Let $D_4$ denote the dihedral group of order 8, let $C_m$ denote the cyclic group of order $m$, and assume $n \geq 8$. In a recent class field theory paper, Michael Bush investigated groups that are part of an interesting family of extensions of $D_4$ by $C_2 \times C_2 \times C_{2^{n-5}}$. We proved that for each fixed $n$, there are 8 inequivalent extensions of $D_4$ by $C_2 \times C_2 \times C_{2^{n-5}}$ that are non-isomorphic as groups. We achieved this in two main parts. First, we used group cohomology to prove there are 8 such inequivalent extensions. Second, we used the $p$-group generation algorithm to find presentations for 8 non-isomorphic groups that are extensions of $D_4$ by $C_2 \times C_2 \times C_{2^{n-5}}$. These must be the 8 extensions of interest. In this talk, we will outline our proof. (Received September 20, 2011)