Radar Target Definition
by Steve Dashew

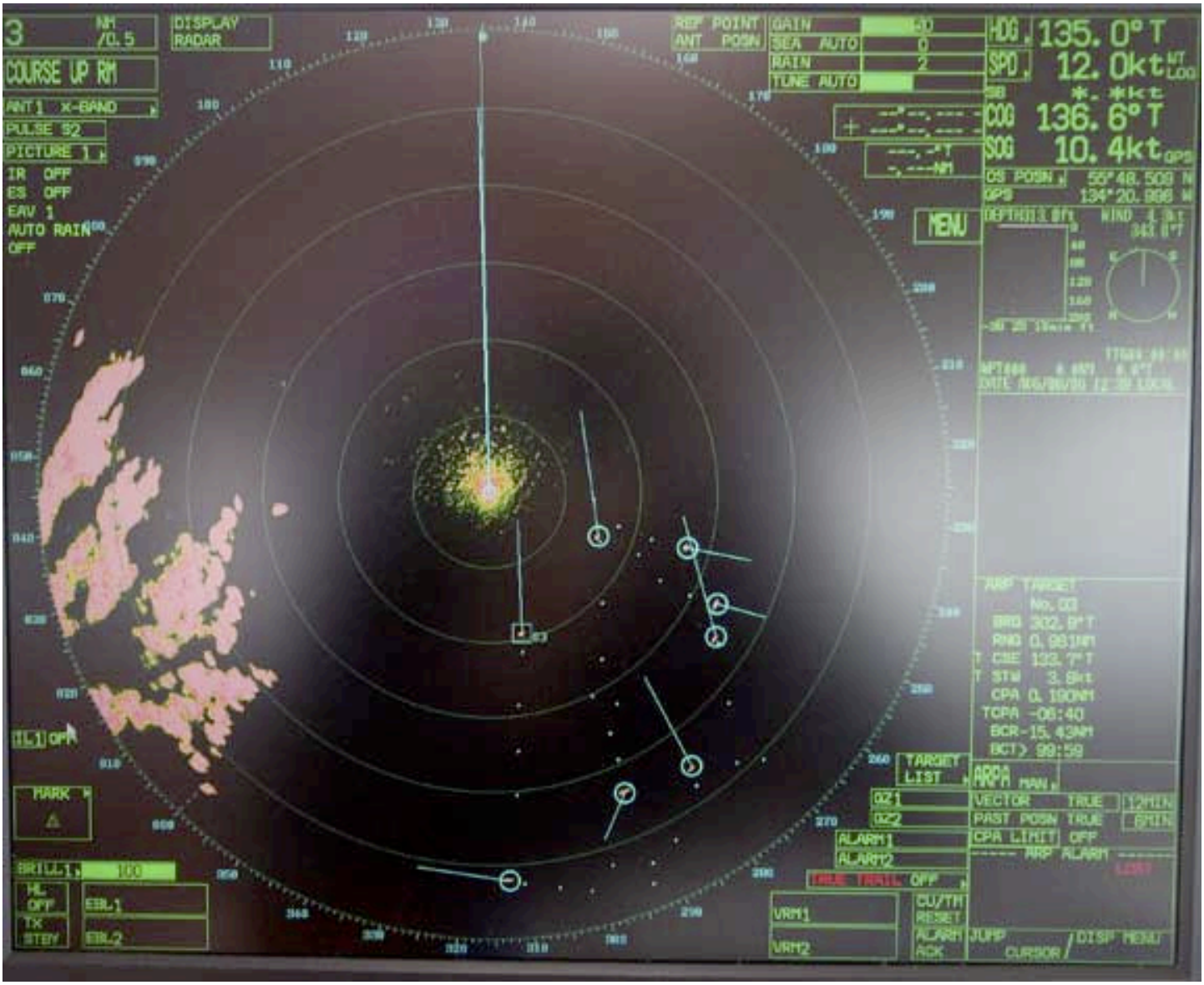
Modern radar's have an amazing assortment of features and capabilities. But in our opinion the single most import criteria is the ability of the radar to pick out targets in difficult conditions.

We've been using a Furuno 2117 black box radar on *Wind Horse*, our 83 foot (23.4m) ocean going motor vessel, and have been amazed at its abilities. Our unit has a six-and-a-half foot (2 m) scanner mounted 16 feet (4.9m) above sea level. The photos which follow were taken during the very wet summer of 2006 in Southeast Alaska.

