

Determination of a Search Area

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When a vessel in distress sends a distress signal and requires immediate assistance, then loses radio communication, how do you find them? The vessel, or if the vessel sinks, the survivors in a survival craft or in the water, may start to drift under the same weather/oceanic conditions as at the time of the distress call. To where are they drifting?

Different objects have different drift characteristics depending on the following:-

- i) Shape of the object;
- ii) Size of the object;
- iii) Submerged portion of the object;
- iv) Exposed portion of the object above the waterline.

In maritime drift, there are two important forces which cause the object to drift. One is the Total Water Current (TWC) which includes Sea/Ocean Current (SC), Wind Current (WC), Tidal Stream Current and other current, if any. It should be noted that:-

- 1) Tidal stream current generally exists within 3 nautical miles of the shore line, particularly within bays and sounds;
- 2) Wind current exists when the distance is greater than 20 nautical miles from the shore with water depths greater than 30 metres;
- 3) Sea current exists when the distance is greater than 25 nautical miles from the shore with water depths greater than 100 metres.

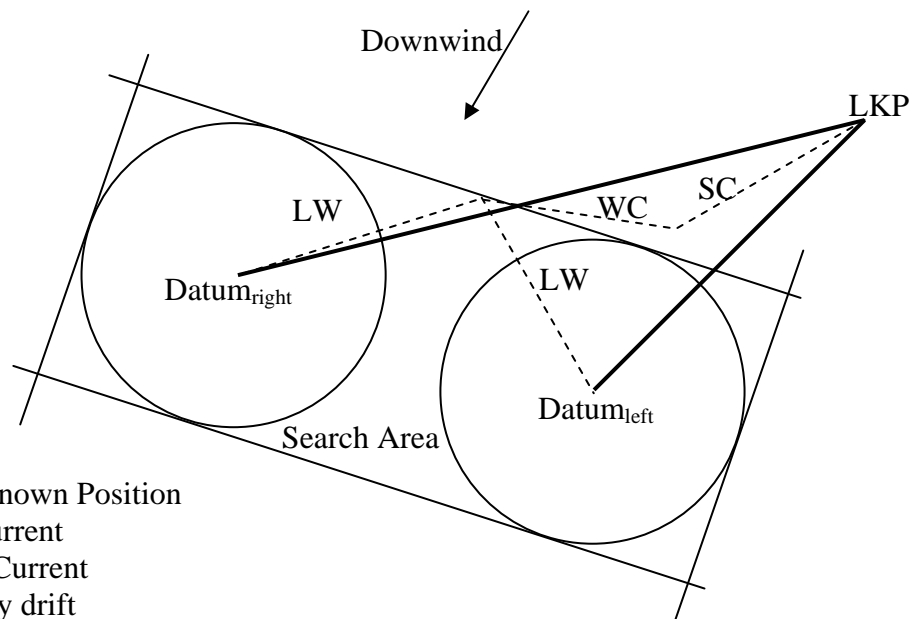
If the above criteria for each wind current and sea current are not met respectively, the depth of water is important and prevails.

The other is the Leeway (LW) which is caused by the wind blowing over the area for a long period of time, say in open sea, from 4 to 48 hours, creating the movement of surface water.

Leeway is generally in a downwind direction, but as both the shape and the exposed portion of the object are factors which contribute to the direction and rate of drift, LW will not always exactly follow the downwind direction. The object will tend to drift to the left side or to the right side of downwind. In model calculations, we call this the angle of divergence. Therefore, for an object drifting in the open sea, there will be two datum points known as datum_{left} and datum_{right} respectively for the establishment of the search area. If the distance between two datum points in which the separation ratio (SR) is greater than 4, (the ratio of distance between two datum points (DD) and the Probable Error of Position (E), i.e. $SR = DD/E$), a Widely Diverging Datum calculation is required. Otherwise, one complete search area covers both datum points.

The above is always taken into consideration by the Search Mission Co-ordinator (SMC) who plans the Search Action Plan in the Maritime Rescue Co-ordination Centre (MRCC) ashore. The "International Aeronautical and Maritime Search And Rescue Manual (IAMSAR) Vol. II" provides all necessary information such as graphs, curves, corrections to navigational errors for both search ships and vessels being searched, uncorrected sweep width

for both of merchant ships, helicopters and fixed wing aircraft, weather corrections, wind causing leeway for different objects with rate of drift, angle of divergence etc, to the SMC who makes the search plan.



LKP = Last Known Position
 SC = Sea Current
 WC = Wind Current
 LW = Leeway drift

Generally, there are three uncertainties causing inaccuracies of calculated search areas. The accuracy of search areas depends on many factors, such as accuracy of the reported incident position, time of incident position, and direction of drift. The most important is the actual observation of wind and current on scene, and the On Scene Co-ordinator (OSC) should be capable to report wind and current with drift direction to SMC at regular intervals in the Situation Report (SITREP).

However, from the Master's point of view, he can take the simplified technique to calculate the datum and start searching, if there is no Search Action Plan given from MRCC. The Master considers the Total Water Current and Leeway causing the drift of object to determine the datum, and with an assumed radius of 10 nautical miles depicting the search area. Another publication "International Aeronautical and Maritime Search And Rescue Manual (IAMSAR) Vol. III" provides all necessary and useful information to the Masters of ships when they are involved and participate in rendering assistance to search objects, persons or vessels in distress at sea. This "IAMSAR Vol. III" is a mandatory manual on board merchant ships and at SAR facilities.

In Section 3 (On Scene Co-ordinator of "IAMSAR Vol. III" – Planning the Search by the Shipmasters), there are some differences in calculations of search plans made by shipmasters, as the information given in Vol. III does not include the "Persons in Water" (PIW) leeway speed and divergence angles or Leeway speed given for drifting of life rafts without divergence angles. The datum for the search in principle is found as follows:-

- (1) reported position and time of the incident,
- (2) time interval between the incident and the arrival of the search vessel,
- (3) calculate the total water current and leeway.

It is noted that for PIW, no leeway has been mentioned in "IAMSAR Vol. III", but in fact, and according to "IAMSAR Vol. II" for SMC, PIW do have leeway and divergence angles in calculations as well. So the information given in Vol. III for shipmasters is much simpler than the information given in Vol. II for SMC in MRCC.