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INTERNATIONAL POLITICS AND INTERNATIONAL SCIENCE:

A Study of Scientists' Attitudes

by

Albert H. Teich

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DEPARTMENT OF POLITICAL SCIENCE
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INTERNATIONAL POLITICS AND INTERNATIONAL SCIENCE:

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B.S., Massachusetts Institute of Technology

(1964)

Submitted in Partial Fulfillment

of the Requirements for the

Degree of Doctor of

Philosophy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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ABSTRACT

International Politics and International Science
A Study of Scientists' Attitudes

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Albert H. Teich

Submitted to the Department of Political Science at the Massachusetts Institute of Technology on May 5, 1969, in partial fulfillment of the requirement for the degree of Doctor of Philosophy.

This dissertation reports on a study of the attitudes of nearly 400 scientists and engineers working in the international laboratories of Western Europe. Such laboratories are said to have a special role to play in the future development of European science and technology and European political integration. The vehicle of an attitude survey at CERN (the European Organization for Nuclear Research), ESTEC (the European Space Technology Centre), ISPRA (the largest EURATOM Joint Research Centre), as well as several smaller establishments, has been employed in order to examine the potential of this rọle. The work is divided into four parts.

Part One presents introductory and background material. At the outset, the place of international laboratories is defined within the general framework of science and international relations. The ability of such establishments to perform a political (integrative) function is examined in two ways: through performance on the scientific/technological level, and through effects on the directly political plane. The ideas of functionalist theory are stressed with regard to this second aspect. Chapter II outlines the history of the study itself and discusses the methodology which was employed in its execution. The third chapter presents the histories of the various organizations whose laboratories were incorporated in the study. Included here is a qualitative description of each laboratory as it appeared at the time of the study.

In Part Two, data from the survey is employed in analyzing outstanding characteristics of the scientists who were drawn to the laboratories as well as their personal and professional reactions to the experience. It appears that despite large differences in the nature of the various laboratories, the sample is characterized by broad demographic homogeneity. However, important contrasts do show up in examining the motivations which originally brought the scientists to the several laboratories. In particular, a higher degree of professionalism is evident in the expressed motives of CERN scientists in comparison with scientists from ESTEC and ISPRA. Chapters V and VI discuss the international laboratory experience from the point of view of the personal and professional life it offers. It is found that extra-national influences seem to create a predisposition among the scientists to seek out an international laboratory, and that as they remain longer in the lab, they tend to lose much of their desire and ability

to return home. While scientists at two of the three major centers (ISPRA and ESTEC) found their work disturbed by an unstable political situation, scientists at all laboratories agreed that the international character of the environment was both personally rewarding and a source of professional stimulation.

Part Three, devoted to the scientists' political views, begins with a discussion of the place of politics in their lives. Although the scientists' positions are by nature apolitical, they do maintain strong interests in public affairs on a primarily intellectualized plane. Within the conventional political spectrum, the largest number of respondents place themselves in a moderate leftist position. The notion that "leftism" represents something of a political norm within these communities is reinforced by the finding that those who rate themselves as rightists report significantly lower levels of political interest and discussion.

The remainder of Part Three follows up this general picture with an elaboration of the scientists' opinions on specific current issues. Of greatest interest are opinions on issues relating to alternative European futures. Although there is some disagreement over details, there is widespread enthusiasm among the scientists for expanding economic integration and eventual political integration of Europe. Comparisons with studies of opinion among European elites in non-scientific fields suggest that the scientists differ mainly in the intensity of their desire for closer integration, and in the breadth of their consensus, which transcends, for the most part, differences in national viewpoint. One portion of the survey was designed to test the functionalist notion that the European orientation should grow stronger as the scientist remains in the laboratory. So strong is the consensus that it is impossible to detect any variation over time. An examination of the interaction between European regionalism and broader internationalism (measured in terms of commitment to a world-wide community of nations) shows that no conflict of loyalties exists in the minds of the respondents. It is perfectly possible (and even mutually supportive) to be a regionalist and an internationalist at the same time.

The fourth and final part of the dissertation consists of a single concluding chapter in which the implications of the survey responses for the laboratories' scientific and political roles are weighed. A number of conclusions are reached which stress first of all the fact that political cohesion is a prerequisite of such large-scale scientific and technological collaboration rather than an outcome of it, and second that the direct political role which these laboratories and their scientists might be expected to play in the near future is rather small.

Thesis Supervisor: Eugene B. Skolnikoff

Title: Professor of Political Science

TO THE MEMORY OF MY FATHER, MAURICE TEICH

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PREFACE

Scientists (outside of the social sciences) often resent the attempts of social scientists to treat them as a "class" and to study their characteristics and their behavior. Why, they ask, should one want to study "scientists" any more than "bookkeepers" or "canasta players"? In large measure their feelings are understandable. Scientists, like all other human beings, are individuals, and to the extent one loses sight of their individuality through statistical analysis, it is a dehumanizing process. Nonetheless, if one maintains the proper perspective on such analysis, it need not detract from the value of the individual, and may in fact enhance it.

The most pressing problems which confront man today are of a different genre than those with which he dealt in earlier historical epochs. Instead of problems which devolve from his environment, they are problems which stem from man's own existence--problems of human interaction. The application of scientific method to the study of man in social situations rather than slighting the human spirit by dealing with aggregates, gives one hope that through the ability to understand and predict man's behavior, one may eventually arrive at some solutions to these pressing problems--an entirely "human" goal.

In this light then, scientists may indeed be considered a class apart from other members of society; in fact a small but very important class, worthy of study by those who hope to understand the workings of society. What distinguishes scientists is their intense participation in that enterprise which has all but solved most of man's environmental problems while exacerbating many of his social problems. To understand the ways in which the scientific enterprise relates to other elements of society is the goal of the relatively new social science field (Science and Public Policy) within which the present study was conceived. The scientists whose individual identities were necessarily commingled in the execution of this study doubtless share this ambition in some sense, and, we hope, will understand the need for this sort of excursion into their private affairs.

In another sense, there is an inherent risk--well discussed by Gunnar Myrdal in the preface to An American Dilemma--in allowing a member of one culture to attempt an analysis within another culture. Since I am a native-born American studying a group of Europeans of diverse nationalities, surely the influence of my cultural background was felt in the design of this study and the interpretation of its results. Nevertheless, as Myrdal suggests, there are some advantages to being in the position of an outsider looking in. Despite the fact that I was told a few times by respondents that I had a "characteristically American" tendency to speak of Europe as an entity in places where a European probably would not have done so, I feel that the study has not suffered materially as a result of the cross-cultural factor, and may well have benefited.

It is finally somewhat disappointing for a scholar to sit back after devoting a significant portion of his life to a task such as this, and reflect on the fact that what he has to say cannot justly be called definitive, even within its highly specialized area. This work must be classed--in the sense that Herbert Gans classed his study The Urban Villagers--as a reconnaissance, a foray into a relatively unexplored realm which might yield some tentative analytic schemes, and will hopefully stimulate interest, criticism, and better work. In any case, my disappointment is of course an artifact of the novelty of the field which I chose to investigate; it is minor compared to the intellectual reward which I have gained from this project.

Compared with that of the average doctoral dissertation, the number of persons who rendered assistance to me in this study, and in whose debt I stand, is large indeed. The lengthy list of names which follows is by no means exhaustive. Professor Eugene B. Skolnikoff of M.I.T., who was largely responsible for stimulating my interest in the field of Science and Public Policy, served as a member of my dissertation committee from its inception, and as chairman during the past year. His guidance, encouragement, and criticism were invaluable to my effort. Professors Lincoln P. Bloomfield and Harvey Sapolsky, who were kind enough to serve as the other two members of my committee, provided many useful comments and suggestions as well as some much-needed encouragement during the past year. Professor Daniel Lerner, whose European Elite Panel Survey was in many ways the grandfather of this study, was the original chairman of my committee and my mentor for several years. A voyage around the world took him away from M.I.T. during the 1968/69 academic year, and in an intellectual as well as a personal sense, I felt his absence most keenly. Mr.

Jean-Jacques Salomon, head of the Science Policy Division of OECD, provided major assistance to me during the early stages of the study while I was in Paris, and to my good fortune, arrived at M.I.T. as a visiting scholar at the time I was working on this manuscript. The comments which he rendered upon reading it as well as the stimulating discussions we had were most valuable for me.

Without the agreement of a few key individuals it would have been impossible to carry out survey research in the various organizations incorporated in this study. The gracious assent of Professor Pierre Auger (Director-General of ESRO),* Professor Bernard P. Gregory (Director-General of CERN), and Mr. Jules Gueron (Director-General of Research and Training at EURATOM) is hereby acknowledged. Individuals in charge of the laboratories also played a major role in facilitating my data collection: Dr. Hans Kramers (Director of ISPRA), Mr. P. Schalin and Mr. R. Gibson (Acting Director and Director of Administration at ESTEC), Dr. Stig Comet (Director of ESDAC), Mr. Sam Lloyd (Interim Director of PETTEN), Dr. Henry Seligman (Deputy-Director-General, Department of Research and Isotopes, IAEA), Mr. Steinar Aas (Project Manager, HALDEN). A number of persons played special roles in our visits to the laboratories and several became good friends in the process. The many favors--above and beyond the call of duty--done by Mr. Claude Deplanche (Public Relations Department, ISPRA), Mr. Edwin Shaw (Chief Information Officer, CERN), Mr. H. O. Schuster (Manager of General Services, ESTEC), Miss Suzanne Debatty (Administrative

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* Positions are given as of the time of the study. Many of these persons no longer hold the indicated posts.

staff, PETTEN), and Mr. Rainer Grumbach (Scientific staff, HALDEN) are remembered and gratefully acknowledged. The several hundred scientists and engineers who generously gave of their time in order to be interviewed or to fill out questionnaires cannot, of course, be thanked by name; their anonymity is preserved throughout this report. They all have, however, my sincere appreciation. Many will receive a brief report outlining the main findings of this study, as an expression of gratitude.

During the period of this research, as throughout most of my career as a graduate student, I held a predoctoral research fellowship (Number F01 Ch 29, 403) from the U.S. Public Health Service. This support allowed me to concentrate on my work with a minimum of financial concerns. Research and travel funds also came, at various stages of the project, from the M.I.T. Center for Space Research (under NASA Research Grant number NGL 22-009-019), the M.I.T. Center for International Studies, and the M.I.T. Department of Political Science. The final typing of the manuscript was handled masterfully by Mrs. Bonnie Harris. Miss Stephanie Jones graciously consented to act as a proof reader.

The most important acknowledgment is reserved for last. My wife Carolyn contributed to this study in many unusual and very major ways. While accompanying me on our nine months' sojourn in Europe, she served as my research assistant (perhaps "partner" would be more appropriate) and besides sharing with me the responsibility for interviewing and distribution/collection of questionnaires, she typed some 800-plus single-spaced pages of interview transcripts. Upon our return to Cambridge, she continued to work with me in coding the data and handling the early stages of data preparation and computer analysis. Throughout this period as well as the final (and rather hectic) writing stage during which she typed the first draft of this volume, she put up with my long hours of work and neglect of other responsibilities. And, as if this and her own studies were not enough, she took time out this Spring to give birth to our first-born son, Mitchell Craig.

Cambridge, Massachusetts

May 1969

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GLOSSARY

CERN	European Organization for Nuclear Research
EC	European Community (Includes EEC, ECSC, EURATOM; "The Six")
ECSC	European Coal and Steel Community
EDC	European Defense Community (Non-existent)
EEC	European Economic Community ("Common Market")
EFTA	European Free Trade Area ("Outer Seven")
ELDO	European Launcher Development Organization
ENEA	European Nuclear Energy Agency
ESDAC	European Space Data Centre (Part of ESRO--now called ESOC)
ESLAB	European Space Research Laboratory (Part of ESRO--merged into ESTEC)
ESOC	European Space Operations Centre (Part of ESRO)
ESRO	European Space Research Organization
ESTEC	European Space Technology Centre (Part of ESRO)
EURATOM	European Atomic Energy Community
HALDEN	OECD reactor project in Norway
IAEA	International Atomic Energy Agency
ISPRA	EURATOM Joint Research Centre in Italy
OECD	Organization for Economic Cooperation and Development
OEEC	Organization for European Economic Cooperation (Predecessor of OECD)
PETTEN	EURATOM Joint Research Centre in Holland

PART ONE

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CHAPTER I

INTERNATIONAL SCIENCE AND INTERNATIONAL POLITICS

The study upon which this volume reports is a rather specialized investigation of a unique group of people. Despite its apparent specialization, however, it raises questions of broad concern in the study of science and society. It seeks to examine the attitudes of scientists and engineers working in the international laboratories of Western Europe. The perhaps unfamiliar term "international laboratory" refers to a form of organization peculiar to modern-day Europe: a research center sponsored and financed jointly by several governments, in which scientists and engineers from different countries carry out their work together. Our study of the attitudes of these individuals is based upon a growing recognition of the vital place which science and science-based technology have come to hold in the modern world. We[1] seek here to explore the

[1] Although this study is the work of one individual, the editorial "we" is used occasionally for reasons of style.

attitudes of these scientists and engineers because we feel that a better knowledge of the interaction between these new research environments and their professional personnel may yield some significant insights into the future societal role which large-scale scientific collaboration may play first of all in Europe, but also in other areas of the world.

A. A New Scale of Cooperation

Science is by definition a cooperative enterprise. The work of one who seeks to extend knowledge does not begin in a vacuum, but is dependent at least on the work of his predecessors, and very nearly always on that of his contemporaries as well. In its cumulative aspect, therefore, the content of science must be international, and it is well recognized and often repeated that in this sense science respects no barriers, including those which delimit nation-states. That there is a long history of international cooperation in science should hence surprise no one. But, in the words of one scholar of science policy,

> in less than a quarter of a century, international scientific cooperation has changed its scale, its intentions and its significance. As to its scale, it no longer involves a few scientists meeting briefly and intermittently. It is no longer confined to exchanges of research results reserved for specialized circles but extends to the joint conduct of vast enterprises . . . in intergovernmentally supported research institutions employing considerable personnel, equipment and capital. As to its intentions, having originated and developed almost exclusively on the initiative of scientific circles and within those circles, it is now encouraged and largely financed by governments and within the framework of institutions whose aims and activities are not exclusively scientific. As to its significance, the cost and advantages of common action are no longer to be measured solely in the light of the general

> interests of science, but also in that of the general aims pursued by the individual countries of their own programmes of scientific, economic or military expansion.[2]

This new scale of cooperation, while conceptually relevant to all areas of the world, is presently of practical import only to Western Europe. The United States and the Soviet Union possess, in their status as continental super-powers, sufficient resources to economically pursue research in expensive fields of science and technology on a national basis. Most of the other nations of the world (with a few significant exceptions) have not yet reached stages of development where they can benefit from large-scale cooperation in research. Europe, on the other hand, is in many ways ideally suited for joint efforts. The nations on that continent are, on the whole, highly developed, with powerful economic and industrial bases. Europe is of course the birthplace of modern science, and nearly all of the scholars upon whose work rests the entire scientific edifice--from Galileo to Einstein--were Europeans. Nevertheless, despite these deeply-rooted scientific traditions and considerable economic strength, the level of resources most European nations are able to commit to research is no longer compatible with the needs of certain fields of science and technology. Unwilling to abandon advanced research in these fields, these nations have found an obvious solution to their dilemma in joint action, collaboration, and, in some cases, the establishment of common facilities for research. Thus one finds roughly a score of international research establishments in Europe, nearly all of them created within the last two decades.

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[2] Jean-Jacques Salomon, "International Scientific Policy," Minerva, II, 4 (Summer 1964), p. 418.

Upon the success of such collaboration rests much of Europe's future ability to participate at the frontiers of important scientific progress. In a larger sense, it has been suggested that the exigencies of this new situation may in fact prove to be assets: As a result of their international character, joint technological facilities are said to be unique as research environments and to represent the logical extension (at least in theory) of scientific internationalism. More importantly, the laboratories and their parent organizations offer special opportunities to advance the cause of European integration through joint efforts in a realm where the need for such integration is evident. According to the functionalist theory, which is discussed in more detail below, political cohesion between the European nations will be increased through interdependence generated by collaborative activities. Within this frame, a vanguard of "Europeanized" scientists, engineers, and administrators, experienced in the international laboratories, will emerge to facilitate the movement.

It is not necessary to review here either the comparatively short history of international laboratories or the long history of scientific cooperation which preceded it. The former topic is covered in some detail in Chapter III, and the latter is dealt with admirably by Salomon in his above-quoted article, as well as in the introduction to International Scientific Organizations.[3] Rather, the remainder of this chapter is

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[3] OECD, International Scientific Organizations (Paris, 1965).

devoted to sketching the broad outlines of the relationship between science and international affairs--the relationship from which this study derives its interest and within whose bounds its conclusions must be evaluated. We examine first the role of internationalism in the scientific community and in the behavior and attitudes of scientists. Then, taking a rather different vantage point, we look at the effects which science and science-based technology have had and are having on the international political system, particularly in the European arena.

B. Internationalism and the Scientific Community

1. Institutions and Environment

When speaking of a scientific "community," it is necessary to distinguish between various genres of science and technology. A genuine community--in the sense of a group of individuals with shared interests, methods, and values, whose work represents a more or less coordinated effort--exists primarily among basic researchers in "pure" science.[4] As one moves toward applied sciences and technology, the entrance of profit motives (economic, political, or military) increasingly restricts coordinative mechanisms and the sense of community is reduced. Remembering this limitation, there is nevertheless considerable value in dealing--as this discussion does--primarily with basic researchers. Sociologists of

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[4] One famous but rather idealized view of this community is presented by Michael Polanyi, "The Republic of Science: Its Political and Economic Theory," Minerva, I, 1 (Autumn 1962), p. 54.

science recognize that the value structure of this group is a major factor in shaping the behavior of other scientists and engineers. In the words of Norman Storer:

> . . . this central cadre of scientists [basic researchers] constitutes the principal reference groups for most of the other groups [applied scientists and engineers] . . . the norms and values characterizing it serve as ideal standards for the others.[5]

The scientific community is structured upon a communication net which supports its coordinative mechanism. This net possesses two main functions: (1) facilitating the dissemination of ideas and research results upon which the cumulative nature of science is based--so that each scientist can define his problems and interpret his results in light of related work by others, and (2) permitting recognition of those scientists who succeed first in formulating key ideas--recognition is an important source of gratification for the scientist.[6] The international aspect of this communication net is so natural a part of the concept that it should not be understood in terms of international <u>cooperation</u>, but rather, in the words of S. Dedijer, as international <u>research relations</u>.[7] Dedijer

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[5] Norman W. Storer, <u>The Social System of Science</u> (New York: Holt, Rinehart and Winston, 1966), p. 15.

[6] See Robert K. Merton, "Priorities in Scientific Discovery: A Chapter in the Sociology of Science," <u>American Sociological Review</u>, XXII, 6 (December 1957), pp. 635-659; and Warren Hagstrom, <u>The Scientific Community</u> (New York: Basic Books, 1965), pp. 23-56.

[7] S. Dedijer, "The Future of Research Policies," unpublished paper based on a talk delivered at the Gordon Conference on The Formulation of Research Policies, Santa Barbara, California, February 1966. We are in debt to this very interesting paper for many of the ideas presented in this section.

defines research relations as "every pattern of exchange across national borders that individual groups, organizations, firms, whole countries or groups of them mutually engage in (or refrain from engaging) either to develop joint research production capacities or to perform jointly or separately the various types of research work."[8] The most general aspect of these international relations is indirect communication through scientific literature. Even in countries which ostensibly have no other sorts of relations, and where direct contacts between scientists are very rare, such indirect communication exists. Dedijer cites, as a striking example of this, a tabulation of the original citations in a recent issue of a scientific journal from the People's Republic of China. Of the 148 papers cited, 38% were from the United States.[9]

Besides indirect communication, Dedijer enumerates some of the other patterns of direct international communication between scientists:

> Exchanges of letters, of preprints and of reprints, patents, designs and licenses, visits of individuals and groups of students, of researchers and research administrators between foreign centers for longer or shorter periods, participation in organizations either governmental or non-governmental established on a bilateral, multilateral, regional and world basis for the systematization, standardization and exchanges of data and techniques, participation in international symposia, conferences and congresses, the publication of international research journals, etc. . . . Many of these . . . occur independently of whether the participants are in competition with each other and independently of the political relations between their countries.[10]

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[8] _Ibid._, p. 2.

[9] _Ibid._

[10] _Ibid._, pp. 5-6.

The operation of these mechanisms is enhanced through the development--with increasing specialization--of small sub-communities whose members share a concern with a more restricted set of problems.[11] Further, in the entire world, the number of centers doing really important work in a highly specialized subject-area is generally rather small. Thus, it is most often the case that basic researchers working on the same or similar problems are mutually aware of the details of each others' activities.[12]

Formal bodies of international scientific relations encourage interchange on a larger scale; the most important of these is the International Council of Scientific Unions (ICSU). Functioning chiefly in international scientific planning (coordination of research), information exchange, and organizaton of congresses, ICSU is composed of 57 national members (the scientific academies of various countries) and 14 scientific members (international unions in fields such as astronomy, biology, and chemistry). Other formal organizations, specialized functionally or geographically to various extents, also exist; Salomon in fact enumerates several hundred.[13] International scientific and technological congresses held each year by such organizations number more than 1,600.[14]

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[11] See Derek J. de Solla Price, Little Science, Big Science (New York: Columbia University Press, 1963), p. 83.

[12] For one scientist's account of this phenomenon and its inherent tension between cooperation and competition, see James D. Watson, The Double Helix (New York: Atheneum, 1968).

[13] OECD, International Scientific Organizations. See pp. 20-21 for a discussion of the difficulties of such counting procedures.

[14] Dedijer, "Future of Research," p. 7.

Communication networks, thus, really do maintain a scientific community on an international scale. Although some of the communication involves the participation of government (for example, either as sponsor of conferences or as the body which pays the bills for scientists participating in individual exchanges)[15], most occurs as a natural part of science, resulting from desires of scientists to seek as wide as possible a base for cumulation of ideas and recognition. Interchange is limited in basic science by natural barriers to communication which result from distance (linguistic and cultural as well as physical distance), and in applied science, engineering and technology, by restrictions based on economic, political, or military motives.

2. Attitudes of Scientists

Within the communication nets, one major factor which binds the scientific community together and permits it to function on an international basis is the wide sharing of a set of values concerning science.[16] Several of these values which derive from the information exchange and recognition needs of the scientific process are particularly functional

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[15] For early instances of the U.S. Government's interest in international scientific communication, see U.S. Department of State, International Science Policy Survey Group, Science and Foreign Relations (Washington: Government Printing Office, 1950); and Walter B. Cannon and Richard M. Field, "International Relations in Science," Chronica Botanica, IX, 4 (Autumn 1945), pp. 253-298, which was originally written as a report for the National Research Council.

[16] Again, as in the previous section, we are speaking, in the main, of basic science.

with respect to science's internationalism.[17] (1) Universalism--the facts of science are the same to all men. (2) Commonality--the ideas of science are not the property of any individual but belong in common to humanity.[18] (3) Absence of bias-- the rejection of *argumentum ad hominem*, and the belief that the value of a scientific work is measurable only on scientific criteria and not in relation to personal qualities of its author.

These values, superimposed on the common methods, tools, and subject matter of science, are of great importance in shaping the world-view of scientists. As Hagstrom observes, "The socialization of scientists tends to produce persons who are so strongly committed to the central values of science that they unthinkingly accept them."[19] It is not unreasonable to suppose that a cosmopolitan outlook based on science influences a scientist in other aspects of his behavior. One may further suppose that cosmopolitanism is functional in the international contacts of the scientist, and that the contacts, in turn, probably reinforce cosmopolitanism. As the internationalism of science is often described

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[17] See Robert K. Merton, "The Ethos of Science," in *Social Theory and Social Structure* (New York: Free Press, revised edition 1957), pp. 552-561. Also S. S. West, "The Ideology of Academic Scientists," *IRE Transactions in Engineering Management*, Vol. EM-7 (1960), pp. 54-62.

[18] Hagstrom, *Scientific Community*, p. 12, notes in this connection the fact that articles in scientific journals are called "contributions" and as the author generally receives no compensation and sometimes even must pay publishing costs, they are in effect "gifts" to science.

[19] *Ibid.*, p. 9.

in glowing terms, so the international attitudes of scientists are frequently held up (as often as not by scientists themselves) as a shining example to other mortals:

> . . . in scientists, engineers, and technologists, we have a large international community of people who understand each other, who think similarly on many problems, and who tackle problems from a common point of view. In general they have also a common interest in solving problems and a common aspiration to circumvent the problems of the world with new and heretofore untried solutions.[20]

> CERN [the European Organization for Nuclear Research] might today well be the place where one can find the 'first Planetarians,' earth dwellers who no longer feel loyalty to a single nation, a single continent, or a single political creed, but to the common knowledge that they advance together.[21]

Based on such evaluations, one finds a belief among many politically active scientists that they have a "special role" to play in the affairs of nations. One section of the well-known "Vienna Declaration" exemplifies this view:

> We believe that, as scientists, we have an important contribution to make toward establishing trust and cooperation among nations . . . Scientists with different national allegiances easily find a common basis of understanding. . . . The ability of scientists all over the world to understand one another, and to work together, is an excellent instrument for bridging the gap between nations and for uniting them around common aims.[22]

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[20] Donald F. Hornig, "World Comity Through Science and Technology," in U.S. Congress, House, Committee on Science and Astronautics, Government, Science and International Policy (Washington: U.S. Government Printing Office, 1967), p. 29. Dr. Hornig was Special Assistant for Science and Technology to President Johnson from 1964 through 1969.

[21] Robert Jungk, The Big Machine (New York: Scribner's Sons, 1968), p. 150.

[22] "The Vienna Declaration," Statement from the Third Pugwash Conference, held at Kitzbühel and Vienna, Austria, September 14-20, 1958.

Such discussion of scientists' attitudes is aesthetically pleasing and makes a certain amount of intuitive sense. If one looks, however, for more substantive data, the picture becomes somewhat obscure, as empirical research on the political attitudes of scientists has been very limited.[23] One occasionally finds passing references to this topic, such as Anne Roe's comment, from her analysis of interviews with 64 prominent American scientists, that "their political views ranged from rather rightist to very leftish, with the bulk of them definitely liberal."[24] Or a similar brief reference in a somewhat less rigorous survey of scientists by the editors of Fortune magazine, which indicates that they found most of the respondents to be Democrats.[25]

A recent doctoral dissertation in M.I.T.'s Political Science Department treats the subject in a good deal more depth. Entitled "The

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[23] There is some literature on the political opinions and activities of more active scientists, for example, Robert Gilpin, American Scientists and Nuclear Weapons Policy (Princeton, N.J.: Princeton University Press, 1962) and Donald A. Strickland, Scientists in Politics: The Atomic Scientists Movement 1945-1946 (Lafayette, Ind.: Purdue University Press, 1968) but its scope and method are rather limited. Recently there has also been some more general and empirical work on opinions of American academics (including scientists) with regard to such specific issues as the war in Vietnam and the "space race." See Everett C. Ladd, Jr., "Professors and Political Petitions," Science, CLXIII (March 28, 1969), pp. 1425-1430, and Donald A. Strickland, "Physicists' Views of Space Politics," Public Opinion Quarterly, XXIX, 2 (Summer 1965), pp. 223-235.

[24] Anne Roe, The Making of a Scientist (New York: Dodd, Mead and Co., 1952), p. 228.

[25] Francis Bello, "The Young Scientists," in Paul C. Obler and Herman A. Estrin (eds.), The New Scientist (Garden City, N.Y.: Anchor Books, 1962), pp. 64-65.

Political Attitudes of a Scientific Elite," this work by David Nichols reports on a series of depth interviews with 37 politically active academic American scientists. Nichols separates his respondents into three types according to their political attitudes:

> The overall political outlook of scientists charged with professional responsibility for military research and development we have found to be characterized by a broad satisfaction with the professional-political _status quo_ (the conservatives); the outlook of physicists and men in electrical engineering/computer science, by hope for change (the moderates); the outlook of mathematicians and biologists, by distrust of government (the radicals).[26]

Nichols' discussion is based largely (but not exclusively) on issues relating to political uses of science and relations between scientists and politics, and although he considers the divisions he uncovers to be rather deep, it is interesting that the self-image of all three of his types--radical, moderate, and conservative--is generally that of a "liberal."[27] In any case, his highly interesting paper is concerned solely with American scientists and unfortunately does not at all go into the question of internationalism.

A recent study in which this author participated (it is discussed briefly in the next chapter) looks at the political attitudes of a group of European scientists.[28] This survey found a strong consensus among

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[26] David Nichols, "The Political Attitudes of a Scientific Elite," (unpublished Ph.D. dissertation, Dept. of Political Science, M.I.T., 1968), p. 192.

[27] _Ibid._, p. 174.

[28] Daniel Lerner and Albert H. Teich, "International Scientists Face World Politics: A Survey at CERN" (M.I.T. Center for International Studies, Document No. C/68-2, January 1968).

scientists of several nationalities on a range of political issues, and a tendency towards internationalism which seemed to be manifest not only in approval of international activities, but in evaluation of the worth of such activities in an international frame of reference. The respondents in this group were not intended to be "typical" scientists (they came from an international laboratory) and one hesitates to generalize on the basis of this sample. It was however apparent that at least this group of scientists displayed some unique attitudes on topics of international interest and this work was in part responsible for the genesis of the present study.

Internationalism, thus, is an integral part of the structure of the scientific community. It is, further, highly relevant to the attitudes and behavior of professional scientists and the logic of international research facilities may be seen in this light. On the other side of the coin, the international political system is increasingly subject to pressures for change based on the progress and products of science. Examination of this phenomenon, which frames the political prospect of international laboratories, requires a shift in one's viewpoint from the scientific system to the political system.

C. Science and International Relations

That science and technology have been prime factors in the transformation of international relations which the world has witnessed in the twentieth century, particularly during the past quarter-century, is a well-recognized fact. The emergence of the United States and the Soviet

Union as super-powers--probably the most important single aspect of this transformation--is based in large measure on economies of scale which allow these two giants to harness science and technology in development of political, economic, and military power. Science and technology are also, in the words of Eugene B. Skolnikoff, "the predominant force causing today's unprecedented rate of change in man's physical and social environment."[29]

Skolnikoff has performed a systematic analysis of the interaction between science and foreign policy which, in its concluding chapter, speculates on future patterns of international affairs. Central to this speculation is the notion that science and technology are operating as internationalizing forces in the modern world. Its "trends and forces . . . raise questions about some of the cherished traditions of nationhood, about the assumptions associated with the present organization of the international political system. . ."[30] The pressures which science can conceivably exert on the international political system may be dichotomized into two broad categories: (1) those pressures stemming from the consequences of science, and (2) those stemming from the needs of science. The former, although of much broader impact as agents of social change, are of less specific concern to this discussion and hence are given only brief treatment. The latter, serving as a basis for functionalist theory, are treated in more detail.

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[29] Eugene B. Skolnikoff, Science, Technology and American Foreign Policy (Cambridge: M.I.T. Press, 1967), p. 3.

[30] Ibid., p. 315.

1. Consequences of Science

Historically, products of technology, whose origins may be traced back to science, have affected virtually all sectors of society. In the present age, perhaps the most profound and characteristic development has been the advent of what Skolnikoff has called "global technologies." Essentially these are derivatives of science, the consequences of which do not mesh geographically with conventional political boundaries.

Some such technologies are actually global in function and define their own scale of measurement:

> New technology has made large-scale human activity possible; but there is more to it than that. Contact techniques, by reason of their operational characteristics, are inherently expansive. It is not simply that they have facilitated the performance of large-scale economic, political, and military activities--they spontaneously enlarge the scope of human action by setting up their own level of operations; a level imposed by their functional rules and requirements.[31]

We need not look far for an example of this: communications satellites represent precisely such a technology; their specific function is the broadening of the geographical scope of communications. Supersonic air transport is another example. The functions of these technologies are defined by their scale and clearly make sense only in international terms.

On the other hand, certain types of technologies have global

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[31] Laurance Reed, Europe in a Shrinking World: A Technological Perspective (London: Oldbourne Book Co., 1967), p. 29. Reed uses "contact techniques" as a general term for communication and transportation.

consequences not so much because their function is of a global character, but merely because the physical nature of the world is not, in these respects, congruent to political boundaries. As one scholar, examining the byproducts of technology, remarked, "The earth is one ecological unit."[32] Such technologies generally involve environmental alteration, which may occur either by intent or as an unintentional side-effect of another process. Intentional weather modification will soon be a reality. Widespread unintentional air and water pollution are already unpleasant realities.

Along these same lines, the technology of modern armaments, mainly but not exclusively nuclear weapons, is probably the major cause for the profound alterations which have already occurred in the relationships between nations.[33] Nuclear weapons, coupled with intercontinental ballistic missiles (as well as chemical and bacteriological weapons), are global in function due to the intended range of their power--i.e., such weapons are specifically designed to exercise their function from one nation to the territory of any other nation on the globe. They are *de facto* global as the effects of their employment (radioactive fallout in one sense, the general holocaust which is presumed by many to be an inevitable consequence of their use in another sense) are again not constrained by political boundaries. It is evident that weapons with such

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[32] Abel Wolman, "Pollution as an International Issue," *Foreign Affairs*, XLVII, 1 (October 1968), p. 168.

[33] See John Herz, *International Politics in the Atomic Age* (New York: Columbia University Press, 1959), for a fuller development of this proposition.

profound effects must rapidly become objects of concern not only to the nations which possess them, but to the entire world.

In all of these areas, the consequences of science and technology are capable of producing pressures for change in the international political system. Nevertheless, the pressures do not all operate in the same direction. In particular, to those who foresee larger political units developing as consequences of modern science and technology, Reed gives some words of caution:

> There is nothing inevitable about it. Technology may be spontaneous but political organization is not. Manmade boundaries do not automatically shift to suit the idiosyncracies of techniques. Technology may change the value of boundaries for the bounded area. It may diminish their relevance, alter their function, or even water-down their divisive strength, and in this fashion technology may exert powerful pressures for the revision of political frontiers--but that is all. Modern techniques make large-scale political organizations possible, not certain.[34]

2. Needs of Science

In discussing the consequences of certain fields of science and technology, it was observed that the effects they produce simply do not relate in any meaningful way to the artificial political boundaries which man has drawn upon his planet. This, too, is the case with respect to the subject-matter--and hence the needs--of certain scientific disciplines. The sciences dealing with the study of the Earth are prime examples: geodesy, geophysics, and one of their most important applications, seismology, all require data which can only be obtained through international effort. The International Geophysical Year (IGY)

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[34] Reed, Shrinking World, pp. 30-31.

represented a major world-wide effort to obtain such data. The International Polar Year, which predated IGY by more than half a century, represented a similar effort in a somewhat different area of science. The effects of such programs on the international political system have not been very significant to date. As global sciences advance to states where they realize the need for more synoptic data, as they progress towards more practical applications (e.g., earthquake prediction), and as they become more expensive, thus involving governments more deeply, one might expect their political effects to grow in importance.

The existence of international laboratories, as noted at the beginning of this chapter, is based not so much on the data requirements of science, but rather on the scale of investment (financial and human) which certain fields demand. "Big science," characterized by a "technology of research,"[35] has developed in such a way as to require enormous pieces of equipment, large groups of highly-trained personnel working together in teams, and vast expenditures in order to progress. Enough has been written about the changes this expansion has wrought in the scientific community.[36] For purposes of this discussion two of

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[35] This very apt expression was coined by Spencer Klaw, in The New Brahmins (New York: William Morrow and Co., 1968).

[36] See, for example, Lew Kowarski, "Psychology and Structure of Large-Scale Physical Research," Bulletin of the Atomic Scientists, V, 5 (May 1949), pp. 186-190; Price, Little Science; Daniel S. Greenberg, The Politics of Pure Science (New York: New American Library, 1967); and Alvin M. Weinberg, Reflections on Big Science (Cambridge: M.I.T. Press, 1967).

its external consequences are most important: (1) It has brought scientists into the political arena as benefactors of government's largesse and competitors for a still-growing share of government's budgets--a process in which scientists have of course been aided by the perceived coupling between scientific progress and national power; and (2) It has placed the game's ante beyond the reach of most nations, thus forcing them to act jointly or not at all.

Consider the obvious case of high energy physics. Concerned with exploring the structure of the atomic nucleus in order to probe the fundamental nature of matter itself, this field of science demands devices of Brobdignaggian proportions. The United States may be able to afford spending $35 million to construct a single 30 BeV accelerator at Brookhaven National Laboratory, and $47 million a year to operate it;[37] the Federal Government spends on the order of $17 billion a year for all manner of research and development. But what of Norway, whose total annual R&D expenditure ($42 million)[38] is smaller than Brookhaven's annual operating budget, and whose total population of scientists and engineers working in R&D (2,290)[39] is less than the number of persons working at Brookhaven? Is a country such as Norway (or Belgium, or Switzerland, or Austria for that matter), highly advanced in all other

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[37] AEC expenditures for all of Brookhaven for fiscal 1964.

[38] OECD, The Overall Level and Structure of R&D Efforts in OECD Member Countries (Paris, 1967), p. 14.

[39] Ibid.

aspects of society, simply forced to abandon any hope of participating in the exploration of this basic area of human knowledge? Certainly not. In the particular case of high energy physics, the solution to the dilemma has been an international laboratory: Norway--as well as Belgium, Switzerland, and Austria--is a member of CERN, the European Organization for Nuclear Research, and participates actively in its research. An intergovernmental institution, a very concrete form of internationalizing action, has been created in response to pressure from the needs of science.

Dixon Long, in a recent paper on science and international affairs, distinguishes in a manner similar to that used here between internationalism in the "effects of science" and in the "practice of science."[40] While considering together the practice of that science which is international because of its nature, and that science which is international because of its cost, he describes a "spectrum" of activity which may be assigned to the international level. It is worth taking note of this spectrum here because it illustrates the scope of international action which science may demand, and thus provides some feeling for the types of political initiatives likely to result. The spectrum extends from "decisions about research and development activity, through allocations to such activity and finally to actual laboratory or workshop performance. The extreme ends of the spectrum represent on the one hand consultation

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[40] T. Dixon Long, "International Science, Technology, and Regional Integration," unpublished paper presented at the 9th Annual Convention of the International Studies Association, Washington, D.C., March 30, 1968.

about research, and on the other actual performance of research."[41] One might suppose that broadly international arrangements are likely to occur at the consultation end of the spectrum, while actual performance will be more probable among regional groupings.

In terms of the political pressures which they are capable of generating, the needs of technology, because of their direct ties with the vital issues of prosperity, military security, and political self-sufficiency, are considerably more important than the needs of science. An obvious and very current example of this type of pressure has materialized in terms of the "technological gap" between the United States and Europe.[42]

Although the "gap" has been used for diverse political purposes by public figures with widely differing goals, it should be noted that the man who is generally credited with having originated the debate (Pierre Cognard)[43] as well as the man who probably did the most to popularize it (Jean-Jacques Servan-Schreiber) both were primarily interested in a "Europeanist" (integrative) solution to the problem. The technological gap has been analyzed in many ways: as an inability to make practical

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[41] Ibid., p. 4.

[42] See Chapter X for a discussion of European scientists' views of this gap.

[43] Cognard's paper, published anonymously in the journal of the French D.G.R.S.T., Le Progrès Scientifique (September 1, 1964), was reprinted under the title Recherche Scientifique et Indépendance, by the Centre de Recherches Européennes in Lausanne (1965). The second paragraph in this booklet reads: "Pour notre part, nous persistons à penser que seule une Europe unie aura les dimensions suffisants pour qu'une réponse affirmative puisse être apportee à ces questions."

use of new knowledge, as a problem of market size, as a matter of managerial or organizational technique, as a fault of antiquated educational systems, as a basic cultural or sociological defect, or simply as a result of a lower level of investment in research and development. It is, to a greater or lesser degree, all of these. The main symptoms of this gap have been the feelings in Europe (whether they are based on fact or not is not nearly so important as the fact that they exist) that most of the important technological breakthroughs are occurring in America, that American power is consequently growing more rapidly than either that of any European country or of Europe considered as a whole, that Europe is falling farther and farther behind in these respects, and that the European economy is gradually being taken over by American industry.

