MTS DP Webinar #1
Q&A

Q1. Do you see remote control ships as a more likely solution than fully autonomous ones? What if loose connection ?
Both solutions have several pros and cons. Remote control has strong dependencies on communication, human decision and maybe more subject to cyber attacks. Fully autonomous control is of course very challenging due to the higher overall complexity.
Significant efforts are still needed to make it real.

Q2. Have these improvements in the DP controller model been implemented in the field? If so do you have real time data showing the improvements in DP performance as a result of implementing them?
At the moment it is not the case, all the works are done in simulation but following Hardware and Software in the loop principles.
First series of tests at model scale are planned for Q2 2021 and full scale tests in the end of 2021.
Besides several papers detailing the performances and the global schemes will be published and shared among the community.

Q3. How many objects can the Deep-Mantis system track at the same time?
We did not hit any limits so far even when tracking more than 20 objects simultaneously. But this number does not strongly affect the whole algo performance. More investigations are in progress.

Q4. Is there work going on with Class on a Class notation analogous to DP Class for MASS equipped vessels? How does MASS protect against potential cyber attacks? Lastly, has D-ICE done MASS studies for Orsted in support of wind projects? Thanks in advance.
Guidelines have been published by class certifications (DNV or BV) but to our knowledge, no rules are yet in force.
At the moment, our works were more focused on the physical simulations and control algorithms development. We are not yet involved in demonstration projects but are in ongoing discussions with several stakeholders. For all items

relating with cybersecurity, we will simply follow and apply the guidelines and the rules.

Q5. Thank you very much. Can you tell a bit how you include dynamics into the A* graph search?
This hybrid A* algo does not yet include dynamics per se it explores the free space with motion primitives that reflect the ship manoeuvrability such a limited turn radius, limited pure rotations and translations. But it is possible to use second order models that we integrate of course. We are exploring this option although it would come with an higher computational load.

Q6. What will be the systems integrator role for getting all these algorithms to work together and between vessels working in SIMOPS?
Our vision is to deliver class-certified hardware containing all required algorithms packaged in our software suite with clear and exhaustive documentation. Communication with other ships or systems will be done through standardized and documented protocols. System integrators will have the role to install the system and configure it to the vessel and operations specificities.
Note that the core of our softwares is also used by marine engineers to plan the operations which gives full control from the planification up to the execution.

Q7. Can you elaborate on the collision avoidance simulation - how many moving targets have you successfully tested against?
B.P: We have run several simulations to push our algorithm to the limits and the number of obstacles appears to be a minor load to the algorithm. When too obstructed the ship slows down or is even able to perform stops and stay in station-keeping until the way is clear enough. Moreover, we consider the obstacles within the range of the sensory suite fusion (e.g., lidar + cameras + radar). Note that an optimal solution is always found in less than 10ms.

Q8. For the COLREGS compliant navigation, is your research primarily simulated or have you collected live datasets/performed real world testing of your sensors, algorithms, and systems? If so are you conducting tests on smaller scale systems (ASVs) to expand later to larger vessels? "
We are designing all our software and algorithms to adapt automatically or with minimal tuning effort to different system capabilities, maneuverability and actuators.

But indeed, due to a lack of manoeuvrability cargo ships will need to have a larger range of course and speed decision than zodiacs to evade obstacles early enough.
Now a key aspect is to generate a human-like behaviour, e.g., reduced abrupt accelerations, clear evasions manoeuvers readable by surrounding (manned) ships.

Q9. Have you done any studies regarding sensor fusion to bring together the camera data with radar and other detection methods for situational awareness?
Not yet but it is on the roadmap.

Q10. New technology is consistently difficult to regulate. How will you navigate these complexities for vessels that don't have a regulatory framework to dictate what is required for autonomous navigation?
How the programming bugs issue planned to manage in Fully autonomous ships?
Very good question. All our products communicate together and raise several levels of alerts visible on the different HMI and are stored in a secured database. Now a robust decision behaviour layer would be necessary to handle critical situations or suspicious behaviour triggered by coding errors maybe.
Besides we have an experienced team with excellent programming skills and put in force strict programming and testing rules. Note that the software management (bugs, evolutions, testing, etc.) will be an important part of the rules.
The role of the certification societies is crucial.

Q11. Do you have a DP capability software available for purchase? like the one you mentioned shipKEBAB?
Yes indeed we have a DP capability software. You can contact us at sales@d-ice.fr for more information.

Q12. How are going the tests/simulations in order to perform load/unload with container/shuttle tanker vessels?
Our frameworks are dedicated to model, simulate, control and monitor such complex operations. For more technical information, please visit www.frydom.org where you will have access to the different equations and models.

Q13. How do you deal with vessels really not suited for DP due to limited propulsion configurations?

This is the strength of the model-based approach and typically MPC (Model Predictive Control) is able to cope with lack of standard DP capabilities. Note that COLREGS are already addressing the maneuverability and propulsion issues.

Q14. The DP System needs 20-30 mins to learn the model. How during transit mode to avoid collision this will be effective? High chances vessel drift and collision..

With new generation fully nonlinear estimation and control, the “learning” phase is not needed anymore. It is indeed a new way to consider marine and DP operations.

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