

Supporting marine mobility development through control and simulation technologies!



PONAM-35SV (top) and PONAM-31 (bottom) Source: TMC



Toyota Motor Corporation
New Business Promotion Dept.
Marine Div.
Product Promotion Group Manager
Mr. Takai



Toyota Motor Corporation
New Business Promotion Dept.
Marine Div.
Mr. Shinoda

◆What type of work do you do?

Toyota Motor Corporation (TMC)'s Marine Mobility Division is carrying on the vision of the late Honorary Chairman Shoichiro Toyoda as it works toward becoming a mobility company that serves land, sea, and air. Since its launch in 1997, the marine business has grown into its 27th year, with vessel and marine power unit businesses serving as its two core pillars. In our nautical business, we manage the entire value chain from planning and development through design, manufacturing, sales, and after-sales service for leisure vessels. On the other hand, our marine power unit business supplies automotive engines and vessel control support technologies to other companies, contributing to ever-better maritime safety. We are also advancing the development of engine ECUs and vessel control systems, as well as vessel electrification, helping to provide boats that fully incorporate Toyota Motor Corporation's technologies. Furthermore, we are contributing to the advancement of the entire maritime industry through technologies in various fields, including autonomous operation and connected technologies

◆What were the key requirements for solving these issues?

We were the first in the world to successfully commercialize TDA, but today other companies are developing similar technologies. To maintain our competitiveness, we need to continue advancing its functionality. Other companies have also begun developing TDS, so we believe that TDS alone will not be enough to remain competitive in the future. Traditionally, the development of TDA and TDS has taken seven to eight years, but we are now required to reduce that timeframe by half, shortening it to three to four years. To reduce the development period by half, we need to accelerate testing and decision-making, and we believe simulation technology is essential to achieving this. When evaluating vessels, it is nearly impossible to prepare prototypes or perform test runs in the same environment as we can with vehicles. That is why we needed to leverage simulation technologies, including virtual reality (VR)-based vessel-handling simulators, to provide a more realistic experience of evolving technologies and demonstrate new functions more effectively

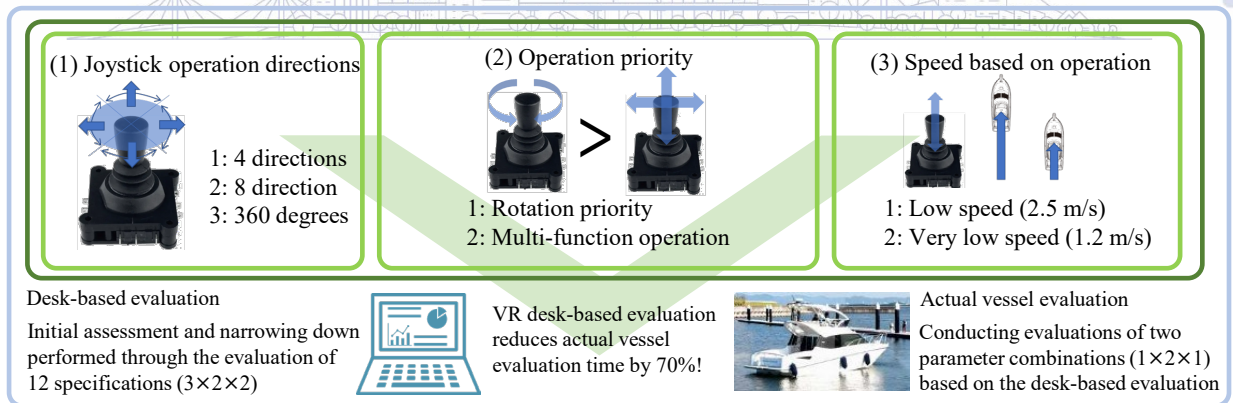
◆Tell us about the challenges you face in your work

We face two significant challenges when it comes to vessel operation support technologies. The first is a functional challenge: the operation of systems such as the joystick system (TDA1) and automated docking technology (TDS2) can be difficult. Although these technologies have already been commercialized, further improvements are needed to ensure that even beginners can operate them with confidence while adapting to marine conditions such as wind, waves, and vessel movement. The second challenge is related to development. The development of TDA and TDS requires a long lead time of seven to eight years, and this creates challenges in terms of cost and competitiveness compared to other companies.

