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TECHNICAL EVALUATION REPORT ON THE MULTI-PANEL SYMPOSIUM ON FIG--ETC(U)
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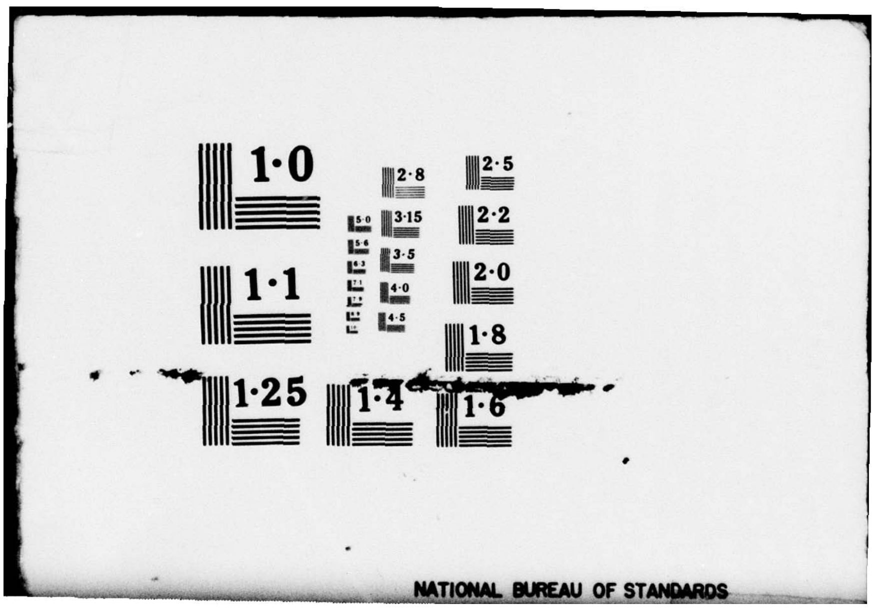
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AGARD ADVISORY REPORT No. 119

Technical Evaluation Report on the Multi-Panel Symposium on Fighter Aircraft Design

by

H. Andrews and R.J. Balmer

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NORTH ATLANTIC TREATY ORGANISATION

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT

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AGARD Advisory Report No.119

TECHNICAL EVALUATION REPORT

on the

MULTI-PANEL SYMPOSIUM

on

FIGHTER AIRCRAFT DESIGN

by

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This Advisory Report was prepared at the request of the Flight Mechanics Panel of AGARD.

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TECHNICAL EVALUATION REPORT
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1. FOREWORD

Responding to a request from the Military Committee to assess the state of technology as related to the design of future fighter aircraft, the Flight Mechanics Panel initiated a multi-Panel Symposium addressing the various technical areas involved. The appropriate panels were requested, and agreed to organise sessions in their areas co-ordinated with the overall fighter aircraft design theme.

The Symposium was held at the SCUOLA DI GUERRA AEREA, Florence, Italy October 3–6, 1977. About 180 attendees registered at the Symposium, most of them attending through the four days. A good proportion were concerned with overall fighter design in their current positions, and therefore stood to benefit most by integrating the views of the specialised papers presented and discussed. NATO Secret classification ensured that areas in which no useful information could be presented without this coverage were represented and this coverage plus adequate discussion time ensured a full exchange of views on many significant issues.

Conference Proceedings will be published under the normal schedule. However, the significant points of the meeting are of sufficient importance to warrant their separate forwarding to the Military Committee in response to the original request. The following sections present the significant recommendations, with a supporting summary of the Symposium content. Most of these recommendations are not new. They do represent a current view of the issues and actions in fighter aircraft design based on a matrix of responsible overall design individuals across the NATO nations and specialists in the involved disciplines from these same countries.

2. RECOMMENDATIONS

Recommendations arising from the Symposium presentations and discussions fall logically into two areas: those for action by the Military Committee and those within the province of AGARD itself. They are presented in these two groupings. While no attempt has been made to strictly prioritize these recommendations, those listed initially are considered generally to have more significance in future fighter design or related research activities than those listed at the end.

