Using a pulsed-nozzle Fourier-transform microwave spectrometer, rotational transitions of the $\text{N}_2\text{O-paraD}_2$ complex were measured in the 5 - 21 GHz frequency region. For each of the $^{14}\text{N}^{14}\text{NO-paraD}_2$, $^{15}\text{N}^{14}\text{NO-paraD}_2$, $^{14}\text{N}^{15}\text{NO-paraD}_2$ and $^{15}\text{N}^{15}\text{NO-paraD}_2$ isotopomers, 4 transitions were recorded. In addition, the nuclear quadrupole hyperfine structure due to the presence of two $^{14}\text{N}$ ($I_z=1$) nuclei and $p\text{D}_2$ ($I_{a\alpha}=1$) were detected and analyzed. Three potential energy surfaces with different orientations of the $p\text{D}_2$ unit relative to $\text{N}_2\text{O}$ were calculated at the CCSD(T) level of theory. The aug-cc-pVTZ basis set was used for all atoms in the complex. Midbond functions were used to complement the basis set. The strategy is to construct a hybrid surface that can reproduce the observed transition frequencies.