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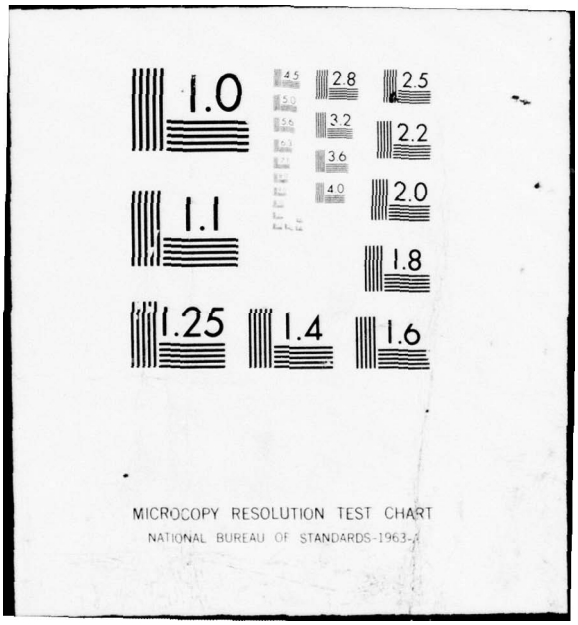
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AGARD

ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

7 RUE ANCELLE 92200 NEUILLY SUR SEINE FRANCE

(6) AGARD BULLETIN

MEETINGS, PUBLICATIONS, MEMBERSHIP

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(11) JANUARY 1978 78-1

(12) 86p.

NORTH ATLANTIC TREATY ORGANIZATION

AGARD BULLETIN

MEETINGS · PUBLICATIONS · MEMBERSHIP

JANUARY 1978

CONTENTS

THE MISSION OF AGARD

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:

- Exchanging of scientific and technical information;
- 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;
- Providing scientific and technical advice and assistance to the North Atlantic Military Committee in the field of aerospace research and development;
- 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;
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential;
- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community.

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 Program and the Aerospace Applications Studies Program. 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.

Published January 1978

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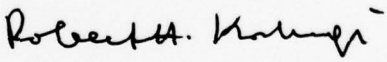
PREFACE

AGARD accomplishes its mission through the programs of the Panels, the Consultant and Exchange Division and the Military Committee Studies Division. The Panel programs of AGARD are conducted at meetings which are organized as conferences, symposia, specialists meetings, or working group meetings, and planned at business meetings. The Consultant and Exchange Division organizes Lecture Series and Short Courses as well as provides individual consultants to the nations and AGARD Panels. The Military Committee Studies Division organizes and participates in Technology Studies conducted by the Panels and special Aerospace Applications Studies; both types of studies are requested by or through the North Atlantic Military Committee.

At the present time the undertaking of new Aerospace Applications Studies has been postponed in view of the extensive involvement of the Military Committee Studies Division in an assessment of potential technological advances in aerospace up to the end of the century, and their possible impact on military systems. This study, known as Project 2000, was initiated by AGARD in 1976 at the request of the North Atlantic Military Committee.

This AGARD Bulletin contains information on all the planned 1978 AGARD meetings including dates, locations and brief descriptions of their themes. Additional specific information will be provided by means of individual Meeting Announcements which will be distributed by the various Panels. Queries about participation in AGARD meetings can be addressed to the appropriate Panel Members or National Delegates whose names and addresses are listed in Section III of this Bulletin

Included in this Bulletin is also a list of all AGARD publications which were released in 1977, together with their abstracts. Complete listings of all AGARD Publications which appeared since the founding of this agency are included in the "AGARD Index of Publications 1952–1970", the "AGARD Index of Publications 1971–1973" and the "AGARD Index of Publications 1974–1976" which are updated by Annual Supplements. Information on how AGARD documents may be obtained is given on the back cover of this Bulletin.



Robert H.Korkegi
Director

SECTION I

1978 AGARD TECHNICAL MEETINGS

- CALENDAR OF AGARD MEETINGS 1978
- SUMMARY OF 1978 MEETING THEMES

Attendance at AGARD Panel Meetings and Lecture Series is by invitation only and is normally limited to citizens of the NATO Nations. Applications should be made to an AGARD National Delegate or Panel Member from the applicant's own country. Citizens of the Federal Republic of Germany or of the United States of America must apply respectively through the appropriate German or US Panel Coordinator. Citizens of the Italian Republic must apply through the Italian National Delegate Office. The names and addresses of National Delegates and Panel Members will be found in Section III of this Bulletin.

CALENDAR OF AGARD MEETINGS – 1978

Date	*Location*	*Activity*	*Type of Meeting/Subject*
20–24 February	BELGIUM (Brussels)	Fluid Dynamics/VKI	Lecture Series No.94 **Three Dimensional and Unsteady Separation at High Reynolds Numbers**
15–17 March	FRANCE (Paris)	Headquarters	44th **National Delegates Board Meeting** 24th **Panel Chairmen Meeting** 25th **Steering Committee Meeting** 8th **National Coordinators Meeting**
3–7 April	UNITED KINGDOM (London)	Propulsion & Energetics	51st Panel Meeting/Specialists' Meetings – **Icing Testing for Aircraft Engines** – **Seal Technology in Gas Turbine Engines**
10–14 April	DENMARK (Aalborg)	Structures & Materials	46th Panel Meeting/Specialists' Meeting **Characterization of Low Cycle High Temperature Fatigue by the Strainrange Partitioning Method**
17–18 April	NETHERLANDS (Delft)	Technical Information	Lecture Series No.92 **The Application of Inexpensive Minicomputers to Information Work**
20–21 April	TURKEY (Ankara)	Technical Information	Lecture Series No.92 **The Application of Inexpensive Minicomputers to Information Work**
24–28 April	CANADA (Ottawa)	Electromagnetic Wave Propagation	Symposium **Operational Modeling of the Aerospace Propagation Environment**
24–28 April	BELGIUM (Brussels)	Flight Mechanics	52nd Panel Meeting/Specialists' Meeting **Piloted Aircraft Environment Simulation Techniques**
1–5 May	UNITED STATES (Fort Rucker, (Ala))	Aerospace Medical	Specialists' Meeting **Operational Helicopter Aviation Medicine**
8–12 May	NORWAY (Sandefjord)	Guidance & Control	26th Panel Meeting/Symposium **The Impact of Integrated Guidance and Control Technology on Weapons Systems Design (Classified)**
8–9 May	NORWAY (Oslo)	Electromagnetic Wave Propagation	Lecture Series No.93 **Recent Advances in Radio and Optical Propagation for Modern Communications, Navigation and Detection Systems**
11–12 May	UNITED KINGDOM (London)	Electromagnetic Wave Propagation	Lecture Series No.93 **Recent Advances in Radio and Optical Propagation for Modern Communications, Navigation and Detection Systems**
15–16 May	ITALY (Rome)	Electromagnetic Wave Propagation	Lecture Series No.93 **Recent Advances in Radio and Optical Propagation for Modern Communications, Navigation and Detection Systems**
22–25 May	GREECE (Athens)	Fluid Dynamics	42nd Panel Meeting/Symposium **Dynamic Stability Parameters**
5–9 June	GERMANY (Munich)	Avionics	35th Panel Meeting/Symposium **Digital Communications in Avionics**
6–7 June	UNITED KINGDOM (London)	Guidance & Control	Lecture Series No.95 **Strap-Down Inertial Systems**

AGARD

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Calendar of AGARD Technical Meetings 1978

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NORTH ATLANTIC TREATY ORGANIZATION

CALENDAR OF AGARD MEETINGS – 1978

Date	*Location*	*Activity*	*Type of Meeting/Subject*
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15–16 May	ITALY (Rome)	Electromagnetic Wave Propagation	Lecture Series No.93 **Recent Advances in Radio and Optical Propagation for Modern Communications, Navigation and Detection Systems**
29 May–1 June	GREECE (Athens)	Fluid Dynamics	42nd Panel Meeting/Symposium **Dynamic Stability Parameters**
5–9 June	GERMANY (Munich)	Avionics	35th Panel Meeting/Symposium **Digital Communications in Avionics**
6–7 June	UNITED KINGDOM (London)	Guidance & Control	Lecture Series No.95 **Strap-Down Inertial Systems**

Date	*Location*	*Activity*	*Type of Meeting/Subject*
12–13 June	NORWAY (Bolkesjö)	Guidance & Control	Lecture Series No.95 **Strap-Down Inertial Systems**
15–16 June	GERMANY (Porz-Wahn)	Guidance & Control	Lecture Series No.95 **Strap-Down Inertial Systems**
19–20 June	ITALY (Rome)	Guidance & Control	Lecture Series No.95 **Strap-Down Inertial Systems**
4–8 September	GERMANY (Munich)	Electromagnetic Wave Propagation	25th Panel Meeting/Symposium **Millimeter and Sub-Millimeter Wave Propagation and Circuits**
18–20 September	PORTUGAL (Lisbon)	Headquarters	14th **Annual Meeting** 45th **National Delegates Board Meeting** 25th **Panel Chairmen Meeting**
25–29 September	ITALY (Florence)	Structures & Materials	47th Panel Meeting/Specialists' Meetings – **Advanced Fabrication Processes** – **Computer Aided Design**
25–29 September	CANADA (Ottawa)	Flight Mechanics	53rd Panel Meeting/Symposium **Stability and Control**
2–6 October	NORWAY (Sandefjord)	Fluid Dynamics	43rd Panel Meeting/Symposium **High Angle of Attack Aerodynamics**
5–6 October	NETHERLANDS (Delft)	Structures & Materials	Lecture Series No.97 **Fracture Mechanics Design Methodology**
9–10 October	GERMANY (Munich)	Structures & Materials	Lecture Series No.97 **Fracture Mechanics Design Methodology**
12–13 October	PORTUGAL (Lisbon)	Structures & Materials	Lecture Series No.97 **Fracture Mechanics Design Methodology**
9–13 October	NETHERLANDS (The Hague)	Guidance & Control	27th Panel Meeting/Symposium **The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility (Classified)**
16–21 October	UNITED STATES (Monterey, Calif.)	Avionics	36th Panel Meeting/Symposium **Data Handling Techniques and Systems** Specialists' Meeting **Strategies for Automatic Track Initiation**
16–20 October	FRANCE (Paris)	Technical Information	31st Panel Meeting/Specialists' Meeting **Information and Industry**
16–17 October	GERMANY (Munich)	Propulsion & Energetics	Lecture Series No.96 **Aircraft Engine Future Fuels and Energy Conservation**
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6–10 November	FRANCE (Paris)	Aerospace Medical	35th Panel Meeting/Specialists' Meetings – **Human Biodynamic Response and use of Analogues and Models for Evaluation of Escape/Crash Injuries and Protection** – **Human Factors Aspects of Aircraft Accidents and Incidents** – **Recent Advances in Aeronautical and Space Medicine**

No Aerospace Applications Studies Committee Meetings will be taking place in 1978.

Meetings of "Project 2000 Review Board" will be organized at the discretion of its Chairman.

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Seules sont admises à assister aux Réunions des Groupes de Travail et aux Séries de Conférences de l'AGARD les personnes munies d'une invitation et, en règle générale, les citoyens des pays de l'OTAN. Les demandes d'invitation devront être adressées à un Délégué National ou à un membre de Groupe de Travail du pays dont le candidat est un ressortissant. Les citoyens de la République Féderale d'Allemagne ou des Etats-Unis devront respectivement faire leur demande par l'intermédiaire du coordonnateur allemand ou américain du Groupe de Travail en cause. Pour tout renseignement sur les noms et adresses des Délégués Nationaux et des membres des Groupes de Travail, *se reporter à la 3ème Partie du Bulletin* 78-1 de l'AGARD.

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SUMMARY OF 1978 MEETING THEMES

AEROSPACE MEDICAL PANEL

Specialists' Meeting: **Operational Helicopter Aviation Medicine.**
1–5 May 1978, US Army Aeromedical Research Laboratory, P.O. Box 577, Fort Rucker, Alabama 36362, USA.

Operational Helicopter Aviation Medicine – Aircraft inventories of NATO Nations have been evolving from an almost totally fixed-wing fleet to a mixed fleet of fixed-wing and rotary-wing aircraft. There is a trend to increase the number of helicopters in direct support of the ground soldier to provide air mobility and fire power. The helicopters employed have become increasingly complex and the operational missions extremely difficult and demanding for aircrews. The operational demand for combat flexibility provided by military helicopters assures their continuing importance to NATO in high-mobility land warfare. Operations at sea involving long duration station holding, antisubmarine warfare, foul weather search and rescue create entirely different problems. Experience has shown that helicopter operations present work environments, special stresses and environmental demands on aircrews which are significantly different in type and/or degree from those in fixed-wing operations.

This first panel meeting entirely devoted to the unique and special medical problems of helicopter flying will be divided into the following major topical areas:

- Human Factors of Helicopter Design and Operation: cockpit design, instrument configuration, aircrew workload and its assessment, performance measures, combat operations under primitive or field conditions, sustained operations in support of ground combat operations and related subjects.
- Helicopter Safety and Crashworthiness: crash injury analysis, designs for injury prevention, restraint systems, energy-absorbing seats, helicopter escape, postcrash fire and related subjects.
- Visual and Acoustic Aspects of Helicopter Design and Operations: cockpit lighting, aircraft conspicuity, visual displays, night vision equipment, communication noise, aircrew hearing loss, weapons impulse noise and related subjects.
- Environmental Aspects of Helicopter Operations: environmental effects and control of hot and cold climate operations, oxygen systems to support high altitude missions, the acute and chronic effect and control of helicopter vibration, cockpit toxicology and related subjects.
- Helicopter Aircrew Physical Standards, Selection and Retention: Physiologic and psychiatric helicopter aircrew selection and retention criteria waivers and flying with handicaps or partial disability, disease entities unique to helicopter flying and related subjects.
- Medical Aspects of Helicopter Patient Evacuation and Rescue Operations: helicopter inflight patient monitoring, resuscitation and support, hoist and rescue missions, special medical equipment requirements and developments, design of helicopters specifically for medical evaluation and related subjects.

35th Panel Meeting
6–10 November 1978, Amphithéâtre Charles Renard (ENSTA), 32 Bld. Victor, 75015 Paris, France
Specialists' Meeting: **Human Biodynamic Response and Use of Analogues and Models for Evaluation of Escape/Crash Injuries, Protection and Performance. Human Factors Aspects of Aircraft Accidents and Incidents.**

Human Biodynamic Response and Use of Analogues and Models for Evaluation of Escape/Crash Injuries, Protection and Performance – The designer of crash/escape protection systems has for many years relied on both animal and dummy testing to evaluate escape systems, support and restraint systems, protective helmets and cockpit design. The recent growth of civilian interest in automotive crash safety has further intensified the need for optimized test procedures. However, the choice of test subject, be it animal, a specific design of test dummy or other model, has not been guided by state-of-the-art data on the biomechanical properties governing comparability of the varying responses. It would be beneficial to bring together what is known in this field in order to make definitive recommendations to the protection systems design community on the proper use of animal, dummy and mathematical model data. The session will cover studies on the impact response of the whole body and body parts to provide data for the development of more representative biodynamic models, will deal with biodynamic models to describe and predict aircrew physiological response and performance in biodynamic environments, their limitations, etc.