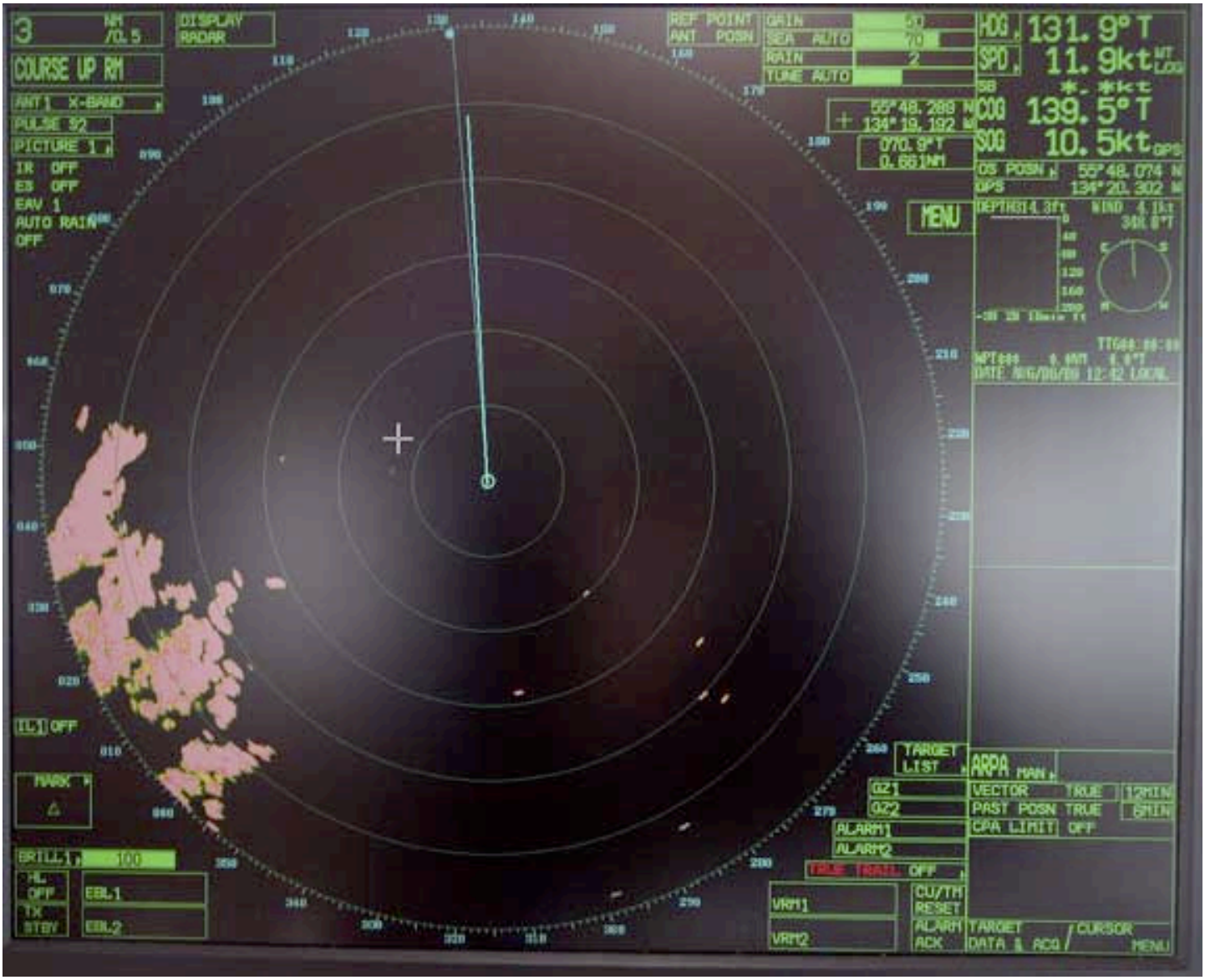
Sea Clutter

Picking out small targets in sea clutter is what we want most from our radar. Large vessels sit well above the waves and have a good radar return in almost all conditions. But smaller vessels are often lost in the radar clutter reflected back from waves. And, there is a trade off here between using tuning controls to reduce sea clutter and losing those small boat targets we really want to see. There are various controls on the 2117 which allow us to refine the image surrounding us in rough water. These include Rain and Sea Clutter, target averaging, and pulse length. We're going to show you how some of these controls work for us.

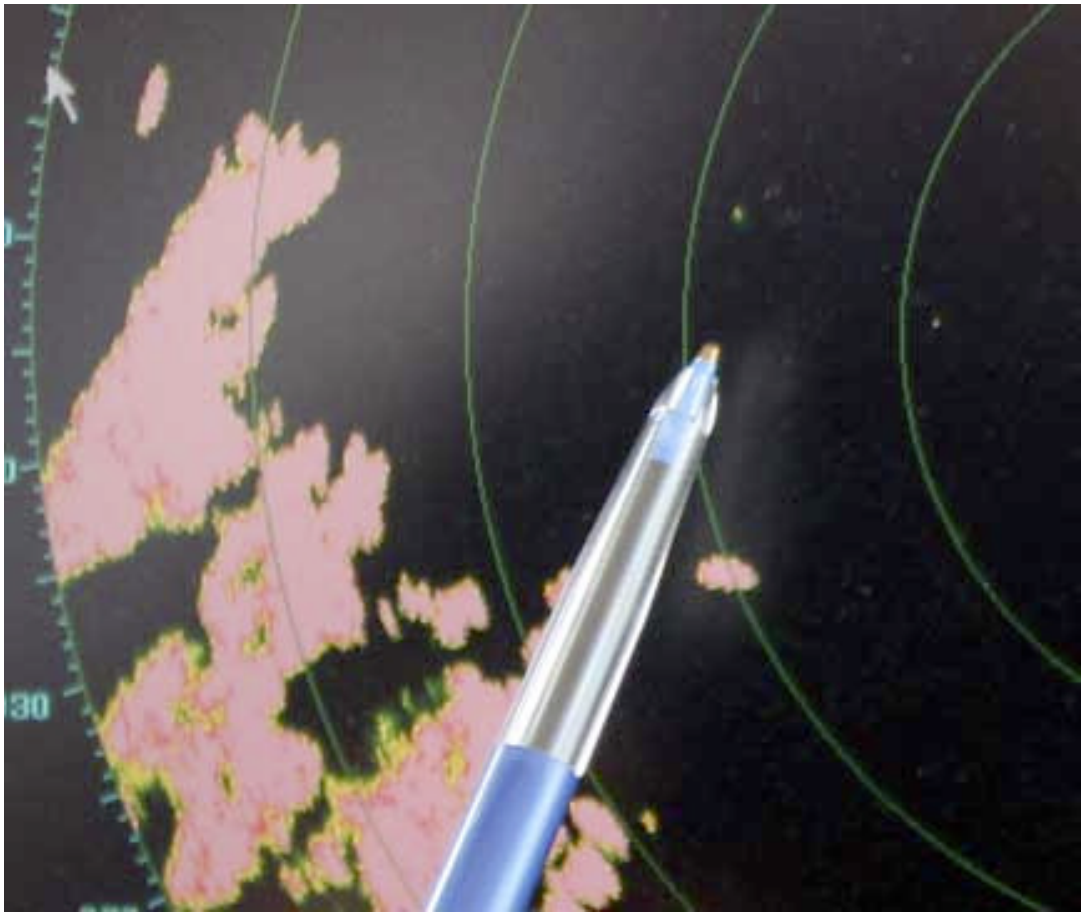
The following photos were taken on the western side of Baranof Island, over the continental shelf which fronts the Gulf of Alaska. The local trollers are out after salmon. There is a large swell running in from the west at 6 to 10 feet (1.8 to 3m). This small wooden vessel was practically hidden every few seconds as it dropped into the troughs.



