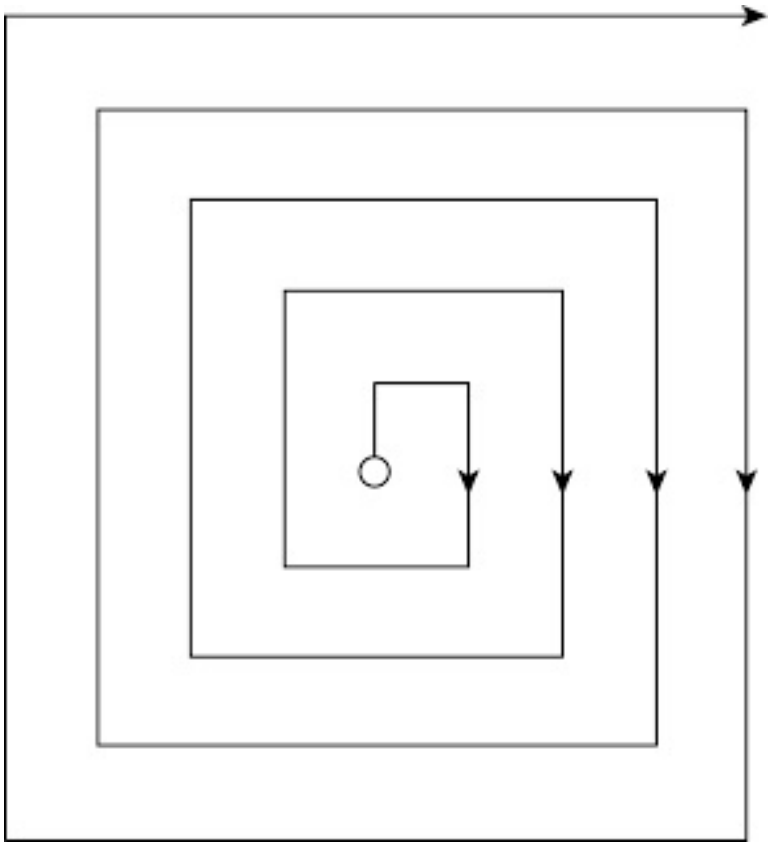
Weems & Plath Expanding Square SAR Course Identifier #113

A common search pattern used in search and rescue (SAR) operations is called the *expanding square* pattern, which is just what it says it is. You travel along calculated route legs in a pattern that expands every 3rd leg so you systematically cover the the search area in an expanding pattern, as shown below.



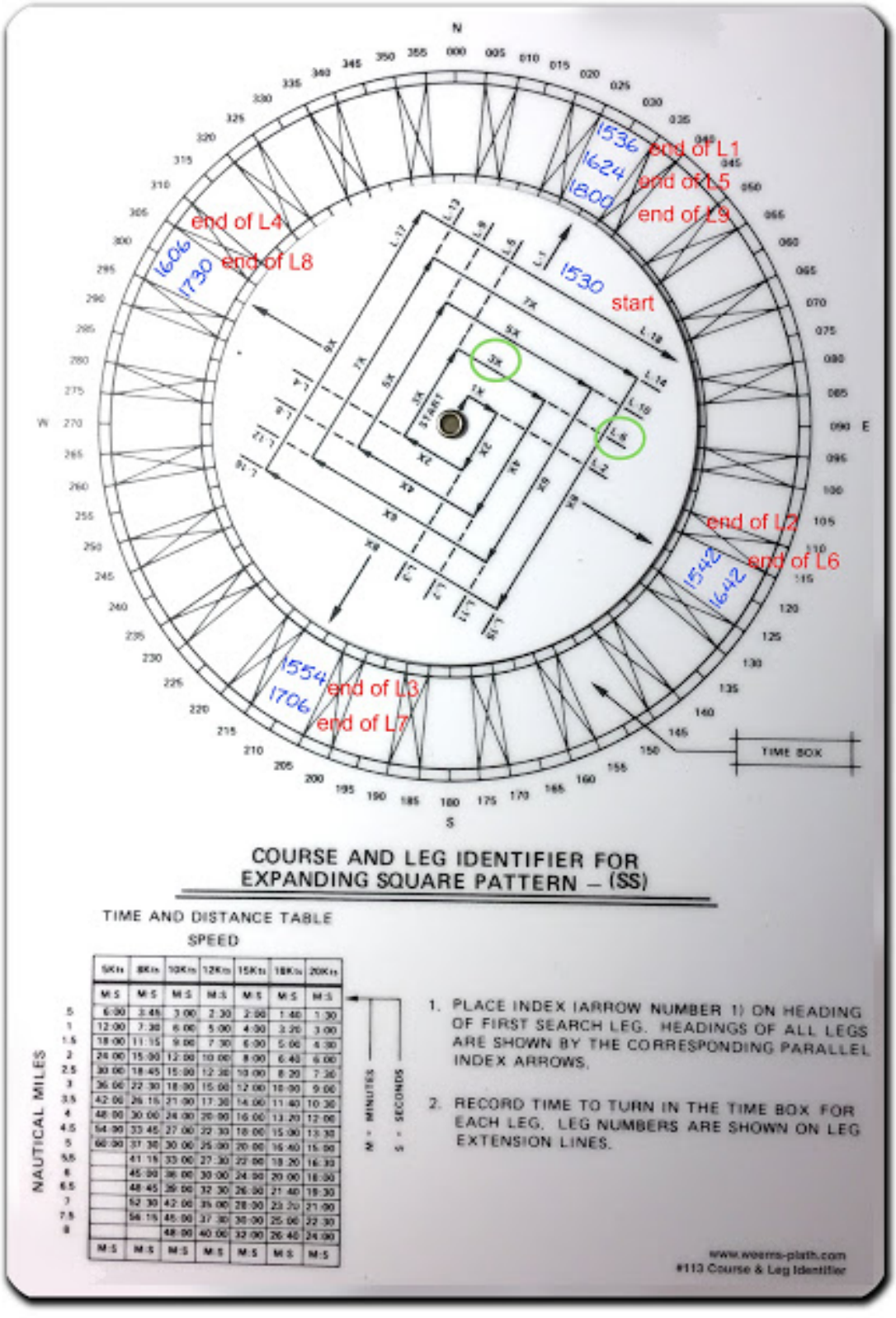
To plan out such a pattern you need to know your (1) initial heading, (2) the distance you want between the squares, (3) your boat speed, and (4) the time you plan to start.

