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CANADA AND THE NATO SCIENCE PROGRAM A REVIEW (REVISED VERSION)

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Revised Edition

CANADA AND
THE NATO SCIENCE PROGRAM
A REVIEW (REVISED VERSION)

J.A.S. Walker
Project Director
Ministry of State for
Science and Technology

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A REVIEW

SECTION I - INTRODUCTION

BACKGROUND

In 1976 the International Division of the Ministry of State for Science and Technology, MOSST, carried out a review of Canada's participation in the NATO Science Program. The main objectives were to:

i) Assess the benefits accruing to Canada from its membership in the NATO Science Committee (NSC) and to recommend future policy guidelines;

ii) Assess the effectiveness of existing national arrangements in support of such membership; and to

iii) Review the role of MOSST in support of Canada's participation in the NSC.

In preparing the study extensive use of appendices was made to present those officials concerned with what amounted to a 'ready reference' manual of the rather complex programs and subsidiary bodies of the Science Committee. In addition, although rescurces and time available precluded an in-depth cost-benefit analysis of the Science Program, sufficient data was at hand to permit comments on its value to the Alliance as a whole as well as to Canada alone.

For these reasons it was felt that the Review could be useful to wider readership if amended to remove those portions concerned with purely Canadian aspects or internal Canadian Federal Government administrative mechanisms. This version has therefore been prepared by leaving the original document intact as far as possible where any value to a more general audience is thought to exist. The reader's indulgence is sought for the inevitable breaks which occur in the flow of the review.

Finally although exchange rates have fluctuated somewhat, especially over recent years, a flat rate of 40 Belgian Francs, (BF), to the U.S. dollar has been used for simplicity's sake except where otherwise noted.

SECTION II - THE NATO SCIENCE COMMITTEE

HISTORY (Appendix A)

The NSC was established in 1958 as a result of a growing awareness of the importance of science and technology to the Alliance, coupled with a desire to expand collaboration into non-military fields. The Committee owes its existence to two related actions - the establishment by the NATO Council in 1956 of a three-man committee of foreign ministers (including Lester B. Pearson of Canada), followed in 1957 by a "Task Force on Scientific and Technological Cooperation".

The findings of both these bodies emphasized the crucial role of science and technology in maintaining the economic, political and military strength of the Atlantic Community and urged that measures be taken to improve cooperation in this area between member nations. Among the specific measures recommended and subsequently endorsed by the Heads of Government were the setting up of a science committee, and the appointment of an eminent scientist to act as advisor to the Secretary General.

The Science Committee held its first meeting in March, 1958, chaired by the newly appointed Science Advisor. In 1961, as a result of the growing importance of the Committee's activities, the Science Advisor's appointment was changed to that of Assistant Secretary General for Scientific Affairs and a Scientific Affairs Division was established.

MAIN OBJECTIVES[1]

Within the overall general mission of stimulating and strengthening science within the Alliance, the Science Committee's main objectives can be summarized as follows:

(a) To provide advice to the Council on problems of science and technology of concern to the NATO Alliance.

(b) To increase the supply of trained scientists by stimulating the exchange of post-graduate and post-doctoral students between member countries.

(c) To identify gaps in scientific capability and knowledge and to establish programs aimed at catalysing remedial action at national and international level; and

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[1] NATO and Science 1958-1972

(d) To increase the effectiveness of national scientific efforts through programs aimed at pooling scientific facilities, collaboration between scientists of member countries and the exchange of information.

In considering the programs set up by the Science Committee to achieve its objectives, it is important to bear certain fundamental principles carefully in mind. The Committee's role is to stimulate and catalyse action which will supplement, not replace, national programs. It therefore avoids taking on large or lengthy projects. Furthermore, though an integral part of the NATO structure, the Committee is completely non-military in nature. Finally, though there are exceptions, its fundamental orientation is towards basic rather than applied research.

GENERAL SCIENCE PROGRAMS

Three main programs established in the first year of the Science Committee's existence remain the backbone of its activities - the Science Fellowships Program, the Advanced Study Institutes Program and the Research Grants Program. They are supplemented by two smaller programs; the Senior Scientists Program and the Science Committee Conference Program. Although of many years standing, these programs are not static but are re-assessed and frequently re-oriented. A short description of each follows:

(a) The Science Fellowships Program (Appendix B)

The main purpose of the NATO Science Fellowships Program is to stimulate the international exchange of post-graduate and post-doctoral students. Under its provisions financial support is supplied to cover the living and travelling expenses of the student for a period of one year although extensions are common.

While under the general supervision of the Science Committee, detailed administration is carried out in each country by a national agency. The choice of level of fellowship offered and the selection of recipients is made by the national agency.

Traditionally the largest, financially speaking, of all the NSC activities the Program absorbs about 55% of the total budget representing some $3 million US in 1975 and a total investment of about $42 million US since its inception. Over 11,000 fellowships have been

awarded to date, more than half being taken in the fields of chemistry and physics.

(b) The Advanced Study Institute Program (Appendix C)

An advanced study institute is primarily a high-level teaching activity in which a carefully defined subject is presented in a systematic and coherently structured program.

Subjects, which range over the whole gamut of modern science, are treated in some depth by lecturers eminent in their field. Research scientists of varying degrees of attainment form the 'student' body.

Institutes, of which some 50 are sponsored annually, typically last for two weeks and are restricted to between 50 and 70 participants. The common aim is the dissemination of advanced knowledge and the establishment of contacts between scientists of different countries.

Support is provided in the form of financial assistance to help cover small honoria for lecturers and the travelling and living expenses of participants. Grants, amounting to just over $1 million US in 1974, represent about 20% of the Science Committee's budget.

Since its inception in 1959, the Program has supported nearly 700 Institutes in which about 40,000 scientists have participated. The proceedings of some 400 Institutes have been published to date.

(c) The Research Grants Program (Appendix D)

The main purpose of the Research Grants Program is to promote the flow of ideas and of theoretical and experimental methods between universities and research institutions in NATO countries. This is achieved by the financial support of research projects carried out as joint international projects.

Projects supported vary greatly in magnitude and nature. Grants may be made to cover the travel of one scientist wishing to apply a sophisticated technique developed in one country to a problem under study by a research group in another. At the other extreme are larger joint international research projects for which grants to cover living as well as travel expenses are

made for periods of up to three years. In all cases however, the emphasis is on placing a limited amount of funds where they will do the most good.

Since 1960, grants in excess of $11 million US have been made in support of over 900 projects.

(d) The Senior Scientists Program (Appendix E)

One of the smallest activities of the Science Committee, the Senior Scientists Program provides limited funds to enable a small number of outstanding scientists to give a series of lectures on advanced topics in several member countries or to develop research projects during an extended visit to a laboratory of another member country.

The Program, which is cooperatively funded by the Minna-James-Heinneman Institute of Germany, has made a total of 53 grants (ranging from $2,000 to $7,000 US in 1974). Funding normally covers travel and living expenses.

(e) The Science Committee Conference Program (Appendix F)

Science Committee Conferences are held in those scientific areas which the Committee feels are in need of special treatment. Their main purpose is to identify particularly fruitful areas for future research, and their recommendations are addressed both to those having a responsibility for selecting and supporting research and to the Committee itself as a guide for the allocation of resources.

The typical conference, at which attendance is limited to about 50 invited experts, is a working meeting with all participants taking part in working groups and contributing to the conclusions.

Twelve Conferences have taken place to date on subjects ranging from High Temperature Materials, (Norway 1967) to Thermal Energy Storage, (Scotland 1976). Proceedings are published.

SPECIAL SCIENCE PROGRAMS (Appendix G)

The Science Committee's general and more permanent programs are complemented by several shorter term programs designed to

provide preferential support to certain scientific areas identified as needing special encouragement. The aim is to highlight gaps in knowledge, deficiences in trained scientific manpower, or areas of special importance and to catalyse national/international interest. Once such interest is aroused, the program is closed down and resources are applied elsewhere.

Following a major reorganizational review in 1972, this effort has been embodied in several Special Program Panels of experts, each Panel dealing with a specific area and having an initial life of three years. Though largely autonomous in nature, the activities of each are subject to regular review by the Science Committee.

A variety of mechanisms are available to Panels to stimulate international activity. These range from the sponsorship of conferences and the financial support of small collaborative research projects on the one hand, to the support of "Visiting Experts" and various university training schemes on the other.

The special Programs are financed by a Program Development Fund allocated annually by the Science Committee. The fund amounted to some $750,000 US in 1976 representing 10.3% of the total science budget.

Seven Special Program Panels have been established since 1973 of which two were dissolved in 1975. Existing Panels cover the areas of Eco-Sciences, Human Factors, Systems Sciences, Air-Sea Interaction and Marine Sciences. The establishment of a further Panel dealing with Materials Science is currently under consideration.

THE NATO SCIENCE BUDGET

Funding for the programs of the Science Committee is provided as part of the NATO Civil Budget and therefore competes directly with other activities such as the Information Program and the Committee on the Challenges for Modern Society - as well as with common operating and capital costs. As far as the Science Committee is concerned, there appear to be as many advantages as disadvantages to this system relative to a separate budget for science alone although, because of the steady erosion of the value of science budget, the latter has been under consideration recently at the working level. It appears unlikely that a change will be introduced in the near future.

As the Science Committee does not have a separate budget, national contributions to its funds can be considered to be in

the same ratio as those made for the support of the Organization as a whole. These have remained roughly the same in terms of percentage for some years and are given in Table I, page 51. Canada's contribution is about 5.8% (approximately $420,000 in 1976), and is administered by the Department of External Affairs.

The science budget has grown from about $1.15 million US in 1959 to $7.25 million US in 1976. Figures for 1974, 1975 and 1976 together with percentage distribution to the major science programs are given in Table II, page 52.

STRUCTURE (Appendix H)

The NATO Science Committee itself consists of one representative per member country and is chaired by the Assistant Secretary General for Scientific Affairs. National Representatives vary from university professors (Belgium) and heads of science centres (Canada) to senior scientists employed by governments (United Kingdom). All share, however, the basic requirement of being highly qualified to speak authoritively on scientific matters. The Committee meets three times a year for two or three days, twice in NATO Headquarters, Belgium, and once in a member country.

While exercising overall control of its programs, the Committee delegates detailed authority in most program areas to subsidiary bodies of which two major categories exist. The first consists of standing bodies, program oriented, covering action in all fields of science and of indefinite duration (e.g. The Advisory Panel on Research Grants). Forming the second group are temporary bodies oriented towards a specific subject area with a Science Committee decision being necessary for their continuation beyond three years (e.g. The Special Program Panels). In nearly all cases, both groups share the common features of a membership of experts rather than national representatives, (usually six), and two or three meetings annually. Membership is usually for 2-5 years.

Permanent administrative support is provided in the form of the seven-man Scientific Affairs Division, (five scientific officers and two administrators). The Division is responsible for the provision of secretarial support to both the Science Committee and the Committee on the Challenges of Modern Society with each officer typically looking after more than one program.

SECTION III - GENERAL EVALUATION

GENERAL

The assessment, even in general terms, of an activity such as the NATO Science Program is far more difficult than that of a project whose end result is a readily measurable product. While objective judgments can be made on the basis of the number of grants or fellowships awarded the real test of the success of the Program lies in such subjective areas as the increase in scientific knowledge and capability accruing to those who have been able to study, exchange experience or work together with colleagues in other member countries. Of equal importance is the question of what the scientific community has gained which could not otherwise have been gained - or gained more cheaply - through national programs.

THE PROGRAMS

In this context, it is useful to consider first the Science Fellowships Program - by far the biggest and absorbing well over half the total budget. At first sight, the Program appears to be merely an extension of some existing national programs with funds being returned by NATO at roughly the same level as national contributions. There are however, several important benefits apart from those of a purely educational nature of which possibly the most important is the value to the student of working with the scientific community of a foreign country. This goes deeper than the purely scientific aspects, the exposure to the society of the host country not only enriches the student himself but helps towards a better understanding between an important and influential segment of the population of member countries of the Alliance.

