A simple rocket mission involving two tests of bare-tether application

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A simple rocket mission involving electro-dynamic bare tethers is proposed. In a first electrical arrangement (A), an aluminium tape 1 km long and a hollow cathode are connected to the positive and negative terminals of a power supply with multiple settings; electrons collected by the tape cross the supply and are expelled at the hollow cathode. In a second arrangement (B), the tape and a deployable boom 20 m long are connected to the negative and positive terminals of the power supply; electrons collected by the boom cross the supply and leak out at the rate of ion impact plus secondary yield. Both arrangements provide a broad test of the validity of the Orbital Limited Motion (OML) current-collection law for a bare tether in orbit: Collection is tested for different bias settings; different cross-section shapes; different cross-section sizes (boom cross-section selected to be beyond the OML regime, the tape within that regime); different magnetic and ram-motion effects on the collected particles. Arrangement B provides a first simple test of auroral effects produced by a bare tether left electrically floating in an orbiting satellite: Secondary electrons liberated by ambient ions that impact with keV energies result in column-integrated emissions, as observed from the satellite, showing a peak in brightness that would allow determining the neutral-density vertical profile in a critical E-layer; a solar array and a plasma contactor would be on at daytime to make the tether an autonomous, effective e-beam source for continuous observation of its E-layer emissions. In the rocket B arrangement, tape-bias would vary through an extended series of shots, resulting in different penetrations of secondary electrons into the E-layer.