Notice of University Oral Examination

Geodesy and Geomatics Engineering

Doctor of Philosophy

Garret Duffy

Thursday, February 23, 2006
Head Hall – ADI Room @ 2:00 pm

Supervisor:	Dr. John Hughes Clarke, Geodesy and Geomatics Eng.
Examining Board:	Dr. David Wells, Geodesy and Geomatics Eng.
	Dr. Karl Butler, Geology
	Dr. Katy Haralampides, Civil Engineering
External Examiner:	Dr. Mike Li, Bedford Institute of Oceanography, NS
Chair:	Dr. Gwendolyn Davies, School of Graduate Studies

Bedform Migration and Associated Sand Transport on a Banner Bank: Application of Repetitive Multibeam Surveying and Tidal Current Measurement to the Estimation of Sediment Transport

ABSTRACT

A new integrated method of measuring bedload transport using repetitive multibeam surveys of a sand bank in Mispec Bay, Saint John, NB, has been developed. Migration rate and morphometric parameters, all derived from the bathymetric dataset, are used to calculate net sediment transport that is expressed as migrating bedforms. This bedform associated sediment transport value was tested for validity by combining observed median grain size and observed hydrodynamic data from one of three M2 tidal current measurement cycles, the latter initially conducted to investigate the nature of the current field in Mispec Bay. The maximum bedform associated bedload transport value of 30 kg/m/tide falls in the range predicted by a pre-existing sediment transport model of the area. At the least, the bedform associated bedload transport value is a good lower estimator of bedload transport. This is because of the unknown component of bedload not expressed in bedform migration.

A conceptual model for the formation and maintenance of the Cape Spencer sand bodies has been proposed. Comparison of observed hydrodynamic data with pre-existing hydrodynamic and sedimentary models of headland localities reveals that the asymmetric coastline of Cape Spencer has an impact on its local current field and consequently sand bank development. With respect to ebbing currents, the coastline of Cape Spencer has an elliptical aspect ratio greater then the threshold necessary to advect a major tidal eddy in Mispec Bay. In contrast, for opposing flood currents the elliptical aspect ratio is less than this threshold to the east so a major eddy is not advected on this tidal phase. Thus, the tidal eddy advected in Mispec Bay locally induces major tidal asymmetry, with a line of net bedload reversal, inferred from hydrodynamic observations, separating the flood dominated and ebb dominated regions. Mispec bank has built up inshore of this line and sediment is continually advected from its tip, where there is an increasing net sediment transport rate; a portion of this sediment ends up being redeposited on the distal end of the bank only to be recirculated around the bank. Therefore, a steady state recirculation appears to maintain the bank.