Servan-Schreiber, whose somewhat sensationalistic concern in The American Challenge is the take-over of European industry, argues for a delicately-phrased "minimum of federalism."[44] The point is that to maintain the pace of technology which the United States is setting, Europe must organize itself into a more efficient political unit with some degree of central direction. An analogous but less known British work reaches essentially the same conclusion:

> If Europe wishes to remain a technological 'third force' in the world, capable of competing against, or partnering, others on a basis of equality, some progress towards political unity is absolutely indispensable. Cooperation is not enough.[45]

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[44] Jean-Jacques Servan-Schreiber, The American Challenge (New York: Atheneum, 1968).

[45] Reed, Shrinking World, p. 183.

The British government's proposal for a European Technological Community in 1967 embodied much of this spirit.[46] In sum, pressures for greater regional integration in Europe are being strengthened by Europe's desire to maintain a technology on a par with the superpowers.

D. Functionalism and the Logic of International Laboratories

It is a cherished belief among many scientists that science is an ideal medium for international cooperation, and, further, that such cooperation may lead to better understanding between nations and perhaps the reduction of world tensions. On a European level, this belief meshes conveniently with the "European spirit" and cooperation in science and technology has for many years been seen as one of the instruments through which closer political integration of the various nation-states might be achieved. This vague yet highly seductive line of thinking is central to the aura which surrounds the international laboratories incorporated in this study.

1. Science: The Ideal Medium

Earlier portions of this chapter laid the groundwork for understanding the "logic" of international scientific cooperation. Without recourse to syllogistic style or formal logical manner, its essential thrust should be apparent from a number of assertions: (1) The content and method of science are international. (2) A scientific community, based on formal

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[46] New York Times, January 24, 1967, p. 1.

and informal communication networks, exists on an international scale. (3) Scientists, through their participation in this community as well as their socialization into science itself, are basically internationalist in orientation. (4) The effects of science and technology on other areas of human endeavor are growing in importance. (5) Scientists are becoming more influential in the conduct of public affairs. (6) Modern science, through its consequences as well as its needs, is creating a variety of pressures on nation-states for international actions.

Most of these assertions are more or less implicit in the statements of many of the scientific, diplomatic, and political figures who deal with international science. To them, cooperation in science has a political potential, which, though vaguely understood, is considerable. Several quotations, from a variety of sources, illustrate the point: From a panel of the U.S. National Academy of Sciences (1950):

> Since science is essentially international in character, it provides an effective medium by means of which men can meet and exchange views in an atmosphere of intellectual freedom and understanding. It is therefore an effective instrument of peace.[47]

From Henri Laugier, spokesman of the French delegation before the Economic and Social Council of the United Nations (1946):

> . . . the joint creative effort of scientists from different nations [in U.N. laboratories] could contribute, in great measure, to bringing about an international spirit.[48]

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[47] U.S. Department of State, Science and Foreign Relations, p. 3.

[48] Quoted in R. Jungk, Big Machine, p. 31.

From Glenn T. Seaborg, Chairman of the U.S. Atomic Energy Commission (1967):

> By the example of institutions such as the International Theoretical Physics Conference, by the active participation of scientists in the affairs of government, and in many other ways, scientific internationalism is transforming relationships between countries. It is doing this far more quickly and more profoundly than most of us, even those close to the scene, realize.[49]

And finally, from C. J. Bakker, former Director-General of CERN (1960):

> . . . CERN is trying to further international cooperation of scientists and scientific effort. The creators of CERN will certainly regard it as a great reward if such cooperation not only leads to scientific progress, but also to a better understanding of the peoples of the world.[50]

Within this notion that science is ideally suited to serve as a medium for cooperation between nations is the idea that, in addition to being aesthetically pleasing, such cooperation must also be in some real sense necessary for science itself. The needs of "big science" and technology, described in detail above, have created such a situation for European science.[51] Europe, furthermore, is one area of the world where

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[49] Glenn T. Seaborg, "The Promise of the International Atomic Energy Agency," Science, CLVIII (October 13, 1967), pp. 226-230.

[50] C. J. Bakker, "CERN as an Institute for International Cooperation," Bulletin of the Atomic Scientists, XVI, 2 (February 1960), p. 57.

[51] One prominent European scientist has extended the conventional sphere of such needs (extra-national subject matter, large investment of money and/or manpower) to include the condition "when the number of specialized research workers within the nation is too limited to staff committees (always subject to rapid turnover) which are asked to elaborate scientific policies and evaluate research proposals in the ever increasing number of specialized disciplines." Adriano A. Buzzati-Traverso, "Scientific Research: The Case for International Support," Science, CXLVIII (June 11, 1965), p. 1442.

cooperation between nations appears to be capable of producing, in the foreseeable future, some form of permanent supranational political entity. Thus, with the ultimate goal of political unity in mind, European leaders have sought domains of joint action. Pressure from the demands of science and technology made it an obvious choice for such joint action, and the suitability of science for international cooperation seemed to create conditions for a long and happy marriage.

2. Functionalism

The theory which views international cooperation in various sectors of society as leading to political integration of the nations concerned is known as "functionalism," or in its specifically European incarnation, "sector integration." In conventional usage, the theory is more broadly conceived than is relevant for purposes of this discussion.[52] Nevertheless, a brief description of its main points is important as a context in which to view the role of international laboratories.

The most direct application of functionalist theory to international scientific cooperation resulted in the establishment of EURATOM (the European Atomic Energy Community, see Chapter III). Here a technical vehicle (nuclear energy) was consciously chosen as a functional means of

[52] An elaborate discussion by one of the theory's chief proponents may be found in Ernst B. Haas, Beyond the Nation-State (Stanford, Calif.: Stanford University Press, 1964).

furthering a primarily political goal (unification of the Six).[53] By way of introducing a well-reasoned analysis of EURATOM, Lawrence Scheinman presents a brief summary of functionalist arguments:

> Current theory postulates that under certain conditions (principally ideological and socio-economic homogeneity) certain functions (social and economic welfare issues that are fairly specific but not so limited as to lack the quality of potential 'spillover' into other functional activity), performed under certain institutional arrangements (primarily expert bodies vested with a degree of autonomy and power to act directly on the international constituency), are conducive to a growing interdependence of the participants and to an increasing integration of previously separate and autonomous entities. Although not all participants, such as government officials, political leaders, and interest group spokesmen, share a common view of the result of this increasing interdependence, the general expectation of most is that a new, currently undefined, political community will eventually emerge.[54]

Stanley Hoffmann captures the essence of the argument in noting that one of the crucial assumptions of the functionalist theory is:

> that the dilemma of governments having to choose between pursuing an integration that ties their hands and stopping a movement that benefits their people could be exploited in favor of integration by men representing the common good, endowed with the advantages of superior expertise, initiating proposals, propped against a set of deadlines, and using for their cause the techniques of package deals.[55]

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[53] We are, admittedly, mingling scientific cooperation with technological cooperation. In the particular case of EURATOM, although the subject matter is largely scientific (nuclear research), the context is technological and economic (power production) and much of the internationalism of the scientific community is overshadowed by the nationalism of the industrial sector. Our confusion in this respect, however, mirrors that of the policy-makers.

[54] Lawrence Scheinman, "Euratom, Nuclear Integration in Europe," International Conciliation, No. 563 (May 1967), p. 6.

[55] Stanley Hoffmann, "Obstinate or Obsolete? The Fate of the Nation-State and the Case of Western Europe," Daedalus, XCV, 3 (Summer 1966), p. 883.

Putting matters even more concisely, in his articulate critique, Hoffmann observes that functionalism involves the expectation that national sovereignty "could be chewed up leaf by leaf like an artichoke."[56] If we stretch this metaphor a bit (through literary though not agricultural license), it would seem that the functionalists see science and technology as very large but easily digestible leaves whose digestion in the international (European) stomach should be a major step toward the development of interdependence and the limitation of national sovereignty.

There are four general means by which functional integration is supposed to operate.[57] First, a set of decisions is removed from the domain of international politics and turned over to a specialized agency with certain supranational powers. To use the functionalist vocabulary, this means the substitution of <u>welfare</u> decision-making criteria for <u>power</u>. In large-scale international scientific cooperation such decision the level of a supranational executive, conceivably could involve the allocation of scientific resources and the distribution of effort across member states in certain fields. Second, the lessons learned in a given sector may be applied to other sectors. Thus either by providing an example of successful operation or by the stimulation of its own requirements for say, materials, manpower, or legal authority, an international laboratory

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[56] <u>Ibid</u>.

[57] See Haas, <u>Beyond the Nation-State</u>, pp. 21-22, 47-50.

might encourage integrative efforts in other sectors.[58] (This is the widely-held notion of "spill-over.") Third, task (welfare) orientation is favored through the participation of technical experts rather than political actors. At the level of large-scale international scientific cooperation, the *de facto* science policy-making by scientists is seen as a positive contribution in the functionalist sense. Finally, the existence of a supranational entity provides the basis for the development of a larger set of loyalties which may be superimposed on national allegiances. This is of particular relevance to international laboratories: since it is widely assumed that scientists are international in orientation, the evolution of a Europeanist technological elite through scientists' participation in such organizations could be anticipated as an outcome.

3. Reality and Its Discontents

It is probably fair to say that despite all of its functionalist potential, international scientific cooperation in Europe--including large-scale organization--has not to date had any marked effect on European integration. The most ambitious project in terms of financial investment as well as political potential--EURATOM--has been a great disappointment, falling victim, practically since its inception, to one crisis after another. The most successful project in a scientific sense--CERN--cannot honestly claim much current impact on the European political scene. Nevertheless, the problem is not at all restricted to *scientific*

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[58] An unsuccessful example, of course, might discourage such efforts.

cooperation. A large dose of economic integration, accomplished through the Common Market, has failed to produce any perceptible movement toward European political unity and even a casual look at the recent policies of the major European governments suggests that nationalism--or at least the assertion of national self-interest--has grown rather than declined over the past decade.

The tyranny of reality--that "the nation-state is still here and the new Jerusalem has been postponed"--is analyzed with considerable insight in the above-quoted article by Hoffmann.[59] Read together with Scheinman's analysis of EURATOM, this paper provides the elements of an understanding of what has, in fact, occurred in Europe. Hoffmann speaks of a "logic of diversity" in the national situations of the various European countries, and describes the events of the past 15 years as a race between the logic of integration (in the functionalist model) and the logic of diversity. Three main features govern the European political arena in Hoffmann's analysis: (1) the temporary demise of nationalism following World War II, (2) the political collapse of the old Europe, and (3) the balance of terror between the United States and the Soviet Union. Under these conditions, in the late 40's and 50's, countries with diverse national situations were temporarily allied in their joint desire (although for divergent reasons) for European integration. As the situational allowed, however, the diversity of motives which the countries brought to integrative efforts emerged, and the logic of diversity has apparently won the race.

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[59] Hoffmann, "Obstinate or Obsolete?", p. 863.

In looking critically at functionalist theory, Hoffmann observes that the logic of diversity "sets limits to the degree to which the 'spill-over' process can limit the freedom of action of the governments."[60] Furthermore, it restricts the domain of functional integration to welfare activities. In essence, the logic argues in favor of national preference for the relative certainties of national control rather than the ambiguities of supranational dominance. The two most important general lessons which may be drawn from the European experience with functional integration, according to Hoffmann, are that: (1) "its . . . success in the relatively painless area in which it works relatively well lifts the participants to the level of issues to which it does not apply well any more," and (2) "by trying to be a force, the [functional] bureaucracy here, inevitably, makes itself even more of a stake that the nations try to control or at least to affect."[61]

Scheinman's analysis of EURATOM provides some insights on technological aspects of integration. EURATOM is an organization in which functional integration has not only failed to foster the desired political initiatives, but has also failed to produce a viable body in a technological sense. While much of Scheinman's argument is of limited generality, a number of his points are applicable to areas of scientific and technological cooperation outside of nuclear energy.[62] First of all,

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[60] Ibid., p. 882.

[61] Ibid., pp. 887-888.

[62] See Scheinman, "Nuclear Integration," pp. 57 ff.

the restriction of EURATOM to a highly specific sector of society (nuclear energy), considered an advantage in the functionalist view, has at least one important drawback--the fact that it does not permit (as the Common Market does) intersectoral bargaining between nations. Second, the assumption that technical experts can generally reach agreement on technical grounds where politicians fail is not always valid. Particularly where the subject matter is hardware-oriented (technological) rather than knowledge-oriented (scientific) and the economic costs and payoffs are high, technical experts from different nations have a tendency (illustrated by Scheinman for specific cases in EURATOM)[63] to act very much like politicians. Third, the rapid change which is so characteristic of modern technology may decrease the willingness of nations which see themselves as less advanced in certain technological areas to make short-term concessions. Although trading such concessions is often necessary in the functional process, fear of falling farther behind in a vital technology might well prove an inhibition for a concerned nation.

Perhaps Scheinman's most general point is that cooperative ventures in scientific/technological fields cannot have real effects on political integration without becoming politicized themselves. In the functionalist sense the beauty of employing scientific cooperation for the furtherance of political integration hinges on the international, non-political nature of science. This non-political condition can only obtain when the science is seen by national governments as being essentially irrelevant

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[63] Ibid., pp. 63-64.

to vital policy goals. Where it becomes relevant, Hoffmann's logic of diversity is likely to prevail.

4. International Scientists: A Bridge Between Ideal and Reality?

The political role of large scale international scientific cooperation--international laboratories in particular--appears then in something of an ambiguous situation. On paper such cooperation is an ideal instrument for fostering European (and potentially wider) integration through the functionalist model. In reality, although some international laboratories seem to work better than others, the functional approach itself appears to be severely flawed. Nevertheless these laboratories will continue to exist and the future will surely bring demands for more of them, for as Salomon points out,

> . . . intergovernmental co-operation in science and technology is the only way in which the European countries can at the same time concentrate resources and avoid being eliminated from the game.[64]

And in their operation, with or without the benefit of functionalism these laboratories will, by definition, play some political role.

There are innumerable ways to attack the problem of studying this role. This study has chosen to do so through a direct and empirical examination of the attitudes and behavior of the scientists and engineers who comprise the professional population of these laboratories. Such an approach is sure to leave unanswered many highly interesting and even vital questions. As a point of entry, nevertheless, it has a number of

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[64] Jean-Jacques Salomon, "Feasibility of Multilateral Co-operation," Nature, CCXVIII, 5144 (June 1, 1968), p. 819.

significant merits.

The political role of the international laboratories may be conceptualized as depending upon two sets of factors: (1) those which relate to the performance of the laboratory as a scientific or technical institution, (2) those which relate to the political performance of the laboratory in the sense of the functional model. Obviously, the first set of factors, concerning the performance of the laboratory as a scientific institution, is important from many points of view. It is not unreasonable to suppose that the laboratory's international character may influence the behavior of its scientists. In the words of Salomon,

> The working together of scientists from different countries in one laboratory certainly poses difficulties which should not be minimized: the diversity of their training, languages and attitudes is not the most favourable factor for communication (even scientific) or for the efficiency of an enterprise . . . In this connexion, it is to be regretted that there has been no research carried out in Europe on the behaviour of scientists in an international laboratory and the organizational and 'ecological' factors affecting their creativity.[65]

Internationalism is more than an abstract principle in these laboratories; it is a fact of daily life whose consequences must continually be reckoned with. By looking at the scientists as they operate in this new environment, as they weigh its assets and liabilities, and as they react to it as a professional but also personal experience, one may get some feeling for the scientific potential and limitations of international laboratories. Through this same process, in learning who the scientists are, from where they have come, and where they are going (or hope to go),

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[65] Ibid., p. 821.

the possibility of relating these research establishments to the broader institutional structure of science and technology in Europe presents itself.

In terms of the second set of factors, the scientists and engineers in international laboratories behave not only as their professional roles dictate, but also, in varying degrees, as political animals. One of the more interesting aspects of the functionalist approach lies in its projection of a developing elite, committed to the ultimate goal of political integration. There is evidence to suggest that strong Europeanist orientations do develop among many high level officials (both in national and international positions) who have participated in functionally integrative activities. Lindberg, in a study of policy-making on agriculture in the Common Market, reports:

> Among the 38 high national agriculture officials interviewed, there appeared to be a striking similarity of outlook . . . A return to a strictly national approach was considered impossible by most, and unthinkable or highly undesirable by all.[66]

He attributes such Europeanist attitudes to participation in the system:

> Our analysis has revealed the extent to which civil servants become socialized into the Community system by virtue of their intense participation in it over time.[67]

It is perhaps in this respect that an investigation of the behavior of the scientists--and the attitude structure which determines and characterizes this behavior--can be conceived of as a bridge between the

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[66] Leon N. Lindberg, "Decision Making and Integration in the European Community," International Organization, XIX, 1 (Winter 1965), p. 72.

[67] Ibid., p. 76.

functionalist ideal and the more mundane reality. To what extent does the scientists' behavior represent, as one scientist claimed, "all the problems of Europe in a microcosm"? Or is there, rather, within these international communities a broad consensus on the major European issues? How, finally, do the scientists' attitudes develop over the time they spend in the laboratory? In any case, with or without functionalist theory, the future political role of such laboratories and their internal political climates are intriguing subjects for study.

In sum, then, both as scientific institutions *qua* scientific institutions and as part of the political scene in Western Europe, international laboratories are worthy of investigation. Their existence, based on the needs of science and facilitated by the international character of science itself, creates opportunities for science as well as for broader segments of society. The degree to which they will live up to these opportunities depends in part on how much is known about their performance to date. While it does not propose to provide any final answers to the questions at hand, this thesis undertakes to begin the asking process.

CHAPTER II

THE STORY OF THIS STUDY

The idea of studying international laboratories and the scientists who inhabit these laboratories began to take shape in the Fall of 1965. A developing interest in problems of science and international affairs was shaped by an opportunity to work with some of the data from a large survey of the political attitudes of European elites. This intersection of ideas eventually came to focus on a study of international scientific laboratories which employs the tools of survey research.

A. The Genesis of an Idea

The study with which the author had the good fortune to become acquainted in the Fall of 1965 was The European Elite Panel Survey (TEEPS).[1] Within the framework of this monumental decade-long project, a small army of interviewers, field directors, coders, and analysts under the direction of Dr. Daniel Lerner of M.I.T. amassed some 4,000 long personal interviews and an additional 4,000 self-administered questionnaires. Data was

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[1] For a complete report on the TEEPS project see Daniel Lerner and Morton Gorden, Euratlantica: Changing Perspectives of the European Elites (Cambridge: M.I.T. Press, 1969 in press).

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gathered in the years 1955, 1956, 1959, 1961, and 1965 from panels in Britain, France, and Germany. The panels for all years were drawn from the most influential groups in public affairs: elective political leaders, top civil servants, trade union leaders, military, clergy, and the "communication elite." These individuals were asked to articulate their views on a range of current--and often controversial--issues including such matters as East-West relations, European integration efforts, the Atlantic Community, and the arms race and disarmament. Although a great deal of analysis on parts of the survey had been done over the years, the Fall of 1965 marked the beginning of the final analytical stage: all the material had been collected and the time had come to take an overview of the complete data set.

At various times during the research on TEEPS, special panels covering particularly interesting groups which did not fit into the main panels were added to the study. One such side panel comprised, in 1956, a mail questionnaire to the presidents of France's largest corporations. Another, this one in 1965, included respondents from high levels in the bureaucracy of the European Community in Brussels as well as members of the European Parliament in Strasbourg. The side panel which we found to be of particular interest was a 1965 group composed of scientists and engineers at CERN--the European Organization for Nuclear Research at Geneva.

The roughly 100 self-administered questionnaires which were collected at CERN by Dr. Vidya Joshi (under the direction of Dr. Lerner) asked many of the same questions which had been posed to the main elite panels in 1965. In addition, the data included some 70 loosely structured interviews with CERN personnel, in which the respondents discussed their personal backgrounds, some general aspects of their political views, and their experiences at and impressions of CERN. The author had the opportunity to do a number of small-scale analyses of this data in the form of term papers, research memos, etc. The results of the most important of these analyses, in which the political attitudes of CERN scientists were compared with the attitudes of the other elites, were summarized briefly in Chapter I.

The data from CERN presented a tantalizing picture--it raised questions which it was not capable of answering. For one thing, these scientists were clearly highly intelligent individuals and many appeared (from scattered voluntary comments written on the questionnaires and from hints in the interviews) to have well-articulated views on the political scene. Yet, aside from these comments and hints, the only expression of the scientists' views on specific issues which existed in the data were forced choices on the questionnaires.[2] Then, too, questions on the scientists' backgrounds arose--questions whose interest could not have been anticipated in the design of the CERN study. Why had these individuals chosen to come to an international laboratory? Where did they intend to go when they left? Had the international experience changed them in any way, particularly with regard to political orientation?

The CERN panel had been added to the TEEPS program for 1965 in an effort to include an important elite segment of European society whose attitudes had not previously been studied systematically. In the present

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[2]The questionnaire, in fact, was a less-than-ideal instrument, since it had been designed for use in a study of European Community civil servants.

context, interest in this panel narrowed in scope and broadened in detail. For the reasons discussed in Chapter I, the attitudes of scientists working in an international laboratory became a subject worthy of study in and of itself--independent of TEEPS. At the same time, the questions which we wanted to explore began to multiply until the central core--the political attitudes of the scientists--was enveloped in a whole matrix of problems.

B. Hypotheses

The process through which this study developed was not a neat progression from idea to hypothesis to experiment to conclusions. More realistically, there was a continual feedback and revision process through which the original ideas and hypotheses were modified as the experiment progressed. Thus, although the process is described here in straightforward fashion, it should be recognized that the novelty of the subject caused its conceptualization at the beginning to be less rigorous than we later would have liked.

At the center of the conceptual scheme was the concept of "internationalism." With regard to the present context, this notion is really rather ill-defined. Hence one object of the study was to refine the concept, at least as it applied to the political attitudes of scientists. It was tentatively decided to search for the dimensions of internationalism as degrees of identification and commitment to political entities of varying geographical scope, as well as varying scopes of activities and authority. It was hypothesized that internationalism, to the extent that one could succeed in uncovering it, should increase with the amount of time a scientist spent in an international laboratory--assuming that the international aspect of the individual's experience was positive.

On the basis of this (and on the basis of experience with the TEEPS data) it was proposed that nationality should be one of the prime variables. The hypothesis germane to this point is that the individual's political views should be determined in part by his nationality (the policies, interests, and traditions of his country) and in part by the influences of his scientific background. An interesting corollary to this would be that, under the influence of the international situation, differences in political views among various nationalities should decrease with time.

Some institutional differences in the political views of scientists at various international centers were anticipated. This might be due to a process of preselection as well as to the influence of the center's atmosphere and orientation. In particular, it was felt that scientists at organizations aimed more directly at political goals (such as EURATOM) would tend to display greater involvement with these goals (unity of the Six, in the case of EURATOM) than scientists at other organizations. On the other hand, it was believed that an overall consensus among scientists should dominate specific institutional differences.

We sought confirmation of some of the conclusions which came out of the CERN study: that the average scientist in these centers displays a substantial interest in political matters, but not a heavy emotional investment in politics; and that views converge around a "leftist" consensus. It was also hypothesized that scientists and engineers would differ in their general orientations, but we sensed difficulty in distinguishing scientists from engineers by conventional methods.

A substantial amount of interesting information was expected from the marginals[3]--essentially, the reasons for which scientists and engineers came to international institutions, the rewards they found there and the penalties they paid, their major sources of satisfaction and complaint, the sorts of connections they maintained with families and professional associates in their home countries, the difficulties they and their families had in adjusting to life as international civil servants in a foreign country, the degree to which the language barrier interfered with technical work. All of these questions were not difficult to answer in principle, but had never been asked of "real live people." Overall, we felt that this was a novel area of exploration; we would need to deal flexibly with our hypotheses, and while maintaining order and purpose, intentionally introduce some of the elements of a fishing expedition. On this basis, the problem of research design was attacked.

C. Methodology: Experimental Design and Data Collection

The results of an experiment are determined by the particular aspects of the general problem at which the experimenter chooses to look, by the instruments he employs, by the skill with which he employs these instruments, and by the judgement which he uses in interpreting his data. As survey research experiments are not usually replicable in the sense of physical or life science experiments (or even controlled laboratory-situation behavioral science experiments) it is even more essential in survey

[3]For the benefit of those readers not familiar with survey research terminology, the term "marginal" is used throughout to describe a simple tabulation of the number (or percentage) of respondents who gave each of the possible responses to a given question in multiple-choice format. For example: 60% "yes," 30% "no," and 10% "don't know" (DK).

research that the experimenter report fully on his methods, so that the reader can properly evaluate the experimenter's conclusions. In this section as well as the next, therefore, we shall outline our procedures in some detail.

1. Site Selection

Several alternative routes appeared to be open for dealing with the questions in which we were interested. We had the options of: (1) going as deeply as possible into the CERN data without gathering any more; (2) attempting to gather additional data from CERN to supplement the original material; (3) attempting to replicate the study at CERN with a refined instrument; (4) carrying out a similar study with a refined instrument (or the original instrument) at another international laboratory; or (5) performing a study of several laboratories (including CERN) with a new instrument. The reader, recognizing the tone of such an enumeration, probably found it lacked some element of suspense--evidently we chose the last option. By performing a study of several laboratories we hoped to obtain a larger sample of scientists of several key nationalities; we hoped to be able to assess institutional differences between the various international centers; and we hoped to obtain, over the entire sample, data on pertinent issues that were not covered in the original study.

It was decided to restrict the study to international scientific organizations which actually perform in-house research. International scientific organizations such as ELDO (European Launcher Development Organization) and OECD (Organization for Economic Cooperation and Development) were excluded chiefly because, while their international secretariats were interesting, they were administrative and not laboratory research bodies.

Scientists in their employ were performing as administrators and not researchers. The type of people and the atmosphere in these organizations were expected to differ significantly from the atmosphere in laboratory organizations. This left a relatively small field of choice. Three large centers were obvious selections--CERN, the EURATOM joint research center at Ispra, and the European Space Research Organization's (ESRO) technical center, ESTEC. They were obvious because they are by far the largest of the international laboratories, and thus could provide the most complete samples for the study. Then, too, each one of these centers represents an important establishment in a major field of "big science": high energy physics, nuclear power, and space technology. They span a range of ages: CERN, the oldest, was founded in 1954, while ESTEC came into being 10 years later. And, in addition, they are credited with varying degrees of success--CERN has achieved world renown in its field, while ISPRA has been beset by a continuous political crisis, and ESTEC has not yet emerged from its "breaking-in" period.[4]

Beyond these three large centers, under constraints of time and resources, the decision was made to include just a few of the many small establishments. ESRO presented several possible candidates, but since one was north of the Arctic Circle in Sweden (which was simply too far out of the way to visit) and two others were quite tiny, the choice was narrowed to ESDAC, the Space Data Center. EURATOM also had three joint research centers in addition to ISPRA, and although none was more

[4]We shall not discuss the laboratories in detail here as all of Chapter III is devoted to this topic.

desirable than any of the others, the PETTEN center came to be the most opportune. As our field headquarters was in Paris, a EURATOM "association" (see p. 135) in the French nuclear center in suburban Fontenay-aux-Roses was used for a small pretest. (Selection of this establishment was made purely on the basis of accessibility and convenience of location.)

Two other small centers were chosen from a range of possibilities because of special characteristics.[5] The Vienna and Seibersdorf laboratories of the International Atomic Energy Agency were chosen because of the highly international character of the organization--IAEA had 98 member states in 1967. Selection of the OECD Halden reactor project was made for a rather different reason--this project consists of an international contingent placed in the framework of a national atomic institute. The International Centre for Theoretical Physics in Trieste was also visited, but for a variety of reasons this very exciting establishment was not studied with the same methods used in the other centers and it is not included as part of this dissertation.

2. Design of the Instrument

While selecting the laboratories from which the sample was to be drawn, it was necessary as well to design the instrument which would be used to collect the data. In an effort to conserve the best aspects of two methods, we introduced something of an innovation in the experimental technique. The ideal situation would have permitted us to gather all of our survey

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[5]See OECD, International Scientific Organizations (Paris, 1965) for a fine enumeration of the various international laboratories. This book, indeed, proved invaluable in the selection process.

data through interviews. The advantages of personal interviews over self-administered questionnaires are particularly important in an exploratory study such as this. However, as the various strata within which we wished to sample dictated a substantial sample size, we saw that it was going to be necessary to use self-administered written questionnaires for reasons of economy. The decision therefore was made to employ interviews for part of the sample and questionnaires for the rest, while using as nearly as possible the same instrument. The intent was to obtain the necessary volume of respondents for meaningful analysis, while preserving the richness which only interviews could supply. A ratio of about three questionnaires to each interview seemed appropriate and manageable.

The selection of questions proved to be one of the most difficult parts of the project. Several constraints were apparent: We expected to encounter a certain amount of resistance from the subjects--on account of the tediousness of the task of filling out a form as well as suspicion of the motives of the experimenter.[6] This suggested keeping the form as short as possible and avoiding highly controversial matters. The elite nature of the population, further, made certain types of questions seem inappropriate. Information tests and most types of psychological probes were excluded on these grounds. The somewhat loosely structured theoretical base on which the study was conceived and the character of the political attitudes in which we were interested dictated that the political questions

[6]The problem of being an American doing political research abroad was compounded by the CIA scandals which broke in the press shortly before the data collection was to begin. In fact, the resistance encountered was rather less than anticipated.

conform more to the pattern used in the TEEPS project (more or less poll-style questions) rather than to more sophisticated social science scales.

Under these constraints a list of questions was drawn up, ordered into an interview format, and pretested through a series of seven interviews in the Paris area.[7] Several items were added, several deleted, and a number modified as a result of this pretest, but the basic list of questions remained relatively stable. Subsequently, the list of questions was rearranged and converted to a self-administered questionnaire format. This form, printed in English, was pretested (with about 20 respondents) at ESTEC, the first large laboratory visited. Several revisions were made following the pretest, and the final questionnaire form, in French and German translation as well as English, was printed and used for the balance of the survey.

The actual self-administered questionnaire which was employed (English version) is reproduced in this volume as Appendix 1. It is followed, in Appendix 2, by the list of questions used in the interviews. The topics covered on both included, generally: nature of present work; professional background; personal background; reactions to international experience; ties with home country; views on current topics such as (1) the "technological gap," the "brain drain," and the "space race," (2) European economic and political integration, (3) military problems, including nuclear weapons, and (4) East-West relations. The questionnaire was 14 1/2 pages long, incorporating 63 amply-spaced questions. It was organized into four sections: Professional Background, Current Experience, Current Issues,

[7]The author, for a period of four months during which the preparations and preliminary stages of this project were executed, resided in Paris.

and Personal Background. A covering letter (see Appendix 1 for text) frankly explaining the purpose of the study--"a study of the experience and effects of working in an international scientific organization"--and introducing the experimenter was printed on the front. Most of the questions were of the multiple-choice variety; often "yes" and "no" were the choices proffered. The form was anonymous, and the average time needed for its completion was on the order of twenty to thirty minutes.

The interview was designed to run about one hour. All questions were asked in an open-ended form, with the respondent being free to interpret and answer them as he pleased. All of the interviews were carried out by the writer or his wife (who served as a research assistant on the project). Hence, because the interviewers were not simply "hired-hands," it was possible to allow more flexibility than is customary in structured interviews, and questions were sometimes added and sometimes omitted as the situation seemed to require.[8] The interviews were tape-recorded with the subjects' knowledge and verbatim transcripts of each interview were typed. Nearly all of the interviews were conducted in English--occasionally switching into another tongue for clarification--with the exception of three which were carried out in French.

3. Operational Procedure and Sample Selection

A sample size of about 400 was chosen. This figure was arrived at by taking a smallest cell size of 10 respondents and multiplying it first by

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[8]Omissions were caused chiefly by time pressure or by the fact that the respondent had already covered the particular question in response to a previous question. A number of questions were developed and experimented with as the study progressed.

4 (for the number of laboratories: ESTEC, CERN, ISPRA, and "other"), then by 2 (for the time-spent-in-laboratory variable: high and low), and finally by 5 (for the nationalities: British, French, German, Italian, and "other").[9] This meant about 300 questionnaires and 100 interviews according to our scheme. We estimated 100 respondents at each of the three large laboratories, with the remainder to be divided up among these smaller centers.

During the preparatory stages of the project, arrangements were made to gain access to each of the selected centers. This was by no means a trivial task and it occupied a substantial amount of our time. We decided to abandon our Paris headquarters in the Spring and perform the entire data collection job in one manic sweep lasting from mid-April through the end of July (1967), and covering, geographically, most of the map of Western Europe. This plan allowed for a visit of approximately three weeks at each of the large centers, and about one week at each of the smaller ones.[10] Travelling between the laboratories involved well over 3,500 miles of driving. The relative positions of the various centers are shown on the map of Western Europe in Figure 2.1. The numbers by which the laboratories are designated indicate the sequence in which they were visited. Each visit was a period of frenzied activity--interviewing, distributing

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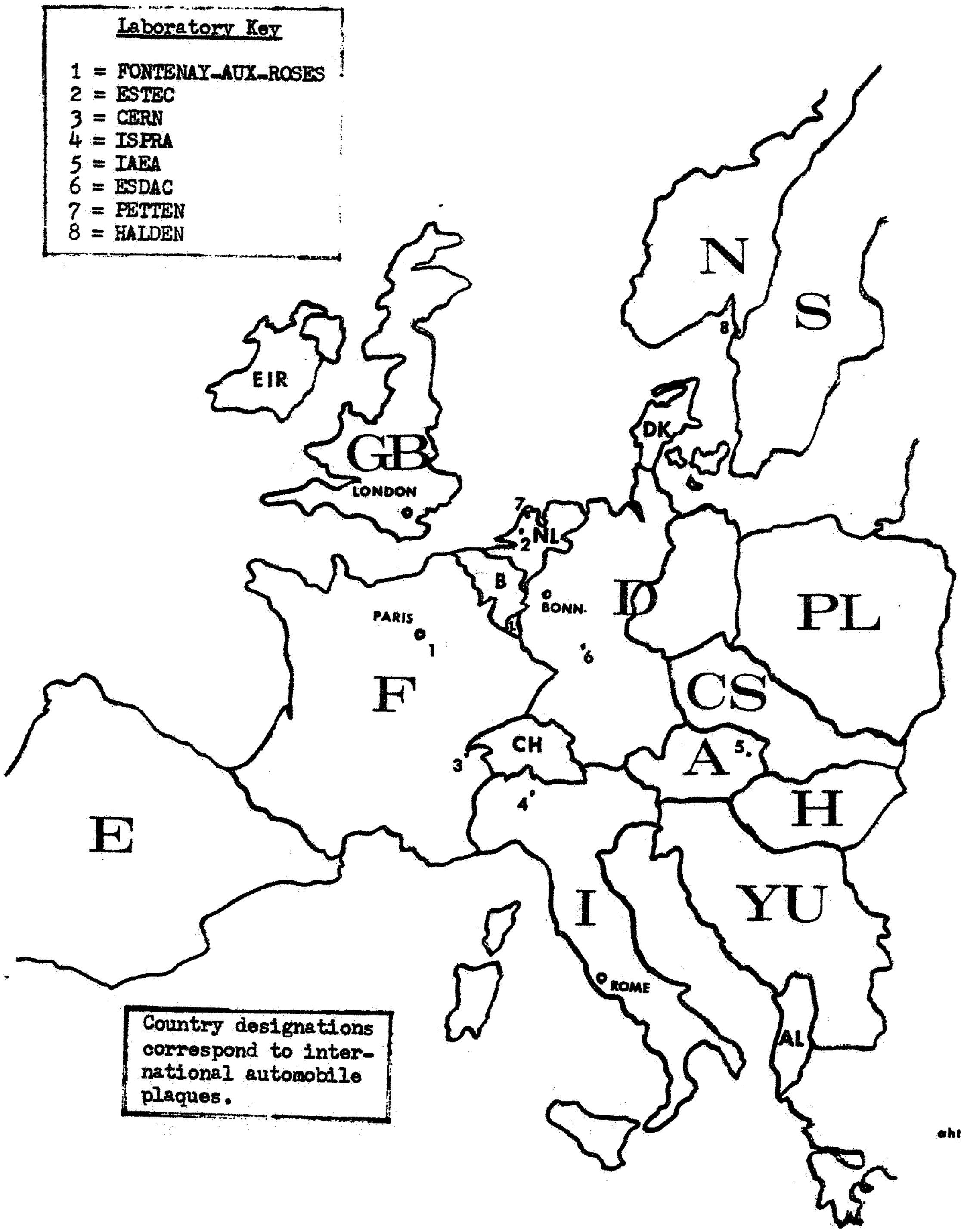
[9] It should be noted that the data processing system employed in our analysis is an extremely flexible one, allowing great facility of division and recombination. Hence most of the analysis deals with cells much larger than this basic figure.

[10] ESTEC, where the questionnaire pretest was done, was revisited for an additional week in July, in order to augment the sample.

Figure 2.1

Map of Europe, Showing Laboratories Visited



and collecting questionnaires, as well as organizing the data, while at the same time trying to observe and absorb as much as possible of the environment.

Essentially, what was done after arriving at a laboratory was to arrange for the individual who was handling our visit[11] to introduce us to division and department heads. From here, personal introductions to lower echelons were sought, and through these introductions we scheduled interviews and personally distributed questionnaires. Two things are noteworthy with regard to this mode of procedure: (1) the sample was not derived through conventional random selection operations, and (2) personal contact was utilized extensively at all levels.

That random selection methods were not used resulted from the fact that they were deemed neither necessary nor practical. We chose to set quotas for the four large nationality groups and accept smaller numbers of the other nationalities, rather than making the sample correspond strictly to the percentage composition of the labs. As the population was limited to professional grade employees of the several centers selected, its magnitude was not large relative to the projected sample size. We estimated the total number of potential respondents at slightly more than 2,000.[12] Discounting this figure somewhat to account for the fact that

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11 The position of this individual varied from one establishment to another, ranging from the head of the center in one place to a representative of the public relations office in another.

12 Table 3.1 in the next chapter gives the figures from which we arrived at this estimate.

some of the potential respondents would be ineligible on the grounds of their nationality, we could conclude that a sample of about 400 would represent between 20% and 25% of the total population. In view of this percentage, and the fact that the procedure, which consisted of sampling through a sequence of personal introductions, contained no apparent bias, we decided that the gain from attempting to obtain complete lists of potential respondents and selecting people from such lists by random methods would not be worth the cost of such a procedure. Our decision was reinforced by the fact that such lists (including names, nationalities, and professional grades) were not readily available in the centers, and attempting to compile them would have infinitely complicated our task. Finally, the agreements which we made with the administrations of the various centers--which were not in all cases overly enthusiastic about allowing us to poke about asking political questions--stressed that each individual's participation in the study would be purely voluntary, and we saw personal distribution and collection as a means of optimizing responsiveness under these circumstances.

The personal contact upon which our method depended also provided several benefits. The sanction which was gained through being introduced by one friend to another or by a division or group leader to a member of his or her staff proved invaluable in gaining the confidence of subjects. The fact that we returned--several times if necessary--to collect a questionnaire from each subject to whom we had given one also gained us many responses which we would have otherwise lost on account of the respondent's laziness or forgetfulness. The fact that we actually took the trouble to meet and speak with each respondent also convinced them of our sincerity, and in many cases encouraged a substantial commitment.. One piece of evidence supporting this assertion is the response rate obtained. Although exact counts were not kept owing to the non-list procedures described above, we estimate that roughly 90% of the subjects who were approached agreed to participate (either by being interviewed or by completing a questionnaire). Among those who took a questionnaire, about 90% actually returned a completed form. Not one interview appointment was ever broken (although a few were postponed for a day or two).[13] Furthermore, the subjects' commitment was demonstrated by the fact that a large percentage of the questionnaire recipients took advantage of the space allowed for voluntary comments and wrote extensively, and by the fact that interviews designed to require no more than one hour, averaged about one and a quarter hours (they ranged from 35 minutes to over 3 hours).