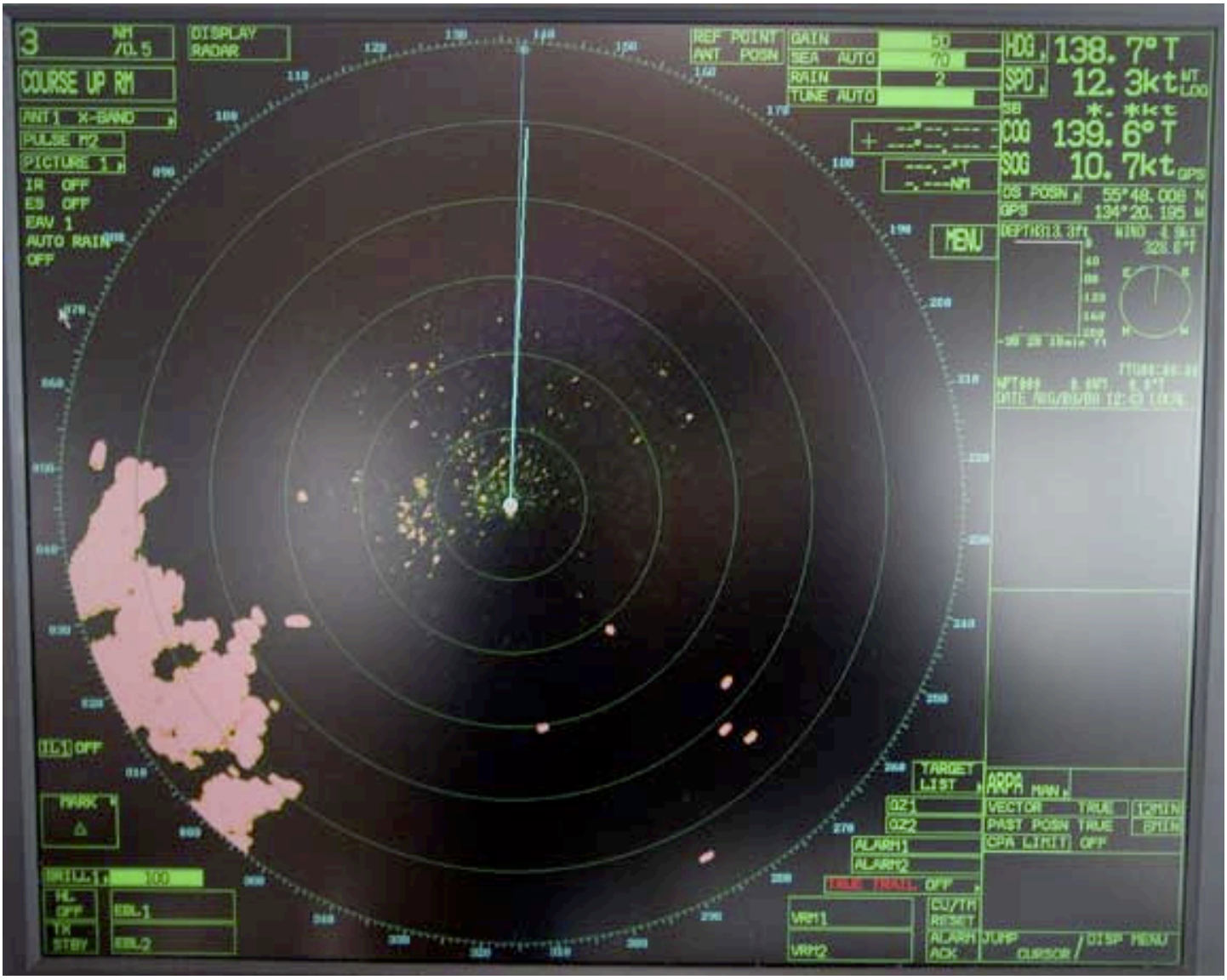
The combination of this group of trollers and big swells present an excellent opportunity to practice with our radar. In the image above, sea and rain clutter are turned off. Gain is turned up to 50 - where we leave it offshore (this is too high for inshore work where there are close targets surrounding us). Notice the almost solid return from the sea clutter within a quarter of a mile of the boat. ARPA vectors are set to true here, to show us the actual courses of these targets.



All of the settings remain the same here, except that auto sea clutter is now at a setting of 70. This eliminates all sea clutter close in, but maintains these small fishing boats in the ground swell. Notice that echo averaging (EAV) is also turned on to its first setting. This really helps pull out targets from sea clutter.