For the Military Committee the following recommendations are worthy of consideration and action:

(1) With the ever-increasing cost of fighter aircraft it is vitally important that operational requirements should be carefully developed and clearly defined.

(2) Future fighter aircraft designs must retain flexibility to meet changing requirements during their long lifetime.

(3) While full use should be made of the available technology, the cost penalty of overspecifying aircraft and system performance must be clearly recognised.

(4) Requirements, particularly in the sub-system area must always recognise the real limitations, but should challenge technology so that new straightforward solutions may emerge.

(5) Operational requirements should recognise the intended use of the aircraft in its actual combat role and not over emphasise conflicting peacetime needs.

(6) With respect to weapons, internally or externally carried, and other externally carried stores, future requirements should clearly define the quantity to be designed for, which should be the minimum necessary to give the required military capability. While the use of external stores provides a great deal of mission flexibility, all weapons/stores carriage affects the design, and excessive capability will result in unnecessary adverse impacts in other characteristics.

(7) Consideration should be given to spending more in the development of a new aircraft in order to save still more during its Service life.

(8) The ever present conflict between the solutions offered by many relatively simple aircraft and a smaller number of sophisticated aircraft still merits careful consideration.

(9) The risk of concentrating on the manned fighter aircraft to the exclusion of alternative means of meeting the threat should not be ignored.

(10) Sub-system requirements present an area for improved cost-effectiveness that is often overlooked.

Recommendations for actions that can be taken by AGARD through its Panels or the Aerospace Applications Study Committee:

- An appropriate attempt should be made to address the lessons to be learned from operational experience with current aircraft that can be applied to the design of future aircraft so that all NATO nations can benefit from the advantages and deficiencies found in current operations.
- Continue the current level of attention to active control technology, addressing overall design impacts, life-cycle cost aspects, structural applications, and research in specific areas such as new control modes and the pilot controller and control laws to implement them.
- Continue the current emphasis on use of piloted simulation, addressing its effective use in systems studies, design development and training.
- The Aerospace Applications Study Committee should undertake studies beyond those specifically requested by the Military Committee; these studies would explore potential technology applications.
- The current efforts with regard to store carriage, including the work of AGARD Working Group 03 reported in AGARD AR 107, should be extended with further studies of store integration in fighter aircraft design. These should include weapon launch and carriage environment considerations.
- Encourage and support progress towards international standards for aircraft structural materials, particularly for any new materials such as composites.
- Support further research in inlet design, emphasizing tolerance to high angle of attack and sideslip conditions, better understanding of inlet distortion causes and effects, and improved computational techniques to reduce development costs.
- Encourage further development of effective analysis techniques for use in establishing system and design requirements.
- Provide for the interchange of the results of composite structures flight experience.
- Continue to support and advance the use of wind tunnels, with emphasis on their use in developing the aerodynamic design of specific configurations.
- Support the development of new metal technology for cost effective applications.

3. SUMMARY OF THE SYMPOSIUM

The Symposium was arranged in nine sessions covering the overall requirements and technology for the future, operational experience, specific technical areas and a final Round Table discussion. A resume of the main points of each session follows.

3.1 Fighter Requirements for the 80's and Beyond

The opening paper, prepared by the International Military Staff of NATO, described the threat as it is known now together with a forecast of its development in the future. This was followed by an Industry paper on Technology Developments to meet the Military Requirements. It pointed out that fighter aircraft fall broadly into three types:-

(i) Intercepter

(ii) Air-to-air fighter

(iii) Ground attack fighter.

The requirements for these differ in many aspects, but few fighters are so specialised that they cannot undertake more than one of the roles.

The paper warned against putting too much trust in the many parametric expressions which have been produced as a measure of optimum combat performance. The importance of persistence in combat-time available at combat power – was stressed. The opposing requirements of turning performance vs smooth ride at low level was discussed, with the feeling that turning performance should not be sacrificed for ride quality.