D. Methodology: Data Reduction and Analysis

The total sample obtained, after elimination of duplicates[14] and the few people of non-professional grade who managed to creep in, came out to 384--slightly lower than the projected 400. Of these, 279 were

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[13] In contrast, another American student who distributed a somewhat more complex questionnaire by internal mail at ISPRA about one month after we left achieved a response rate of about 10%. (Michael Useem, "Scientific Normative Orientations and Research Methodologies" /unpublished paper, Department of Social Relations, Harvard University, 1967/). Of course his results may well have been skewed by our activities.

[14] A few individuals insisted on filling in questionnaires as well as being interviewed. In such cases only the questionnaire was included in the sample and the interview was used to check coding consistency, as well as for qualitative analysis.

questionnaires and 105 were interviews. The distribution by nationality, laboratory, and seniority is shown in Chapter IV, Table 4.1. There was a certain unevenness in the distribution of nationality and seniority across the laboratories, the reasons for which are discussed in Chapter IV.

1. Coding

The interviews were treated in two ways: First, they were analyzed qualitatively by thorough reading of the typescripts of the tapes. This process yielded many ideas which were used in more quantitative analysis, as well as the numerous quotations used in Parts Two and Three of this thesis through which we hope to convey to the reader the flavor of the respondents' own feelings. Second, the free-flowing responses were reduced to categories, coded along with the questionnaires, and analyzed numerically. This was a two-step process. In reducing the free responses to categories, an interview transcript was actually transposed into a blank questionnaire. A multiple-choice answer corresponding to the sense of the open-ended response was marked and a comment was written in when appropriate. The coding of the entire sample of 384 was then effected, treating these "questionnaires" along with the others.

In order to compile a codebook incorporating the comments as well as the closed responses, we took a sample of all the comments from 35 randomly-selected questionnaires, typed these on index cards, and sorted the comments for each question into empirical categories. Comment codes were not always mutually exclusive, but they simply sought to reflect, as unambiguously as possible, the most frequently used comments. The codebook was then written considering the closed response categories and the comment categories as separate items. Figure 2.2 illustrates a sample codebook entry. Using ADMINS (see below), this allowed us to treat the data either including or excluding write-in comments, for any particular piece of analysis. All coding was done by the writer and his wife/research assistant and double-checked; the IBM cards which were punched from the code-sheets were verified to eliminate punching errors.

2. Analytic Techniques

After having been punched on IBM cards, this sizable data set (some 1,500 cards) was ready for computer analysis. The main quantitative tools which were employed in the analysis were marginal distributions of the frequency of responses to questions, and cross-tabulations,[15] as well as some simple scales and indexes based on combinations of questions. Rather than utilize "canned" programs on batch processing to carry out such operations, it was decided to use a new on-line computer system for the treatment of social science data, which has been developed and implemented on the M.I.T. time-shared computer system. Called ADMINS, this system is sufficiently novel to be worth a few words of explanation.[16]

The philosophy of the ADMINS system is based on the premise that the relationship between the social scientist and the computer should be interactive. This means that the social scientist should be able to put a question about his data to the computer as he thinks of it; receive an answer

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[15] A "cross-tabulation" of two questions, one with possible responses A and B and the other with possible responses C and D, would show, in a 2 x 2 table, the number (or percentage) of respondents who answered A to one question and C to the other, as well as A and D, B and C, B and D.

[16] The next two paragraphs are adapted from Lerner and Gorden, Euratlantica, Annex 7, to which this author contributed.

Figure 2.2

Sample Codebook Entry

CARD 3

Column

7 Q3-8a Would you approve the integration of a major part of your own country's armed forces into a permanent supranational force?

Punch

0 = Don't Know
1 = Yes
2 = No
9 = Skipped in sequence of 4 or more skips

8 Q3-8a (Comments on 3-8a)

0 = No comments
1 = Conditionally, under certain conditions
2 = Necessary element of European unity
3 = Would like to reduce size of forces
4 = Anti-armed forces
5 = Only after political integration
6 = Other

in seconds; choose his next question on the basis of the answer he has just received; put his next question to the computer and receive a prompt answer; and so proceed step by step.

Such an approach to data analysis conforms to the basic conceptual form of data-handling used by social scientists. Until recently, however, most large-scale social science data was handled by batch processing at a central computation facility, where it took hours and often days to receive one's results. Under these conditions, the analyst tended to ask a great many questions simultaneously to avoid the long delays required by serial questioning. By circumventing this problem of "turn-around time," ADMINS is designed to make the analysis a more natural and efficient process. It enables a sequence of questions to grow directly and immediately out of previous answers.

Sitting in his own office at a console--a device quite similar to a teletype machine which is connected to a central computer by telephone lines--the analyst can deal with a data set containing hundreds of respondents with the same facility of manipulation as if they were only a handful. All of the quantitative analysis, which is the backbone of this project, was done in this way on the ADMINS system.[17] It is not our object here to spell out, in a step-by-step manner, the process by which we

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[17] ADMINS was conceived quite broadly and has many uses beyond those to which we have put it. See the following monographs of the M.I.T. Center for International Studies: Stuart D. McIntosh and David M. Griffel, "The ADMINS Primer" (November 1968); S.D. McIntosh and D. Griffel, "ADMINS from Mark III to Mark V" (September 1968); Ithiel de Sola Pool, S. D. McIntosh, and D. Griffel, "On the Design of Computer-Based Information Systems" (September 1968).

arrived at the various conclusions presented throughout the balance of this work. Most of this should become clear as the reader follows the development of Parts Two and Three.

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This study occupied, from the beginning of its data collection phase through the end of its analysis phase, about two years, not including the year during which the ideas explored herein were developed and shaped into a research program. Compared to the life-times of the establishments included in the study, two years is a non-trivial period of time. In the Spring and Summer of 1967, during our wave of interviewing and questionnaire distribution, a great deal was happening in these centers. Our analysis must take into account the reasons for which these centers exist, the events which have gone into their making, and their state at the time of study. The next chapter, therefore, is devoted to these topics.

CHAPTER III

EUROPE'S INTERNATIONAL LABORATORIES

Although the laboratories included in this study share the important aspect of being international in sponsorship, their fields of work, aims, accomplishments, historical contexts, physical appearances, and atmospheres vary enormously. To consider these laboratories as completely unrelated would be to miss the essential point that in being _international_ they share a peculiar quality which sets them apart from other technological establishments--a quality of which the staffs are highly conscious. Yet, in failing to take note of the differences between these centers, one loses an important dimension along which the attitudinal data must be explored.

This chapter, therefore, outlines briefly the backgrounds of the several centers dealt with in the study, their histories, and some of the basic data needed for understanding them as they were at the time of the study. It attempts to convey the _ambiance_ of each center, using as source materials not only published items but also material from informal conversations with individuals at the centers, as well as our own personal, highly subjective, observations based on stays at these centers ranging from five days to four weeks. As ESTEC, CERN, and ISPRA are the most important international laboratories in Europe and as they provided the bulk of the survey data, their descriptions have been accorded proportionately more space and greater detail here. For reference in later chapters, Table 3.1 summarizes some of the quantitative data presented in this chapter.

A. Space Technology

Two establishments concerned with space research were incorporated in the survey. One, ESTEC (the European Space Technology Centre), is the newest of the large international laboratories. The site of most of the in-house research and engineering carried on by ESRO, it came into existence in early 1963. ESDAC, the European Space Data Centre, a smaller sister establishment to ESTEC, is charged with the task of processing the telemetry data from ESRO's space activities. Since an understanding of the character of both of these centers requires a knowledge of the development of the parent organization, ESRO, we shall begin there.

1. The Founding of the European Space Research Organization (ESRO)

ESRO had its origins in a series of informal discussions between a small number of influential Western European scientists. Concerned about the European role in the new and rapidly growing field of space research, and encouraged by the success and prestige of CERN, this group (several of whose members had been involved in the early stages of CERN and also in EURATOM) developed the basic concept of a joint European space effort.

Table 3.1

Summary Data on International Laboratories

Laboratory Acronym	Laboratory Full Name	Parent Organization	Location	Main Functions	Date of Origin	Staff S&E	Staff Total	1967 Budget	Members[a]
ESTEC	European Space Technology Centre	ESRO	Noordwijk, Neth.	Payload design & integration. Space related research.	3/63	343	525	$48mil[b]	10 (B,DK,F, D,I,NL,E,S, CH,GB)
ESDAC	European Space Data Centre	ESRO	Darmstadt, Ger.	Reduction of telemetry data; orbital calculations; programming.	2/64	~25	53	$48mil[b]	10 (B,DK,F, D,I,NL,E,S, CH,GB)
CERN	European Organization for Nuclear Research	CERN	Geneva, Switz.	Fundamental research in high-energy nuclear physics.	9/54	~800	2350	$40mil	13 (A,B,DK, F,D,GR,I,NL, N,E,S,CH,GB)
ISPRA	EURATOM Joint Research Center at Ispra	EURATOM	Ispra, Italy	Applied research on nuclear reactors & associated work.	3/61	~600	1700	$17mil[c]	6 (B,F,D,I, NL,L)
PETTEN	EURATOM Joint Research Center at Petten	EURATOM	Petten, Neth.	Reactor & nuclear materials research.	11/62	~60	176	$5mil[c]	6 (B,F,D,I, NL,L)
IAEA	International Atomic Energy Agency	IAEA	Vienna & Seibersdorf, Austria	Chiefly radioisotope applications.	1960	~30	50	$0.2mil[d]	98
HALDEN	OECD Halden Reactor Project	OECD/ENEA	Halden, Norway	Operation of heavy boiling water reactor; on-line computation.	7/58	40	160	$1.2mil[e]	7 (DK,SF,NL, N,S,CH,GB)

Notes: [a] Key to country abbreviations-- A=Austria; B=Belgium; D=Germany; DK=Denmark; E=Spain; F=France; GB=Britain; GR=Greece; I=Italy; L=Luxembourg; N=Norway; NL=Netherlands; S=Sweden; CH=Switzerland.

[b] Budget for all of ESRO. Not available for separate establishments.

[c] Five year (1963-1967) budget divided by five.

[d] Estimated.

[e] Three year (1964-1966) budget divided by three.

At a COSPAR[1] conference in January 1960, Professor Pierre Auger of France became the "promoter" of the ESRO idea, and, within a few months, the governments of several nations, including notably Britain and France, had become sufficiently interested to warrant the holding of more formal meetings and the establishment of a study committee.

On November 28, 1960, official delegates from ten nations (Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom) met at Meyrin, Switzerland (site of CERN) to develop the formal structure of the organization. Unable to agree on a wide range of basic issues, including whether the organization should concern itself with just space craft or both space craft and launch vehicles, the delegates finally concluded a formal agreement to establish a preparatory body, known as COPERS (Commission preparatoire europeen pour la recherche spatiale). This body produced a Convention establishing ESRO, which was opened for signature in Paris on June 14, 1962.

The organization, through a long and somewhat painful birth, lost valuable time with respect to other space activities. Although COPERS was intended to last no more than a year, it was necessary to extend its agreement, in all, four times because the ESRO Convention did not come into force until, on March 20, 1964, it was finally ratified by the required

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[1] COSPAR is the Committee on Space Research of the International Council of Scientific Unions.

number of states.[2] National space research in the United States, the Soviet Union, and several of the ESRO member-states was progressing rapidly during the 1961-1964 period, while the embryonic ESRO project more or less marked time. COPERS, through its small secretariat and working groups, devoted itself to the recruitment of a staff nucleus, the planning of scientific and technical activities, and the development of organizational policies during this period.

2. Development Since 1964

The purpose of ESRO, according to Article II of its Convention, is "to provide for, and to promote, collaboration among European States in space research and technology, exclusively for peaceful purposes."[3] To this end, the Convention provides that ESRO may:

a. design and construct sounding rocket payloads, satellites and space probes, carrying instruments provided by Member States or by the Organization itself;

b. procure launching vehicles and arrange for their launching;

c. provide means for the reception, collection, reduction and analysis of data;

d. support research and development as required for its programs;

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[2] The nations which ratified the Convention and are therefore member states of ESRO include: Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, Switzerland, and the United Kingdom. Austria and Norway, signatories to the original agreement, failed to ratify the Convention, but were granted observer status by the ESRO Council. In December 1967, the Spanish government notified the Council of its intent to withdraw from the organization, but it later agreed to remain in by means of a complex financial arrangement.

[3] European Space Research Organization General Report 1964-1965 (Paris, 1966), p. 109.

e. promote and provide for contacts between scientists and engineers, their interchange and advanced training;

f. disseminate information among Member States;

g. co-operate with research institutions in the Member States and assist in the coordination of their efforts;

h. make contractual arrangements for the use of launching ranges for rockets and satellites and other facilities available in Member or other States.[4]

ESRO is authorized in the Convention to establish several facilities including a research laboratory (ESLAB); sounding rocket launching facilities (ESRANGE); a data center (ESDAC); a tracking, telemetry, and telecommand network (ESTRACK); and a technology center (ESTEC). The formal function of the latter is "to undertake or arrange for the activities referred to /above, section a.7 and to promote and take part in advanced technological research and specific studies related to space research."[5] Implicit in the foregoing sentence, through the use of the word "promote," and certainly strong in the minds of some of the political figures connected with ESRO, was the hope that ESTEC, by contracting out much of its work, would contribute to the development of a technologically advanced European space industry--more or less "spread the wealth."[6]

The activities of the organization have been confined to the use of space craft and sounding rockets for scientific experiments in such fields

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[4] Ibid., p. 110.

[5] Ibid.

[6] See the "Report of the Group of Experts to Study the Internal Structure, Procedures and Methods of Work of ESRO" (Paris: ESRO Internal Publication, March 1967), p. 15. This document is commonly known as the "Bannier Report."

as ionospheric and auroral phenomena and cosmic rays. ESRO obtains its launch vehicles from outside of the organization and has not been occupied with such applications as weather satellites and manned space flight.[7] The original budget provided for the expenditure of the equivalent (at 1962 prices) of 1,509 million French francs ($300 million) over an 8-year period. This included funds for the construction of the establishments listed above (plus a small basic research institute, ESRIN, not specifically mentioned in the Convention), as well as an ambitious launching program of 300 sounding rockets and 10 to 12 satellites over the 8-year period.

In general, ESRO has operated as a service organization, oriented to the scientific needs of national groups. These groups, which come as units from universities or government laboratories in the member countries, propose experiments for inclusion in sounding rocket or satellite payloads. The proposals are evaluated by <u>ad hoc</u> subject-oriented working groups each composed of about a dozen eminent European scientists. Often the same individuals proposing experiments are members of the <u>ad hoc</u> group evaluating them. A Launching Programs Advisory Committee (LPAC) considers proposals forwarded from the <u>ad hoc</u> groups with respect to their scientific merit and their possible inclusion in future payloads, and makes recommendations to the Directorate.[8] Experiments which are approved and

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[7] The only departure from this policy to date has been the performance of a feasibility study for a European communications satellite, on a contract basis for another international organization.

[8] Until recently, the LPAC made its recommendations to the Scientific and Technical Committee, a subordinate of the ESRO Council. The change was suggested by the Bannier Report discussed below.

incorporated into payload plans are then designed, built, and integrated into the actual space craft by ESRO personnel or industrial contractors, in cooperation with the national team. Beyond the construction and testing stage, ESRO is responsible for launching of the payload, operation of the spacecraft, and reduction of the telemetry into data understandable by the experimenter. Thus, although this situation may change in the future, ESRO does not carry its own experiments aboard its space craft--its scientific subjects come from outside the organization.

Through the end of 1967, ESRO had launched 56 sounding rockets representing 28 different scientific payloads. Out of a total of 172 experiment proposals submitted, 39 had been launched by that time and another 33 were programmed for launch in 1968 and 1969.

At the time of our first visit to ESTEC (April 1967), the organization had not yet attempted any satellite launchings. Although the first launching attempt failed, a second copy of the same satellite (called initially ESRO-2, then renamed IRIS), which carried seven experiments concerned with solar astronomy and cosmic rays, was successfully launched by NASA in May 1968. This was followed by the successful orbiting of a similar small scientific satellite called ESRO-1 (later AURORAE) in October 1968, and a highly eccentric orbit satellite (designated HEOS-A1) in December 1968. A second HEOS satellite will also be launched by NASA. At the time of our visit ESTEC was working on two large (1,000 lb.) general-purpose satellites (TD-1 and TD-2) and a large astronomical satellite (LAS), but the former two were abruptly killed in April 1968, and the latter, which was supposed to have been placed in orbit by an ELDO vehicle, has not yet gotten beyond the planning stage.[9] The experiments on board these satellites all originated with national scientific groups, and most of the actual construction work was (and is being) carried out by industrial firms in the member countries on a contract basis.

3. Growing Pains

Numerous problems have plagued ESRO during its brief existence. Uncertainty as to the real purpose of the organization, compounded by impatience and an unwillingness to compromise on the part of member-states are at the root of these problems. The symptoms have been financial and organizational crises.

The major financial problems relate to the ESRO Council's "no carry forward" decision. Because of delays in setting up its facilities, ESRO underspent its allocation by 130 million francs during its first three-year budget period (1962-1966).[10] The Council decided not to carry this money forward to the second period; hence, money which the Directorate had felt would be available for the operational program had to be used during the second period for buildings and equipment, and the level of operations was cut back.

A lack of trust between member states was manifested clearly in the organization's original design. As in most intergovernmental organizations the supreme policy-making body is the Council, a group composed of

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[9] TD-1 has since been resurrected as a "Special Project" financed by nine of the member-states, and is scheduled for a March 1972 launch.

[10] It is perhaps characteristic of ESRO that the first 3-year budget period should be 4 years long. In a similar vein, the first ESRO satellite to be launched was designated ESRO-2, and the second was called ESRO-1.

two representatives (one diplomat and one scientist) from each member state, in which each nation possesses one vote. Here the national interests of each member state are properly represented. The administrative body is a Directorate, headed by a Director-General. The Directorate is supranational in character and its members are supposed to represent not the interests of the country from which they come, but rather those of the organization as a whole. From the time ESRO began operation, the Council was given direct responsibility for a wide range of matters, and very few things were left to the discretion of the Director-General. Rather than limiting itself to broad issues of policy, the Council and its subsidiary body, the Administrative and Finance Committee, were given responsibility for decisions on relatively minor matters.[11] The Director-General and his staff were unable to function properly as executives and were overburdened with frequent presentations before the Council and its committees.

It became evident by mid-1966 that the organization was in deep trouble, and the Council agreed to appoint a "Group of Experts to Study the Internal Structure, Procedures and Methods of Work of ESRO." Its report, completed in March 1967, and known as the Bannier Report,[12] characterized ESRO as being the victim of a "crisis of confidence." Its

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[11] For example, all contracts for sums over $20,000 placed by direct negotiation within the member states and all contracts of any amount placed outside of the member states had to be approved by vote of the Administrative and Finance Committee.

[12] From the name of the group's chairman, J. H. Bannier, former chairman of the CERN council.

major recommendation for resolving this crisis was a far-reaching reorganization, including substantial delegation of authority to the Director-General, and a limitation on the powers of the Council. The Council adopted the full report in principle and, in mid-1967--shortly after our first visit to ESTEC--began to implement many of the recommended changes.

4. The Nature of the European Space Technology Centre (ESTEC)

For a number of reasons, one could best describe the condition of ESTEC in April-May 1967 as that of state of flux. The newness of the top management (the Director, Head of Administration, and Head of Personnel had all been replaced within the past several months), the Bannier Report, which was debated by the Council and then released at the end of April, and the physical moving of the organization from its temporary quarters in Delft to its permanent site in Noordwijk all contributed to this impression.

Although ESTEC was not officially established until the organization came into being in early 1964, a staff nucleus had been working in Delft since January 1963. Nevertheless, the establishment was rather slow in reaching full operation. First of all, the site originally chosen near Delft, Holland, was found to be unsuitable because of the nature of the soil. An alternative site of some 100 acres at Noordwijk, a town on the North Sea coast about midway between Amsterdam and The Hague, was eventually agreed upon. During construction of its permanent quarters, ESTEC was given temporary space in a building belonging to the Technical University of Delft. A prefabricated building which accommodated ESLAC and part of ESTEC was also erected on the permanent site, for use pending completion of the new buildings. In October 1966, this prefabricated building was totally destroyed by a fire. It was necessary to find temporary working accommodations for the 225 displaced staff members in local hotels.

At the time of the study, ESTEC was organized into five departments:[13] Applied Research (the largest), Sounding Rockets, Spacecraft Projects, Engineering, and Administration. About half of the establishment was located in Delft at the time of our first visit. The personnel office was located in a hotel on the beach in Noordwijk, and the remainder of the establishment had already moved into the permanent buildings. At this time, ESTEC employed a staff of 464, of which 321 were considered to be of professional grade.[14]

5. ESTEC's Atmosphere

In Chapters V and VI we discuss the reactions of scientists and engineers to being placed in an international situation. In that context, quantitative data on the feelings of ESTEC's personnel toward their center are analyzed. Here we comment in a more impressionistic fashion on the atmosphere and character of ESTEC as it appeared in mid-1967.

Several themes dominate the picture. In the first place, to the extent that a single nationality can be said to give a "flavor" to an

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[13] The Bannier Report recommended several changes in this structure.

[14] Official figures as of June 1, 1967; does not include about 30 persons working for the ESTRACK Control Center, then at ESTEC, but since moved to Darmstadt.

establishment, ESTEC has a distinctly British flavor. Although the official languages of ESRO are English and French, English is used almost exclusively in both technical and non-technical conversations at ESTEC. Only in a few isolated pockets--the largest of which is in the Sounding Rockets Department--is French used as the working language.[15] About one-fourth of the entire staff complement at ESTEC is British; many are civil servants on leave from government establishments. While direct figures are not available, there seems to be disproportionate number of Britons in administrative and technical managerial posts, and this probably makes their presence even more strongly felt. Afternoon tea, a hallmark of British life, is customary at ESTEC.

The second dominant theme which strikes even the most casual observer is the general lack of intellectual excitement in the air. To a visitor accustomed to a more or less academic atmosphere, where a deep commitment to one's work is the norm, this is especially striking. Perhaps the comparison is unfair, since ESTEC is avowedly "technological" in nature rather than "scientific" and its work tends to be engineering and development (hardware-oriented) rather than research (knowledge-oriented). In any case, one feels that the atmosphere is more akin to an old and undistinguished government establishment than to, say, a university laboratory. To what extent this is due to the presence of many middle-aged British civil servants in administrative posts is a matter

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[15] In contrast, at ESRO Headquarters in Paris, French is the dominant tongue, and one suspects that some of the communications difficulties between ESTEC and Headquarters, which the Bannier Report attributes to distance, are compounded by this language factor.

for some speculation, but one suspects that there is a relationship.

There are no name people here--"technological stars" one might call them--who could attract bright young scientists and engineers. There is little after-hours work; several staff members complained that they would like to do some, but petty regulations inhibited them. Administrators, on the other hand, believed that this was not a valid complaint--there was simply very little desire among the staff to work outside of the standard office day, and those who did want to work after hours were only motivated by overtime pay.[16] There appears to be little internal professional activity at ESTEC which is not directly related to one's job. A scientist at ESLAB--the small more basic research-oriented establishment operated in conjunction with ESTEC--noted that several attempts to set up continuing ESTEC colloquia and seminars about topics in space science had failed because of lack of interest.

A third theme which pervades ESTEC reflects a general feeling that the choice of Holland as a location was a mistake, and the selection of Noordwijk compounded this mistake. The fact that ESTEC has had difficulties in recruiting staff from the Latin countries is often cited, and the character of the location is generally thought to be the chief reason. In this connection, one may note that while France pays 20% of the ESRO budget, less than 15% of the ESTEC staff is French, and while Italy pays more than 11%, less than 3% of ESTEC staff is Italian. While the location of ESTEC is not necessarily a negative factor for all c

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[16] One notable exception to this was the Control Centre group, which during our stay in April-May was in a period of frantic activity.

concerned, it is rarely a positive one.[17] Holland has some problems with overcrowded housing conditions and is not seen by most other Europeans as an especially interesting country or one with a very pleasant climate. Noordwijk in particular is a resort town of about 20,000 with virtually no cultural or intellectual life and a local population which is not especially cosmopolitan. The site on which ESTEC is located abuts a row of sand dunes, on the other side of which is the sea. Blowing sand and strong winds are constant sources of irritation. In sum, the location is far from ideal.

Of course, on the other side of the coin, one suspects that the exigencies of the location have contributed to the development of a community spirit at ESTEC. There are many organized extra-curricular activities such as bridge clubs, sports car clubs and so on, which are popular among the staff members. In a related line, there is very little integration into the Dutch community around Noordwijk. With few exceptions, the non-Dutch ESTEC personnel have only minimal contact with the indigenous population.

Overall, however, there was a great deal of hopefulness evident in the ESTEC atmosphere in Spring 1967. Everyone spoke of the mistakes of the past several years, but most were willing to attribute the bulk of these mistakes to ESTEC's "running-in" period. Several persons who had held responsible executive posts were viewed as catastrophic failures--

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[17] Except perhaps for some of the British who see Holland as the least "foreign" part of the Continent.

whether this was due to their own ineptness or constraints placed upon their offices by the organization's structure is an open question--but their replacements were looked upon more favorably. The impending completion of ESTEC's permanent buildings and the moving out of Delft were seen as important steps towards "getting settled," since in the past many man-hours had been wasted in the 45 minute commute between Noordwijk and Delft. The launching of the first satellite, giving the world the first tangible evidence of ESRO's accomplishments, was anticipated as a morale booster.[18] Finally, the Bannier Report was seen--though not by the most cynical--as giving official sanction to common gripes which "we had known about all along" and therefore providing common-sense solutions to many of the organization's troubles.

6. The European Space Data Centre (ESDAC)

The ESRO installation in Darmstadt, Germany, is now known as ESOC--the European Space Operations Center--and consists of ESDAC (the European Space Data Centre) and the ESTRACK Control Center. At the time of our visit (July 1967) the Control Center was still in Noordwijk, and ESDAC, which is responsible for the reduction of telemetered data into a form usable by the experimental groups and for the performance of mathematical

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[18] A statement of the new Director-General, Professor H. Bondi, following the successful launching of ESRO-2, testifies to this morale boost: "In every major endeavor there is a somewhat anxious and frustrating period between the decision to start work and the gathering of first fruit . . . When at last IRIS (ESRO-2) was in orbit and operating, ESRO could begin to wear a different and far more self-confident face. Our purpose is to satisfy our customers, the space scientists of Europe. To see them gathering satellite data for the first time made us all feel proud of our work and brought home to us forcefully the whole aim of our activities." ESRO/ELDO Bulletin (Paris), No. 2 (August 1968), p. 4.

work such as orbital calculations, was quite well established in its permanent building. ESDAC's chief equipment consists of an IBM 360/50H computer together with its associated hardware. The Center employs a staff of 53 persons.[19]

ESDAC was established in early 1964, and for its first two and one-half years operated in rented quarters in Darmstadt. Construction of the permanent building proceeded rapidly, and by late 1966 the computer had been installed and much of the establishment had already moved in. Structurally, the Center is divided into an Administrative Division, a Data Processing Division which handles the magnetic tapes received from the Control Center and produces tables, graphs, etc. for the experimenters, and a Data Analysis Division which does orbital calculations and programming for the analysis of observations as well as for other ESRO institutions. As the lines between the jobs of these two scientific divisions are somewhat blurred, it is not intended to maintain rigid distinctions within ESDAC.

Darmstadt is a city of about 140,000 persons located in the central part of the Federal Republic of Germany, approximately 20 miles south of Frankfort/Main. Capital of the <u>Land</u> of Hesse, it was heavily damaged in the war and has been largely rebuilt. Although the city is rather industrial (several large chemical firms and engineering works are located there) and does not have the charm of Bavarian towns, it is certainly not so grim as some of the industrial areas of northwestern

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[19] Figure for end of 1967.

Germany. There are substantial recreational and cultural opportunities--as well as a prominent Technical University--in Darmstadt and in the surrounding cities. The permanent site of ESDAC is located at the outskirts of the city, in a wooded area very near to the Hamburg-Basel Autobahn.

One gets the impression that ESRO's crises, for some reason, have not affected ESDAC as deeply as ESTEC. In part, this may have been due to the fact that ESDAC did not fall victim to such extrinsic problems as the change of site and the fire. Then too, ESDAC's relatively small size and the well-defined character of its mission may have helped to keep difficulties on a manageable scale. Of course, the time of our visit to ESDAC was two months later than our visit to ESTEC and the period of our stay was only one week, so the conditions for forming impressions were not identical.

In any case, the atmosphere in ESDAC is substantially different from that in ESTEC in a number of aspects. Although again there are many British staff members here, the German presence is also quite strong. While English is the working language, the place does not "feel" as British as ESTEC. Further, the qualities of the location are such that the need for developing a community spirit like that at ESTEC is greatly reduced. While the ESDAC staff does not seem to be genuinely integrated into the German community, it--probably owing to its relatively small size--does not appear as an alien presence in the local milieu to the extent that ESTEC does. The staff seems pretty much content with life in Darmstadt, and the main complaint about the location, voiced by several individuals, was the separation from Noordwijk and the consequent need to make frequent trips there. This situation probably changed with the removal of the Control Center to Darmstadt.

B. High Energy Physics

CERN, the European Organization for Nuclear Research, is generally recognized as the major triumph of European scientific cooperation. It is the standard to which all of the other international laboratories--fairly or unfairly--are compared. There is no question that CERN has been an outstanding success. It has maintained European high energy physics--one of the frontier fields of science--on a par with that of the United States or the Soviet Union, a feat which very likely could not have been accomplished by any one European nation acting alone.

1. The Founding of the European Organization for Nuclear Research (CERN)

Being the oldest of the major international laboratories, CERN had the distinct advantage of having been conceived at a time when the European nations were ripe for this sort of venture. An authoritative history of the events which surrounded the founding of CERN has been written by a scientist who was himself deeply involved in the process. Although, as in most such official accounts, the factors of personality whose interaction strongly influenced the course of the organization are not really treated, this paper, by the French physicist Lew Kowarski, gives us a valuable picture of the origins of CERN. Kowarski describes the conditions which led to CERN's establishment:

> The early history of CERN is that of an encounter between two drives which became operative in Europe immediately after the war: the scientists' search for new ways of acquiring large-scale equipment, and the statesmen's search for domains

> of common interest in which a joint effort could be made to produce tangible manifestations of European unity. It is hardly surprising that the branch of science in which this encounter actually took place, turned out to be nuclear physics: its newly demonstrated importance made the promotion of its claims at the same time imperative and easy.[20]

The feeling that "something" should be done in the way of European cooperation was an essential component of the atmosphere in the intellectual communities of the European countries as well as the United States after World War II. Within this framework, members of the tightly-knit community of nuclear physicists easily came to see that one of their most pressing needs was well-suited to this "something." The scientists themselves took the initiative in developing the idea of CERN. Several influential members of the international physics community--Europeans, Americans, and European expatriates living in America--began to discuss possibilities for intergovernmental action in this sphere in private talks around 1948. Kowarski cites, in addition to himself, H. Kramers (who later became head of EURATOM's ISPRA laboratory), Pierre Auger (who later was ESRO's first Director-General), and J. Robert Oppenheimer, as being involved in the first discussions. These men and other prominent scientists who soon became interested were acquainted with the academic and governmental individuals and offices who were responsible for scientific development in Europe. They were able without

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[20] Lew Kowarski, "An Account of the Origin and Beginnings of CERN" (Geneva: CERN Document, 1961), p. 1. This section relies heavily on Kowarski's paper. Robert Jungk, in The Big Machine (New York: Scribner's Sons, 1968) has presented a highly readable and rather less official version of this story which incorporates some of the personality factors mentioned above. The reader is referred to it also as a more complete background on CERN than is presented here. See especially pp. 45-62.

great difficulty to enlist the support of European-minded governmental officials.

The developing idea emerged from private discussions to become a more public matter at the European Cultural Conference held in Lausanne in December 1949. Although physics was not specifically mentioned there, a proposal was made for an international research institution in Europe.[21] I. I. Rabi of the United States repeated the call at a General Conference of UNESCO in Florence in June 1950, and the Conference passed a resolution authorizing the Director-General of UNESCO to "assist and encourage the formation and organization of regional research centres and laboratories . . ."[22] Auger, who was then Director of Natural Sciences at UNESCO, obtained funds totalling about $10,000 at a December meeting of the European Cultural Centre's (founded at the 1949 conference cited above) Commission for Scientific Cooperation. He established an office within UNESCO and appointed a board of consultants, which met three times in 1951, and in turn was able to prepare a "complete and well reasoned agenda" for a December 1951 intergovernmental conference to which UNESCO invited formally empowered delegates of the European nations. These delegates heard a plan, worked out by the consultants, for construction of two accelerators: a large one, second to none in the world, and a

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21 Kowarski, "Origin and Beginnings," p. 2. Jungk, Big Machine, p. 30, notes that such proposals were frequent in the early post-war era.

22 Kowarski, "Origin and Beginnings," Annex II. UNESCO's role in setting up CERN has been described as that of a "fairy godmother." CERN Courier (Geneva) VIII, 3 (March 1968), p. 58.

smaller less powerful one which could be built more quickly, and which would be used while the larger one was being built. Thus, instead of having to generate plans at this meeting, the delegates were presented with a concrete proposal. The proposal also recommended the immediate establishment of a provisional organization with a small budget which, in a period of a year to a year and one half, would carry out detailed planning and elaboration for the final organization. The commitment to join such a provisional organization was relatively small in financial terms and after a second meeting of the delegates in Geneva, an Agreement establishing a provisional organization was opened for signature in February 1952.

The Agreement was ratified by the required number of states within three months and the Council of the provisional organization held its first meeting in May. Professor Edoardo Amaldi was appointed Secretary-General and four study groups were created: two to handle the proposed machines, one for theoretical physics, and one for the structural framework of the organization. These groups, which by March of 1953 had acquired a staff of about 70 persons, were successful in carrying out their tasks to the extent that by June of that year a Convention establishing the permanent organization was concluded and signed by twelve states.[23]

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[23] Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Norway, Sweden, Switzerland, United Kingdom, and Yugoslavia. Austria and Spain joined in 1959 and 1961 respectively; Yugoslavia withdrew in 1961 and was granted observer status. Poland and Turkey have also been granted observer status.

Although the necessary ratifications of the signatures were not completed for fifteen months, CERN--in a manner which ESRO partially copied some years later--acted as if it already had a legal existence. During this period the Council established a provisional laboratory in Geneva, began to prepare its site, made detailed architectural drawings, and began to train a scientific and technical staff--all of which, if one takes the view that ratification was not guaranteed, was a rather expensive gamble.[24] In any case, the gamble paid off, because when CERN officially came into existence in September 1954 it was already a going concern.

Looking back at this initial period, Kowarski cites three factors which were important in its successful outcome:

> 1) Ambitious and sharply-defined objectives were aimed at from the very beginning. . . .
>
> 2) Scientific and technical experts participated at all stages of organizational planning, and not merely were called in 'to perform' in a framework not of their making. . . .
>
> 3) It was recognized that the inevitably modest initial pace of even a very big project could be financed on a modest scale and in an unassuming legal framework; thus, an initial stage could be run _concurrently_ with the full-scale legal building-up, instead of waiting for its completion.[25]

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[24] Kowarski, "Origin and Beginnings," pp. 10-11. In contrast, the 3-year delay in ratification of the treaty establishing another European organization (ELDO) has been cited as one of the main reasons for the organization's lack of effectiveness. See Robert L. Pfaltzgraff, Jr., and James L. Deghand, "European Technological Collaboration: The Experience of the European Launcher Development Organization (ELDO)," _Journal of Common Market Studies_, VII, 1 (September 1968), pp. 22-34.

[25] Kowarski, "Origin and Beginnings," p. 14.

2. "The Big Machine"

CERN's purposes are very clearly spelled out in its Convention. Article II states that:

> The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available.[26]

The Convention further defines the basic purpose of the Organization as:

> (a) The construction of an International Laboratory . . . for research on high energy particles, including work in the field of cosmic rays. The Laboratory shall consist of:
> (i) a proton sychrotron for energies above ten gigaelectronvolts (10^{10}eV);
> (ii) a synchro-cyclotron capable of accelerating protons up to, approximately, 600 million electron-volts ($6X10^{8}$eV);
> (iii) the necessary ancillary apparatus . . .
> (iv) the necessary buildings . . .
>
> (b) The operation of the Laboratory specified above.
>
> (c) The organization and sponsoring of international cooperation in nuclear research, including co-operation outside the Laboratory . . .[27]

Provision is made for expansion of the program, providing two-thirds of the member states concur.

CERN has operated for 14 years in accordance with the aims set out in the Convention.[28] The "new-born" organization had a total staff of

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26. "Convention for the Establishment of a European Organization for Nuclear Research" (Geneva: CERN, 1953), p. 1.

27 *Ibid.*

28 At the December 1967 meeting of the Council, a revised version of the Convention, incorporating provisions for the proposed 300 GeV accelerator, was presented to the governments of the member states.

120 (excluding fellowship holders and occasional consultants) and sufficient funds to operate comfortably. Construction of the accelerator began shortly and a full beam was produced on the 600 MeV synchrocyclotron (the smaller machine) for the first time in April 1957. Many experiments were performed on the synchrocyclotron while construction of the larger machine proceeded, and on November 24, 1959, the 28 GeV proton synchrotron became operational. From this time forward, CERN has been among the foremost high energy physics centers in the world. At the time of this study, the capabilities of CERN's "big machine" were matched only by the machines at Brookhaven National Laboratory in the United States and Dubna Joint Institute for Nuclear Research (JINR) in the Soviet Union. Since that time a 76 GeV proton synchrotron has become operational at Serpukhov, U.S.S.R.

Professor Victor F. Weisskopf, former Director-General of CERN, summed up the accomplishments of his laboratory:

> A number of discoveries of fundamental character were made, which had significant influence on the development of physics . . . the establishment of the electron-neutrino decay of the pion was done quite early with the small machine; the exact determination of the magnetic moment of the muon; the radioactive decay of the charged pion into the uncharged pion; the discovery of a number of boson and baryon resonances and their properties . . . the first observation of the so-called shrinking of the diffraction peak in proton-proton scattering of high energy; the detailed investigation of neutrino-induced reactions. Thus CERN has established itself quickly as a center of research comparable in importance to the U.S. centers at Brookhaven and Berkeley.[29]

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[29] U.S. Congress, Joint Committee on Atomic Energy, High Energy Physics Research: Hearings Before the Subcommittee on Research, Development, and Radiation, 89th Cong., 1st Sess., 1965, p. 242.

The original staff of 120 grew by a factor of greater than seven during the first five years of CERN's existence, and by the time of our visit, in May 1967, there were about 2,300 staff members employed at CERN and about 400 visiting scientists working there. CERN's early budget estimates called for the expenditure of about $30 million over a seven-year period. Costs, of course, went beyond that, and it is reported that total expenditures between 1952 and 1960 (mostly for construction of the two accelerators) were approximately $56 million.[30] The 1955 budget was about $5.8 million.[31] By 1967, the annual budget had grown to $40 million (not including supplemental programs). Each member nation contributes to this budget according to a formula based on the national incomes of the members.

CERN has striven to keep its research facilities up to date. A large 2-meter hydrogen bubble chamber was built and is used in conjunction with the proton synchrotron. Although it encountered some problems in early operation, it has provided several million photographs of track chamber events for researchers to analyze. The Accelerator Research Division, working with a study group concerned with future projects, developed plans for a set of intersecting storage rings, which will greatly increase the effective power of the proton synchrotron. The

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[30] Warren B. Walsh, Science and International Public Affairs (Syracuse, N.Y.: The Maxwell International Relations Program of Syracuse University, 1967), p. 25.

