Cancer is a particularly difficult disease to manage and treat, with cancer of the lung being a notably complex disease to treat with radiation therapy. In this study, a stereolithography-based 3D printing process was developed to fabricate human lung phantoms with identical mechanical and physical properties of human lungs in order to assist with targeted radiation therapy. A highly flexible UV photopolymer material with an elastic modulus of approximately 350 KPa was formulated for use in a custom-built stereolithography-based 3D printing apparatus. The printer built for 3D printing of the photopolymer features a large build volume with off-shelf components with fully open-source and efficient design. A lung phantom model of approximately 1/3rd scale was printed and further tested to simulate the tidal breathing motion in a respirator apparatus.