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Fluid Dynamics Research on Supersonic Aircraft

(les Travaux de recherche en dynamique des fluides relatifs aux aéronefs supersoniques)

This report is a compilation of the edited proceedings of the Special Course on "Fluid Dynamics Research on Supersonic Aircraft" held at the von Kármán Institute for Fluid Dynamics (VKI) in Rhode-Saint-Genèse, Belgium, 25-29 May 1998.

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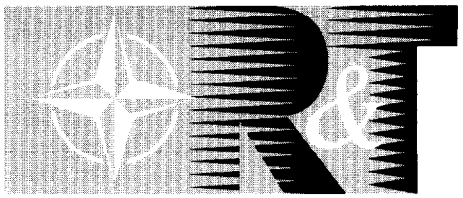

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Fluid Dynamics Research on Supersonic Aircraft

(RTO EN-4)

Executive Summary

This report is a compilation of the edited proceedings of the Special Course on "Fluid Dynamics Research on Supersonic Aircraft" held at the von Kármán Institute for Fluid Dynamics (VKI) in Rhode-Saint-Genèse, Belgium, 25-29 May, 1998.

Considering the growth in air travel demand on long range routes, high speed transportation is now being seriously considered. The evaluation of the current state-of-the-art in high speed aerodynamic research and its coupling with connected fields, namely those related to economical feasibility and environmental aspects, is mandatory to determine the status of the critical technologies which are necessary for the development of high speed transport aircraft. It should be noted that many of the current critical technologies relate both to commercial and military aircraft.

This series of lectures, supported by the RTO Applied Vehicle and Technology Panel and the von Kármán Institute for Fluid Dynamics, reviewed the current major supersonic transport programs of Europe, Japan, Russia and the United States; and included detailed lectures addressing aerodynamic design methods including optimization of L/D, laminar flow control, vortical flow and aerodynamic interference; environmental aspects including sonic boom and emissions; and propulsion integration.

The environmental and economic barriers to high-speed flight remain a challenge. There is some thought that a supersonic corporate jet may be the first supersonic civil aircraft of the next generation to be produced. Military technology and excess production capacity may provide the basis for making such an aircraft affordable.

Les travaux de recherche en dynamique des fluides relatifs aux aéronefs supersoniques

(RTO EN-4)

Synthèse

Ce rapport est un recueil du compte rendu du cours spécial sur "La recherche en dynamique des fluides pour les aéronefs supersoniques" organisé à l'Institut von Kármán (VKI) à Rhode-Saint-Genèse en Belgique, du 25 au 29 mai 1998.

Vu la croissance de la demande de places sur les lignes long courrier, des efforts considérables sont actuellement consacrés à l'étude du transport à grande vitesse. Par conséquent, il est nécessaire d'évaluer l'état actuel des connaissances dans le domaine de la recherche en aérodynamique supersonique, ainsi que ses liens avec certains domaines connexes, comme la faisabilité économique et l'environnement, afin de déterminer l'état d'avancement des technologies critiques nécessaires au développement des avions de transport à grande vitesse. Il y a lieu de noter que bon nombre de ces technologies déterminantes s'appliquent à la fois aux aéronefs civils et militaires.

Ce cours, présenté sous l'égide conjointe de la Commission RTO des technologies appliquées aux véhicules et l'Institut von Kármán, a fait le point des grands programmes concernant les avions de transport supersoniques actuellement en cours de développement en Europe, au Japon, en Russie et aux États-Unis. Le programme a inclu notamment des présentations très complètes sur les méthodes de conception aérodynamique y compris l'optimisation de la portance/traînée, le contrôle des écoulements laminaires, les écoulements tourbillonnaires et l'interférence aérodynamique, ainsi que l'intégration de la propulsion. En ce qui concerne l'environnement, le bang sonique et les émissions ont également été examinés.

A l'heure actuelle, les défis posés par les barrières économiques et écologiques au vol à grande vitesse restent à relever. A l'avis de certains, le premier aéronef supersonique civil de la prochaine génération à être réalisé pourrait être un jet privé, auquel cas, l'acceptabilité financière d'un tel aéronef pourrait être obtenue par le biais des technologies militaires, associées à un excédent de capacité de production.

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Special Course Staff

COURSE DIRECTORS

Professor R. SEEBASS
University of Colorado
Aerospace Engineering Sciences
Campus Box 429
Bourder, CO 80303-0429
United States

Professor J-M. CHARBONNIER
von Kármán Institute for Fluid Dynamics
Chaussée de Waterloo, 72
1640 Rhode-Saint-Genèse
Belgium

LECTURERS

Dr. D. PRAT
Aérospatiale-Aéronautique
Direction Technique
Service A/BTE/EG/Aéro
316, Route de Bayonne
31060 Toulouse Cedex, France

Doctor J.J. THIBERT
ONERA
Directeur Aérodynamique Appliquée
29, Avenue Division Leclerc
B.P. 72
92322 Châtillon Cedex, France

Dr. J. MERTENS
Daimler-Benz Aerospace-Airbus GmbH
D-28183 Bremen, Germany

Professor H. SOBIECZKY
DLR German Aerospace Center
Department SM/SK
Bunsenstrasse, 10
D-37073 Gottingen, Germany

Doctor K. YOSHIDA
Advanced Tech. Aircraft Project Center
National Aerospace Laboratory
6-13-1, Osawa, Mitaka
Tokyo, 181-0015, Japan

Professor A. KHARITONOV
Head of Aerodynamic Division
Institute of Theoretical and
Applied Mechanics SB RAS (ITAM)
Instituskaya 4/1
Novosibirsk, 630090, Russia

Mr. A. CROSS
Aerodynamic Technology Dept
British Aerospace Military Aircraft
and Aerostructures
Brough, East Riding of Yorkshire, HU15 1EQ
United Kingdom

Mr. B. PROBERT
Aerodynamics Dept (W310P)
British Aerospace Military Aircraft
and Aerostructures
Warton Aerodrome
Preston, Lancashire PR4 1AX
United Kingdom

Professor R. SEEBASS
University of Colorado
Aerospace Engineering Sciences
Campus Box 429
Bourder, CO 80303-0429, USA

Professor P. SFORZA
Director Graduate Research
and Engineering Center
University of Florida
1350 N. Poquito Road
Shalimar, FL 32579, USA

Mr. A. WHITEHEAD
Manager of High Speed Research Project
Environmental Impact Team
NASA Langley Research Center
Hampton, VA 23665-5225, USA

PANEL EXECUTIVE

Mr. J.K. MOLLOY

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14. Abstract

Contains the lecture notes prepared for a Special Course on 'Fluid Dynamics Research on Supersonic Aircraft' organised by the RTO Applied Vehicle Technology Panel (AVT). The Course was held at the von Kármán Institute for Fluid Dynamics (VKI) Institute, Rhode-Saint-Genèse, Belgium 25-29 May 1998.

The following topics were covered: History & Economics of Supersonic Transports, Supersonic Aerodynamics, Sonic Boom Theory and Minimization, Multi-Point Design Challenges, Vortex Plume Interactions, Propulsion System Design. Presentations on the major world wide supersonic transport programs were also included.

The material assembled in this publication was prepared under the combined sponsorship of the RTO Applied Vehicle Technology Panel, the Consultant and Exchange Program of RTO, and the von Kármán Institute (VKI) for Fluid Dynamics.

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