In one sense, the next logical step is turn to your electronic charting program, put in the way points, select an average speed and start time, and look at the resulting route plan, which will tell you the headings and times to turn onto each leg. Then print that plan or take a picture of it with your cellphone. In fact, the route itself will be laid out on the chart plotter and you can just follow it.

Or you could simply start off with the boat's track showing, and create the route from your displayed and saved vessel track... But that is not the point at hand. Several agencies, including the USCG who certify assist vessels require that you solve this manually, without relying on any electronics, and we can't truly fault them for that. We want this done right, and we don't want it fouled up if the electronics hick up, or we accidentally push the wrong button on some display.

A device for doing this is offered by Weems-Plath.com called the **#113 Course and Leg Identifier**, and this note explains how to use that. The instructions that come with the device are sparse and strangely enough several other descriptions of the device I have seen do not add to it. So we were happy to add a few notes on this when asked.

Below is a picture of the device. The middle disk rotates so you can point it in the initial heading of the search pattern, in this example 030. This device implies this will be on a heading that is a multiple of 15º, but it does not matter if you use true or magnetic headings for this.



For higher res image, click above, then right click and choose open in

new tab.
Or download pdf of this note.

Procedure

Step 1. Point the track to your initial heading in multiples of 15.

Step 2. Choose your track spacing and boat speed, and enter the table (bottom left) of times for various leg separations and boat speeds. In the example used here, we choose legs 1 mile apart with a vessel speed of 10 kts. This gives us a time increment of 6 min. Had we chosen a separation of 1.5 miles with a boat speed of 12 kts, the tine interval would be 7m 30s.

[This is just the boat speed in minutes per mile (60/S) multiplied by the distance run.]

