Turbulence Mast Project (McPhee/Stanton/Nilsen)

The turbulence mast project is designed to measure mean quantities, turbulent fluxes, and high resolution shear utilizing a variety of instruments including 3-d fixed level acoustic current meters, 3 acoustic Doppler profilers (ADPs), and SBE T, C, and mC sensors. There are three masts, one for measuring near surface fluxes with two turbulence instrument clusters (see Fig. 1); another for fluxes at mid-depth or near the base of the surface mixed layer; and a third for measuring across the pycnocline, or in subpycnocline well mixed layers. The upper mast will include an ADP with typical range of about 30 m in polar water. The lower mast will include high and mid frequency ADPs (Fig. 2), plus a thermistor string spanning the vertical extent of the mast. Diagrams of each are shown in Fig. 3, and possible deployment strategies in Fig. 4.

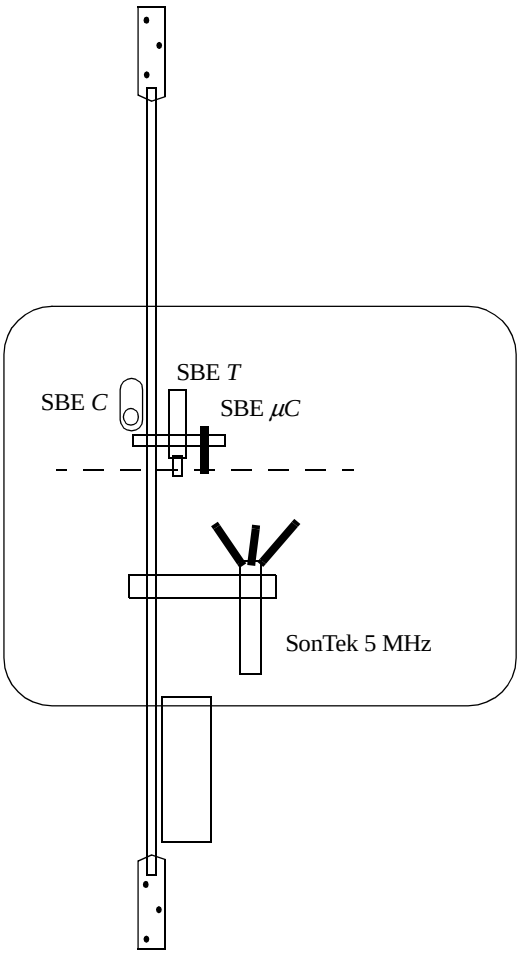


Figure 1. Each Turbulence Instrument Cluster (TIC) comprises Sea-Bird T, C, μC sensors, sampled at rates up to 24 Hz, plus a Sontek acoustic Doppler velocimeter, capable of measuring 3-dimensional currents in a 1x1x2 cm volume 18 cm removed from the sound source, in a plane as indicated by the dashed line. The SBE thermometer and μC sensor are positioned in the same plane, offset so as not to interfere with the velocity measurement. The instruments are all interfaced to a special SBE 9+ CTD system. Data from the SonTek ADVs can be routed either through the integrated serial ports of the SBE 9+, or configured for its analog voltage channels.

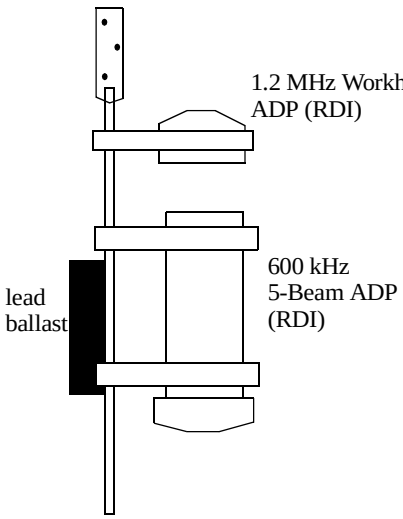


Figure 2. There will be 3 masts deployed at different levels in the water column during MaudNESS. In addition to two TICs, the third mast will include an upward looking, 1.2 MHz ADP, capable of high resolution shear and Reynolds stress profiles across the span of the mast; a downward looking, 5 beam, 0.6 MHz ADP; plus a thermistor string spanning the length of the mast.