[31] 25 million Swiss Francs. First Annual Report of the European Organization for Nuclear Research (Geneva, 1955), p. 53.

rings are presently under construction. This is a large project and it required a formidable investment and expansion of the CERN site. Other current improvements on the proton synchrotron include systems for increasing the intensity of the proton beam and increasing the repetition rate of the machine. CERN's leaders have also been very active in the European Committee on Future Accelerators which is concerned with establishing a "CERN II"--a giant 300 GeV accelerator more powerful than the American device being constructed at Batavia, Illinois.

3. CERN's Structure and Mode of Operation

Like ESRO, CERN is governed by a Council on which each member state has two delegates (one scientist and one diplomat/administrator) and one vote. The Council is responsible for determination of the Organization's policy in scientific as well as technical and administrative matters, controls the budget and expenditures, and staff appointments and dismissals. Most decisions are taken by a simple majority vote, except for staff appointments and dismissals and changes in the scale and amount of financial contributions of the member states, which require a two-thirds majority.

Subordinate to the Council are the Committee of Council--the "steering" committee of the organization between Council meetings--whose chairman is the President of the Council, as well as the Finance Committee and the Scientific Policy Committee. These committees are not specifically mentioned in the Convention, but were created by the Council through its authority to "establish such subordinate bodies as may be necessary for the purposes of the Organization."[32]

A Director-General, appointed by the Council, is the chief executive of CERN. For many years he operated with the assistance of a directorate consisting of four members (one each for research, applied physics, technical management, and administration), and supervised the operation of eleven divisions. In June 1966, however, the Council approved the Director-General's plan for internal reorganization, and as a result of this, the Directorate was eliminated and the divisions were placed under seven administrative departments.[33] Table 3.2 (see following page) lists the departments and the subordinate divisions within this structure, which was in operation at the time of our visit to CERN.

According to the 1966 Annual Report, "The Director-General and the Directors of Departments now form a Board of Directors. The Board deals with all important problems connected with the running of CERN and assists the Director-General in taking the necessary decisions."[34] Although this reorganization seems to be aimed towards reducing the direct power of the Director-General, and increasing the coordination between divisions, most CERN people do not seem to feel that it will make a great deal of difference in the operation of the organization.

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[32] "CERN Convention," p. 24.

[33] CERN Annual Report 1966 (Geneva, 1967), p. 16.

[34] Ibid., p. 1[illegible].

Table 3.2

Structure of CERN

Physics I Department	
	Nuclear Physics Division (NP)
	SC Machine Division (MSC)
Physics II Department	
	Track Chambers Division (TC)
Theoretical Physics Department	
	Theoretical Studies Division (TH)
Proton Synchrotron Department	
	PS Machine Division (MPS)
	Nuclear Physics Division (NPA)
Applied Physics Department	
	Data Handling Division (DD)
ISR Construction Department	
	Intersecting Storage Rings Division (ISR)
	Accelerator Research Division (AR)
Administration Department	
	Finance Division (FIN)
	Personnel Division (PE)
	Technical Services and Buildings Division (SB)

It is worth noting that, in comparison to ESRO and EURATOM, CERN is a very loosely organized body. People are not overly concerned with the formal organization chart, and informal channels of communication seem to have greater importance than in the other centers. Individuals also do not seem to be as aware of their own titles or the titles of their colleagues. The divisions seem to operate quite autonomously, although the Director-General, when he chooses to, can exert virtually absolute authority. The autonomy of the divisions is the subject of some internal criticism, but in general it appears to work rather well. Persons who have remained at CERN through the tenure of several Directors-General report that the power of the Director-General's office has varied substantially depending on the person holding it.[35] The degree of authority concentrated in the hands of the Director-General is even more striking to Europeans than it is to Americans. A strong executive such as is usually found at the head of American research establishments and academic institutions is rarely seen in Europe. Successful adaptation of this pattern to CERN's situation is an important element in the organization's achievements.

CERN operates both as a service organization for scientific groups belonging to its member states, and as a scientific establishment with an in-house capability for doing important physics. This situation may be contrasted to that in ESRO, which we recall operates solely as a service to national groups, and to that in EURATOM, which as we shall see later, operates its joint research centers as almost 100% in-house operations. CERN plays host to an average of 400 visiting scientists at any given time. These scientists come singly or in groups from universities and other physics centers, largely but by far not entirely, in the member countries. It is common, in fact, for a European high energy physicist who is on the staff of a university to spend anywhere from one to three months of his year at CERN. And, as CERN makes it a policy to restrict the number of indefinite contracts it gives, there is quite a

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[35] Jungk, Big Machine, pp. 138-139, observed roughly the same thing.

bit of personnel interchange between the CERN staff and academic and government institutes in the member countries.

Often groups will design and build a piece of equipment for a particular experiment, transport it and themselves to Geneva, and carry out the experiment utilizing the particle beam from one of CERN's accelerators. In such cases the national group pays most of the cost of the project, but CERN, in addition to supplying the beam, provides support personnel and equipment as needed by the group. Besides this form of service, CERN provides a great deal of raw data to various research centers in the member countries. Such data generally takes the form of bubble chamber photographs--which portray the paths of colliding and decaying subatomic particles--and the analysis of these photographs constitutes a substantial part of the research program of a number of European institutes.

CERN has also had, from the beginning, a strong internal scientific complement. These highly-regarded scientists perform experiments either in their own groups or, more frequently, in conjunction with visiting groups. In terms of evolutionary trends, while CERN's own team has been scientifically strong from the beginning, the organization has probably moved towards more participation of national groups. The presence of such frontier facilities in Western Europe has undoubtedly stimulated the growth of high-energy physics in Europe and encouraged young scientists to enter the field. As a consequence there has been more demand for CERN's facilities and the practice of admitting visiting teams has expanded.

It should be apparent by this time that CERN's scientific life is focused around the accelerated beam of protons which emerges from the proton synchrotron machine (PS). The critical aspect of CERN's decision-making structure is the allocation mechanism for time "on" the machine and space on the floor of the experimental hall.[36] A thorough study of decision-making with regard to time and space on the CERN PS would be a valuable contribution to the sociology of science. Unfortunately, our purpose and the duration of our visit did not allow for such a study. What we did learn is that the procedure for selection of experiments goes something like this (and this is not at all apparent from CERN's organization charts or any of its published material): Individual physicists or groups either inside or outside of CERN develop proposals for experiments. These proposals are then sent to one of the three experimental committees--Track Chamber Experiments, Physics III, or Electronics Experiments--groups composed of established European physicists in these areas and chaired (usually) by a physicist who is not a CERN staff member. The committees evaluate the proposals competitively with regard to scientific merit, potential for achievement of results, contribution to the field, and cost (in space, time, and money). The recommendations

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[36] The PS is shaped like a huge ring. It produces a beam of high energy particles by taking these particles, which have been injected at low energy at a point along the ring, and spinning them faster and faster around the ring by means of an electro-magnetic field. High energy physics experiments employ the accelerated particles to produce collisions with other particles in order to study the results of these collisions. Such experiments require large but finely tuned pieces of equipment located at such points where they may intercept the particle beam. Only one--or if the beam is divided, a few--experiments may use the beam at one time. Hence the competition for time "on" the machine (use of the beam) and space on the floor of the experimental hall (where the beam is extracted).

are then coordinated by a Nuclear Physics Research Committee (NPRC) which is chaired by the Director-General and includes the chairmen of the experimental committees as well as the CERN division leaders. Most of the decisions are actually taken here, although via discussions leading to consensus and not by vote. The Director-General has the absolute final say in the decision of whether or not to include a particular experiment in the program, but in practice his authority is rarely exercised in a formal manner. A physicist can, if he wishes, submit a proposal directly to the Director-General, but this again is usually not done.

Overall, the entire decision process is characterized by a great deal of informal communication at all stages, and most of the real issues are worked out in this way. In all really important experiments--and there are certain experiments which are easily recognized by the physicists as having crucial bearing on some aspect of a current theory--there is an unwritten CERN policy of assembling teams composed of both CERN people and outsiders, rather than just one or the other.

There is some talk among the CERN staff of an "Italian mafia"--a group of prominent Italian physicists who tend to support each other's proposals and run roughshod over the desires of others. There is also some talk of an "in-group" and an "out-group" among the physicists, implying that those in the in-group find it much easier to get their experiments approved than those in the out-group. (Those who brought this up, however, admitted that the groups were defined more on the basis of past scientific performance than personality.) In any case, if there is discontent with the allocation system or its results, it was not widespread at the time of our visit to CERN, and one can safely conclude that as a mechanism for making "scientific choices" the system operates quite well.

4. The Ambiance at CERN

CERN is located in Meyrin, a suburb about 10-15 minutes drive from the center of Geneva. It occupies an area of approximately 200 acres, nearly equally divided between Switzerland and France. The original site comprised only the Swiss portion of this territory, but in order to build the intersecting storage rings, it was necessary to expand across the Franco-Swiss frontier. This has been accomplished with only minor complication. At the time of our visit, in May 1967, the only work that was taking place on the French side was construction work, and so the substance of this section will be confined to the original portion of the site, as was our visit. Within this 101 acre tract were located some 57 buildings, ranging from small nondescript prefabricated barracks to quite large, modern and aesthetically pleasing laboratory and office buildings. The proton synchrotron is a wheel shaped structure more than 650 feet in diameter, mostly buried in the ground. It is not a particularly obvious feature of the CERN landscape--its form and size are such that it is best recognized from the air. (Important guests are in fact given a short air tour.)

CERN is blessed with an extremely beautiful location, but this is more a credit to the surrounding landscape than the site itself: Although the site itself is quite flat, as it must be for the installation of the machine, only a few miles to the north the Jura Mountain Range rises steeply. Beyond the city of Geneva, to the south and east, the snow-capped French and Swiss Alps tower in the distance. From those several buildings whose occupants are fortunate enough to have windows facing the proper direction, one can on a good day admire Mont Blanc, a good sixty miles away. There are few CERN personnel who, even after many years, do not find time during their working day to enjoy the scenery. In addition, the location provides both the pleasanter aspects of pastoral life--quiet, clean air, and a generally relaxed feeling, and since Geneva is so readily accessible, much of the variety and excitement of an international city. CERN people often rhetorically asked during our visit: where else in Europe could one find a location with such beautiful surroundings, ten minutes from a cosmopolitan city, five minutes from an international airport, fifteen or twenty minutes from several beaches, and an hour or so from some of the world's finest skiing areas?

The rather relaxed and informal feeling is part of what might be called the dominant impression of CERN--that is, an atmosphere of academia. In a number of respects CERN is very strongly reminiscent of an educational institution. There is some physical similarity between parts of CERN's site and a college campus, and in addition the visitor is also certain to notice the relatively large number of youthful faces. Some of the original staff members are reaching or have reached middle age, but a large percentage of the staff is quite young and many fellows and visitors are either students or recent university graduates. A certain indefinable intellectual excitement pervades the atmosphere. While this is a highly subjective mode of description, a number of more objective indicators might also be mentioned. For example, CERN--alone among the centers we visited--operates on a 24-hour-a-day basis. The product of an economic necessity, since anything less would be terribly wasteful of the vast investment represented by the accelerators, this schedule adds to the informality of the CERN scene. Professional staff members and visiting scientists, especially those concerned with experiments in process or operation of the machines, are almost as likely to be found in their laboratories at midnight as they are at noon. There is no such thing as a nine-to-five day for these individuals--technicians as well as Ph.D.'s--and although most are quite conscious of their leisure time, they willingly put in long hours when their work demands it. The administration has shown itself to be quite adaptable to such situations and one finds, for example, that there is no problem getting in or out of the gates after hours, that the canteen is open almost always (although the excellent selection of food is rather restricted outside of normal mealtimes), and that there is no pressure to constrain professional people to regular hours--most are given virtually full responsibility for themselves. Another indication of the intellecutal excitement present at CERN is the large number of seminars, colloquia, conferences, and lectures that are always on the calendar. In addition to this type of activity--generally concerned with particle physics or closely allied fields--there are also training classes in technical areas, lectures on other areas of culture or public affairs, concerts, and the like.

Perhaps the most important among these indicators of the intellectual atmosphere is the presence of numerous "name" physicists at the laboratory. Virtually anyone who is anyone in European high-energy physics is in some way associated with CERN. This is true both for theoretical and experimental physics. Many of the permanent staff members, as well as most of the top scientific management, are respected and well-known men in their fields. Further, other important high-energy physicists in European institutes and universities are associated in some way with CERN, and occasionally spend time there. Any non-European high-energy physicist passing through Europe is certain at least to stop in for a short visit at CERN to see his friends and learn how their latest experiments are progressing. The presence of men with such "intellectual sex appeal"[37] is a great attractant for young scientists and many come not only to participate in use of the machines, but to work under and learn from these men.

In the foregoing, we have spoken of the various aspects of CERN's intellectual atmosphere as if they were in some way separable. They are not. The informality, the odd hours, the flexibility of the organization, the intense (formal and informal) communication of ideas, and the excellence of the scientific staff are all interwoven, and, taking account of the special nature of CERN's task, none could exist without the others. On the other hand, this type of atmosphere is not unique to CERN. It is a necessary part of being in the mainstream of fundamental research and other centers of physics excellence, such as Brookhaven and Berkeley in the United States, and other laboratories of diverse types possess similar intellectual _ambiances_.

There are other aspects of CERN worth taking note of, which are unique to this establishment and not necessarily related to the intellectual _ambiance_. In comparison with ESTEC, where we noted a dominant

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[37] An epithet once applied to J. Robert Oppenheimer. See R. Jungk, _Brighter Than A Thousand Suns_ (New York: Harcourt, Brace and World, 1958), p. 132.

British "flavor," there is no special national flavor at CERN. Although the largest contingents among the professional staff come from Britain, France, Germany, and Italy, and the bulk of the lower grade personnel are French and Swiss (with some Italians), there is no domination by any single one of these groups. CERN's official languages are French and English, and one of the requirements for employment is fluency in one of these languages and at least a working knowledge of the other. The two languages seem to be used in about equal proportions--with perhaps a slight edge for English in professional discussions and a similarly slight edge for French in other types of conversations--and there do not appear to be any areas within the organization where one of the languages totally excludes the other.[38] For large meetings there is usually simultaneous translation through earphones at each seat; smaller conferences, such as group meetings, generally arrive at a consensus about which language to use, not necessarily one of the official languages. This lack of a single dominating flavor is also reflected in administrative practices. A member of the personnel section described the situation well:

> Newcomers must then be helped to adapt themselves to the Organization, where different national trends and traditions are merged into practices which are peculiar to CERN and which are unique in the field of personnel management.[39]

The fact that CERN is located in as international a city as Geneva, while not directly affecting the internal atmosphere of the organization,

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[38] This occasionally leads to minor problems, as in deciding which language to use in answering the telephone.

[39] CERN Annual Report 1965 (Geneva, 1966), pp. 142-143.

is quite important with respect to the CERN community. Geneva has for many years been the seat of numerous international organizations. Besides CERN, the larger ones include the World Health Organization (WHO), the World Meteorological Organization (WMO), the International Labor Organization (ILO), and the European Headquarters of the United Nations. The staffs of these and the other international organizations constitute a substantial international community, which exists on its own within the greater Geneva area. One indication of the magnitude of this foreign presence is the statistic that nearly one-third of the pupils in the Geneva public schools (Canton of Geneva) are non-Swiss.[40] This presence greatly facilitates adaptation to the Geneva area for CERN personnel.[41] Such seemingly minor matters as the availability of foreign newspapers and goods, the fact that local Genevois are accustomed to dealing with foreigners, the possibility of taking part in cultural and recreational activities of the other international organizations are quite important. At most international laboratories outside of Geneva, one either remains within a circle of acquaintances restricted to the organization or attempts to integrate with the indigenous population (usually quite difficult). In Geneva there is a third alternative, that of participating in an international society which incorporates a much broader spectrum of people than one would find in his own organization.

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[40] Pierre Zumbach, Head of CERN Social Affairs Section, "L'Integration des Fonctionnaires Internationaux a la Communaute de Geneve," Speech Before the Junior Chamber of Commerce of Geneva, March 3, 1966.

[41] It also creates many other problems as Zumbach (Ibid.) pointed out.

C. Nuclear Power

The two EURATOM Joint Research Centers covered in this study, ISPRA and PETTEN, belong to an organization which is best known for the problems which have beset it. Many of the numerous books and articles which have been written about EURATOM--and much more has been written about EURATOM than about any of the other organizations in the study--are concerned with "what went wrong" or "why did EURATOM fail." In fact, although EURATOM cannot truthfully be considered a success at this point, the organization has managed to survive and its ultimate fate has yet to be determined. EURATOM's problems, its wide publicity, and its basic differences from the other organizations in the study can be traced to one very clear and over-riding cause--the fact that EURATOM is a political organization rather than a scientific one and its goals are political rather than scientific.

1. The Birth of the European Atomic Energy Community (EURATOM)

A real understanding of the origins of EURATOM would require a full review of post-World War II European history with particular emphasis on efforts at European political integration. EURATOM (its full title is the European Atomic Energy Community), it will be recalled, belongs to the "Six." Together with the ECSC (European Coal and Steel Community) and the EEC (European Economic Community--the Common Market), it is part of the European Community, a body of nations which, on the road to a future political federation,

> have set themselves the task of gradually abolishing all national obstacles to the movement of goods, people, and capital throughout their combined territory; of establishing

> within it a single integrated economy under common rules and institutions; and of adopting a common policy--as well as a common external tariff--in their economic dealings with the rest of the world.[42]

The idea of an atomic energy community in Europe first came to the fore upon the failure of the plan for a European Defense Community (EDC) in 1954. When the French National Assembly failed to ratify the treaty for the EDC, hopes for the rapid political integration of Europe were dashed. But, immediately the resourceful "Europeanists" began to seek new paths towards their long-range goal. In December 1954 the Common Assembly of the ECSC asked for the establishment of a working group which was to study possibilities for expanding the scope of the community. This group, in turn, proposed the convening of a high-level intergovernmental conference on future steps toward European integration. The conference of Foreign Ministers of the ECSC, which was held at Messina, Italy, on June 1 and 2, 1955, served this purpose.

The Messina conference approved a resolution which incorporated parts of action proposals from Germany, Italy, and the Benelux countries, and in keeping with the pattern of proliferating committees, it appointed a committee of national representatives and professional experts to work towards the aims of the resolution. This committee which came to be known by the name of its chairman, Paul-Henri Spaak, worked through the second half of 1955 and the early part of 1956 at a chateau outside of

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42 Richard Mayne, The Community of Europe (London: Victor Gollancz, 1962), pp. 12-13. This section on EURATOM's history owes much to the excellent summary which Mayne presents in Chapter VI.

Brussels. In April 1956 it presented to the Council of Ministers its report, commonly known as the Spaak Report. The report was adopted by the Ministers a month later and at the same time the Spaak Committee was transformed into "a conference with Treaty-making powers."[43] The Treaties which established both EURATOM and the Common Market emerged from this conference in less than a year's time and were signed in Rome, in a historic moment for European unity, on March 25, 1957. Ratification was rapidly forthcoming and the treaties came into force on January 1, 1958. Soon thereafter, the headquarters of both new organizations were established at Brussels.

While all of this official governmental activity was taking place, the "father" of the European unity movement, Jean Monnet, was exerting his profound influence from outside of official circles. In October 1955 he had formed a pressure group which was composed of thirty-three important political leaders representing a broad range on the political spectrum of the Six countries, and which was called the "Action Committee for the United States of Europe." Many of the resolutions which this committee adopted at its semi-annual meetings were binding not only on the members of the committee, but also on the political parties and trade unions which they represented. Hence, as Mayne concludes,

> By prodding governments and winning over parliamentary and trade union opinion, there can be no doubt at all that Monnet and the Action Committee played a decisive part in securing the adoption and ratification of the Euratom and Common Market Treaties.[44]

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[43] Ibid., p. 109.

[44] Ibid., p. 110.

An important contrast between the histories of CERN and ESRO and that of EURATOM should be quite apparent from this brief outline: Scientists themselves were not key figures in the birth of EURATOM as they were in the other two organizations. This was the result of the fact that while CERN and ESRO came into being largely as political responses to scientific/technological needs, EURATOM arose as a technological response to a political problem. A high-level EURATOM scientist, who had grown cynical over his organization's difficulties, suggested to us that EURATOM's concern with atomic energy is only accidental. The politicians, he claimed, passed around a hat for ideas as to what their new European organization should do and atomic energy seemed to be the best thing that came out!

There is, in fact, a kernel of truth in this wise-crack. The problem which beset the Europeanists upon the failure of the EDC was how to put the machinery of European unity in motion again, how to regain momentum. That atomic energy was perceived as the solution (along with, of course, the Common Market), was the result of several factors: (1) Integration of atomic energy resources appeared to complement efforts of the Coal and Steel Community to integrate European energy production. (2) Atomic energy was, to a large extent, the "vogue" during the early 1950's. Great progress was expected to come out of its peaceful application in a relatively short time--the vast potential for destruction as well as progress pointed towards international effort. (3) It was believed, as Scheinman points out, that since atomic energy was a new field, "there were few vested interests to be overcome, and little restructuring of impacted attitudes was involved."[45] (4) It was evident that full development of the potential of nuclear power was an extremely expensive proposition, which was beyond the capabilities of all individual nations except the super-powers. In more blunt terms this meant, as it did in the cases of CERN and ESRO, pooling Europe's efforts to keep up with the United States. (5) The concept of EURATOM also extended the principle of sector (functional) integration established by ECSC. In this regard, Scheinman notes,

> Euratom's virtue was to sustain the European movement while the supposedly much more delicate task of working out an agreement on a general economic union was pursued. In the end, the Euratom and EEC treaties were ratified at the same time, though in separate instruments. From the moment of ratification, Euratom's utility as a vehicle for European integration was spent, and the organization was left to justify its existence by its own action.[46]

Beyond these five reasons there is, of course, the major argument which dominated all discussions of EURATOM and which still fills most of EURATOM's public relations material--that is, the matter of Europe's energy requirements. A number of studies were performed which predicted that, as a function of increasing industrialization, Europe's energy requirements would grow very rapidly.[47] Questions were raised as to the

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[45] Lawrence Scheinman, "Euratom: Nuclear Integration in Europe," International Conciliation, No. 563 (May 1967), p. 9. Scheinman is also aware, in retrospect, of the fallacy of this belief--in light of France's *force de frappe* and Germany's private industrial interests.

[46] *Ibid.*, p. 11.

[47] The most important of these was Organization for European Economic Cooperation, "Some Aspects of the European Energy Problem" (Paris, 1955). This report was prepared by Louis Armand who later became one of the "Three Wise Men" discussed below.

costs of different forms of energy production, the effect on Europe's balance of payments of ever-increasing imports of fossil fuels, and the national security problems caused by the need to rely so heavily on imported fuels (especially from the Middle East). Optimistic assumptions about the economics of atomic energy showed it to be the best solution to these problems.

Foremost among these studies was the report of the "Three Wise Men," which originated in a 1956 resolution of Monnet's Action Committee. Louis Armand (former head of the French national railways), Franz Etzel (Vice-President of the ECSC High Authority), and Francesco Giordani (an Italian nuclear expert) were appointed to study the problem. Their report, which was presented in May 1957, and which acted as a spur towards ratification, was entitled "A Target for EURATOM." In response to the energy requirement forecasts, it set forth for the EURATOM countries a 1967 production goal of 15 million kilowatts. The "Wise Men's" report was considered authoritative throughout EURATOM's early period, and its numbers have been widely quoted. Armand, in fact, was chosen as the first President of EURATOM's Commission in January 1958.

2. Structure and Development

Compared with ESRO and CERN, EURATOM is a rather complex organization. Research and development comprise but one part of its functions, and its nature is essentially "promotional."[48] As an indication of its relative

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[48] Pierre Mathijsen, quoted in Scheinman, "Nuclear Integration," p. 11.

complexity, we note that while the Convention establishing ESRO (as reprinted in its 1964-1965 General Report) occupies the space of nine pages, and CERN's Convention is of about equal length, the English edition of the EURATOM Treaty is bound as a book consisting of 222 pages. (Of this, 112 pages represent the Treaty itself, and the remainder consists of annexes, definitions, protocols, declarations of intent, and so forth.) The sensitivity of technological areas with which EURATOM was intended to cope and the potential domain of its political effects are of course responsible for this complexity. Compared to the other organizations discussed here, EURATOM was designed with many more intrinsic strains, but also a much wider range of political opportunities.

Article 1 of the Treaty specifies EURATOM's aims:

> It shall be the aim of the Community to contribute to the raising of the standard of living in Member States and to the development of commercial exchanges with other countries by the creation of conditions necessary for the speedy establishment and growth of nuclear industries.[49]

In Article 2, the Community is directed to take certain actions toward the attainment of its aims. Specifically, it shall:

> (a) develop research and ensure the dissemination of technical knowledge,
>
> (b) establish, and ensure the application of, uniform safety standards to protect the health of workers and of the general public,
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> (c) facilitate investment and ensure, particularly by encouraging business enterprise, the construction of the basic facilities required for the development of nuclear energy within the Community,

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[49] "Treaty Establishing the European Atomic Energy Community" (Brussels: EURATOM, 1957), p. 17.

(d) ensure a regular and equitable supply of ores and nuclear fuels to all users in the Community,

(e) guarantee, by appropriate measures of control, that nuclear materials are not diverted for purposes other than those for which they are intended,

(f) exercise the property rights conferred upon it in respect of special fissionable materials,

(g) ensure extensive markets and access to the best technical means by the creation of a common market for specialized materials and equipment, by the free movement of capital for nuclear investment, and by freedom of employment for specialists within the Community,

(h) establish with other countries and with international organizations any contacts likely to promote progress in the peaceful uses of nuclear energy.[50]

Although this discussion is chiefly concerned with EURATOM's research functions, it should be noted that the organization's other functions were intended to be of considerably wider scope than its own in-house research.[51] Within the realm of research and training (which are treated under a single rubric), EURATOM is empowered to facilitate dissemination of information, supply nuclear materials and personnel to enterprises in the member states, place research contracts, and establish its own "Joint Nuclear Research Centre." This Centre, which is discussed in Article 8 of the Treaty, consists in fact of four establishments: ISPRA (Italy),

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[50] Ibid., pp. 17-18.

[51] The interested reader is referred to the writings of Scheinman, Mayne, and W. Walsh, as well as Jaroslav Polach, Euratom (Dobbs Ferry, N.Y.: Oceana Publications, 1964) for more complete discussions of EURATOM. Polach's detailed bibliography and historian Walsh's extensive list of footnotes are also very helpful.

PETTEN (Holland), KARLSHRUE (Germany), and GEEL (Belgium).[52] Its initial program is spelled out in an annex to the Treaty, where provisions are made for "general chemical, physical, electronic and metallurgical laboratories;" several special laboratories in areas including nuclear fusion, isotope separation and radiobiology; a bureau of nuclear standards; a documentation center; several reactor prototypes; and special high-flux reactors.[53]

Before going on to see how EURATOM's research activities have developed from this initial statement in the Treaty, it is worth spending a few moments examining the organizational structure of EURATOM, for this aspect is certainly unique among technological organizations. The executive body of the organization is an Executive Commission, rather than a single Secretary-General. Until July 6, 1967, the EURATOM Commission consisted of five members, each from a different member state. On that date, however, the "fusion of the executives" took place; a 14-man Commission took executive control over the entire European Community (EURATOM, ECSC, EEC) and this action was viewed by the Six as a major step towards integration. The fusion actually occurred between the time of our visit to ISPRA and our visit to PETTEN, but no direct consequences were visible at the laboratories. Let us consider, therefore, the Commission as it existed prior to fusion. The five members (Luxembourg, having

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[52] In a bit of double-talk, separation "for geographical [!] or operational reasons" was foreseen in Article 8.

[53] "Euratom Treaty," Annex V, p. 153.

no national atomic program was not represented on the Commission) were supposed to represent areas of technical expertise, and act supranationally, but in fact it has been widely recognized that the Commissioners operated as representatives of political (national) interests.[54] The Commission had a President and a Vice-President (the Presidents were all Frenchmen), and below the Commission there existed the entire administrative structure of EURATOM. Members of the Commission were appointed to renewable four-year terms by the governments of the member states, "acting in common agreement."

Besides the Commission, the only other Community institution with any real power is the Council of Ministers. This Council consists of six representative of cabinet rank, one from each member state. Unlike ESRO and CERN, there is no clear-cut conceptual division of responsibility between the Council (charged with policy-making at CERN and ESRO) and the Executive (charged with administration). The EURATOM Council is empowered to "take all measures within its competence in order to coordinate the actions of Member States and of the Community."[55] Here the representatives are supposed to act as representatives of their nations. Council decisions are taken by vote according to a rather complex scheme. Certain decisions, such as establishing or revising a basic five-year research program, require a unanimous vote, but annual budget allocations

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[54] See Scheinman, "Nuclear Integration," p. 22; W. Walsh, Science . . . Affairs, p. 81; and Polach, Euratom, p. 105.

[55] "Euratom Treaty," Art. 115, p. 79.

(within the fixed amount) need only a qualified majority. In part because of the fact that the Commission possesses powers beyond those of an executive, the relationship between the Commission and the Council has been crucial to the functioning of the organization. As Scheinman suggests,

> Perhaps most important, the Commission possesses the right of initiative, which theoretically gives it considerable influence over the nature, tempo, and direction of Euratom policy. Without its proposals, the Council would be reduced to near impotence.[56]

The superstructure of EURATOM also includes the European Parliament, which serves chiefly as a forum for discussion, although theoretically it has the power to dismiss the Commission on a two-thirds vote; the Court of Justice, which has enforceable powers to ensure the observance of law and justice in the application of the Treaty; and three large but impotent "consultative bodies," the Scientific and Technical Committee, the Economic and Social Committee, and the Consultative Committee for Nuclear Research. The Parliament, the Court, and the Economic and Social Committee are shared by all three parts of the Community.

With regard to the administrative structure of EURATOM beneath the Commission, detailed information is not generally available. Several divisions exist, including the Information and Documentation Center, the Eurisotop Bureau, the Security Inspectors, and a number of others. The Joint Research Centre falls under the division of Research and Training which is headed by a Director-General. Besides its own research establishments, the division also administers EURATOM's research contracts

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[56] Scheinman, "Nuclear Integration," p. 23. See also p. 24 for a discussion of the Council's Committee of Permanent Representatives.

and contracts of association. Such contracts--of which 450 were signed with industrial firms and groups, universities, and public and private research organizations between 1958 and 1963[57]--accounted for about 50% of EURATOM's research expenditures.[58] In general, research contracts are let for performance of specific tasks by an outside organization, while contracts of association involve EURATOM participation (with money as well as personnel) in projects at outside organizations.

In order to put the Joint Research Centre into operation quickly, EURATOM, instead of beginning to construct its own facilities, decided that it would take over and expand existing facilities in the member states. The first of its laboratories, the Central Nuclear Measurements Bureau, began operation in 1960, in buildings provided by the Belgian government at Geel, near the Belgian nuclear center at Mol. In March of the following year, the Italian Comitato Nazionale per l'Energia Nucleare (CNEN) transferred its large general-purpose nuclear center at Ispra entirely to EURATOM. In 1962, the Dutch reactor center at Petten transferred part of its facilities to the Community, and finally, on the site of a German nuclear research center at Karlsruhe, EURATOM constructed its fourth establishment--the European Transuranium Institute.

Despite the fact that the organization decided to use mainly existing facilities, EURATOM's research program got off to a rather slow start.

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[57] OECD, International Scientific Organizations (Paris, 1965), p. 141.

[58] Jules Gueron, "The Lessons to be Learned from Euratom," Bulletin of the Atomic Scientists, XXIII, 3 (March 1967), p. 40.

Polach observes that a change of attitude on the part of the Commission was later responsible for speeding up research activity. He implies that although research was expressly provided for in the original plan, the Commission did not deal seriously with it until it was apparent that EURATOM's role in actual power production was not going to proceed according to plan.[59] In addition he ascribes some of the difficulties in starting up research to a lack of large-scale facilities and problems in recruiting high-level scientific personnel. Whatever the cause, out of its initial five-year $215 million research program, EURATOM expended less than $4 million in its first two years, of which $2 million went to EURATOM participation in OECD reactor projects.[60] In 1960 and beyond, the pace of activity increased markedly, especially in the area of contract research. While during 1959 EURATOM spent only about $3¼ million on research, by late 1960 it had spent more than $34 million.[61] (EURATOM's funds, incidentally, like those of CERN and ESRO, are derived from contributions of the member states, although EURATOM does theoretically have the power, through Article 173 of its Treaty, of levying taxes upon its members.) By the end of the five-year period (end of 1962), all but $20 million of the $215 million research budget had been earmarked. In June 1962, the Council of Ministers approved a second five-year program (for 1963-1967), this one for a total of $425 million. This amount was reduced

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[59] Polach, _Euratom_, p. 139.

[60] _Ibid._

[61] W. Walsh, _Science . . . Affairs_, p. 83.

from the $480 million proposed by the Commisson, and later (1964) it was adjusted slightly upwards over the objections of the French government.[62] As the adjustments which were finally approved ($5.5 million against a request for $48 million) were not sufficient to cover the rising costs of EURATOM's research, the organization, in 1965, began cutting back on some of its areas of research. The continuing program crisis, compounded by the need to approve a new five-year plan for the period beginning with 1968, has severely impaired EURATOM's functioning as a research body; it will be discussed in more detail below.

Of the $425 million budget, $127 million was allocated to building up and operating the four Joint Research Centre establishments, and about half of the total was to be spent on work carried out at the Centres.[63] Approximately $57 million was allocated to EURATOM's "star" project--ORGEL. This program, housed at ISPRA, involves research on natural uranium fueled reactors using an organic liquid as a coolant and heavy water as a moderator. Other interesting work has been going on at all of the EURATOM establishments: several reactors were completed and are being used both as tests of reactor design and for materials and system testing; a large information processing center (CETIS) is providing computer facilities for the organization and is doing important work on mechanical translation as well; van de Graaf and linear accelerators are in use for preparation of primary standards for nuclear measurements.

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[62] See Scheinman, "Nuclear Integration," pp. 43-51, for a discussion of the crisis this provoked.

[63] "Community Topics," (Brussels: European Community Information Service, n.d.), No. 7, p. 4.

3. EURATOM's Continuing Crisis

The crisis which set upon ERUATOM in 1964-65 has not yet been resolved.[64] Its immediate causes have been the inability of the Community partners to agree on a program, and their unwillingness to allocate large sums of money for which they are not assured of immediate direct (national) returns. Its roots go much deeper. Two of the fundamental premises upon which EURATOM was founded have proved to be inconsistent with reality: (1) that atomic power would be required by Europe and economical to produce by the mid-to-late 1960's and (2) that the nuclear field was well-suited to cooperative efforts because of the lack of vested interests.

The "great nuclear development crisis" (as Jules Gueron calls it in his article cited above) resulted when technologists and policy-makers in Europe began to realize that fossil fuels--especially petroleum products and natural gas (whose use had been growing at the expense of coal)--were not going to be in such short supply, that reactor efficiency was not increasing as fast as predicted, and that atomic power was not going to be more economical to produce than conventional power in the immediate future.[65] As disparities between early optimistic reports and the current

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[64] This brief summary of the situation is not intended as an authoritative evaluation, but only as a means for the reader to become familiar with the problems of the organization.

[65] The discovery of natural gas under the North Sea off the Dutch coast was an important factor here. In 1964, electric power produced by nuclear means in Europe still cost 50% more than that produced conventionally. (W. Walsh, Science . . . Affairs, p. 90.) At present (1969), it is believed that nuclear power has reached a competitive price level in the U.S.

atomic power picture grew, the Six countries began to question EURATOM's role.

At the same time, national nuclear establishments, which in the mid-1950's were quite small, began to grow rapidly and rather than being co-ordinated by EURATOM, began to compete with it. The member states, especially the larger ones, discovered that they could in fact do more alone than they had first thought. France's desire for a force de frappe, in particular, soon impelled that country to embark on a national nuclear energy program of the same order of magnitude as EURATOM's. In the company of such competition, EURATOM had tended to come off second-best. As one journalist observed recently,

> Euratom has lacked a constituency; industry has its own interests to consider, and Euratom appears as a rival to the national programs of the most active governments.[66]

These root problems have been compounded by the nature of the organization itself. Structurally, it has been incapable of taking the decisive measures needed. In particular, the Commission, unable to withstand the pressures of national interests in its operations as the top executive body, has been at fault. Several confrontations have occurred between the Commission and member governments, one resulting in the departure of Etienne Hirsch, second President of the Commission, who was, in Scheinman's words, "the Community['s] first and only dynamic leader."[67] What

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[66] John Walsh, "Euratom: After 10 Years, Still Seeking the Way," Science, CLVIII (October 6, 1967), p. 95.

[67] Scheinman, "Nuclear Integration," p. 36. Scheinman gives an excellent summary of EURATOM's troubles on pp. 35-51.

the Six partners did, in effect, when they constructed EURATOM, was to establish an organization with limited scope and powers, with little control over national activities in its member states, and with an overly ambitious program. Had it been practical to carry out this program--it was not--it would have required combining the members' national efforts rather than running them in competition.

At the time of our visits to the EURATOM laboratories (mid-1967), the organization had been working on month-by-month interim allocations--without an approved budget for the current year--since January. Although the budget was finally approved by the Council in July, the dispute, which concerned support of an Italian fast-reactor program and an assessment of $2.8 million for plutonium supplied by the United States which France refused to pay, prevented the approval of a new five-year research program. Rather than waiting for approval of the full five-year program, the Council then took up debate of the 1968 budget itself and slashed the figure the Commission had proposed in half from $82 million to $40.7 million. As Science reported it, "The action was the culmination of a long period of bickering over budgets, which reflected the member nations' differing conceptions of Euratom's proper scope."[68] This cut, while it left the Joint Research Centres in relatively good shape, suspended all association contracts, under which nearly all of EURATOM's nuclear fusion and biological research was financed. At the time of our visits, as at the time of this writing, EURATOM personnel had no notion as to the long-

[68] John Walsh, "Euratom: A Cut for Cooperation," Science, CLVIII (December 29, 1967), p. 1657.

term plans of the organization, and actually were operating without even knowing whether their organization would continue to exist.

4. The Joint Research Centre at ISPRA

From the time of its founding in 1957, until March 1961 the nuclear research centre at Ispra, Italy was a part of the Italian nuclear program. When, in 1961, the Italian offer to transfer the center to EURATOM was accepted and put into effect, the laboratory began work with about 350 employees (including locally recruited labor). Although a number of buildings already existed on the site, EURATOM began expanding the facilities in order to accommodate its rapid growth. By the end of 1961 the number of employees at ISPRA had nearly tripled, and by mid-1967 it had risen to more than 1,600. ISPRA is by far the largest of the four EURATOM centers--its personnel number more than the combined total of the other three. Its importance is further magnified by the fact that it houses the ORGEL project, in which EURATOM has invested heavily. Within the first five-year plan, ISPRA's budget accounted for $45 million, and within the second $87 million, plus a separate $45.5 million allocation for ORGEL experiments carried out at ISPRA.[69]

The ISPRA site comprises some 400 acres at a distance of slightly more than one mile from the Western shore of Lago Maggiore and about 45 miles northwest of Milan. Scattered about this heavily-wooded site are 3 reactors (ISPRA-1, ECO, and ESSOR), a large computation center, and some

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[69] EURATOM's budget figures vary from one source to another, and these figures represent the author's best estimates based on a variety of sources.

40 laboratories, experimental halls, workshops, and so forth. The center is divided into 11 main "services," some of which are further subdivided into sections and experimental groups: Reactor Physics (the largest service, with over 200 staff), Engineering, Metallurgy and Ceramics, Physical Chemistry, Chemistry, CETIS (the European Scientific Information Processing Centre), Direct Conversion, Protection, Medical, Library and Documentation, and General Services. A Director is in charge of the establishment, and subordinate to him are the heads of the various services. The ORGEL project, which has been mentioned earlier in this chapter as being "housed" at ISPRA, is exactly in that situation. Although administratively, ORGEL falls under the control of the ISPRA administration, its top management is independent and, while it must work in cooperation with ISPRA departments, it reports directly to Brussels.