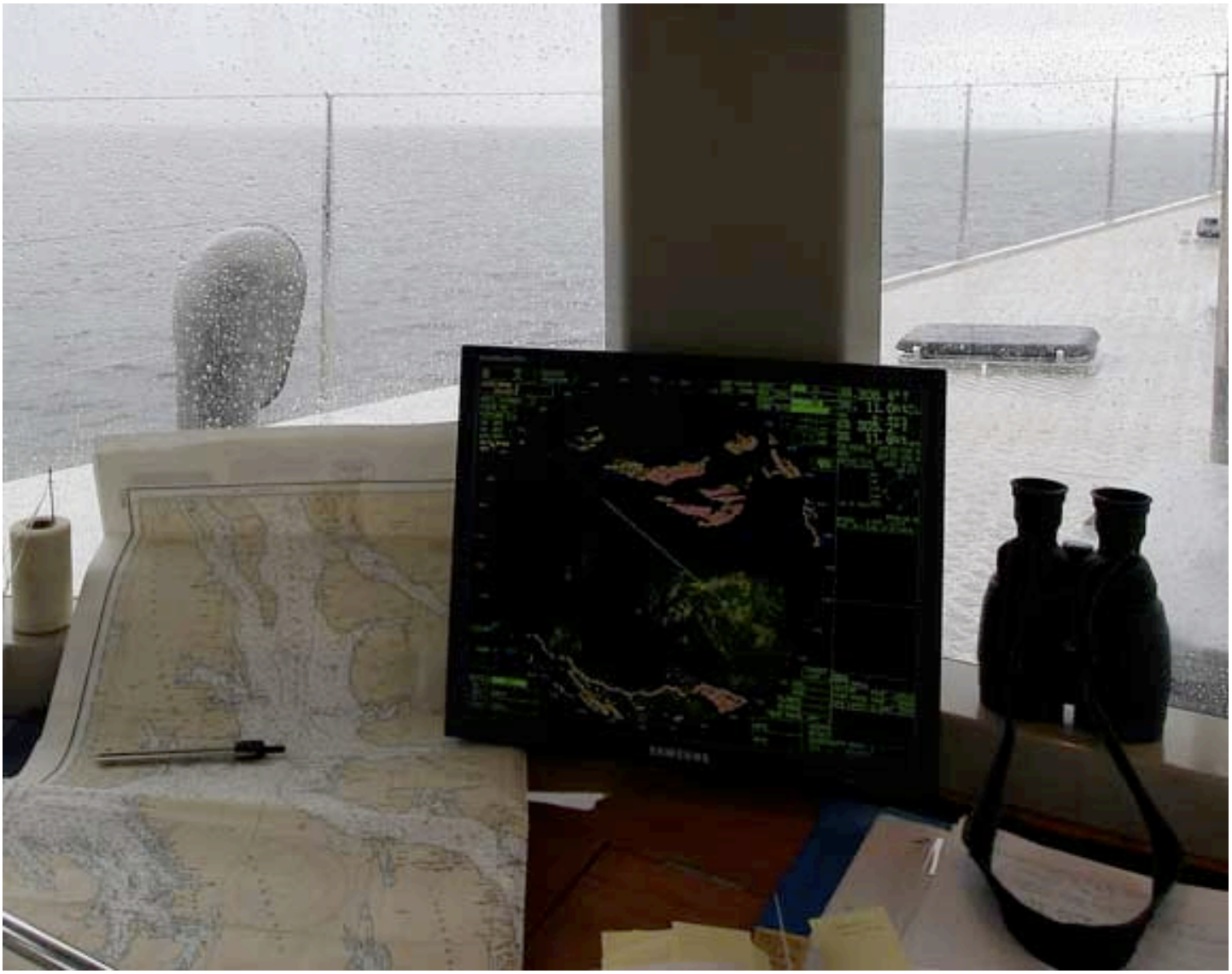
The toughest target to define here is this small rock, above the pen being used as a pointer. With these settings we can still see this rock, so we make a note of what these are in the radar section of our log book for future reference.