On a larger scale, two more benefits are apparent. First, the Program has had a catalytic effect in that several member nations have established similar fellowships schemes on a national basis; second, many have modified national programs to incorporate the experience and ideas gained from the National Administrators of other members. Finally - and in accordance with a deliberate policy - the lesser scientifically advanced nations have enjoyed substantial financial preference as well as the advice and assistance of colleagues administering pertinent national post-graduate or post-doctoral schemes.

The other main activity emphasizing the higher educational role of the Committee is the Advanced Study Institute Program.

The basic feature of the Advanced Study Institute (ASI) is its indepth treatment of a specialized subject by scientists from many countries. Yet this same international character precludes, generally speaking, its support as part of a national program.

Specifically tailored to be short enough (about two weeks), to facilitate the attendance of eminent lecturers and senior scientists, the typical ASI nevertheless permits a structured program of tutorial type lectures to be presented in an informal atmosphere encouraging maximum participation by all concerned.

Apart from its value in a strictly educational sense, the Program, through the application of limited financial support, has stimulated hundreds of senior scientists throughout the Alliance to organize the presentation to their peers of new ideas, methods and results of advanced scientific research. In so doing, it fulfils two of the major objectives of the Science Committee - those of enhancing the formation of contacts between scientists and the dissemination of advanced scientific knowledge within the Alliance.

With over 700 Institutes supported to date, involving some 40,000 scientists and the publication of an authoritative series of 'state of the art' books, the Program is judged to be one of the most successful of the Science Committee's activities.

The Research Grants Program complements the Committee's major educational initiatives by offering opportunities for scientists of different countries to collaborate in joint research projects or in solving problems of common concern.

By supporting only those projects for which international collaboration is demonstrably necessary, the Program enhances, not duplicates national research activities. Additionally, as large projects of the type which attract national or international funding are not eligible, the end result is what amounts to the spreading of 'seed money' in the form of travel/living expenses among a wide variety of small yet useful projects - projects which otherwise would almost certainly not be able to attract foreign collaborators.

The extent of the joint collaborative research work stimulated by the Program is illustrated by the 900 or so projects so far supported. In excess of 3,000 scientists throughout the Alliance have been involved representing not only a valuable exchange of experience but a useful extension of national research efforts.

A facet of the Science Committee's activities considered to be of special significance is its identification of gaps in knowledge, lack of trained scientists and of areas needing special attention. The recommendations made by the members of the Committee, the experts of its Special Program Panels and those scientists participating in the Special Science Committee Conferences are addressed to those having responsibility for the direction of research within member countries. These are of particular value because they represent the views of experts largely unconstrained by political objectives.

Recommendations resulting from these activities are utilized by the Science Committee itself as a guide for the commitment of resources and in particular to support one of its most innovative programs - the Special Science Program.

Operating within an overall budget of about $750,000 annually, the five or so Special Program Panels each consisting of a few unpaid experts have initiated a wide variety of activities in areas needing special attention. State of the art reviews, conferences and symposia have focussed attention on problems and gaps in knowledge. In some cases action so initiated has been taken up by other international organizations. Small grants have encouraged cooperative research projects in important areas. Particular emphasis has been placed on advanced training through advanced study and research institutes and training schemes have been devised which have resulted in the cooperative involvement of several universities in different member countries. In particular the funding of study visits, exchanges of scientists and the provision of visiting experts have been of special value to the lesser scientifically developed member nations.

Several major factors are considered to have contributed to the success of the Special Science Program; the choice of areas where limited resources can have optimum impact, imaginative support techniques, the ability to move rapidly in and out of projects, and the careful control by the Science Committee of the activities of Panels - including the will to terminate them when appropriate. Continuous attention to all these will have to be applied in the future if the present momentum of the Program is to be maintained.

MANAGEMENT AND ADMINISTRATION

A factor of particular interest is the way in which the Science Committee has succeeded in controlling and administering both a substantial budget and a series of many faceted programs

with a permanent staff of only five scientific administrators. Members of the Committee itself are eminent scientists whose attendance costs NATO nothing. Although national representatives, their activities often involve member governments in travel and living expenses only (Canada is a case to point). This principle of leaving the direction and administration of programs in the hands of 'working scientists' is applied across the whole gamut of the Committee's activities. The Science Fellowship Program is administered by National Administrators, Advanced Study Institutes are planned and managed by the scientists organizing them, and the many activities of the Advisory and Special Program Panels are initiated and controlled by the panelists themselves.

By involving scientists rather than government administrators the Committee ensures that each area is addressed by an expert in the field and that political bias is kept at a minimum. The inertia characteristic of many other international organizations such as the UN and its specialized agencies is thus avoided. Finally, the very fact that so many scientists are prepared to devote time and effort to the Committee's programs at no remuneration testifies to their assessment of the value of these activities - an assessment borne out in the reports of many of the Canadian panelists.

While the delegation of responsibility to many sub-bodies has advantages it does make the overall control of their various activities proportionately more difficult. Yet without such continuous and effective control there is always the danger that these sub-bodies - which do not have the overview of the NATO Science Program enjoyed by members of the Committee - will progressively go their own separate ways.

To meet this need the Committee in recent years has adopted the principle of devoting one of its three annual meetings to the review of its Advisory and Special Program Panels. Reviews are based on an annual report from each sub-body presented in person to the Committee by each chairman and usually result in the passing on of useful guidance as well as the production of a healthy amount of criticism.

The Science Committee also reviews its own mechanisms at regular intervals, the establishment of the Special Science Program and its panels being the result of such a review held in 1972, the Program being re-examined again in 1975.

A further control mechanism worth comment is the principle of allocating, to each non-standing group a definite lifespan which can only be extended as the result of a specific decision

by the Committee. Adopted first in 1972 this principle has already been applied, two Special Program Panels having been terminated last year. Even where a standing body has unlimited life its terms of reference are reviewed at five-year intervals.

The Science Committee appears to be well aware of the dangers of duplication and overlap both within its own programs and with comparable work of other international organizations. Examples of steps adopted to avoid such duplication are the arrangements whereby each officer of the Scientific Affairs Division provides administrative support to more than one program and the recent insistence by the Committee that several Special Program Panels hold meetings jointly. These and other efforts are complemented by the fact that many panel members, as experts in their respective fields, are aware of other major international programs and indeed in some cases are personally involved in them.

In sum, the management and administration of the Science Program as presently conducted is considered to be vigorous, effective and carried out at relatively low cost - especially in comparison with other comparable international activities.

PARTICIPATION BY SCIENTIFIC DISCIPLINE

Statistics relating to the distribution of fellowships, grants and Advanced Study Institutes (ASI) reveal that the vast majority lie in the area of the mathematical and physical sciences; (68.4% of all ASIs and 55.5% of all awards made under the Research Grants Program exemplify the general trend which has been relatively steady since the inception of the Science Program).

While the onus lies primarily with the individual scientist it is suggested that a major contributory factor to this rather anomalous situation is that the Program is far better known to scientists in these fields. The Science Committee should consider whether wider or more effective publicity of its programs in other areas - would help to ensure a wider and more equitable participation.

CONCLUSIONS

The NATO Science Program was created in recognition of the need to maintain one of the great strengths of the Alliance - the power and vigour of its technology sustained by scientific excellence.

The Program has proved to be of high quality and innovative - the latter being of particular value at a time when stringent financial limitations tend to restrict new departures in science Its activities complement rather than duplicate national efforts and would almost certainly be more expensive if pursued on a purely national or bilateral level.

Its contribution to the post-graduate education in the West over the last seventeen years has been significant and has resulted in the forging of useful links between the scientific communities cf member countries. In so doing the Program has provided to the scientific community an image of NATO as something more than just a military - and thus to many a suspect - alliance.

No program is perfect and the NATO Science Program has its weaknesses. These, however, are considered to be too minor for inclusion except as covered in the recommendations made.

At a time when scientific cooperation is being actively pursued between member countries and Eastern Nations it is important to maintain the viability of a program which does so much, relative to the modest resources made available, to enhance the scientific cooperation within the Western community itself.

SECTION IV - CANADIAN ADMINISTRATIVE ARRANGEMENTS

CANADIAN NATIONAL ADVISORY GROUP

The many hundreds of Canadian scientists who have benefited from the activities of the NATO Science Committee owe a great deal to their fifteen representatives on its various bodies. Their work has undoubtedly been the greatest single factor in obtaining the recent high return on the National investment in the Science Program.

To be most effective however these representatives - located in different parts of the Country and disposing of very limited resources - require some kind of permanent focus and common administrative support. Two major needs are apparent: A mechanism which enables them to meet at regular intervals in order to review progress and establish agreed policies, and a permanent administrative base to provide common services.

To meet the first of these requirements the Ministry of State for Science and Technology established, in 1972, an ad hoc National Advisory Group consisting of Canadian scientists serving on the Science Committee's Advisory and Special Panels, and representatives of interested federal government departments. Chaired by the Canadian member of the NATO Science Committee the Group meets once a year with secretarial services being provided by the Ministry. A small steering group meets a further two times a year. Apart from its value as a forum for the exchange of views the Advisory Group provides Canadian representatives with an overview against which the individual activities of the Science Committee can be placed in context, together with advice on appropriate national policies in the domestic and international areas. In addition it represents to the Federal Government a useful means of briefing the Canadian member of the NATO Science Committee, of assessing the return on the national contribution, of exercising overall control and of providing, through its Department of External Affairs member, guidance to the Canadian Mission at NATO Headquarters.

ADMINISTRATIVE SUPPORT

A certain number of modest, though important, managerial and administrative functions have to be performed in support of Canada's participation. These include the maintenance of overall control on behalf of the Federal Government and the provision of policy advice and guidance, as well as more mundane administrative tasks such as the servicing of the National

Advisory Group and the provision of a permanent link to the NATO Scientific Affairs Division. These activities demand a low but continuous investment of manpower and financial resources involving in the main a commitment of about a one-third officer, (AS7 level), and a one-third secretary year. Non-salary expenses - usually to meet travel and living costs - are typically some $5,000 annually.

CONCLUSIONS

The effects of austerity within the research efforts of most member nations are already resulting in keener competition for NATO science awards and grants. If the substantial return on National investment in the Program is to be sustained a policy of maintaining a high level of Canadian representation should be pursued.

Current arrangements for providing support and guidance to Canadian representatives are considered to be effective and low cost. In the words of one panelist they are "likely to become a model for other member countries". These activities - particularly the National Advisory Group arrangement - should continue to be energetically supported.

Because of the importance of, and need for, effective publicizing of the potential of Science Committee's programs it is suggested that membership in the National Advisory Group be extended to include representatives of a few key non-governmental organizations such as the Association of Universities and Colleges of Canada.

SECTION V - RECOMMENDED FEDERAL GOVERNMENT POLICY

GENERAL SUPPORT

From a purely scientific standpoint, the NATO Science Program is considered to have achieved a great deal relative to its limited resources. These have been applied imaginatively and have benefited many thousands of scientists within the Alliance offering opportunities which would not otherwise have been possible, at least to the same degree, under national research programs. In a more general context, it has - as originally intended - strengthened the Alliance by emphasizing an important non-military aspect of cooperation and, in so doing, has favourably influenced an important segment of the Alliance community - a segment traditionally suspicious of NATO's military orientation.

> The Canadian Government should therefore, as a general policy, continue to give strong support to the NATO Science Committee and its Programs.

DEGREE OF CANADIAN INVOLVEMENT

In terms of cost and manpower resources, the difference between passive membership on the one hand and active, involved participation in the Science Committee's activities on the other, is negligible*. Canada, over recent years, has been one of the Committee's most active members both at Committee level and in its subsidiary bodies. The benefits of this policy are judged to have been well worthwhile both in terms of the number of Canadian scientists participating in the various programs and in terms of the reputation of its scientific community within the Alliance. In the larger political context, Canada's active participation in the Science Program strengthens its image as a contributor to the Alliance and supports national aspirations towards closer relationships with Europe.

> The Canadian Government should therefore encourage a high level of participation by members of the scientific community in the subsidiary bodies of the NATO Science Committee.

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*A member country makes the same financial contribution regardless of its involvement.