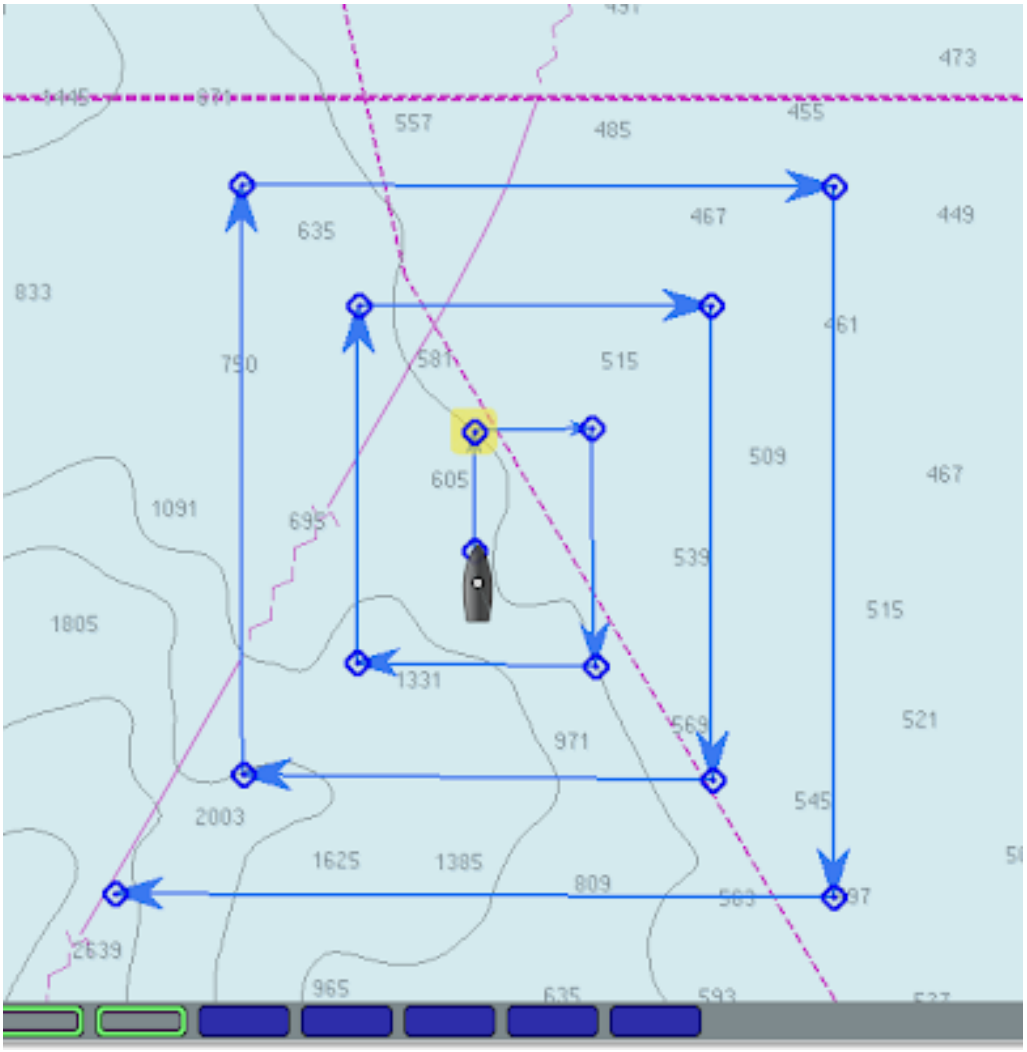
This 6 min the main time interval used to figure the times for each turn. Each leg has a multiplier on it. For leg 5 this is x3. See green circles in the figure.

Step 3. Mark the start time at the base of leg 1, and then compute the turn times for each leg and write them with pencil in the spaces provided as shown. Pencil marks on this disk can be erased for later use.

This step takes some care as mistakes are easy, so double check your work. Then you head off on the headings indicated and turn at the times you have marked.

Obviously, if you do have a chart plotter, watch it to be sure you are making a square search pattern. Current or leeway could through this off, so you would have to adjust the headings as needed.

