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ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

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AGARD ADVISORY REPORT 319

Hypersonic Experimental and Computational Capability, Improvement and Validation

(l'Hypersonique expérimentale et de calcul – capacité, amélioration et validation)

Volume II

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| Aerothermodynamics | Real gas effects | | | | | | | | | | | | | | | | |
| Rarefied gas dynamics | | | | | | | | | | | | | | | | | |
| 14. Abstract The results of the phase II effort conducted under AGARD Working Group 18 on Hypersonic Experimental and Computational Capability, Improvement and Validation are presented in this report. The first volume, published in May 1996, mainly focused on the design methodology, plans and some initial results of experiments that had been conducted to serve as validation benchmarks. The current volume presents the detailed experimental and computational data base developed during this effort. | | | | | | | | | | | | | | | | | |

Hypersonic Experimental and Computational Capability, Improvement and Validation

(AGARD AR-319 Vol. II)

Executive Summary

The present report is a summary of four years of activity by the AGARD Fluid Dynamics Panel's Working Group WG-18. This Working Group was composed of a group of senior managers and researchers from the United States and Western Europe. An initial report, which summarized the first two years of the Working Group, was published in May 1996.

A series of experiments conducted on standard test models in a wide range of hypersonic facilities provided a unique opportunity for facility and computational fluid dynamics code development. In addition, the Working Group contributed to the success of the initial calibration and shake-out of four new real-gas facilities.

This work has resulted in a better focusing of the major issues remaining in hypersonic vehicle design, and to a wide range of recommendations to address these issues. Specifically, it is recommended that resources be allocated within the NATO nations to:

- Resolve facility, computational and modeling deficiencies with targeted research efforts
- Accelerate the multiple facility/multiple computational strategy with standard models

The need for sustained hypersonic flight has been expressed by a number of NATO member states. Support of the above recommendations and the definition of specific NATO-wide projects, which will serve as drivers for increased collaboration in the future, would greatly advance the state of the art for Hypersonic Vehicle Design.

L'hypersonique expérimentale et de calcul – capacité, amélioration et validation

(AGARD AR-319 Vol. II)

Synthèse

Ce rapport est un résumé de quatre années d'activités du groupe de travail WG-18 du Panel AGARD de la dynamique des fluides. Le groupe a été composé de cadres supérieurs et de chercheurs des Etats-Unis et de l'Europe occidentale. Un premier rapport, résumant les deux premières années de travaux, a été diffusé au mois de mai 1996.

Une série d'expériences, réalisées sur des maquettes normalisées, dans des installations hypersoniques très diverses, a permis le développement en parallèle des installations et des codes de calcul. En outre, le groupe de travail a contribué au succès de l'étalonnage initial et à la mise en service de 4 nouvelles installations à gaz réel.

Ces travaux ont permis une meilleure compréhension des principales difficultés qui restent à résoudre dans le domaine de la conception des véhicules hypersoniques, et ont donné lieu à des recommandations permettant de les aborder. En particulier, il est recommandé que des ressources soient affectées au sein des pays membres de l'OTAN, afin de :

- Suppléer les carences au niveau des installations, des maquettes et des codes de calcul par des efforts de recherche bien ciblés
- Accélérer le progrès de la stratégie « installations multiples/calculs multiples » par l'adoption de maquettes normalisées

La capacité de vol hypersonique soutenu a été demandée par bon nombre de pays membres de l'OTAN. L'approbation et l'appui de ces recommandations, ainsi que la définition de projets spécifiques tout-OTAN pourraient être le moteur d'une collaboration plus intensive à l'avenir, qui feraient progresser de façon considérable l'état actuel des connaissances dans le domaine de la conception des véhicules hypersoniques.