3.2 Operational Experience

Four papers were presented, three from the Services and one from Industry. The F-14 and its operational system was described. This aircraft, with its capability to deal simultaneously with multiple targets, represents the most sophisticated solution in current technology. Nevertheless, it can be operated successfully with existing facilities. The

Harrier, in contrast, is a relatively simple aircraft but has the unique V/STOL capability. It was shown to be able to operate effectively from dispersed sites. Its thrust vectoring capability in flight, together with its high dry thrust to weight ratio offer special features for air combat. In discussion, the question was raised of the relative cost-effectiveness of putting more development into V/STOL or of laying more concrete strips in the NATO arena. While some lessons learned from current experience were included in these two papers, this useful aspect was unfortunately largely neglected.

The third paper covered aspects of training to ensure combat effectiveness in the USAF. The use of simulators to reduce the number of flying hours needed was discussed. Simulators save more time in some areas of training than in others. Further study of the role of the simulator is needed.

Finally, the development of armament systems on the Mirage family was presented. This paper covered all aspects, including carriage, release and firing. Special-to-type stores designed for optimum aerodynamic efficiency were described.

3.3 Systems/Design Approach

The papers in this session covered analysis methodology to establish the design requirements to meet specific military mission needs; a current view of approaching the overall design of a fighter aircraft; and the technology and design aspects in two specialized areas which require an integrated view, specifically advanced control systems and stores integration.

Recognising that peacetime and wartime use of fighter aircraft place different requirements on many of their design features, the overall design paper set forth an effective approach to incorporating the required characteristics during all phases of the design and development process. Advanced control systems were given a very practical look, including their application, typical research projects, and some issues still to be resolved. The integration of stores with fighter aircraft, emphasizing weapon integration, covered the many aspects of this always difficult design task in light of current knowledge.

Highlighted in the papers and discussion were a number of significant points. While computer capability makes possible very complex analytical simulations of potential future war situations, simpler analysis can be used effectively to support decisions with regard to future fighter aircraft provided that the appropriate elements of the total problem are properly selected. In the overall design of fighter aircraft lethality must be the primary objective. To provide the most effective aircraft, priorities must be established for the various characteristics (performance, cost, survivability/ vulnerability, etc) at the outset of the design in consonance with the military requirements to which the aircraft is being designed, and these must be adhered to during design and development. Agressive exploitation of technology at its demonstrated level in any new design was recommended as the appropriate path to the most cost-effective aircraft. The advanced control system technologies already demonstrated, or soon to be demonstrated, promise major advances in fighter effectiveness, offering the designer more flexibility in design and the operator potentially more accuracy in weapon delivery with reduced pilot workload and training requirements. However, it was noted that further research is necessary to fully demonstrate that these operator benefits will be realized and to establish the system characteristics necessary to achieve them. A single course to optimum stores integration in fighter aircraft is still not evident, and design and development of any future fighter aircraft must make full use of all of the available tools to ensure the most effective possible carriage and employment of its weapons and other externally carried stores.

In establishing requirements for future fighter aircraft the Military Committee should clearly recognise the intended use of the aircraft in its actual combat role, giving lesser emphasis to desirable features during peacetime operations, though certainly not ignoring this aspect of fighter aircraft operations. The extent of external stores to be carried, both weapons and others should also be clearly defined and kept to the minimum level possible, consistent with the missions(s). Recognition should also be taken of the significance of launch/release speeds on the weapons installation designs as well as on the overall design. In planning future programmes, AGARD and its Panels could well explore further development of effective analysis tools for use in establishing requirements for future systems and supporting decisions regarding requirements and design. The presently established "stores drag" activity should be expanded to cover the more inclusive aspects of stores integration into overall combat aircraft systems, with appropriate Panel involvement. The high level of activity in advanced control systems should continue, with new emphasis on assessing the impact on the total aircraft system, including life cycle costs, and with attention to remaining problem areas such as the proper exploitation and characteristics of new control modes.