Human Factors Aspects of Aircraft Accidents and Incidents – Experience across the NATO community in general indicates that aircraft accidents rates have not declined significantly in the past decade, despite the fact that there is continuing development of safety equipment and various onboard sub-systems designed to enhance safe operations; and despite the increasing emphasis upon flight safety education. Of particular concern are those accidents attributed to human factors, of which "pilot error" is a subset. The cost in lost aircraft and crews is obvious and rising as both aircraft and aircrew training become more and more complex and therefore more expensive. A further

complication is the reduction in flying hours (and an increase in the use of simulators to replace in-flight training) necessitated by fuel constraints and declining "real dollar" budgets. There is therefore a significant need for the NATO aerospace medical community to focus renewed and continuing attention upon the problem of aircraft accidents where human factors play a role.

In as much as aerospace medicine embraces a wide range of disciplines and problem areas, the session will entertain a diversity of presentations on topics such as factors contributing to partial or complete pilot incapacitation, human factors design deficiencies which enhance the probability of an accident, human factors improvements which reduce the probability of an accident, analyses of the underlying mechanisms of "pilot error" accidents, analyses of significantly large sets of accidents which identify or reject global assumptions/hypotheses regarding causes of human factors accidents, lessons learned or to be learned from investigations of incidents, techniques for the investigation of accidents/incidents, with specific attention to the demonstrated usefulness of such techniques.

AVIONICS PANEL

35th Panel Meeting – Symposium: **Digital Communications in Avionics**
5–9 June 1978, Munich, Germany

The Spring Symposium is entitled, "Digital Communications in Avioncs". This symposium will examine the results of continued technological advances in digital communications systems and techniques. The entire technology will be examined, including basic concepts, methods of coding and decoding, special devices and terminals, applications of fiber optics to digital multiplex communications in aircraft and test equipment and procedures.

36th Panel Meeting – Symposium: **Data Handling Techniques and Systems**
16–21 October, 1978, Monterey, Calif., USA

The Fall Symposium is on the subject, "Data Handling Techniques and Systems". Technologically complex and sophisticated systems are currently in use which make available to Tactical Commanders vast amounts of data which must be rapidly assimilated, processed, and displayed or transmitted to permit coordinated, cohesive prosecution of a given task. This technological aspect of modern tactical warfare will be examined during this symposium. The significant advances in solid state computing devices and memories, programming, high order languages and the commensurate growth in information requirements will be considered. The results will provide to the NATO military engineering community a cohesive assessment of the advances and equipments.

ELECTROMAGNETIC WAVE PROPAGATION PANEL

Symposium: **Operational Modeling of the Aerospace Propagation Environment**
24–28 April, 1978, Ottawa, Canada

Waves over the entire electromagnetic spectrum are propagated through the atmosphere, ionosphere, and beyond. Current and planned high-performance military and civilian systems operating in the aerospace environment must utilize full knowledge of the propagation environment to perform in an optimum manner. Users of these systems, too, must have continuous knowledge regarding the state, variability, and susceptibility to natural disturbances of the media.

Forecasting techniques must be developed which are based on media models capable of periodic or real time updating of data at specific locations. The modeling and, as a consequence, forecasting can and must be improved significantly through a better understanding of the government processes of the interrelated parts of the space environment. This symposium will stimulate discussion of the techniques to improve media characterization models, bringing together the developers and the users of the models so that they might better understand each others problems.

25th Panel Meeting – Symposium: **Millimetre and Submillimetre Wave Propagation and Circuits**
4–8 September 1978, Munich, Germany

Recent progress in radio-electric and optical techniques makes it possible to consider in one symposium both bands of the electromagnetic spectrum, i.e. millimetric (30–300 GHz) and decimillimetric/infrared. The extent to which radio techniques can move toward shorter wavelengths and to which optics can utilize longer wavelengths will be considered during this meeting, examining particularly the physical and technological limits of expansion of the bands of the two spectra. Contributions will postulate the most promising bands of the spectrum for telecommunications and unguided propagation detection on the one band and for guided, fibre optics or circular waveguide telecommunications on the other. The Avionics Panel has been asked to solicit papers which deal with circuits in these areas of technology to present the total aspect of the problem.

FLUID DYNAMICS PANEL

42nd Panel Meeting – Symposium: **Dynamic Stability Parameters**
22–25 May 1978, Athens, Greece

The modern aircraft is exposed – much more often than in the past – to unsteady flow fields that may have significant effects on its characteristics of motion. The space shuttle and the high performance military aircraft (including CCVs and VLFs) are prime examples of vehicles for which these phenomena are of high interest. The unsteady flow fields involved are usually highly nonlinear and complex and result in stability characteristics that are strong functions of angle of attack and that may represent a significant aerodynamic coupling between the longitudinal and the lateral degrees of motion.

A firm knowledge of stability characteristics at high angles of attack is essential for a better appreciation of the entire complex of stall/spin problems and may even lead to re-examination of the present formulation of equations of motion.

This Symposium will center on the determination of needs for dynamic stability information, the form in which it should be presented, and on identifying the best means for obtaining such information.

43rd Panel Meeting – Symposium: **High Angle of Attack Aerodynamics**
2–6 October 1978, Sandefjord, Norway

The demand for high maneouvre capability and hence for high angles of attack both in aircraft and missiles leads to flows with separation and the formation of vortices. These vortices typically have a large influence, both favorable and unfavorable, on vehicle aerodynamic characteristics and an increased understanding is needed of their creation, convection and interaction effects. The meeting will assess and establish improved flow modeling concepts for design purposes. Theoretical and experimental investigations, techniques and procedures will be presented and reviewed.

FLIGHT MECHANICS PANEL

52nd Panel Meeting – Specialists' Meeting: **Piloted Aircraft Environment Simulation Techniques**
24–28 April 1978, Brussels, Belgium

This Specialists' Meeting will concern 'Piloted Aircraft Environment Simulation Techniques'. As simulators can range from very simple devices, used in research, to very complex systems, such as in advanced airline or complete mission training, then a technical meeting on the general subject of simulation will cover a wide range of topics. As a consequence, the most recent AGARD meetings on this subject have allocated little time to environment simulation techniques. The objectives of this meeting are, therefore, to review and exchange information on the general state-of-the-art and special purpose mission applications of environment simulation techniques. The meeting will address, for ground-based piloted aircraft simulators, the generation of out-of-the-cockpit visual scenes, simulation of motion cues, and modelling of and techniques for generating, atmospheric characteristics which affect both the visual scene and aircraft motions. Emphasis will be placed on qualitative assessments of the techniques on simulation fidelity. In the context of this meeting, the term environment simulation applies to the representation of real

world phenomena which are independent of the specific aircraft being simulated. The first five sessions will cover the basic aspects of environment simulation including: atmospheric modelling, 'out-of-the-cockpit' visual scenes, and motion and indirect motion cues. The final session will cover special mission phases including, the 'up-and-away' mission. The meeting will be concluded with a Round Table Discussion.

53rd Panel Meeting – Symposium: **Stability and Control**
25–29 September 1978, Ottawa, Canada

This Symposium will concern developments in the design of aircraft stability and control systems. Since the last symposium on this subject, there have been many basic and radical changes in this field and a review of the state-of-the-art is therefore appropriate. As the range of topics related to stability and control is very broad it will be essential, to ensure the necessary depth of treatment, to restrict the subjects addressed to those of major significance. One obvious area of importance is that of the design of Control Configured Vehicles (CCVs), as this has a strong influence on the various aspects of aircraft stability and control. Emphasis will be placed, not on control system design, but on the more fundamental relationships between the use of advanced CCV concepts and sound, basic aerodynamic design. Six sessions are proposed, commencing with a summary of recent activities in the various disciplines. FDP will participate in this session with an overview from their symposium on Dynamic Stability Parameters. Session two will cover the application of active controls to specific aircraft configurations. Session three will examine the general problems concerning stability and control including the use of mathematical models. Session four will look at results obtained with actual CCV's. Session five will examine the criteria for satisfactory behaviour of aircraft equipped with advanced stability and control systems and session six will investigate the participation of the pilot. The meeting will be concluded with a Round Table Discussion.

GUIDANCE AND CONTROL PANEL

26th Panel Meeting – Symposium: **The Impact of Integrated Guidance and Control Technology on Weapons Systems Design** (Classified)
8–12 May 1978, Sandefjord, Norway

The rapidly developing technologies in navigation sensors, target identification sensors, command and control and computation capability are structuring a command network that demands increased functional integration of crew station and control configuration to permit effective use of that technology. This technology when combined with advancing technologies in guidance and control, the driving forces of acquisition and life cycle costs, needs for operational tactical flexibility, survivability/vulnerability, and critical space, volume and weight constraints dictates the need for integrated guidance and control at a higher function level than heretofore considered. This higher functional level involves an effective blend of the sensor, vehicle and kill-mechanism, that can provide a multi-role capability for advanced and present operational vehicles.

The purpose of this symposium is to address the subject so as to ensure effective employment of advancing technologies. Furthermore, when one considers the large array of sensors available and the fundamental commonality of functions and control algorithms for different missions, it appears logical that these capabilities should be utilized to augment each other to achieve flexibility and growth capability.

The preliminary programme includes twenty-eight papers to be presented in seven sessions:

- Functional Design Concepts, Requirements and Trends
- Weapon Delivery/Flight Control Integration
- Command, Control, Communications (C^3) and Sensor Data Integration
- Crew Station Configurations and Display Concepts
- Pilot/System Interaction
- Data Processing and Distribution Systems
- Development and System Test Experiences

27th Panel Meeting –Symposium: **The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility** (Classified)
9–13 October 1978, The Hague, Netherlands

The desire of operators of helicopters and V/STOL aircraft to extend the use of these aircraft much more effectively into conditions of night and poor visibility has been met by the rapid advances in a number of fields, but most particularly in the development of electro-optical sensors of various kinds.

In a meeting held by the Guidance and Control Panel in May 1974, many promising sensor developments were reported but there had been little progress at that time towards the integration of these sensors into operational guidance and control systems, both for aiding the pilot in flying the vehicle and in weapon aiming and surveillance tasks. The purpose of the symposium is to review and consolidate progress.

The topic areas are:

- Current and future operational requirements utilizing the rapid growth in technology in the fields of Flight Control Systems, Cockpit Displays and Electro-Optic Sensors.
- Progress in the development of electro optical sensors as applied to the various piloting tasks in helicopters and V/STOL aircraft as well as advances in the application to Weapon Aiming and Surveillance and Reconnaissance Systems.
- Progress in display and flight control technology aimed at improving misssion effectiveness of helicopters and V/STOL aircraft.
- Landing Operational Systems: Operational procedures, tactical radio and visual landing aids, flight control and display systems.
- System Integration: Special problems of integration of sensors, computers, displays, etc. in helicopter and V/STOL vehicles.
- Man-machine interface problems: Keeping the pilot workload down to acceptable levels as well as improving the overall performance of pilot/vehicle combination.
- Experience of design, performance and capabilities of complete systems in advanced state of development or production for night and low visibility operations.

PROPULSION AND ENERGETICS PANEL

51st (A) Specialists' Meeting: **Icing Testing for Aircraft Engines**
3–4 April 1978, London, UK

Military aircraft and helicopters may be required to operate under icing conditions, which could affect both the performance and the mechanical integrity of unprotected engines. In order to develop and then certify suitable protection systems, it is necessary to be able to test engine intakes, complete powerplant, and helicopters, in simulated icing conditions. The purpose of the meeting is to bring together specialists in this subject to review the requirements for icing tests, and the facilities, techniques, and measurement methods currently available, and hence to assess the need for further research and new facilities for icing testing.

51st (B) Specialists' Meeting: **Seal Technology in Gas Turbine Engines**
6–7 April 1978, London, UK

This meeting is one of a series in the gas turbine engine field* sponsored by the Propulsion and Energetics Panel of AGARD. It will provide a forum to discuss technology of gas turbine engine seals. The discussion will be limited to cases where relative motion exists between parts of the seals. Both gas path and oil path seals will be covered.

The initial presentation is a comprehensive survey showing the effect of engine operation on seal performance and the effect of seal performance on engine performance. This survey will be followed by presentations on new developments in material technology that influences seal design and operation. The user's view of seals will focus on operational performance, its impact on airline operations, maintainability of seals including repair techniques, and maintenance costs.

Engine producers will contribute discussions based on their experience in the development of seals for large and small engines.

The program will include presentations upon laboratory measurements and other investigations of seal behaviour as well as the development of suitable test facilities.

Methods of design and performance computations will be presented and applied to some particular seal configurations.

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* Other meetings held recently dealt with 'High Temperature Problems in Gas Turbine Engines', 'Powerplant Reliability', 'Secondary Flows in Turbomachines', and 'Variable Geometry and Multicycle Engines'.

52nd Symposium, on **Stresses, Vibrations, Structural Integration and Engine Integrity (including Aeroelasticity and Flutter)**
23–27 October 1978, Cleveland, Ohio, USA

This Symposium will address the great variety of mechanical topics encountered in engine development, engine aircraft integration, and in engine operation.

Experimental analysis of mechanical stresses and vibrations, and stress analysis techniques in particular advanced finite element methods will be discussed. Application of analytical methods in the design phase to calculate steady and alternating stresses will be reported with respect to engine structural integrity as well as to component and engine life time prediction or component deterioration. Computation of thermal stresses in cooled components will be included.

Another major part of the Symposium will be devoted to engine airframe integration. Here, various cases like the integration of turbofans and after-burner systems, and the small turbine engine installation are to be surveyed and their special problems are to be discussed.

The third part of the Symposium will focus on aeroelasticity and flutter. Engine instabilities caused by inlet distortion, subsequent rotating stall, unsteady pressure distributions on fan and compressor blades are subjects to be addressed in this part which will include component and engine vibrations and their analysis.

This Symposium provides links with activities of the Structures and Materials Panel on Flutter, with those of the Fluid Dynamics Panel on Unsteady Aerodynamics, and with the 1975 PEP Symposium on 'Unsteady Phenomena in Turbomachinery'.

STRUCTURES AND MATERIALS PANEL

46th Panel Meeting – Specialists' Meeting: **Characterization of Low Cycle High Temperature Fatigue by the Strainrange Partitioning Method**
9–14 April 1978, Aalborg, Denmark

Many advanced turbine engine materials for military applications are now being used to a very high fraction of their ultimate capabilities, and there is thus a great need for more meaningful high temperature mechanical property tests on these materials and also for improved analytical techniques for the prediction of their service or residual life. One particularly vexing problem has been the difficulty of describing and predicting the behaviour of materials at high temperatures and in real environments, such as creep/fatigue interactions present in low cycle high temperature fatigue of engine components. The Panel is actively attacking this problem with a cooperative testing programme aimed at the evaluation of the strainrange partitioning approach to the analysis and prediction of low cycle high temperature fatigue life.

A number of laboratories in several countries are participating in this programme, each testing its own materials of interest under its own laboratory conditions to ensure that the results obtained will provide validation for a wide range of aerospace materials and to ensure maximum usefulness to each participating laboratory. The final step in the programme will be this Specialists' Meeting which will bring together each of the principal participants to permit sharing of the testing experience, to permit an in-depth evaluation of the strainrange partitioning techniques and to provide the maximum possible exposure of this new approach to LCHTF testing.

47th Panel Meeting – Specialists' Meeting: **(A) Advanced Fabrication Processes, (B) Computer Aided Design**
24–29 September 1978, Florence, Italy

(A) Increasing acquisition and maintenance costs of current aerospace systems are reflected in greater emphasis, within many of the NATO nations, on means of reducing processing costs and improving the quality of manufactured components through improved material/process selection and control. Indeed, there are emerging efforts in many of the NATO nations to bring together the design, materials and mechanics fundamentals underlying materials deformation, metal removal, joining, coating and other related processes. Similarly, new processes are emerging, both within the aerospace processing community and within the more general commercial area, that offer significant opportunities for lower cost, higher quality aerospace components. This Meeting will bring some of the more important of these processes to the attention of all the NATO nations so that they can be more readily exploited, and will also most importantly promote a dialogue between the fundamental and engineering disciplines which will expedite the development of low cost advanced fabrication processes.

