAR*. The *MUNIN* concept, sees the **autonomous ship** as the symbiosis of the **remote ship**, remotely operated by a shore-based operator (SBO) and the **automated ship**, which has advanced decision support system onboard and undertakes all the operational decisions independently. The *NOVIMAR* concept relies on platooning that is a manned ship, temporarily leading smaller unmanned vessels. This could be particularly well used in inland waterways.

A glimpse of the main challenges of autonomous ships are introduced here. The reduction and automatization of task and skills of a complete crew, which are mainly contributing to the maintenance and repair of the machinery. The reliability and resilience of the engines, being of primary importance, since support of an autonomous ship on high sea implies high costs.

On a technical basis, the autonomous navigation system is highly dependent on the situational awareness. The situational awareness component having to extract all relevant information from the surroundings, fusion and process it in order to give real time information to the navigation system. The maritime environment being unpredictable and particularly harsh, along with the low manoeuvrability of ships, proves to be difficult. On a societal basis, legal challenges are of great importance, in particular the questions, whether a vessel has to be competently or sufficiently crewed, how to deal with the shipmaster's responsibilities and duties and therefore the liability question, how to comply with sensitive areas requiring pilotage and the navigational compliance with the COLREG, preventing collisions at sea.

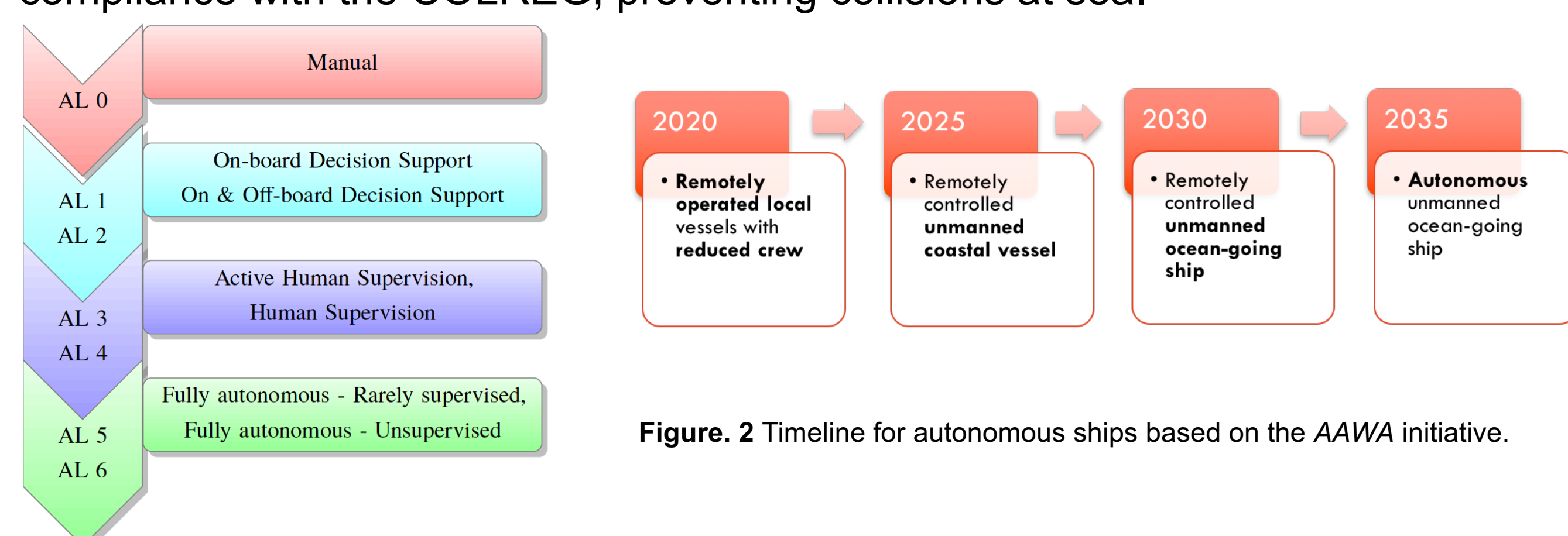


Figure 1 Autonomy Levels for Ships based on Lloyds register

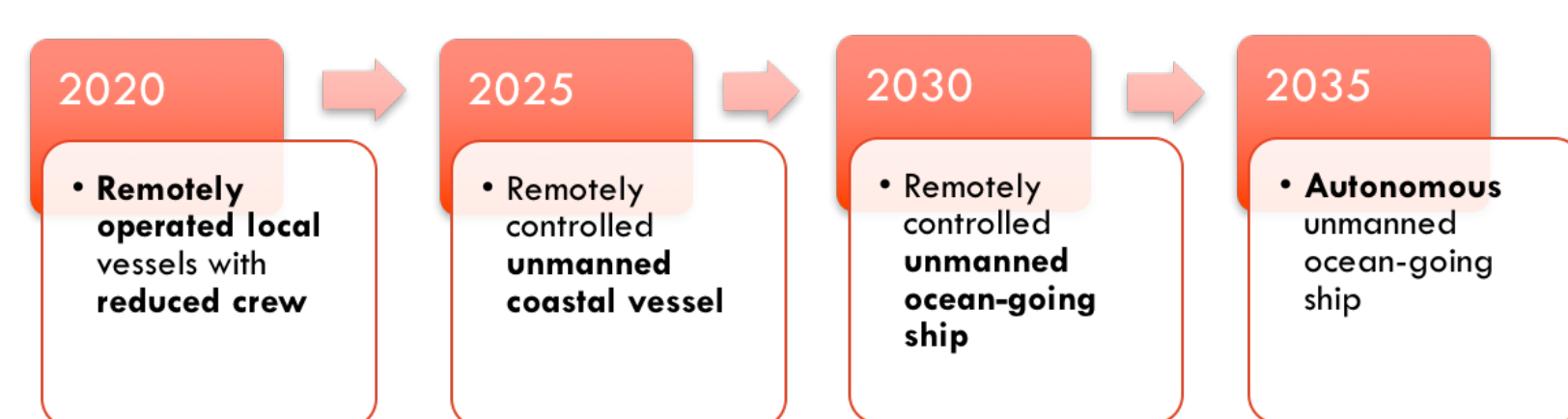


Figure 2 Timeline for autonomous ships based on the AAWA initiative.

3 Coastal Shipping In Australia

The implementation of autonomous ships as a revival of coastal shipping, was analysed in three steps. First potential coastal shipping route, were defined based on the road distance (main competitor) and their current and future non-bulk freight movements. The identified routes were then further assessed, considering rail competitors and whether a potential freight shift could happen. Finally, since coastal shipping needs much higher transit times than road or rail, freight rates must be much lower, in order to make up for the longer journey. Therefore available freight rates were compared and with freight values for travel time savings, the economical viability was explored. The Australian routes were divided into three corridors: North-South, East-West and the Bass Strait, which links Melbourne and Tasmania.

