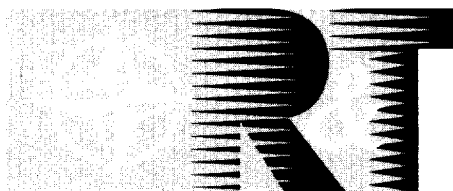


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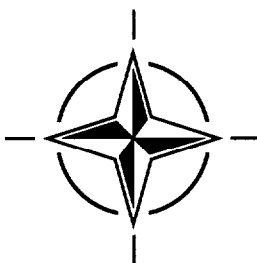
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Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs

(Exploitation des données relatives aux efforts structuraux et à l'intégrité des structures en vue de la diminution des coûts globaux de possession)

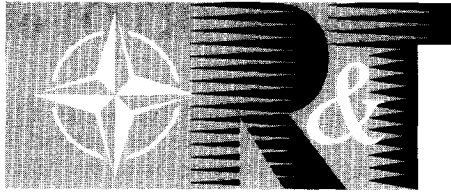
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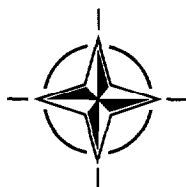
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RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote cooperative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective coordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also coordinates RTO's cooperation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of initial cooperation.

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- SAS Studies, Analysis and Simulation
- SCI Systems Concepts and Integration
- SET Sensors and Electronics Technology
- IST Information Systems Technology
- AVT Applied Vehicle Technology
- HFM Human Factors and Medicine

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Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs

(RTO MP-7)

Executive Summary

With the increasing sophistication of monitoring systems, the operators of current and next generation military aircraft have the means available to understand the actual loading environment and the on-going health of their weapons platforms. This Applied Vehicle Technology Panel Specialists' Meeting brought together the designers and operators of monitoring systems for fixed-wing aircraft, helicopters and engines to review the potential benefits from the exploitation of existing and emerging systems.

The meeting covered a wide range of tracking and monitoring techniques, ranging from the complex Eurofighter Structural Health Monitoring System to the simple event counting technique for 3 NATO 707s used as AWACS Trainer Cargo Aircraft. The papers highlighted the reliance of most fixed-wing fleets on direct monitoring methods whereas helicopters and engines rely on more indirect methods. One emerging theme was the need for the integration of the knowledge derived from monitoring systems with maintenance activities so that the benefits could be exploited at an earlier stage, rather than wait for life extension programmes.

Once the designers of weapon systems also include fully integrated monitoring systems (for fatigue, health and usage), it was felt that the design safety factors, used in part to account for usage variability, should be reviewed. Any reduction in such factors would reduce life cycle costs by extending lives without undermining current airworthiness standards.

Exploitation des données relatives aux efforts structuraux et à l'intégrité des structures en vue de la diminution des coûts globaux de possession

(RTO MP-7)

Synthèse

La sophistication grandissante des systèmes de surveillance permet aux exploitants de la génération actuelle ainsi qu'à ceux de la prochaine génération d'avions militaires de connaître l'état de fonctionnement et le chargement réel de leurs plates-formes d'armes. Cette réunion de spécialistes organisée par la commission technologies appliquées aux véhicules a rassemblé concepteurs et exploitants de systèmes de surveillance pour aéronefs à voilure fixe, hélicoptères et propulseurs pour un examen des avantages pouvant découler de l'exploitation des systèmes existants et à venir.

Le programme de la réunion a couvert un large éventail de techniques de surveillance et de localisation de pannes, allant du système complexe EUROFIGHTER de contrôle de l'état de la structure, à la technique de simple comptage des événements utilisée pour les 3 BOEING 707 de l'OTAN, utilisés comme avions cargo pour entraînement AWACS. Les communications présentées ont mis en relief la dépendance de la majorité des flottes d'avions à voilure fixe vis à vis des méthodes de surveillance directe, comparée aux hélicoptères et aux propulseurs pour lesquels il est plutôt fait appel aux méthodes indirectes. La réunion a souligné l'importance de l'intégration des connaissances dérivées des systèmes de surveillance dans les activités de maintenance de façon à pouvoir les exploiter plus tôt et ne pas avoir à attendre les programmes de prolongation du cycle de vie des appareils.

La réunion a conclu que dès que les concepteurs de systèmes d'armes mettent en place des systèmes de surveillance intégrés (pour le contrôle de la fatigue, de l'état de fonctionnement et de l'aptitude de l'appareil vis à vis de la mission), il semble qu'il faille réexaminer les coefficients de sécurité qui couvrent actuellement une très large gamme d'opérations. La réduction de ces coefficients aurait pour effet de diminuer les coûts globaux de possession, car le cycle de vie des appareils serait prolongé sans compromettre les normes de navigabilité.

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Preface

With the increasing sophistication of monitoring systems, the operators of current and next generation military aircraft have the means available to understand the actual loading environment and the on-going health and usage of their weapons platforms. The objective of this Specialists' Meeting was to examine the state of the art in loads measurement and health monitoring systems to see how these were contributing to the management of life cycle costs of both fixed-wing aircraft and helicopters fleets.

The Specialists' Meeting took place in Brussels, Belgium in May 1998, and 19 papers were presented from industry, academia, military operators, and research institutions, covering airframe and engine monitoring systems. This broad range of topics provided an excellent forum for the exchange of ideas between practitioners working with current systems and designers preparing future systems. Therefore, the meeting fulfilled its objective of providing an open exchange of scientific and technical information between all the NATO countries.

S. WELBURN
Wg Cdr, RAF
Chairman of Sub-Committee

Sub-Committee Members

Chairman

Wing Commander S. WELBURN
HQ Logistics Command
ADSM 17
Room, W113, Swales Block
RAF Wynton
HUNTINGTON, Cambs PE17 2DL

D. Chaumette - FR
J. Coyle - US
H. Goncalo - PO
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D. Paul - US
C. Perron - CA
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Panel Executive

Dr. J.M. CARBALLAL, SP

Mail from Europe:

RTA-OTAN/AVT
BP 25
7, rue Ancelle
F-92201 Neuilly-sur-Seine Cedex
France

Mail from US and Canada:

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Equipment health monitoring	Utilization														
Life cycle costs	Helicopters														
Cost engineering	Machinery health monitoring														
Fatigue (materials)															
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