(B) Computer Aided Design in this connection refers to the use of computer aids in close relation to the work in the design and drawing offices where information for the production process of an aircraft and its components is formulated. Each major aircraft company is developing its own modules for their respective systems which, at present, do not fit together. Since, in Europe at least, each major aircraft programme will be a cooperative venture between nations, a time and money consuming process evolves at the beginning of each project. The objective is to reach common guidelines and standards to provide the highest possible degree of correlation, commonality or integration of the methods, means and equipment used in this field.

TECHNICAL INFORMATION PANEL

31st Panel Meeting – Specialists' Meeting: **Information and Industry**
16–20 October 1978, Paris, France

Increasing importance is being given to the exploitation of scientific and technical information developed as a result of defense and aerospace research. It is therefore desirable to review the state-of-the-art in 1978 and to ensure that the results of this study are communicated to industry, and in particular to those who could benefit from the utilization of information resulting from aerospace research and development. Further, the information services play an essential part in technology transfer; the meeting will therefore survey the main facilities in the field of information now available to industry, of which in many cases they are unaware, such as the major data banks (Chemical Abstracts, INSPEC, NASA/RECON, etc.), Information Analysis Centres, interfaces between information Centres and manufacturers (Industrial Liaison Officers) etc., and compare the various methods of Information Transfer. It will also serve to bring together specialists familiar with these problems and industrial managers, in order to draw attention to available facilities for the transfer of aerospace information and technology, and to the need to ensure the dissemination of research information.

LECTURE SERIES

Lecture Series 92: **The Application of Inexpensive Minicomputers to Information Work** (with Technical Information Panel)
17–18 April 1978, Delft, Netherlands
20–21 April 1978, Ankara, Turkey

Minicomputers are now extremely powerful and can be equipped with large access stores. These features make them ideally suited to information work and their cost is sufficiently low that an information centre or service can even justify having one solely for its own use. This avoids all the problems inherent in the sharing of a main frame computer, either in an associated organization or at a commercial bureau.

This Lecture Series will outline the ways in which many computers can be used in information work and will include examples of their current use in a number of different areas, such as editing and publishing information bulletins, SDI and retrospective retrieval and library housekeeping.

Lecture Series Director: Mr R.A.McIvor, Director, Defence Scientific Information Services, Ottawa, Ontario, Canada.

Lecture Series 93: **Recent Advances in Radio and Optical Propagation for Modern Communications, Navigation and Detection Systems** (with Electromagnetic Wave Propagation Panel)
8–9 May 1978, Oslo, Norway
11–12 May 1978, London, UK
15–16 May 1978, Rome, Italy

The aim of this Lecture Series is to introduce engineers and system designers to new studies in the field of radio wave and optical propagation. With new requirements of greater data rates in communications, great accuracy in both satellite and low frequency navigation systems and with optical systems of communication and detection being developed, the limits of the medium through which the energy is propagated must be considered.

Ionospheric limitations and tropospheric effects which contribute to radio wave propagation problems will be introduced, as well as the problems of coherent propagation and image reconstruction, incoherent propagation, and remote sensing, in optical systems. Propagation problems associated with modern systems will be investigated, including those relative to laser transmission, such as transmission-radiation difficulties, blooming and LIDAR. Incoherent optical propagation will be discussed, with emphasis on scintillations, absorption, refraction and scattering loss. The effects of atmospheric properties, surface signatures and the sea on infra-red, ultra-violet, and microwave remote sensing will be presented. Radio wave scintillation effects on tracking and methods of communication through the aurora and the equatorial irregularities also will be presented, leading logically into a description of the need for forecasting and prediction of the ionospheric parameters, and discussion of development of techniques to accomplish that prediction.

The Lecture Series will include examination of low frequency radio wave propagation, analyses of LF navigation system errors and problems and new LF systems. The field of range and position error correction in navigation and positioning systems will be discussed and will include radar and navigation correction techniques. HF transmissions will be presented, including backscatter and forward scatter HF radars, developments in ray tracing, and channel selection topics.

The Lecture Series will conclude with techniques applicable to artificial modification of propagation media, with both high power and chemical release methods being presented.

This ambitious Lecture Series will summarize several symposia and specialists meetings, provided expert condensation of the material and describe the need for additional effort as well as the latest progress in the field.

Lecture Series Director: Dr Jules Aarons, Senior Scientist, Air Force, Cambridge Research Lab., Bedford, Mass., USA.

Lecture Series 94: **Three Dimensional and Unsteady Separation at High Reynolds Numbers** (with Fluid Dynamic Panel)
20–24 February 1978, von Kármán Institute Brussels, Belgium

This Lecture Series will be devoted to two major aspects of the topic: the physics of flow separation and reattachment, with particular reference to turbulent flows, and a consideration of some practically important types of separated flows which occur in aeronautics. Under both headings lectures will be included on the most recent experimental work, computational techniques and production methods, and an attempt made to assess progress and to identify those areas in which further work should be done. Although attention will not be confined to incompressible flows, it is intended that only passing reference should be made to shock-wave boundary layer interaction.

Lecture Series Director: Mr M.Sirieix, Directeur Scientifique Adjoint de l'Aérodynamique, ONERA, France.

Lecture Series 95: **Strap-Down Inertial Systems** (with Guidance and Control Panel)
6–7 June 1978, London, UK
12–13 June 1978, Bolkesjo, Norway
15–16 June 1978, Porz-Wahn, Germany
19–20 June 1978, Rome, Italy

The state-of-the-art in Strap-Down Inertial Systems Technology has advanced to a state where it seems timely to present it to the NATO Community in the form of a Lecture Series. Until now, this technology has been covered only in many separate papers, and no coherent document covering the whole spectrum of this technology is available.

The Lecture Series will provide an overview of the current technologies being implemented in strap-down navigation, control and guidance systems. Technology highlighting and up-to-date techniques employed in the development of inertial sensors, analysis, data processing and subsystem integration will be discussed, along with predictions of the directions these techniques are likely to take. This will provide the overall background necessary for understanding the principles and mechanisms of real, current-day, strap-down systems and likely future systems using the newest technology.

Lecture Series Director: Dr G.Schmidt, Technical Director, The Charles Stark Draper Lab Inc., USA.

Lecture Series 96: **Aircraft Engine Future Fuels and Energy Conservation** (with Propulsion and Energetics Panel)
16–17 October 1978, Munich, Germany
19–20 October 1978, London, UK

The world's petroleum resources are rapidly being depleted. If we continue to consume these resources at our current rate of consumption, the consensus is that the world will essentially run out of fuel by the turn of the century. The need for fuel conservation will be most urgent if not mandatory, because the future of aviation, as we know it today, is at stake.

The Lecture Series will present:

- Statement of Problem; increased demand for fuel; decreased supply of fuel; economics of energy conservation and impact on civil and military aircraft operations and on aircraft noise and pollution requirements.
- Future Fuels for Aviation: hydrocarbon fuels outlook; alternative aviation fuels outlook including coal, oil shale, tar sands; methanol, methane hydrogen.
- Low Energy Consumption Energy: (a) conventional engines: high temperature and pressure turbofans; variable geometry; reliability, durability, maintainability; unconventional cycles; (b) turboprops regenerative turbofans, variable geometry; reliability, durability, maintainability.
- Engine Component Improvements: increased efficiency (all components); improved seals and tip clearance controls.
- Low Energy Conservative Aircraft Designs and Operational Procedures: high aspect ratio wings; integrated aircraft/engine controls; cruise speed and altitude.
- Energy Savings through Broadened Fuel Specifications: reduced energy refining processing; impact of broadened fuel specifications on engine components.
- Summary and Recommendations.

Lecture Series Director: Mr N.Rekos, Acting Deputy Director, Aeronautical Propulsion Div., Office of Aeronautics and Space Technology, NASA Hqs, Washington DC, USA.

Lecture Series 97: **Fracture Mechanics Design Methodology** (with Structures and Materials Panel)
5–6 October 1978, Delft, Netherlands
9–10 October 1978, Munich, Germany
12–13 October 1978, Lisbon, Portugal

This Lecture Series will consist of three major parts: Fracture Mechanics Principles; Damage Tolerance Analysis; and Damage Tolerance Design.

The first part will provide the tools for the second and third and will consist of a general introduction to the subject, followed by presentations on residual strength will review the criteria for slow crack growth and fast fracture, and discuss the use and limitations of fracture toughness data for plane strain as well as plane stress. The session on fatigue-crack propagation will point out proper ways to evaluate and use da/dN data. A discussion will follow on retardation and prediction of crack propagation under actual service loading will be treated.

The second part of the Series will discuss means for a formal stress-intensity analysis of complex structures. Subsequently, techniques for a quick appraisal of stress-intensity factors will be presented. This will set the stage for a treatment of damage-tolerance analysis of actual aircraft components, such as forgings, joints, and stiffened structures. The prediction of residual strength, as well as crack propagation, will be reviewed.

The final part will address the means to achieve damage tolerance. An evaluation will be made of the accuracy of residual strength and crack-growth predictions (from experiments and computations). This problem will be addressed from the points of view of scatter of the material data, unknowns in the load history, and limitations of the analysis. Finally, the application of reasonable safety factors and the use of damage-tolerance requirements will be addressed.

Lecture Series Director: Dr D.Broek, Structural Materials and Tribology Section, Battelle, Columbus Lab., Ohio, USA.

MILITARY COMMITTEE STUDIES

Meetings of the Aerospace Application Studies Committee will not be held during 1978 due to the activities associated with Project 2000.

The Project 2000 Review Board will meet in May and November 1978. The location and exact dates will be announced at a later date.

Project 2000 is an evaluation of the fundamental technological developments in aerospace up to the year 2000 and their impact on possible military applications.

SECTION II

1977 AGARD PUBLICATIONS

- 1977 AGARD PUBLICATIONS BY SERIES
- ABSTRACTS OF 1977 AGARD PUBLICATIONS BY PANEL OR ACTIVITY

ABBREVIATIONS

ASMP	AEROSPACE MEDICAL PANEL
AVP	AVIONICS PANEL
EPP	ELECTROMAGNETIC WAVE PROPAGATION PANEL
FMP	FLIGHT MECHANICS PANEL
FDP	FLUID DYNAMICS PANEL
GCP	GUIDANCE AND CONTROL PANEL
PEP	PROPULSION AND ENERGETICS PANEL
SMP	STRUCTURES AND MATERIALS PANEL
TIP	TECHNICAL INFORMATION PANEL
MCS	MILITARY COMMITTEE STUDIES
LS	LECTURE SERIES

1977 AGARD PUBLICATIONS BY SERIES

ADVISORY REPORTS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AR88 Volume II	USE OF PRECISION POSITIONING SYSTEMS BY NATO Aerospace Applications Study No.6 (Classified)	January	MCS
AR88 Volume III	USE OF PRECISION POSITIONING SYSTEMS BY NATO Aerospace Applications Study No.6 (Classified)	November	MCS
AR 90	A STUDY OF STANDARDIZATION METHODS FOR DIGITAL GUIDANCE AND CONTROL SYSTEMS	May	GCP
AR91 Volume I	TECHNIQUES FOR SUPPRESSION OF RADARS ASSOCIATED WITH SAMs – Aerospace Applications Study No.7 (Classified)	January	MCS
AR100	COMPUTER APPLICATIONS I.J.Gabelman (Editor)	February	AVP
AR101 Volume I	ENGINES FOR SMALL PROPELLER-DRIVEN RPVs	November	PEP
AR103 Volumes I & II	ADVANCED TECHNOLOGY TO COUNTER THE LOW ALTITUDE THREAT	November	MCS
AR104 (Eng)	AERO ENGINE DETERIORATION IN AIR FORCE SERVICE (Classified)	September	PEP
AR104 (Fr)	DETERIORATION DES MOTEURS D'AVIONS DANS LES SERVICES DES ARMEES DE L'AIR (Classified)	November	PEP
AR105	A FURTHER REVIEW OF CURRENT RESEARCH RELATED TO THE DESIGN AND OPERATION OF LARGE WINDTUNNELS	August	FDP
AR106	PHYSICAL VULNERABILITY OF AIRCRAFT DUE TO FLUID DYNAMIC EFFECTS	July	FDP
AR107	DRAG AND OTHER AERODYNAMIC EFFECTS OF EXTERNAL STORES (Classified)	November	FDP
AR109	TECHNICAL EVALUATION REPORT ON THE 49th (A) PEP SPECIALISTS' MEETING ON SECONDARY FLOWS IN TURBOMACHINES K.Papailiou	November	PEP
AR110	TECHNICAL EVALUATION REPORT ON THE 49th (B) PEP SPECIALISTS' MEETING ON POWER PLANT RELIABILITY G.P.Sallee	November	PEP
AR112	RAPPORT D'EVALUATION TECHNIQUE du CONGRES DU PANEL DE LA DYNAMIQUE DES FLUIDES sur LA MISE EN OEUVRE DE MOYENS NON PERTURBATEURS D'ETUDES DES ECOULEMENTS DES FLUIDES	December	FDP
AR113	TECHNICAL EVALUATION REPORT on the AVIONICS PANEL/ GUIDANCE AND CONTROL PANEL JOINT SYMPOSIUM on AVIONICS/ GUIDANCE AND CONTROL FOR REMOTELY PILOTED VEHICLES (RPV's)	December	AVP/GCP

REPORTS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
R653	SOME ENGINEERING PROBLEMS IN THE ROYAL AIR FORCE H.Durkin	February	SMP
R654 Advance Version	SPECIAL COURSE ON CONCEPTS FOR DRAG REDUCTION	March	FDP
R654	SPECIAL COURSE ON CONCEPTS FOR DRAG REDUCTION	June	FDP
R655	METHODS OF TECHNOLOGICAL FORECASTING F.Hetman	May	MCS
R656	HUMAN FACTORS TOPICS IN FLIGHT SIMULATION: AN ANNOTATED BIBLIOGRAPHY	June	ASMP
R657	MAXIMIZING EFFICIENCY AND EFFECTIVENESS OF INFORMATION DATA BANKS Y.M.Braunstein	May	TIP
R658	A CATALOGUE OF CURRENT IMPACT TEST DEVICES	September	ASMP
R659	CORROSION FATIGUE OF AIRCRAFT MATERIALS	October	SMP
R661	FACTORS OF SAFETY	November	SMP
R662	COMPUTER AIDED DESIGN	December	SMP

AGARDOGRAPHS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AG160 Volume 1 Reprint	BASIC PRINCIPLES OF FLIGHT TEST INSTRUMENTATION ENGINEERING A.Pool and D.Bosman (Editors)	March	FMP
AG160 Volume 8	LINEAR AND ANGULAR POSITION MEASUREMENT OF AIRCRAFT COMPONENTS J.C. van der Linden and H.A.Mensink	January	FMP
AG213 (Fr)	ETUDE COMPARATIVE DES REGLEMENTATIONS SUR L'APTITUDE MEDICALE AUS EMPLOIS DU PERSONNEL NAVIGANT DANS NEUF AVIATIONS MILITAIRES DE SEPT PAYS DE L'ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD E.Evrard	November	ASMP
AG213 (Eng)	COMPARATIVE STUDY OF REGULATIONS ON STANDARDS OF MEDICAL FITNESS FOR FLYING DUTIES IN NINE AIR FORCES COVERING SEVEN COUNTRIES OF THE NORTH ATLANTIC TREATY ORGANIZATION E.Evrard	November	ASMP
AG220	AERODYNAMICS OF CASCADES Translated and revised by A.Klein	December	PEP
AG223	A CRITICAL COMPILATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYER DATA H.H.Fernholz and P.J.Finley	July	FDP
AG224	INTEGRITY IN ELECTRONIC FLIGHT CONTROL SYSTEMS Technical Director: P.R.Kurzhals	April	GCP

