requirement is necessary to overcome excessive deformation of segments. Also relatively larger outside diameters are required for segmented containers because segments offer no hoop support to the liner. These are distinct disadvantages of containers using segments.

Because of the practicable design limitations, the designs were evaluated for outside diameters limited to 72 inches and interferences limited to 0.007 in./in. maximum. High-strength liner materials of 300,000 psi ultimate tensile strength were assumed for which some fatigue data were available. A fatigue life of 10^4-10^5 cycles was selected for ideal conditions, i.e., no stress concentrations or material flaws in the liner. On this basis, the predictions of maximum pressure capability for 6-inch-diameter bore designs, for example, are as follows:

Container	Outside Diameter, inches	Maximum Pressure, p, psi
Multi-ring	51.0	300,000
Ring-segment	60.0	290,000
Ring-fluid-segment	72.0	286,000
Pin-segment	72.0	195,000

These pressure capabilities apply at room or elevated temperatures, provided the ultimate strength of the liner is 300,000 psi at temperature. Higher maximum pressures are theoretically possible with higher strength materials. For example, a maximum pressure of 450,000 psi would be predicted for a container with a 450,000 psi ultimate strength liner material, if such a material could be found that had the same proportionate increase in its fatigue strength.

Residual stress limitations were also found for containers designed for high-temperature use. If the coefficient of thermal expansion of the liner is smaller than that of the outer components, then a decrease in temperature from operating temperature to room temperature may cause excessive residual stresses in the liner. Therefore, a higher coefficient of thermal expansion would be recommended for the liner.

There are other possible material limitations. The design evaluations conducted herein were based necessarily on the uniaxial fatigue data available for the liner materials, although a biaxial or triaxial state of stress exists in a pressure container. Also, a compressive mean stress on the liner was assumed beneficial. However, fatigue behavior of high-strength steels under combined stresses and compressive mean stress is unknown. In addition to fabrication and transportation difficulties, heat treatment of large cylindrical forgings may also present problems. In this respect a pin-segment-plate arrangement or a strip-wound layer offers advantages as a replacement of cylindrical rings for outer support members.

A materials study is proposed to determine data on the important properties of high-strength materials for high-pressure container applications. Based upon the design study just completed, a new high-pressure container design is suggested. This design is a combination of two multi-ring containers with a fluid-supporting pressure between the rings. It makes use of the benefits of fluid-support pressure and prestress from shrink-fit. It avoids some of the difficulties associated with the segmented containers. A pressure capability of 450,000 psi can be practicably achieved with this design, with a liner of only 300,000 psi ultimate tensile strength.

Additional details of analysis are included in the appendices of this report. Bending deformations and stresses within segments, and derivations of shrink-fit interferences are some of the items included. Computer programs used for calculations are also briefly described.