Below is this example, roughly laid out in OpenCPN (ie legs and headings not precisely set; just click, click, click...) and the corresponding route plan, which can be used to check if we were right with the Course and Leg Identifier.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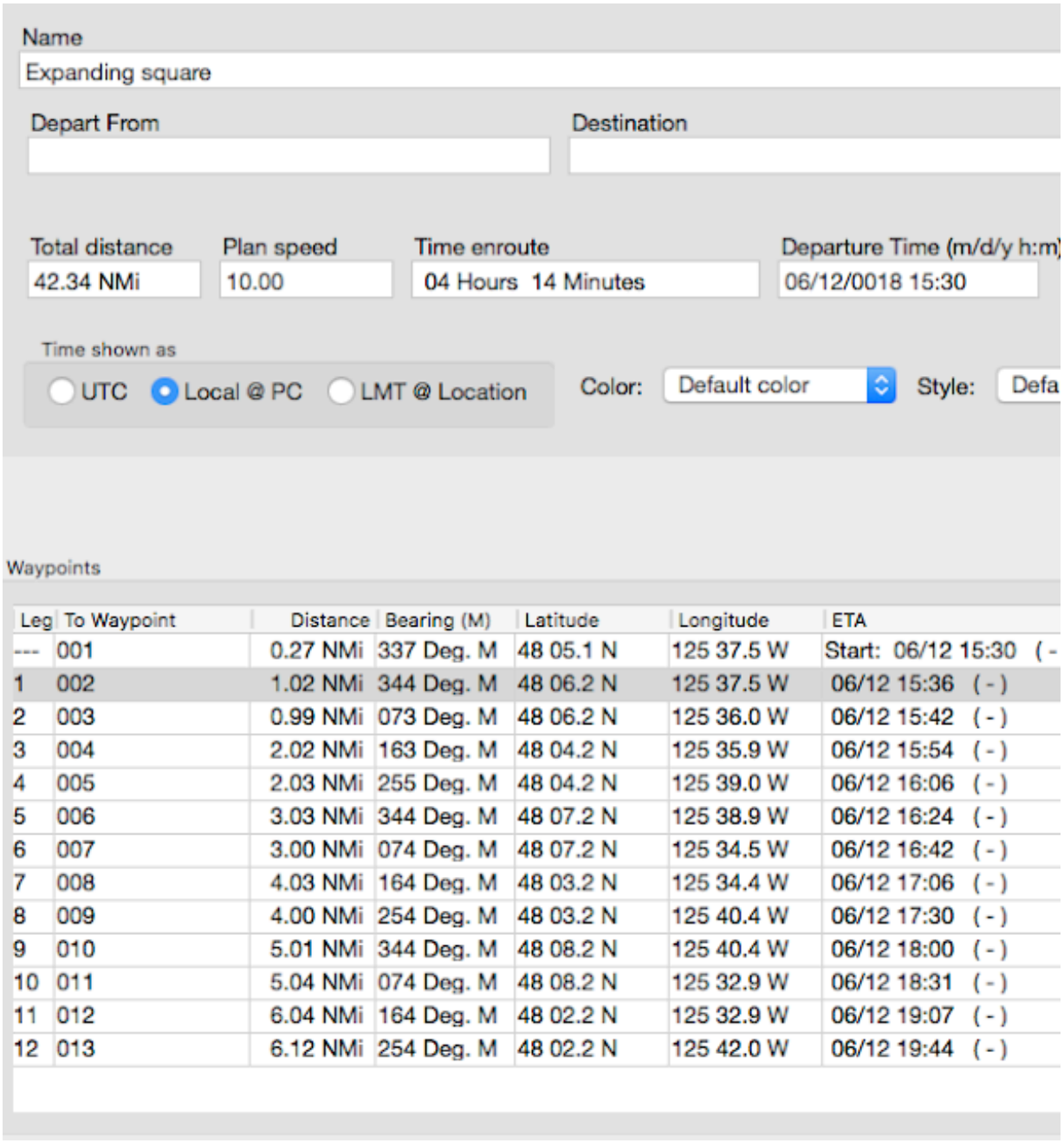

Leg	To Waypoint	Distance	Bearing (M)	Latitude	Longitude	ETA
---	001	0.27 NMi	337 Deg. M	48 05.1 N	125 37.5 W	Start: 06/12 15:30 (-
1	002	1.02 NMi	344 Deg. M	48 06.2 N	125 37.5 W	06/12 15:36 (-)
2	003	0.99 NMi	073 Deg. M	48 06.2 N	125 36.0 W	06/12 15:42 (-)
3	004	2.02 NMi	163 Deg. M	48 04.2 N	125 35.9 W	06/12 15:54 (-)
4	005	2.03 NMi	255 Deg. M	48 04.2 N	125 39.0 W	06/12 16:06 (-)
5	006	3.03 NMi	344 Deg. M	48 07.2 N	125 38.9 W	06/12 16:24 (-)
6	007	3.00 NMi	074 Deg. M	48 07.2 N	125 34.5 W	06/12 16:42 (-)
7	008	4.03 NMi	164 Deg. M	48 03.2 N	125 34.4 W	06/12 17:06 (-)
8	009	4.00 NMi	254 Deg. M	48 03.2 N	125 40.4 W	06/12 17:30 (-)
9	010	5.01 NMi	344 Deg. M	48 08.2 N	125 40.4 W	06/12 18:00 (-)
10	011	5.04 NMi	074 Deg. M	48 08.2 N	125 32.9 W	06/12 18:31 (-)
11	012	6.04 NMi	164 Deg. M	48 02.2 N	125 32.9 W	06/12 19:07 (-)
12	013	6.12 NMi	254 Deg. M	48 02.2 N	125 42.0 W	06/12 19:44 (-)

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