AGARDOGRAPHS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AG226	ANTONIO FERRI: SELECTED PAPERS ON ADVANCED DESIGN OF AIR VEHICLES	August	PEP
AG227	LA PSYCHO-PATHOLOGIE DE L'ELEVE-PILOTE ET LA SURVEILLANCE MEDICO-PSYCHOLOGIQUE EN ECOLE DE PILOTAGE *THE PSYCHO-PATHOLOGY OF THE STUDENT PILOT AND MEDICO-PSYCHOLOGICAL MONITORING IN THE FLYING SCHOOL* J.R.Galle-Tessonneau	August	ASMP
AG228	USE OF GENERAL FATIGUE DATA IN THE INTERPRETATION OF FULL-SCALE FATIGUE TESTS W.Barrois	October	SMP
AG229	SURVEY OF COMPUTER-ASSISTED WRITING AND EDITING SYSTEMS P.I.Berman	July	TIP
AG230	THE PRINCIPLES OF UNDERWATER ESCAPE FROM AIRCRAFT A.F.Davidson	November	ASMP

CONFERENCE PROCEEDINGS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
CP192	ARTIFICIAL MODIFICATION OF PROPAGATION MEDIA H.J.Albrecht (Editor)	January	EPP
CP192 (Suppl.)	ARTIFICIAL MODIFICATION OF PROPAGATION MEDIA (Classified) H.J.Albrecht (Editor)	June	EPP
CP197	NEW DEVICES, TECHNIQUES AND SYSTEMS IN RADAR	February	AVP
CP202	SPECIAL ASPECTS OF AVIATION OCCUPATIONAL AND ENVIRONMENTAL MEDICINE M.S.Hughes (Editor)	February	ASMP
CP203	RECENT ADVANCES IN SPACE MEDICINE J.Colin (Editor)	January	ASMP
CP204	PREDICTION OF AERODYNAMIC LOADING	February	FDP
CP205	VARIABLE GEOMETRY AND MULTICYCLE ENGINES	March	PEP
CP208	EM PROPAGATION CHARACTERISTICS OF SURFACE MATERIALS AND INTERFACE ASPECTS A.J.Albrecht (Editor)	June	EPP
CP209	PROPAGATION LIMITATIONS OF NAVIGATION AND POSITIONING SYSTEMS	February	EPP
CP212	AIRCRAFT OPERATIONAL EXPERIENCE AND ITS IMPACT ON SAFETY AND SURVIVABILITY	January	FMP
CP212 (Suppl.)	*AIRCRAFT OPERATIONAL EXPERIENCE AND ITS IMPACT ON* SAFETY AND SURVIVABILITY (Classified)	February	FMP
CP213	AVIONICS/GUIDANCE AND CONTROL FOR REMOTELY PILOTED VEHICLES (Classified)	June	GCP
CPP214	SECONDARY FLOWS IN TURBOMACHINES (Preprints)	March	PEP

CONFERENCE PROCEEDINGS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
CP214	SECONDARY FLOWS IN TURBOMACHINES	September	PEP
CPP215	POWER PLANT RELIABILITY (Preprints)	March	PEP
CP215	POWER PLANT RELIABILITY	August	PEP
CPP216	METHODS TO ASSESS WORKLOAD (Preprints)	April	ASMP
CPP217	STUDIES ON PILOT WORKLOAD (Preprints)	April	ASMP
CP217	STUDIES ON PILOT WORKLOAD R.Auffret (Editor)	November	ASMP
CPP218	THE USE AND ABUSE OF SOCIAL DRUGS (Preprints)	April	ASMP
CPP219	OPTICAL FIBRES, INTEGRATED OPTICS AND THEIR MILITARY APPLICATIONS (Preprints)	May	EPP/AVP
CP219	OPTICAL FIBRES, INTEGRATED OPTICS AND THEIR MILITARY APPLICATIONS H.Hodara (Editor)	October	EPP/AVP
CP221	FRACTURE MECHANICS DESIGN METHODOLOGY	February	SMP
CP222	ACOUSTIC FATIGUE REVIEW	April	SMP
CP223	FLIGHT TEST TECHNIQUES	April	FMP
CPP224	LAMINAR TURBULENT TRANSITION (Preprints)	April	FDP
CP224	LAMINAR TURBULENT TRANSITION	October	FDP
CPP225	THE IMPACT OF FUTURE DEVELOPMENTS IN COMMUNICATIONS, INFORMATION TECHNOLOGY AND NATIONAL POLICIES ON THE WORK OF THE AEROSPACE INFORMATION SPECIALIST (Preprints)	May	TIP
CP225	THE IMPACT OF FUTURE DEVELOPMENTS IN COMMUNICATIONS, INFORMATION TECHNOLOGY AND NATIONAL POLICIES ON THE WORK OF THE AEROSPACE INFORMATION SPECIALIST	September	TIP
CP226	UNSTEADY AIRLOADS IN SEPARATED AND TRANSONIC FLOW	July	SMP
CPP227	UNSTEADY AERODYNAMICS (Preprints)	August	FDP
CPP228	STRUCTURAL ASPECTS OF ACTIVE CONTROLS (Preprints)	August	SMP
CPP229	HIGH TEMPERATURE PROBLEMS IN GAS TURBINE ENGINES (Preprints)	September	PEP
CPP230	IMPACT OF CHARGE COUPLED DEVICES AND SURFACE ACOUSTIC WAVE DEVICES ON SIGNAL PROCESSING AND IMAGERY IN ADVANCED SYSTEMS (Preprints)	September	AVP

CONFERENCE PROCEEDINGS
(Continued)

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
CPP231	PROSPECTIVE MEDICINE OPPORTUNITIES IN AEROSPACE MEDICINE (Preprints)	October	ASMP
CPP232	SPECIFIC FINDINGS IN CARDIOLOGY AND PULMONARY FUNCTION WITH SPECIAL EMPHASIS ON ASSESSMENT CRITERIA FOR FLYING (Preprints)	October	ASMP

LECTURE SERIES

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
LS80	AERODYNAMIC NOISE	January	DPP
LS86	COMPUTATIONAL FLUID DYNAMICS	April	DPP
LS87	MICROPROCESSORS AND THEIR APPLICATIONS	March	DPP
LS88	APPLICATIONS OF REMOTE SENSING TO OCEAN SURVEILLANCE	September	DPP
LS89	TASK-ORIENTED FLIGHT CONTROL SYSTEMS	May	DPP
LS90	LASER OPTICAL MEASUREMENT METHODS FOR AERO ENGINE RESEARCH AND DEVELOPMENT	July	DPP
LS91	ADVANCED MANUFACTURING TECHNIQUES IN JOINING OF AEROSPACE MATERIALS	September	DPP

MISCELLANEOUS

Number	*Title/Author/Editor*	*Publication Date*	*Activity*
AGARD BULLETIN 1977/1: MEETINGS, PUBLICATIONS, MEMBERSHIP		January	HQ
DIRECTOR'S ANNUAL REPORT TO THE NORTH ATLANTIC MILITARY COMMITTEE 1976		March	HQ
AGARD HIGHLIGHTS 77/1		March	HQ
AGARD BULLETIN 1977/2		August	HQ
AGARD HANDBOOK (Revised)		August	HQ
AGARD HIGHLIGHTS 77/2		September	HQ
AGARD INDEX OF PUBLICATIONS 1974–1976		October	TIP

AEROSPACE MEDICAL PANEL (ASMP)

Conference Proceedings 203
J.Colin (Editor)
January 1977
122 pages
ISBN 92-835-0186-1

Recent Advances in Space Medicine
This publication contains 13 papers presented at a Specialists' Meeting of the Aerospace Medical Panel, held in Athens, Greece, 20–24 September 1976. A Technical Evaluation Report, in French and English, is included.

Conference Proceedings 202
M.S.Hughes (Editor)
February 1977
96 pages
ISBN 92-835-0188-8

Special Aspects of Aviation Occupational and Environmental Medicine
The Proceedings contains twelve papers presented at the ASMP Specialists' Meeting, Athens, 20–24 September 1976 and are arranged in groups dealing with their common aspects. The groups are sub-titled: (a) Medical, Psychiatric and Psychological Problems of Air Traffic Controllers and Radar Operators; (b) Monitoring, Measurement and Assessment of Potential Hazards Associated with Aircraft Operations; and (c) Industrial Hazards and their Control Associated with Aircraft and Missile Operations. Many of the current health hazards were identified and those that workers may be exposed to in the future were pinpointed. Recommendations were made as to their avoidance and control.

Conference Preprint 216
April 1977
108 pages

Methods to Assess Workload
Preprints of papers delivered at Specialists' Meeting, Porz-Wahn, April 1977.

Conference Preprint 217
April 1977
40 pages

Studies on Pilot Workload
See Conference Proceedings 217 below.

Conference Preprint 218
April 1977
40 pages

The Use and Abuse of Social Drugs
Preprints of papers delivered at Specialists' Meeting, Porz-Wahn, April 1977.

Report 656
June 1977
144 pages
ISBN 92-835-1246-4

Human Factors Topics in Flight Simulation: An Annotated Bibliography
This bibliography contains 504 references, with summaries, to reports concerned with human factors topics in flight simulation. Reports dealing solely with the engineering aspects of flight simulation have been excluded, unless they contain items of human factors interest. The bibliography, covering the years 1940 to 1976, is mainly comprised of English-language reports and contains no reference to classified material.

AGARDograph 227
J.R.Galle-Tessonneau
August 1977
46 pages
ISBN 92-835-0201-9

La Psycho-Pathologie de l'Elève-Pilote et la Surveillance Médico-Psychologique en Ecole de Pilotage
The Psycho-Pathology of the Student Pilot and Medico-Psychological Monitoring in the Flying School

Le problème le plus important qui se pose dans une Ecole de Pilotage est celui de l'adaptation aéronautique des élèves-pilotes du métier aérien. Cela ne va pas sans difficultés soit sur le plan corporel et physiologique, soit sur le plan émotionnel et affectif, soit sur le plan relationnel et collectif.

Dans une deuxième partie de ce travail, nous proposons une tentative de synthèse à partir des aspects spécifiques de la "situation aéronautique" et d'une certaine forme d'angoisse qui lui est propre et cela nous conduit à une élaboration plus théorique qui pourrait rendre compte des divers processus de l'adaptation et de l'inadaptation.

The most important problem which arises in a flying school is that of the aeronautical adaptation of the student pilots to an air career. This does not take place without difficulties which may be physical and physiological, emotional and affective, or in relationships and communal living.

In the second part of this work we propose an attempt at synthesis from the specific aspects of the "aeronautical situation" and from a certain form of distress which is inherent in it and this brings us to a more theoretical formulation which could take into account the various processes of adaptation and non-adaptation.

Report 658
September 1977
110 pages (of which 62 are printed)
ISBN 92-835-1256-1

A Catalogue of Current Impact Test Devices
This report is the result of a Working Group set up in 1972 under the auspices of NATO/AGARD Aerospace Medical Panel to consider the standardisation of bio-dynamic impact testing with special reference to helmets, seats and harnesses. Helmets were considered separately (AGARD Report No.629). This report is based on replies to questionnaires sent to research laboratories, and catalogues 52 impact test devices. They are listed according to the operating organisations, and classified by principle of operation (accelerators, decelerators, horizontal, vertical etc). Details of construction, performance and use of each facility are given. Also described are some current standards for crash impact testing and the principles of operation of the more common types of test devices.

Conference Preprint 231
October 1977
64 pages

Prospective Medicine Opportunities in Aerospace Medicine
Preprints of papers delivered at Specialists' Meeting, London, October 1977.

Conference Preprint 232
October 1977
154 pages

Specific Findings in Cardiology and Pulmonary Function with Special Emphasis on Assessment Criteria for Flying
Preprints of papers delivered at Specialists' Meeting, London, October 1977.

Conference Proceedings 217
R.Auffret (Editor)
November 1977
134 pages
ISBN 92-835-0205-1

Studies on Pilot Workload
Twelve papers were presented at the ASMP Specialists' Meeting held in Köln, Germany, 18–22 April 1977.

Six related to the evaluation of the work-load on the helicopter, thus revealing the importance and the new difficulties of helicopter operational missions. They comprised a general study of the stresses peculiar to helicopter piloting (B1), the problems raised by low altitude flight (B2 and B3), by long duration flights (B4), by blind flying and landing (B5 and B6).

Five papers were devoted to problems specific to aeroplanes; long duration flight in a combat aircraft in transoceanic deployment (B7), metabolic and endocrinal cost of flight in combat aircraft (B8), new aiming system for air-to-ground firing (B9), deck landing at night during prolonged operational campaigns on aircraft carriers (B10), flight quality and work-load on a short-haul transport aircraft (B11). One paper studied by a selectively directed questionnaire the special characteristics of the work of different categories of pilots (B12).

AGARDograph 230
A.F.Davidson
November 1977
30 pages
ISBN 92-835-1262-6

The Principles of Underwater Escape from Aircraft
Since the early days of aviation, aircraft have landed in water either intentionally or by accident. This paper attempts to review the physical, mechanical and physiological factors involved in escape from aircraft following ditching and describes some mechanical devices which can be used to assist the aircrew to reach the surface safely. It also includes comments on the conduct of trials and the training of personnel in the techniques of underwater escape from aircraft.

AGARDographie 213 (FR)
E.Evrard
novembre 1977
140 pages
ISBN 92-835-2102-1

Etude Comparative des Règlementations sur l'Aptitude Médicale aux Emplois du Personnel Navigant dans Neuf Aviations Militaires de Sept Pays de l'Organisation du Traité de l'Atlantique Nord
Dans cet ouvrage sont exposés les règlements relatifs à la médecine aéronautique en vigueur dans le domaine militaire. L'accent est mis en particulier sur:
- la terminologie
- les normes et les règlements
- les méthodes et techniques des tests et le procédures d'examen
- les critères d'interprétation

utilisés par les différentes forces aériennes des nations de l'OTAN.

AGARDograph 213 (Eng)
E.Evrard
November 1977
136 pages
ISBN 92-835-1265-0

Comparative Study of Regulations on Standards of Medical Fitness for Flying Duties in Nine Air Forces Covering Seven Countries of the North Atlantic Treaty Organisation
In this work are laid down the aeromedical regulations in the military field. Special emphasis is placed on:
- terminology
- standards and regulations
- methods and techniques of tests and examination procedures
- interpretation criteria

used by the various air forces in the NATO nations.

AVIONICS PANEL (AVP)

Conference Proceedings 197
February 1977
606 pages
ISBN 92-835-0185-3

New Devices, Techniques and Systems in Radar

This publication comprises the proceedings of a Symposium on New Devices, Techniques and Systems in Radar held in The Hague, Netherlands in June 1976 by the Avionics Panel of AGARD.

The objective was to review the influence on radar systems of new devices and techniques, improvements in fundamental knowledge and better methods of performance prediction.

The papers and discussion are grouped under the following headings; Devices and Modules; Radar Techniques; Targets, Clutter and Propagation; Simulation and Detection Theory; and New Systems and Concepts.

The technologies of antennas and displays were not emphasised as these topics had been covered by AGARD Symposia in 1972 and 1975 respectively.