5. ISPRA's Atmosphere

EURATOM's difficulties, combined with some special characteristics of the ISPRA situation, have created a very unusual atmosphere in the center. The personnel at ISPRA are all well aware of the fact that their establishment is often cited as an example of how not to run an international scientific laboratory. ISPRA has survived EURATOM's crises and it has weathered a number of crises which were not general to EURATOM, but it has not emerged the stronger for the experience. The most evident characteristic of the atmosphere is a general feeling of resignation. In other words, the staff has been subjected to the center's difficulties for so long that it no longer cares enough to be militant. Rather the *fonctionnaires* are quietly and sadly aware that matters outside of their control determine the fate of their organization and their work. They hold some mild hope for the future, but not much enthusiasm. Most of all, they feel that their work and the real scientific capabilities of their center are unrecognized because of irrational political disputes.

Coexisting in this atmosphere of resignation are several other dimensions of ISPRA's character--some of which are separable from the resignation and some of which are not. First of all, one must acknowledge that despite its transfer from CNEN to the Community in 1961, ISPRA in 1967 is still very much an Italian establishment at heart. Of the ISPRA staff, excluding locally recruited labor, nearly half are Italians. If one includes these agents locaux, who are virtually all Italian, one begins to see that through the weight of numbers alone, the Italians exert a profound influence. (Many of these people were employed by CNEN at ISPRA and simply stayed on when EURATOM took over.) Add to this the fact that the center is placed in a highly parochial rural environment, so that if a foreign individual wishes to have any contacts outside of the EURATOM community, he must adapt to Italian ways, and the Italian flavor becomes even more comprehensible.

The Italian language, too, is a feature of ISPRA. Officially, ISPRA (like the whole European Community) has four languages--French, German, Italian, and Dutch. Community documents are issued in all four languages plus, often, English. At ISPRA, since most people find a knowledge of Italian essential for survival in the locale, Italian is most often chosen as a common tongue and much of the center's business (formally and informally) is carried out in it. Probably second in currency is English, a language which while not officially recognized by the EC, is widely spoken especially among Germans and Dutch at ISPRA. In addition, many internal technical reports are circulated in English. French is used widely, of course, particularly in the parts of the center with the highest concentrations of French and Belgians.

In painting this portrait of ISPRA, one cannot ignore that aspect which is perhaps most attractive--ISPRA's setting. It is hard to describe this setting without the use of adjectives more suitable for travelogues than for the present context. From the grounds of the laboratory one can see the snow-capped Alps rising majestically behind the azure waters of Lago Maggiore. Tiny orange-tile-roofed villages literally dot the countryside--from a height each one is distinguishable amidst the green forests just as on a map. The visitor to ISPRA cannot fail but to be impressed--even distracted--by the beauty of the surroundings, and as at CERN, he feels that even those employees of long standing have not become oblivious to it.

Unlike that of CERN, however, ISPRA's location also exhibits a number of profound disadvantages. The idyllic view of life in Italy's lake country, is soiled a bit when one learns that ISPRA's climate is not quite so ideal, that three months of winter submerge the area in diluvian rains and continual fog.[70] Further, the village of Ispra is not Geneva, or even Noordwijk. It is a hamlet of some few hundred residents, and since the only large city in the region, Milan, is sufficiently distant (45 miles) to preclude commuting or even casual trips for all but a

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[70] See Claude Deplanche, "Ispra," EURATOM Bulletin d'Information Interne, No. 8 (1966), p. 3, for a "Euratomian's" view of the ISPRA weather.

venturesome few, one lives primarily in a rather rural area, where the variety and diversions of urban life, and the prerequisites for a cosmopolitan way of life are almost totally lacking.

EURATOM, aware of the defects of the ISPRA locale and highly conscious of the social welfare of its staff has moved to take care of its own. As a result, the organization has created a more or less self-sufficient community which is largely independent of the indigenous population. In the words of a member of this community,

> La concentration de plus de 4,500 personnes y compris les familles en pleine campagne constitue un fait unique non seulement dans les Communautés mais dans toutes les organisations européennes ou internationales.[71]

For the visitor or newly-arrived employee, ISPRA has its own motel-type accommodations. EURATOM participates in various ways in providing permanent housing for its staff--there are even some permanent apartments on the site.[72] An attractively designed club-house serves as a social center for after-hours activity, and clubs of every variety (tennis, ping-pong, judo, horseback riding, and bridge, for example) abound. There is a EURATOM beach at the lake; concerts, movies, and lectures are available for interested individuals. ISPRA is perhaps the only international laboratory (or national laboratory for that matter) which has its own "miniature golf" course.

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[71] Ibid., p. 5.

[72] Only a few people are actually accommodated on the site or in the village of Ispra--most of the staff live in the many small villages around Ispra and in Varese--a town of about 65,000 located about 15 miles from the center.

One problem which EURATOM has solved quite successfully is that of education. In Varese, the Community has provided one of its "European Schools," several of which are scattered about Europe. Here, a child from any of the Six countries may study from kindergarten up to university level without fear of being excluded from the mainstream of education in his own country.

Despite this tightly organized environment, ISPRA has had some rather severe morale problems. These stem in part from the political difficulties of the Community, the fact that funds have been in short supply, the fact that no one is really quite sure what the ultimate aim of all this reactor research is (this would not be so bad if the laboratory had not been constructed with such an applied orientation), and the fact that the future course of the organization is completely unknown. Uncertainty about the future is compounded by the fact that most of the EURATOM staff have what the Europeans call "fonctionnaire" status. This is roughly equivalent to a civil service appointment in the U.S., and implies a high degree of job tenure. Naturally, a secure job in an organization whose very existence is in doubt is not conducive to high morale.[73] European Community salaries are probably the highest among European organizations and it is the only such organization to provide pension rights for its employees. Complaints among the ISPRA staff, however, include the grading and promotion system, which, it is felt, do not reflect one's professional performance.

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[73] See below, Chapter VI.

Some of the consequences of this morale problem have been perhaps unique in the realm of scientific organizations and are worthy of a study in themselves. The phenomenon of the locked gates is one of these consequences. Nearly all of the laboratories included in this study have some sort of gate to restrict access to their sites. For employees, passage of these gates is nothing more than a formality. At ISPRA, however, the gates are kept locked day and night except for a short period in the morning, lunch time, and a similar short period in the evening. Employees (from the leading scientists on down) who arrive more than 15 minutes after the starting time in the morning are not allowed to enter unless they give their names to the guard and fill out a "tardy slip," which eventually is forwarded to their supervisor. In the evening, no one is allowed to leave until the official quitting time, and the long line of automobiles in a queue behind the gate with their engines running ten minutes before quitting time is a most amusing sight to the visitor. This action, it is said, was occasioned by the fact that employees were taking advantage of the normal professional freedom.

Also connected to the morale problem are the relations between the Local Committee of Personnel (Staff Association) and the administration. These have been at times very strained, and there was once even a short strike in which professionals stopped work along with non-professionals. The Personnel Committee has gone so far as to carry out its own survey of employee satisfaction, and has often demanded a greater (even exclusive) voice in shaping the center's program.

Only in a few areas of the organization does one find relatively high morale--those areas which are more peripheral to the center's main foci and therefore less dependent upon its direction. Included here are such activities as biology and theoretical physics, where one finds people quietly going along and doing very good work almost unnoticed. Except for these areas, the type of intellectual excitement that was apparent at CERN does not exist at ISPRA. Despite its recruitment difficulties--"none of the member states granted too much to the new Community in the way of personnel"[74]--ISPRA has accumulated some excellent people. A few, particularly in ORGEL, might potentially have "star" qualities. But organizational problems have prevented the center from becoming in any sense a place where bright young scientists and engineers might wish to come and learn from top people in their fields. ISPRA's physical isolation, the hostility of "competing" national programs, the fact that there is very little turn-over among the personnel, and the fact that ISPRA attracts few short-term visitors, have combined, finally, to give ISPRA people the impression that they are rather isolated and outside the mainstream of activity in their fields.[75]

6. The Joint Research Centre at PETTEN

The physical contrast between ISPRA and PETTEN is most striking. One finds PETTEN in perhaps the most barren part of northern Holland.

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[74] Scheinman, "Nuclear Integration," pp. 36-37.

[75] The low personnel turn-over is a result of the staff's *fonctionnaire* status and the fact that most of ISPRA's recruitment was done in a space of about two years. The rapid build-up and the ensuing financial restrictions meant that there were few new places available after 1962-63, and the *fonctionnaire* status meant that few people left.

The land around it is flat and largely devoid of trees. Like ESTEC, PETTEN is situated on one side of a row of sand dunes, on the other side of which is the sea. Unlike ESTEC, however, the land around PETTEN is quite empty--PETTEN itself is a village so small it does not even have a hotel. To the tastes of most Europeans, the climate is not particularly appealing. Distance to the nearest large city (Amsterdam--35 miles) is such that employees are generally confined to living in either Petten, or the neighboring towns of Bergen and Alkmaar (which are much more attractive).

Like ISPRA, PETTEN is a general-purpose nuclear research center. It stands on the grounds of the Reactor Centrum Nederland and its original buildings were acquired by transfer from that agency. The Center actually began operation in early 1963, and it has since grown to the size of about 200 employees.[76] (The Dutch center surrounding it has about 600 employees.) A handful of buildings house its labs, and a high-flux materials-testing reactor, which is presently operated by the Dutch center (although it is owned by EURATOM) is its chief piece of equipment.

At the time of our visit (August 1967) PETTEN was in a state of transition. Having begun as a basically technical institution, it was gradually changing over to a more scientific orientation. In EURATOM's original program, PETTEN was intended to be substantially larger than it presently is, and it was to be concerned with technical coordination in the

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[76] As of mid-1967.

domain of high temperature gas reactors. As this role has been pretty much abandoned, PETTEN has come to focus more on the study on non-fissile reactor materials. PETTEN is organized into five scientific branches: Calorimetry, Applied Research on Graphites, Structure of Materials, Hydraulics, and Electrochemistry (a group which was at ISPRA in August 1967, but which shortly thereafter moved to PETTEN). In addition there is an Irradiation Service and a Post-irradiation Service, plus a General Services Division.

A number of factors have combined to create a much healthier spirit at PETTEN than that which was to be found at ISPRA. In the first place, the center is substantially newer and the change-over to a more scientific orientation has helped to keep this freshness alive. Also, as PETTEN was originally intended to be much larger, its budget, which was cut, still is sufficient to give it an atmosphere of some affluence--the staff does not feel hemmed-in by budgetary constraints. Furthermore, the EURATOM program has given PETTEN some liberty to take on outside work on a contract basis for industrial clients. This work has provided the center with valuable industrial contacts, and has minimized the sense of professional isolation which the environment might otherwise induce. In all, PETTEN's staff has a much higher professional orientation and few of the morale problems which exist at ISPRA.

PETTEN works primarily in English, although, as at ISPRA, it is not an official language. French and Dutch are next most popular, in that order. One suspects that the unattractiveness of the location has acted as something of a filter, and that those people who have actually come to work at PETTEN have been prepared for the situation. In any case, one finds (rather to the surprise of the author) that there are not nearly as many complaints about local conditions as at ESTEC. EURATOM has provided, as at ISPRA, such things as housing (several apartment blocks in Bergen and Alkmaar), and a European School (at Bergen). Although a great variety of clubs, cultural, and social activities exist, the sense of a closed community is not nearly as pervasive as at ISPRA--probably as a result of PETTEN's smaller size.

D. Atoms for Peace

The final portion of this chapter is devoted to two organizations which are treated in the same section only on account of their relatively minor role in this study. Their short treatment here, however, does not reflect their real importance relative to the other organizations described above.

1. The International Atomic Energy Agency (IAEA)

The International Atomic Energy Agency (IAEA) is the only truly *world-wide* organization included in this study. In strict usage, the other organizations should all be considered regional. In contrast, IAEA, an arm of the United Nations, is world-wide and included (in July 1967) 98 member-states--most of the countries in the world. The origin of the Agency can be traced back to the fear-hope ambivalence with which scientists and politicians viewed atomic energy in the late 1940's and early 1950's. President Eisenhower's suggestion of a United Nations atomic energy agency in his famous "Atoms-for-Peace" speech in 1953 was followed by approval of an Atoms-for-Peace Plan by the General Assembly and a United Nations conference at Geneva on the peaceful uses of atomic energy. Out of this conference came, in August 1955, a Draft Statute, which was revised and eventually signed by some 70 nations in October 1956.[77] After ratification by the required number of states, the Agency began its formal existence slightly more than a year later.

According to its statute, the objective of the Agency is to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."[78] In practical terms, the main functions of the Agency are twofold: First, to promote peaceful uses through (a) exchange of printed information, convening of conferences and symposia; (b) provision of technical assistance to those countries which require it (IAEA is the only one of the international bodies discussed here to which most of the developing nations belong); and (c) sponsoring and/or carrying out research in selected fields. Second, to act as an international inspector and apply safeguards against diversion of fissionable materials into military projects. It is this second role for which IAEA is probably more known to the general public in the United States and Europe, and this role has grown in importance with the conclusion of the Non-Proliferation Treaty.

While the agency is linked to the United Nations like the specialized UN agencies through a "relationship agreement," it retains

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[77] See W. Walsh, Science . . . Affairs, pp. 47-69, for more details.

[78] Statute of the International Atomic Energy Agency (Vienna: IAEA, 1965), Article II, p. 5.

independence in policy, program, and budgetary matters. It submits annual reports to the General Assembly and the Economic and Social Council. At the top of the agency's structure is the General Conference, which meets once a year, and in which each member nation has one vote. A 25-member board of governors (13 of the seats are fixed; others are elected by the General Conference within certain geographical criteria) handles policy matters, more or less as a committee of the conference, and a Secretariat--headed by a Director-General--performs executive functions. Beneath the Director-General are five departments: Safeguards and Inspection, Technical Assistance, Administration, Research and Isotopes, and Technical Operations.

In mid-1967, the headquarters of the Agency were located in a large office building--actually converted from two adjacent hotels--in the center of Vienna. At that time IAEA's paid staff numbered more than 600; nearly half were of professional grade. In this study we dealt mainly with those individuals who were actually involved in research within the agency, but the actual research which IAEA performs is quite small in proportion to the organization's size. The fact that any in-house research is carried out at all is mainly due to the initiative of the head of the Research and Isotopes Department. Small laboratories were first set up in the basement of the Vienna headquarters in 1959 when IAEA became involved in the provision of calibrated radio-isotope samples to laboratories in the member states. Work on environmental contamination also began in these makeshift facilities. In 1961, thanks to a $600,000 grant from the United States government, the Agency was able to erect more spacious quarters on the grounds of the Austrian National Atomic Laboratories, some 25 miles away in the village of Seibersdorf. At the time of our visit, about 40 scientists, engineers, and technicians were working in Seibersdorf, while a handful of others continued to work in the basement of headquarters.

The laboratories were divided into three sections: Chemistry, Agriculture, and Technical Support. Much of the laboratories' work is done in support of IAEA field projects in developing countries. Scientists come either on a temporary basis from jobs in their own countries, or as permanent employees. A disproportionate number are Austrian. The scientists all seem to be aware that theirs is a relatively minor role in IAEA, and even that the existence of their laboratory is not particularly well-known, but they also seem to be aware of the fact that this makes life in such a broadly international body that much easier.

The atmosphere at Seibersdorf (and even in the Vienna basement) gives a different impression than most of the organization. The greater part of IAEA is administratively-oriented and appears rather slow-moving and bureaucratic. As one might expect in the case of an organization supported by nearly 100 governments, rules and regulations abound, posts are filled on a geographic quota basis, and the wide political scope of the organization (including both East and West) necessitates a certain amount of delicacy in interpersonal relations. The research orientation in IAEA's laboratories, on the other hand, seems to draw the type of individual who likes to subvert (or at least bend) petty regulations, and who is much more informal in his manner. Consequently, the atmosphere in the labs gave the impression of being considerably more relaxed than that which exists elsewhere in the Agency.

The limited length of our stay made it hard to judge the strength of community feeling throughout the agency, but it was evident that the laboratories at least did not possess much of this kind of spirit. In at least one way, however, the Seibersdorf arrangement was a bit unusual: The establishment is so completely isolated (some of the staff refer to it as "Siberias-dorf") that the Agency has found it necessary to provide transportation for the staff. Hence, virtually the whole staff rides back and forth to work on chartered buses, and the laboratory work is generally confined to the standard 9-to-5 day.

2. The OECD HALDEN Reactor Project

Whereas IAEA was cited as being the most international of the various organizations discussed here, the HALDEN reactor project is probably closest to a national center. In fact, the project does not even have a legal status separate from the Norwegian Institute for Atomic Energy, within whose walls it is located. HALDEN is one of three joint projects of OECD's nuclear energy agency, ENEA (European Nuclear Energy Agency), and consists simply of an agreement to operate jointly a reactor owned by the Norwegian Institute.

Before dealing specifically with HALDEN, a few words about ENEA are in order. Concerned over the same sort of energy forecasts as led to the foundation of EURATOM, and looking for ways for dealing with atomic energy, the Organization for European Economic Cooperation (OEEC) began thinking, in the mid-1950's, of joint action in the nuclear field. In large measure, the history and final shape of ENEA are inextricably intertwined with those of EURATOM.

> EURATOM was begun as an effort to create an independent capability both for electric power and for the production of weapons material. ENEA was designed as a countereffort to split the Continental Six and to isolate the French weapons interest. The U.S.-British maneuver was brilliantly successful and brought about an interpenetration of both ENEA and EURATOM.[79]

ENEA was established in December 1957, following the actions and proposals of a sequence of consultants, commissions of experts, working groups, and special committees within OEEC. The seventeen member countries of OEEC signed the original statute. (Austria, Belgium, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, and the United Kingdom. Spain acceded later.) The agency is rather loosely organized, and its powers are even more circumscribed than EURATOM's. Its statement of purposes gives evidence to this fact:

> The Agency shall, as far as possible, promote the confrontation and harmonization of programs and projects of participating countries. . .
>
> To this end, participating countries shall be invited . . . to communicate periodically to the Agency their national or joint programs of estimates . . . to notify the Agency of their publicly or privately sponsored projects.
>
> The Steering Committee may give its advice . . . in the form of recommendation to the countries concerned.[80]

The organization has been quite active in a research and development role--in the HALDEN project as well as EUROCHEMIC (a nuclear chemical

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[79] H. L. Nieburg, "EURATOM: A Study in Coalition Politics," World Politics, XV, 4 (July 1963), p. 597. The reader is referred to this article for a strategic analysis of the behind-the-scenes maneuvering which took place in the early stages of both EURATOM and ENEA, with particular emphasis on the U.S. role.

[80] ENEA Statute, quoted in W. Walsh, Science . . . Affairs, p. 39.

processing plant in Mol, Belgium) and DRAGON (a jointly constructed and operated power reactor in Winfrith, U.K.). It has also played a legal role, both as a control agency and as sponsor of the European Nuclear Energy Tribunal; and it has served as a communications center for nuclear data.[81]

Member governments in ENEA are not required to participate in each joint undertaking (a mode of operation which, incidentally, is presently under consideration by other European scientific organizations) and so HALDEN was originally sponsored by seven signatories: the governments of Austria and Switzerland, the national atomic energy authorities of Denmark, Norway, Sweden and the U.K., and the EURATOM Commission. This agreement, which was signed in June 1958, was extended twice and lasted through the end of 1963. As an objective, it simply provided for the joint operation of the HALDEN reactor belonging to the Norwegian Institute for Atomic Energy, "with a view to studying the physics and technology of reactors cooled and moderated with boiling heavy water and evaluating the industrial possibilities of this type of reactor."[82] The reactor went critical in 1959 and since that time has been the source of some interesting technological developments. A new agreement was signed in late 1963, covering the period through 1966, and at this time EURATOM

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[81] ENEA maintains a small computer program library within ISPRA, by agreement with EURATOM, from which it disseminates programs for nuclear calculations. It also operates a Neutron Data Compilation Center at Saclay, France.

[82] OECD, International Scientific Organizations, p. 107.

withdrew and several of its member states signed as individual nations. In its current three-year program, HALDEN is exploring a new field--on-line digital computation, with an eye towards continuous optimization of reactor operation.

HALDEN's program is designed by a program board on which each signatory is represented by a scientist or engineer, and approved by a Board of Management. (Each member has one vote on the Management Board, except for the Norwegian Institute which has two.) The budget is not large--for the 1964-1966 program it totalled $3.6 million. At the time of our visit (August 1967) some 160 persons were employed on the project, of which only about 40 were considered professional grade scientists and engineers. Of these 40, roughly half were non-Norwegian. In addition to operations personnel, the project was divided into two groups--Statics and Dynamics, but in mid-1967, Dynamics was being phased out and a new group concerned with computation was being formed.

Halden is a relatively small town (population 10,000), located about 40 miles south of Oslo on the Eastern side of the Oslo Fjord. It is an attractive area, although Norwegians claim this is not a particularly nice part of Norway, but winters are long, and for a non-native to enjoy living in Halden for an extended period probably requires that he be something of a "Norwegiophile." Outdoor sports are very popular; aside from this, the town offers few opportunities for cultural enrichment. The Norwegian working day, which the project follows, is unusual: It lasts from about 8:00 a.m. through 3:30 or 4:00 p.m., with only a coffee break at noon. Dinner is eaten after work, at about 4:30 p.m.

The Norwegian "flavor" completely dominates the HALDEN project; even the universal use of English in work and informal conversation does not diminish this impression. (Virtually all educated Norwegians speak a reasonable English as their second or third language.) The Institute provides housing for foreign as well as Norwegian staff. Foreign staff members generally are seconded from organizations in their own countries for periods of two years or more. Often these contracts are extended and some of the international staff have been at HALDEN since the project began. In addition some non-Norwegians who are not seconded from their own countries are employed directly by the Institute. The Institute housing, as well as the smallness of the town have made the project's professional staff--Norwegian and non-Norwegian--a rather tight-knit community. There appear to be many close friendships among the staff members and their families. A high degree of professional commitment and *esprit d'école* are evident, with many individuals working extra hours strictly on their own initiative. This is reinforced by a general belief that the results coming out of the project will be of considerable significance in nuclear technology.

* * *

This discussion of the various centers included in the study has emphasized differences rather than similarities. Each center was seen as possessing its special personality, deriving from the history and nature of its parent organization, as well as the peculiarities of its locale. Amidst this mass of diverse information about the laboratories there is, however, a certain symmetry. Such symmetry emerges more clearly when we begin to examine the data supplied by the respondents. Part Two deals with the personal and professional characteristics of the scientists. We begin in the next chapter with their backgrounds and the reasons for which they sought work in an international environment.

PART TWO

CHAPTER IV

PORTRAIT OF THE RESPONDENTS

The ability to make reasonable prognostications about the scientific futures of these laboratories, as well as about the political roles which they are capable of playing, requires a rather intimate knowledge of the types of people who are involved in their operation. The broad constrasts in the atmospheres of ISPRA, CERN, and ESTEC suggest that the staffs of these laboratories are rather different from each other--at least in terms of professionalism and attitudes toward the laboratory. In addition, the institutional structure of education and scientific research varys widely among the several countries represented in the sample. One might expect, on this account, national differences in the professional and academic backgrounds of these scientists.

Despite all of this, perhaps the most striking single aspect of the sample which was drawn in this study is its homogeneity. In many of their sociological characteristics, as well as in a wide range of their attitudinal choices on political issues, the respondents were all quite similar to one another. This overall homogeneity is most interesting in that it emphasizes first the rationale for treating scientists as a distinct elite segment of the population, and second the essential similarity between the various international laboratories which were studied. Bearing in mind this homogeneity as well as the ultimate policy interest of such a "portrait of the respondents," it is worth taking a careful look at those differences among respondents which do appear, as they often point to significant characteristics.

A. Basic Variables

1. Laboratory, Nationality, and Seniority

As outlined in Chapter II, the sample was drawn within three basic parameters: laboratory (4 categories), nationality (5 categories), and time spent in the laboratory (2 categories, henceforth termed "seniority"). Ideally, we sought a sample distributed evenly across all possible combinations of these parameters. In other words, we would have liked to select as many high seniority Italians from ESTEC as low seniority Britons from ISPRA, and so forth. Table 4.1, which presents the distribution of respondents across all three parameters, reveals that this goal was not achieved.

Reflecting their large size as well as the sampling plan, the CERN, ISPRA, and ESTEC laboratories dominate the sample. For some purposes, as the discussion develops we may choose to deal with the other laboratories (IAEA, ESDAC, PETTEN, HALDEN, and FONTENAY) in an aggregated form (designated "OTHLAB" as in Table 4.1). Otherwise the discussion is based entirely on the three large centers, with occasional individual reference to the smaller centers. The relative strengths of the organizational hierarchies are reflected in the sample sizes yielded by our sampling

Table 4.1

Respondents by Laboratory, Nationality, and Seniority

	Br[a]	Fr	Ge	It	Othnat[b]	TOTAL
				ESTEC		
Low Seniority[c]	24	14	15	4	15	72
High Seniority[d]	11	5	5	3	11	35
TOTAL	35	19	20	7	26	107
				CERN		
Low Seniority	11	7	10	10	7	45
High Seniority	14	6	7	9	16	52
TOTAL	25	13	17	19	23	97
				ISPRA		
Low Seniority	0	2	9	8	1	20
High Seniority	2	23	26	31	14	96
TOTAL	2	25	35	39	15	116
				OTHLAB[e]		
Low Seniority	2	3	9	0	15	29
High Seniority	5	1	8	6	15	35
TOTAL	7	4	17	6	30	64
GRAND TOTAL	69	61	89	71	94	384

Notes: [a] Abbreviations Br, Fr, Ge, It are used in tables throughout to represent Britain, France, Germany and Italy

[b] Includes: Holland (24), Belgium (21), Switzerland (13), Austria (12), Sweden (4), Denmark (3), Norway (8), Finland (2), and Spain (7).

[c] Less than 2½ years in lab (166).

[d] More than 2½ years in lab (218).

[e] Includes: IAEA (11), ESDAC (18), PETTEN (10), HALDEN (20), and FONTENAY (5).

technique at CERN, ESTEC, and ISPRA. CERN, because of its rather loose structure, was the most difficult place in which to make the personal contacts needed for data collection and therefore yielded the smallest sample. ISPRA, in contrast, provided the easiest connections and the largest sample.

Examining the nationality distribution, large groups of British, French, German, and Italian respondents may be seen, with smaller numbers drawn from the Benelux countries, Scandinavia, Austria, Switzerland, and Spain. Paralleling treatment of the laboratories, most of the analysis is based on the four largest nationalities, while the smaller groups are brought in occasionally where appropriate. Unevenness in the nationality distribution is explained by two main factors. In the first place, sufficient numbers of the four large nationality groups were not available in all the centers. For example, since Britain is not a member of the European Community, very few British scientists are to be found at ISPRA. The climate and style of living in ESTEC's location (Noordwijk, Holland) are not attractive to many Europeans, particularly Italians, and the seven Italians included in the ESTEC sample represent the bulk of the Italian population there. Secondly, differential response rates were displayed by the various nationalities. There was, for example, a significantly higher refusal and non-respondent rate among the French than among any other group. The British, on the other hand, acted in quite the opposite fashion and their quota was often overfilled.[1]

The seniority distribution is even more unbalanced.[2] We chose, somewhat arbitrarily, a criterion of 2½ years in the laboratory to divide our sample between high and low seniority. While the gross sample is divided in two rather neatly by this criterion, at ESTEC the sample is weighted heavily towards low seniority, while at ISPRA it is weighted heavily towards high seniority. Two simple facts explain this imbalance: ESTEC is a new laboratory and did a great deal of hiring in the 1965-1967 period. ISPRA, on the other hand, was set up in 1961, sustained a rapid build-up immediately thereafter, and has done very little hiring since its early years. CERN, because of its age and intentional high rate of personnel turnover, is the only one of the major laboratories with a balanced seniority. distribution.

2. Demography of the Sample

Within its basic parameters, the sample is demographically rather homogeneous. Aside from their stratifications by nationality, there is

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[1] Such differences, resulting from differing national styles of self-expression, have been reported by other researchers. For example, see comments in Adam Przeworski and Henry Teune, "Equivalence in Cross-National Research," Public Opinion Quarterly, XXX, 4 (Winter 1966-67), pp. 551-568; Henry A. Landsberger and Antonio Saavedra, "Response Set in Developing Countries," Public Opinion Quarterly, XXXI, 2 (Summer 1967), pp. 214-229; Karl W. Deutsch, Lewis J. Edinger, Roy C. Macridis, and Richard L. Merritt, France, Germany and the Western Alliance (New York: Charles Scribner's Sons, 1967), pp. 20-23; as well as the extensive discussion in Daniel Lerner and Morton Gorden, Euratlantica: Changing Perspectives of the European Elites (Cambridge: M.I.T. Press, 1969 in press), Chapter 3.

[2] This problem limited our ability to make one of the basic tests of functional theory. See Chapter VIII.

no reason to believe that each sub-sample is not representative of its laboratory population.[3] However, we have no way of comparing the makeup of international laboratories with that of other types of European scientific establishments, so we are constrained here to presenting mainly a descriptive account of what was found, relying on our judgement for external comparisons.

More than 95% of the sample is male (370 male, 14 female) and this distribution reflects the composition of the professional staffs of the centers. Science and engineering in Western Europe--like the United States and unlike the Soviet Union--are mainly men's professions. The normal factors which tend to limit the number of women entering these professions[4] are compounded at the international centers by an important situational factor: married female scientists and engineers are not likely to come to these centers unless their husbands also work there, as joining one of the centers generally requires a substantial move. For most married couples, the primary factor in a relocation decision is generally the husband's career and not the wife's. As a result, nearly all of the women at the laboratories are either unmarried or spouses of an employee of the center. While among the men, only 16% were single,

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[3] In fact, despite our attempt to draw equal numbers of the four major nationalities, their proportions in the samples from each lab are roughly equal to their proportions in the respective lab populations.

[4] An excellent discussion of these factors may be found in Alice S. Rossi, "Barriers to the Career Choice of Engineering, Medicine or Science Among American Women," in Jacquelyn Mattfield and Carol G. Van Aken, Women and the Scientific Professions, (Cambridge: M.I.T. Press, 1965), pp. 51-127.

more than half of the women (56%) were unmarried--at least at the time of the study.

The respondents were in general a rather youthful group, their average age being 35 years. This average was nearly constant across the major nationalities and laboratories, Although the range of ages extended from 19 through 61 years, nearly 60% of the respondents were in their thirties. It is worth noting, with regard to potential influences on political attitudes, that respondents in this age bracket were entering or passing through adolescence while World War II was raging around them.

Intersecting the mode of each of these demographic characteristics, one may describe a hypothetical "modal" respondent in the sample: This person would be a male in his thirties, married, with two or fewer children.[5] In fact, so homogeneous is the sample, that 40% of the respondents fall precisely into that category!

B. Professional Background

1. Education

Because of the differences between European academic systems, cross-national analysis of educational data rapidly becomes a complex matter. A useful starting point is simply the number of higher degrees reported by respondents. Leaving aside those who indicated that they had received some higher education but no degree (3%), those who reported receiving no

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[5] The average number of children among married respondents was 1.7.

higher education (2%), and those who did not respond to the question (2%), one finds that the majority of the respondents (58%) received one degree beyond secondary school, nearly a third received two degrees (32%), but only a few (3%) received three degrees.

A baffling array of degrees and titles is available across Europe; the problem of cataloging and comparing them has plagued many besides ourselves--including, incidentally, the personnel officers in the several international laboratories. Not only are the titles far from standardized, but in a number of countries (Germany and Italy, for example) higher academic credentials are often obtained through research programs which do not necessarily lead to a degree.[6] In coping with this data, we have attempted to reduce the various national systems to one approximate common standard, and for convenience the entire matter is discussed in terms of "equivalent" American degrees.[7] The equivalents are based, with some adjustments, on the number of years of study required for attaining the degree. Using this system, Table 4.2 (see following page) presents

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[6] Italy has been attempting to set up its first Ph.D. program, under the auspices of an international institute in Naples. See D. S. Greenberg, "Italy: First Ph.D. Program Stalled by New and Old Politics," Science, CLXIII (March 21, 1969), pp. 1306-1308.

[7] For a concise summary of the higher technical educational systems of the Western European countries, the reader is referred to "Technical Education Systems, Western Europe & USA: A Comparison" (Schenectady, N.Y.: General Electric Company, 1963). This report, compiled by Dr. J. K. Wolfe of the Doctoral and International Recruiting Division of G.E., proved quite valuable in our educational analysis.

the breakdown of respondents' higher degrees.[8] Most of those holding a

Table 4.2

Title of Highest Degree

(n=384)

Ph.D.	6%
M.S.-Ph.D.	8
M.S.	19
B.S.-M.S.	41
B.S.	8
Below B.S.	9
Other, DK	9

Ph.D. or M.S.-Ph.D. equivalent had obtained only one lower degree previous to it. For most of those holding a B.S. or B.S.-M.S., this was their only degree. The French at all laboratories were most likely to have more than one degree. ISPRA had the greatest proportion of respondents with more than one degree (47%), but CERN had a significantly greater proportion of Ph.D.'s than the other laboratories.

More than half of the respondents had received their highest degrees in either physics (34%) or electrical engineering (20%). The next most popular fields were mechanical engineering, chemistry (in which we have included metallurgy), and mathematics, in that order. The distribution of fields corresponded, as one might expect, to the nature of the

[8] The number of Ph.D. and M.S.-Ph.D. equivalents is probably understated here since people who had worked beyond the highest degree in their country--as assistants, for example--often did not report this fact in response to our question.

laboratories: CERN had mostly physicists with some electrical engineers; ISPRA had physicists, chemists, and nuclear engineers; ESTEC had electrical, mechanical, and aeronautical engineers as well as some physicists.

A majority of the respondents from every large nation except Germany had received their highest degree from one of their country's major universities. Germany's system of Technische Hochschulen provided the educations of nearly half of the German scientists and engineers in the sample. Of all the national contingents in the sample, the British were perhaps unique in that a significant proportion of them (11%) had worked their way up through the British system of extension courses and local technical colleges rather than going straight through a university-type program. These men were a rather different breed than most of the engineers of other nationalities, as the following excerpt from one interview suggests:

> My higher education was hardly gained. I left school at 15. I went to sea and was six years at sea . . . I then came home, got married and only then did I realize that virtually the only difference between me and the people who were getting 2,000 pounds a year, was that they had letters behind their name and I hadn't. It took me over ten years of night school to acquire my qualifications . . . I had to do the final year by correspondence and home study . . .

Apart from these "self-made" engineers, most of the respondents completed their educations in a normal age pattern. Roughly two-thirds were between the ages of 22 and 28 years at the time of receipt of their highest degree--the average age was 26.

One feature of this data is particularly striking: very few of the respondents had gone outside of their own country for any part of their higher education. The academic backgrounds of respondents in the four large national groups (Britain, France, Germany, and Italy) were examined.

Among those 283 for whom there was complete data, only 26--about 9%--reported having studied at a higher educational institution outside of their own country.[9] Of these, 9 had gone to the United States, and 3 had gone elsewhere outside of Europe, leaving a total of only 14 respondents who had studied in a European country other than their own!

Here, among perhaps the most internationally-oriented group of scientists in Europe, one finds strong evidence of a lack of scientific interchange among European universities.[10] Various reasons may be suggested to account for this apparently low rate of interchange. Looking back at the vast differences between European educational systems, one suspects that variations in admission requirements and concern about the suitability of foreign degrees for domestic employment (at least in the engineering professions) probably account for the reluctance of many individuals to study abroad. Perhaps even more important is the fact that financial support in the form of grants and fellowships is much more likely to be available for students who choose to pursue a degree at home than for those who go to a foreign country. In any case, among the scientists and engineers in this sample, few had ventured outside of their own countries to study.

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[9] The proportion was slightly higher for the smaller countries.

[10] P. M. S. Blackett, in his Presidential Address before the British Royal Society (November 30, 1966) deplored this situation, citing a Royal Society survey which showed that "the number of post-doctorate [science] students from Europe working in Britain was less than a fifth of those from the U.S.A." He announced in this address that the Royal Society was undertaking a program aimed at making a "notable increase in the scientific interchanges within Europe."

2. Previous Employment

From what sorts of jobs do the international scientists come? To what extent are they fresh out of school, and to what extent are they drawn away from careers in government, industry, and the academic world? The answers to these questions are essential to an understanding of the relationships between international laboratories and national scientific establishments. Additionally, they may determine the potential ability of these scientists to play the role of a functional elite in European integration. The information which was gathered concerning the respondents' previous employment does not comprise their complete work histories. A desire to keep the questionnaire reasonably short made it necessary to restrict questioning to the respondents' activities immediately previous to their arrival at the international laboratory. This in itself, however, reveals a great deal.

Within the gross sample, some 15% of the respondents had come to their present positions directly from their studies. The vast majority (85%), however, had been previously employed. CERN, whose academic "flavor" was discussed in Chapter III, shows the most respondents coming straight from their studies (25%), while ESTEC shows the least (7%). Of course, CERN's intended role is closer to that of an educational institution and its work is more closely linked to that which goes on at a university than either of the other major centers, so one need not be too surprised at this result, or at the fact that among those respondents who were previously employed, the percentage coming directly from a university position was highest at CERN (27%). In this respect, ESTEC and ISPRA were quite similar, drawing roughly half of their personnel from industry

(51%, 42%), a third from government laboratories (32%, 38%), and only a few from the universities (8%, 14%).[11]

The respondents' previous employment also appears to be a function of their nationality. Table 4.3 presents this picture. The strengths of

Table 4.3

Previous Employment by Nationality

	British (69)	French (61)	German (89)	Italian (71)
Government Lab	54%	45%	29%	16%
University	17	4	17	21
Industry	26	39	53	52
Other and DK[a]	3	11	--	11

[a] "DK" is used throughout as an abbreviation for "Don't Know," equivalent in most of our usage to "no response."

governmental science bureaucracies in Great Britain and France are reflected in this table. Scientists and engineers with permanent posts in government agencies are often able to take temporary leave to work in the international organizations, and for the British at least, the pay is generally a good deal above what they earn at home. The Science Research Council maintains Britain's relations with international scientific organizations

[11] It is worth noting parenthetically that a total of 10 respondents had come to their present jobs directly from another international laboratory and several others had at some previous time worked in another international laboratory. The financial, intellectual and/or psychological rewards of working in such centers are apparently hard for some individuals to forego.

and it seems to have encouraged this secondment process. A number of the Frenchmen who were drawn from the government sector come from the Commissariat à l'Energie Atomique, and a few have been on leave from CEA during the greater part of their professional lives. The very small percentage of Frenchmen coming from universities is somewhat surprising, and one may speculate that perhaps because university appointments are so difficult to get in France, Frenchmen who receive such appointments are less likely than academics of other nationalities to either give them up or go on leave to work in an international center.[12]

Those respondents coming from governmental employment tended to have spent a longer time in their previous positons. Nearly half had been five years or more in that position, while only a third of those coming from the universities or industry had been employed that long. Independent of the sector from which they came, the British tended to have spent the longest time in their previous job, while the Italians had spent the least.

Although most respondents came from positions in their own countries, it is significant that a non-negligible fraction originated at jobs which were already outside of their country. A few had been working as foreigners in the country where the international center was established and perhaps saw joining the center as a way of remaining in that country while raising their legal status from that of an alien to that of an

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[12] Cf. Robert Mosse, "France: A Case Study," in Walter Adams (ed.), The Brain Drain (New York: Macmillan, 1968), pp. 159-162.

international civil servant. Others--a total of 11 in the sample--came back to Europe from jobs in the United States. This "reverse brain drain," while small, corresponds to one of the aims of these organizations. Its spirit is epitomized in the interesting but atypical experience of one ESTEC space scientist who, in an interview, explained how he happened to come to the organization:

> I was studying in [a university] in California, and I was going to make a Ph.D. in Aeronautical Engineering there. One day I was driving in my car and I heard over the news that Europe had created its own space agency; this surprised me greatly because I thought they would take at least ten years to make such a thing . . . I thought if this is going to be a CERN for space research, it's exactly what I'm looking for--it's European and it's space. So I quit my studies with only an engineer's degree, came to Paris and immediately went there and said, 'Look, can I work for you?'

