



TOTEM DST

TOTEM DST: Decision Support Tool for Collision Avoidance at sea

Introduction. Collisions are still a major hazard to seafarers, resulting in considerable loss of life. During 2013 alone there were more than 10 collisions between ships, with more than 150 seamen that lost their lives and more than 1000 tons of heavy fuel that polluted the seas. Statistics show clearly that most of the collisions are the result of wrong interpretation or ignorance of the International Regulations for Preventing Collisions at Sea. With that in mind, Totem Plus has developed a revolutionary Collision Avoidance system called DST (Decision Support Tool), supporting the OOW (Officer On Watch) by advising in ample time what course change and/or speed change should be taken in order to stay clear from all targets and avoid collisions. The advice given is in full compliance with the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and can handle a multiple vessels scenario.

Method. The DST Collision Avoidance system has the capability to analyze automatically ALL the targets within the selected range around the ship, and advise the OOW on the best course to steer or the best speed required. Such advice is given in order to stay farther than the selected CPA from all targets and avoid a collision. The stipulations of the COLREGS are taken into account and the advice is complying in full with the COLREGS. The system automatically analyzes the data of all targets, categorize the targets according to their status (crossing, overtaking, head-on etc.) and applies the requirements of the COLREGS (Give Way, Stand On etc.) according to the required parameters. The DST will inform the OOW in real time on the required action and will update the advice continuously. The OOW can select the range the max TCPA for which the analysis will be done, and the minimum CPA to be kept from all targets as dictated by the traffic circumstances (see figure 1).

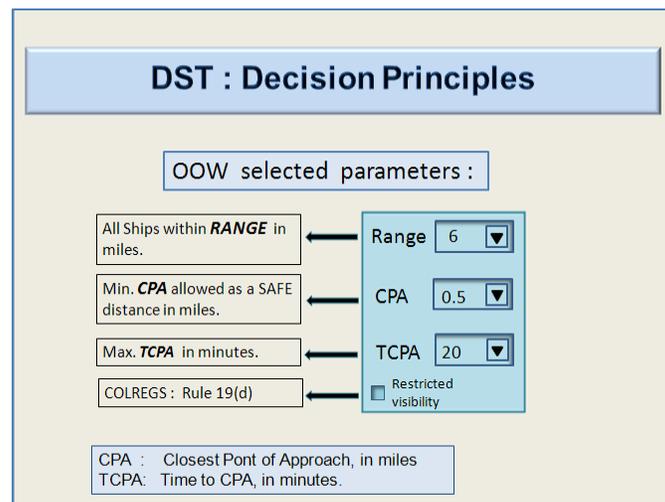


Figure 1: DST Decision Principles

Based on the selected parameters, the system will analyze the data and will decide on safe sectors (in blue in figure 2 below) and dangerous ones. A dangerous sector means that if the vessel will sail on a course within this sector, she will pass closer than the required CPA from at least one of the targets within the selected TCPA. Same principle holds for the speed, where the speed bar shows the safe and dangerous segments as a function of speed. The advised course or speed will be the ones complying with both the COLREGS and staying out of the red sectors. In the example in Fig. 2 we see that the vessel is sailing on a COG of 240° at 18.7 knots, inside the red, and the advice is either to steer 250° or decrease speed to 14.8 knots (or increase to 20.9 knots).