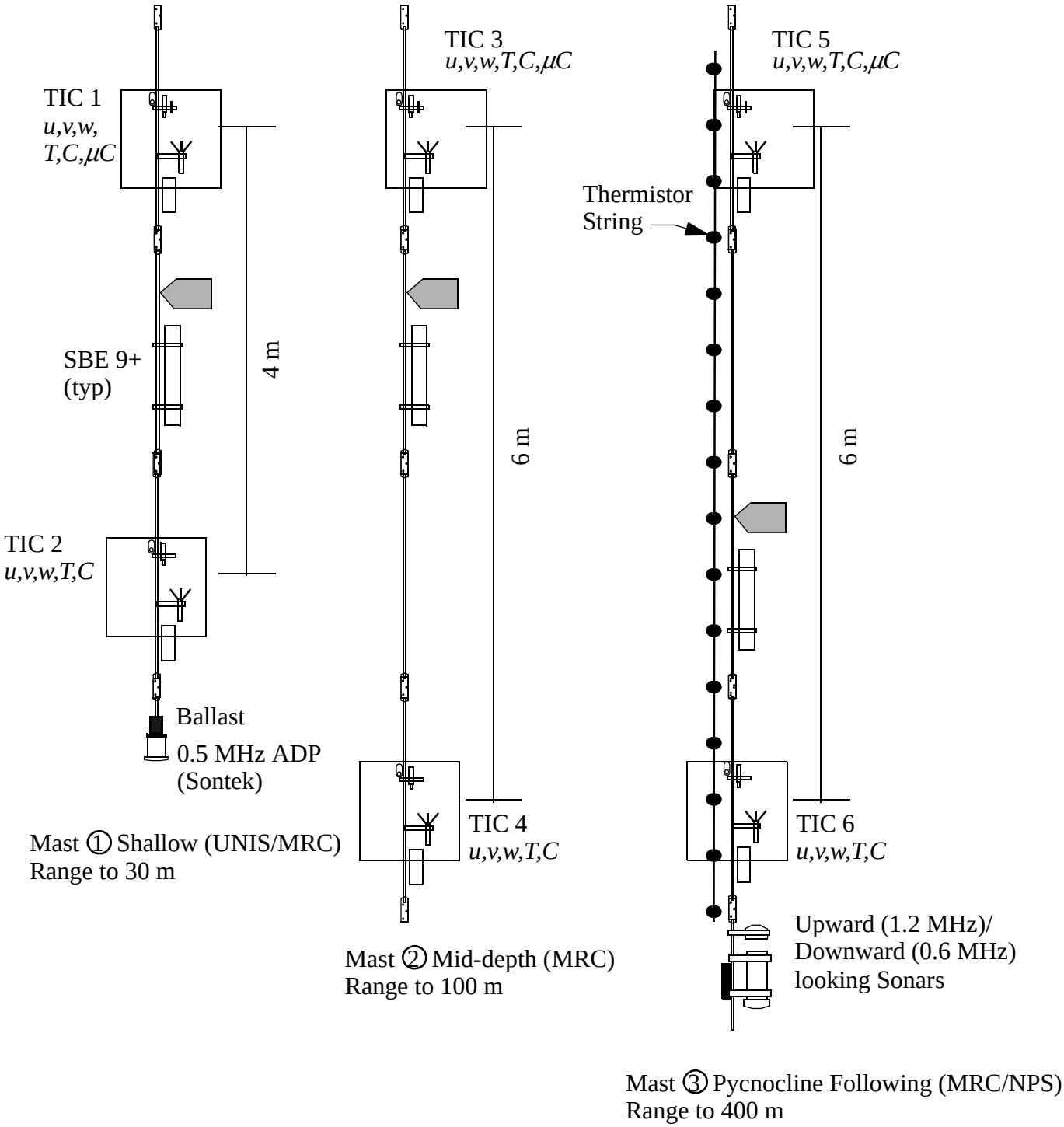
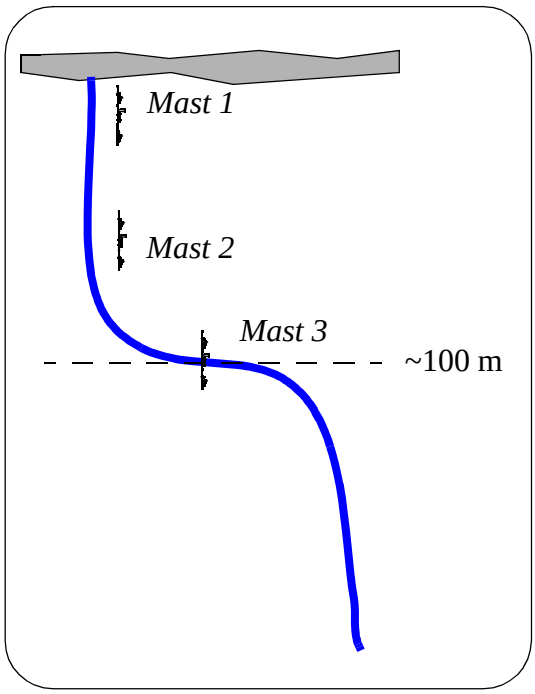
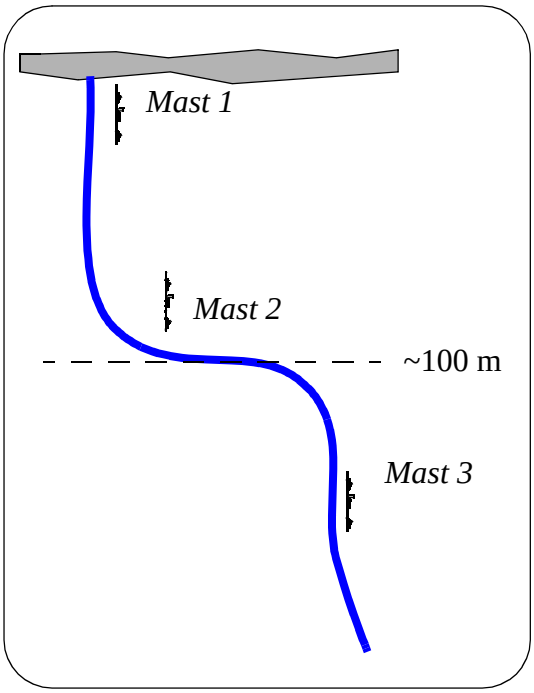


Figure 3. Diagrams of the three separate turbulence masts deployed during MaudNESS.



Deployment configuration when there is no obvious subpycnocline well mixed layer. The elevation of Mast 3 is controlled by a servo driven winch motor interfaced to the cycling CTD, with the system designed to follow major (low frequency) excursions of the pycnocline.



Deployment configuration when there is a subpycnocline well mixed layer, e.g., evidence of Type III thermobaric/cabbeling instability. Here Mast 2 is lowered to investigate fluxes near the base of the surface mixed layer, while Mast 3 is positioned at a fixed level within the subpycnocline well mixed layer.

Figure 4. Deployment scenarios for the drift station phases. Masts 2 and 3 will be deployed from the ship, while Mast 1 will deploy from ice removed from the ship when possible.