3.4 Aerodynamics and Aircraft Configurations

Covered in this session were a range of subjects from work in basic wing section technology through development of the aerodynamic configuration for a specific design. The wing section technology review covered variable camber wings, including results achieved in current practice, potential improvements shown by recent research and a preview of new research now underway. Preliminary studies of a supersonic cruise tactical aircraft were reported showing that current technology will support a practical aerodynamic configuration to achieve this goal if mission effectiveness requirements make its capabilities necessary. Also reported were sophisticated studies using combat simulators and digital computer model analysis, which showed that particular missions, with one-on-one combat as a basis would dictate a fighter aircraft utilizing a variable sweep wing configuration. Development of the aerodynamic configuration for a specific set of mission requirements was illustrated by a new delta wing design where the application of all current aerodynamic technology and the extensive use of the wind tunnel as a configuration development tool resulted in the selected delta wing design best meeting the mission requirements which were established.

The papers and discussion, highlighted several items. It is quite evident that the use of new aerodynamic research results and the use of traditional and emerging tools can yield improved aerodynamic performance in new fighter aircraft. The requirements to which any such new fighter will be designed will significantly affect the choice of configuration for the design, and all feasible configurations, using the latest aerodynamic knowledge and with appropriate consideration for other design aspects, should be explored before selecting the optimum configuration to meet an established set of military requirements. Extensive aerodynamic development before final establishment of the detailed design configuration, including full use of wind tunnel models remains essential to achieving the most effective design. In the use of simulator and computer analysis, care must be taken that the simplified analysis truly represents the significant features of the intended operational application. As an example, designs optimised based on one-on-one simulation will over emphasise manoeuvering performance while multiple aircraft real world combat situations will place a greater premium on other characteristics.

Based on this session, the Military Committee should take note of the importance of providing carefully developed and clearly defined operational requirements for any future fighter aircraft. These will continue to play a major role in establishing the most basic characteristics of the fighter's design. If not clearly defined in a competitive design selection situation, the problem of selection among alternative proposed configurations will be made more difficult. AGARD and its appropriate Panels should note that the wind tunnel can still be a major development tool for aerodynamic design of specific configurations and the availability and improvement of wind tunnel facilities should continue to be supported. A great deal of emphasis has already been placed on the use of simulators in all phases of aeronautical activities; this should be continued with special emphasis on their use in configuration exploration and selection. The selection of appropriate piloted or computer analysis simulation as related to the real world combat task should also get continued attention.

3.5 Propulsion

The subjects covered in this session ranged from intake design and variable cycle engines to specialised two dimensional exhaust nozzles. The compromise between cost and complexity in engine design was also addressed.

The prime requirements of an intake are to provide high pressure recovery, low flow distortion and low drag throughout the flight envelope. While much is already known about intake design, there are still problem areas at transonic and supersonic speeds and at the high angles of attack and sideslip obtainable with the new generation of fighters. For the higher supersonic speeds (greater than about $M = 1.8$) variable geometry intakes are necessary with attendant penalties in cost and complexity. Intake development depends greatly on full scale and model testing. Development costs could be reduced if better computational methods were available.

Variable cycle engines (VCE) offer significant reductions in specific fuel consumption and improved intake and nozzle matching. At the current state of technology they suffer from excessive weight, complexity and cost. These factors currently outweigh the advantages when considering VCE for fighter aircraft. Should these penalties be reduced, VCE would be very attractive for fighter applications.

Non axisymmetric, two-dimensional, nozzles show potential advantages in improved airframe/engine integration and reduced I.R. signature. However, there are also certain disadvantages. Further work is needed to define more precisely the benefits of these nozzles in a practical airframe/engine combination.

A computational method has been developed to assess the minimum cost engine to meet a given sortie specification. The program takes account of the important engine parameters such as compression ratio and bypass ratio. While the examples shown were for relatively simple missions, the method clearly has a potential for helping in the choice of the appropriate parameters in a new engine design.