CURRENT FUNDING LEVEL

Like so many other national and international programs, the NATO Science Program has experienced a steady erosion of its resources due to world-wide inflationary pressures. In the case of the Science Committee however, the point has now been reached where its main programs are in danger of losing their viability. Both because of their intrinsic value and the adverse effect on the growing confidence in the Alliance by its scientific community, a continued erosion is considered to be unacceptable. While a move to return the real value of the Program to its original level of some years ago is clearly impractical, it is strongly recommended that its present (1976) level in real terms be maintained.

THE LESSER SCIENTIFICALLY DEVELOPED NATIONS

Since its inception the NATO Science Committee has pursued a policy of favouring where possible the lesser scientifically developed member nations. Though in some cases difficult to apply the policy has been successfully implemented to the considerable benefit of such nations. The policy is considered to make good practical as well as political sense and merits the whole-hearted support of the Canadian Government. Present austerity measures are however being felt within the national research program of every member nation and will place the application of the aid principle under increasing pressure. Vigilance will be required if the benefits to the less favoured member nations are to be maintained at past levels.

The Canadian Government should continue to support the principle of favouring the lesser scientifically developed member nations within the programs and activities of the NATO Science Committee, and should instruct its representatives to monitor the implementation of this policy as the effect of national austerity measures are felt.

SECTION VI - RECOMMENDATIONS FOR MINISTRY POLICY

PUBLICITY

In spite of the marked increase over the last few years in the number of Canadian scientists receiving awards or otherwise participating in the Science Committee's programs, there is a need to ensure wider publicity of their possibilities and benefits. A continuing effort is required to ensure that new generations of scientists are aware of their existence and that misconceptions - especially regarding the non-military emphasis - are removed. In addition, certain important scientific fields are poorly represented. This is not considered to be the result of any deliberate policy on the Science Committee's part, but more probably because of lack of knowledge of its programs within the appropriate segment of the scientific community.

Canadian Panel and Advisory Group members have done a great deal to ensure publicity within their own disciplines. They do not, however, have the necessary resources to cover all of the scientific community, nor should they be expected to do so.

It is recommended that the Ministry of State for Science and Technology, with the assistance of the Canadian National Advisory Group, consider ways and means of more effectively publicizing the NATO Science Committee's programs with special emphasis on those fields poorly represented.

NATIONAL ADMINISTRATIVE SUPPORT

That Canada has benefited from the NATO Science Program to the degree that it has over recent years is directly attributable to the effective and energetic participation of its representatives on the Science Committee and its various subsidiary bodies. It is important that scientists expert in their fields are chosen to fill these positions rather than government administrators. It is however, equally important they they be supported by an appropriate focus within the Federal Government which can on a continuous basis provide advice on national policies, administrative support and secretarial services. In particular the mechanism of an ad hoc National Advisory Group consisting of past and present Canadian members of the Science Committee and its subsidiary bodies has proved useful in offering to all concerned - and at very modest resource cost - a forum for the exchange of views and the maintenance of a coherent national approach.

It is therefore recommended that MOSST continue to support the principle of a National Advisory Group for the NATO Science Committee and of the provision of a modest level of administrative support from Federal Government resources for its naticnal representatives.

Appendix A

THE NATO SCIENCE COMMITTEE
BRIEF HISTORICAL BACKGROUND

The North Atlantic Treaty signed in 1949, is primarily concerned with the threat of war and the means of resolving international disputes. Article 2 however, calls for the strengthening of the free institutions of member ccuntries and for collaboration and consultation between them.

While NATO's first years were committed to its primary goal of collective defence a growing recognition of the need to expand cooperation in non-military fields in the spirit of Article 2 resulted, in 1956, in the setting up of a committee of three foreign ministers to advise on the advantages and opportunities of such cooperation. This Committee, known as the 'Three Wise Men' on which Canada was represented in the shape of Lester B. Pearson, drew attention amongst other things to the special importance of science and technology to the Alliance.

In 1957, on the recommendation of the Committee, the North Atlantic Council established a "Task Force on Scientific and Technical Cooperation". The report of this body examined some of the urgent problems facing the Alliance both in short term and long term scientific development. It was emphasized that although large national efforts had to form the basis of an improvement of the situation, there was much to be gained from more effective ccoperation between its member countries. In this respect two specific recommendations were made by the Task Fcrce; that the Council establish a science committee and that a Science Advisor to the Secretary General be appointed.

The Heads of Government considered the recommendations of the Task Force at their meeting in December 1957 and made the following declaration:

> "We recognise that in most of our countries more should be done to increase the supply of trained men in many branches of science and technology. The full development of our science and technology is essential to the culture, to the economy and to the political and military strength of the Atlantic community.

> We realise that progress will depend on vigorous action within individual states and in particular on the devoted contribution of teachers and scientists. We must increase the provision for the training of young people in scientific and technical subjects and must also ensure that the free pursuit of fundamental research continues to flourish. Each of our Government will therefore reappraise the support being given to scientific and technical education and to fundamental research.
>
> We seek to increase the effectiveness of national efforts through the pooling of scientific facilities and information and the sharing of tasks. We must build on the established tradition of the universality of true science. Our Governments will support the international organizations doing work in this field.
>
> We have decided to establish forthwith a science committee on which all of the NATO countries will be represented by men highly qualified to speak authoritatively on scientific policy. In addition, a scientist of outstanding qualifications will be appointed as science adviser to the Secretary General of NATO".

The first meeting of the Science Committee took place in March 1958. Three years later in 1961, the Science Advisor to the Secretary General was made Assistant Secretary General for Scientific Affairs and the Scientific Affairs Division of the NATO Secretariat was established.

In its first years, the Committee examined a large number of ways for stimulating science in an international context. During this period the three programs: the NATO Science Fellowships Program, the NATO Advanced Study Institutes Program and the NATO Research Grants Program, which today remain the backbone of the NATO science activities, were established.

The Science Committee has kept a continuing watch for areas in particular need of stimulus and has tried within its limited resources, to meet such challenges with effective measures - a prime example being its Science Committee Conferences. In addition, the Committee initiated activities in a number of specialised scientific fields which would be of more immediate or

short-term interest to the Alliance. These are the Special Science Programs.

The Committees' programmes have never been static, but have continuously been reassessed both in relation to other activities in NATO, to new developments and to the wider area of international and national support of science. Although they have changed during the years, the predominant characteristics of the various programmes have remained an emphasis on co-operation and catalysis, and a capacity for rapid response to new developments.

Appendix B

THE SCIENCE FELLOWSHIPS PROGRAM

POLICY

Two of the fundamental reasons for the establishment of the NATO Science Committee (NSC) in 1958 were the need foreseen by the Heads of Government for an increase in the supply of trained people in many branches of science and technology, and the desire to increase national scientific efforts through the pooling of facilities and information.[1]

In line with these basic requirements and recognizing the value of a period of training for young scientists outside their own countries, the Committee established as its first - and financially most important - program, the NATO Science Fellowships.

The main aim of the Program is to increase the scientific strength of the Alliance by stimulating the international exchange of post-graduate and post-doctoral students of the pure and applied sciences.

GENERAL DESCRIPTION

Under the provisions of the Program, financial support is given to cover the living and travelling expenses of the student for a period of about one year with extensions of up to a further year being common. With few exceptions, recipients are expected to study in institutions of another member country.

Although under the general supervision of the Science Committee, detailed administration is carried out in each country by a national agency - usually that which administers national fellowship schemes.

Selection is carried out by the national agency and is based on scientific ability although criteria vary from one country to another. The level of student covered also varies, with some nations restricting participation to the post-doctoral research worker and others emphasizing post-graduate training. In many cases, the NATO Fellowships Program forms an integral part of the national fellowship scheme. A Sub-Committee of National Administrators meets twice annually.

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[1] Declaration of Heads of Governments of the Alliance, Dec. 1957.

To date, about half the fellowships have been taken in the fields of physics and chemistry but mathematics, engineering, the medical sciences, biology and geology are also represented.

The Program is by far the largest, financially speaking, of all the Science Committees' programs, about 55% of the total budget being dedicated to it on a regular basis. The allocation of funds to individual member countries is by formula agreed some ten years ago. Under the terms of this formula, an amount roughly equal to each country's contribution to the budget is returned to it with special provision made to promote science in certain countries at the expense of the more scientifically developed.

In 1964, the Program was expanded to include a NATO Senior Research Fellowships Prcgram for which countries could, if so desired, allocate up to 20% of the funds received under the Fellowships Program. These fellowships are aimed at enabling universities and non-profit making research institutes to send senior staff members to research and educational institutions in other NATO countries.

GENERAL ASSESSMENT

Since its inception in 1959, the NATO Fellowships Program has awarded grants totalling slightly in excess of $42 million US. From 1961 onwards, the annual amount has varied from about $2,500,000 US to nearly $3,000,000 US in 1975. (Table III, page 53, modified by AC/137-D/571, 10 April 1975).

As the Program is administered by National Agencies, costs to NATO are very modest. Main expenditures include part of the salary of one full-time scientist on the staff of the Scientific Affairs Division and the travel/living expenses involved in the annual meetings of the National Administrators.

The funds provided have enabled over 11,000 students from member countries to study for up to three years abroad. Of these, the vast majority have selected the United States (4,384), the United Kingdom (2,750) and France (973) as host country. (Table IV, page 54).

While the level of funding itself represents a small - though useful - portion of the total devoted to many national programs, the main benefits lie in other areas. Perhaps the most important of these is the value to the student of the experience and broadening of the mind resulting from working with the scientific ccmmunity of a foreign country. This goes deeper than

the purely scientific aspects; the exposure to the society of the host country not only enriches the student himself but helps towards better understanding between an important element of the population of member countries of the Alliance. These benefits are not restricted to the individual student for the host institution also gains - though to a lesser extent - from the experience brought by the foreign student and the resulting contacts made with other scientific communities. A final factor is the image of NATO provided by the Program to the intellectual communities of member countries, an image of something more than just a military - and therefore to many a suspect - alliance.

A final and considerable benefit offered by the Program is the catalytic effect it has had on the establishment, in several member countries, of comparable national schemes. This in effect is enhanced by the regular exchange of ideas and experiences between National Administrators at their annual meetings.

As is the case with every other program of the Science Committee, the Fellowship Program has, over the last decade, suffered from the effects of the world-wide inflationary trend. While a detailed analysis of the problem lies outside the scope of this review the major effects can be summarized as follows. Although the total dollar cost of the Program has only increased by 8% between 1963 and 1973, both the number of fellowships and the associated months of study have declined substantially - by 37.8% and 49% respectively. Due to a change in the system of reporting in Canada in 1973 actual figures for this year are somewhat higher than quoted. Nevertheless the overall trend is representative and reflects a suggestion by the NATO Statistics Service that the purchasing power of the 1973 program is some 35%-40% less than that of 1963[2]. The problem, as mentioned in the main text, is one shared by many national research programs and is currently under review by the Science Committee.

In sum, the NATO Science Fellowships Program is considered to have contributed significantly to post-graduate scientific education in the West over the last seventeen years and to the forging of useful links between the scientific communities of member countries. At a time when scientific cooperation is being actively pursued between member countries and Eastern nations, it is important to maintain a program which does much to enhance the scientific cooperation within the Western community itself.

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[2] AC/137-D/578, 24 July, 1975.

Appendix C

THE ADVANCED STUDY INSTITUTES PROGRAM

GENERAL POLICY

The Fellowships and Research Grants Programs support individual studies and collaborative research projects respectively. The Advanced Study Institutes Program on the other hand is aimed at enhancing the dissemination of advanced knowledge and the formation of contacts between scientists by financing certain types of international meeting.

International conferences and symposia are a common feature to virtually all fields of science. At the other end of the scale from these short-term activities lie longer term summer institutes and schools for advanced scientific study. The normal Advanced Study Institute falls between the two. Typically of two weeks duration, it is short enough to facilitate the attendance of senior scientists, including those from industry, yet long enough to permit the presentation of a structured program of tutorial type lectures.

DESCRIPTION

The Advanced Study Institute, (ASI), is primarily a high level teaching activity at which a carefully defined subject is presented in a systematic and coherently structured program[1]. The subject is normally treated in some depth by lecturers eminent in their field and is presented to scientists who have already specialized in the field or who possess an advanced background. Increasingly, multi-disciplinary subjects are addressed and the roles of lecturer and 'student' are reversed during the Institute.

