Journal of Pressure Vessel Technology

# Guest Editorial

## Second Special Issue on Pressure Vessels Technology Applied to Gun Tubes

The previous open conference with a focus on large caliber gun tube design took place in Oxford, England, in 2002; this gave rise to the August 2003 special issue of JPVT. A second Oxford conference, GT 2005, was held in April 2005; papers from that conference are included in this special issue. The 21st century will require rapid reaction, mobility, and technological effectiveness. This implies weight reduction and more extreme firing environments, including operating pressures, temperatures, and chemistry. In these respects the 30 months between the conferences have produced some significant developments.

By design, a large caliber gun routinely operates closer to its fatigue envelope than virtually any other device. The lifetime of a gun tube is limited by bore damage and by fatigue crack growth, frequently mitigated by advantageous autofrettage residual stresses. The maximum firing pressure is selected to limit plastic behavior. A keynote paper reviews the development of these concepts.

Fatigue lifetime depends crucially upon near-bore thermal damage arising from initial firings. The thermo-mechanical basis for early craze cracking and subsequent loss of liner material has moved from conjecture to general acceptance. A second keynote paper provides an overview of this crucial development. In other papers, coating-substrate mechanics and alternative coating materials are critically examined. Ceramic liners represent an alternative to traditional coating methods, but raise significant challenges—recent work, part of a major project, is reported herein. The drive for reduced weight and improved portability has resulted in significant numerical and experimental investigation of external carbon fiber wrapping; extensive work is reported in detail.

Bauschinger effect, involving the significant nonlinear reverse-loading behavior of pressure vessel steels, reduces the potential benefits of autofrettage; this effect is now incorporated in all realistic analyses. This behavior, unique to each candidate steel, is being fully characterized and made available for input in standard numerical analyses. Other features, including biaxiality effects, are being quantified. Such materials data is, in turn, being used in multi-parameter analysis and optimization. Several papers address one or more of these issues.

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