The papers and discussion of this session highlighted particularly the penalties in weight, complexity or cost that can arise from choosing an unnecessarily complex or non-optimum engine to meet a specified performance or from specifying a greater supersonic speed capability than is needed. The importance of the cost of fuel and other operating costs should not be ignored in assessing the most cost-effective solution.

It is recommended that the NATO Military Committee should be fully aware of the cost penalties inherent in over specifying required performance, particularly when requiring supersonic speeds in excess of $M = 1.8$. AGARD should support further research and development into intake designs more tolerant to high angles of attack and sideslip, a better understanding of the causes and effects of intake flow distortion and the development of improved computational techniques to reduce the cost of intake development.

3.6 Structures

The papers in this session included reviews of composites and metals for aircraft structures, the impact of active controls on structural design and some general points relevant to aircraft structures and materials.

The paper on composites showed that large areas of a typical fighter aircraft could be made in composites, carbon fibre reinforced plastic being the preferred material. Some parts of the aircraft, such as the rear fuselage/engine bay would still be made of metal because of complex interfaces. Examples were shown of numerous aircraft components, from access doors to wing tips that have been made in carbon fibre and successfully tested. The tests have confirmed the significant weight savings that can result from using composites. No problems in fatigue or environmental effects have been found. Questions on such aspects as how best to provide lightning protection have still to be answered.

The paper on metallic materials showed that in designing a thin fighter wing, current metal properties would have to be increased significantly to match the strength and stiffness of a composite structure at the same weight. In particular, the modulus of elasticity would need increasing by as much as 100%. Some increases in properties can result from better quality control in metal manufacture and from new alloys. These are not enough to outweigh the potential benefits of composites. A further disadvantage of metals is the comparatively low utilisation of the raw material when manufacturing complex components by current methods. Some parts must, however, still be made from metal, as recognised in the paper on composites. Furthermore metal structures are less susceptible to accidental impact damage, more easily inspected for cracks and similar damage, and more easily repaired in the field. New developments such as powder metallurgy, spray casting and fibre reinforced metals could help to maintain the competitiveness of metals in certain structural areas.

Active control technology may be used to reduce structure weight due to its capacity to decrease loads, reduce gust response, automatically limit the flight envelope, improve ride quality and prevent flutter – especially with external stores. Some of the benefits have already been demonstrated in wind tunnel and flight tests. Further flight testing is planned. Yet more design, testing and analysis would be necessary before implementing such techniques in a new aircraft.

The papers and discussion emphasised the competition between metals and composites for future fighter structures. Composites have a significant potential advantage in terms of weight and cost. Metals will still be used in particular areas and technology is under development to improve their properties and reduce fabrication costs. The success of composites as a practical material for aircraft in Service must still depend on relatively unknown factors such as damage tolerance and life expectancy in an operational environment. A particular problem for the NATO community is the multiplicity of different national specifications for similar or identical structural materials. Steps should be taken to hasten agreement on international specifications, particularly for new materials such as composites.

AGARD should support all exercises to obtain maximum inflight experience with composite components and should foster the interchange of the experience so gained. It should continue to monitor the progress of ACT in the structural field. It should encourage progress towards the compilation of international specifications for aircraft materials and should support the development of cost-effective improvements in metal technology.

3.7 Avionics/Guidance & Control

This area was covered in terms of an assessment of the effectiveness and limitations of airborne radar and other electronic systems in the potential NATO European war environment, a report on the experience with an actual complete digital fly-by-wire control system and a paper on the design of a very specialized receiver for intercepting electromagnetic signals. In developing the requirements for future electronic systems to be used in the NATO European theatre, the predicted threat, particularly in ground based systems was outlined, against which potential systems could be assessed with attention to both the capabilities achievable with, and limitations inherent in, electromagnetic radiation systems. While not addressed to a fighter aircraft, the paper on the YC-14 digital flight control system covered fully the experience gained in successfully applying this new technology, including problems encountered and their solutions. The "High Probability of Intercept Receiver" paper covered the need, concept and prototype design for this very specialized receiver.