Advisory Report 100
I.J.Gabelman (Editor)
February 1977
90 pages
ISBN 92-835-1237-6

Computer Applications

New developments in solid state technology have emerged which make possible significant improvements in computer capability. These improvements allow for wider applicability of data processing equipments in effecting command and control in the NATO military environment.

Solid state technology has decreased by orders of magnitude the volume and power required by computer circuitry and hence has made possible more sophisticated data processing. The technology is now available to construct high level language computers; to control functions in hardware rather than software, to build microprocessors for distributed use in tactical environments; to make available for field use low power, non-mechanical, mass memory systems; to tailor computer architectures to specific applications, and for many other innovative uses.

This report describes the solid state technical developments and assesses the importance of these developments in their application to satisfying NATO military requirements.

Conference Preprint 230
September 1977
334 pages

Impact of Charge Coupled Devices and Surface Acoustic Wave Devices on Signal Processing and Imagery in Advanced Systems

Preprints of papers delivered at Symposium, Ottawa, Canada, October 1977.

Advisory Report 113
Morris A.Ostgaard
December 1977
14 Pages
ISBN 92-835-1264-2

Technical Evaluation Report on the Avionics Panel/Guidance and Control Panel Joint Symposium on Avionics/Guidance and Control for Remotely Piloted Vehicles (RPV's)

A joint symposium of the AGARD Avionics Panel and Guidance and Control Panel was held in Florence, Italy 4–8 October 1976.

Forty-five papers were presented on the following topics: Operational Concepts and Requirements, Electro-Optical Sensors, Radar and Radiometric Sensors, Communications, Guidance and Flight Control Techniques, Target Acquisition and Weapon Delivery, Command and Control.

This Technical Evaluation Report gives a brief review of the papers presented, the conclusions to be drawn from them and recommendations for further studies.

ELECTROMAGNETIC WAVE PROPAGATION PANEL (EPP)

Conference Proceedings 192
H.J.Albrecht (Editor)
January 1977
204 pages
ISBN 92-835-1234-1

Artificial Modification of Propagation Media

Papers and discussion material were presented at the Specialists' Meeting of the Panel held in Brussels, Belgium, 26–29 April 1976.

Communication systems are affected by characteristics of different propagation media depending on frequency range and distances to be covered. An artificial modification of the propagation media may improve system reliability or even establish the propagation conditions basically required.

A Specialists' Meeting was particularly concerned with recognition and definition of limiting propagation criteria, optimum methods of modification, and efficiency of changing propagation media as a function of means employed. It represented an early, if not the first scientific meeting actually addressing, with its main topic, the anthropogeneous changes to the earth's atmosphere as a propagation medium. The entire subject was subdivided into three sections, viz. modification of non-ionized media, of ionized media by e.m. waves, and of ionized media by chemical substances.

In addition to the recognition of the state of the art and the predominant directions of progress, the stimulation of propagation-oriented modification projects may be mentioned as a major achievement of the meeting; it also indicated promising areas of future research.

Conference Proceedings 209
February 1977
350 pages
ISBN 92-835-0189-6

Propagation Limitations of Navigation and Positioning Systems
In order to assess the requirments for navigation and positioning systems, the current status of these systems, and the limitation the propagation medium places on systems in being or planned, the AGARD EPP held a Specialists' Meeting in Istanbul, 20–22 October 1976, on this subject. The concept of the meeting was to outline requirements and progress in systems and to plan programs for future studies to reduce any propagation limitations on navigation systems.

Accordingly, the meeting reviewed various subjects including civilian requirements for sea, air and ground navigation systems both short and long range, and propagation study needs of Loran C, Omega, NAVSTAR, and Aerostat. In addition, requirements for other systems were outlined and possible propagation problems discussed. Proposed future research and development programs was the subject of a round table discussion. The aim was to mitigate the propagation problems that systems will and have encountered.

Conference Preprint 219
May 1977
448 pages

Optical Fibres, Integrated Optics and their Military Applications
See Conference Proceedings 219 below.

Conference Proceedings 192
(Supplement)
(Classified)
H.J.Albrecht (Editor)
June 1977
16 pages

Artificial Modification of Propagation
This publication summarizes the classified discussion which took place at the Specialists' Meeting held in Brussels, Belgium, 26–29 April 1976. The papers presented at this meeting are published as AGARD-CP-192.

Communication systems are affected by characteristics of different propagation media depending on frequency range and distances to be covered. An aritifical modification of the propagation media may improve system reliability or even establish the propagation conditions basically required.

A Specialists' Meeting was particularly concerned with recognition and definition of limiting propagation criteria, optimum methods of modification, and efficiency of changing propagation media as a function of means employed. It represented an early, if not the first scientific meeting actually addressing, with its main topic, the anthropogeneous changes to the earth's atmosphere as a propagation medium. The entire subject was subdivided into three sections, viz. modification of non-ionized media, of ionized media by e.m. waves, and of ionized media by chemical substances.

In addition to the recognition of the state of the art and the predominant directions of progress, the simulation of propagation-oriented modification projects may be mentioned as a major achievement of the meeting; it also indicated promising areas of future research.

Conference Proceedings 208
H.J.Albrecht (Editor)
June 1977
246 pages
ISBN 92-835-0196-9

EM Propagation Characteristics of Surface Materials and Interface Aspects
Papers and discussion material were presented at the Specialists' Meeting of the Panel held in Istanbul, Turkey, 18–19 October 1976.

In the field of electromagnetic wave propagation, essential limiting conditions may be represented by characteristics and behaviour of boundaries of the propagation environment. The performance of propagation paths may depend significantly upon variations in such surface properties.

A Specialists' Meeting was particularly concerned with surface characteristics and accounted for the increasing importance of appropriate parameters for a number of modern fields of research and engineering applications, such as remote sensing and surveillance, target recognition, sub-surface propagation, etc. Sessions dealt with EM surface characteristics, propagation in interface media, and global distribution of EM surface characteristics. Material presented and discussed was supplemented by a round-table discussion.

The meeting provided a review of the state of the art in this field of research, discussed theoretical and engineering aspects, and indicated promising areas of research.

Conference Proceedings 219
H.Hodara (Editor)
October 1977
594 pages
ISBN 92-835-0206-X

Optical Fibres, Integrated Optics and their Military Applications
Papers presented at the Electromagnetic Wave Propagation Panel/Avionics Panel Joint Symposium held in London, 16–20 May 1977.

Rapid developments in laser semiconductors and low-loss optical fibres have revealed many new applications. The obvious advantages of a high degree of communi-

cation security, freedom from electronic interference, large length-bandwidth product, and system miniaturization possibilities have led to new concepts and applications in military systems.

This conference provided a forum to review and discuss the latest developments in fibre and integrated optics, with emphasis on military applications.

FLIGHT MECHANICS PANEL (FMP)

AGARDograph 160
Volume 8
J.C.van der Linden and
H.A.Mensink
January 1977
46 pages
ISBN 92-835-1236-8

Linear and Angular Position Measurement of Aircraft Components

This AGARDograph is the 8th of the AGARD Flight Test Instrumentation Series and concentrates on the flight test instrumentation for determining the position of movable aircraft components such as:–

– rudder, elevator and aileron surfaces,
– wing flaps, trim tabs, speed brakes, spoilers,
– power-control levers,
– elements of nosewheel-steering systems and of landing gear mechanisms, etc.

The sensitivity and frequency responses of the various systems used for making these measurements are discussed in the following groups with examples:–

– potentiometers,
– synchros,
– inductive systems,
– digital systems.

Conference Proceedings 212
January 1977
340 pages
ISBN 92-835-0187-X

Aircraft Operational Experience and its Impact on Safety and Survivability

The AGARD Flight Mechanics Panel Symposium on Aircraft Operational Experience and its Impact on Safety Survivability was held in Sandefjord, Norway, 31 May – 3 June 1976 so that experts in the fields of aircraft accident investigation; aircraft design for reliability and survivability; and hazards and piloting factors in aircraft operation could share their understanding, knowledge and experience in order to improve aircraft safety and survivability.

The Symposium should be viewed as a continuation of the activities of the Symposium on Lessons with Emphasis on Flight Mechanics from Operating Experience, Incidents and Accidents sponsored by the AGARD Flight Mechanics Panel in 1970 at Baden-Baden (AGARD-CP-76).

This meeting provided the military and civilian participants with a unique opportunity for discussions and exchanges concerning common problems and their solutions. The papers presented offer an excellent overview of the international state-of-the-art in aircraft safety and survivability. Particularly noteworthy are the strong interdisciplinary aspects of the papers.

The Symposium included 27 papers organized into five sessions as follows: (i) Accident Statistics and Analysis; (ii) Design Practices for Aircraft Safety; (iii) Design for Aircraft Vulnerability and Survivability; (iv) Operational Experience and Safety Considerations; (v) Aircrew Considerations.

Two papers of Session III are Classified, and are published separately in AGARD-CP-212 (Supplement).

Conference Proceedings 212
(Supplement)
(Classified)
February 1977
24 pages

Aircraft Operational Experience and its Impact on Safety and Survivability

This Supplement contains the two classified papers presented at the above meeting; the 25 unclassified papers are published in AGARD Conference Proceedings No.212.

AGARDograph 160
Volume 1
A.Pool and D.Bosman (Editors)
Reprint March 1977
180 pages incl. references,
figures and index

Basic Principles of Flight Test Instrumentation Engineering

This first volume of the AGARD Flight Test Instrumentation Series presents an overall review of instrumentation principles and is especially directed toward flight test engineers. It discusses the main lines along which a flight test instrumentation system is developed, indicates the main steps taken during the design, and defines the basic concepts used by instrumentation specialists. Both data collection and data processing aspects are considered. This volume, containing twelve chapters, is divided into three main parts covering general considerations about the design of a flight test instrumentation system, design of a single measuring channel and design of multi-channel instrumentation systems.

Conference Proceedings 223
April 1977
434 pages
ISBN 92-835-0194-2

Flight Test Techniques
This Symposium held at DFVLR, Porz Wahn, Germany, 11–14 October 1976 was organized around three subject areas and concentrated on techniques rather than results:
- Weapons System Clearance,
- Weapon System Development and Evaluation,
- Data Acquisition and Handling Techniques.

The first session was devoted to techniques used in flight clearance of the basic air vehicle, including flight control systems, engines, engine-inlet systems, etc., and the externally carried weapons. Session II papers gave a broad but fairly coherent coverage of the techniques used in weapon system development. Papers in the third session covered advances in the state-of-the-art of instrumentation systems and components, data transmission, data processing, and airborne displays required for safe and efficient flight tests. The Symposium was concluded with a Round Table Discussion.

FLUID DYNAMICS PANEL (FDP)

Conference Proceedings 204
February 1977
342 pages
ISBN 92-835-1238-4

Prediction of Aerodynamic Loading
This FDP Symposium, held at NASA Ames Research Center, Moffett Field, California in September 1976, was primarily concerned with the fluid dynamic aspects of predicting aerodynamic loads on aircraft and their external stores, and in particular those loads that represent difficult design and operating problems. Emphasis was on theoretical and semi-empirical methods for determining the level and distribution of the expected loading, and on assessing and evaluating the accuracy of the predicted values through comparison with available experimental data from windtunnels or from flight tests.

Four sessions were conducted: Experimental and Semi-Empirical; External Stores and Vortex Interactions; Calculation; Quasi-Steady Loads; and Transient or Fluctuating Loads. Following the last session, a Round Table Discussion was conducted, led by session Chairmen, in which all participants were invited to comment.

Report 654
Advance Version
March 1977
176 pages

Special Course on Concepts for Drag Reduction
See Report 654 below.

Conference Preprints 224
April 1977
230 pages

Laminar Turbulent Transition
See Conference Proceedings below.

Report 654
June 1977
300 pages
ISBN 92-835-1247-2

Special Course on Concepts for Drag Reduction
The material assembled in this book was prepared under the combined sponsorship of the Fluid Dynamics Panel, the von Kármán Institute and the Consultant and Exchange Program of AGARD and was presented as an AGARD Special Course at the von Kármán Institute, Rhode-St-Gènese, Belgium on 28 March – 1 April 1977.

A growing research effort is being mounted in a number of countries into investigations of ideas for drag reduction, some novel and some that were looked at in the past but were not then pursued to the point of application because the economic 'facts of life' were different from and less pressing than they are now.

These ideas include means for reducing skin friction drag (e.g. compliant walls, boundary layer control, etc.), induced drag (e.g. winglets), interference drag, transonic shock wave drag (supercritical wings) and supersonic wave drag. In addition the internal aerodynamics of ducting, especially diffusers is receiving attention to improve the performance of engines.

Already this research effort is bearing fruit and it was thought by the AGARD Fluid Dynamics Panel and the Von Kármán Institute that the time was opportune to provide a Special Lecture Course devoted to this work and its potential for the future. The organisers of the course were fortunate in persuading outstanding experts in this field in the USA and in Europe to contribute to the Course.

AGARDograph 223
H.H.Fernholz and P.J.Finley
July 1977
480 pages
ISBN 92-835-1245-6

A Critical Compilation of Compressible Turbulent Boundary Layer Data
The compilation provides data obtained in 59 experimental studies of compressible, two-dimensional, turbulent boundary layers. The data are presented in standardised form as tables and microfiche, and are available on magnetic tape. The published descriptions of the experiments have also been standardised, and in many cases supplemented by additional information provided by the original authors, who have also supplied much, as yet, unpublished data.

The 'entries' which describe the experiments are preceded by a general introduction describing the principles and methods applied in the compilation of the data catalogue. There is also an initial discussion of some of the problems of interpretation encountered in this field.

Advisory Report 106
D.B.Ankeney
July 1977
82 pages
ISBN 92-835-1249-9

Physical Vulnerability of Aircraft due to Fluid Dynamic Effects
The material in this Report is intended to supplement and provide a more detailed fluid dynamic input to AGARD Advisory Report No.47, *The Physical Vulnerability of Aircraft*, (3 volumes, September 1972, May 1973 and May 1973, NATO Classified). Readers with a general interest in the subject of aircraft physical vulnerability are referred to AR-47.

The present report consists of two Papers: (1) Techniques for Predicting Structural Response due to Explosive Air Blast; and (2) Hydraulic Ram Pressure Prediction and Structural Response.

Advisory Report 105
August 1977
130 pages
ISBN 92-835-1252-9

A Further Review of Current Research Related to the Design and Operation of Large Windtunnels
This is the third in a series of reports on research related to windtunnel design and operation. The first two were written by MiniLaWs (AGARD AR-68 and AR-83). This report is written by the Windtunnel Test Techniques (TES) Subcommittee of the AGARD Fluid Dynamics Panel. Current results and planned effort for 340 studies and research investigations underway in nine countries are reviewed and commented upon in this report.

Part I describes the work of the TES Subcommittee and gives the rationale for the effort. Part II reviews the research that is underway and gives comments and recommendations derived from that review. These comments and recommendations are the principal contributions of the TES Subcommittee members. Part III summarizes the main conclusions and recommendations. Part IV lists titles, investigators' names and locations for the research and studies that are reviewed herein.

Seventy-nine leading research workers from nine countries participated in the work of the TES Subcommittee and made valuable contributions.

Need for advances and the possibilities for achieving further technology gains are developed in this report and sixteen technology gains requiring further research are specified in Part III.

Conference Preprints 227
August 1977
188 pages

Unsteady Dynamics
Preprints of papers presented at Specialists' Meeting, Ottawa, Canada, September 1977.

