

In this article, construction of what is called the “mini-superambitwistor space” is given by dimensional reduction of a supersymmetrized ambitwistor space. It is shown that the mini-superambitwistor space is useful for an analysis of  $\mathcal{N} = 8$  super Yang-Mills theory in three dimensions; more concretely, it can be used for establishing a Penrose-Ward transform of the theory. Applications of this space to Yang-Mills-Higgs theory in three dimensions are also considered in this article. These results are expected to be useful for further understanding of topological string theory and particularly twistor string theory.