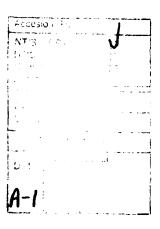


AGARD-CP-448

# NORTH ATLANTIC TREATY ORGANIZATION ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT (ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD)

## AGARD Conference Proceedings No.448 ENGINE CONDITION MONITORING — TECHNOLOGY AND EXPERIENCE





Papers presented at the Propulsion and Energetics Panel 71st Symposium, held in Quebec City, Canada, 30 May-3 June 1988.



### THE MISSION OF AGARD

According to its Charter, the mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes:

- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community;
- Providing scientific and technical advice and assistance to the Military Committee in the field of aerospace research and development (with particular regard to its military application);
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
- Exchange of scientific and technical information;
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential;
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field.

The highest authority within AGARD is the National Delegates Board consisting of officially appointed senior representatives from each member nation. The mission of AGARD is carried out through the Panels which are composed of experts appointed by the National Delegates, the Consultant and Exchange Programme and the Aerospace Applications Studies Programme. The results of AGARD work are reported to the member nations and the NATO Authorities through the AGARD series of publications of which this is one.

Participation in AGARD activities is by invitation only and is normally limited to citizens of the NATO nations.

The content of this publication has been reproduced directly from material supplied by AGARD or the authors.

Published October 1988
Copyright © AGARD 1988
All Rights Reserved

ISBN 92-835-0481-X



Printed by Specialised Printing Services Limited 40 Chigwell Lane, Loughton, Essex IG10 3TZ



### RECENT PUBLICATIONS OF THE PROPULSION AND ENERGETICS PANEL

#### Conference Proceedings

Testing and Measurement Techniques in Heat Transfer and Combustion AGARD Conference Proceedings No.281, 55th A Meeting, May 1980

Centrifugal Compressors, Flow Phenomena and Performance AGARD Conference Proceedings No.282, 56th B Meeting, May 1980

Turbine Engine Testing
AGARD Conference Proceedings No.293, 56th Meeting, Sep/October 1980

Helicopter Propulsion Systems AGARD Conference Proceedings No.302, 57th Meeting, May 1981

Ramjets and Ramrockets for Military Applications AGARD Conference Proceedings No.307, 58th Meeting, October 1981

Problems in Bearings and Lubrication AGARD Conference Proceedings No.323, 59th Meeting, May/June 1982

Engine Handling
AGARD Conference Proceedings No.324, 60th Meeting, October 1982

Viscous Effects in Turbomachines AGARD Conference Proceedings No.351, 61st A Meeting, June 1983

Auxiliary Power Systems AGARD Conference Proceedings 352, 61st B Meeting, May 1983

Combustion Problems in Turbine Engines AGARD Conference Proceedings 353, 62nd Meeting, October 1983

Hazard Studies for Solid Propellant Rocket Motors AGARD Conference Proceedings 367, 63rd A Meeting, May/June 1984

Engine Cyclic Durability by Analysis and Testing AGARD Conference Proceedings No.368, 63rd B Meeting, May/June 1984

Gears and Power Transmission Systems for Helicopters and Turboprops AGARD Conference Proceedings No.369, 64th Meeting October 1984

Heat Transfer and Cooling in Gas Turbines AGARD Conference Proceedings No.390, 65th Meeting, May 1985

Smokeless Propellants AGARD Conference Proceedings No.391, 66th A Meeting, September 1985

Interior Ballistics of Guns AGARD Conference Proceedings No.392, 66th B Meeting, September 1985

Advanced Instrumentation for Aero Engine Components AGARD Conference Proceedings No.399, 67th Meeting, May 1986

Engine Response to Distorted Inflow Conditions AGARD Conference Proceedings No.400, 68th A Meeting, September 1986

Transonic and Supersonic Phenomena in Turbomachines AGARD Conference Proceedings No.401, 68th B Meeting, September 1986

Advanced Technology for Aero Engine Components AGARD Conference Proceedings No.421, 69th Meeting, September 1987

Combustion and Fuels in Gas Turbine Engine AGARD Conference Proceedings No.422, 70th Meeting, October 1987



### **Working Group Reports**

Aircraft Fire Safety
AGARD Advisory Report 132, Vol.1 and Vol.2. Results of WG11 (September and November 1979)

Turbulent Transport Phenomena (in English and French) AGARD Advisory Report 150. Results of WG 09 (February 1980)

Through Flow Calculations in Axial Turbomachines AGARD Advisory Report 175. Results of WG 12 (October 1981)

Alternative Jet Engine Fuels AGARD Advisory Report 181. Vol.1 and Vol.2. Results of WG 13 (July 1982)

Suitable Averaging Techniques in Non-Uniform Internal Flows AGARD Advisory Report 182 (in English and French). Results of WG 14 (June/August 1983)

Producibility and Cost Studies of Aviation Kerosines AGARD Advisory Report 227. Results of WG 16 (June 1985)

Performance of Rocket Motors with Metallized Propellants AGARD Advisory Report 230. Results of WG 17 (September 1986)

#### Lecture Series

Non-Destructive Inspection Methods for Propulsion Systems and Components AGARD LS 103 (April 1979)

The Application of Design to Cost and Life Cycle Cost to Aircraft Engines AGARD LS 107 (May 1980)

Microcomputer Applications in Power and Propulsion Systems AGARD LS 113 (April 1981)

Aircraft Fire Safety AGARD LS 123 (June 1982)

Operation and Performance Measurement of Engines in Sea Level Test Facilities AGARD LS 132 (April 1984)

Ramjet and Ramrocket Propulsion Systems for Missiles AGARD LS 136 (September 1984)

3-D Computation Techniques Applied to Internal Flows in Propulsion Systems AGARD LS 140 (June 1985)

Engine Airframe Integration for Rotorcraft AGARD LS 148 (June 1986)

Design. Methods Used in Solid Rocket Motors AGARD LS 150 (April 1987) AGARD LS 150 (Revised) (April 1988)

### Other Publications

Airbreathing Engine Test Facility Register AGARD AG 269 (July 1981)

Rocket Altitude Test Facility Register AGARD AG 297 (March 1987)

Manual for Aeroelasticity in Turbomachines AGARD AG 298/1 (March 1987) AGARD AG 298/2 (June 1988)

Application of Modified Loss and Deviation Correlations to Transonic Axial Compressors AGARD Report 745 (November 1987)



# DOCKET A L A R M

# Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

### **Real-Time Litigation Alerts**



Keep your litigation team up-to-date with **real-time** alerts and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

### **Advanced Docket Research**



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

### **Analytics At Your Fingertips**



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

### API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

### **LAW FIRMS**

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

### **FINANCIAL INSTITUTIONS**

Litigation and bankruptcy checks for companies and debtors.

### **E-DISCOVERY AND LEGAL VENDORS**

Sync your system to PACER to automate legal marketing.