Conference Proceedings 224
October 1977
398 pages
ISBN 92-835-0204-3

Laminar-Turbulent Transition
Papers presented and Discussions held at the Symposium held at the Technical University of Denmark, Lyngby, Denmark, 2–4 May 1977.

This Symposium provided a forum for an exchange of views and an assessment of the state of the art in the field of laminar-transition flows. Recent advances in laminar stability theory and prediction methods for laminar-transitional flows were presented. The meeting indicated that many of the complicated transitional flow processes and mechanisms are not well understood and are not amenable to calculation. There still remains a basic, fundamental limitation of our knowledge and mathematical ability to describe and compute the fluid mechanical processes, except for simplified cases. The difficulty of obtaining meaningful, consistent, accurate experimental data, free from adverse tunnel environment effects, was expressed. To enhance their usefulness, all experimental studies should contain adequate documentation of all local and free-stream test conditions and parameters. There is a basic need for a complementary dialogue to be established between the experimentalist and the theoretician. A fruitful exchange between the foremost researchers in the field identified some critical areas for future theoretical and experimental studies.

Advisory Report No.107
(Classified)
November 1977
304 pages

Drag and Other Aerodynamic Effects of External Stores

At the request of the NATO Military Committee the AGARD Fluid Dynamics Panel established in September 1974 a Working Group on "*Drag and other aerodynamic effects of external stores*". The main aims of this Working Group were an assessment of future prospects and possibilities and an identification of promising areas for research and development in connection with external stores.

The Working Group has laid down in this report its analysis of the present situation and its recommendations for the future.

Advisory Report 112
X.Bouis
December 1977
8 pages
ISBN 92-835-2103-X

Rapport d'Evaluation Technique du Congres du Panel de la Dynamique des Fluides sur la Mise en Oeuvre de Moyens non Perturbateurs d'Etude des Ecoulements des Fluides

The FDP Symposium provided a survey and review of non-intrusive measurement concepts, particularly the laser doppler anemometer. Application of laser anemometry and Raman diffusion techniques in research facilities has become commonplace. These research tools require specially trained operating personnel who often are the aerospace engineer or aerodynamicist himself. These techniques are widely used in simple cases for obtaining data at a single measurement point, but their usage is extremely difficult in complicated, three dimensional flow configurations and close to a wall. Basic problems include the restriction of optical access to the test field, the tedious time consuming process of obtaining local point measurements, measuring accuracies and corrections, and interpretation of results. In the future, these measurement techniques will become indispensable in both research and industry.

The Proceedings of the AGARD Fluid Dynamics Panel Symposium on "Applications of Non-Intrusive Instrumentation in Fluid Flow Research" are published as AGARD CP-193.

GUIDANCE AND CONTROL PANEL (GCP)

AGARDograph 224
Technical Director: P.R.Kurzhals
April 1977
384 pages
ISBN 92-835-0192-6

Integrity in Electronic Flight Control Systems

The intent of the AGARDograph is to address the hardware, software and man-machine interface aspects of reliable flight control systems. Rapid advances in solid-state electronics which resulted in a hundred-fold decrease in computer size, power and cost over the past two decades have revolutionized the design of modern flight control systems. Designers have capitalized on these gains primarily by incorporating additional control functions to improve aircraft or weapon system performance and survivability. As a result, control system complexity also has increased by 1 to 2 orders of magnitude, and highly-reliable flight control system operation has become critically important to mission planning and execution. While some increases in system reliability were obtained through redundancy in system mechanization, concerted efforts aimed at improving system integrity were not initiated until the late 1960's. This AGARDograph summarizes associated analysis, design, development and checkout approaches.

The AGARDograph is organized into three major parts. Part I, *Background and Requirements*; Part II, *Analysis and Testing*; and Part III, *Design and Implementation*.

Advisory Report 90
May 1977
560 pages
ISBN 92-835-1244-8

A Study of Standardization Methods for Digital Guidance and Control Systems

This Report contains the findings of the AGARD GCP Working Group No.02, set up to investigate standardization methods for digital guidance and control systems, particularly with regard to data transmission techniques and high level programming languages. It includes discussion of the general problems and techniques, reports on the particular experience of the individual nations, and concludes that, whilst much work remains to be done on software aspects, the field of data transmission may be amenable to early standardization.

The Annexes to the Report contain full details of the techniques studied, and include comparisons of data transmission methods and high level languages. These comparisons are not intended as quantitative assessments but are designed to outline the relevant features of the different techniques.

Conference Proceedings 213
(Classified)
June 1977
568 pages

Avionics/Guidance and Control for Remotely Piloted Vehicles

These Proceedings include the papers presented at a Joint Symposium of the AGARD Avionics Panel and Guidance and Control Panel, held in Florence, Italy 4–8 October 1976.

Forty-five papers were presented on the following topics: Operational Concepts and Requirements, Electro-Optical Sensors, Radar and Radiometric Sensors, Communications, Guidance and Flight Control Techniques, Target Acquisition and Weapon Delivery, Command and Control.

Advisory Report 113
Morris A.Ostgaard
December 1977
14 Pages
ISBN 92-835-1264-2

Technical Evaluation Report on the Avionics Panel/Guidance and Control Panel Joint Symposium on Avionics/Guidance and Control for Remotely Piloted Vehicles (RPV's)

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Forty-five papers were presented on the following topics: Operational Concepts and Requirements, Electro-Optical Sensors, Radar and Radiometric Sensors, Communications, Guidance and Flight Control Techniques, Target Acquisition and Weapon Delivery, Command and Control.

This Technical Evaluation Report gives a brief review of the papers presented, the conclusions to be drawn from them and recommendations for further studies.

PROPULSION AND ENERGETICS PANEL (PEP)

Conference Preprints 214
March 1977
134 pages

Secondary Flows in Turbomachines
See Conference Proceedings below.

Conference Preprints 215
March 1977
84 pages

Power Plant Reliability
See Conference Proceedings below.

Conference Proceedings 205
March 1977
474 pages
ISBN 92-835-0193-4

Variable Geometry and Multicycle Engines

These Proceedings consist of 33 papers including the discussions after each paper, and the Round Table Discussion at the end of the Symposium in Paris, 6–9 September 1976 (48th Meeting of the Propulsion and Energetics Panel). The papers from 6 nations (CA 1, IT 3, FR 5, GE 5, UK 8, US 11) were grouped into four *Sessions: Military Aspects of Variable Geometry Engines, Applications of Variable* Geometry Engines for Future Aircraft, Variable Geometry (Fans, Compressors, and Propellers), Variable Geometry (Combustors and Turbines). The session related to components included two papers on integrated power plant control systems.

Both military and civil aspects of variable geometry engines were analyzed, a broad variety of cycle investigations presented as well as on geometry variations of the engine components. Discussions of individual presentations and the final Round Table Discussion placed concern on weight and complexity problems of the engine under consideration and tried to identify what risks and costs are likely to be involved as tribute to an advanced performance during the different parts of flight missions.

AGARDograph 226
August 1977
140 pages
ISBN 92-835-1235-7

Antonio Ferri: Selected Papers on Advanced Design of Air Vehicles

This publication contains a selection of ten papers by Professor Antonio Ferri, who died in 1976 after many years association with AGARD. These papers were selected by a committee composed of Professor P.Libby, Professor R.Monti, Professor R.G.Napolitano, Dr D.M.Rogers and Professor R.Vaglio, and are concerned with the advanced design of air vehicles. They are published to bring together in one place examples of Professor Ferri's most important contributions to aerospace research and development. A biography of Professor Ferri is included, together with a bibliography of his works, and tributes from his friends and colleagues.

Conference Proceedings 215
August 1977
230 pages
ISBN 92-835-0198-5

Power Plant Reliability

These Conference Proceedings contain 18 papers presented at the 49th Meeting of the Propulsion and Energetics Panel on "Power Plant Reliability" held at the Koninklijk Instituut Van Ingenieurs, The Hague, Netherlands on 31 March and 1 April 1977. The discussions of the papers as well as a Round Table Discussion at the end of the sessions, and a Technical Evaluation Report are included in the Proceedings.

The meeting was organized to review and discuss engine reliability from four aspects:

- the reliability of current civil and military engines as experienced by the users,
- civil and military authorities' plans to promote improved reliability in future engines,
- what manufacturers are doing to improve reliability through design and testing programs,

- the role that engine health monitoring and diagnostics is taking in minimizing the impact of engine unreliability for both civil and military users.

High Engine performance, achieved step by step from one engine generation to the next has to be paid for with higher costs both of the original engine and the maintenance due to the increased complexity. Today, economic forces have produced the need for both users and manufacturers to re-evaluate their priorities on performance and engine reliability.

The meeting gave insight to major causes for engine unreliability (problems arising repeatedly and with every user, differences between engine usage and design basis, dependence on auxiliary parts or components of the engine) and showed the need for comprehensive data feedback to manufacturers.

Conference Preprints 229
September 1977
328 pages

High Temperature Problems in Gas Turbine Engines
Preprints of papers presented at Specialists' Meeting, Ankara, Turkey, September 1977.

Conference Proceedings 214
September 1977
312 pages
ISBN 92-835-0199-3

Secondary Flows in Turbomachines
These papers were presented at the 49th Meeting of the Panel held at the Koninklijk Instituut van Ingenieurs, Prinsessegracht, 23, The Hague, The Netherlands, 28–30 March 1977.

Improvement of the theoretical calculation of the inviscid core of the high performance turbomachines are more and more demanding the better understanding of the secondary flows, i.e. the part of the flow field that is close to the inner or the outer walls and is therefore subjected to high viscous stresses as well as to the effect of the vortices induced by the blade-casing junction. The meeting was divided into four sessions – a total of fifteen invited papers and seven short presentations – followed by a round table discussion.

Representatives from industry made clear: – why up to now they were not able to use the theoretical approaches available in the literature; – the need for a theoretical estimation of the blockage factor to help them to calculate more correctly the low-loss core of the flow; – the need for correct loss estimation formulas.

The response from research workers suggested: – simplified secondary vorticity considerations and pseudo-boundary layer approaches seem to be promising for multistage compressor analysis if backed by experimental results; – this analysis seems to be inadequate for turbines and fully three-dimensional calculation methods must be used. These are still time consuming but are certainly less expensive than experiments; – new experimental techniques must be used, in spite of cost and effort, to provide the necessary flow models. However, experiments must be carefully planned; – lack of understanding and experimental information exists in the areas of multistage environment, tip clearance effects and radial machines.

Advisory Report 101
Volume I
November 1977
108 pages
ISBN 92-835-1259-6

Engines for Small Propeller–Driven RPVs
In this report engines in the power range up to 100 hp are studied for application into small propeller-driven RPVs. From an inventory of existing engines, it is found that a number of two- and four-stroke piston engines in this power class are available, but most of them will not fulfill the requirements for RPV-applications with respect to reliability, quality control, noise, vibrations, etc. Up till now no other types of shaft-power engines are available for application to small RPVs, although turboshaft engines and possibly also electrically-driven propellers might offer advantages for some missions.

For payloads between 10 and 50 kg and flight endurances of up to 3 hours some parametric calculations are presented for fixed-wing and rotary-wing vehicles, to illustrate vehicle sizes and engine power requirements.

Some recommendations are given for the future development of piston- and turboshaft engines suitable for propeller-driven RPVs, emphasizing the need for Demonstrator Engine Programs. Data on actual and projected engines and some typical specifications are added in appendices.

Advisory Report 104 (English)
(Classified)
September 1977
28 pages

Aero Engine Deterioration in Air Force Service
In April 1975 a Working Group of the Propulsion and Energetics Panel of AGARD was established to determine the change in engine performance, maintenance cost and reliability of figher aircraft with respect to time in service. This Advisory Report is the result of this study.

Rapport Consultatif 104 (French)
(Classified)
Novembre 1977
30 pages

Deterioration des Moteurs d'Avions dans les Services des Armees de l'Air
En avril 1975 un Groupe de Travail du Panel Propulsion et Energétique de l'AGARD a été créé pour étudier les modifications des performances des moteurs, des coûts d'entretien et de la fiabilité des avions chasseurs en fonction de leur service opérationnel. Les résultats des cette étude font l'objet du présent Rapport de synthèse.

Advisory Report 109
K.Papailiou
November 1977
12 pages
ISBN 92-835-1263-4

Technical Evaluation Report on the 49th (A) Propulsion and Energetics Panel Specialists' Meeting on Secondary Flows in Turbomachines
This Technical Evaluation Report on the 49th (A) PEP Specialists' Meeting on "Secondary Flows in Turbomachines" contains a critical survey of the 15 papers presented, on the informal presentations and on the extended Round Table Discussion. Conclusions are drawn, areas with high priority interest are marked and solutions both for compressor and turbine flows are suggested.

The papers presented at the meeting together with the discussions, the informal contributions and the Round Table Session are published as AGARD Conference Proceedings CP 214 "Secondary Flows in Turbomachines".

Advisory Report 110
G.P.Sallee
November 1977
10 pages
ISBN 92-835-0207-8

Technical Evaluation Report on the 49th (B) Propulsion and Energetics Panel Specialists' Meeting on Power Plant Reliability
This Advisory Report contains the Technical Evaluation Report as well as the Technical Evaluation Memorandum of the 49th (B) Specialists' Meeting on the Propulsion and Energetics Panel on "Power Reliability" held in The Hague, Netherlands on 31 March and 1 April 1977.

The meeting was organized to review and discuss engine reliability from four aspects:

- the reliability of current civil and military engines as experienced by the users,
- civil and military authorities' plans to promote improved reliability in future engines,
- what manufacturers are doing to improve reliability through design and testing programs,
- the role that engine health monitoring and diagnostics is taking in minimizing the impact of engine unreliability for both civil and military users.

This report contains the conclusions drawn from the meeting and offers recommendations.

The papers presented at the meeting, together with the discussions and the ad hoc organized Round Table Session are published as AGARD Conference Proceedings CP 215.

AGARDograph 220
Translated and revised
by A.Klein
December 1977
610 pages
ISBN 92-835-1260-X

Aerodynamics of Cascades
"Cascade Aerodynamics" is a revised English translation of N.Scholz's book "Aerodynamik der Schaufelgitter", published in 1965, the most complete account of two-dimensional cascade flow ever written. After explaining the fundamental fluid mechanics principles of turbomachines, the book deals, in four main chapters, with the inviscid, steady, incompressible flow through rectangular cascades. It is primarily the method of singularities which is used in this part of the book to treat, in a comprehensive form, first the special cases of high- and low-solidity cascades and then cascades with arbitrary blade spacing.

The most important contributions of conformal mapping theory are also included. Both the design and the analysis problems are dealt with, and the results are illustrated by a great number of figures and diagrams. The effects of viscosity and of compressibility are explained in two more main chapters, where special regard is given to losses. The theoretical results are compared with and supplemented by measured data. Scholz's original version has been extended by an additional chapter which summarizes both the theoretical and experimental achievements since 1965. It reviews about 350 subject papers. It is the intention of the book to be not only of value to the specialist, but to bridge a gap between scientific progress and the requirements of the practising engineer in this field of applied fluid mechanics. In addition to a broad theoretical basis it therefore presents a large number of worked-out examples, computation schemes, working charts and compilations of formulae and data.

STRUCTURES AND MATERIALS PANEL (SMP)

Report 653
H.Durkin
February 1977
12 pages
ISBN 92-835-1239-2

Some Engineering Problems in the Royal Air Force
In this presentation, Air Marshal Durkin provides a valuable reminder to the research and development community of the importance of a variety of qualities required in air vehicles for satisfactory performance in service. Although reliability and ease in maintenance are tacitly accepted as requirements they have tended to get less attention from the research and development community than the more alluring goal of ever high performance. Air Marshal Durkin's wholesome reminder should provide a needed stimulus toward achievement of an appropriate balance of research and development goals.

