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Abstract	This paper describes the optimization method, which is developed to optimize main structural components of cryogenic upper stages. It utilizes free shape as well as nonlinear shape optimization techniques. Contrary to the optimization of upper stages using storable fuel, the above mentioned structures are subjected not only to high forces and pressures but also to high temperature gradients. Additionally, the production of the structure implies geometrical constraints in the shape of the structure. The goal of this work is therefore to combine these requirements into a comprehensive and as far as possible automated optimization method for use in preliminary structural optimization phase.