The dimeric complexes, CH\textsubscript{3}OH-CO\textsubscript{2} and CH\textsubscript{3}OH-H\textsubscript{2}CO, were observed with pulsed-beam Fourier transform spectrometers at NIST. For the formaldehyde complex a heated reservoir nozzle was employed and pressurized with a gas sample of 1\% methanol in either Ne or Ar carrier and the nozzle heated to about 75 °C. For the CO\textsubscript{2} complex, a cylinder containing 1\% methanol and 1\% CO\textsubscript{2} in Ar was used with a room temperature nozzle. Measurements were carried out from 8 GHz to 23 GHz. Both complexes exhibited internal rotation splitting due to internal rotation of the methyl group, and the formaldehyde complex showed an additional splitting on b-type transitions which is interpreted as a C\textsubscript{2} tunneling motion of the H\textsubscript{2}CO monomer. Several isotopically substituted forms have also been studied for improved structure determination. The CO\textsubscript{2} complex is van der Waals bonded (C of carbon dioxide to O of the methanol), while the formaldehyde complex is hydrogen bonded (H of the hydroxyl group to O of formaldehyde). Discussion of the rotational, Stark, internal rotation, and structure analyses will be presented. These results will be compared to ab initio calculations, as well.