Conference Proceedings 221
February 1977
278 pages
ISBN 92-835-1090-X

Fracture Mechanics Design Methodology
Papers and other contributions presented at the 43rd Meeting of the Panel held in London, UK, 28–29 September 1976, discussed the many problems in the aerospace field that are concerned with new high-strength materials, flow susceptibility, stress corrosion, non-destructive testing, fractographic material examination, crack propagation and residual strength aspects of the fatigue of aircraft structures, and brittle fracture require that fracture mechanics concepts be made available to the engineer and designer. The purpose of this Meeting was to present examples of how fracture mechanics is used in the design of aircraft structures and their components. In addition to practical examples being emphasized, gaps of knowledge required by the designer were identified. The presentations and subsequent discussions will provide a contribution to the AGARDograph on "Practical Applications of Fracture Mechanics" now being prepared.

Conference Proceedings 222
April 1977
86 pages
ISBN 92-835-0195-0

Acoustic Fatigue Review
In the late 1960's and early 1970's the Structures and Materials Panel of AGARD supported a programme of activities in the field of acoustic fatigue under the direction of a Working Group chaired by Mr A.H.Hall. A notable achievement of that programme included a survey undertaken by Professor B.L.Clarkson, the Panel's Co-ordinator on acoustic fatigue. This led to the preparation of an inventory of acoustic fatigue test facilities available within NATO, as at 1969, and a major symposium on acoustic fatigue held in September 1972. Finally, between 1970 and 1974, six of the NATO countries collaborated in the acquisition of design data and agreed on procedures for their analysis and interpretation by the Engineering Sciences Data Unit for the preparation of design data sheets. These data sheets were published by AGARD as the four parts of AGARDograph 162.

The Panel decided that, some two years after the data sheets had been introduced, a review should be made of acoustic fatigue activities in the NATO countries as a guide to the need for any additional action in this subject and also to assess the use which had been made of the data sheets which the Panel had published. This present publication includes the five national papers presented at the Review Meeting together with a summary of the discussion and conclusions reached, and were presented at the 43rd Meeting of the Panel, held in London, UK, 30 September 1976.

Conference Proceedings 226
July 1977
286 pages
ISBN 92-835-0197-7

Unsteady Airloads in Separated and Transonic Flow
The papers were presented at the 44th Meeting of the Panel held in Lisbon, Portugal, 19–20 April 1977.

The first session reviewed the prediction and description of the separated flow environment and the essential effects of airframe response on individual aircraft components. These effects may lead to failures of primary or secondary structures when exceeding design stress limits, or design fatigue loads. This is a special concern for military aircraft where flight operation at extreme manoeuvre conditions associated with flow separation frequently occurs. The scope of study included analytical approaches, windtunnel tests, as well as flight test techniques and data evaluation.

The second session dealt with flutter, aeroservoelastic instabilities involving coupling with active control systems and other static and dynamic aeroelastic problems, which can be dangerous flight safety phenomena and which must therefore be predicted with accuracy and prevented. Margins of safety are least in the transonic speed range which is consequently the most critical speed regime. However, no dependable theoretical methods are yet available for predicting unsteady transonic airloads on lifting surfaces and control surfaces. Accurate prediction of the latter becomes more important for active control systems used in load alleviation. In addition to improving analytical confidence, a dependable approach could reduce the cost of aeroelastic model and flight flutter tests.

Conference Proceedings 228
August 1977
106 pages
ISBN 92-835-0200-0

Structural Aspects of Active Controls

These papers were presented at the 44th Meeting of the Panel held in Lisbon, Portugal, 21 April 1977.

The Meeting dealt with the philosophy and approach on the use of active controls to realize structural improvements. The question of what constitutes a good balance of effort to achieve a successful active control system was posed. Specifics dealt with the techniques for evaluating the system transfer function, with the relative roles of ground vibration testing, bench testing of component parts and the merits of open and closed loop testing. The question of what is an appropriate index of performance is of central significance.

AGARDograph 228
W.Barrois
October 1977
78 pages
ISBN 92-835-1250-2

Use of General Fatigue Data in the Interpretation of Full-Scale Fatigue Tests

The fatigue behaviour of notched specimens depends on two elasticity parameters, namely the stress concentration factor and the relative stress gradient or the radius of curvature at the notch root. Laboratory fatigue test results are not always representative of the environmental conditions within aircraft structural assemblies, particularly because of water condensation in gaps and recesses. The frequency effect is mainly ascribable to humidity, and therefore to corrosion, owing to hydrogen penetration.

In assemblies, stress concentrations due to load transfer through fasteners are investigated for the case of asymmetric single shear. The breakdown of the applied loadings must include the peak-to-peak, ground-air-ground variation. In load transfer by fastener bearing stresses, the low compressive loads may be neglected, the local highest stresses varying from zero to the maximum. Interpretation of full-scale fatigue test results, either for a different loading or for a slightly modified local design of the structure, is essentially comparative.

In order to locate the computation points within a suitable region, the stress concentration factor is multiplied by a damage adjustment factor, k_{DA}, such that the Miner damage is 1 for the local failure of the structure considered. A structure may provide as many k_{DA} values as the failures observed during the full-scale fatigue test. A number of further investigations would enable the variation of k_{DA} with structural assembly parameters to be investigated.

Report 659
October 1977
94 pages
ISBN 92-835-1261-8

Corrosion Fatigue of Aircraft Materials

Environmental effects on the fatigue of aircraft materials have been neglected in the past. Damage behaviour of aircraft structures was analysed by fatigue and fracture mechanics without paying much attention to the environment.

A few years ago, some laboratories of NATO countries started to investigate corrosion fatigue. A proposal was made to the Structures and Materials Panel for new activities in corrosion fatigue with the intention of presenting the state of the art in this field of interdisciplinary R & D of corrosion and fatigue engineers.

The SMP approved the presentation of four pilot papers on the corrosion fatigue of high strength aluminium, titanium and steel alloys at the 44th Panel Meeting in April 1977. The four papers are of interest to materials and structural engineers and give detailed information on experimental results from four laboratories together with recommendations of areas for future research.

Report 661
November 1977
70 pages
ISBN 92-835-1255-3

Factors of Safety – Historical Development, State of the Art and Future Outlook

This Report contains three papers presented at the 43rd, 44th and 45th Meetings and the Technical Address given at the 44th Meeting of the Panel.

The concept of the factors of structural safety presently applied to the design of fixed-wing aircraft can be traced back some 50 years. The last decades have brought about rapid progress in establishing aerodynamic derivatives, defining load conditions and predicting structural loads as well as enabling more detailed analyses for stress and deformation to be made. The lack of a rational basis for the factors of safety together with the progress made brought about a discussion of changing the concept and the factors involved.

The three pilot papers contained in this report address the different aspects which are envisaged, and show up inconsistencies of the present concept as well as means and methods for possible changes and examples of the outcome. An additonal paper summarizes what is going on in the field of civil engineering with respect to structural safety.

Report 662
December 1977
32 pages
ISBN 92-835-1267-7

Computer Aided Design

While some of the largest aerospace companies within the NATO community have already installed very complex, but nevertheless modulized software and hardware configurations for computer-aiding the design process in its different fields, other

companies apply only specialized and/or isolated modules of software and hardware configurations.

This situation is caused not only by the engineering capacity and amount of money involved, but stems also from the lack of criteria by which the benefits of money invested may be estimated. The latter holds true especially because design directly causes only a small proportion of costs, whereas up to 80 percent of total product costs may be influenced by the design process. Thus much of the benefit of introducing more effective means and methods into the design process have to come downstream from material supply and manufacturing of a product.

From this it follows that each isolated module of software and hardware must not only fit into a general concept for the design process of one company, but must have a well defined interface with manufacturing facilities of the same company. This point becomes its special feature if cooperative programs between two or more aircraft companies in different countries are concerned.

The pilot papers contained in this publication will help to define the present possibilities, needs and applications of CAD in the design process, bearing in mind that design is not an aim in itself, but only one step towards manufacturing and selling a product.

Two papers presented at the 45th Structures and Materials Panel Meeting, Voss, Norway, September 1977.

TECHNICAL INFORMATION PANEL (TIP)

Conference Preprints 225
May 1977
80 pages

The Impact of Future Developments in Communications, Information Technology and National Policies on the Work of the Aerospace Information Specialist
See Conference Proceedings 225 below.

Report 657
Y.M.Braunstein
May 1977
18 pages
ISBN 92-835-1243-X

Maximizing Efficiency and Effectiveness of Information Data Banks
This paper examines several of the principles underlying the efficient and effective production, transfer, and use of information. The first sections examine the cost savings and benefits that accrue to users from increased cooperation among the the participants in the information transfer process. This discussion covers both cooperation between producers, intermediaries, and users ("vertical cooperation) and cooperation among the producers or among the intermediaries ("horizontal cooperation"). Next, the impact of networking on information services is discussed. Here the distinctions are made among computer networks, communications networks, and information networks. Each is analyzed in turn. The final sessions deal with the effects of charges for information. Particular attention is paid to the transactions costs associated with any pricing and collection mechanism and to the economic impact of the use of copyright protection for information products and services.

AGARDograph 229
P.I.Berman
July 1977
66 pages
ISBN 92-835-1251-0

Survey of Computer-Assisted Writing and Editing Systems
This AGARDograph is directed toward the technical author in the aerospace industry. It surveys the available technology for automating the preparation of technical and scientific documents, and it attempts to demonstrate the range of possibilities inherent in such technology by reviewing a number of typical system configurations. It also tries to suggest the trends of automated publishing systems and to provide some qualitative guidelines for selecting and implementing such systems.

Conference Proceedings 225
September 1977
90 pages
ISBN 92-835-1254-5

The Impact of Future Developments in Communications, Information Technology and National Policies on the Work of the Aerospace Information Specialist
The rapid development of new communication techniques, combined with greatly reduced unit costs of communication hardware, has led to easier access to more information for larger segments of the population. In the area of aerospace scientific and technical information, this development should provide greater opportunities for making systematic use of mankind's aggregated experience and knowledge, collected and stored over time.

The role of the information specialist is undoubtedly changing with the advent of these developments, and it may also be desirable for him to influence their future course. The theme of the AGARD Technical Information Panel Specialists' meeting held in Lysebu, Norway, 22–23 June 1977 was to identify the main trends in

communications and information technology, to assess their impact on the information specialist, and to consider what other developments might be desirable, particularly in relation to aerospace scientific and technical information. A number of papers outlined national plans for the future of their Scientific and Technical Information activities.

Index 74/76
October 1977
404 pages
ISBN 92-835-1257-X

AGARD Index of Publications 1974–1976
This book, which is the fifth in the current AGARD Index series, provides abstracts and indexes for AGARD publications published during the period 1974–1976. Full bibliographic citations and abstracts are included, and the listing is indexed by Subject (based on NASA Thesaurus nomenclature), Personal Author, Corporate Source, Report/Accession Number, and Accession/Report Number.

LECTURE SERIES

Lecture Series 80
January 1977
316 pages, including Bibliography
ISBN 92-835-0180-2

Aerodynamic Noise
This Lecture Series 80 on 'Aerodyanmic Noise' was co-sponsored by the Fluid Dynamics Panel of AGARD and by the von Kármán Institute of Fluid Dynamics, and implemented by the Consultant and Exchange Programme of AGARD together with VKI. It was presented at the VKI, Rhode-St-Genèse, Belgium, 6–9 December 1976.

The aim is to provide an up-to-date account and authoritative appraisal of aerodynamic noise concepts, theory and experiments. Particular emphasis is given to practical methods for the prediction, measurement and reduction of external noise from jet/fan aircraft. Following a brief overview of relevant aircraft design and operational considerations, the main lectures include detailed presentations on the fundamental theory of aerodynamic noise generating and propagation, basic aeroacoustics of jet efflux noise, engine exhaust noise characteristics, fan noise, airframe self-noise, airframe/engine interaction effects, aero-acoustic measurement and analysis techniques, aircraft flyover noise measurement, noise-source identification and location methods, and ground-based facilities with forward-speed representation. A bibliography of 171 items is included in the publication.

Lecture Series 87
March 1977
164 pages
ISBN 92-835-0191-8

Microprocessors and their Applications
The microprocessor (miniaturized processor) has recently become a viable proposition and promises a revolution in system design, flexibility, volume and cost in the data and signal processing areas of all types of avionics systems.

Microprocessor hardware available on the market is rapidly evolving with the employment of alternative technologies such as Silicon on sapphire and Schottky Bipolar to enable operation at clock rates orders higher than the early capability. In addition, manufacturers are developing realistic hardware to enable rapid vectored interrupt handling which is often necessary in real-time applications. As usual, hardware is running ahead of software and although most applications are currently written in symbolic assembler code, there is increasing awareness of the advantages of efficient high-level compilers and effort is now being expended on the implementation of such languages.

One of the problems with microprocessors is the necessity to design both hardware and software configurations for a particular problem. In two years' time, the potentialities of the microprocessor will be fully established and that would seem to be the appropriate point at which to present the new technology to a wider Avionics audience in an AGARD Lecture Series. A bibliography of 146 items is included in the publication.

The material was assembled to support a Lecture Series under the sponsorship of the Avionics Panel and the Consultant and Exchange Programme presented in the US; England and Germany in April 1977.

Lecture Series 86
April 1977
174 pages
ISBN 92-835-1241-3

Computational Fluid Dynamics
This Lecture Series is devoted to recent advances in the theory and application of numerical methods to solve complex problems of fluid mechanics. Particular emphasis is given to an introduction of the Finite Element Method and the advances which have been obtained so far. Further major topics such as numerical turbulence modelling, relaxation methods in fluid dynamics, flow representation, including separated regions, by discrete vortices and recent advances in the treatment of the

full Navier-Stokes equations are presented and discussed in detail. The material was assembled to support a Lecture Series under the joint sponsorship of the Von Kármán Institute and the Fluid Dynamics Panel, together with the Consultant and Exchange Program of AGARD. Presented at the Von Kármán Institute in March, and in the US in April 1977.

Lecture Series 89
May 1977
122 pages
ISBN 92-835-1242-1

Task-Oriented Flight Control Systems

Recent Developments in Data processing are establishing the viability of high-integrity high-authority full-time electrical flight control systems, which in turn offer a range of new possibilities in the design of the control system and of the complete aircraft. The use of digital processors now allows the control system characteristics to be varied during or between flights to match particular operational needs. This concept of Task-Oriented Control Systems is the subject of this Lecture Series, which aims to present information on the benefits, problems, design and engineering aspects of these new developments, commencing with a state-of-the-art review of modern flight control theory and practice. The contributions are based on the practical experience of the authors and their organisations in several nations. This Lecture Series was recommended by the Guidance and Control Panel of AGARD and is implemented under the Consultant and Exchange Programme. A bibliography of 145 items is included in the publication.

Presented in the UK and the US in June 1977.

Lecture Series 90
July 1977
166 pages
ISBN 92-835-1248-0

Laser Optical Measurement Methods for Aero Engine Research and Development

In recent years many optical measuring methods, most using lasers, for determining flow velocity (with turbulence and fluctuations), temperature and species concentration have been studied. The main advantage is that the flow is not disturbed. They are of great value for research and development on engines and components and for the understanding of fundamental flow processes.