The Program is deliberately kept flexible to permit the financial support of a variety of meetings where the timeliness of the subject is considered to warrant such support. The vast majority of ASIs however, have the following general characteristics: Duration about two weeks, total participants between 50 - 70 with a high lecturer/student ratio. A highly structured program is presented, aimed mainly at the post-doctoral level with lectures occupying some 70% of the time. New apparatus or experimental techniques may be demonstrated. The informal atmosphere of the typical ASI encourages an easy exchange between lecturers and students.

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[1] AC/137-D/486 (Revised), 18 November 1975.

In principle, ASIs in nearly all scientific fields are eligible for support and indeed since the Program's inception in 1959 Institutes have covered virtually the whole range of scientific endeavor, (see Table V, page 55).

ADMINISTRATION

The responsibility for the planning and execution of an ASI lies entirely with its organizer and his staff, aided on occasions by members of the NATO Scientific Affairs Division. His responsibility also covers choice of location, (providing that this lies within one of the NATO countries), lecturers and students - many of the latter being invited directly by the organizer and his lecturers. The primary criteria for participant selection is quality and potential benefit from the Institute. Participants are however expected to be drawn from as many member countries as possible although provision is made for participation by nationals of non-member countries, (e.g. about 12.6% in 1974).

Applications for NATO support of potential ASIs are made in the form of unsolicited proposals to the Scientific Affairs Division. Decisions are made on behalf of the NSC by a seven member Advisory Panel, (including one Canadian), which meets twice annually and which is assisted as required by international referees. Additionally many ASIs are sponsored by the Special Program Panels of the NSC.

Support is provided in the form of NATO grants which cover small honoraria for lecturers and travelling and living expenses for participants. Ratios vary but as a guide some 39.3% of total grants made in 1974 covered travel and 36.8% covered living expenses.[2] While the typical grant covers most expenses, some other source of financial support is usually necessary. About 52 million BF (roughly $1.3 million US), was devoted to this Program in 1974.[3]

PUBLICATIONS

The proceedings of about two-thirds of all ASIs are published and are recognized as authoritative surveys of their subject. In 1973, four commercial publishers undertook the regular publication of the NATO ASI Series in hard cover editions.

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[2] ASG. SEA(75)102, 2 May 1975

[3] AC/137-D/563, 7 January 1975

GENERAL EVALUATION

A total of about 681 ASIs have been supported by the NATO ASI Program between its inception in 1959 and the end of 1974, (Table V, page 55). Some 40,000 scientists have participated, drawn mainly from member countries. To date about 400 publications[4] have been produced, publications which have had wide circulation within the Alliance and whose success has now attracted commercial publishers.

Both applications for the support of ASIs and participation in them are currently oversubscribed, a fair indication of their reputation within the scientific community. This reputation is further supported by the large numbers of eminent scientists willing to participate as lecturers for relatively little remuneration.

The costs of the Program are of two main categories; grants to ASIs and Program administrative expenses. The grants, amounting to just over $1.5 million US in 1976, represent about 21% of the total NSC budget and place the ASI Program second in importance in terms of financial outlay. Administrarive expenses are minimal, the main costs being part of the salary of one scientific officer of the Scientific Affairs Division staff and the travel/living expenses involved in the two annual meetings of the Advisory Group. Members of the latter do not receive remuneration.

The Program has encouraged many leading scientists to organize and participate in international institutes of a type which supplements the usual international conferences and symposia for which financing is available from other sources. In so doing, it fulfils one of the major objectives of the NSC - that of enhancing the formation of contacts between scientists and the dissemination of advanced knowledge. It is judged to be one of the most successful of the Science Committee's programs.

There is, nevertheless, one area which would appear to justify further examination. The distribution of ASIs according to fields of research, (Table V, page 55), reveals that the vast majority, (68.4%), lie in the area of the mathematical and physical sciences. This has been a steady trend since the inception of the Program and probably indicates that it is better known to scientists in these fields. It is suggested that this inequitable situation be brought to the attention of the NSC with the suggestion that wider or more effective publicity of the Program in other areas such as the social sciences might be considered.

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[4] AC/137-D/594

Appendix D

THE RESEARCH GRANTS PROGRAM

GENERAL POLICY

While of the opinion that scientific research is most appropriately funded on a national basis, the NATO Science Committee recognizes that the regulations of most national programs preclude allocations for work in a foreign laboratory. In 1960 therefore, the Committee established the Research Grants Program with the overall objective of stimulating research collaboration between scientists in different member countries. The Program provides financial assistance to enable research to be carried out jointly by scientists in institutions in several different NATO countries thus promoting a pooling of facilities and expertise as well as a combined approach to the solution of common problems.

GENERAL DESCRIPTION

The third largest of the NSC programs, the Research Grants Program has regularly been allocated about 13% of the total funds available to the Committee[1]. In addition however, it has become customary to remit annually to the Program any unexpended funds from other programs. These two sources provided, as an example, some 35.9 million Belgian Francs, (roughly $890,000 US), in 1974[2].

To be eligible for a grant, projects must have scientific excellence, show that international collaboration is necessary for success and provide assurance that NATO support will not duplicate the activities of national or other international organizations.

All fields of scientific activity are eligible for support with emphasis on fundamental sciences rather than applications. Exceptions are very costly fields such as high energy physics which are considered to be adequately supported by other organizations.

Although rules are kept flexible, most grants are made to cover travel/living expenses and, to a lesser extent, consumable supplies. The purchase of special pieces of equipment is however sometimes allowed as well as, in exceptional cases, the payment of salaries.

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[1] AC/137-D/571

[2] ASG:SEA(75)103 2 May 1975

Grants are normally made for one year but are often extended though support for more than a three-year period is most unusual. Amounts vary but the average grant in 1974 was about $5,000 US[3]. In 1975, this had dropped to $3,000 US.

Applications for grants under the Program are dealt with by an unpaid seven member Advisory Panel which meets for two days, three times a year. There is close collaboration between the Panel and the various Special Program Panels with the latter providing advice as well as sponsoring certain grants for collaborative research in their own areas. Referees are also used on occasion.

GENERAL ASSESSMENT

Between the start of the Program in 1960 and the end of 1974, grants totalling about $11 million US have been awarded to support 852 projects. Furthermore, since each project invclves two, three or more scientists in different countries, the total number of participants has probably been of the order of 2,500, (Table VIII, page 58). Projects have been supported in most fields of science with the majority, (55.5%), being in the mathematical and physical sciences. Total distribution is given in Table IX, page 59.

Grants are made according to the criteria mentioned earlier and not related to the contribution made by each member natien to the budget. An exception to this rule is however made in favour of those countries considered to be in special need of scientific development. In attempting to assess - in very general terms - the utilization of the program by countries, it is nevertheless useful to compare the advantages gained in terms of grants, participation and level of grant funding against national contributions as given in Table I, page 51.

Detailed figures in respect of only one of these three factors are available for the whole period of the Program. This is distribution of grants between member countries, (Table VIII, page 58). In terms of grants received up to 1972 as compared with national contributions Germany and France have gained least, the US and UK are net 'donors' while Italy, Greece, Portugal and Turkey have gained the most. Although a very rough guide, these results are in line with the general policy of the Program.

In 1972 and to an increasing extent through 1973 and 1974, however, there has been a marked reversal of this trend, with a far greater percentage of grants going to the US, UK and France. Detailed figures for 1974 given in Table X, page 60 and Table XI,

[3] ASG.SEA(75)103 2 May 1975

page 61 are most revealing. During this year, for instance, 29.5% of new grants went to the US and 54.8% of participants came from that country. In terms of funding, the corresponding figures are 28.3% and 26.6% of the total budget. The same trend is applicable to extensions granted and is probably due to reductions in national research support.

A factor giving rise to concern is the rapidly increasing number of applications for grants.

Though doubtless to some extent influenced by reductions in the level of support for national programs, this increase also reflects a growing awareness of the benefits offered by the Program and its success. Faced with a steady increase in applications and a virtually stationary budget however, the Advisory Panel is now having to refuse support to an increasing number of projects meriting assistance. In addition, the average funds granted per project have had to be steadily reduced until the stage has already been reached where further reductions, in the view of the Panel, are not realistic, (Table XII, page 62).

In view of the prevailing economic climate, it is unlikely that a substantial increase in funds will be available to the Science Committee in the near future. It does appear however, that the time has come for a reassessment by the Committee of its majcr programs to determine whether the benefits of, say, the Research Grants Program merit an increase in its funding at the expense of one or more of the others.

Appendix E

THE NATO SENIOR SCIENTISTS PROGRAM

The Senior Scientists Program has two main aims; to promote collaboration between senior scientists of member countries, and to enhance the dissemination of scientific information within the Alliance.

The Program in its present form was established in early 1973[1] [2] mainly as an extension of the already existing Visiting Lecturers, Visiting Professorships and Senior Science Fellowships Programs. Under the terms of reference of the latter two programs, member countries can, if so desired, use up to 20% of the funds provided for the NATO Science Fellowships Program to support senior fellowships or visiting professors. In practice however, only five nations have chosen to support senior fellows and one, (Italy), to fund visiting professors.

The Senior Scientists Program provides funding to assist a limited number of outstanding scientists, not qualified for support under the other science programs, to:

(a) Give a series of lectures in several member countries on advanced topics or on the results of new research achievements;

(b) Develop research projects during an extended visit (6-12 months) to a laboratory of another member country.

The main sources of funds for the Program are an allocation of 1% of the Science Fellowships Program (1,600,000 BF or about $40,000 US in 1976), supplemented by grants received from the Minna-James-Heinemann Foundation of Germany. These amounted to about DM 30,000 (approximately $12,000 US) in 1974[3] [4].

Only a few senior scientists can be assisted under the Program, annual awards varying for example from 3 in 1970 tc 14 in 1974. Awards also vary substantially in terms of both magnitude, (ranging from just over $2,000 US to nearly $7,000 US in 1974), and duration, (six weeks to one year in 1974)[5]. They cover travel and living expenses and on occasion augment salaries.

[1/2] AC/137R/43, 1973 (AC/137-D/543, 15 May 1973.

[3/4] AC/137R/39, 1971 (DASG.SA(74)392, 13 July 1974

[5] AC/137D/564, 8 Jan. 1975.

The Program is administered on behalf of the Science Committee by a Standing Group of three Committee members meeting three times annually, (after each Science Committee meeting). The Canadian member of the Committee participated in the Standing Group from 1973 to 1976.

A total of 53 awards have been made since the Program's inception in 1966 and have been taken up in 12 different member countries (Table XIII, page 63, Table XIV, page 64). Up to and including 1973, senior scientists from only five member countries secured awards, the United States, Canada and the United Kingdom being the main beneficiaries. Although the spread increased in 1974, this dominance still continues and is probably due to the wide acceptance of the sabbatical year concept in these countries.

The Science Committee at its February 1976 meeting expressed satisfaction with the effectiveness of the Program and its value as of one of the few existing sources of funds, (albeit modest), available to encourage senior scientists to travel to, and engage in joint research projects within, other member countries. Concern was however expressed at the limited finances available to support the Program and methods of increasing the level of funding are being explored.

Because of its limited resources, the Program has, as a deliberate policy, never been widely publicized. Furthermore as awards are made strictly on scientific merit, no attempt has been made to obtain an equitable distribution amongst member countries. While this practice is difficult to fault - particularly as regards the more scientifically developed member countries - the benefits accruing to the lesser developed have been small. A guiding principle applied to most of the Science Committee's activities provides for special consideration to be given where possible to the enhancement of the scientific capabilities of the lesser developed member countries. It is therefore suggested that means of increasing the participation of these member ccuntries - perhaps by wider local publicity - be explored.

Appendix F

THE SCIENCE COMMITTEE CONFERENCE PROGRAM

Prominent among the mechanisms used by the Science Committee to help it identify areas of scientific endeavor in need of catalytic action is the NATO Science Committee Conference Program.