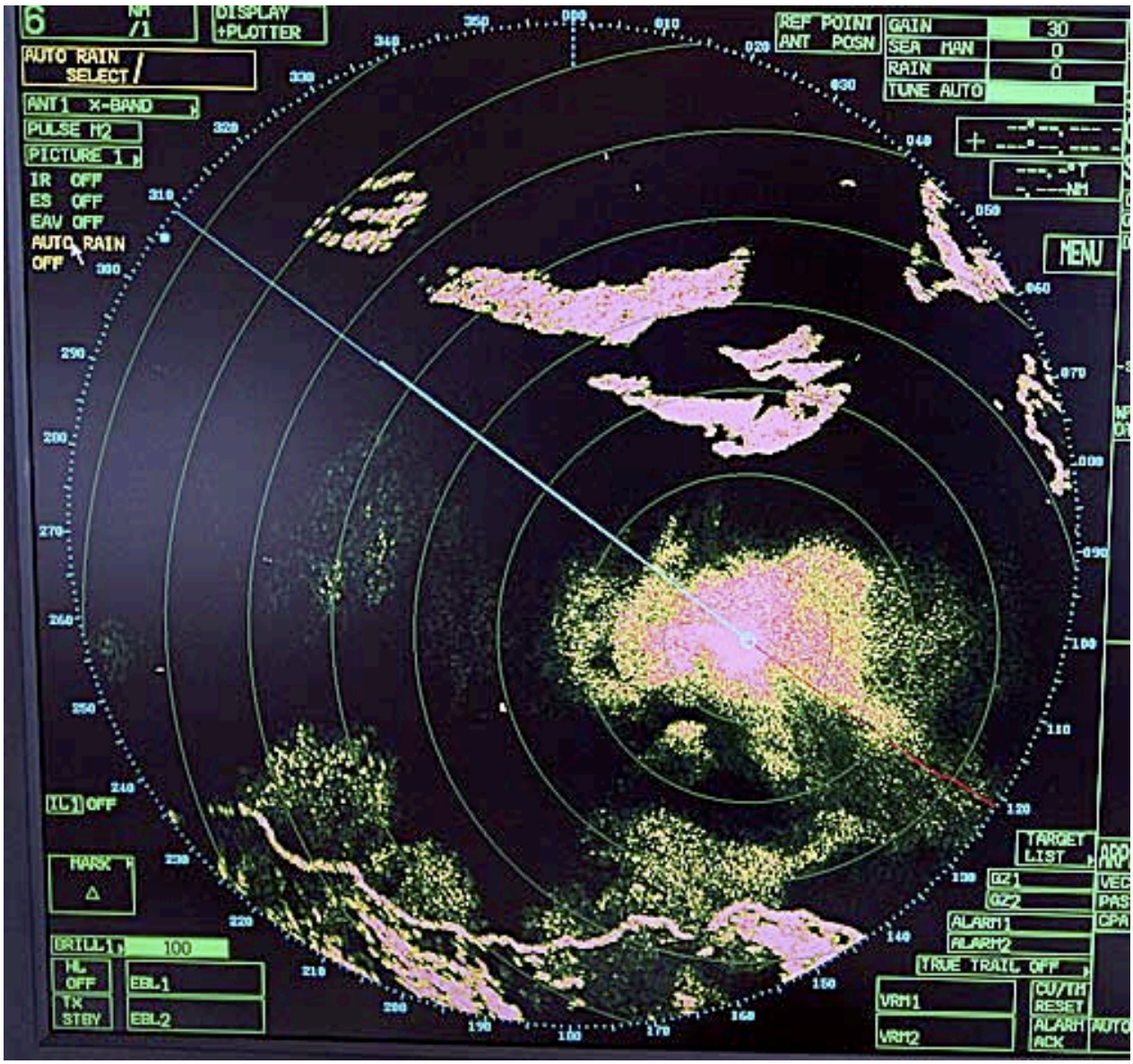
Here's another experiment. We normally have our pulse length set to minimum available on each range. However, lengthening pulse length will make small targets appear larger. The problem is that this also increase the size of the return from wave clutter. The photo above has all the same settings as before, except we've gone from S2 (short 2) on pulse length to M1 (medium 1). The targets are indeed larger and easier to see. But then there is a lot more sea clutter ahead, in particular on the port beam. With calmer seas we would probably use a longer pulse length offshore. But close in, with more targets, we stay with the shortest pulse lengths available.

Rain Clutter

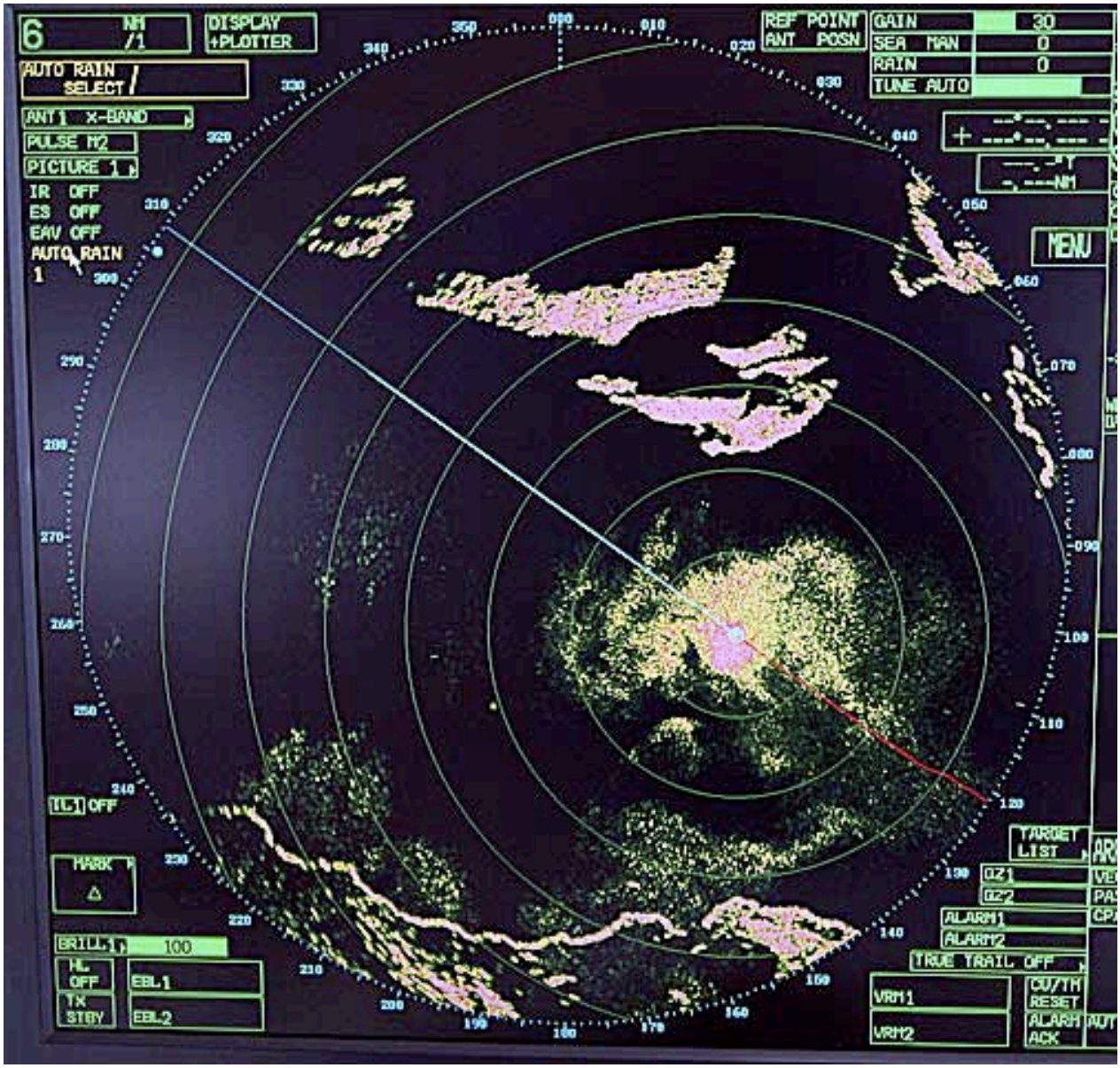
If you've spent much time using X band radar in rain you know that even a small rain shower can mask important targets. All radars have some form of anti-rain clutter control to try and help the situation, but we've never seen one as effective as that on our Furuno 2117.



