

A. GARN BUTCHER
Explosives Safety Specialist

**AREAS OF
SPECIALIZATION**

- ▲ Combustion of Solid Propellants
- ▲ Acoustic Instability of solid Propellant rocket motors
- ▲ Sensitivity Response of Solid Propellants
- ▲ Test Development
- ▲ Process Hazards Analysis
- ▲ Quantitative Risk Assessment
- ▲ Detonation and Deflagration of Solid Propellants

EDUCATION

B. E. S., Mechanical Engineering, Brigham Young University, 1972

M.E., Mechanical Engineering, Emphasis on Thermodynamics and Heat Transfer, Brigham Young University, 1972

AFFILIATIONS

Member JANNAF Safety and Hazards Classification Panel

Certified witness by the DOT for Classification testing

Mr. Butcher joined Safety Management Services, Inc. in the West Jordan, UT office in July 2001 after retiring from Alliant Aerospace (formerly Hercules Incorporated) having been employed by them for 29.5 years. Mr. Butcher has been associated with solid propellant testing and analysis in the aerospace industry throughout his career. He has specialized in combustion and detonation hazards research and testing. He is well known in the industry among government and private agencies and is considered an expert in the field of deflagration to detonation transition test and evaluation methods.

DIRECTLY RELATED EXPERIENCE

Propellant Combustion and Acoustic Instability

Conducted acoustic testing and analysis on the Minuteman Third Stage motors related to Lot 13 motor instability through the early 1970's. Published a number of JANNAF reports on acoustic instability test and analysis methods related to Minuteman and other studies on predicting acoustic instability in solid propellant rocket motors.

Assisted in acoustic stability analyses on numerous other motors for the Hercules Bacchus, ABL and McGregor facilities. Served on the JANNAF Acoustic Stability and Propellant Combustion Subcommittees.

Performed testing and analysis on Minuteman II Stage 3 RSLP studies since 1997. Supervised all combustion related testing and data reduction on the RSLP program. Identified potential links between aluminum, aluminum oxide and nitramine content as they affect acoustic instability and saddle pressure at ignition. Published a JANNAF paper related to the findings of this work in 1999.

Engineering and Project Management

Supervised the Hazards Analysis and System Safety engineering group at Alliant from 1997 until retirement in 2001 including supervision of the High Hazard Testing Labs. Managed implementation of System Safety requirements on all major motor production efforts including Process Hazards Analyses of these operations.

Managed a series of Independent Research and Development projects related to explosives characterization and development. Managed a series of contracts with NSWC, Silver Spring MD on the development of a new underwater explosive for a specific

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the development of a new underwater explosive for a specific application.

Hazards Testing and Analysis

Developed numerous diagnostic tests related to the study of deflagration to detonation transition, propellant sensitivity to shock, shear and thermal stimuli and participated in the use of these tests for characterization of solid propellant. Was a principal investigator on a four year study into the phenomenon of impact initiated delayed detonation.

Supervised and conducted testing on a number of pyrotechnic mixtures, gun powders and incendiary powders. Developed a new underwater explosive for the Navy.

EMPLOYMENT HISTORY

- ▲ Safety Management Services, Inc., Salt Lake City, UT,
July 2001-Present, *Explosives Safety Specialist*
- ▲ Alliant Techsystems Inc., Magna, UT, 1972 - 2001, *Mechanical Engineer, Combustion and Hazards Analysis*