The aim of these Conferences is to identify fruitful areas for future research and to make recommendations both to the Committee itself as a basis for future resource deployment and, more generally, to those having a responsibility for selecting and supporting research programs.[1]

Unlike other Committee Programs the Conferences are planned and administered by the staff of the Scientific Affairs Division aided usually by an organizing committee of about six experts from various member countries. Attendance is restricted to some 60 experts and a few observers, participants being expected to play an active contributory role.

Conferences, typically lasting about five days and often interdisciplinary in nature, are limited to about one a year with the Committee providing basic funding - about $50,000 US per conference in recent years.

Twelve conferences have been held since the Program's inception in 1967. They are:

(1) High Temperature Materials, Norway 1967
(2) Software Engineering, Germany, 1968
(3) Software Engineering Techniques, Italy, 1969
(4) Stress Corrosion Cracking in Alloys, Portugal, 1971
(5) North Sea Sciences, Scotland, 1971
(6) Catalysis, Italy, 1972
(7) Modelling of Marine Systems, Portugal, 1973
(8) Technology of Efficient Energy Utilization, France, 1973
(9) Eco-Toxicology of Metals and Halo-Organics, Canada, 1974
(10) Benthic Boundary Layer, France, 1974
(11) Properties of Wood in Relation to its Structure, France, 1975
(12) Thermal Energy Storage, Scotland, 1976

Using the most recent four as an illustration, the Eco-Toxicology Conference attracted 65 scientists from 13 nations,

[1] NATO AND SCIENCE 1958-1972

Canadian representation being 14. Total participation in the other three conferences was 66, 52 and 62 respectively with a level of Canadian attendance of 5, 7 and 9. It is worth noting that Canadian representation has increased substantially over the last three years. Up to and including the Catalysis Conference (1972) a total of only 12 Canadians (2.9%) had participated in the program. Canadians scientists were also on the organizing committee of both Eco-Toxicology and Thermal Energy Storage Conferences.

Although objective analysis of the results of the conferences is not possible, it is fair to say that in most cases they have attracted experts from the fields concerned, identified gaps in knowledge and produced recommended guidelines for future research priorities. The proceedings of all but the most recent have been published commercially, one at least being a "best seller" with over 10,000 copies distributed to date (Software Engineering).

Appendix G

THE SPECIAL SCIENCE PROGRAMS

INTRODUCTION

The NATO Science Committee's, (NSC), general and more permanent programs to strengthen scientific capability within the Alliance are complemented by a series of special shorter term programs designed to stimulate activity in important areas considered to have been neglected.

The objective is to identify areas of special importance or gaps in knowledge and to use a series of techniques to catalyse international and/or national interest. Once given visibility, the intention is for other organizations to carry on thus releasing limited NSC resources for application elsewhere.

Initially, these special subject-oriented activities were dealt with by a few ad hoc advisory groups or, as in the case of oceanography, by a special sub-committee of national representatives. In 1973, however, as one result of a major reorganizational review, several new Special Program Panels were established to add impetus to this aspect of the NATO Science Program.

A detailed review of the Special Program Panels and their activities is beyond the scope of this paper. Instead more general aspects common to most panels will be touched upon and supplemented by short descriptions of the scope of each.

GENERAL DESCRIPTION

A Special Program Panel is only established after detailed and careful consideration usually involving three major steps. Typically, an area having been identified by the Science Committee, an ad hoc working group of experts is set up to produce an initial rationalization and outline proposals. If accepted by the Committee, these are further refined to include a recommended scope statement which then forms the basis for the formal establishment of a panel. The process is completed when the panel submits a detailed set of objectives and plans.

Increasingly, over recent years the activities of each panel have been subject to detailed examination by the Science

Committee and it is now routine for the Committee's winter meeting to be devoted mainly to this review.

The special programs normally last only a few years, the panel being terminated once the particular activities it was set up to foster have been established. Under current rules a panel is allotted an initial life of three years at which point a decision is made by the Committee to extend by a further three years or to terminate. In 1975 for instance, two panels (Radio-Meteorology and Stress Corrosion) were terminated and four extended. A fifth, Marine Sciences, will be subjected to a major review in 1977.

Members of the Special Program Panels are selected by the Science Committee on the basis of their expertise in the field concerned. There are normally six to eight per panel with terms of service ranging from two to five years so arranged that a balance between old and new members is maintained. Membership is rotated between member countries, a retiring member not being replaced by the same country.

Panels meet twice or three times a year under a chairman selected from the members and assisted by a permanent executive officer from the Scientific Affairs Division. Members are not paid for their services but receive travel and living expenses. Panel chairman usually change annually.

Panel activities are financed through a Program Development Fund which, as an example, amounted to 13.5% of the Science Committee's budget in 1974. This percentage has declined since, being 12.5% in 1975 and 10.3% in 1976. A fixed amount of the fund (18% in 1976) is held uncommitted at the beginning of the year, the remainder is allocated to panels to support their various activities.

In 1976 the distribution was:	Belgian Francs Million	$US
Special Program Panel SPP on Eco-Sciences	5.0	$125,000
SPP on Marine Sciences	4.5	$112,500
SPP on Air-Sea Interaction	4.0	$100,000
SPP on Human Factors	5.0	$125,000
SPP on System Sciences	6.0	$150,000
Program Reserve	5.5	$137,500
	30.0	$750,000

Various techniques are available to panels to enable them to accomplish their missions. These include the sponsorship of conferences, symposia, Advanced Study and Research Institutes, the financial support of small research projects (including the development of specialized equipment or techniques), the funding of study visits and exchanges of scientists and visiting experts. Also utilized, though to a lesser extent, are various training schemes such as the Graduate Degree Apprentice Program, (Systems Sciences Panel), and the Air-Sea Interaction Panel's Training Scheme.

The use of these techniques varies from panel to panel although conferences and the provision of support to enable scientists of one country to visit research institutes or to lecture in another are used by most. Two or three Advanced Study Institutes are sponsored by most panels annually and nearly all sponsor their own research grants, (usually worth more than those supported by the Research Grants Panel itself). In the main however, panels select or devise those mechanisms best suited to achieving their own objectives with the Science Committee exercising overall supervision and providing general guidelines.

CURRENT PANELS

Five Special Program Panels, (SPP), are currently in existence. A short description of the major objectives of each together with some illustrative activities are given below:

SPP on Eco-Sciences. The overall objective of this Panel, established in 1971, is to further knowledge of the Eco-System and its modifications. In view of the broad ramifications of the subject area and the number of other organizations already active within it, the Panel is charged with identifying a limited spectrum of problems where its activities can make a significant impact. One of the first areas selected for action was eco-toxicology where in particular a need to improve the supply of scientists knowledgeable in the field was identified. Opportunities provided for the further training of scientists in this subject and other complementary disciplines in the eco-sciences are exemplified by the Advanced Study Institute on Eco-toxicology arranged for 1976.

Other examples which typify the spectrum of activities undertaken by the Panel are a major conference on "The Function of Living Plant Collections in Conservation and in Conservation-Oriented Research and Public Education", which attracted, in 1975, 150 delegates from 28 countries, and the sponsoring of a large scale computerized research project on "Man in a Sub-Arctic Environment" being carried out in Iceland.

SPP on Human Factors. The Human Factors Program is one of the oldest special programs of the Science Committee having started originally in 1962.[1] Its unusually long life can be attributed to the recognition of the importance by the Science Committee of the social aspects of many scientific problems. Although the Program has changed emphasis over the years, the basic aim still remains to being about a better understanding of human behaviour by supporting selected basic research and applied research in the behavioural sciences, e.g. psychological physiology, cybernetics, ergonomics etc.[2]

Over recent years, the Panel's main activities have included the provision of advanced instruction through sponsorship of Advanced Study Institutes and study visit grants, the support of cooperative research and in particular the organization of conferences and symposia. Three conferences took place in 1975: "Neuropsychology of Learning Disorders", "Empirical Approaches to Stress and Anxiety", and "Transportation and Urban Life", the latter being jointly sponsored by the Human Factors and Systems Sciences Panels. Seven conferences/symposia are scheduled for 1976.

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[1]The Advisory Group on Psychology became the Advisory Group on Human Factors, which in turn became a Special Program Panel in 1973.

[2]AC/137 - D/486 dated 18 Nov. 75.

SPP on Systems Sciences. The Systems Science Program is an extension of the Operational Research Program originally started in 1960. It differs from the other special programs in that its terms of reference emphasize the applied science aspects rather than the basic research with which other programs are mainly concerned. The Panel's main aim is to direct research capabilities into new application areas where full utilization of previously developed techniques and theories has not been achieved.[3]

The Panel's activities are directed towards the exchange of information, provision of education and the support of selected collaborative research. A major emphasis over recent years has been the encouragement of the application of systems sciences in resource management, health care, socio-economic systems and telecommunications.

Perhaps to a greater extent than any other, the Panel uses virtually all the various techniques available to support its program. A Visiting Expert from the United Kingdom will advise the Greek Ministry of Social Services in 1976 on the introduction of systems science concepts and methods. Three conferences were sponsored in 1975 and a further two are planned for 1976. Two Advanced Research Institutes on "Earth Observation Systems for Resource Management" and "Discrete Optimisation and Systems Applications" are scheduled for 1976.

Close contact is maintained between members of the Panel and other international organizations working in the same area, (such as the International Institute for Applied Systems Analysis), to ensure no overlap of activities.

SPP on Air-Sea Interaction. One of the more recent Programs, (established in 1972), the Air-Sea Interaction Program is aimed primarily at accelerating progress towards a fuller understanding of the complex interactions between the atmosphere and the sea. These consist principally of the exchanges of heat, moisture and mechanical energy between and within the lower level of the atmosphere and the upper layer of the ocean.[4]

Within this broad aim, the Panel is concentrating on redressing imbalances apparent in existing programs and identifying in particular those areas which will benefit by a coordinated effort by several teams. Two major cooperative international programs JASIN, (Joint Air-Sea Interaction Project), and JONSWAP, (Joint North Sea Wave Project), are of particular interest to the Panel which has provided financial support amounting to nearly half its budget to enable scientists

[3] AC/137 - D/486, 18 Nov. 75.

[4] AC/137 - D/486, 18 Nov. 75.

to participate in, and plan experiments for execution under, the auspices of these programs.

Apart from research grants, (some 14 in 1975), the Panel has supported exchange visits between air-sea interaction institutes and laboratories offering unique facilities and has organized a training scheme at the Universities of Hamburg, Southhampton and Washington.

Rather less use is made by the Panel of Advanced Study Institutes (ASI) and conferences. One ASI, on "Modelling and Predicting the Upper Layers of the Ocean", was held in 1975 and a major conference on "Turbulent Fluxes Through the Atmosphere Ocean" is scheduled for 1977.

An editorial board has been established by the Panel to collate and publish a series of invited articles on the theme "Instrumentation for Air-Sea Interaction Measurements".

SPP on Marine Sciences. In recognition of a continuing need within the NATO Alliance to further knowledge of the oceans, the Science Committee, in 1974, established a Special Program Panel on Marine Sciences with the basic aim of contributing to the understanding of the processes active in the thin layer between the oceans and the sea bed.[5] An additional narrowing of the field of interest is explicit in the Science Committee's request that the Panel attempt to confine its activities to the benthic boundary layer of the open area and continental shelf.

The Panel's main concern up to 1975 has been the identification of areas of research worthy of special encouragement. A research grant and workshop supported in 1975 have led to the organization of two conferences in 1976; "Marine Natural Products" with emphasis on the role of new marine products in the fields of taxonomy, pharmacology and animal behaviour, and another concerned with the entry and effects of naturally produced organic species into sea water.

Four research grants have been made one of which supported the development and sea trials of a laser doppler anemometer. The sponsorship of exchange visits and training schemes for younger scientists are under consideration as the Panel's program evolves.

SPP on Materials Science. Partially as the result of the successful work of the Study group on the Rational Use of Scarce Metals, the Science Committee decided in early 1976 to set up an ad hoc group of experts on Materials Science. This group has been tasked with a further assessment of the field, a refinement

[5] AC/137 - D/486, 18 Nov. 75.

of the draft Scope Statement and with the production of suggested objectives for a new Special Program Panel on Materials Science. If established the new Panel is likely to begin work in 1977.