Examination of the respondents' educations as well as their previous positions reveals some patterns which will help us later in understanding differences in types of scientists and engineers drawn to the various centers. It was noted that ESTEC, where the laboratory as well as the sample was weighted with a large proportion of Britons, had more engineers, few academic types and many individuals recruited directly from government and industry. ESTEC was also the only one of the large centers in which a significant percentage (15%) of the respondents had spent more than 10 years in their previous job. CERN was the most academic in orientation, with the largest percentage of respondents coming directly from their studies and the largest percentage coming from previous employment in a university. The greater part of the ISPRA respondents were scientists and most came from the government and industrial sectors. The proportion drawn to ISPRA from the academic world was less than that at

CERN but greater than that at ESTEC.

C. Joining an International Laboratory

The decision to join the staff of one of these international centers clearly represented a major decision in the life of each respondent. For most it meant giving up a job at home and moving to a foreign country, often uprooting one's family in the process and rupturing personal and professional ties. This analysis attempts to break the decision process down into two parts: (1) the decision to leave one's former position, and (2) the decision to join the international center. Using the r responses obtained, we attempt here to describe the various ways in which the process operated among the respondents.

1. Decision to Leave Former Job

In an open-ended fashion, the questionnaire and interview both asked the repondents to state the reasons for which they had left their previous positions. In the coding process, the responses were sorted into several categories: (1) Lack of work; (2) Intellectual dissatisfaction (e.g., "uninteresting work," "lack of challenge"); (3) Career dissatisfaction (e.g., "low salary," "no prospects for advancement"); (4) Desire for broader experience (no dissatisfaction); (5) Better opportunity (no dissatisfaction); (6) Personal reasons; and (7) Other reasons. Overall, the responses were well distributed across all of these reasons with the most frequent choice being career dissatisfaction (20%) and the least frequent being personal reasons (6%).

Cross-tabulation by laboratory, however, uncovers some significant differences. At CERN one finds that few of the respondents were dissatisfied with their previous positions--either in an intellectual or career sense--only 23% so state. The two most frequent reasons given for leaving former jobs--accounting together for 42%--are "better opportunity" and "broader experience." Compared to scientists from other laboratories, the CERN respondents were not particularly unhappy at their former jobs, but they found the attraction of CERN irresistible for reasons we shall examine shortly. At ISPRA, on the other hand, a plurality (41%) left their former jobs because of career (20%) or intellectual (21%) dissatisfaction. Apparently they sought to improve their situations by changing jobs. Finally, at ESTEC, one finds the largest single choice among any of the major laboratories--career dissatisfaction--which drew an even 30%. This was followed by those who complained of a "lack of work" of the type they desired in their former jobs (16%). ESTEC also had the highest proportion of responses classified as "other reasons" (19%) among the large centers, and the ranks of this group were swelled by a number of Britons who stated that they left chiefly out of a desire to get away from their country for a time.[13]

2. Attractions of the International Centers

What, then, made these centers attractive to the respondents? The

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[13] Cf. James A. Wilson, "The Emigration of British Scientists," Minerva, V, 1 (Autumn 1966), pp. 20-29. Many British scientists who had gone to America referred to "irritating conditions in British universities, the scientific civil service, or British industry and commerce" among their reasons for leaving. (p. 25.)

questionnaire recipients were presented with a number of possible reasons for coming to their present jobs and asked to rate each reason as "very important," "a factor," "not important." They were also asked to note the one reason which they felt was "most important" in their decision.[14] The interviewees were simply asked to describe how and why they came to the organization and their free-flowing responses were coded onto the questionnaire forms.

While all of the respondents answered at least part of this question, selection of one most important reason was rejected by nearly a third of the respondents. These individuals either did not select any response for this category, or gave multiple answers. This is taken as a strong indication of the fact that for many respondents the attraction of the international center was based on a combination of factors, none of which was sufficient individually, but which together provided the impetus for the decision. The marginal for this essential question, plus the tabulations for the three large centers are presented in Table 4.4 (see following page). Considering only those respondents who did indicate one most important reason (i.e., excluding those classified as "other, multiple, and no answer"), it appears that, in the total sample, "opportunity to pursue a particular type of work" accounted for more than half (51%) of the decisions. Ranking a somewhat distant second as a most important reason was "the desire to work with people of other nationalities."[15] Among those

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[14] See Appendix I for actual layout of this question.

[15] Responses which had entered under "Other," but which were judged to be equivalent to this category (for example, "desire to work for Europe"), were coded together with this response.

Table 4.4

Most Important Reason for Coming to the Organization, By Laboratory

	Total Sample	ESTEC	CERN	ISPRA
	(384)	(107)	(97)	(116)
Opportunity to pursue a particular type of work	35%	32%	40%	34%
Desire to work with a particular individual or group	2	2	0	3
Quality of equipment	3	2	3	4
Higher salary	8	11	6	9
Desire to work with people of other nationalities	11	12	8	12
Location	2	0	2	3
Job security, tenure	1	0	2	1
Lack of opportunities in own specialty in own country	6	7	4	6
Other, Multiple, and No Answer	33	34	33	29

who did give one most important reason, this category drew 17% of these responses.

It is clear from this table that when asked to select the <u>one most important reason</u> which brought them to their present jobs, a plurality of respondents at all three major laboratories (as well as at the smaller ones not shown here) gave the professional answer: "opportunity to pursue a particular type of work." Because it appeared, however, that many of the respondents' decisions were codetermined by a number of factors, and because differences between the laboratories are rather hard to distinguish from this tabulation, we looked a bit further into those reasons which the respondents felt were not "the one most important," but were nevertheless "very important" or at least "a factor" in their decisions.

The distribution of importance for each reason was thus cross-tabulated by laboratory. In order to reduce the resulting mass of data into manageable form, each proffered choice was rated as having either high, medium, or low importance for the scientists of each center.[16] A choice was rated high in importance for a particular laboratory if 40% or more of the respondents ranked it as "most important" or "very important." A choice was ranked low if 40% specified it as "not important" or did not rate its importance at all.[17] Choices of medium importance were those that fit neither the high nor the low criteria. Table 4.5 displays the result (see following page).

The strength of professional orientation at CERN is evident from this table: CERN's staff ha come to Geneva to do high energy physics at the best machine in Europe --or for those who were not high energy physicists, at least to follow a line of work which interests them. For most CERN respondents, other considerations were secondary. Of particular note is the fact that CERN's international makeup, while (as will be seen later) enjoyed by nearly everyone, was not rated as an important reason for coming to CERN in the first place.

In contrast, ESTEC's personnel were attracted not only by the nature of its work, but also by the higher salaries it offers (particularly relative to those in Britain), and by the fact that it is an international

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[16] This technique also made use of those multiple responses in the "most important" category which were not utilized in the above discussion.

[17] Referring to the question format in Appendix 1, the reader may see how we could consider both of these possibilities as more or less equivalent.

Table 4.5

Relative Importance of Reasons for Coming to the Organization, by Laboratory

	ESTEC	CERN	ISPRA
Particular type of work	high	high	high
Particular individual/group	low	low	low
Quality of equipment	low	medium[a]	low
Higher salary	high	low	medium
People of other nationalities	high	low	medium
Location	low	low	low
Job security	low	low	low
Lack of opportunities	low	low	low

[a] While 43% of those at CERN considered quality of equipment not important, the number of respondents who considered it most important or very important (33%) was so much greater at ESTEC or ISPRA, that we do not feel justified in rating this choice as low. Evidently it is the uniqueness of CERN's accelerator which is relevant here rather than, strictly speaking, its "quality."

center.[18] One might speculate that such initial expectations in the minds of ESTEC staff members imply a lower degree of professionalism, and greater degree of commitment to non-technical (career and socio-political) goals.

The relative importance of the various reasons at ISPRA is similar to that at ESTEC, but with less emphasis on salary and internationalism. Given the overtly political nature of EURATOM, this finding is somewhat unanticipated. We may hypothesize that scientists are likely to have a

[18] See Footnote 13, p. 228.

more professional orientation (and thus be more concerned with the particular type of work) than engineers, and as the ISPRA sample has a relatively larger proportion of scientists than ESTEC, this would account for the differences in Table 4.5. Table 4.6, in which scientists and engineers have been distinguished on the basis of academic degrees, supports this assertion.[19]

Table 4.6

Percentage of Scientists and Engineers Choosing "Type of Work" as Most Important Reason, by Laboratory

	ESTEC	CERN	ISPRA
Scientists	36% (n = 36)	41% (n = 49)	39% (n = 69)
Engineers	27% (n = 60)	42% (n = 43)	23% (n = 39)

To summarize this discussion, one may model two types of processes operating to bring scientists and engineers to these international laboratories--processes probably not much different from most other job change processes. The first model seems to divide into two subprocesses: its initial stage is a decision to leave the former job. This decision, based on either career or intellectual dissatisfaction, is followed by the selection of another job from a range of alternatives--choice being based on such extra-professional considerations as the international atmosphere of the organization and level of salary, in addition to the type of work available. This

[19] We may also observe in this table that at least when distinguished according to education, CERN scientists and engineers are much more alike than scientists and engineers in the other laboratories.

model seems to predominate at ESTEC and ISPRA. The second type of process does not separate neatly into two parts but finds the individual relatively satisfied with his former position. A vague desire for broader experience or simply the appearance of a better opportunity in the international center motivates the job change, and often the decision to leave the former job is a product of the decision to take the new one, rather than its predecessor. This latter process seems to occur more often at CERN.

D. Organizational Status

Before concluding this portrait of the respondents it is worth looking briefly at the places they hold within their organizations. No effort was made to select particular strata among the professional staffs of these laboratories, and in this respect, the samples seem to be adequate representations of the actual organizations. The greater part of the respondents might be described as young "bench scientists" and engineers--more or less the rank and file of these laboratories. Some, of course, are destined to become important figures in their fields; others will finish out their professional careers at more or less the same level. Scientists with high level posts in the organizations are represented in the sample in rough proportion to their numbers in the labs.

Table 4.6 in the previous section showed the distribution of scientists and engineers (according to academic degree) at the three large laboratories. This same pattern is mirrored in the distribution by organizational job title--with ISPRA having more scientists than engineers, CERN having about equal numbers, and ESTEC having more engineers than scientists.[20] A certain number of programmers and engineering technicians (with appropriate degrees) are included in the sample, comprising about a fifth of the ESTEC and CERN samples, but less than 10% of the ISPRA sample. The 15% of the sample which is comprised of division and group leaders is distributed fairly evenly across the major centers.

The distribution by field of educational specialization is reflected in the distribution of actual fields of work. In other words, most respondents were working in the fields in which they were educated. Respondents were also asked to classify their work as to whether it was basic research, applied research, development, engineering, technical service, or administration. The tabulation of this question by laboratory is presented in Table 4.7. Given the nature of the various

Table 4.7

Type of Work, by Laboratory

	ESTEC (107)	CERN (97)	ISPRA (116)
Basic Research	2%	18%	10%
Applied Research	20	20	36
Development	8	24	16
Engineering and Design	22	20	19
Technical Service	17	5	8
Administration	16	2	4
DK, Other, Multiple Answer	15	11	7

[20] The CERN sample includes some scientists (13) who were not actually classified as "scientists" by title but as "fellows" or "visitors."

organizations, this table offers few surprises. The only words of explanation really required relate to the large proportion of "administrators" at ESTEC, and the unexpectedly small proportion of "basic researchers" at CERN. With respect to the former, this is not out of proportion for ESTEC--a number of the respondents were contract supervisors in the Spacecraft Projects Department whose work consisted of overseeing the construction of ESRO's satellites in industry. With respect to the latter, "machine users" at CERN are probably under-represented with respect to "machine builders" and "service" scientists and engineers. Otherwise the samples appear reasonably representative of the organizations. The samples from the smaller laboratories (ESDAC, PETTEN, HALDEN, IAEA) seem to be concentrated strongly among applied research types, as are the laboratories.

* * *

The material in this chapter was presented primarily in order to acquaint the reader with the basic characteristics of those individuals who, as inhabitants of the international laboratories of Europe, became part of this study. It should be evident from this brief portrait that despite a broad demographic homgeneity, the characteristics of these scientists and engineers vary significantly in response to qualities of the different laboratories and under constraints of different national scientific systems. Of particular importance are the variations in institutional background, which reflect differential relationships of the laboratories to industry, government, and academia. Furthermore, the contrasts in degree of professional motivation in decisions to come to the international laboratory as well as in reasons for leaving previous jobs, point to important implications for the achievement potentials of the different laboratories. In any case, armed with this portrait, one may begin to look in more detail at the international ties in the respondents' lives and at the ways in which they have reacted to the international situation in the laboratory.

CHAPTER V

THE INTERNATIONAL LIVING EXPERIENCE

Most of the scientists and engineers who come to the international laboratories are, for longer or shorter periods of time, leaving their homes and going to live in foreign countries. To some extent, the future patterns of their lives will be shaped by this experience. For many individuals, however, earlier exposure to more than one national culture has created the preconditions for successful adjustment to international life. In exploring the operating characteristics of international laboratories, this chapter deals with life inside and outside of the laboratory as an international living experience. It begins by examining multinational influences in the respondents' lives--those aspects of their family backgrounds which extend beyond the confines of a single nation, the extent to which they have previously lived abroad, their travels, and their language competence. It looks further at the ways in which they have adjusted to life in a foreign country. Finally, it examines the respondents' relationships with their own countries: the personal and professional ties they maintain at home, their participation in the national life of their country, and their future plans for returning--or not returning.

A. Foreign Exposure

1. Family Influences

The vast majority of the respondents came from conventional mono-national families, in which both parents were of one nationality and they were of the same nationality. Only a small number--26 in all (7%)--came from families in which one or both parents possessed a different nationality than they themselves. As Europeans of mixed parentage generally take the father's nationality, most often among these cases it was the mother whose nationality differed from the respondent's.[1] At least in this respect, then, the respondents were probably not very different from most of their countrymen--they were Frenchmen born of French parents, Germans born of German parents, and so forth.

While a man of course cannot choose his parents, he is normally free in modern society to choose his wife; and it is significant that a sizable proportion of the respondents chose wives whose nationalities differed from their own. The data, unfortunately, does not reveal how many of the respondents were married before coming to their present jobs, and how many met their wives while at the international laboratory. It does indicate,

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[1] The number of cases in which the respondent's parents had immigrated to the country of the respondent's nationality may have been slightly underestimated as the question asked for parents' nationality--not country of their birth.

however, that some 18% of the respondents have foreign spouses. Although it is difficult to tell because the numbers become quite small, there does not seem to be any pattern among the intermarriages--Frenchmen seem about as likely to have married German girls as Belgians; Dutchmen seem about as likely to have married Italian as Swedish girls. Nearly all, however, are married to other Western Europeans.

2. Travelling and Living Abroad

Chapter IV reported that a relatively small proportion of the respondents had received their educations outside of their own countries, but that a somewhat larger proportion had come to the international center directly from employment outside of their own country. This latter proportion--varying from 11% to 14% across the major nationalities--greatly understates the number who have lived and worked abroad at some previous time in their lives because it includes only that period immediately previous to the present job. The number of respondents who reported having lived abroad at any time previous to coming to the laboratory was very nearly one-half of the sample (48%).[2]

There is some indication that a significant proportion of the respondents were exposed to life in a foreign country during their childhood. Adding those respondents who were born abroad, and those who were born inside their own countries but lived in another country before beginning their higher education yields a total of 57 individuals. This is nearly one-third of the total number who have lived abroad, and indicates that

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[2] Living abroad was defined in the question as "3 months or longer."

for many of the respondents, an international influence has deep roots in their background.

Among those 185 respondents who had lived outside of their own country before coming to the international center, more than a fourth had lived in more than one country. Most had spent significant periods of time abroad, nearly half spending greater than 2 years, and nearly a quarter spending greater than 5 years. Geographic proximity and language consideration seemed to play some role in the choice of countries within Europe, but more respondents had lived in the United States (53) than any other single country. Britain (22) ranked second behind the U.S., followed by Switzerland (21), and France (19). Significant numbers of British had lived in Canada or other Commonwealth countries, and a number of Frenchmen had lived in French colonies or ex-colonies.

The proportion of respondents with foreign living experience varied markedly with laboratory and nationality, as Table 5.1 illustrates. This

Table 5.1

Previous Living Abroad, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
	(35)	(19)	(20)	(7)	(25)	(13)	(17)	(19)	(25)	(35)	(39)
Yes	37%	68%	65%	57%	36%	23%	6%	32%	52%	43%	62%
No	63	32	35	43	64	77	88	68	48	54	36
DK	0	0	0	0	0	0	6	0	0	3	2

table reveals important differences between the types of individuals drawn to the three major laboratories. CERN respondents from all countries had the least foreign living experience. Overall, only one-third of these individuals had lived abroad before coming to CERN. At ISPRA, approximately half of the respondents of each major nationality had previously lived abroad--the average including smaller nationalities was 53%. It is important to note that at both ISPRA and CERN, the various nationalities were fairly similar to one another. ESTEC is strikingly different from either of these cases. Among the French, Germans, and Italians at ESTEC, nearly two-thirds had previously lived abroad, generally a higher proportion than at the other laboratories. In contrast, only about one-third of the ESTEC British seem to have done so. This is the only case of such a strong reversal in the table.

The reasons behind this table relate to the respondents' motivations for joining the international organizations. ESTEC's attractive power, it will be recalled, was based nearly as much on the extra-professional factors of salary level and international atmosphere as on the type of work it was doing. Further, ESTEC had the smallest percentage of respondents coming directly from their studies. Most respondents were drawn from industry or government. In Britain, ESRO's main means of recruitment is the circulation of vacancy notices in government establishments (where a great proportion of the persons with the needed skills exist) and in Britain also, the salary differential is greatest. Many career civil servants come to ESTEC on secondment from Britain for a limited period of time. These individuals are likely to have had limited international exposure in their careers. ESRO recruitment in France, Germany, and Italy, on the other hand, is less concentrated in the government sector, fewer individuals are seconded from career government posts, and salary levels are not that different. Among these nationalities, then, one would not expect international experience to be quite as limited as among the British and in fact one might expect to find more individuals for whom past foreign experience has created the desire to work in an international atmosphere. Indeed this is what is found.

At CERN, where the main attractions are the type of work and the facilities, considerations such as salary and desire to work in an international atmosphere are less relevant. Although the CERN respondents are a cosmopolitan group, most come to CERN for professional reasons unrelated to previous international experience. Furthermore, it should be recalled that 25% of the CERN sample came directly from their studies and thus had less opportunity for previous foreign experience.

ISPRA was intermediate to ESTEC and CERN with regard to the factors which served to attract scientists and engineers. Extra-professional factors were more important than at CERN, but less important than at ESTEC. Similarly, previous foreign exposure falls at an intermediate level for ISPRA. It is perhaps significant that the group with the highest percentage of foreign living experience at ISPRA was the Italians. These scientists may well have enjoyed the international atmosphere, finding what one called "best of two worlds"--a non-Italian organization in Italy.

It might be expected that (1) being scientists and engineers, (2) working in a foreign country, and (3) having done a substantial amount of living abroad, the respondents would, in general, be a well-travelled group. This, in fact, is the case, as the data shows. Table 5.2 presents the percentage of respondents who reported having travelled to various areas of the world.

Table 5.2

Percentage of Respondents Reporting Travel To Selected Regions of the World

Western Europe	100%
Eastern Europe	16%
Soviet Union	4%
United States/Canada	40%
Middle East	12%
Asia	7%
Africa	15%
Latin America	5%
Other Areas	3%

The character of travel varied substantially between different parts of the world. Very few (8) respondents, for example, reported visiting the United States purely for touristic purposes. Most (146) went there either for professional reasons, or combined professional trips and tourism. Travel in the Middle East and Eastern Europe was, on the other hand, predominantly touristic, while travel in the remaining areas (outside Western Europe) was largely professional (including military service). A trichotomized index of <u>amount</u> of travel compiled from the data showed little variation either across laboratories or nationalities.[3]

3. <u>Language Competence</u>

The language barrier is sometimes mentioned as an impediment to effective work in an international scientific enterprise. In this analysis, the degree to which the respondents were able to communicate in more than one tongue might be taken as a partial indication of their exposure to alien cultures as well as of their ability to cope with and profit from the international situation of the laboratory. Each respondent was asked to enumerate the languages he spoke. The total number of languages for each respondent was coded, and a respondent was also coded as either speaking or not speaking each of the seven most popular languages.

Virtually all educated Europeans speak a second language, and many, especially those coming from smaller countries, speak a third. Thus the average number of languages spoken by the respondents in this study--3.3--was remarkable only by American standards. Only 17 persons in the entire sample were monolingual. Interestingly enough, all 17 were British (14 from ESTEC)--comprising one-fourth of the total number of British respondents. Fifty-two respondents spoke five or more languages. The average number of languages spoken by the various nationalities as well as the

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[3] The index was constructed in the following manner: Those who reported having only travelled through "some" of Western Europe (for touristic or professional reasons or both) were assigned the value "low travel" (n = 91). Those who had travelled through most of Western Europe, or some or most of Western Europe plus one area outside of Europe, were classified "medium travel" (n = 218). Anyone who had travelled more than that was considered "high travel" (n = 75).

frequency of speaking several of the most popular languages is given in Table 5.2. Most impressive here is the enormous power of the English

Table 5.3

Language Competence by Nationality

	Br (69)	Fr (61)	Ge (89)	It (71)	Hol (24)	Bel (21)	Swi (13)	Aus (12)	Scand (17)	Spain (7)
Avg. No. of Langs.	2.17	3.15	3.40	3.35	4.67	4.14	3.69	3.17	3.53	4.00
Percent Speaking:										
English	100%	97%	100%	90%	100%	100%	100%	100%	100%	86%
French	71	100	73	94	79	100	100	58	50	100
German	12	39	100	27	100	76	54	100	100	43
Italian[a]	7	48	36	100	21	52	23	25	0	8

[a] Virtually all non-Italians who speak Italian are from ISPRA.

language. Only ten persons in the entire sample did not speak English--seven of these ten were Italians at ISPRA.[4] English is clearly the lingua franca of this international scientific community. Overall, French is a relatively close second to English in currency. (One must remember that all of these laboratories have either French or English or both as

[4] Although questionnaire subjects were given their choice of English, French, and German forms, and 21% took French, while 14% took German, the French and German forms were more a matter of convenience than necessity for the respondents. It is evident from Table 5.3 that the study could have proceeded substantially unhindered if it had been done entirely in English.

official languages.) German follows as a distant third.[5]

Despite differences in language requirements, the scientists at the various laboratories do not differ markedly in linguistic capabilities. Although German is an official language at ISPRA and not at CERN and ESTEC, roughly the same proportion of non-Germans speak the language at all three laboratories (25-30%). English is nearly as widely spoken at ISPRA as at CERN and ESTEC, and French is only slightly more popular among non-native speakers in CERN than elsewhere. Among the major languages, the only deviant case is Italian. In the entire sample outside of ISPRA, only 19 non-Italian respondents spoke that language. At ISPRA, knowledge of Italian is so essential for living in the area that only 4 non-Italians in the sample have not managed to pick it up.

Amount of travel, number of languages spoken, and foreign living experience are all highly intercorrelated. A high score of international exposure on one variable generally suggested a high score on the others. An index of "international exposure" was constructed using all three of these indicators; its construction is shown in Table 5.4 (see following page). This index serves to emphasize the important differences between the national groups at the major laboratories and thus summarize the results of this section. Table 5.5 (see following page) shows the distribution of the index for each major nationality at the three major

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[5] Our result here brings to mind the words of one respondent, an eminent French physicist, who was asked if he had found language to be much of a problem in his laboratory: "No, I spoke French from birth, English from Physics, and German from prisoner-of-war. It was no problem for me!"

Table 5.4

Index of International Exposure

Living Abroad	Travel	Language[a]	Index	n	Group n
yes	hi	hi	1	29	
yes	hi	lo	1	24	53
yes	med	hi	2	52	
yes	med	lo	2	58	
yes	lo	hi	2	12	122
yes	lo	lo	3	9	
no	hi	hi	3	9	
no	hi	lo	3	10	
no	med	hi	3	36	64
no	med	lo	4	72	
no	lo	hi	4	15	87
no	lo	lo	5	55	55

[a] Hi language = more than 3
Lo language = 3 or less

Table 5.5

Index of International Exposure,
by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br (35)	Fr (19)	Ge (20)	It (7)	Br (25)	Fr (13)	Ge (17)	It (19)	Fr (25)	Ge (35)	It (39)
Index											
1 (hi)	9%	32%	10%	29%	16%	0%	6%	5%	12%	3%	13%
2	23	32	50	29	16	23	0	26	40	40	41
3	11	11	15	14	8	15	24	5	32	29	13
4	37	21	20	29	52	31	53	32	8	20	13
5 (low)	17	5	5	0	8	31	18	32	8	6	21

laboratories. As living abroad is a major component of this index, the results parallel and refine those of Table 5.1. It may be seen that, except for the British, the ESTEC respondents have all been rather highly exposed to aspects of international life. The British differ sharply--showing a much lower level of exposure. At CERN, all four major nationalities show a uniformly low level of prior exposure. The level of exposure of the four nationalities at ISPRA is also fairly uniform; it is intermediate between ESTEC (apart from the British) and CERN.

B. Adjustment

Varying degrees of prior international exposure suggest varying reactions to life in a foreign country. The respondents were asked if they had had any difficulties in adjusting to life in the country and community in which the laboratory was located. Overall, only 25% responded that they had, but in looking at the cross-tabulations and questionnaire comments one gets a better feeling for the real meaning of this response.

The British, both at ESTEC and CERN, were most likely to say that they had encountered problems in adjusting. Forty-three percent of the former group and 40% of the latter so indicated. Other groups at ESTEC--notably the Germans--report a similar level of difficulty, giving ESTEC the distinction of having the most difficult location to which to adjust.[6]

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[6] A number of Frenchmen and Belgians at ESTEC solved their adjustment problems by leaving their families at home, living in small flats or rented rooms near ESTEC, and commuting home each weekend.

If one excludes Italians--who were actually living in their own country--from the ISPRA tabulations, then ISPRA displays a slightly greater rate of adjustment difficulty than CERN, and a slightly lower rate than ESTEC. Among all nationalities, problems of adjustment seemed fewest at CERN.

What sorts of difficulties appeared? In large part they were similar to problems which might arise among any ordinary persons who went to live in a foreign country. Complaints about "local conditions," "customs," and "mentality" were the most prevalent.[7] The ESTEC British, most problem-prone in the sample, often cited such things as weather, housing conditions, and cost of living as sources of irritation. More than one-third of this group volunteered such complaints. A handful of respondents at CERN and ISPRA mentioned that they found the life-style of the local population difficult to adjust to. Language problems were only rarely mentioned at the major laboratories.

One suspects that the relative paucity of adjustment problems reported by the ISPRA respondents is to be credited not so much to the favorable qualities of the location, since ISPRA's location, in fact, might be expected to prove difficult to adjust to. Rather, it is a credit to the efforts which EURATOM has made to facilitate adjustment of new staff members (see Chapter III). These procedures have naturally been refined

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[7] Although nearly 30% of the respondents wrote in comments in response to this question, too great a stress on numbers here might be somewhat misleading. Qualitative examination of the interviews was also important in developing some of these ideas.

as the organization has grown and their effectiveness is brought out by the fact that those ISPRA respondents who reported that they had had adjustment problems are all in the high seniority group. Not a single individual (out of a total of 20) who arrived at ISPRA during the past 2½ years reported problems in adjusting.

The staffs of all of these international laboratories are given a special status by the host governments. As international civil servants they have rights and privileges similar to, but naturally not as broad-ranging as, diplomatic personnel: exemption from customs duty for cars and personal possessions, exemption from income tax for the salaries earned inside the organization, and so forth. The special status of international civil servant operates in two divergent ways, however. On the one hand, many of the normal problems which foreigners might encounter upon settling in an alien country are alleviated. One does not have to deal too frequently with the unfamiliar bureaucracy of the country. One has many compatriots in a similar position, and one's position, due to its attendant privileges, is somewhat above other foreigners in perceived status.[8] On the other hand, the international civil servant status serves to isolate the individuals from the community in which they are placed. In the concise words of one questionnaire respondent, commenting

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[8] In fact, these considerations apply to a lesser degree at ESTEC, where conflicts between the organization and the Dutch government over many of these very matters are a frequent source of complaint among the staff. It is assumed that these disagreements will be--or already have been--worked out.

on the question of adjustment:

> Natural participation in local community excluded by legal status of 'international organization staff.'

To the extent that the scientists desire to integrate, their status inhibits this process and for many this lends something of an artificial quality to their stay.

This effect may be seen in the manner in which respondents evaluated the mentalities of people in their host country--a manner which seemed almost independent of the country itself. At CERN, nearly everyone except the Swiss themselves expressed the opinion that the Swiss were rather cold and aloof in their dealings with foreigners and that it was very difficult to make friends among them. At ESTEC one could hear virtually the same evaluation, replacing "Swiss" with Dutch. The reaction was similar with respect to the Italians at ISPRA. Three short quotes serve to demonstrate this point:

> From the Swiss community it's very, very hard to meet people. We meet them on the staircase or in the lift--'Hello, fine weather today,' and that was the end of the contact with the Swiss. . . I think even the Swiss among themselves don't have very close contact. Just everyone by himself, that's the most important part of the world.
>
> --German at CERN

> This in my opinion is a bad aspect of ISPRA. It's like a colony. . . Italy is a country in which you do not have a middle class, you have only rich people and poor people. Varese is a town of rich people. . . and to contact this kind of society is extremely difficult.
>
> --Frenchman at ISPRA

> . . . I don't feel myself very much at home in Holland. I think this is due to the Dutch character. You see, for instance, they leave their jobs in the evening, go home and settle at home. They don't have very much of society or common life. . . They are quite nice, but they don't easily make friends.
>
> --Frenchman at ESTEC

Some of the respondents did in fact recognize that the special status of the international civil servant and the fact of being one of a large group of foreigners accounted for this phenomenon. In any case, the phenomenon was less pronounced at the smaller centers, such as ESDAC and PETTEN, probably because of the centers' size. Since they were relatively few in number, the scientists were forced to look outside of their organization for at least some of their social contacts, and, simultaneously, the local residents were less prone to identify them as part of a class of "outsiders."

The range of adjustment problems discussed here, it must be remembered, pertains to a minority of the respondents. The greater portion of the respondents in all national groups at all major laboratories responded negatively to the question of adjustment problems. A different question, however, dealing with satisfaction with life in the laboratory's location, provided more broadly-based data. Table 5.6 shows its tabulation

Table 5.6

Satisfaction with Life in the Location, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br (35)	Fr (19)	Ge (20)	It (7)	Br (25)	Fr (13)	Ge (17)	It (19)	Fr (25)	Ge (35)	It (39)
Completely satisfied	3%[a]	5%	0%	14%	20%	15%	18%	0%	4%	3%	5%
Very satisfied	14	16	5	0	36	62	65	32	36	51	28
Satisfied	26	47	45	29	36	23	18	42	24	37	46
Somewhat satisfied	49	21	35	29	8	0	0	26	32	6	18
Very unsatisfied	9	11	15	14	0	0	0	0	4	3	3

[a] Here, as well as in Tables 6.3, 7.4, 8.4, 8.5, and 10.2, below, DK is omitted for the sake of simplicity.

by nationality and lab. The results, clearly, parallel those of the foregoing discussion. The level of satisfaction is highest in Geneva (CERN), lower in Ispra, and lowest at Noordwijk (ESTEC). The ESTEC British, who reported the highest frequency of adjustment problems, were also the least satisfied with life, but otherwise the level of satisfaction was more a function of location than nationality. The only additional point worth noting is the virtual absence of dissatisfaction with life in Geneva.[9] For most of the respondents, satisfaction with life in the host country appears to be associated with prior foreign exposure. Excluding Italians from ISPRA (who are living in their own country), those respondents who showed a higher degree of prior foreign experience (measured by the scale in the previous section) were likely to show greater satisfaction with life in the laboratory location.[10]

C. Domestic Ties

In light of their prior international exposure and their living experience in the host country, one should expect the degree of commitment which the respondents still show toward their own country to be an

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[9] The 5 Italian respondents from CERN (26%) who replied "somewhat unsatisfied" to this question appear as something of an anomaly as no collaboration or explanation appears either in the interview texts, questionnaire comments, or related questions.

[10] A significant exception to this relationship appears at ESTEC. Here a number of individuals with very high indices of prior exposure are very dissatisfied with the location--giving further support to those who claim that ESTEC's location was a poor choice.

important dimension. The commitment dimension--since it relates first to the scientific performance of the laboratories (in maintaining important talent as part of the European scientific community) and second to the direct political role (since if the scientists are to assist in European integration they must remain in Europe)--is of particular concern from a policy standpoint. The extent to which the scientists follow current events in their countries, the types of contacts they maintain there, and their expressed desires to return or not are all aspects of this key question.

1. Keeping Up with Events

In response to the query "Do you try to keep up with national life in your country through newspapers, radio or other means?" virtually all of the respondents replied that they did. Those scattered few who said they did not were more likely to come from smaller countries. For these people from smaller countries, it seemed that the unavailability of newspapers as well as a feeling that events in these countries were not so interesting, reduced the incentives to keep up to date. Respondents' main sources of information from home were newspapers and radio broadcasts.[11] Newspapers--weekly as well as daily--seemed to be the most important primary source, while radio was clearly used as a supplement. Nearly half of those who responded gave newspapers as their sole source and about an

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[11] Although the questionnaire encouraged these two responses for the sake of clarity, the interview format did not suggest them and obtained the same response pattern.

equal number gave both newspapers and radio, but very few gave only radio. Personal contacts and correspondence were also mentioned occasionally. The importance of the press as a means of following events in one's own country is further emphasized by the fact that in a separate question which asked the respondents to list the daily and weekly papers they read, fewer than 10% failed to list at least one publication of their own country. Nearly half, in fact, read papers only from their own country.[12]

Beyond simply following events in their own countries, the scientists--to a greater or lesser extent--maintain ties by returning home for visits. In addition to regular vacations, the major organizations allow professional staff members an annual or biennial "home leave," in which the organization pays the cost of a trip home for the staff members and his family. Depending on how far they are from home, the respondents may, naturally, also go home on their own expense during vacations or on holiday weekends and most gave "every few months" as the frequency of their trips home. The British at CERN and ESTEC deviated somewhat, with most returning home only once a year and some even less often than that. A few respondents (French and Germans at ESTEC, Italians at CERN) said they managed to get home about once a month.

2. Professional Contacts

Of course, as scientists and engineers, these individuals live in a world in which professional reputation and professional contacts mean a

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[12] Except at CERN, where most individuals picked up one of the local Geneva paper, not many respondents reported reading papers of the host country.

great deal. In asking whether they maintained professional ties in their home country then, one is tapping an element of the respondents' ability to return home and resume a career there. It was somewhat surprising, therefore, that nearly half (excluding those who were citizens of the host country) stated that they did not maintain such ties. Those on leave from their former posts automatically had ties at these institutions; this was the most popular form of relationship. Personal contacts with colleagues and membership in professional societies were next in importance. ISPRA scientists, since they were engaged in career positions at EURATOM, tended to have the fewest professional ties at home. (Only 44% maintained such ties at ISPRA, compared to 57% at CERN, and 53% at ESTEC.) As the engineering profession in Britain is structured around its professional societies, and as the British contingent in the sample also included a high percentage of persons on leave from government labs, this group had the largest proportion of respondents with domestic professional contacts. As one might expect, such ties tended to decrease with time spent abroad. A few respondents, in fact, mentioned having contact with professional groups in their own countries, but felt they were regarded by these groups as foreign colleagues working in the same field of research!

3. Living Preferences

Those several respondents who felt that they were viewed as foreigners in their own countries did not express a particular desire to return home. A good many others, however, fully intended to do so either when their current contracts expired or at some unspecified time in the future.

The questionnaire recipients and interviewees were asked if they had any preference as to the type of organization and country they would choose to work in if they left their present job. More than a quarter (26%) indicated that they had no preference--specifying either merely "research," or that they would be very happy remaining where they were, or that they would rather judge future opportunities on their individual merits.[13] The remaining 74% indicated that they did have definite preferences.

Among those who indicated a choice of country, 55% ranked their own country as first choice, while 45% preferred a different one. The CERN respondents had the highest percentage not indicating a preferred country, but at the same time, those CERN scientists who did choose a country were most likely to pick their own. Overall, fewer of the Dutch and German respondents chose their country, while more of the Italians did so. Rather than nationality or laboratory, however, choosing a foreign country seemed to be most strongly related to one's previous foreign experience. Among those respondents with the highest index of international exposure (groups 1 and 2) 55% indicated a foreign country as their first choice, while among the remainder of the sample, only 39% did so.

The United States, not unexpectedly, arose most frequently as a

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[13] We suspect that some of the questionnaire responses on this item are not entirely reliable. Many responses of "no preference" on the interviews, when probed a bit deeper, revealed certain underlying preferences--if not with regard to type of organization, at least with regard to country.

desired place to work. It was mentioned (counting both first and second choices) a total of 57 times--far more than any other foreign (European or non-European) country. Among the first choices alone, it accounted for more than a third of those who chose a country other than their own. Germans, particularly, indicated a desire to go to America. Few respondents from the large European powers wanted to go to any other large European power. Among those few who did, France and Italy accounted for most of the responses, while not a single non-British chose Britain and only one non-German chose Germany.

4. Commitment Index

The various indicators discussed in this section are all measures of a latent dimension we have called "commitment" to one's own country. We may combine them to form an index of this dimension in a manner similar to that used in the index of international exposure. (See Table 5.7, next page.)

In order to understand the impact of the prime variables on this index of commitment, it is necessary to divide the sample by all three (laboratory, nationality, and seniority) simultaneously and compare the distributions of commitment scores within each cell. The numbers become quite small in this process, but our conclusions are reinforced by impressions from the interviews. The main conclusion is that those respondents who have spent the longest periods of time in the international environments of the laboratories are the least committed to their own countries. Although there are many variations, no regular patterns can be found in comparing the commitment scores of respondents broken down by

Table 5.7

Index of Commitment to One's Country

Preferred country	Maintain ties	Keep up with life	Index	n	Group n
own	yes	yes	1	75	75
own	yes	no	2	4	
own	no	yes	2	32	36
own	no	no	3	1	
none	yes	yes	3	44	
none	yes	no	3	2	47
none	no	yes	4	51	
none	no	no	4	4	
different	yes	yes	4	36	
different	yes	no	4	1	92
different	no	yes	5	51	
different	no	no	5	6	57

nationality and laboratory, even when seniority is held constant. Within virtually all laboratory-nationality groups, however, those respondents with higher seniority show lower commitment scores. The effect was most clear-cut at CERN where the distribution by seniority was relatively uniform, but it could also be seen at ISPRA and ESTEC where the samples were weighted with high seniority and low seniority respondents, respectively. One should not be particularly surprised at this result--it seems rather obvious that a set of respondents who have been outside of their own countries for a longer period of time should be less committed to returning there--either as a result of a cause/effect relationship or through a selection process whereby respondents with high commitment leave the organizations sooner and therefore fewer of them achieve high seniority. What must be noted here is (1) that we <u>have</u> observed this effect of decreased commitment with time, and (2) that it is not a highly pronounced one.

Among the many variations that were found across nationality-laboratory groups, one of the most surprising was that low seniority British at ESTEC displayed a lower commitment than any other low seniority group. (Commitment was equally low among high seniority British at ESTEC.) Since commitment was lower among those with high prior foreign experience, it might be expected that these particular British comprised the minority of their group with high foreign experience. In fact, the situation is quite the opposite. Most of these men show very low levels of prior foreign experience. One is led to the conclusion that despite the fact that a number of these men are on secondment from career positions, this group might represent something of an incipient "brain drain" for Britain. Rather than going to America or a Commonwealth country, however, they have chosen to "immigrate" to an international organization.

