Crossing the "T" in Antarctica

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In the Battle of Trafalgar, the British fleet demolished the Franco-Spanish fleet by abandoning the traditional deployment of aligning the two fleets side-by-side and blasting away with broadsides. Instead, as the Franco-Spanish fleet sailed slowly northward, the British fleet approached from the west and crossed the path ahead of the Franco-Spanish fleet, aiming broadsides at the lead ship, sinking it, then aiming broadsides at the next ship as it approached, and so on, until nearly the entire Franco-Spanish fleet was sunk or disabled with no losses to the British fleet. This tactic took advantage of the fact that ships-of-the-line in the days of sail had few cannons in the bow. It became known as crossing the "T" in the annals of naval engagements.

Our poster presents a similar tactic for mastering the dynamics of ice discharged from the Antarctic Ice Sheet by way of ice streams. Studies of West Antarctic Ice Streams show that tributaries develop in slow sheet flow and converge to produce fast stream flow. How these tributaries develop is a major unsolved glaciological problem. Crossing the "T" consists of designing an ITASE tractor-train traverse that crosses the tributaries of major ice streams along the main traverse, and then crosses the main traverse with a side traverse that follow a central flowline into the main trunk of the ice stream. This has the advantage of collecting data from several tributaries, to get a sense of how they develop in separate paths, and then follow the main path to track development along flow. This captures development of stream flow transversely and longitudinally. It overcomes a main drawback of "flowband" modeling while avoiding the logistical cost of establishing a traverse grid needed for gridpoint modeling in the map plane.

Two applications of crossing the "T" are presented. The first application will take place during the 2006-2007 ITASE traverse from Taylor Dome to the South Pole. It will consist of crossing the upper end of tributaries feeding into Byrd Glacier, crossing the "T" with a traverse along part of the flowline from Vostok Station to Byrd Glacier. This will connect glaciological records at Vostok and climate records down the Vostok corehole with the ITASE data set and surface velocity data on Byrd Glacier spanning a half-century. It will complement a proposal submitted to NSF to map Byrd Glacier and the zone of tributary glaciers by radar sounding to the bed. A similar strategy is contemplated for another outlet glacier, perhaps Beardmore Glacier, during the 2007-2008 leg of the ITASE traverse.

The other application is presented here as a proposal. After completing the 2007-2008 leg of the ITASE traverse, the tractors will continue to the site of the WAIS deep-drilling site on the West Antarctic ice divide. We propose that the route be around the east side of

Crary Mountains near the heads of Foundation Ice Stream and Support Force Glacier, which deliver the great bulk of East Antarctic ice through the Bottleneck into West Antarctica. This, combined with the already-completed ITASE traverse through the Bottleneck on the west side of Crary Mountains, will provide comprehensive data for modeling discharge of East Antarctic ice into both the Ross and Weddell sectors of West Antarctica. It will allow prognostic modeling of how much East Antarctic ice can be discharged through the Bottleneck as (and if) the West Antarctic Ice Sheet continues its Holocene gravitational collapse. This traverse would also be crossing the "T" and it would look to the future on a scale much larger and more important than what took place by way of Byrd Glacier (and Beardmore Glacier) as the West Antarctic Ice Sheet collapsed in the Ross Sea Embayment to leave the Ross Ice Shelf.

These applications of crossing the "T" in Antarctica provide a pilot study (or studies) of Byrd Glacier (and Beardmore Glacier) that will prepare us for a study of the main event aimed at predicting future ice discharge through the Bottleneck.