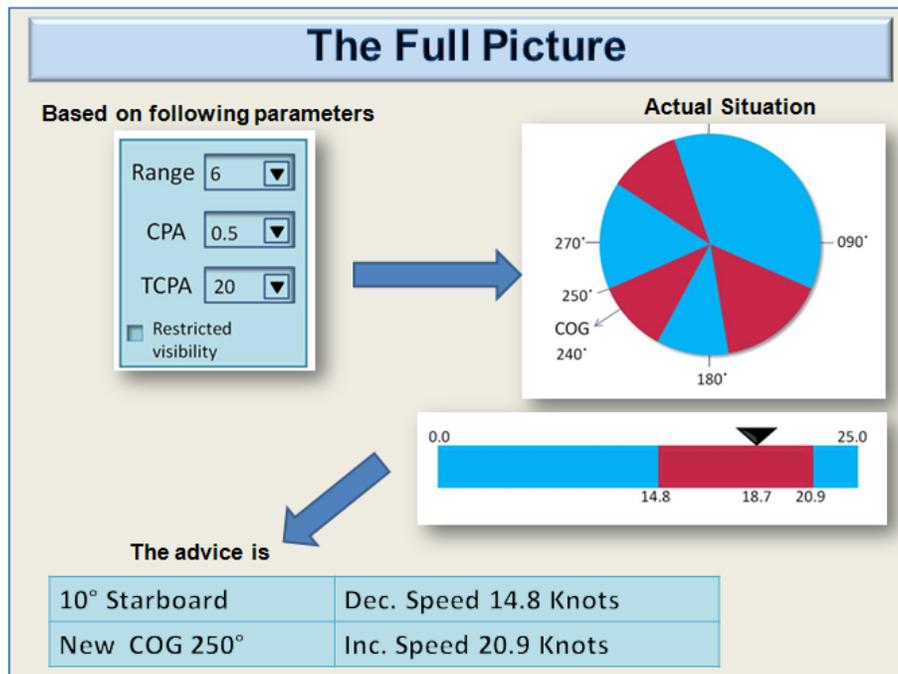


Figure 2: DST : The Full Picture

Give way and Stand-on. Obviously, the International Regulations for Preventing Collisions at Sea 1972 stipulates which vessel is the “Give Way” and which is the “Stand On”, and the DST should handle both correctly. Consequently the OOW will be notified if he is the stand-on vessel for any target at ample distance. Further, the DST will give immediate advice to the OOW when his obligation to notify the other ship according to rule 34(d) starts, or when the other vessel is too close and he should exercise his duty and give way himself (take action - in accordance with rule 17(a)(ii) and rule 17(b)). The distances for such advice may vary according to the specific ship and prevailing circumstances, and should be set by the Master in advance using the appropriate COLREGS setup form. Different values should be entered for those distances, one for vessels crossing from portside and another for vessels overtaking (both considered as Give Way vessels). Once the distance to such vessel is below the threshold for warning, the OOW will be notified that it is time to hail the other ship that they should give way. If this does not help and the other ship is getting below the



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threshold for action, the system will immediately notify the OOW and will include the not-giving-way vessel in the give way algorithms. In Figure 3 it can be seen how the system responds to the vessel “Arpa_202” crossing from portside and notifies the OOW on his possible choices – alter course to STBD or reduce speed.

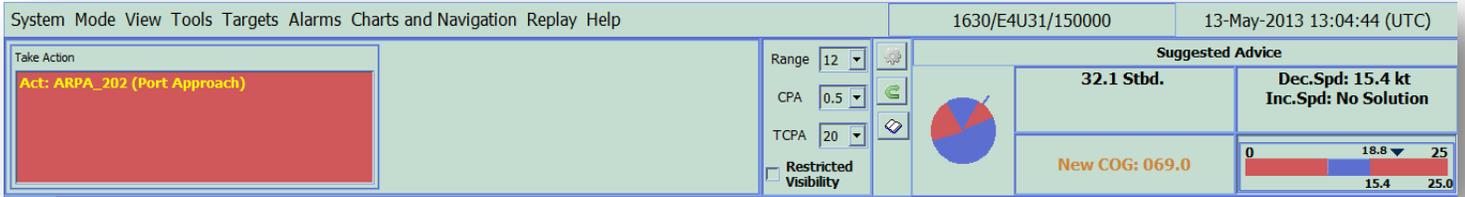


Figure 3: Take Action for Give Way vessel

Case study. The DST is in operation for more than 6 years, is installed as part of Totem ECDIS on several hundred ships, and was tested in numerous situations. In the pictures below (figure 4), taken from Totem ECDIS during a real situation in the North Sea, it can be seen how the DST analyses the data of 10 targets within the selected range of 12 miles. The OOW has selected 0.5 miles as CPA, 30 minutes as TCPA (ships with higher TCPA are not relevant now), and the system advice is to change course to COG 140° or reduce speed to 9.5 Knots.