* * *

Overall, the personal experience a scientist gains in going to work at a large international laboratory appears to differ substantially from the experience which he might reasonably expect to find in a non-international establishment abroad. Although in general the scientists appear prepared (one might even say predisposed) for the experience in light of their previous foreign exposure and language abilities, there are a number of significant areas in which the individuals drawn to the three major centers from the four main nationalities seem to diverge. The fact that CERN personnel report that they had had the least foreign exposure previous to coming to the lab appears to fit with the high degree of professionalism expressed in their motivations for coming: If one is coming for the scientific experience, international influences in one's background should not be especially relevant. Furthermore, despite the fact that low foreign exposure otherwise presaged lower satisfaction with life in the host country, CERN respondents clearly showed the highest level of satisfaction with their extra-curricular lives.

Variations in the dimension which was labelled here "commitment" (measuring the strength of ties with one's own country) suggested that its major determinant was the length of time respondents had worked in the international laboratory. (The chief exception to this was found among the low seniority British at ESTEC--a group which gave indications of being part of the famous "brain drain.") In viewing the political role of these laboratories--which appears to require maintaining relationships between the international scientists and the scientific communities of the member countries--this finding underlines the wisdom of CERN's relatively high rate of personnel turnover.

Chapters IV and V have drawn the outlines of personal style and attitude within which the scientists operate in their laboratories. A number of features which characterize their backgrounds and their ambitions have been uncovered. To this point, however, the study has not really dealt with the central issue in this international adventure--the process of doing research in the multi-national environment. Chapter VI is devoted to the many facets of this theme.

CHAPTER VI

SCIENCE NATIONAL AND INTERNATIONAL

American scientists who have studied in any of this nation's major universities or worked in larger industrial or government laboratories are quite accustomed to seeing scientists from diverse nationalities casually working together. A team incorporating graduate students from, say, Japan, Belgium, Egypt, and Israel as well as a couple of Americans is neither an uncommon sight in the engineering labs of M.I.T. nor one worthy of particular note in its context. The current situation in most European science centers, however, does not present itself in quite the same light. In Chapter IV we took note of the weakness of educational exchange among European universities and some of the reasons for it. Further, while it was found that a large proportion of the respondents had had experience living and working abroad, it might have been added that those who worked in universities, government, or industrial centers in European nations other than their own often found themselves either alone or part of a very small minority of foreigners.

As scientific working environments, the international laboratories are in this regard unique in Europe. They are further differentiated from

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other research centers because of their administrations. These bodies, although free from the limitations of national administrative practice, are often subject to the political whims and cross-pressures of a multiplicity of member states. This chapter examines several characteristics of the international environment: how it differs from other research environments, the implications of these differences for the performance of scientific work, and how our respondents react to the environment in a personal sense. Our task is in one sense complicated by the fact that we are not dealing with _an_ international environment _per se_, but with several different laboratories each displaying a host of unique characteristics and sharing only the aspect of being international in sponsorship. It is in another sense facilitated by this same factor, since those characteristics of the environment which do appear to be shared by the several centers can be attributed with greater confidence to the internationalism of the centers.

A. National Style and International Science

Foreign scientists coming to work or study in the United States generally tend to adapt themselves to a vague set of operational habits, customs, and values which constitute the American style of life. They speak continually in English, they eat sandwiches for lunch, they deal informally with their superiors, and so forth. While some alterations in the behavior patterns of the resident Americans might be expected (e.g., speaking more slowly and distinctly in order to be understood) it is the foreigners who do most of the adapting. In ISPRA, CERN, and

ESTEC as well as the smaller centers, there are no real "natives" whose behavior represents the norm and acts as a basic pattern for others. The need for adaptation is common to all, and a central meeting ground must be found which, while drawing on the characteristics and styles of its various components, is distinct from them all.

Finding this central meeting ground is of course greatly facilitated by the subject matter of science. Common problems on which to work and common methods of work are the forces which tend to place the activities of scientists in a context perceived as largely independent of cultural and societal differences. It is naive to think, though, that nationality plays no role in the research process or that it can be ignored as a factor in operation of these laboratories. To quote one of our respondents,

> The research, the methods of research are quite the same. There is no national physics; the physics I studied in Germany, I continued to study in the U.S.A., and I practice here [in ISPRA] are all quite the same. The thing that is different is the way different people attack a problem . . . I mean a solution is a solution--but how you get to the solution, this depends on your background, your cultural and national background.

1. Language

The perception of differences between colleagues and the process of adaptation begins with language. We described earlier the remarkable linguistic abilities of the respondents, noting that they spoke, on the average, more than three languages. Despite this level of fluency, though, very few were genuinely bi- or tri-lingual, and the need to communicate constantly in one or several foreign tongues was the most obvious and important difference between working in an international establishment and any other kind of laboratory.

Some comparison with the situation of foreigners working in a national laboratory is of course valid. It is important, however, not to underestimate the differences. Most national laboratories are monolingual environments; the languages used are natural products of their locations and are native tongues to a large majority of the staff. The international centers are de jure and de facto polylingual communities; their official languages are determined by treaty--each organization having at least two and as many as four considered "official"--while the unofficial use of a language is generally a product of mutual convenience. A majority of the staffs--not a minority as in other labs--do a major part of their communicating in a language which is not native to them. The fact that many technical terms are the same or nearly so in most European languages is a significant asset.[1] On the other hand, language use patterns (as observed in Chapter III) tend to vary throughout different parts of the organizations and seem sometimes to act as communications barriers.[2] Most of the scientists[3] did not consider language to be a problem in daily

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[1] Non-technical words also are adapted from one language into another, sometimes resulting in jargon hardly intelligible to an outsider.

[2] Our instrument and our sampling technique were not suitable for precise data gathering on this subject, but a sociometric study of language use patterns in international organizations would be a most interesting project in itself.

[3] Including, surprisingly, those whose language abilities were most limited.

work. In answer to a question on this matter, four-fifths of the sample responded negatively. Among the laboratories, the percentage who did encounter a language problem was highest at ESTEC (26%) and lowest at ISPRA (11%). Within each laboratory, the different nationality groups did not vary greatly, leading one to the interesting conclusion that the scientists' language difficulties were determined more by the laboratory in which they worked than their nationality. Three basic reasons are thought to account for the relatively larger difficulty reported at ESTEC. First, there is a greater need at ESTEC to deal with outside, non-scientific persons (in contract administration) and language problems are likely to arise here more often than in intra-laboratory communication. Second, although the British, many of whom were monolingual, did not report more language problems than the other nationalities at ESTEC, their presence in large numbers may well have caused language problems for the others. Finally, ESTEC had a large contingent of recently-arrived personnel, who, as explained below, might be expected to report more language problems.

Viewing the marginal for this question in light of the open-ended responses of the interviews suggests that the numbers understate the range of the problem while probably overstating its gravity. On the interviews, very few respondents stated that linguistic difficulties substantially affected their work or that of the laboraotry. Except for these scattered few, the language barrier was more a minor annoyance than anything else. On the other hand, few of those who asserted that language was not a problem did so in an unqualified fashion--suggesting that a small degree of interference was almost universal. Such interference, many respondents pointed out, decreased with time. The first few months were the most difficult, but beyond that, most of the respondents claimed that they had adapted quite rapidly to the multilingual environment.[4] The quantitative data, showing a decreasing frequency of language problems with increasing seniority, tends to support this finding.

2. National Characteristics

Beyond language, a more complex factor which might potentially interfere with the communication process in an international laboratory is the variation of national styles of life. The fact of being born and raised a "Briton" rather than a "German" implies a whole set of cultural and historical assumptions which are constantly manifest in behavior patterns. The operation of an international laboratory requires the continuous juxtaposition of these patterns.

A fundamental lack of prejudice is essential to the scientific ethos. The belief that nationality, race, and religion are irrelevant and the quality of his work is the only basis on which to judge a fellow scientist pervades and helps to maintain the international scientific community. The functionality of this belief has been demonstrated by the experiences of science in those societies, such as Nazi Germany,

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[4] In most cases, adaptation implied a psychological adjustment and/or refamiliarization with previously learned languages rather than learning an entirely new tongue. The only exception was at ISPRA, where few scientists arrived with a knowledge of Italian, but most acquired it.

which rejected it.[5] Sometimes, however, a scientist's strict adherence to this unbiased outlook leads him to conclude that a scientist's nationality does not affect his style of work. An international laboratory provides an environment where such an illusion may not long survive.

We do not aim here to do a study of national character.[6] Our object is only to describe in approximate terms how our respondents view their colleagues of other nationalities. This mutual perception is an important part of the international laboratory experience and, as will be seen later in this chapter, is responsible for a major part of its reward.

The questionnaire asked whether the respondents had "found any differences in training among scientists and engineers from different countries which affect the way they approach problems." While a bare majority of the respondents (52%) replied that they had found such differences, the nature of the interview responses indicates that the wording and closed-ended nature of this self-administered question rendered it incapable of eliciting the most important data. It was found from the interviews that virtually everyone observed national differences in the styles of work of his colleagues, but most attributed their roots to

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[5] See the accounts in Robert Jungk, Brighter Than A Thousand Suns (New York: Harcourt, Brace and World, 1958), especially Chapter 3; and J. D. Bernal, The Social Function of Science (Cambridge: M.I.T. Press, paperback edition 1967), p. 210 ff.

[6] For an extensive treatment of this sometimes controversial area of social inquiry, see Alex Inkeles and Daniel J. Levinson, "National Character: The Study of Modal Personality and Sociocultural Systems," in Gardner Lindzey (ed.), Handbook of Social Psychology (Reading, Mass.: Addison Wesley Publishing Company, 1954), II, pp. 977-1020. This article,— a revised version of which will appear in Volume 4 of the new Handbook, also provides a substantial bibliography.

"mentality" or "temperament" rather than training. Technical training is, of course, different in the several European nations--more so at the level of engineering than basic science--but the roots of these differences were seen, especially by the more articulate respondents, to lie in cultural and historical patterns of the nations. Hence we altered our interview format slightly and asked about national differences in "training or mentality." Further, when respondents flatly stated, in what seems to be almost an ideologically motivated response, that no national differences existed, that scientists differed only as individuals, we found in many cases descriptions of national differences emerged in response to other questions.

Most often the scientists reported that the widely recognized national stereotypes, although rather too general, had some validity after all. For example, to quote one CERN Frenchman,

> I mean you might sometimes find a well organized Italian and a very fast Dutchman, but the reciprocal is more often true. . . . I mean all these categories are a little absurd, there might be exceptions, but these so-called national characters exist.

As did this respondent, most of the subjects cited the contrast between the Latin and Anglo-Saxon/Germanic temperaments. Their descriptions were informative and sometimes amusing, and it is worth citing a number of them here in order to catch the flavor of expression. A Swiss engineer who was concerned with staff recruitment noted the classic Latin-Nordic contrast and spoke of its relation to employment interviewing:

> There is another difficulty and I'd like to bring it up now. This is the difference in character. The two extremes could be the Swedish people and the Italian people. The Swede is very calm, very discreet, very slow in speech, whereas the Italian is exactly the opposite. So when we have interview

> boards and when we go from one person to the next, it really takes an effort to realize we are talking to a totally different person . . . and try to assess both people correctly.

A British physicist saw comparable differences from a more operational point of view:

> You find the English still want to do everything on war surplus material and they approach everything in a small-minded way. The French, on the other hand, refuse to do anything unless they have the best quality apparatus, the best quality material and enough of it . . . The Germans are typically very thorough, serious-minded about it and start in a very methodical fashion. . . . You find just the national temperaments; the Latin countries tend to be suddenly enthusiastic and then fade off and come again. The Northerners tend to be more dour. But I think this is just a national characteristic more than anything.

Generally, the traits associated with different nationalities were viewed positively and without overt evaluation. They were seen as becoming part of the national scientific traditions. Latins were credited with being more theoretically oriented, abstract, mathematical, and imaginative. Northerners, on the other hand, were considered more practical, persevering, physically oriented, and thorough.[7] A high-ranking German physicist from EURATOM gave a graphic description contrasting his own countrymen with the French:

> There is a conflict particularly between the Germans and the French. The Germans are trained to take a very experimental approach, a physical approach to physics, while the French always look at things mathematically. Do you understand me? The Germans make physics from a model. Angular momentum, for example, of an electron, of a particle, is seen as spinning. [Respondent made hand motions to demonstrate.] It's not just a mathematical symbol or an equation.

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[7] These traits seem to be distilled from the more common general stereotypes, such as those of Frenchmen and Germans systematized by Erich Reigrotski and Nels Anderson, "National Stereotypes and Foreign Contacts," Public Opinion Quarterly, XXIII (Winter 1959-60), pp. 515-528.

A Belgian engineer was slightly more guarded:

> I wouldn't exaggerate the importance [of these differences] but to take an example, German people tend to go into every detail and on the other hand, French or Latin people tend to be more quick and sometimes superficial. But these of course are very general considerations, they might not be true for individual cases.

Finally, a French mathematician provided perhaps the simplest way of distinguishing between European mentalities:

> Of course, the differences in mentality exist . . . For example, you can really draw a line cutting Europe in two parts: the part where the shops are closed after six, and the part where the shops stay open after six. In the first one you have Great Britain, Holland, Germany, Switzerland, and all the Northern countries. In the other part you have Belgium, France, Italy, Spain, and so on.

Although the quantitative data is not strong enough to support them, on the basis of the interviews we may propose two rather general assertions with regard to these stereotypes. First, while it seems that the images of other nationalities are nearly always given with positive or neutral affect, there is little tendency for them to disappear with increasing experience at the centers. In other words, the stereotypes do not seem to be false images based on a lack of knowledge, but, as has been proposed by others, functional aspects of human perception.[8] In fact, there is some evidence to suggest that those individuals with little prior foreign contact who rejected stereotypes as "anti-scientific" seemed to discover, with experience, that they really do exist. A young Briton articulated this process from his own experience:

> At the time I came here I had no national bias whatsoever in the sense that I regarded all people as being equal irrespective of their nationality, language, religion or anything. . . .

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[8] Ibid., p. 518.

> Since being here for about 18 months, my opinion has changed and I think now that whilst people may be born the same, the established tradition of education and all the ways in which people can be influenced in their ideas and their behavior, I think this is different in different countries. . . . So these are national characteristics that everybody is familiar with, the national joke level, the caricatures of the people. But I think there's surprising truth in them--something I didn't believe before I came here. Now I tend to believe that there's a lot of truth in it.

The second general assertion is that the saliency of nationality, and hence of these images, tends to decrease with the professionalism of the scientist.[9] This is not to say that highly professional individuals did not maintain national images; some of the most articulate descriptions--including several cited above--came from the mouths of eminent scientific personalities.[10] Rather, with increasing professionalism, the respondents tended to perceive the special field, school, or place of previous work as stereotyping features of equal or greater importance than nationality. For example, a particular scientist might be viewed as a former co-worker of Professor Amaldi at Frascati (which implies a set of special professional attributes) rather than as a demonstrative or emotional Italian.

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[9] By professionalism we are referring to a qualitative judgement of the individual's commitment to his subject, something discussed earlier in regard to reasons for coming to the laboratory.

[10] Similarly, see the remarks of the enterprising theoretical physicist Abdus Salam in The Way of the Scientist, by the editors of International Science and Technology (New York: Simon and Schuster, 1966), p. 74. Salam speculates, only half tongue-in-cheek, on whether, through their cultural tradition, future great Negro physicists will "introduce the concept of 'rhythm' and 'harmony' in elementary particles."

B. Organizational Response

Having examined, from the point of view of the individual, the intrinsic areas of potential difference between the environments of national and international laboratories--those concerned with the range of languages and national styles present--one may proceed to ask what effects has the internationalism actually had at the operational levels of the organizations, apart from creating the political and administrative messes which were discussed in Chapter III. One is interested here partly in the effects of having so many countries at the top, but more in the effects of having people of many nationalities at the bottom. Concern focuses on two areas which arose frequently in formal and informal discussions with scientists and administrators in the labs. On one side there is the question of the effect of nationality on recruitment and formation of technical departments and teams. On the other there are the matters of actual operation, scientific productivity, and conflict management in a multi-national situation.

1. Aspects of Recruitment

> The main advantage of working in an international laboratory is certainly the choice, the wider choice of staff. So you have the opportunity at least, to try to pick up the best people in Europe and not just the best in your own country.

The Frenchman who made this statement was comparing the international situation to that in his own country. Had he been from a smaller country, a "wider choice of staff" would not have been just a relative advantage, but an absolute one, for the range of specialists needed to construct a team of "critical size" is simply not available in many small--albeit highly developed--countries.

When one of the major international scientific organizations desires to fill a staff position it is generally required to advertise (in newspapers, professional and trade journals, or vacancy notices circulated in government labs) in all of its member countries. Sometimes, especially with regard to higher level positions, the national delegations to the Councils nominate particular individuals from their own country. Occasionally, hiring of these types is said to be carried out through political "horse-trading" between delegations and the detrimental effects on the organization's morale and level of staff competence are evident. CERN appears to have been quite free from this problem, while ESRO appears to have suffered from it in its early stages.

Normally, when recruiting is done on the basis of open advertisements or unsolicited applications, considerations of nationality do not play a major role. Technical qualification is the central matter, moderated by other factors as in any other scientific organization. As a rule, however, the organizations try to maintain the levels of staff from different countries in rough proportion to their financial shares in the body, whether or not this is stated as official policy.[11] Several factors limit the ability of the organizations to do this at all levels: (1) the fact that location and climate of a place tend to attract certain nationalities and repel others (as pointed out earlier with respect to ESTEC); (2) project and department heads of a given nationality, although

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[11] Obviously, this applies only to professional and semi-professional personnel. ISPRA does not recruit janitors from Holland.

ostensibly unbiased in their approaches to hiring, naturally are more familiar with people of their own country and thus may know better where to find them as well as how to judge their qualifications;[12] and (3) certain types of professional talent simply are not evenly distributed across all the member countries.

An example of this last factor was brought out in one of the interviews at CERN. In order to counter-balance, for various reasons, a surplus of French computer operators in one division it was decided to recruit a number of operators from non-Latin countries. "So," in the words of our informant, "we advertised in these Northern climes and we got 175 applicants from England, 8 from Germany, and about 3 from Scandinavia and Holland." The more advanced state of Britain's computer industry combined with Britain's lower salary level made balanced recruitment impossible.[13]

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[12] In the words of an Italian group leader from ISPRA: "I am Italian. So 90% of the Italians I chose, I may say, are very good people, because I was able to evaluate them before I took them into my division. People of other countries, I wasn't able to judge them so deeply."

[13] Comparative data on average scientific and engineering salaries in the various European nations is very scarce. In Great Britain, Committee on Manpower Resources for Science and Technology, The Brain Drain: Report of the Working Group on Migration (London: Her Majesty's Stationery Office, 1968), p. 118, some figures are given relating to salaries of rather high level personnel in technological industry in mid-1966. From these, we may derive the following statistics, converted here to U.S. dollars: For the same position at which he would earn $14,000 (gross) in Britain, a man could make $17,500 in Holland, $18,500 in Germany, $18,700 in Belgium, $19,450 in Italy, $21,250 in France, $21,500 in Sweden, and $26,400 in the United States. While the base figure is well above the salary level of most of our respondents, and the relationships may not be extrapolated linearly, this gives some idea of the scale of salary differences among the European countries.

Primarily for these reasons, teams heavily weighted with persons of one nationality were encountered throughout all of the organizations as often as teams which appeared well-mixed. Although at ISPRA some individuals mentioned early conscious attempts to balance teams by nationality, these efforts apparently did not last long. The presence of a professional person on a team cannot be justified either to himself or to his colleagues solely on the basis of his nationality. So in order to operate in reasonable fashion, virtually all of the organizations allow teams to recruit and select members without introducing nationality questions.

The matter of nationality in staffing is a more important issue at aggregate levels of the organization than at the individual or team levels. In other words, nationality need not be overtly considered (although as we have said it has definite effects) at the lower levels, as long as no significant displacements occur overall. Only when individual matters threaten to upset a certain unspoken balance over the whole organization might there be an interaction. For example, in most of the organizations the promotion of a German scientist to division leader might be delayed or foreclosed even though he merits the position on professional grounds, if there are already, say, three other German division leaders in the laboratory.

All of these nationality considerations in recruitment are much more important in a career-oriented organization than in one which is professionally oriented and geared to relatively short periods of employment for important staff members. The establishment of EURATOM on the basis of civil service practice and the granting of "*fonctionnaire*" status to the permanent staff is most dysfunctional here from the point of view of scientific output. Aside from the fact that it tends to reward seniority rather than productivity--a real problem but one which is not inherently related to the internationalism of the organization--career orientation creates an attitude in an international organization which magnifies potential conflicts in the nationality sphere. The hypothetical problem of the German wanting to be promoted to division leader would be much more severe at ISPRA than at CERN, even though the turn-over of division leaders might be no more rapid at CERN, simply because the importance of being a division leader (status) is much greater in a career-oriented body. Achievement is measured on technical productivity in the dominant parts of CERN, whereas this is true of only isolated parts. of ISPRA. (The pattern had yet to be determined in ESTEC at the time of our visit, although there were many complaints about the grading and promotion system.)

2. Aspects of Operation

In actual operation the characteristics inherent in the internationalism of a laboratory are not strongly evident. One of the striking features common to all of the laboratories included in this study was the virtually total absence of any conflicts among the staffs drawn on national lines. It was, of course, a source of pride to many of the scientists to whom we spoke that tendencies to coalesce on the basis of nationality did not appear. Conflicts--concerning, for example, the allocation of machine time at CERN, rules and regulations at ESTEC, or definition of the future program at ISPRA--were far from absent in any of the laboratories. But they pitted one division or team against another or the scientific staff against the administration rather than one national group against another. This is perhaps not really so surprising in light of the fact that interests in such disputes were likely to be distributed according to position and not nationality. Further, simply because friction between national groups was an anticipated--and potentially inflammable--problem area, people took pains to assure that it did not become involved where it potentially might. In EURATOM, where conflicts between the policies of member governments toward the organization have been practically continuous--often finding France opposed to the other five members--the personnel, whose own self-interest regularly differs from their governments' policies, have not reflected these disputes.

Beyond the question of national conflicts, one might expect the laboratories to show some effects of their internationalism in other aspects of operation such as technical productivity. In a study more specifically concerned with this problem it would certainly be worthwhile to generate objective measures of certain operational and productivity variables as well as to attempt the exercise of controls on the measurements. Here we report somewhat subjectively, basing our conclusions on personal observations combined with the responses of the interviewees (using them as informants instead of respondents here).

Several aspects are worth noting: In the first place, the broad range of national styles provides stimulation from diversity in problem solving. A division leader at CERN described the experience of doing research in mixed nationality teams in humorous terms, attributing different talents to each mentality:

> It's a little like the famous joke of the man who said that American orchestras were the best in the world, because the

> violins were Russians, the woodwinds were French, and the brass were Germans. Provided you have a good orchestra leader it works very well.

Even if national differences are ignored, the size and geographical scope of the organizations are important in obtaining diversity. The largest of the European countries have only a very limited number of "schools" (establishments as well as schools of thought) in a particular segment of a field such as nuclear or space research; the smaller nations may have no more than one. A large establishment drawing on various nations, as only the international labs have done, can benefit from the cross-fertilization of different schools.

On the other hand, there is no question but that this same diversity of national styles combined with the range of languages spoken does reduce the efficiency of communication in the international laboratory. We have already mentioned the circumstances under which language creates difficulties, while noting that respondents felt it was not a major problem. We shall deal later in this chapter with individual response to the national style differences. Let us simply note here that potential areas of friction do exist because of language and style diversity, and although in the long run the amount of information lost because of communication inefficiency may not be significant, there is certainly a need for greater effort in communication than in a national center.

As a third point, the remoteness of the international laboratory from the scientific hierarchy of any single nation permits a certain latitude in administrative practice that would not be possible in a national framework. An institution such as CERN or ISPRA, if it were under the auspices of a single nation would certainly, as a number of our interviewees pointed out, fall within the purview of a long-established and probably quite rigid government agency or ministry. Such matters as its personnel regulations, its budgetary practices, and so forth would automatically be defined in this case. As an international laboratory, there is at least the opportunity to circumvent this problem and develop procedures specifically suited to the establishment. In this regard the (often obstructive) influence of powerful individuals (both scientific and administrative) who may have developed an "empire" with tight personal control in a particular scientific area in one nation can also be circumvented.

Finally, on the opposite side of this coin, while reducing the rigidities of national structure, the international character of these centers necessarily subjects them to a wider scope of political pressure. The mere fact that more than one country is involved must inevitably complicate all activities for which responsibility is not designated to supranational levels of the organization. In operation, one would expect pressures to be greater in an organization in which results were more tangible and more directly related to economic and security considerations than in an organization more abstractly oriented. As we have seen, this has been the case.

C. Individual Response

1. Special Characteristics of Each Center

Asked to discuss the outstanding features which differentiate hi present environment from other environments with which he is familiar, the scientist is first and foremost conscious of many attributes which do not relate directly to its internationalism. Strong contrasts therefore appear in comparing, by laboratory, the responses to questions such as: "Are there any characteristics of this laboratory which might make it easier to perform research or other technical activities than in a national or university laboratory?" or the follow-up "Are there any characteristics which might make it more difficult?"

It becomes clear that what is being measured is largely a function of the special state of affairs within each center, and reflects, in each case, much of the atmosphere described in Chapter III. Table 6.1 presents the data for the above two questions.

Table 6.1

Ease and Difficulty of Performing Research, by Laboratory

	ESTEC (107)	CERN (97)	ISPRA (116)
Easier:			
Yes	44%	73%	48%
No	43	12	44
DK	13	15	8
More difficult:			
Yes	64%	37%	65%
No	21	45	25
DK	15	18	10

The contrast between CERN on one side and ISPRA and ESTEC on the other is evident. These two questions drew more write-in comments on the questionnaires than any others. Nearly half of all the CERN respondents (an extremely high proportion for a voluntary comment) cited "more money" or "better facilities" by way of explaining what made things easier; 15% cited "more freedom." At ISPRA and ESTEC only about one-quarter of the respondents made the first type of comment, while a scattered few made the second. In commenting on the added difficulty of their present organization, ESTEC and ISPRA respondents most frequently mentioned the problem of "bureaucracy"--more than 25% doing so in each case, compared to 7% at CERN.[14] "Political problems at the top" were mentioned, not unexpectedly, by 15% of the ISPRA respondents, while problems of "mixing nationality" accounted for a like proportion of comments at ESTEC. The most frequent write-ins of difficulty at CERN were "language" and "mixing nationality," but each drew only 10% of the total number of CERN respondents.

There was some variation by nationality within each laboratory, but this was minor compared to the strength of trends between the laboratories. The interviewees also expressed in words what the numbers above present. The answers to the "easier-more difficult" questions at CERN were almost stereotyped:

> Well, CERN is unique for a start. It's the only place in Europe where you can do this high energy physics work.
> --British physicist

> First of all, CERN is a much bigger organization. It has got a budget of some 170 million Swiss Francs, while my institute in Italy had perhaps half a million. This is a hell of a difference!
> --Italian physicist

The feeling--at least among the physicists--is one of expansiveness, of freedom. A greater willingness of the administration to take "long-shots" on experiments and a lack of bureaucratic restrictions were often mentioned.

[14] This is a common gripe among scientists in government and industry. For an appraisal of bureaucratic obstacles to innovation see Victor A. Thompson, "Bureaucracy and Innovation," Administrative Science Quarterly, X, 1 (June 1965), pp. 1-20.

Among the CERN engineers, the feeling is somewhat more restrained; the differences between CERN and the domestic establishments with which they have experience tend to be discussed more in terms of immediate jobs and collegial relations, and communication problems are more often cited. Except in a few cases, however, they reflect at least part of this same spirit.

ISPRA presents a rather different picture. Bureaucratic restrictions and political complications render the performance of research or other scientific activity a much more trying process than the respondents would like.[15] Some interview excerpts will serve to develop the ideas which emerged from the questionnaires:

> I think that if one comes from a university institute the first thing that strikes one in such an institution as EURATOM is a highly developed bureaucracy. This bureaucracy poses a certain handicap in the work because one wastes a lot of time in writing progress reports, predictions on the work one is doing, monthly newsletters and similar things. This is the thing which is evaluated by higher management here--but it is completely useless for one's work.
>
> --German scientist

> We are complaining here of the lack of management. I think it's true probably because now the European Community has come to a difficult point and there is no political will to continue, to go deeper. This lack of political strength at the top level of the Communities reflects down to this lack of management. There is no well-defined purpose to go to. . . You may be working with some colleagues who share your interest but, well, you are not feeling as part of some project which is building up.
>
> --Italian physicist

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[15] Even the Commission has taken official--if belated-- note of this situation, pointing out in its 1967 annual report that political problems have created an atmosphere in the Joint Research Centers "which is unpropitious to the normal pursuit of the work and which must not be allowed to persist if the morale of the researchers is to remain unimpaired." (Commission of the European Communities, First General Report on the Activities of the Communities, 1967 [Brussels-Luxembourg, 1968], p. 297).

> Basically [ISPRA] is motivated for political reasons and so we sometimes have the feeling that the essential thing is that ISPRA is there--as a demonstration of some political framework--and what we are actually doing here is not interesting for anybody . . . We could as well be making ice cream, but politically of course it must be said that we are doing technical work.
>
> --Italian physicist

Perhaps the most significant part of the ISPRA situation is this feeling, expressed well by the last of these respondents, that what the scientists do does not matter very much, that scientific performance is not the real criterion by which they will be judged. What does matter, Community politics, is totally beyond their control. This feeling goes through several levels: On the individual level a number of persons pointed out that promotions seemed to be granted on a random basis--a certain percentage of those with a given seniority were selected for promotion each year--rather than on the basis of actual merit.[16] Similarly, research and development projects were seen as more or less political footballs, their fortunes subject to the whims of one or another member country rather than being determined by their technological performance. Finally, the fate of the entire organization (and of more immediate concern, the ISPRA Center) was felt to hinge not on how well it worked scientifically, but on the political situation of the Europe of the Six. Being on the one hand scientists committed to their work, and on the other hand "Europeans" (as will be seen later) committed to European integration, they cannot avoid a sense of impotence. In the revealing

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[16] We were not able to determine how true this allegation was, but the fact that the feeling is extant is significant in itself.

words of one ISPRA Frenchman,

> This matter of [EURATOM] politics is not made at our level at all. In fact it is made at such a level that nobody can do anything about it.

ESTEC, finally, shows neither the expansiveness of CERN nor the frustration of ISPRA. The respondents here see problems but they are not nearly as serious as those at ISPRA. Mainly, they stem from organizational politics:

> This is an organization that in principle is supposed to return some of the money invested by the members in the form of contracts. The effects of this, at least for the moment, are quite bad because it makes, at high levels, political conflicts that are sometimes far from technological and scientific interests.
>
> --Spanish scientist

Bureaucracy is also a part of the ESTEC scene and the reaction to it is similar to that at EURATOM:

> [The main difficulty] is certainly the fantastic mess you have from the administrative point of view. This is an algebraic addition of all the defects of national administrations and it is really something to see.
>
> --French scientist

At ESTEC, to a larger extent than at CERN or ISPRA, respondents tended to describe the differences between the experience of doing scientific work (its pros and cons in an international environment) in terms of their own specific job and immediate set of colleagues rather than in terms of the organization as a whole. It is suspected that this somewhat narrower interpretation of the question related to the less professionally-scientific character of the ESTEC sample (and the ESTEC population, for that matter). Being more concerned with immediate surroundings, these less professionally-oriented respondents were also more prone to find difficulties in the cross-cultural situation. (It will be recalled that

ESTEC had by far the highest proportion of write-in comments of this nature.) We heard, for example, that:

> When you have foreigners from all countries speaking only basic English to each other, you have a lot more misunderstandings than you have in a uniform society. . . Further, they have different backgrounds and methods of doing things and when they have to work together on one project each guy is convinced that his method is the only correct one and they have a hard time agreeing on one way of doing it.
>
> --Swiss engineer

The net result of the interview analysis was to suggest that although the percentages of respondents who found advantages and disadvantages to the international environment were quite similar at ESTEC and ISPRA, the real feelings were rather different. Individual response to defects in the organization was much more severe at ISPRA than at ESTEC.

2. Rewards of the International Life

Beyond the special characteristics of each center, there is at least one area of widely shared attitudes throughout the sample--reactions to the internationalism of the environment. In one sense the feelings are ambiguous: Many felt, as did the Swiss engineer quoted above, that the mixing of different languages and different national styles decreased the efficiency of communication in the laboratory. Others disagreed, claiming that this was no problem at all. Regardless of their opinions about ease of communication, however, virtually all of the respondents remarked on the personal and professional stimulation of the international environment. Although in evaluating research at ISPRA and ESTEC, most respondents felt that the political and administrative disadvantages resulting from the international structure far outweighed the advantages of the cross-cultural stimulation, an appreciation of the importance of this stimulation was still present throughout. The analogy of the American orchestra with Russian strings, French woodwinds, and German brass, cited in the previous section, was but one particularly well phrased sample of many similar responses. The value of diversity in a scientific team is widely recognized and appreciated.[17]

In terms of its personal value, the mode of description which respondents used in discussing the stimulation which they received from the international environment was reminiscent of the vague ways in which people often speak of the value of travel:

> From a personal point of view I prefer to live in such an atmosphere because to a certain degree it gives me new viewpoints. . . So I think the individual profits from it whether or not the laboratory as a whole does.
>
> --German physicist at ISPRA

> Meeting people of different outlooks is always stimulating. . .
>
> --British engineer at ESTEC

> I believe there are better possibilities to get new ideas in such a center because people are coming from many different countries and maybe the information is not different, but . . .
>
> --French physicist at ISPRA

> I think coming here and working with other nationalities has been quite a good experience; it broadens one's experience.. You can't put your finger on it exactly and say 'now this is very good,' but I feel it broadens one's experience.
>
> --British engineer at CERN

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[17] There is some danger, of course, that responses on this subject were self-justifying, representing conscious or unconscious attempts on the part of respondents to rationalize their present situations. Without independent checks it is impossible to ascertain the full extent of this effect. We should note, however, that the responses here are first rather widespread across the various laboratories, and second, not inconsistent with other response patterns.

The reward is in part that of experiencing directly that which one has been accustomed to learning only from secondary sources. In such direct experience a person feels more capable of separating evaluative material from objective material than he does in secondary reports. We might surmise that the ability to be objective would be of particular value in the mind of a scientifically trained individual. Further, in the international experience there is the simple joy of discovery--finding known facts or ideas placed in new contexts or viewed in different ways. In the words of two of our respondents:

> You have heard that having a Chinese father and an Italian mother makes a very nice girl. The same is true of the brain, I think. Making your brain work with brains trained in different ways with a different language gives you certainly new opportunities for discovery. This is really, I think the main positive aspect of my experience in international bodies.
>
> --French scientist from ESTEC

> If we had the same CERN in Italy staffed wholly with Italians I'd perhaps do the same physics or the same mathematics and I'd enjoy these things professionally. But I would miss this contact with other people who have other kinds of education, other ideas in their heads, other prejudices than mine.
>
> --Italian physicist at CERN

Finally the reward of the international experience appears to be that of making one's own self-image more cosmopolitan. Within the value system of science, being cosmopolitan is a highly valued trait. By comparison with their reference groups at home, these respondents feel themselves far more experienced and sophisticated. A French physicist from ISPRA (leaving himself open to being called a snob) put it this way:

> I believe that my fellow countrymen who have stayed in their own country for all their lives cannot have a very objective way of judging many problems. They are biased and this is unconscious, I would say. It is a very amusing

> experience when you go back to your own country and discuss some problems to see how people are biased. They never lived outside their own country and were never exposed to different points of view.

The feeling that one has been "broadened" seems to mean a good deal to the respondents and the way in which they view themselves. It is common to the several nationalities in all of the laboratories included in the study.

In order to explore further this notion of "broadening," the respondents were asked, "Do you feel that the experience of working in an international atmosphere has changed your perspective on your home country?" The positive response--56%--indicates general agreement with the above-quoted Frenchman. The cross-tabulation by laboratory and nationality is given in Table 6.2 below. The only sizable departure from

Table 6.2

Changed Perspective on Home Country, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
	(35)	(19)	(20)	(7)	(25)	(13)	(17)	(19)	(25)	(35)	(39)
Yes	66%	63%	60%	57%	64%	54%	53%	63%	68%	51%	44%
No	34	26	35	43	32	38	41	26	32	46	44
DK	0	11	5	0	4	8	6	11	0	3	12

overall figures is among the Italians at ISPRA. The fact that they are living in their own country as well as the broadly Italian flavor of the ISPRA establishment might account for the somewhat weaker effect on these nationals. Otherwise, a rather consistent proportion around 60%

report a change in their perspective. As might be expected, those who had little foreign exposure before coming to the lab were more likely to state that their perspective had changed than those who had high prior foreign exposure. In commenting on their responses, many of those who had answered that their perspective had not changed wrote that before coming to the laboratory their views of their own country were already different from (read "broader") most of their compatriots. Remarks such as "it was not necessary to change, I had already changed" were typical.

Among those who claimed that their perspectives had changed, the most frequent comment reflected a belief that the individual's views had become "more objective." A fair number of respondents (28) volunteered the information that they had become more critical of their own country, while a few more (32) felt that they had become less critical, that they now appreciated their country more. The distributions of these two groups according to amount of time spent in the organization showed marked differences. Only two of the "more critical" respondents had been in the organization less than 18 months, while seven of the "less critical" respondents fit this description. Conversely, only seven of the "less critical" respondents had been in the organization more than four years, while seventeen of the "more critical" had this high degree of seniority. There were too few respondents with very low seniority to be able to make a clear statement of the individual's feelings towards his country during the first few months of his stay in the international laboratory, but beyond this early period there seems to be a process in which the individual's affinity for his country and identification with it is at first heightened and then slowly decreased over an extended period away from home. In this respect our data roughly parallels the findings of research on the attitudes of foreign students toward their own countries.[18]

The change in respondents' perspective was documented not only in these numerical data but also, even more graphically, in the interview data. While one could quote at great length here, the words of but two individuals serve to convey the spirit of many of the responses: First, an Italian physicist from CERN:

> I am a bit afraid that when I will have to go back and live there [in Italy] I will find some difficulties. I will not be able to accept certain things which are taken for granted there and I will try to add on some things which I learned here, which I consider better . . . Well, I find it in my holidays already, when I discuss anything with my parents or old friends. . . They accuse me of having changed my feelings or they tell me 'Oh, you are a foreigner now . . . '

Then, at ISPRA, a Frenchman:

> Yes. [Interviewer: In which way has it changed?] Well, in such a way that I realize that France is not the center of the world!

It is important to remember here that we are not measuring actual changes in respondents' feelings toward their countries, but only their introspective evaluations of such changes. The subject of a changed perspective often arose within discussions of the rewards which the scientists received from the international atmosphere of their laboratories, and it should be apparent that possession of a more realistic perspective on their own countries is part of their cosmopolitan self-image.

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[18] Amar K. Singh, "The Impact of Foreign Study: The Indian Experience," Minerva, I, 1 (Autumn 1962), p. 43.

3. Job Satisfaction

The final segment of this discussion of work in an international laboratory concerns the degree to which the scientists report they are pleased with this experience. In reality, job satisfaction is not entirely separable from reactions to life in the area where the laboratory is located--that is, disaffection in one sphere no doubt encourages it in the other. By asking two separate but adjacent questions, however -- one specifically aimed at satisfaction with life in the area (discussed in Chapter V) and one concerned with job satisfaction--we hoped that respondents would be able to distinguish at least partially between their reactions to their professional positions and institutions and their reactions to outside life.