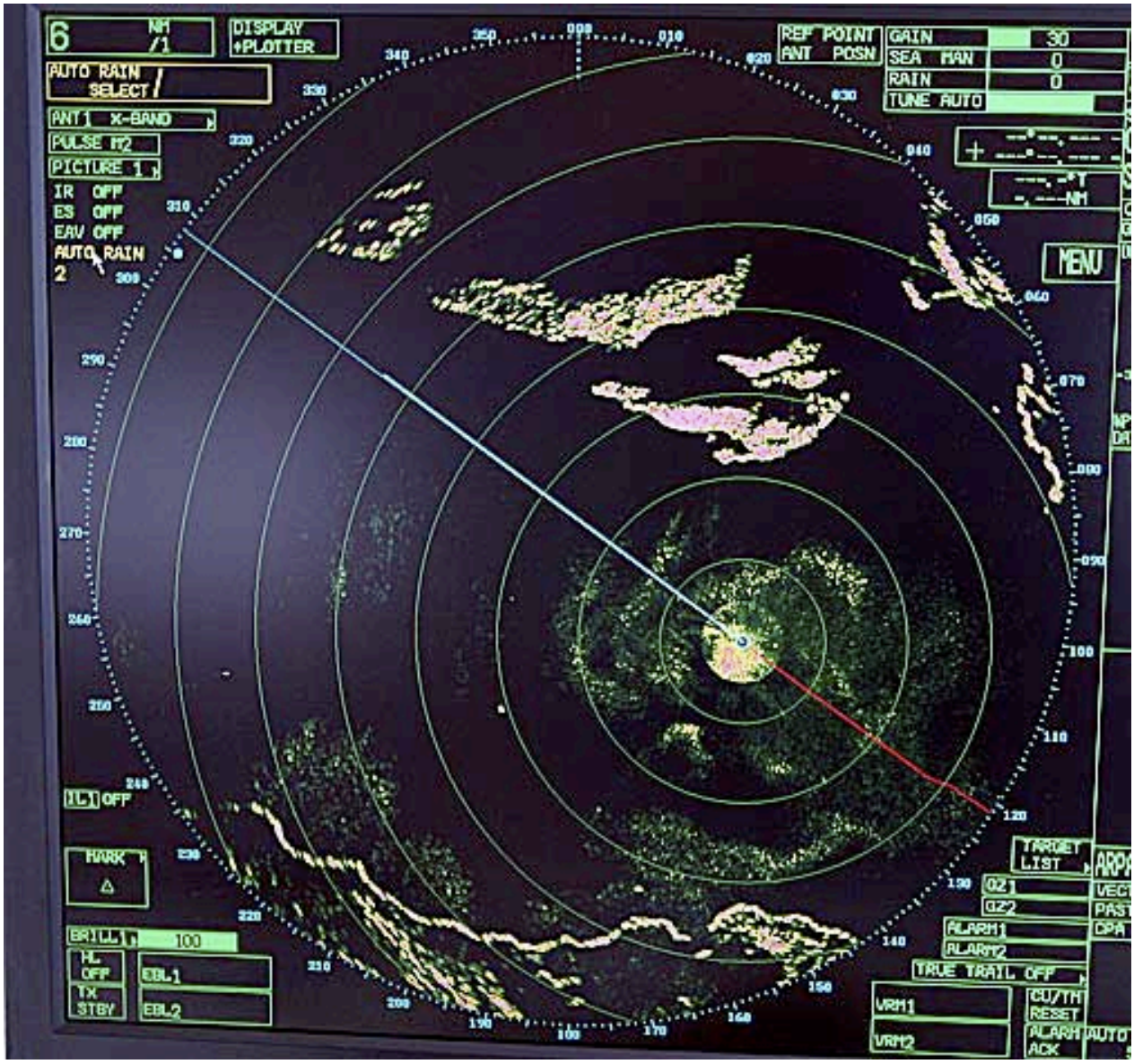
The following series of photos were taken approaching St. Petersburg, Alaska, from the south, on a very wet, intermittently squally afternoon.