Significant points gathered from these papers tended to focus in detail areas. The inherent limitations in electronic systems must always be recognised in developing systems concepts. The experience gained with the digital flight control system on the YC-14 gives solid confidence that the technology to produce these systems exists, and also highlights some problems and their solutions, as well as some lessons for future applications.

The promised versatility has been shown to exist, but problems particularly in software documentation must be carefully addressed. The receiver paper demonstrated how a well specialized need in the electronic warfare field could be met by a new look at concepts once rejected, employing the latest technology to make these concepts workable today, and thereby meet a high priority military need.

In establishing requirements for sub-systems, just as for overall aircraft, the Military Committee should be aware that careful definition is made of the future need. In addition, while inherent limitation of electromagnetic equipment must be taken into account, the posing of a real need can frequently goad the technologist into providing a hitherto unrecognised approach to meeting the need. Within AGARD, the Aerospace Applications Study Committee should explore an expanded systems study program to better define potential technology applications.

3.8 Human Factors

The papers in this area addressed both general aircrew considerations and aircrew equipment, and specific features intended to improve the capabililty of future fighter aircraft. Significantly the general area chosen for discussion was that of pilot data sensing and decision making, particularly in high-stress situations, and one of the two papers addressing specific features covered pilot display/workload relationships as related to advanced display capabilities now becoming available. High acceleration cockpits involving a reclined seat reduce the amount of visible panel space but new electronic displays offer the prospect of a solution to this problem. As an example of area where sub-system technology promises cost effective benefits for future aircraft, new concepts in on-board oxygen generating equipment were reviewed, as were some of the deficiencies in current oxygen-regulating systems.

A number of points were made in the papers and subsequent discussion. To obtain the most effective pilot-aircraft combination human-factors considerations must be included at the outset of the design. This is particularly true when new features such as advanced automated displays are to be incorporated, and even more so when incorporating a novel concept such as a high acceleration cockpit. In general, there are adequate tools available for this work, but the selection and appropriate use of the right one is essential. However, the ability to represent the full environmental stress and task-loading situations was also questioned, and ultimate evaluation and demonstration in flight seems essential. An area that is frequently overlooked for life cycle cost gains is that of personnel support sub-systems. Research to establish these benefits should not be overlooked in favour of more glamorous areas.

Actions suggested of the Military Committee are to look carefully at the need for capabilities promised by new technology such as high acceleration cockpits since the incorporation of such features presents many attendant design problems. The Military Committee could well emphasize the need to look at sub-systems for future gains in overall cost effectiveness. AGARD should continue to emphasize the excellent interchange which has existed regarding the use of simulation in development and operations, and encourage further interchange between the engineering oriented groups and the ASMP in these areas.

3.9 Round Table Discussion

The round table discussion, the final session of the Symposium, involved a multi-national group of Government, Military and Industry experts covering all fields of technology. The participants presented their own views on fighter aircraft design which were augmented by contributions from the floor. Many aspects of the subject were discussed: the salient points of the discussion are presented below.

(i) General Requirements – The Overall Scene

Despite peacetime requirements, a fighter is a war machine. Its only purpose in war is to achieve a maximum rate of kill.

In war, the maximum number of sorties we can produce is our capital investment. We must exploit this to the maximum degree of effectiveness. We must maximise target hit potential per available sortie.

We need a total subsystems approach with a careful balance of *all* associated aspects – threat, target, weapons, aircraft, environment, personnel and materials.

Too much concentration on one area involves the risk of sub-optimisation to the detriment of other aspects.

In particular, concentration on the manned fighter aircraft alone may lead us into the danger of the "battleship syndrome". Full account must be taken of all alternative weapon systems such as cruise missiles, RPV's as well as manned aircraft. Beyond visual range missiles may well change the battle order.

Design for survivability is important to enable penetration of the enemy defences. This involves "stealth" in design – minimum radar cross section, low I.R. signature. There is much to be said for a design which does not need to use reheat over enemy territory except when forced into combat.