- 1: TDA (Toyota Drive Assist): A vessel handling support system that enables safe and smooth docking and undocking operations through simple joystick control.
- 2: TDS (Toyota Docking Support): A vessel-handling support system that assists with docking maneuvers, such as mooring at a pier, through computer control by using registered GPS location data for the destination.

Learn more: <https://www.toyota.co.jp/marine/technology/>

MBD technology significantly reduces software development and vessel evaluation time!



Concept of improving the efficiency of actual vessel evaluation through desk-based evaluation Source: TMC

◆ Could you tell us why you choose TTDC?

There are two reasons why we chose to work with TTDC. The first reason was due to their high level of expertise in control technologies. One of TTDC's strengths is its technical expertise in vessel and ECU controls, as well as the know-how it has cultivated through years of experience. If we were to entrust the work to a new manufacturer or development partner from scratch, it would take a considerable amount of time to explain vessel behavior and the feel of its operation. Moreover, because commercial vessels (which make up the majority of the marine mobility market) are operated by professional captains, they generally do not require the fine control expected in automobiles. Consequently, few companies specialize in vessel control technology. For the leisure vessels we develop, the ideal partner is a company with control technologies that make them as easy to operate as an automobile. The second reason was because of TTDC's technological skill in simulation and model-based development. Their simulator incorporates vessel control technology, and much of this cannot be handled by a typical simulator development company. We also expect TTDC's simulation expertise to enable us to deliver a realistic experience to customers, engineers in the development and evaluation process, and our sales teams. It was for these reasons that we chose to work with TTDC. We were confident that, with their established control technology, simulation expertise, and development know-how, we could work together to solve a wide range of challenges as the project progressed.

◆ What were the benefits of adoption?

From a technological perspective, TDA+3 has been introduced and has entered the mass production phase. This technology has already received high praise at boat shows. The development period was also reduced from the previous seven to eight years to two to three years, delivering results that exceeded our expectations. With TTDC's simulator, we have also been able to incorporate customer feedback from exhibitions and sales activities into our development efforts. The trust we have built allows us to entrust TTDC with milestones and rely on them to deliver without the need for close management. This provides us with great reassurance. We hope to continue evolving together with TTDC through further development of TDA+ while advancing the technology toward the future.

◆ Could you tell us about your plans for the future?

Earlier this year, discussions were held regarding the future of marine mobility. Looking beyond vessel-related business and external sales of units, we are exploring ways to contribute to the broader social systems surrounding marine mobility. By collaborating with other business divisions, we plan to expand the application of TTDC's technologies into the commercial vessel sector as well. TMC also has many engineers with expertise in control and simulation technologies. By strengthening cross-functional collaboration across various departments and advancing our technologies together with TTDC, we aim to further expand the application of these technologies and products. Furthermore, we aim to evolve our products by incorporating automotive technologies. TTDC has continuously provided valuable ideas and proposals for applying a wide range of mobility technologies, including automated driving and advanced safety systems, helping to enhance our product competitiveness. Going forward, we look forward to new ideas that leverage TTDC's extensive technical experience and accumulated knowledge. In the future, we aim to build a control platform that connects mobility across land, sea, and air. By sharing our knowledge and expertise, we hope to continue evolving together.

3: TDA+ (Toyota Drive Assist Plus):

A next-generation vessel-handling support system that reduces the impact of wind and currents on vessel drift, enabling intuitive joystick operation.

Learn more: <https://www.toyota.co.jp/marine/lineup/35/technology/index.html>



Back row, from the left: Mr. Shinoda and Mr. Takai
Front row from the left: Mr. Osawa (TTDC),
Mr. Saida (TTDC), and Mr. Adachi (TTDC)