Passage Planning through the 'Tide Gate'

Tides and tidal currents are usually covered fairly quickly towards the end of rather busy Coastal Navigation Courses. After the discussion of a few general principles and sample calculations based on the National Ocean Service (NOS) or Eldridge Tables there is rarely enough time for detailed passage planning in tidal waters. The subject ends up being deferred to a Bareboat Course…where it often receives an equally superficial treatment unless the immediate teaching environment requires it.

Helping the student create a passage plan in tidal waters should be one of the exercises not left aside. The literature provides next to no guidance for the novice, and available navigation programs do not easily support this critical analysis.

One way to start a teaching discussion is by introducing the concept of '*Tide Gates*', distant isolated areas that need to be transited at the appropriate time or within a suitable time window to avoid long delays due to unfavorable currents. Examples of such Tide Gates are entrances and narrow sections of bays or inlets, canals and other connecting waterways. The challenge for the student can be to plan a passage that places the vessel in or near the Tide Gate at a suitable time and leaves enough time to pass through the entire area with a favorable tide.

After determining the location of the Tide Gate for a longer passage, we like to divide this learning module into three manageable questions:

1. What are the opening hours for the Gate, i.e., what are the earliest and latest times the Gate can be transited with at least a minimum of favorable current?
2. What is the distance and estimated travel time to the Gate assuming some effects from current during the approach?
3. What is the distance after the Gate that needs to be cleared before unfavorable conditions pull the vessel back into the Gate?

Figure 1: Many of our coastal waterways are influenced by strong tidal currents. This buoy is stationary in about 3 knots of tidal current. The wake is clearly visible and can serve as a good indicator even from afar.

Let us tackle these questions individually as each of them carries unique learning elements for the student:

1. The opening hours for the Tide Gate on the day of the passage can be found in Tidal Current Tables. Posing the question of opening hours to the student allows him or her to practice looking up the times of slack water and perhaps orient themselves with Tidal Current Charts for the area (if available). Using suitable reference and subordinate station information, the student will have to record the answers for the day of the passage which, for semi-diurnal or mixed tides, includes both favorable tide cycles. For this discussion we refer to the opening and closing times of the Gate as T1 and T2. Arriving earlier than T1 or trying to pass after T2 would bring penalties from counter currents to the point of perhaps making the attempt futile.

2. The student can measure the distance D from the departure point to the Tide Gate. Assuming a sensible boat speed S, an Estimated Time Enroute (ETE) can be calculated as ETE=D/S. It is advisable to not over-estimate the speed S and allow for some influence of residual tidal currents during the approach to the Gate. With a typical 30ft waterline sailing vessel travelling at about 85% of hull speed the student could perhaps assume a range of speeds S of about 5.5-6.5 knots. This is an opportunity for critical assessment: What if the vessel moves faster due to currents or slower because of the sea state or unfavorable winds? Finding a sensible planning speed and assessing the consequences of not being able to keep it teaches a lot about building 'resilient' passage plans. A prudent skipper should never rely on plans being kept, and enough slack should be built in to accommodate deviations.

   By subtracting ETE from T1 the student can determine a tentative earliest departure time. Subtracting ETE from T2 would similarly give the latest time for departure that would still place the boat in the Gate at the time of slack water. The student can record these two times and thus start refining the passage plan.

3. Tide Gates are rarely geographically isolated phenomena. They usually have some area of reduced but still significant current in front or behind them that should be left behind before the tidal current changes direction. How large is this area, and how far does the vessel have to travel before it will not be pulled back? This is an opportunity for the student to appreciate how the complexity of coastlines and bottom characteristics can lead to dramatic changes in current flow. Tidal Current Charts issued by the NOS give very comprehensive views of the current field for every hour of the tidal cycle. Starting with the earliest arrival time at the Tide Gate (see above), the corresponding Tidal Current Charts for subsequent hours will indicate when the tides change at locations after the Gate. The student can again make a sensible assumption about the speed of the vessel during this time and calculate the ETE through the area following the Gate. Tidal Current Charts or Tables can be used to validate that the current has not turned until the area is left astern.

We have successfully used this three-step iterative process of selecting departure times, estimating arrival times at the Gate and finally at a suitable location behind it as a learning module during Bareboat Courses. The students will work their way from an initial plan to one that has enough 'resilience' built in to accommodate small deviations.

The waterways surrounding Tide Gates are often narrow and 'busy', and spending more time than necessary in or near the Gate should be avoided. This type of planning is currently not supported by available navigation software, and executed correctly on paper a successful plan becomes a real accomplishment for the navigator. We routinely transit the notorious Hell Gate in the East River of New York during our Bareboat Courses, and students generally walk away with tremendous respect for the forces of nature but also with a strong feeling of confidence when the passage is fast and uneventful.

This article is dedicated to the late Capt. Michael M. Landers. His love for the water, for sailing and his boundless energy have stimulated many sailing careers. Fair winds and following seas, Mike, wherever you are!

Capt. Christoph A. Winter has been an ASA Sailing Instructor for over 14 years, teaching more than 1000 students mostly in advanced courses and navigation. He is a USCG-licensed Captain and received three ASA Outstanding Instructor awards. He holds a doctorate in nuclear physics from the University of Goettingen, Germany, and he is still fascinated by the perfect rhythm of the oceans…