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Preface

The world-wide research and technology development activities in hypersonics seems to follow a cycle due to the programs linked with the appearance of a new generation of vehicles. A tremendous effort was made to develop hypersonic technology during the Apollo era. During this period, technology superiority was at stake and cost was not an issue. A second peak of activities occurred in the United States with the development of the Space Shuttle, followed by technology programs such as Hermes and NASP. Finally, the current hypersonic activities are emerging with a focus on the development of low cost reusable launch vehicles. This new generation of vehicles is totally driven by economic aspects, but it does have implications on military capabilities.

The scientific community adapts to these cyclic activities with great difficulty. It is hard to maintain the necessary skills and facilities when there are no approved hypersonic projects. It is even more difficult to re-create them when new projects do appear, Although it may not have been the original objective of this Working Group, which was under the auspices of the AGARD Fluid Dynamics Panel (FDP), the Working Group has contributed to maintain an interest in hypersonics within NATO during the period 1991-1997 when programs like NASP in the United States and Hermes in Europe were progressively abandoned, and the reusable launch vehicle projects were not yet firmly in place. This period was the right time to turn towards hypersonic capabilities, and look at what could be put together, within NATO, to enhance confidence in hypersonic analysis and design tools. The WG18 exploited the opportunity well, and significant advances have been made in understanding hypersonic physics and in validating hypersonic analysis and design tools. In addition, durable links have been established amongst participants from various countries.

The present AGARD Advisory Report is the second and final volume edited by the WG18. Whereas the first volume was mainly focused upon the design methodology, plans, and initial results of experiments conducted to serve as validation benchmarks, the current volume presents a detailed experimental data base and the corresponding computations.

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The Chairman and Co-Chairman would like to extend their special thanks to Mr Jean Muylaert, who served as secretary to the group for the entire period. Mr Muylaert was responsible for maintaining high technical quality of the output of WG18. He is also the principal editor for this final report.

Recent Publications of the Former AGARD Fluid Dynamics Panel

AGARDOGRAPHS (AG)

Turbulent Boundary Layers in Subsonic and Supersonic Flow
AGARD AG-335, July 1996

Computational Aerodynamics Based on the Euler Equations
AGARD AG-325, September 1994

Scale Effects on Aircraft and Weapon Aerodynamics
AGARD AG-323 (E), July 1994

Design and Testing of High-Performance Parachutes
AGARD AG-319, November 1991

Experimental Techniques in the Field of Low Density Aerodynamics
AGARD AG-318 (E), April 1991

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RTO Report MP-5, November 1998

Advanced Aerodynamic Measurement Technology
AGARD CP-601, May 1998

Aerodynamics of Wind Tunnel Circuits and Their Components
AGARD CP-585, June 1997

The Characterization & Modification of Wakes from Lifting Vehicles in Fluids
AGARD CP-584, November 1996

Progress and Challenges in CFD Methods and Algorithms
AGARD CP-578, April 1996

Aerodynamics of Store Integration and Separation
AGARD CP-570, February 1996

Aerodynamics and Aeroacoustics of Rotorcraft
AGARD CP-552, August 1995

Application of Direct and Large Eddy Simulation to Transition and Turbulence
AGARD CP-551, December 1994

Wall Interference, Support Interference, and Flow Field Measurements
AGARD CP-535, July 1994

Computational and Experimental Assessment of Jets in Cross Flow
AGARD CP-534, November 1993

High-Lift System Aerodynamics
AGARD CP-515, September 1993

Theoretical and Experimental Methods in Hypersonic Flows
AGARD CP-514, April 1993

Aerodynamic Engine/Airframe Integration for High Performance Aircraft and Missiles
AGARD CP-498, September 1992

Effects of Adverse Weather on Aerodynamics
AGARD CP-496, December 1991

Manoeuvring Aerodynamics
AGARD CP-497, November 1991

Vortex Flow Aerodynamics
AGARD CP-494, July 1991

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Ice Accretion Simulation
AGARD AR-344, Report of WG-20, December 1997

Sonic Nozzles for Mass Flow Measurement and Reference Nozzles for Thrust Verification
AGARD AR-321, Report of WG-19, June 1997

Cooperative Programme on Dynamic Wind Tunnel Experiments for Manoeuvring Aircraft
AGARD AR-305, Report of WG-16, October 1996

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AGARD AR-319, Vol. I, Report of WG-18, May 1996

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AGARD AR-318, Report of WG-17, September 1995

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AGARD AR-291, Technical Status Review, July 1991

EDUCATIONAL NOTES (EN)

Fluid Dynamic Research on Supersonic Aircraft
RTO EN-4, Special Course Notes, November 1998

REPORTS (R)

High Speed Body Motion in Water
AGARD R-827, February 1998

Turbulence in Compressible Flows
AGARD R-819, Special Course Notes, June 1997

Advances in Cryogenic Wind Tunnel Technology
AGARD R-812, Special Course Notes, January 1997

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AGARD R-813, Special Course Notes, October 1996

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AGARD R-803, Special Course Notes, November 1994

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