PREFACE

Demands on engines used for propulsion and stationary power are increasing, since current applications involve extreme operating conditions and wide variations in load. While performance is the key focus on propulsion engines, particularly for military applications, fuel cost and hence lower specific fuel consumption is the driving factor for stationary engines. Increased speed and range are also desired in addition to reliability and affordability. Though piston engines are extensively used today, gas turbines have taken the lead as primary engines for air, sea, and land power plant operations. Considerable research has been devoted to improve the performance and economy of gas turbine engines. Any further improvements will only be marginal, limited by the thermodynamic efficiency of the constant pressure Brayton cycle. An alternative is to operate an engine using a more efficient thermodynamic cycle. In this context, engines based on pulsed detonation waves, with rapid energy release rates, flexibility, simplicity and easy scalability, operating on a nearly constant volume Humphrey cycle offer a significant potential. Further, multi-tube, multi-cycle detonation engines, with tailored detonations can provide thrust vectoring without external mechanisms, and less moving parts.

Though detonation phenomenon has been studied extensively over the past several decades, and utilized in limited devices, application of detonation to propulsion or stationary engines is not yet realized. The coupling of the various mechanisms and the physical geometry of detonation chambers, and the thermal management are not fully understood. With the recent advances in supercomputing and non-intrusive combustion diagnostics, there has been a global resurgence on applied detonation research focussing on propulsion application. Agencies such as the Russian Foundation for Basic Research and the US Office of Naval Research have sponsored several research projects in detonation, and research and development have been pursued by industry in the US, Europe, and elsewhere. However, funds for research and development have been frugal globally, and have been decreasing in some cases. It was considered timely and appropriate to bring the world's leading researchers in detonation together, and to provide a forum for dissemination of recent research accomplishments, to review the state-of-the-art, and to plan for future efforts.

Consequently an International Colloquium was conducted on "Advances in Experimentation and Computation of Detonations" in St. Petersburg, Russia from September 14 to 17, 1998. The colloquium was jointly supported by the

US Office of Naval Research (ONR)*, ONR International Field Office Europe*, European Research Office of the US Army*, Combustion Council of the Russian Academy of Sciences, Russian Foundation for Basic Research, and ENAS Research & Education Company. Seventy five papers were included as oral and poster presentations. The papers covered the entire spectrum of detonation initiation, detonation wave structure and propagation, detonation mitigation and control, applications of detonation phenomena, and detonability of advanced fuels. Twenty four papers are revised and edited, and included in this volume.

We have attempted to select a proper spectrum of articles to present, as complete a picture as possible, on the advances in experimentation and computation of detonations from basic detonation initiation to practical applications. We have tried to organize the papers in a uniform and easily readable manner, and hope this volume provides adequate insight to the readers with information that will suit their needs. The addresses of the contributors, and a number of references given at the end of each article will enable the reader to further follow up or obtain more information, if needed. This book is intended as a reference for practicing engineers, and as a reference or text for advanced course in detonations.

This book is the result of a number of people who have rendered their time and talent. The editors acknowledge the excellent contribution made by Ms. Olga Frolova, Ms. Marina Sedakova, Ms. Lyudmila Kokushkina, and Mr. Peter Sedakov from ENAS Publishers in producing this volume. We also thank Academician A. G. Merzhanov, the Chair of the Combustion Council of the Russian Academy of Sciences, Prof. S. A. Tsyganov of the Russian Foundation for Basic Research, Prof. Yu. A. Gordopolov of the Institute for Structural Macrokinetics, and Ms. Irina Serova, Ms. Julia Vinyarskaya, and Mr. Alexander Melamed from ENAS Research & Education Company, who helped in organizing and conducting the colloquium, which made the publication of this book possible.

Gabriel Roy
Sergei Frolov
Kazhikathra Kailasanath
Nickolay Smirnov

*The content of the information does not necessarily reflect the position of the United States Government and no official endorsement should be inferred.