We present here a new rotational analysis of the surface electron ejection by laser excited metastables (SEELEM) spectrum of acetylene in the energy region of the $3\nu_2$ vibrational level of the $\tilde{A}^1\Sigma_u^+$ excited electronic state of $\text{C}_2\text{H}_2$. Experimental conditions have allowed for the first time the assignment of rotational quantum numbers to the long-lived, largely triplet-character SEELEM eigenstates, after which the doorway-mediated coupling of the triplet manifold to the singlet level can be fitted to a spin-orbit effective Hamiltonian. The results of this model concerning the vibronic identities of the triplet states, the magnitude of the spin-orbit interaction, and relative singlet/triplet SEELEM detectivities, will be discussed.