The Lecture Series informs propulsion specialists of the techniques that are currently available, how to use them and their limitations. It reviews experience to date in practical applications. Laser-velocimetry is emphasized since it is the only technique which has achieved practical importance up until now. Raman scattering and holography interferometry are also addressed. Commonly-used techniques and qualitative type methods such as infrared for surface temperature and Schlieren techniques are not addressed.

A bibliography of 98 items is included in the publication.

This publication was assembled to support a Lecture Series under the sponsorship of the Propulsion and Energetics Panel and the Consultant and Exchange Programme presented in the US, the UK, and Italy in August – September 1977.

Lecture Series 88
September 1977
270 pages including
Bibliography of 194 items
ISBN 92-835-0202-7

Applications of Remote Sensing to Ocean Surveillance

The sea covers more than three quarters of the earth and the concealment it provides to military forces will make it the area of major activities in the next decade. The defence of land and sea is vital to the NATO alliance. Land surveillance has been covered in several AGARD meetings while the oceans thus far have received little attention. Techniques for ocean surveillance from satellites and aircraft reached a high degree of sophistication as the result of the combined efforts in space and military programs. The limitations of these techniques come not so much from technology itself but rather from the propagation medium, air and sea. These techniques and the interpretation of results are totally different for land and sea.

This lecture series therefore presents the mathematical tools and their applications to the problems of resolving, recognizing and identifying targets and sources of activities in the ocean. This series should be of interest to physicists and engineers who want to learn the mathematical methods applicable to ocean surveillance, to military users who want to interpret results and infer tactical and strategic implications and to industries interested in developing future generation hardware.

The lecture topics cover two broad categories of surveillance:

- Ocean targets, for instance ships (Imaging).
- Ocean phenomena indicative of military activities, for instance changes in biology or surface temperatures.

This publication was assembled to support a Lecture Series under the sponsorship of the Electromagnetic Wave Propagation Panel and the Consultant and Exchange Programme presented in Norway, the Netherlands and Italy, in October 1977.

Lecture Series 91
September 1977
198 pages, including
Bibliography of 190 items
ISBN 92-835-0203-5

Advanced Manufacturing Techniques in Joining of Aerospace Materials
Advanced aerospace structures depend to a large extent on new joining techniques. The highest possible material strength to weight ratio is an important demand. Advanced light materials such as titanium alloys or plastic matrix composites are the answer as well as improved welding and adhesive bonding processes. Often the selection of the optimum joining technology is the prior conditon for success in introducing advanced structural components in the aircraft industry. The Lecture Series presents improved or new, cost-effective welding methods for joints of high integrity and properties close to the parent metal. Progress in joining composites is discussed based on modern design principles.

The Lecture Series was sponsored by the Structures and Materials Panel, and organised by the Consultant and Exchange Programme and presented in the UK, Germany and Denmark in October 1977.

MILITARY COMMITTEE STUDIES (MCS)

Advisory Report 91
Volume I
(Classified)
January 1977
60 pages

Techniques for Suppression of Radars Associated with SAMs – Executive Summary
The study, conducted in response to a request from the North Atlantic Military Committee under the management of the Aerospace Applications Studies Committee, Dr J.Dathe, Chairman, identifies and examines various techniques expected to be available in the 1980's for the suppression of radars associated with surface-to-air missiles for the purpose of reducing the vulnerability of NATO aircraft to SAMs.

The study concentrates on the two basic means of suppression, namely by destruction or by neutralization.

Neutralization covers the aspects of surveillance, target tracking, missile tracking, missile guidance, fuse, and availability status. In the area of destruction, weapon guidance systems are evaluated with attack variables such as range, warhead weight and type of attack. Included is a survey on future enemy SAMs and electronic intelligence. Recommendations include indications of preferred tactics and desired R & D.

The report includes a model for performing trade-off comparisons between the two means of suppression and highlights input data deficiencies. The expertise of the study group, enhanced by battle experience, is used to provide inputs to the model in order to portray some tends as well as demonstrate the utility of the model.

Advisory Report 88
Volume II
(Classified)
January 1977
82 pages

Use of Precision Positioning Systems by NATO
The study, conducted in response to a request from the North Atlantic Military Committee under the management of the Aerospace Applications Studies Committee, Dr J.Dathe, Chairman, is published in three volumes, and concentrates on an evaluation of the potential applications within NATO of a precision positioning system (PPS) – as exemplified by the US NAVSTAR Global Positioning System – with special emphasis on a qualitative and quantitative evaluation of the impact of increased position information accuracy on the tactical air attack capability of NATO in Europe in the 1980's and beyond.

The study concludes that a secure and very precise PPS (less than 10 metres in the three dimensions) is feasible. With such a system, the all-weather attack capability on quasi stationary targets is so promising that continuing operational analyses should be performed. Moreover, in the specific area of guidance and manned and unmanned aircraft, as well as stand-off missiles, PPS could lead to outstanding simplifications and money savings. However, the study also identifies the need for a unified command, control, and communications system. (C^3 system).

Report 655
F.Hetman
May 1977
42 pages
ISBN 92-835-1240-5

Methods of Technological Forecasting
This summary of technology forecasting methodologies was commissioned by AGARD as one aspect of its response to a request by the NATO Military Committee to undertake a technology forecasting effort in the field of aerospace. It includes chapters on: basic modes of apprehending the future; futures research and technological forecasting; projective research; prospective research; selection, procedure and quality criteria.

Advisory Report 88
Volume III
(Classified)
November 1977
106 pages.

Use of Precision Positioning Systems by NATO
See Volume II above. This third volume contains five appendices:– Position Fixing Systems; NAVSTAR GPS; GEOLE System; Satellite Numbers and Orbits for PPS; and Mission Analysis.

Advisory Report 103
Volume 1
(Classified)
November 1977
36 pages

Advanced Technology to Counter the Low Altitude Threat (Other than Aircraft Mounted Radar)
This Study was conducted in response to a request from the North Atlantic Military Committee under the management of the Aerospace Applications Studies Committee, Dr J.Dathe, Chairman, and is published in two volumes.
– To set the stage for the analysis that follows, the first half of the Report presents: (a) the threat (present and future): (b) the current response; (c) an assessment of likely deficiencies in the 1980's; (d) the future operational requirement trends.
– The second half of the Report is an analysis of the technologies available, their application in both conventional and unconventional ways, the recommended form of proposed R & D efforts and the priority accorded to each of them.
– Finally, the Reports present an essay on a completely original concept developed by the study Group based on a new philosophy for defence against attacks below the 300 meter level.

Advisory Report 103
Volume 2
(Classified)
November 1977
140 pages

Advanced Technology to Counter the Low Altitude Threat (Other than Aircraft Mounted Radar)
See Volume 1 above.

AGARD HEADQUARTERS (HQ)

Bulletin 77/1
January 1977
76 pages

Meetings – Publications – Membership
This issue of the AGARD Bulletin gave a schedule of meetings to be held in 1977, a list of publications issued in 1976 and a directory of AGARD members as of 1 January 1977.

March 1977
84 pages

Director's Annual Report to the North Atlantic Military Committee 1976
This Report covers the AGARD 1976 Technical Programme. Achievements are reported in terms of: the meetings which were held to bring together the leading personalities of the NATO nations in a particular field of science and technology for the common benefit of the NATO Community; publications initiated for the purpose of assisting member nations in the effective use of their research and development capabilities; and the budget that supported this stimulus to the advances in the aerospace sciences relevant to strengthening the common defence posture.

Highlights 77/1
March 1977
52 pages

This booklet is the ninth of a series aimed at establishing a more direct and informal means of communications between members of the AGARD community and their friends in the international aerospace profession. Items for publication are invited from all interested readers, and it is hoped that the Highlights will contain articles on the future activities of AGARD and provide a forum for the discussion of matters relating to AGARD's activities.

Bulletin 77/2
August 1977
36 pages

This Bulletin reported the content and scope of the 1978 AGARD Technical Programme approved during the AGARD National Delegates Board Meeting, March 1977.

August 1977

AGARD Handbook (Revised)
This Handbook has been prepared primarily to serve as an introduction to AGARD. It is intended for three groups of readers. First, it should serve the interested scientists, engineers and members of the NATO Community at large who have come in contact with AGARD through one means or another and who would like to know more about what it is and how it works. Second, it is intended to be an introductory guide to newly-appointed members of AGARD, such as members of Panels, Committees, Working Groups and Staff. Third, this Handbook may prove to be useful to the present members of AGARD, who may like to have at hand a simple reference book to help describe AGARD to others, or to refresh their own memories on some points of procedure.

For these reasons, the treatment of the subject has been general rather than detailed in order to give a broad overall picture of AGARD. However, the By-

Laws under which AGARD operates are included in the Handbook for specific detailed reference pruposes.

Highlights 77/2
September 1977
24 pages

See Highlights 77/1 above.

SECTION III

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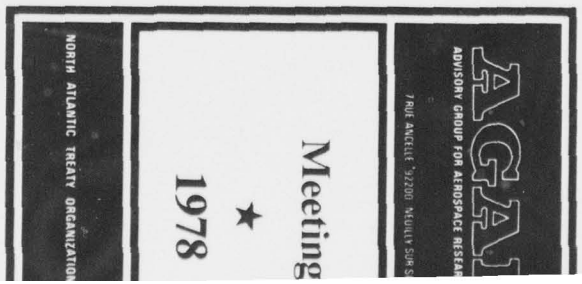
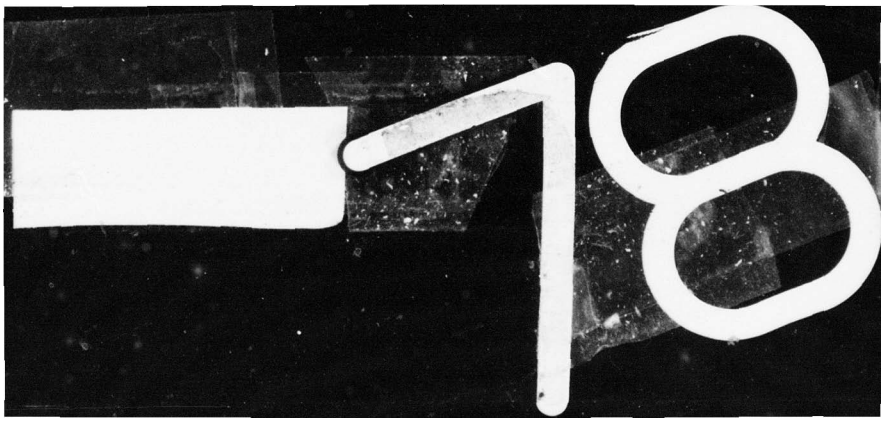
5–6 Oct (Delft) 9–10 Oct (Munich) 12–13 Oct (Lisbon)	SMP Lecture Series No.97; FRACTURE MECHANICS DESIGN METHODOLOGY
9–13 Oct (The Hague)	GCP 27th Panel Meeting/Symposium; THE GUIDANCE AND CONTROL OF HELICOPTERS AND V/STOL AIRCRAFT AT NIGHT AND IN POOR VISIBILITY (Classified)
16–21 Oct (Monterey, Calif.)	AVP 36th Panel Meeting/Symposium; DATA HANDLING TECHNIQUES AND SYSTEMS; Specialists' Meeting; STRATEGIES FOR AUTOMATIC TRACK INITIATION
16–20 Oct (Paris)	TIP 31st Panel Meeting/Specialists' Meeting; INFORMATION AND INDUSTRY
16–17 Oct (Munich) 19–20 Oct (London)	PEP Lecture Series No.96; AIRCRAFT ENGINE FUTURE FUELS AND ENERGY CONSERVATION
23–27 Oct (Cleveland, Ohio)	PEP 52nd Panel Meeting/Symposium; STRESSES, VIBRATIONS, STRUCTURAL INTEGRATION AND ENGINE INTEGRITY (INCLUDING AEROELASTICITY AND FLUTTER)
6–10 Nov (Paris)	ASMP 35th Panel Meeting/Specialists' Meetings; – HUMAN BIODYNAMIC RESPONSE AND USE OF ANALOGUES AND MODELS FOR EVALUATION OF ESCAPE/CRASH INJURIES AND PROTECTION; – HUMAN FACTORS ASPECTS OF AIRCRAFT ACCIDENTS AND INCIDENTS; – RECENT ADVANCES IN AERONAUTICAL AND SPACE MEDICINE

No Aerospace Applications Studies Committee Meetings will be taking place in 1978.

Meetings of "Project 2000 Review Board" will be organized at the discretion of its Chairman.



20–24 Feb (Brussels)	FDP/VKI Lecture Series No.94; THREE DIMENSIONAL AND UNSTEADY SEPARATION AT HIGH REYNOLDS NUMBERS
15–17 Mar (Paris)	44th National Delegates Board Meeting; 24th Panel Chairmen Meeting; 25th Steering Committee Meeting; 8th National Co-ordinators Meeting
3–7 April (London)	PEP 51st Panel Meeting/Specialists' Meetings; – ICING TESTING FOR AIRCRAFT ENGINES; – SEAL TECHNOLOGY IN GAS TURBINE ENGINES
10–14 April (Aalborg)	SMP 46th Panel Meeting/Specialists' Meeting; CHARACTERIZATION OF LOW CYCLE HIGH TEMPERATURE FATIGUE BY THE STRAINRANGE PARTITIONING METHOD
17–18 April (Delft) 20–21 April (Ankara)	TIP Lecture Series No.92; THE APPLICATION OF INEXPENSIVE MINICOMPUTERS TO INFORMATION WORK
24–28 April (Ottawa)	EPP Symposium; OPERATIONAL MODELING OF THE AEROSPACE PROPAGATION ENVIRONMENT
24–28 April (Brussels)	FMP 52nd Panel Meeting/Specialists' Meeting; PILOTED AIRCRAFT ENVIRONMENT SIMULATION TECHNIQUES
1–5 May (Fort Rucker (Ala))	ASMP Specialists' Meeting; OPERATIONAL HELICOPTER AVIATION MEDICINE
8–12 May (Sandefjord)	GCP 26th Panel Meeting/Symposium; THE IMPACT OF INTEGRATED GUIDANCE AND CONTROL TECHNOLOGY ON WEAPONS SYSTEMS DESIGN (Classified)
8–9 May (Oslo) 11–12 May (London) 15–16 May (Rome)	EPP Lecture Series No.93; RECENT ADVANCES IN RADIO AND OPTICAL PROPAGATION FOR MODERN COMMUNICATIONS, NAVIGATION AND DETECTION SYSTEMS
29 May–1 June (Athens)	FDP 42nd Panel Meeting/Symposium; DYNAMIC STABILITY PARAMETERS
5–9 June (Munich)	AVP 35th Panel Meeting/Symposium; DIGITAL COMMUNICATIONS IN AVIONICS
6–7 June (London) 12–13 June (Bolkesjö) 15–16 June (Porz-Wahn) 19–20 June (Rome)	GCP Lecture Series No.95; STRAP-DOWN INERTIAL SYSTEMS
4–8 Sep (Munich)	EPP 25th Panel Meeting/Symposium; MILLIMETER AND SUBMILLIMETER WAVE PROPAGATION AND CIRCUITS
18–20 Sep (Lisbon)	14th Annual Meeting; 45th National Delegates Board Meeting; 25th Panel Chairmen Meeting
25–29 Sep (Florence)	SMP 47th Panel Meeting/Specialists' Meetings; ADVANCED FABRICATION PROCESSES; – COMPUTER AIDED DESIGN
25–29 Sep (Ottawa)	FMP 53rd Panel Meeting/Symposium; STABILITY AND CONTROL
2–6 Oct (Sandefjord)	FDP 43rd Panel Meeting/Symposium; HIGH ANGLE OF ATTACK AERODYNAMICS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