1011-53-73 **Thomas A. Ivey*** (iveyt@cofc.edu). *An Inverse Problem from Sub-Riemannian Geometry.*

One can regard a sub-Riemannian metric on a contact manifold as the restriction of a Riemannian metric to the contact planes. Such metrics arise naturally in variational problems, and are also known as Carnot-Caratheodory metrics. The behaviour of geodesics—contact curves that are critical for length—is quite different from the Riemannian case, in part because there are one-parameter family of geodesics tangent to each contact direction.

This talk concerns the question of when a collection of such curves (or paths) on a contact 3-manifold M are geodesics of a sub-Riemannian metric. The answer involves the vanishing of a sequence of scalar invariants arising as the torsion of a canonically-defined connection on the frame bundle of the second prolongation of M. These results build on earlier work of Fels on the inverse problem for fourth-order o.d.e. in the calculus of variations.

We conclude with a discussion of examples, and remarks on how similar methods might be applied to sub-Riemannian metrics on four-dimensional Engel manifolds. (Received August 12, 2005)