Slow steaming in maritime transportation: fundamentals, trade-offs, and decision models

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EXTENDED ABSTRACT

In recent times, increasing fuel prices and depressed market conditions have brought a new perspective to ship speed. For a variety of reasons, economic but also environmental, sailing at full speed may not necessarily be the best choice. In that sense, optimizing ship speed is receiving increased emphasis these days and is likely to do so in the years ahead.

Ships travel slower than the other transportation modes, but a basic premise has always been that there is value in ship speed. As long-distance trips may typically last one to two months, the benefits of a higher speed may be significant: they mainly entail the economic added value of faster delivery of goods, lower inventory costs and increased trade throughput per unit time. The need for higher speeds in shipping was mainly spurred by strong growth in world trade and development, and in turn was made possible by significant technological advances in maritime transportation in a broad spectrum of areas, including hull design, hydrodynamic performance of vessels, engine and propulsion efficiency, to name just a few. By extension, developments in cargo handling systems and supply chain management and operation have also contributed significantly to fast door-to-door transportation. However, this basic premise is being challenged whenever shipping markets are not very high and whenever fuel prices are not low. In addition, perhaps the most significant factor that is making a difference in recent years is the environmental one: a ship has to be environmentally friendly as regards air emissions. Because of the non-linear relationship between speed and fuel consumption, it is obvious that a ship that goes slower will emit much less than the same ship going faster.

Even for the simple objective to reduce fuel costs (and by extension emissions) by reducing speed, this can be done at two levels. The first level is technological (strategic), that is, build future ships with reduced installed horsepower so that they cannot sail faster than a prescribed speed. However, the first cellular containerships that went up to 33 knots in the late 1960s when fuel was cheap are gone forever. Maersk's new 18,000 TEU 'Triple-E'[1] containerships have a design speed of 17.8 knots, down from the 22 - 25 knots range that has been the industry's norm, and will emit 20% less CO_2 per container moved as compared to the Emma Maersk, previously the world's largest container vessel, and 50% less than the industry average on the Asia-Europe trade lane (Maersk, 2013).

[1] Triple-E stands for Economy of scale, Energy efficiency and Environmentally improved performance.

The second level is logistics-based (tactical/operational), that is, have an existing ship go slower than its design speed. In shipping parlance this is known as “slow steaming” and may involve just slowing down or even ‘derating’ a ship’s engine, that is, reconfiguring the engine so that a lower power output is achieved, so that even slower speeds can be attained[2]. Depending on engine technology, ‘slow steaming kits’ are provided by engine manufacturers so that ships can smoothly reduce speed at any desired level. In case speed is drastically reduced, the practice is known as “super slow steaming”.

In practice, super slow steaming has been pioneered by Maersk Line after it initiated trials involving 110 vessels beginning in 2007. Maersk Line North Asia Region CEO Tim Smith said that the trials showed it was safe to reduce the engine load to as low as 10%, compared with the traditional policy of reducing the load to no less than 40%-60% (TradeWinds, 2009). Given the non-linear relationship between speed and power, for a containership a 10% engine load means sailing at about half of the design speed. Furthermore, China Ocean Shipping (Group) and its partners in the CKYH alliance (K Line, Yang Ming Marine and Hanjin Shipping) were also reported to introduce super-slow steaming on certain routes (Lloyd’s List, 2009).

Slow steaming is not only practiced in the container market, although it may seem to make more sense there due to the higher speeds of containerships. Slow steaming is reported in every market. In December 2010, Maersk Tankers was reported to have their Very Large Crude Carriers (VLCCs) sailing at half their speed. The design speed of 16 knots was reduced to speeds less than 10 knots on almost one third of its ballast legs and between 11 and 13 knots on over one third of its operating days. For example, a typical voyage from the Persian Gulf to Asia normally takes 42 days (at 15 knots laden and 16 knots in ballast). Maersk Tankers decreased speed to 8.5 knots on the ballast leg, thus increasing roundtrip time to 55 days and saving nearly $400,000 off the voyage’s bunker bill (TradeWinds, 2010).

Slow steaming has also an important role on absorbing fleet overcapacity. Since early 2009, the total containership capacity absorbed due to the longer duration of total roundtrip time for long haul services has reached 1.27 MTEU in October 2013 (taking early 2009 as a starting point), based on Alphaliner’s latest estimates (Alphaliner, 2013). The average duration of Far East-North Europe strings had increased from 8 weeks in 2006 to 9 weeks in 2009 when slow steaming was first adopted. The application of even lower speeds has pushed the figure to 11 weeks currently as carriers continue to seek further cost reductions by adopting slower sailing speeds. The same phenomenon has been observed on Far East-Med strings, where the average duration has risen to 10 weeks, compared to only 7 weeks in 2006. As a record number of deliveries of new vessels is continuing to hamper the supply and demand momentum, analysts expect that slow steaming is here to stay. As a record number of vessels were scrapped in 2013; the idle fleet averaged 595,000 TEUs in 2013 compared to 651,000 TEUs in 2012. The lay-up of surplus box ships has been the worst and has lasted for the longest period since early 2009. The twin impact of extra slow steaming and longer port stays has helped to absorb much of capacity but it seems that

[2] Such a reconfiguration may involve dropping a cylinder from the main engine or other measures.

sailing at even slower speeds is not an option. A similar situation pertains to bulk carriers and tankers. Thus, slow steaming is here to stay for the foreseeable future.

The purpose of this paper is to examine the practice of slow steaming from various angles. In that context, some fundamentals are outlined, the main trade-offs are analysed, and some decision models are presented. Some examples are finally presented so as to highlight the main issues that are at play. Material in this paper is mainly taken from various papers and other documents by the authors and their colleagues, including Gkonis and Psaraftis (2012), and Psaraftis and Kontovas (2013, 2014).

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