GENERAL ASSESSMENT

In view of the very limited financial and human resources available, it is suggested that the success of the Science Committee's Special Programs depends upon three main factors; careful choice of areas where the impact can be optimum, imagination and initiative in the use of support techniques, and, finally, careful control of the activities of Panels - including the will to terminate Panels when appropriate.

As mentioned earlier a new panel is only established after careful consideration, not only by the Committee itself but by experts in the field. Such consideration includes the setting of terms of reference and objectives. Once established the work of each panel is assessed annually based on a report presented and defended personally by each Panel chairman. A healthy amount of criticism as well as guidance has usually emerged from these review meetings. Finally, a conscious decision is made at regular (three year) intervals to extend or terminate panels and in fact several have been terminated during the last few years.

Both Committee and Panel members are aware of the dangers of overlap with the activities of other international organizations and between the Panels themselves. Close contact is therefore maintained between Panels and appropriate organizations - sometimes through joint membership - and the practice of allocating the secretarial responsibility for more than one Panel to each scientist of the Scientific Affairs Division is maintained. In some cases (e.g. the Eco-Sciences, Human Factors and Systems Sciences Panels), the Committee has requested several Panels to meet jointly and to Jointly sponsor certain activities. In at least one instance work initiated by a panel has been relinquished tc another international organization. (The Eco-Sciences work on pollution indicators).

The real burden of success or failure rests, however, on the members of the Special Panels. As practising scientists, rather than government administrators, members bring to the panel their expert knowledge of the needs and deficiencies of their own fields and, moreover, are able to operate largely independent of national politics. That they are prepared without remuneration to devote time and energy to the work of the Panels is some measure of their assessment of the effectiveness of the programs involved. As far as the programs themselves are concerned the

very number and variety of methods used, ranging from conferences to special training schemes, indicate that far more time and effort is devoted by panelists than the two or three short meetings held annually. In this respect it is worth remembering that in some cases members are faced with the task of "selling" their colleagues in the scientific community on new research ventures for which only limited travel and expenses funds can be supplied.

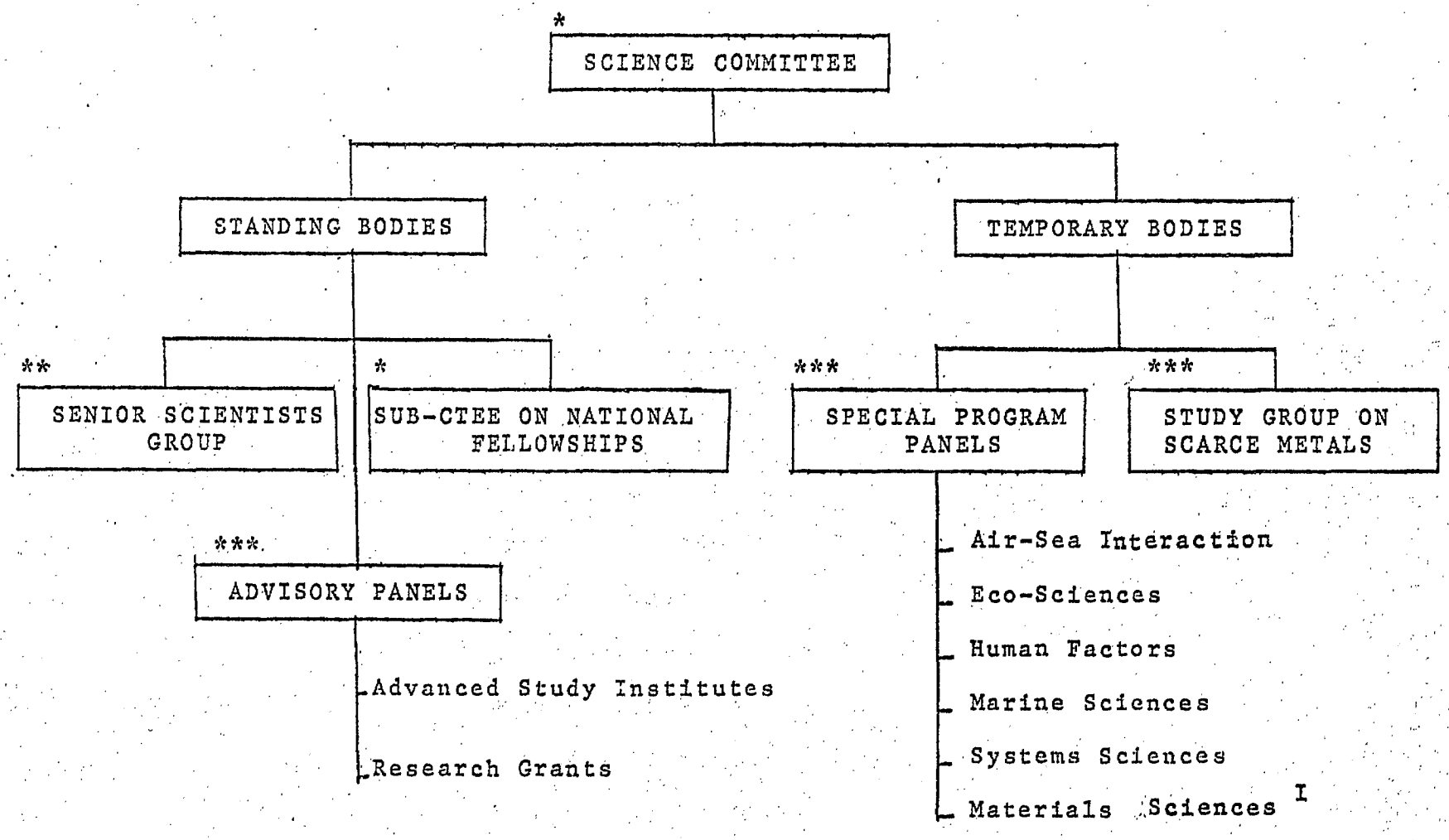
While it is only possible to measure the achievement of the Program in terms of subjective estimates of the value of its activities, it is worth noting that all conferences and symposia have been well attended and considered useful by participants, that many of the proceedings have been published commercially and that most other activities are as a rule oversubscribed.

Finally, the Committee's desire to aid the development of science in its less advanced member countries is fostered by a deliberate policy of study visits, visiting lectureships and by locating conferences where their local educational impact can be maximized.

In sum it is concluded that the present arrangements for the Special Programs are effective and within the obvious constraints imposed by what is, by international standards, a modest program a great deal is being achieved by the judicious use of limited funds.

THE NATO SCIENCE COMMITTEE AND ITS SUBSIDIARY BODIES (1976).

APPENDIX H



* National Representatives

** Three Science Ctte members

*** Experts

I Ad Hoc Group

Appendix I

CANADIAN MEMBERS OF THE NATO SCIENCE COMMITTEE AND ITS SUBSIDIARY BODIES (1972-1976)

The NATO Science Committee	Dr. J.R. Whitehead (1970-1975) Dr. Tuzo Wilson (1975-)
Standing Group on the Senior Scientists Program	Dr. J.R. Whitehead (1973-1975) Dr. Tuzo Wilson (1975-)
Sub-Committee of National Fellowships Administrators	Dr. B.A. Gingras (1973-)
Advisory Panel on the Advanced Study Institutes Program	Prof. C. Sandorfy (1976-)
Advisory Panel on the Research Grants Program	Prof. W.S. Hoar (1973-) (Chairman)
Special Program Panel on Air-Sea Interaction	Dr. R.W. Burling (1973-1975) (Chairman)
Special Program Panel on Eco-Sciences	Dr. McTaggart-Cowan (1972) (Chairman) Dr. F.K. Hare (1973-1975) (Chairman)
Special Program Panel on Human Factors	Prof. R.A. Wendt (1972-1975) (Chairman)
Special Program Panel on Marine Sciences	Dr. N.J. Campbell (1974-)
Special Program Panel on Radio-Meteorology (Terminated in 1975)	Prof. D.R. Hay (1973-1975) (Chairman)
Special Program Panel on Stress Corrosion Cracking (Terminated in 1975)	Dr. G.J. Biefer (1973-1975)
Special Program Panel on Systems Sciences	Mr. J. Gratwick (1972-1974) Prof. D.J. Clough (1974-1975) (Chairman)
Study Group on Rational Use of Scarce Metals	Dr. D. White (1975-)

Table I

REFERENCE: ISM (75)10
5 December, 1975

CONTRIBUTION (% AGE) BY MEMBER COUNTRIES
TO THE NATO SCIENCE COMMITTEE BUDGET

CCUNTRY	% AGE CONTRIBUTION
BELGIUM	2.95
CANADA	5.80
DENMARK	1.74
FRANCE	17.10
GERMANY	16.10
GREECE	0.39
ICELAND	0.05
ITALY	6.12
LUXEMBOURG	0.09
NETHERLANDS	2.94
NORWAY	1.20
PORTUGAL	0.65
TURKEY	1.65
UNITED KINGDOM	18.22
UNITED STATES	25.00

NCTE: These percentage contributions have remained roughly the same for many years.

Ref: AC 137-D/571
10 April 1975

AC 137-D/596
15 January 1976

NATO SCIENCE COMMITTEE BUDGET
1974 to 1976

TABLE II

Program	1974			1975			1976		
	BF (Million)	$ US	%	BF (Million)	$ US	%	BF (Million)	US	%
Fellowships	144	3,600,000	53.9	148	3,700,000	54.2	160	4,000,000	55.2
Research Grants	35	875,000	13.1	36	900,000	13.2	39	975,000	13.5
Advanced Study Institutes	52	1,300,000	19.5	55	1,375,000	20.1	61	1,525,000	21.0
Program Development Fund (Special Programs)	36	900,000	13.5	34	850,000	12.5	30	750,000	10.3
	267	6,675,000	100	273	6,825,000	100	290	7,250,000	100

Ref: NATO and Science
1958-1973

TABLE III

THE NATO SCIENCE FELLOWSHIPS PROGRAM

DISTRIBUTION OF FUNDS AMONGST MEMBER COUNTRIES (US DOLLARS)

Country	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972 *	Total	%
Belgium	26,900	47,075	67,783	65,000	67,500	70,000	70,000	72,800	72,600	72,800	73,640	75,600	71,550	72,900	926,348	2.74
Canada	43,300	84,525	131,580	120,000	122,500	125,000	125,000	130,000	130,000	130,000	131,500	135,000	127,200	129,600	1,660,205	4.90
Denmark	15,180	23,065	33,153	37,500	40,000	42,500	42,500	44,200	44,200	44,200	44,710	45,900	42,400	43,200	540,708	1.60
France	132,400	231,700	332,880	275,000	277,500	300,000	300,000	312,000	312,000	312,000	315,600	324,000	304,750	310,500	4,040,330	11.98
Germany	150,000	262,500	377,272	325,000	327,500	332,500	332,500	345,800	345,800	345,800	349,790	359,100	339,200	345,600	4,538,362	13.45
Greece	24,600	43,050	61,923	107,500	110,000	110,000	110,000	114,400	114,400	114,400	115,720	118,850	135,150	137,700	1,417,693	4.20
Iceland	480	840	1,208	5,000	7,500	7,500	7,500	7,800	7,800	7,800	7,890	8,100	7,950	8,100	85,468	0.25
Italy	149,800	262,150	376,695	417,500	410,000	375,000	375,000	390,000	379,600	379,608	383,980	394,200	376,360	383,400	5,053,325	15.00
Luxembourg	950	1,663	2,382	5,000	7,500	7,500	7,500	7,800	7,800	7,800	7,890	8,100	7,950	8,100	87,935	0.26
Netherlands	33,000	57,925	83,202	60,000	62,500	62,500	62,500	65,000	65,000	65,000	65,750	67,500	63,600	64,800	878,277	2.62
Norway	10,000	17,657	25,383	40,000	42,500	42,500	42,500	44,200	44,200	44,200	44,710	45,900	42,400	43,200	529,350	1.57
Portugal	26,000	45,500	65,345	117,500	115,000	115,000	115,000	119,600	119,600	119,600	120,980	124,200	140,450	141,100	1,481,875	4.40
Turkey	74,200	129,850	186,650	240,000	242,500	245,000	245,000	254,800	254,800	254,800	257,740	264,600	299,450	350,100	3,254,490	9.65
United Kingdom	150,000	262,500	377,272	325,000	327,500	350,000	350,000	364,000	364,000	364,000	368,200	378,000	357,750	364,500	4,702,722	13.96
United States	150,000	262,500	377,272	350,000	325,000	300,000	300,000	313,003	312,000	312,000	315,600	324,000	307,400	313,200	4,280,972	12.63
NATO (Adm, Exp)	10,190	17,500	15,000	15,000	15,000	15,000	15,000	15,600	36,000	26,000	26,300	27,000	26,500	27,000	272,090	0.81
Total	1,000,000	1,750,000	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000	2,600,000	2,600,000	2,600,000	2,630,000	2,700,000	2,650,000	2,700,000	33,730,000	100.00