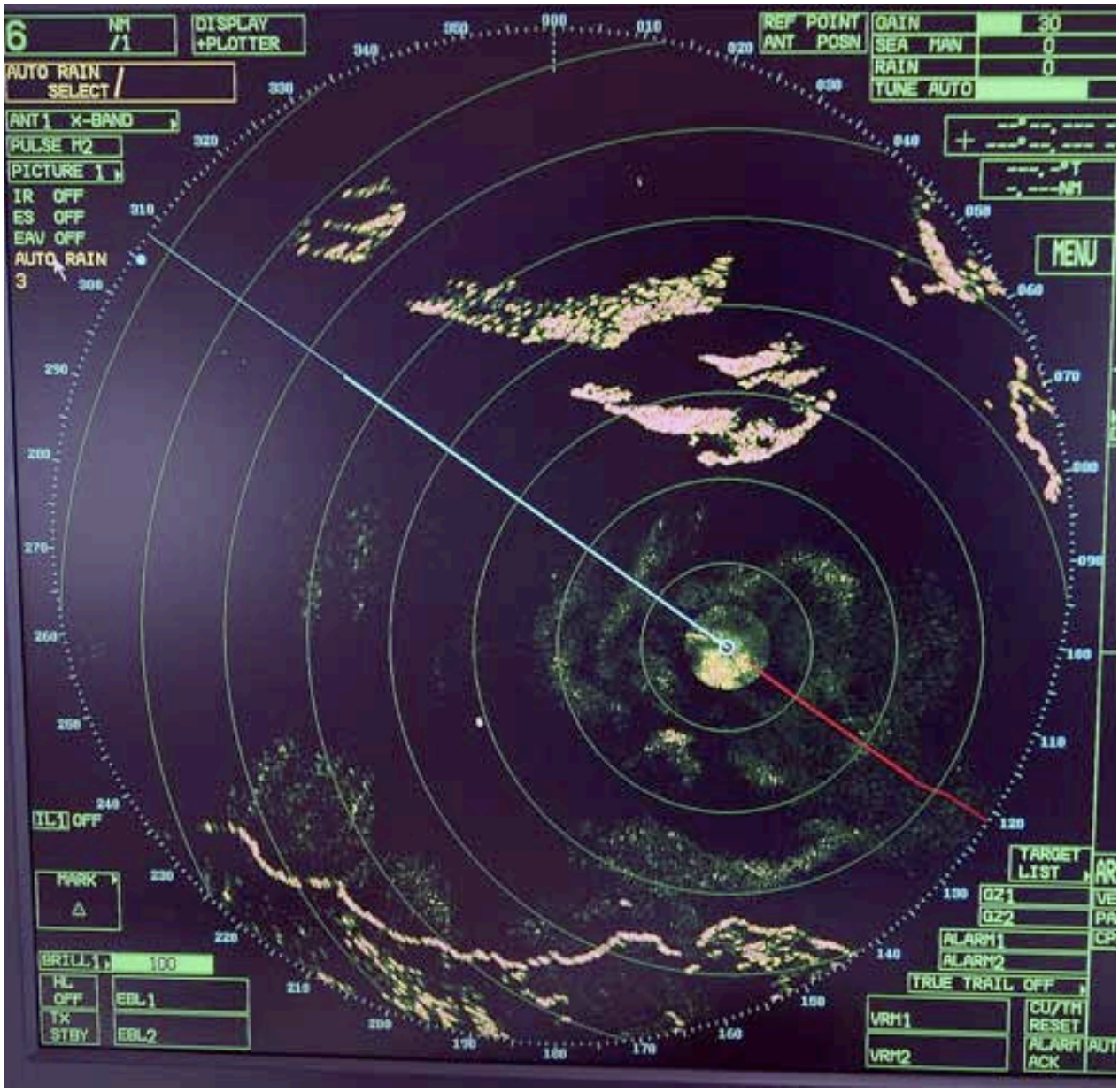
This first image is with Auto Rain turned off. Targets within the one mile range ring are pretty much obscured, and you can see squalls off our port side and just to port off our bow.



Auto Rain is now turned on to level one. Rain clutter is less dense, but still too high to make us comfortable in our ability to see what is ahead of us at close range.



Here we are with Auto Rain set on level two. There's still some interference, but we can see a lot better ahead of the boat .



Auto Rain is now set at three.

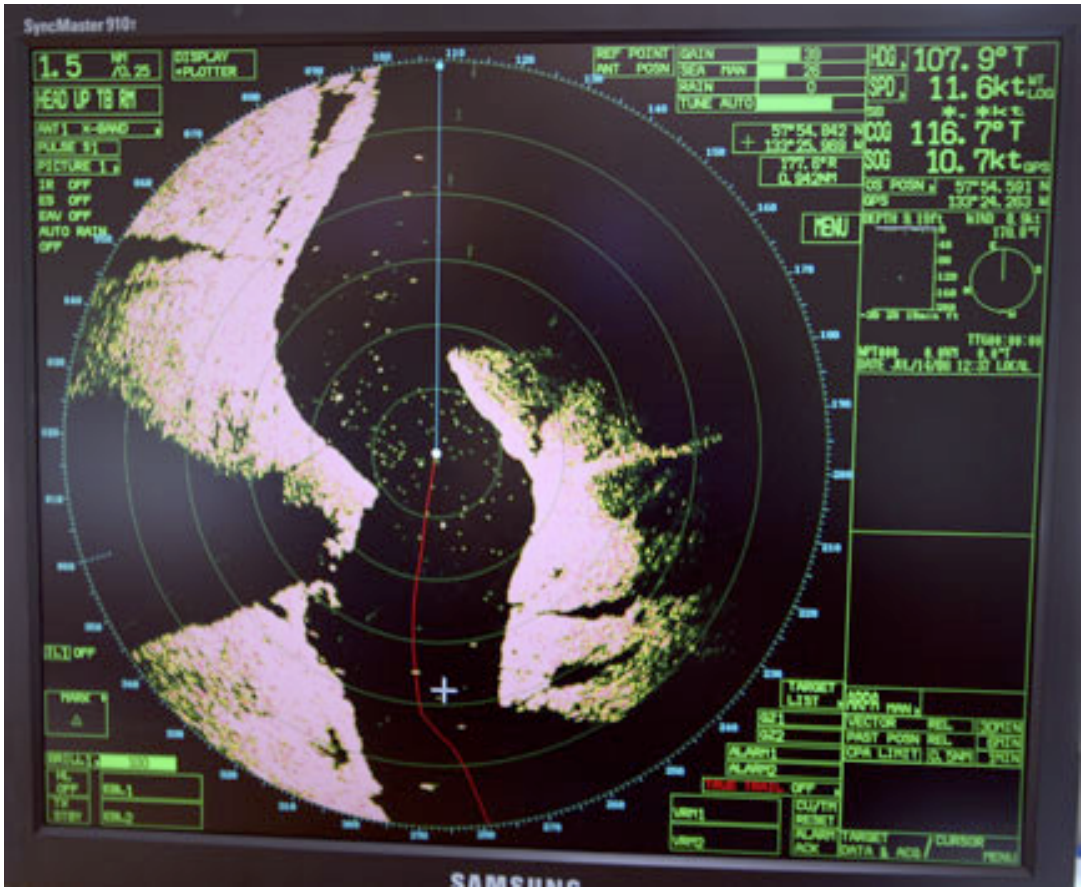
And here we are with Auto Rain set at it highest level, four. Now, go scroll back and compare the land mass and the two boats or buoys shown with this level of Auto Rain and that with it turned off. You'll note that we still have excellent target definition even at level four.