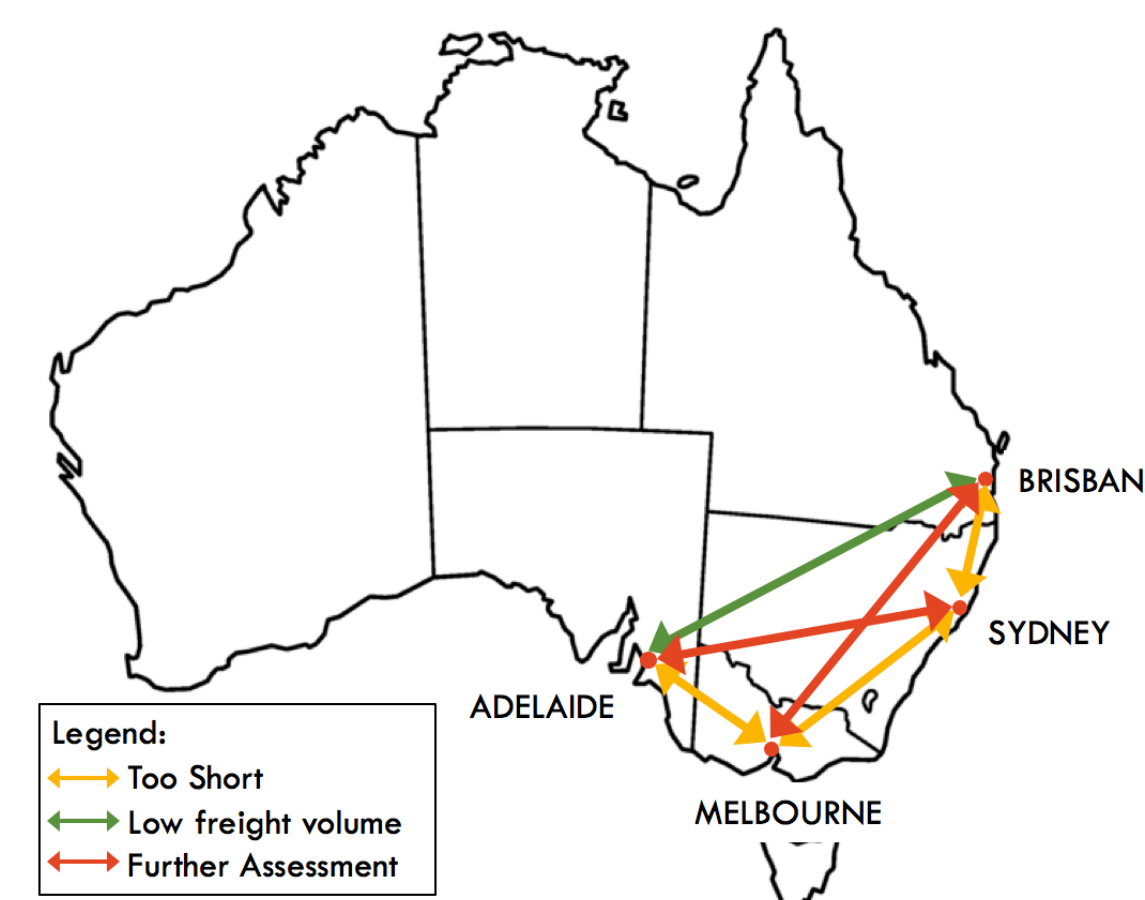


Figure 3 Routes analysed on the North-South corridor

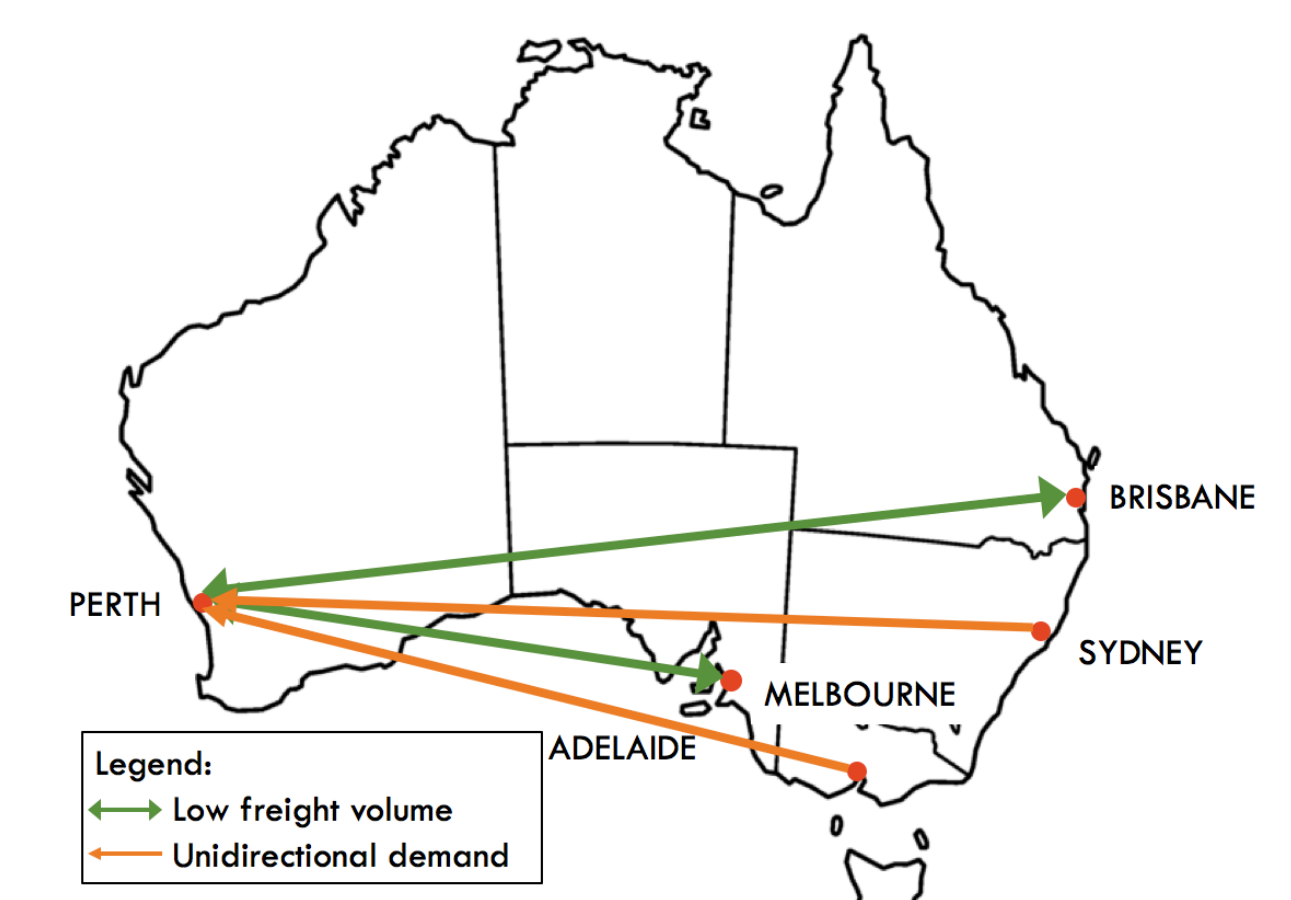


Figure 4 Routes analysed on the East-West corridor

The further assessed routes were Sydney-Adelaide and Melbourne-Brisbane. Sydney-Adelaide showed to have a potential freight shift, but the freight rates target seem difficult to achieve. The Melbourne-Brisbane route, has with the *InlandRail* project (a dedicated rail freight line) an important direct rail competitor and is therefore unlikely too. The last corridor investigated, the Bass Strait, would strictly speaking not be a revival of coastal shipping, since 99% of freight is already moved by sea. Currently three shipping service providers (*Toll ANL*, *SeaRoad Shipping* and *TT-Line*) service the Bass Strait. It is subjected to high freight costs, due to the freight's configuration and trade imbalances, the roll-on-roll-off vessels used and the cabotage regime. These are seen as an obstacle for Tasmanian industries and are therefore subsidized.



Figure 5 BASS Strait Corridor

Autonomous ships are seen here as a technology development of the transportation method and would therefore make sense when the technology is in place and new vessels are needed, due to either capacity needs or vessel replacements from 2028 on.

4 Conclusion

Autonomous ships only will hardly be able to revive coastal shipping in Australia. First because not only shipping faces technology advancements, but also the truck industry aims for electrical and in a close future autonomous trucks, which will lower road prices. Further, shipping needs not only low freight rates to make up for the longer voyage, but also improvements with regards to reliability and availability. There is a need to consider the complete logistic chain and not only a transportation part. It is believed, that the implementation of inter-connected logistic chains and so-called *intelligent* ships and containers, will have a far bigger impact on the logistic chain.

5 Sources

- Lloyds Register (2017): LR unmanned system marine systems code
- AAWA (2016) Remote and autonomous ships: The next step, *Position Paper*, Rolls Royce plc