As an alternative to "stealth" and ECCM, it can be proposed that an onslaught to eliminate the enemy defences at the start of any conflict could be a more cost-effective solution.

Most attention recently has been given to the air-to-air fighter. More attention should be devoted to the air-to-ground attack aircraft. Improved air-to-ground weapons are needed.

(ii) Flexibility

Many speakers emphasised the importance of flexibility in new aircraft design. Some relevant points follow:-

The aircraft must be versatile – "You never fight the war you provided for".

The solution must adequately recognise and address the threat. The threat changes, and a retrofit to counter a change is often more expensive than providing sufficient flexibility in the initial design.

A fighter must be "robust", that is, not sensitive to changes in assumed battle conditions.

Standardization is very well in moderation, but you must not standardise to the point where you have created a single glaring weakness (such as reliance on a minimum available runway of 2000 ft.)

(iii) Cost

Cost and design to cost are clearly of utmost importance under present day conditions. Various relevant comments were made:-

Cost of ownership can be apportioned for current fighters in the following proportions:-

Development	Procurement	Operating
1	3	5-10

These proportions lend strength to the argument that more should be spent on development in order to save even more in operation.

The technical possibilities are unlimited if you can afford them. However, we must optimise against cost.

The "solution" is that aircraft which will beat the enemy at least cost.

(iv) Simplicity

Simplicity is obviously one approach to reducing cost. Many pleas were made for simplicity, but with cautions both against over-simplification and over-complexity.

The number of aircraft available is very important – simplicity of design allows more aircraft to be procured for a given budget.

Simple aircraft are needed to match the predicted future reduction in the number and skill level of service personnel.

Simplicity is desirable, but air power must retain flexibility. We must not over specialise through over-simplification.

Complicated solutions must be specifically justified before they are accepted.

(v) Technology

A diversity of views, some of them conflicting, were expressed on the role of technology in fighter aircraft design. Some are set out below:-

Technology is in hand to build a superior aircraft. The requirements are too timid and do not stretch technology enough.

Technology must not always be pushed to its limits.

Unless you stretch your technical horizons you may not see a better (and cheaper) solution.

The risks inherent in applying new technology for aircraft equipment must be weighed against the dangers of using antiquated equipment.

We are too easily entranced by the marvels of electronics. How do we really integrate then, effectively, into an aircraft? We must not cram too much into one small aircraft.

Technology has greatly advanced the aircraft but man is basically unchanged. Aeromedical aspects must be considered throughout specification and design.

We need to improve poor weather capability – what can the threat do in such conditions?

4. CONCLUSIONS

Technology is available, in all areas of fighter design, to meet the military requirements for the 80's. However, the cost of using the most advanced technology to meet every conceivable requirement can be exorbitant. Cost-effectiveness is of vital importance. Future operational requirements must be carefully developed and clearly defined so as to ensure the most economical solution. Future fighter aircraft must be designed with sufficient flexibility to meet the changing needs during their service life. Research and development should be directed towards those areas offering the most cost-effective solutions.

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14. Abstract

This report evaluates the AGARD Multi-Panel Symposium on Fighter Aircraft Design held from 3–6 October 1977. The primary conclusions of the report are that technology is available, in all areas of fighter design, to meet the military requirements for the 80's. However, the cost of using the most advanced technology to meet every conceivable requirement can be exorbitant. Cost-effectiveness is of vital importance. Future operational requirements must be carefully developed and clearly defined so as to ensure the most economical solution. Future fighter aircraft must be designed with sufficient flexibility to meet the changing needs during their service life. Research and development should be directed towards those areas offering the most cost-effective solutions.

Recommendations are made to the NATO Military Committee and for future studies by AGARD.

This Advisory Report was prepared at the request of the Flight Mechanics Panel of AGARD.

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TECHNICAL EVALUATION REPORT on the MULTI-PANEL SYMPOSIUM on FIGHTER AIRCRAFT DESIGN
H.Andrews and R.J.Balmer
Published February 1978
12 pages

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