Converted from Belgian Francs (1$ = 50 BF)

REFERENCE: NATO and Science 1958 - 1972
AC/137-D515 (Annex I and II)
AC/137-D553
AC/137-D578

TABLE IV

NATO SCIENCE FELLOWSHIPS PROGRAM

Distribution of Fellowship by Country Visited (1959 - 1973)

HOST COUNTRY \ AWARDING COUNTRY	BELGIUM	CANADA	DENMARK	FRANCE	GERMANY	GREECE	ICELAND	ITALY	LUXEMBOURG	NETHERLANDS	NORWAY	PORTUGAL	TURKEY	UNITED KINGDOM	UNITED STATES	TOTAL NUMBER	TOTAL %
BELGIUM	-	23	2	8	8	12	1	21	13	2	1	13	17	32	14	167	1.5
CANADA	10	7	5	44	25	7	2	26	1	5	4	2	5	114	3	260	2.4
DENMARK	6	10	2	3	7	3	13	7	-	-	9	3	2	66	33	164	1.5
FRANCE	17	38	8	85	89	125	1	127	26	7	10	90	74	186	90	973	9.0
GERMANY	10	27	6	20	-	82	5	47	32	-	12	20	189	129	105	684	6.3
GREECE	3	-	-	-	-	33	-	1	-	-	-	-	-	3	1	41	0.4
ICELAND	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-
ITALY	4	7	1	23	9	31	-	40	-	3	1	10	3	37	25	194	1.8
LUXEMBOURG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
NETHERLANDS	2	12	4	9	10	4	4	21	1	-	11	9	4	78	35	204	1.9
NORWAY	1	8	-	2	5	-	7	2	2	2	1	2	-	51	26	109	1.0
PORTUGAL	-	1	-	1	-	-	-	-	-	1	-	95	-	-	-	98	0.9
TURKEY	1	-	-	-	6	-	-	-	-	-	-	-	1	4	-	12	0.1
UNITED KINGDOM	28	146	23	80	90	365	36	302	3	17	66	231	288	754	321	2750	25.3
UNITED STATES	168	74	142	1130	548	157	63	646	15	120	99	33	515	673	1	4384	40.4
SWEDEN	2	-	-	19	8	4	12	23	-	5	4	-	8	68	21	174	1.6
SWITZERLAND	4	5	2	25	9	8	-	29	24	1	2	10	9	141	47	316	2.9
OTHER	1	1	2	24	12	20	10	24	3	3	2	4	8	176	35	325	3.0
TOTAL	257	359	197	1473	826	851	154	1316	120	166	222	522	1123	2514	758	10,858	100.0

NOTE: Fellowships taken by students in their own country are included.

REFERENCE: ASG.SEA(75)102
2 May 1975

NATO SCIENCE COMMITTEE

TABLE V

ADVANCED STUDY INSTITUTES PROGRAMME

Distribution of ASIs According to Fields of Research (1959 - 1974)

Field of Study	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Total	%
Life Sciences																		
Agricultural Sci.		1		2	1	1	1	2			1	1		1			11	1.6
Biochemistry							2		1		2					1	6	0.9
Biology		1	1	1	4	4		2	7	4	6	3	3	6	2	4	48	7.1
Botany					1	1			1		1	1	2			3	10	1.5
Ecological Sci.				1		1	2				1					1	6	0.9
Medical Sciences			1	1	3	3	3	6	6	5	1	2	3	1	1	4	40	5.9
Zoology		1	1		2		1		1	1	1				1	1	10	1.5
Physical & Mathem.Sci.																		
Atmospheric Sci.		1	2	2	1	1	1	4	2	2	3		2		1	1	23	3.4
Computer Science				2	1	1	3	1	1	3	3	2	2	4	3		26	3.8
Chemistry		1	2	1	1	2	2	3	3	3	4	4	2	4	3	4	39	5.7
Earth Sciences				1	1	2	2		1	1	3	1	1	1		6	20	2.9
Mathematics				2	7	8	10	6	5	5	7	6	5	7	5	4	77	11.3
Oceanography			1	1		1			1		1	1			1		7	1.0
Physics	7	10	15	16	19	18	19	23	23	20	15	18	18	21	16	16	274	40.3
Behavioural & Social Sci.																		
Behavioural Sci.						1		1	1	4	5	4	4	1	1	2	24	3.5
Social Sciences												3		2	1		6	0.9
Diverse Applied Sci.																		
Engineering	1	1			3	3	1	1	2	3			3	1	7	2	28	4.1
Material Sciences											2	1			2		5	0.7
Systems Sciences				1		2	1	2	1				1	4	6	2	20	2.9
Information Sci.																1	1	0.1
Total	8	16	23	31	44	49	48	51	56	51	56	47	46	53	50	52	681	100.0

REFERENCE: ASG,SEA(75)102
2 May 1975

TABLE VI

NATO SCIENCE COMMITTEE

ADVANCED STUDY INSTITUTES PROGRAMME

National Distribution of Location of ASIs, (1959 - 1974)

Country	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Total
Belgium			1	2	2	1	1	2	1	1	6	1	4	3	2	5	32
Canada			1		1	1	2	1	5	7	5	5	4	1	3	5	41
Denmark		1		1	2	1	3	2	2	3	1	2		4			22
France	1	1	3	4	5	7	4	7	4	5	5	4	3	7	6	6	72
F.R. Germany		2	4	3	3	2	5	4	2		2	5	7	4	4	4	51
Greece	1	2	2	2	1	5	2	3	6	4	3	1	2	3	1	1	39
Iceland				1			1									2	4
Italy	5	5	6	7	11	10	10	14	15	13	16	13	8	15	12	12	172
Luxembourg																	-
Netherlands		1	1	2	2	3	3	3	1	4		5			1	1	27
Norway	1	1	2	2	2	2	3		2	4	2	1	4	1	3	3	33
Portugal				1	1	1	1	2	2	2	1	1	1	1	1	1	16
Turkey					2	1	1	3	3	1	2	2	2	2	1		20
United Kingdom		3	3	5	9	10	9	8	10	6	9	6	8	10	14	10	120
United States				1	3	5	3	2	3	1	4	1	3	2	2	2	32
Total	8	16	23	31	44	49	48	51	56	51	56	47	46	53	50	52	681
% in + or in -		+100.0	+43.8	+34.8	+41.9	+11.4	-2.1	+6.3	+9.8	-8.9	+9.8	-16.1	-2.1	+15.2	-5.7	+4.0	

REFERENCE: ASG.SEA(75)102
2 May 1975

TABLE VII

NATO SCIENCE COMMITTEE

ADVANCED STUDY INSTITUTES PROGRAMME

1974 - National Distribution of Participants

Countries	Lecturers	%	Students	%	Others	%	Total	%	
1. NATO COUNTRIES									
Belgium	33		118		28		179	5.1	4.4
Canada	39		121		13		173	4.9	4.3
Denmark	9		60		1		70	2.0	1.7
France	62		288		14		364	10.3	9.0
F.R.Germany	76		381		33		490	13.8	12.1
Greece	2		31		1		34	1.0	0.8
Iceland	6		50		13		69	2.0	1.7
Italy	30		255		47		332	9.4	8.2
Luxembourg	-		-		-		-	-	-
Netherlands	28		126		11		165	4.7	4.1
Norway	17		69		14		100	2.8	2.5
Portugal	4		27		8		39	1.1	1.0
Turkey	1		25		-		26	0.7	0.6
United Kingdom	178		420		36		634	17.9	15.7
United States	293		547		21		861	24.3	21.3
Total NATO Countries	778	22.0	2,518	71.2	240	6.8	3,536	100.0	87.4
2. NON-NATO COUNTRIES									
Australia	9		19		-		28	5.5	0.7
Austria	2		24		-		26	5.1	0.6
Finland	1		11		-		12	2.3	0.3
Hungary	1		15		-		16	3.1	0.4
India	1		12		-		13	2.6	0.3
Israël	6		47		-		53	10.4	1.3
Japan	7		25		1		33	6.5	0.8
Poland	2		38		-		40	7.9	1.0
Rumania	-		11		-		11	2.2	0.3
Spain	1		11		-		12	2.3	0.3
Sweden	11		51		-		62	12.2	1.5
Switzerland	28		57		4		89	17.5	2.2
Yugoslavia	1		22		-		23	4.5	0.6
Other Countries	10		78		3		91	17.9	2.3
Total Non-NATO Countries	80	15.7	421	82.7	8	1.6	509	100.0	12.6
GRAND TOTAL	858	21.2	2,939	72.7	248	6.1	4,045		100.0

Note : Seven ASIs have not been taken into account : 74/2 - 74/9 - 74/15 - 74/17 - 74/23 - 74/37 - 74/43

REFERENCE: ASG,SEA(75)103
2 May 1975

TABLE VIII

NATO SCIENCE COMMITTEE

RESEARCH GRANTS PROGRAMME

Distribution of Research Grants (1960 - 1974)

Countries	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Total	%
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Belgium	1	-	1	1	-	-	2	-	3	2	2	4	6	11	6	39	4.6
Canada	-	1	1	1	-	-	1	3	3	3	1	-	9	13	9	45	5.3
Denmark	-	-	-	1	2	-	1	-	2	-	2	2	2	3	4	20	2.3
France	2	7	2	-	4	4	3	2	-	1	3	2	6	9	19	64	7.5
F.R. Germany	-	1	4	2	1	2	3	1	5	2	4	3	6	3	7	44	5.2
Greece	3	4	3	3	3	4	6	1	2	3	6	6	3	3	4	54	6.3
Iceland	-	-	-	2	1	-	2	-	-	-	2	1	1	2	2	13	1.5
Italy	3	11	10	5	2	10	5	6	12	4	10	15	12	16	11	132	15.5
Luxembourg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Netherlands	-	-	-	2	-	2	1	-	-	3	3	4	4	3	4	26	3.0
Norway	2	-	2	3	2	-	2	3	-	1	1	3	1	-	1	21	2.5
Portugal	3	1	3	3	4	3	-	-	4	4	1	1	3	-	3	33	3.9
Turkey	9	5	9	4	3	11	2	10	3	1	3	1	3	2	7	73	8.6
United Kingdom	2	5	8	5	6	7	6	4	7	7	11	10	22	16	26	142	16.7
United States	-	1	-	1	2	1	2	1	3	3	7	14	28	41	43	146	17.1
Total	25	36	43	33	30	44	36	31	44	34	56	66	106	122	146	852	100.0
% in + or in -		+44.0	+19.4	-23.3	- 9.1	+46.7	-18.2	-13.9	+41.9	-22.7	+64.7	+17.9	+60.6	+15.1	+19.7		

REFERENCE: ASG.SEA(75)103
2 May 1975

TABLE IX

NATO SCIENCE COMMITTEE

RESEARCH GRANTS PROGRAMME

Distribution of Grants According to Field of Research(1960 - 1974)