Radar Return From Ice

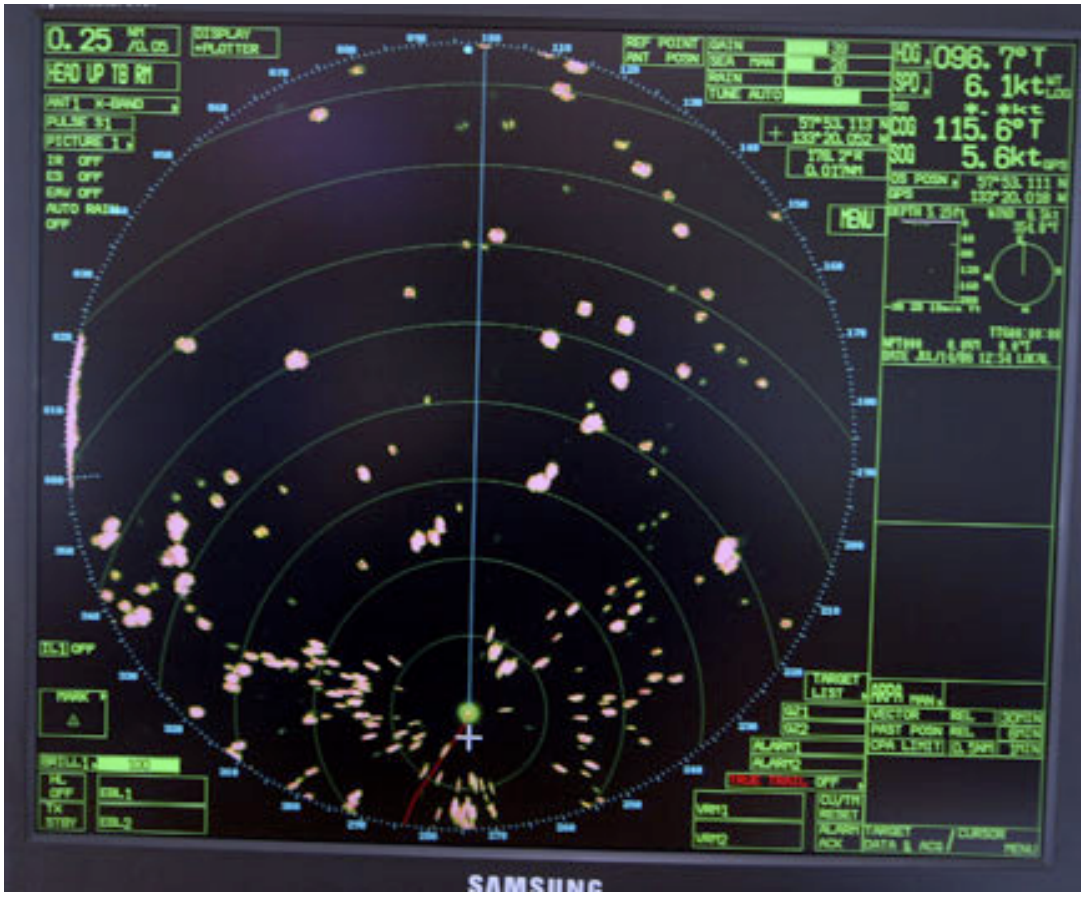
Our distinct preference is to avoid the need to use our radar in ice! But as we are doing a lot of cruising where ice is present, one of these days we're going to have visibility problems with ice flows around.

So, we've been experimenting to see just what the 2117 is capable of in ice.

These photos were taken near the head of Tracy Arm, just south of Ketchikan.



We're coming around a bend in the channel, a couple of miles from the glaciers at the head of Tracy Arm, and the channel is becoming choked with ice. Radar range is set at 1.5 miles, sea clutter is set to 25 and gain is at 30. We have a good impression of a clear path through the ice, but this would not be detailed enough to avoid hitting ice in the denser areas.



This is a lot better. With range set at 1/4 mile we now have a sufficiently detailed picture. This is clearly showing us bergy bits which are a foot or so above the water - and some smaller pieces as well (keep in mind that 90% of the ice is below the waterline, so even a small piece is apt to have a lot of mass).

Could we use this to thread our way in blind conditions? Assuming smooth water, with no return from waves, I think we could do a pretty good job.

Certainly we'd see the bigger pieces with ease. The really big chunks, like that in the photo above, will show up at a several miles. As to the small pieces, we'd probably hit some of those, hopefully without damaging our propellers.

About the Author: Steve Dashew is a yacht designer and the author of eight books. More than 250 of his articles have been published in yachting magazines around the world. His weekly reports can be viewed at www.SetSail.com.