The full case study can be seen in <https://www.youtube.com/watch?v=ZKnAbMt3PdI>

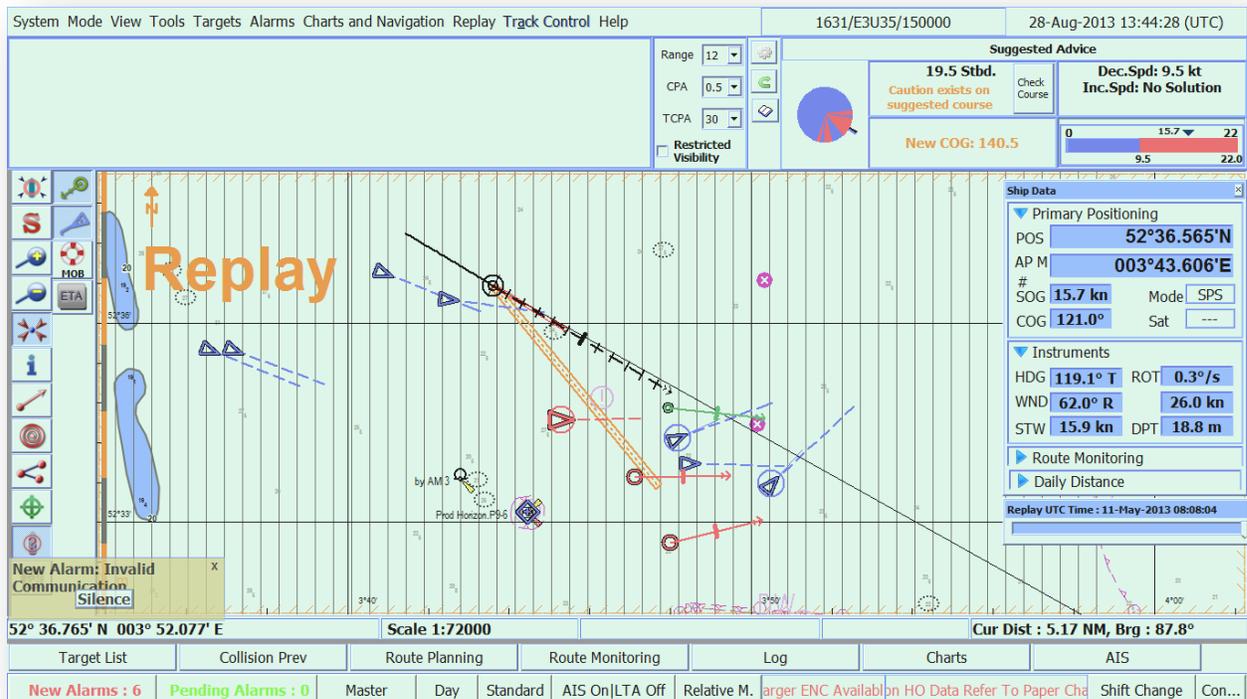


Figure 4: DST in operation, real case.



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Summary. Plotting the possible tracks of multiple targets and solving the issue for the optimal solution in a very short time is beyond the mathematical capabilities of most mariners. Consequently the action of giving way is based on Masters and OOW judgement and experience alone. In most cases the judgement is correct and in agreement with the COLREGS, but the few cases in which it is not are the ones leading to catastrophes. Totem DST provides the mariners with the mathematical solution, and gives them exact advice about what is expected according to the COLREGS. Masters and OOW should consider the DST advice together with “all available means appropriate to the prevailing circumstances”, as the COLREGS rightly states.

More info can be found at www.TotemPlus.com.