Field of Study	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Total	%
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1.1 AGRICULTURAL SC.	1	3	1	-	-	1	-	-	2	2	3	2	2	-	2	19	2.2
1.2 BIOCHEMISTRY	1	6	5	-	2	6	6	3	1	1	7	6	9	12	20	84	9.9
1.3 BIOLOGY	-	1	3	5	-	3	1	1	5	5	1	6	9	17	26	83	9.8
1.4 BOTANY	3	3	2	-	1	-	-	1	1	-	2	1	-	4	1	19	2.2
1.5 ECOLOGICAL SCI	-	1	-	-	1	-	-	1	1	-	-	-	1	-	-	5	0.6
1.6 MEDICAL SCIENCES	1	6	5	-	5	3	4	2	9	2	7	2	4	1	5	56	6.6
1.7 ZOOLOGY	1	1	3	3	-	2	2	3	2	1	2	4	5	2	2	33	3.9
2.1 ATMOSPHERIC SCI	1	4	2	3	2	1	3	2	4	4	1	-	4	2	-	33	3.9
2.2 COMPUTER SCIENCE	-	-	-	1	-	-	-	1	-	-	1	-	4	5	5	17	2.0
2.3 CHEMISTRY	-	1	2	5	5	10	7	9	7	7	17	20	24	30	49	201	23.6
2.4 EARTH SCIENCES	1	2	4	4	4	1	1	-	3	-	4	5	6	5	6	46	5.4
2.5 MATHEMATICS	-	3	1	2	1	1	1	-	-	1	1	2	4	5	5	27	3.2
2.6 OCEANOGRAPHY	1	1	1	1	2	-	-	-	-	-	1	-	-	-	1	8	0.9
2.7 PHYSICS	9	4	10	7	5	14	10	3	4	4	5	13	25	16	11	141	16.5
3.1 BEHAVIOURAL SC	-	-	-	-	-	-	-	-	1	3	-	-	-	-	1	5	0.6
3.2 SOCIAL SCIENCES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.0 DIVERSE APPLIED SC	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1
4.1 ENGINEERING	3	-	2	-	1	1	1	5	2	4	3	3	5	9	7	46	5.4
4.2 MATERIAL SCIENCE	2	-	1	2	1	1	-	-	1	-	1	1	2	6	2	20	2.3
4.3 SYSTEMS SCIENCE	-	-	1	-	-	-	-	-	1	-	-	1	2	-	3	8	0.9
Total	25	36	43	33	30	44	36	31	44	34	56	66	106	122	146	852	100.0

TABLE X

REFERENCE: ASG,SEA(75)103
2 May 1975

NATO SCIENCE COMMITTEE

RESEARCH GRANTS PROGRAMME

1974 - New Grants

Apportionment of Grant Funds by Country of Participants

Countries	Awards made to official recipients of grants				Participation in projects supported by NATO		
	Number of Grants	Percent distribution	Amount	Percent distribution	Percent distribution (146 = 100)	Amount received	Percent distribution
		%		%	%		%
Belgium	6	4.1	1,028,000	3.5	5.5	688,000	2.3
Canada	9	6.2	1,276,000	4.4	11.0	1,433,000	4.9
Denmark	4	2.7	860,000	2.9	6.2	955,000	3.3
France	19	13.0	4,248,000	14.5	15.1	2,941,466	10.1
F.R. Germany	7	4.8	1,536,000	5.2	17.1	2,286,928	7.8
Greece	4	2.7	1,072,000	3.7	3.4	1,020,000	3.5
Iceland	2	1.4	949,600	3.2	2.1	973,200	3.3
Italy	11	7.5	2,192,000	7.5	14.4	2,419,401	8.3
Luxembourg	-	-	-	-	-	-	-
Netherlands	4	2.7	760,000	2.6	6.2	976,000	3.3
Norway	1	0.7	240,000	0.8	3.4	370,000	1.3
Portugal	3	2.1	880,000	3.0	2.1	880,000	3.0
Turkey	7	4.8	1,624,000	5.6	6.2	1,668,400	5.7
United Kingdom	26	17.8	4,316,600	14.8	33.6	4,421,013	15.1
United States	43	29.5	8,282,000	28.3	54.8	7,783,792	26.6
Total NATO Countries	146	100.0	29,264,200	100.0		28,816,200	98.5
Non-NATO Countries :							
Spain					1.4	180,000	0.6
Sweden					1.4	160,000	0.5
Switzerland					1.4	108,000	0.4
						29,264,200	100.0

REFERENCE: ASG.SEA(75)103
2 May 1975

TABLE XI

NATO SCIENCE COMMITTEE

RESEARCH GRANTS PROGRAMME

1974 - Extensions

Apportionment of Grant Funds by Country of Participants

Countries	Awards made to official recipients of grants				Participation in projects supported by NATO		
	Number of Grants	Percent distribution	Amount	Percent distribution	Percent distribution (85 = 100)	Amount received	Percent distribution
		%		%	%		%
Belgium	4	4.7	554,000	3.8	8.2	538,500	3.7
Canada	10	11.8	1,288,000	8.7	18,8	1,260,000	8.5
Denmark	3	3.5	480,000	3.3	5.9	438,000	3.0
France	11	12.9	1,898,000	12.8	16.5	1,406,860	9.5
F.R. Germany	4	4.7	920,000	6.2	12.9	1,172,000	7.9
Greece	1	1.2	140,000	0.9	1.2	100,000	0.7
Iceland	1	1.2	400,000	2.7	1.2	400,000	2.7
Italy	10	11.8	1,872,000	12.7	23.5	2,383,000	16.1
Luxembourg	-	-	-	-	-	-	-
Netherlands	3	3.5	472,000	3.2	8.2	654,927	4.4
Norway	-	-	-	-	2.4	144,000	1.0
Portugal	-	-	-	-	2.4	127,000	0.9
Turkey	2	2.4	380,000	2.6	3.5	444,000	3.0
United Kingdom	11	12.9	1,828,000	12.4	27.1	1,715,441	11.6
United States	25	29.4	4,533,200	30.7	49.4	3,952,590	26.8
Total NATO Countries	85	100.0	14,765,200	100.0		14,737,200	99.8
Non-NATO Countries :							
Japan					1.2	28,000	0.2
						14,765,200	100.0

TABLE XII

NATO SCIENCE COMMITTEE

RESEARCH GRANTS PROGRAMME

DISTRIBUTION OF NATO RESEARCH GRANTS

BY SIZE

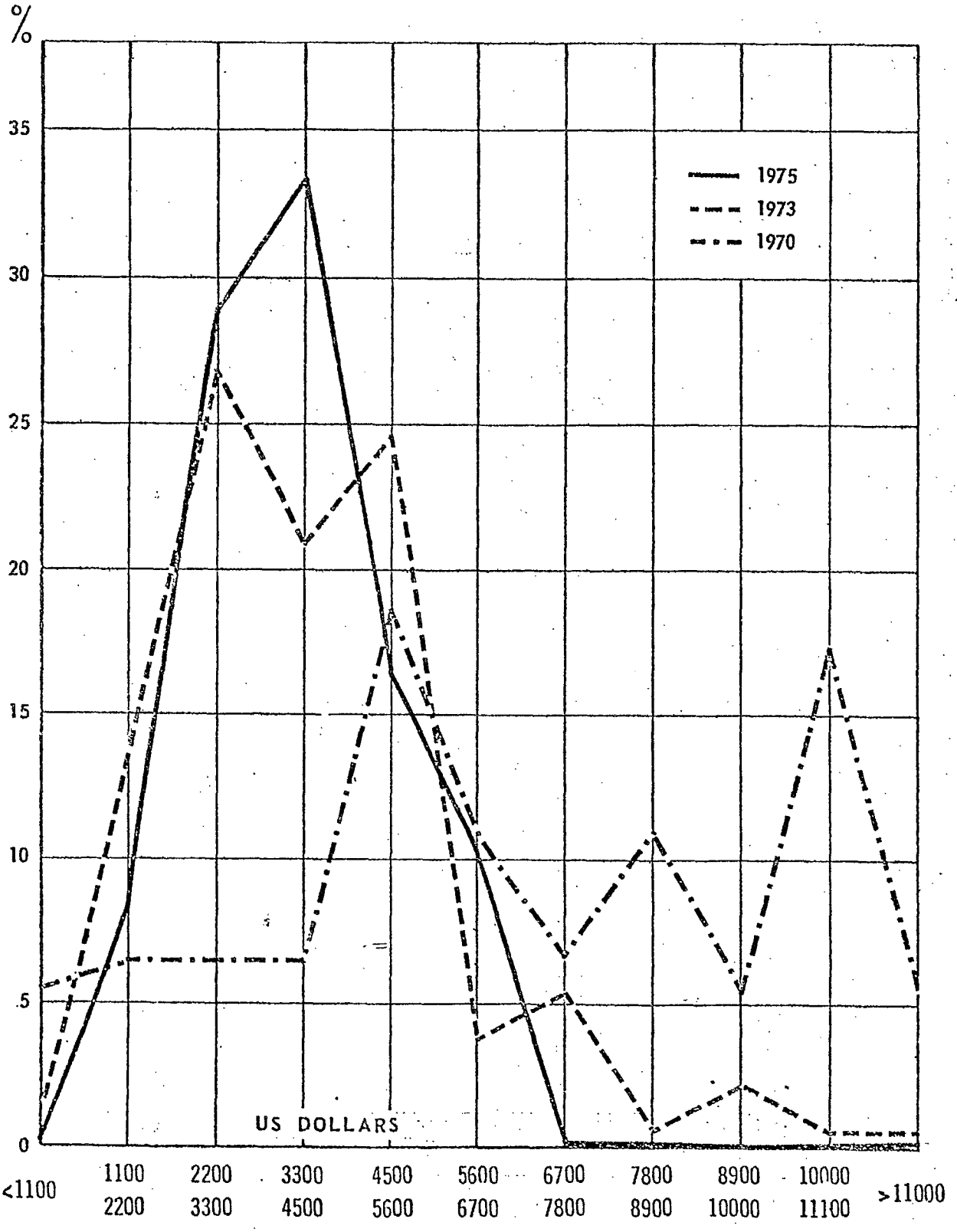


TABLE XIII

NATO SENIOR SCIENTISTS PROGRAM

NATIONS IN WHICH AWARDS HELD (1966-1975)

References: NATO and Science 1958-1972
AC/137-D/531, 11 January 1974
AC/137-D/564, 8 January 1975
AC/137-D/592, 11 December 1975

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	TOTAL
Belgium	1				1			1**			3
Canada											-
Denmark						1			1	1**	3
France		2					1	1	2	1**	7
Germany			1				1	2**	3	3**	10
Greece				1							1
Iceland											-
Italy				1	1	2		1**			5
Luxembourg											-
Netherlands			1	2*		1		1**		1**	6
Norway							1		2	1**	4
Portugal										1**	1
Turkey	1										1
United Kingdom				1	1		3	1	4	4**	14
United States				1					2	5	8
TOTAL	2	2	2	6	3	4	6	7**	14	17	63

Notes: * extension
** One grant split between two or more countries

Data on Awards made in 1974 onwards give collaborators only. Awards are therefore assumed to have been taken in their countries.

TABLE XIV

NATO Senior Scientists Program

Nationalities of Award Winners (1966-1975)

References: NATO and Science 1958-1972
AC/137-D/531, 11 January 1974
AC/137-D/564, 8 January 1975
AC/137-D/592, 11 December 1975

Nationalities	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Total	%
Canadian		1	2	2*					1	3	9	17
French									1		1	2
German									2	1	3	6
Greek											-	
Icelandic											-	
Italian									1		1	2
Luxembourg									1		1	2
Dutch											-	
Norwegian									2		2	4
Portuguese				2							2	4
Turkish							2**				2	4
British	1	1		1		2				3	8	15
American	1			1	3	2	4	4	6	3	24	45
	2	2	2	6	3	4	6	4	14	10	53	

* 1 Extension

** One award shared by two Turkish scientists

MAIN REFERENCES

NATO and Science:	Published by the Scientific Affairs Division, NATO, 1973.
NATO Science Year Book: (1972 & 1973)	Published by the Scientific Affairs Division, NATO, 1975.
NATO Science Committee Reports, Minutes and Other Documents:	MOSST Central Registry Files - 2140 Series.
Reports of Canadian Members of the NATO Science Committee and Subsidiary Bodies:	MOSST Central Registry Files - 2140 Series.
Minutes of the Meetings of the National Advisory Group for the NATO Science Committee:	MOSST Central Registry Files - 2140 Series.
Data on Canada's Participation in the NATO Science Fellowships Program:	National Research Council of Canada.