Comparing Table 6.3 below, which shows job satisfaction by laboratory

Table 6.3

Job Satisfaction, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br (35)	Fr (19)	Ge (20)	It (7)	Br (25)	Fr (13)	Ge (17)	It (19)	Fr (25)	Ge (35)	It (39)
Completely Satisfied	0%	0%	5%	0%	16%	8%	12%	5%	0%	0%	0%
Very Satisfied	40	21	5	14	48	46	59	37	32	20	18
Satisfied	23	53	50	14	20	38	18	47	20	46	44
Somewhat Unsatisfied	34	21	35	43	12	8	12	11	36	26	28
Very Unsatisfied	3	0	5	0	4	0	0	0	12	6	8

and nationality, with Table 5.6, which presents an analogous breakdown for satisfaction with life in the laboratory's location, it appears that the two distributions run in parallel. The lab showing the highest proportion of respondents completely satisfied and very satisfied with life in the area, CERN, also shows by far the highest degree of job satisfaction. In cross-tabulating one type of satisfaction with the other, within each laboratory, a strong degree of association was found. A person who was highly satisfied with his position was generally highly satisfied with the life he found outside of the laboratory, and vice-versa. The converse may be stated even more strongly: no one who showed extreme high or low satisfaction on one scale showed the opposite on the other.

In light of the reactions shown to the particular characteristics of each center, there are no great surprises to be found in the levels of satisfaction which the respondents report. As noted above, the CERN sample, independent of nationality, shows the greatest proportion with a high level of job satisfaction. Both ISPRA and ESTEC show smaller percentages at the upper part of the scale--only one respondent from either laboratory said he was completely satisfied with his position--while substantial numbers appear at the lower part of the scale. ISPRA, in particular, shows a significant few at the extreme of dissatisfaction. Differences between laboratories dominate the variation of nationalities within each laboratory, but one figure which does stand out in Table 6.3 is the high percentage (40%) of British respondents at ESTEC who replied that they were very satisfied with their positions. This figure has no parallel in Table 5.6; in fact, the ESTEC British are the least satisfied with outside life of any national contingent at any laboratory. We propose that the question of job satisfaction is viewed in relative terms by the individual; it seems to measure his comparison of his present career situation with that which he might have otherwise expected to have followed at home. On this basis, it appears that, arriving with a somewhat different set of expectations, the British are compensated by their relatively higher salary level for the organizational and administrative problems which affect the morale of other ESTEC personnel.

This hypothesis is supported by examination of a related question, which asked whether the respondent felt that "the organization is providing [him] with a reasonable amount of intellectual stimulation." Cross-tabulating this question with job satisfaction, one finds, as might well be expected among a group of scientists, that the two variables are highly correlated. Table 6.4 presents this cross-tabulation, with cells

Table 6.4

Job Satisfaction versus Intellectual Stimulation

	Completely Satisfied	Very Satisfied	Satisfied	Somewhat Unsatisfied	Very Unsatisfied
Intellectual Stimulation:					
Sufficient (233)	14	93	93	30	3
Not sufficient (82)	1	9	21	43	8

showing raw numbers (instead of percentages as most of the other tables show). Throughout the various laboratory/nationality groups, those showing a low degree of job satisfaction also express a lack of intellectual stimulation. Among the ESTEC British, however, where 63% were either very satisfied or satisfied with their positions, 58% felt that they were not receiving sufficient intellectual stimulation.

One added point, which concerns not only the ESTEC British but all other respondents as well, is the matter of career patterning. Observation suggests that this is an aspect of some importance, and the main reason for our rather slight emphasis on it is the fact that we are lacking any hard data and are constrained to suggesting rather than demonstrating our notions. It appears that one factor which determines to a large extent the degree of satisfaction which an individual receives from his stay in an international laboratory and which consequently, in aggregate, strongly affects the morale of a center, is the degree to which the scientist sees his stay as permanent. This is a rather complex factor. In essence it seems that the more strongly--and more long-term--one commits himself to one of these organizations, the more sensitive he is to defects in the environment and to instabilities. This is perhaps more a factor of the scientist's state of mind than the real length of his stay. Many of the scientists at ISPRA have been there relatively short periods--on the order of 5 years--while many of the CERN staff members have held their positions much longer--say about 10 years. In EURATOM, however, the scientists are making more or less career decisions in coming to the organization--they receive tenure after about two years and many, when they began, expected to be able to remain in the organization effectively for the duration of their careers. At CERN the organization's intent is to give as many qualified scientists as possible an opportunity to be a part of the organization. Hence an individual generally starts out with a three year contract. This may be renewed, and after the renewal, if the individual wants to stay and the organization still wants him, an indefinite contract may be given. The difference is in the incremental nature of this commitment. One does not see his choices as long-term--rather they are made step-wise. One consequence, reported by many CERN respondents (even those who have indefinite contracts) is that they never feel quite permanent in Geneva. In the words of one British scientist:

> I don't think we ever really feel permanent here, that we are going to stay permanently. . . . One has the feeling, okay, one's been here five years, perhaps I'll stay a few more years, I don't know, perhaps not. But it's still the feeling, this isn't our permanent home.

Although the feeling vaguely disturbs many of the CERN respondents--the above individual mentions elsewhere that he believes some of the value of the experience is lost by it--it seems to be largely functional, in that it allows the scientists to put up with many minor problems--both in and out of the organization--which might be considered more serious if they were seen in a permanent framework.[19]

While CERN and ISPRA represent relatively pure cases, ESTEC is rather too new to fit either pattern. Contracts there are of limited duration and many of the staff members (particularly the British) are on secondment from government establishments. The net result is certainly far from a permanent feeling on the part of the staff, and in fact the other

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[19] When it is necessary to make long-term choices at CERN, such as those involving a child's education, they are likely to have an impact on the scientist's career. According to the CERN Courier (August 1968), "the education factor is a limiting factor in the recruitment of staff."

extreme--that of too temporary a nature--may have been approached. We noted earlier that some respondents--Frenchmen and Belgians--leave their families at home and commute back and forth on weekends. This situation of transience--leading one respondent to reply, when asked about life in Noordwijk, "I must say quite frankly, I don't live there, I just work there," appears to yield a level of commitment to the organization which is less than optimal. Outside of the three major establishments, the level of career commitment appears to be close to that of CERN rather than ISPRA. Even at PETTEN, which is an organ of EURATOM in the same sense as ISPRA, the career orientation does not seem to be on the same order as that at ISPRA. This may be attributed to the relative youth of the establishment, as well as, perhaps, to the recent reorientation of its function.

* * *

This concludes Part Two and its discussion of the personal and professional experience of working in an international laboratory. The discussion has attempted to portray the backgrounds of the individuals who are drawn to such centers as well as the circumstances under which they came. It has explored those aspects of the international experience which appear to be significant in the private lives of these individuals, and it has looked at the scientists as they function professionally in this rather unique environment. All of these matters derive their importance from our desire to understand the scientific potential of international laboratories through their internal accomplishments as well as their relationship to national scientific structure. The laboratory's scientific potential is only half of the story, however. Bearing in mind that the important political context of technological collaboration in Western Europe was the aspect which originally brought us to the study of these scientists, we turn now to look at their political nature and the ways in which they view the social issue areas which surround them. Part Three undertakes this task.

PART THREE

CHAPTER VII

THE PLACE OF POLITICS

In the formal structure of international scientific laboratories there is no place for politics among the professional staffs. Employed on a supranational basis--in which they are not in any sense considered representatives of the countries from which they come--the scientists and engineers are constrained by regulations from participating in partisan or national political activities. Considered in the aggregate, however, the professional functions which they perform are clearly (and quite intentionally) a factor in the political relationships between the member countries. Furthermore, viewed individually, the scientists and engineers possess political attitudes which are of considerable interest to us, first as these attitudes intersect with the international scientific environment, and second in regard to the scientists' elite role and potential influence in policy determination in Europe.

Part Three of this study is devoted to the examination of some of the political attitudes of these international scientists and engineers, as revealed by their responses on the interviews and questionnaires. The task is begun in this chapter by an attempt to place the attitudes in a framework of general political orientation. Three succeeding chapters are then devoted to examination of the scientists' responses to questions on specific issue-areas; ascertainment of response patterns; and analysis of the factors which differentiate the respondents' patterns of views on these issue-areas.

By way of defining the general political orientation of the international scientists and engineers we look in turn at the place which politics occupies in the lives of these men, the degree to which they are concerned with it, the focus of their interest, their distribution on the left-right continuum, and the various aspects of their participation. It is unfortunate that comparable empirical data is not available on the political attitudes of a group of scientists outside of an international laboratory--either in Europe or in the United States--so that we might speak more generally. Thus, in this part of the discussion, as in preceding chapters, we are constrained mainly to describing the situation as we found it in the international laboratories.[1] The degree to which the picture we shall paint conforms to generally recognized impressions

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[1] We rely here also on some of the data which was gathered at CERN in an earlier study described in Chapter II and not replicated in the present study.

of scientists' political thinking[2] as well as its correspondence to the author's personal knowledge of scientists in other environments suggests, however, a rather wider degree of applicability for many of the conclusions.

A. The Depth of Political Involvement

1. Manifest Concern

There are many aspects of life which interest the average scientist as much as or more than political affairs. In the words of one ESTEC Briton,

> Scientists are terribly busy and very interested in what they're doing. They're interested next in their families, in a change of scene, and in their recreation. Anyway, it's only the few who feel *very* strongly politically among scientists and engineers.

To say that politics is not the central interest of these men is far different, though, from saying that they are not concerned or committed to certain basic principles and modes of approach. Politics is very definitely a significant element in the *Weltanschauungen* of these individuals. There is no contradiction between the words of the Briton cited above and those of a German engineer at CERN who, when asked if scientists were not

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[2] For some non-empirical but provocative thoughts on this subject see Albert Wohlstetter, "Scientists, Seers and Strategy," *Foreign Affairs*, XLI, 3 (April 1963); and Warner R. Schilling, "Scientists, Foreign Policy, and Politics," in Robert Gilpin and Christopher Wright (eds.), *Scientists and National Policy-Making* (New York: Columbia University Press, 1964), pp. 144-173. More empirical work has been done by, among others, David Nichols, "The Political Attitudes of a Scientific Elite" (unpublished Ph.D. dissertation, Dept. of Political Science, M.I.T., 1968).

interested in politics, replied: "Not interested? Of course they are! They are full of opinions."[3]

Throughout all of the laboratories included in this study, it was found that the vast majority of scientists and engineers maintained a definite interest in public affairs. To the extent that the "ivory tower" image sometimes attributed to scientists still survives--and at least in the United States it is rapidly fading--this study gave evidence of its inadequacy. In some cases, however, the particular word "politics" provoked resistance in the subjects. This was true especially at CERN, perhaps the most avowedly apolitical of the organizations, but it also happened elsewhere. Experience suggested the use (on both questionnaires and interviews) of "international developments," "public affairs," "current public issues" or any other such terms which describe the larger political domain, and these seemed to be generally accepted. The explanation for this phenomenon appears to be a semantic one, in that the word "politics" alone carries, for some scientists, connotations of local party activities, campaigning, banner-waving, and personal bargaining--activities which are not appealing to men whose basic operational mode is analytical.[4] Such terms as "current public issues," "international

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[3] This quote, together with parts of the remainder of this chapter, is taken from Daniel Lerner and Albert H. Teich, "International Scientists Face World Politics: A Survey at CERN" (M.I.T. Center for International Studies Document No. C/68-2, January 1968).

[4] Our finding here confirms that of Donald A. Strickland, who writes that scientists "often mean by 'political' that an activity is controversial, or that it has a high emotional content (is 'irrational' behavior) . . ." Scientists in Politics (Lafayette, Ind.: Purdue University Press, 1968), p. 94. In addition, the senses of the words politique in French and politisch in German are slightly different from the English "politics," leading to some confusion.

affairs" or even "current political issues" represent, on the other hand, aspects of life with which a scientist,[5] as an intelligent person, cannot help being concerned.

Just how concerned the respondents were with political affairs was measured through the use of two self-report questions, one which asked the subject to estimate how often he discussed current political issues with his colleagues, and a second which asked him to compare his own degree of interest in public affairs with that of his colleagues, in terms of a hypothetical average.

As anticipated, the responses to these two questions displayed a pronounced relationship: a high value on one generally implied a high value on the other and vice versa. The question which asked about frequency of discussion, however, seemed to evoke the most interesting responses on the interviews and we tend to favor giving it the most weight. Two findings of interest emerged from its examination. First, among the major laboratories, political discussions were reported most frequently at ISPRA. Given the political nature of EURATOM and the

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[5] We speak mainly of "scientists" in this chapter although it is generally supposed that scientists and engineers differ significantly in personality traits, socialization experiences, and political outlooks. Seymour M. Lipset reports, in fact, in Political Man (Garden City, N.Y.: Doubleday and Co., 1960), pp. 315-316, that an American poll in 1944 uncovered a heavy Democratic majority among scientists and a heavy Republican majority among engineers. Nevertheless, our experience in this study indicates that in most (but not all) of the areas in which we are interested, the conventional labels do not differentiate sufficiently within our sample and perhaps the orientation towards research (or at least the absence of a routinized production orientation) in these organizations blurs the distinction. We are, however, aware that the generality of our conclusions outside the sample with respect to engineers is probably lower than with respect to scientists.

highly political roots of its current crisis, this finding should come as no great surprise. CERN reported the next greatest frequency of discussion and ESTEC the lowest. Table 7.1 presents this rather clear-cut

Table 7.1

Frequency of Political Discussion by Laboratory

	ESTEC (107)	CERN (97)	ISPRA (116)
Very Often	7%	6%	15%
Often	12	23	34
Occasionally	56	48	35
Rarely	24	20	15
Never	0	3	0
DK	0	0	1

distribution, and Table 7.2 presents the parallel distribution by type of

Table 7.2

Frequency of Political Discussion by Type of Work

	Basic Research (38)	Applied Research (126)	Development (59)	Engineering (69)
Very Often	18%	13%	7%	8%
Often	32	24	25	22
Occasionally	39	44	49	52
Rarely	11	17	19	16
Never	0	2	0	1
DK	0	0	0	1

work from which emerges the second finding. Discussion seemed to be most frequent among basic researchers, and decreased across the spectrum of types of work through applied research, development, and finally engineering.[6] Reference to Table 4.7 provides some idea of the degree of interaction between type of work and laboratory and this gives one some confidence in concluding that both laboratory and type of work have some effect on the frequency of discussion.

Reinforcing an intuitive faith in the finding that basic scientists seem to have a higher political interest than those involved in development or engineering work were statements on the interviews such as that of a French mathematician who remarked:

> When you go from the scientist to the engineer and technician, you lose a certain percentage of what I would call intellectual activity, so this means also political interest. A lot of engineers and technicians are not interested in political issues; they're just working in their own little job.

Or of a Belgian engineer:

> The good ones are interested. The others--they are just making money.

The results of the question which asked for a self-rating on degree of interest in politics, as noted above, paralleled this question. More ISPRA respondents judged themselves to be above average in political interest compared with their colleagues and more ESTEC respondents judged themselves average or below. It is likely, however, that this response

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[6] In addition, scientists showed a slightly higher level of discussion than engineers, and frequency of discussion also increased mildly with educational attainment.

was a bit distorted since (1) persons with low political interest were probably more likely to associate with others of low interest (and *vice versa*) and use these persons as a standard of reference, and (2) to the extent that one's own level of interest acts as an "internal anchor" perception of interest levels of other scientists to whom one has positive affect would be assimilated toward one's own level, making one seem "average."[7]

The questions on frequency of political discussion and self-rating of political interest, however, yield no real *absolute* indication of the strength of political involvement among the respondents. The closest one may come to such a measure is an index of exposure to printed media, which varies with political interest. The question used to construct this index was examined once before in Chapter V. It simply asked respondents to list the newspapers and weekly magazines they read. From this list the number of dailies and the number of weeklies were tabulated separately, then cross-tabulated to form a four-valued scale. The degree

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[7] See on this topic, Muzafer Sherif and Carl Hovland, *Social Judgment* (New Haven: Yale University Press, 1961), especially Chapter 4. A classic example of this latter tendency was displayed by a British engineer at ESTEC who, in regard to his own political interest proclaimed,

> I am a completely politically uneducated person. . . . I don't discuss politics because I know nothing about it and I'm not interested in it.

Later in the interview when asked about the interest of other staff members at ESTEC, he replied,

> Many people are politically uninterested I would say. There was much discussion when the World Cup Soccer series was on, much more . . . but I've never heard of anybody here interested in the results of the French general election or the British general election.

of differentiation on this variable turns out to be rather small. About half of the respondents noted that they read one daily newspaper and a slightly smaller number listed one weekly. Approximately 20% in each case listed two papers, a small proportion (8%) listed three or more, and the remainder failed to list any. (Only a handful declared explicitly that they did not read any daily or weekly papers.) The print media exposure index roughly parallels the distributions of the measures of political interest. It contributes some sense of scale by revealing that most of our respondents do read at least one daily paper and one weekly. In doing so it also reveals the rarity of extremely high interest or extremely low interest.

2. Emotional Investment

The level of the scientists' emotional investment in political affairs is somewhat lower than might be expected on the basis of their interest. While maintaining a generally high information level on matters pertaining to political affairs (manifested in the articulate range of responses which was received on the interviews and questionnaires), the scientists in international laboratories display a tendency to remain rather detached from everyday political trends and developments. Several factors are associated with this tendency, which was first observed in the earlier study of CERN.[8] First, opportunities for direct participation in political affairs are quite restricted. Second, the

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[8] See Lerner and Teich, "International Scientists," pp. 10-12.

amount of emotional energy which professionally-oriented scientists and engineers invest in their own work limits the depth to which they may involve themselves in outside activities, especially those which are neither recreational nor related to family life.[9] Third, in the international situation, one suspects that low emotional involvement may be functional in conflict-avoidance. To the extent that the scientists may maintain intellectual interest in political matters without developing strong emotional ties to a given issue or position, the everyday cross-national contact will certainly be facilitated. Finally--and this is a theme which will be returned to later--it appears that in their political thinking, these scientists tend to extrapolate the methods and viewpoint of science itself. Where things do not quite fit, most are unwilling to make a deep personal commitment.

A short digression on this latter point is in order. The words of the British engineer from ESTEC cited above (p. 257) are again suggestive:

> I think scientists in general feel that politics are a state that go on anyway. You cannot classify politics in the same way, for example, that you can classify the elements, and whilst one will have opinions, one could only influence things in a minor way. . . . So they have feelings, but perhaps they don't inflict them very widely on other people.

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[9] Several psychological studies of scientists such as Anne Roe, The Making of a Scientist (New York: Dodd, Mead and Company, 1952), p. 58, and Bernice Eiduson, Scientists: Their Psychological World (New York: Basic Books, 1962), pp. 89, 94, 95, probe the depth of professional involvement and its effects on other activities.

Politics consists of phenomena which often appear to be quite irrational and whose practice is not normally susceptible to the "neat" methods of science and technology. As a young German scientist stated, "Politics are too much affected by feelings and not enough by rationality." Political decision-making is an uncomfortable entry into a world structured by the extrapolation of science. Socialized to thinking within the norms of the scientific method, unable to impose rational solutions on political problems, and sharing what they admit to be rather idealistic notions about world affairs, many of the respondents seemed to temper their very real interest in political and social affairs with a sense of detachment.[10]

Under these circumstances one finds that political discussions among the scientists normally take the form of exchanges of information rather than emotional disputes. The respondents' own words again tell the story:

> If we invite a couple of English people to our home, the discussion is often about differences between Italy and England. . . . So if we talk about politics, you keep on saying 'in Italy one does like that,' and they say, 'no, in England one does like this.' This is the kind of discussion one often has.
>
> --Italian scientist at CERN

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[10] One scientist who has made a deep emotional commitment, the Russian academician Andrei Sakharov, still demonstrates the desire to extrapolate science in his widely publicized manuscript "Thoughts on Progress, Peaceful Coexistence and Intellectual Freedom," (New York Times, July 22, 1968). A method is "'scientific'" he states, if it is "based on deep analysis of facts, theories and views, presupposing unprejudiced, unfearing open discussion and conclusions." His proposal for cooperation rests on the notion that "international affairs must be completely permeated with scientific methodology," and further that "scientific methods and principles of international policy will have to be worked out."

> I don't go greatly out of my way to impress my views on other people. I'm interested to hear what other opinions on particular issues are . . .
>
> --British engineer at ESTEC

> Most of our discussions are concerned with describing certain political features, you see. It's not very often a real argument.
>
> --German scientist at ESTEC

> Well we have a little bit of argument, yes, but normally the discussions concern what peoples' points of view are.
>
> --Italian engineer at ISPRA

Extreme views are seldom found, and--as will be seen shortly--there is a broad sharing of political orientation and views among these international scientists. This consensus, together with the respondents' sense of detachment, generally serves to maintain political discussions at a low emotional level.

Another byproduct of the respondents' low emotional investment in political affairs is a general feeling among them that their informational level is lower than it should be. Although we have no objective measure of this variable, we have already noted that our impression, through the interview and questionnaire responses, indicates that the level compares reasonably to other highly educated elite segments of society.[11] However, since they are trained as scientists, the respondents hesitate to draw inferences and propose firm conclusions on certain political questions, in particular those which seem to require expertise outside of their own specialty. This "expert syndrome" was observed on the earlier Lerner and Teich CERN study, where questions dealing with economics, for example,

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[11] The notion of incorporating an information test in the interviews and questionnaires was rejected as being likely to antagonize the subjects.

were rejected off-handedly by many respondents with comments such as "I'm not an economist." Accustomed to speaking with authority in their own fields, the respondents were unwilling to give "amateurish" opinions in areas where they felt less knowledgeable. In this study, an effort was made to assure the subjects that they were being asked for personal rather than professional opinions and this technique met with a good deal of success.

B. Direction and Scope of Interest

1. Political Spectrum

The extrapolation of the scientific viewpoint as a theme on which to structure one's political thought leads to some readily identifiable trends among the scientists' attitudes. Within the conventionally recognized spectrum of political thought ranging from extreme left to extreme right, the largest part of the respondents found themselves in a moderate left to center position. The scientists were asked to define their own places on this spectrum; among the 237 respondents for whom there is data (the question was omitted in the interviews), 1% rate themselves as extreme left, 41% as moderate left, 36% as center, 21% as moderate right, and less than 1% as extreme right.

The raw distribution of this variable (not percentages) for the various laboratory/nationality groups is presented in Table 7.3 (see following page).[12] Aggregate figures for the major laboratories are

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[12] The one "extreme right" and two "extreme left" respondents have been added into the moderate factions in this table.

Table 7.3

Political Spectrum by Laboratory and Nationality

	ESTEC					CERN					ISPRA			
	Br	Fr	Ge	It	TOTAL[a]	Br	Fr	Ge	It	TOTAL	Fr	Ge	It	TOTAL
Left	7	6	4	1	25	6	5	7	7	29	8	11	13	34
Center	7	3	6	1	20	3	2	4	1	19	4	13	7	27
Right	7	1	4	2	23	2	0	0	2	8	1	1	6	11
DK	3	5	3	1	12	4	0	2	3	11	2	3	5	13

[a] Including smaller nationalities.

also shown. Despite the limitations of its small numbers, this table reveals a number of trends. ESTEC has the highest proportion of respondents showing up on the right, and the bulk of these are British (as well as some Dutch and Belgians not shown on the table). CERN is the most left-oriented of the major centers, followed by ISPRA. The Germans seem to have a tendency to cluster about the center, while the French and the Italians lean more to the left.[13]

Divided either by title of degree or by present function, the scientists in the sample tend to be slightly more to the left than the engineers. The extent of this tendency, however, is not nearly as large as one would have expected _a priori_ and it does not account for the differences between the various laboratories or nationalities. While

[13] A significant number of ISPRA Italians do, however, appear on the right. Varying assumptions about what constitutes "left" and what constitutes "right" in different European nations clearly have some effect here, although the general images of "left" and "right" are widely shared by these scientists, as discussed below.

differentiations by discipline and basic/applied research did not appear in the data, the larger left response at CERN (most basic research, knowledge-oriented institution) and the larger right response at ESTEC (most applied, hardware-oriented institution) are generally consistent with findings such as that of Lipset who reports that "those involved . . . in the more pure theoretical fields of science, are more likely to be on the left than those in the more practical, applied, or experimental fields."[14]

Some interesting outcomes develop in cross-tabulating political interest by left-center-right. Right-leaning resondents consider themselves less interested in political affairs than their left and center colleagues. Table 7.4 displays this finding. Among those respondents

Table 7.4

Political Interest by Political Orientation

	Orientation:		
	Left (100)	Center (86)	Right (51)
Interest:			
Well Above Average	9%	7%	2%
Above Average	35	19	8
Average	49	60	68
Below Average	4	8	18
Well Below Average	0	1	2

[14] Seymour Martin Lipset, "The Activists: A Profile," The Public Interest, No. 13 (Fall 1968), p. 46.

ranking themselves as leftists, 44% believe that they are above average in political interest. This figure drops to 27% among those in the center and 10% among the rightists. Figures for frequency of political discussion run similarly.

One of the central findings of American voting research is that of the positive association between partisanship and political interest. In American terms this has meant that voters who consider themselves either committed Democrats or committed Republicans are much more interested in political affairs (especially elections) than so-called Independents.[15] If one attempts to draw a parallel between American political partisanship and the political spectrum data on European scientists, one is struck by the contrast in the distribution of political interest. Several alternative explanations may be proposed: (1) It is conceivable that since the American political parties are said to be really non-ideological coalitions and do not correspond to left and right in any meaningful manner, then this parallel is not really valid.[16] (2) On the other hand, these findings may not necessarily be characteristic of the scientists in this sample, but rather of a larger--as yet

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[15] One of the most clear-cut demonstrations of this is given in Bernard R. Berelson, Paul F. Lazarsfeld, and William N. McPhee, Voting: A Study of Opinion Formation in a Presidential Campaign (Chicago: University of Chicago Press, 1954), pp. 26-28.

[16] The empirical literature in this area generally deals with "leftism" and "rightism" as expressed in party preference rather than on an independently generated scale, further complicating our problem. See Lipset, Political Man, as well as Edward C. Dreyer and Walter A. Rosenbaum (eds.), Political Opinion and Electoral Behavior: Essays and Studies (Belmont, Calif.: Wadsworth Publishing Co., 1966).

unexplored--difference between European and American political cultures. (3) It is also possible that the scientists are evaluating their own standing within the framework of a limited reference group--the scientific community--and the scale they are using is linearly shifted with respect to the larger population. Hence the leftists would be fairly strong leftists in relation to the general political spectrum, the centrists would actually be moderate leftists, and the rightists would really belong in the (disinterested and uninvolved) center. This last explanation is reflected in the words of one British engineer at ESTEC in a charmingly unconscious way:

> I think scientists are like any other body of people--they vary tremendously. You get some people who are very, very left and you get people who are a good deal less left.

Regardless of the reasons which lie behind the relationships between interest and place on the spectrum, it does appear that the leftist position represents something of a political norm in the scientific community.[17] Since those who espouse it tend to show the greatest interest, they might be expected to be more influential as well. Just like the British engineer, who found some scientists "very, very left" and others "a good deal less left," many of the respondents observed the tendency toward a liberal-left consensus among their colleagues.

To explore this point further, the question "Judging from your own experience and discussions, do you feel that there are certain political issues on which the majority of scientists and engineers probably share

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[17] A discussion of leftism among American intellectuals may be found in Lipset, Political Man, pp. 310-343.

a common outlook?" was asked on the interviews and questionnaires. The qualitative interview responses are of greatest interest here. The marginal for the question yielded a nearly even break between "yes" and "no," but experience on the interviews showed that very often respondents replying negatively to this question would continue by saying that scientists, nevertheless, were on the whole more "liberal" or "progressive" than the average person.

Typically, the scientific education was seen as a socialization process which produces predispositions toward certain types of attitudes. One interviewee, a Frenchman at ISPRA, proposed a mathematical formulation:

> You have a mean value with a Gaussian distribution, and according to my experience the spread of this Gaussian is surely smaller for the scientific community than for others. I would say there is on the mean--there are more of the same ideas, ideas which are shared. This kind of international education produces it. You will find surely a lot of people in the scientific community with very different opinions, but on the mean they are very close.

Another, a British scientist from CERN noted:

> They tend to be more liberal. I don't think that you can go any further than that. I would say that if you would take a national opinion poll, opinions of scientists as opposed to the rest of the population, you would find them more to the left than to the right, by conventional standards.

Similarly, a German scientist at ESTEC explained:

> Although I never met anybody defending a fierce extreme, I think that our tendency is towards, I would say, the left-wing, which I find actually natural, because science is so international today.

The absence of extreme views and the generally leftist consensus is borne out by most of our data. The fact of being a scientist compounded by the situational factor of being a staff member in an international laboratory produces a rather narrow spectrum of thought concerning many crucial public issues. Although in the balance of this study we shall try to learn from such dissensus as we are able to uncover, it is important not to lose sight of the degree of unanimity with which most of the political questions were answered.

A tendency towards the left, however, does not indicate adherence to something which could rightly be called an ideology, in the sense of a codified doctrine associated with a particular party or political movement.[18] It is rather a shared set of values that produces a common political sentiment of leftism. This is what the French, long habituated to such nuances, call *gauchisme*--and the scientists tend to be *gauchisants* (left-oriented) rather than *gauchistes* (left-affiliated).

From this orientation derive two sets of distinctive, though diffuse, images associated with the left and the right. In the minds of most of these scientists the image of the right is rather negative: its properties are self-interest, power, militarism, traditionalism, and pessimism. In contrast, those properties associated with "leftism" tend to be idealism, generosity, objectivity, and optimism--adding up to a much more positive picture.

These generalized sentiments create a broad transnational consensus that enables European scientists of diverse origins to feel "at home" with each other in facing the world political arena. It is not a "party line" in any narrow sense. It is rather a sharing of values and assumptions, style of thought, and tone of voice. A few excerpts from the

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[18] The next few paragraphs are adapted from Lerner and Teich, "International Scientists," pp. 13-15.

Lerner interviews (done at CERN in 1965, see Chapter II) will convey the flavor of these images. No direct question was asked here; all of these responses are spontaneous, usually by way of explanation of each respondent's classification of his own political orientation. Here, then, are the words of four physicists of different nationalities.

> If a person is on the right, he has some interests. If he is on the left, he has some ideals. . . . In other words, he is capable of an objective evaluation of the world's social problems without taking his own particular interests into the account.
>
> --Italian physicist

> . . . Right people are fundamentally for themselves, for their own particular group . . . Whereas the left--they think of the maximum good for the maximum number.
>
> --British physicist

> . . . Rightists [in Germany] are very much for good old tradition; they are very much for good old allegiance; they are very much for good old soldiers and so on. I don't like it so much.
>
> --German physicist

> We can define two kinds of people. Those from the left think that generosity in other people is the main thing. On the other hand, the people from the right think that power is the main thing . . . What I call a left man is a little bit optimistic about the possibility . . . for man to do better--not in a trivial way, you see, but to a better knowledge of nature and man. On the other hand, a pessimistic view of life is held by the man from the right.
>
> --Swiss physicist

It is important to emphasize again that the prevalence of leftist sentiments is the result of a preferred general orientation toward social problems and not the choice of one political party line or economic ideology over another. The notion of ideology--with its implication of rigidly codified "positions" on a wide range of issues--was roundly rejected by most of these scientists. Although they consider themselves "liberals," the scientists strongly reject any effort to impose a fixed pattern or structure on their views. They seem to prefer compromise, problem-solving, and what seems to be a generally pragmatic approach to the political problems of the world.

2. Scope of Interest

Within the broadly leftist consensus--which one of the above-quoted respondents related to the internationalism of science itself--the not unexpected tendency of the respondents was toward a much stronger interest in international issues than in local or national ones. We say "not unexpected" for the geographic mobility of the respondents as well as the cosmopolitanism of scientists in general and the simple fact of internationalism in the organizations provided a priori reasons to suspect the presence of this tendency.[19] To these scientists, local and even most national issues seem trivial in comparison to the implications of international issues. Furthermore, to most, interest and participation in the routine activities of politics on the local level--attending party meetings and rallies, campaigning, fund-raising, etc.--are clearly unappealing prospects. Finally, and perhaps most compelling, there is a need for a common ground in political discussions between scientists of various nationalities.

A German scientist from CERN (interviewed in the 1965 Lerner study)

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[19] Abrahamson notes that cosmopolitanism and geographic mobility are not part of the same dimension, but are related. Mark Abrahamson, "Cosmopolitanism; Dependence-Identification, and Geographical Mobility," Administrative Science Quarterly, X, 1 (June 1965), pp. 98-106.

expressed this well:

> You see, the kind of politics which interest me, and which interest at least the physicists I know here, is not so much the national politics of their own country. It is not the Swiss politics at all. It is international politics--large developments like the European Common Market, EFTA, NATO, the United Nations, and surely the armaments question.

No evidence at all was found to contradict this finding in the present study, even among those scientists who were living in their own country while working in an international laboratory. On the contrary, much support emerged, despite the absence of a direct question bearing on the <u>scope</u> of political interest. We cite the words of a Dutch engineer at ISPRA, an Italian physicist from CERN, and a French physicist from ISPRA:

> I am not so much interested in the national politics of Holland, that is clear. If there is a government crisis in Holland it doesn't really touch you and also if there is a government crisis in Italy this doesn't touch you. Therefore you are most interested in the foreign policy of big countries like Russia, the United States, and such things as Viet Nam and now [June 1967] the Middle East crisis.

> We normally talk not about politics here but something different. We talk of all the problems. Not politics normally, but international politics--the trend of the world, not a question that is particular to a nation or something like that.

> When you go to dinner all discussions are based on international affairs because nobody is so interested in national affairs of the other one. So international affairs are discussed.

One may consider this focus to be in part a reflection of the leftist orientation and the extrapolation of scientific thought--rejecting local bias in favor of a wider, more open stance toward human problems. It is clearly part of these scientists' attitude structures.

C. Participation and the International Life

As the scientists are employed on the basis of supranational professionalism, the well-being of the organizations requires that they remain aloof from activities serving private, partisan, or national interests. Each of the organizations hence imposes such a restriction as part of its employee regulations. In this respect the situation is similar to that in other non-scientific international bodies and reflects the staff's privileged status in the host country. The staff members are well aware of these rules and apparently adherence to them is quite general.

Several qualifications should be stressed, however. In the first place, forms of political participation at the lower level--as we have already noted--such as attending party meetings, campaigning, and so forth, are not likely to capture the interest of most scientists due to their routinized character. Second, as the interests of most scientists are focused on the international plane, and as they are away from home, the types of activities excluded are not those central to the scientists interests, while direct participation in the issues which interest them is structurally limited. Finally, some forms of political participation are in fact possible.

Within this last category, activities which fulfill informational needs and take the shape of public forums and discussion groups concerned with current international issues are perhaps the most common. The EURATOM centers, ISPRA and PETTEN, for example, quite naturally entertain speakers on issues of European integration. The PETTEN "Europa Forum" meets as a small club every few weeks. Public lectures are a more common form at ISPRA, due to the much larger size of the establishment. The staff association at CERN regularly invites speakers on public issues as part of its cultural program. During our visit, a lecture by a prominent Italian physicist (from outside of the organization) reporting on a recent trip to North Vietnam drew a standing-room-only crowd in a large auditorium. An official from the American Consulate in Geneva was scheduled to speak on American Vietnam policy later that month.

On a different level, some of the top scientists involved in CERN, ESRO, and EURATOM have been among the participants in the Pugwash Conferences on Science and World Affairs. This type of activity, promoting an East-West dialogue, would probably appeal to many of the less prominent scientists who comprise our sample, but the fact that they are not generally able to take part is more a function of their lower professional level than their international status.

Under such circumstances, one of the few measurable evidences of political participation is voting. Unfortunately the governments of the various European nations differ considerably in their policies toward non-resident voting. Hence, the two questions which were asked (only on the questionnaire) on this topic--one on current voting habits and one on former voting habits--are a bit difficult to interpret and do not yield really comparable data for the various nationalities. Other factors which interfere with our objective include the fact that a number of the respondents were too young to vote prior to coming to the international laboratory, while in other cases there has not been a national election in the respondent's country during his tenure at the laboratory.

Thus, not a great deal can really be said on the basis of this data beyond some simple statements. Of those responding to the question "How often did you vote in national elections while living in your own country?" (n = 246) some 73% responded "every time," while an additional 10% said "frequently," and only 7% said "never." When asked about their current voting habits, the proportion responding "every time" dropped to 46%, with 10% still reporting "frequently" and those saying "never" rising to 20%. The most precipitous drop was among the British (at both CERN and ESTEC), where, since non-resident citizens are not allowed to vote, few respondents reported having done so at all since leaving their country.[20] Voting frequency of the French and Germans--for whom the process of voting while living abroad was difficult but not impossible--declined somewhat, but most respondents still reported voting, if not every time or frequently, at least occasionally. Among the Italians, who were encouraged by their government to vote while living abroad, patterns of voting appeared substantially unchanged.

While some respondents (particularly among the British) mentioned in the interviews that their inability to vote or their separation from their own country discouraged interest in political affairs, this did not seem to be the general case. The questionnaire and the interview schedule both asked respondents whether they felt that there had been "any change in their level of interest since coming here?" The overall trend suggested that most respondents believed that there had been no change; some 63% so indicated. Another quarter of the respondents

[20] Those few who said that they did still vote probably maintained a residence in Britain.

claimed that the experience had actually stimulated interest, particularly in international topics, while only 9% felt their level of interest had declined. Few patterns appear to explain the differential effects of the international experience on the scientists' political interest level. Variations in this response are relatively small in all cross-tabulations that were done. Nationality, location on the political spectrum, absolute level of interest in politics, and previous foreign experience do not show any regular differences. The major finding is that respondents at ISPRA appeared slightly more likely to say that their level of interest had increased than respondents at other laboratories. Given the political nature of EURATOM and the other evidence of broader political content at ISPRA, this should not be surprising.

* * *

This completes a qualitative sketch of the shape of political interest among the international scientists and engineers in the sample. The task of filling in this structure with a treatment of the respondents' opinions on specific issues of current import still remains, however. It is to this task that the next three chapters are devoted.

CHAPTER VIII

ISSUES: THE UNITING OF EUROPE

A. Introduction

The portion of the study which dealt with the political opinions of the scientists attempted to strike a balance between the extremes of over-generality and over-specificity. It avoided, in other words, questions concerning highly current topics as well as those on the historical-philosophical plane. It was hoped thereby to uncover distributions of opinion on those issues most salient to the respondents--respondents whose political discussions, in the analogy of one ISPRA Frenchman, resembled "more those you can find in a weekly magazine than in a daily newspaper."

Despite their lack of topicality, the relevant questions were by no means immune to the winds of change, even over the relatively short term. The European milieu of April-July 1967, within which the scientists framed and evaluated a range of policy choices, differed substantially from that of today (mid-1969). Throughout this discussion the reader need bear in mind that at least two very profound events which must inevitably shake the foundations of European life had neither taken place nor even been foreseen: First the unrest in France, which began with student demonstrations in May 1968 and developed into a nationwide upheaval, nearly toppling the Fifth Republic. Although the Gaullist government eventually achieved an overwhelming electoral victory, it--like all of France--emerged from the experience severely tarnished. Second, the rapid liberalization of the Communist regime in Czechoslovakia which was suddenly crushed by the invasion of Russian troops in August 1968. The respondents were considering an environment unaffected by these and other important but less dramatic occurences; their responses must be viewed accordingly. On the other hand, in the immediate political environment, the single issue which might be said to have dominated the European news media during the period of this study was the Middle East conflict. The crisis which led up to the June 1967 war, the war itself, and the decisive yet inconclusive outcome demonstrated at once the fragility and stability of world order, the impotence of the United Nations, and the relative unimportance of the European role in world affairs in comparison with the roles of the United States and the Soviet Union.

Much more could be said about the European scene in late Spring and early Summer of 1967. The European Community was nearing the end of its first decade--a decade which, while witnessing continued economic prosperity in the Six countries, saw hopes for expansion as well as hopes for rapid political union repeatedly frustrated. The major European nation outside of the Community--Great Britain--was faced with severe economic problems superimposed on a national identity crisis. The Cold War--at least in Europe--seemed waning if not already quite dead, and few serious European observers seemed concerned with the threat of an invasion from the East. The United States, on the other hand, was increasingly involved in a war in Southeast Asia, a war for whose perceived aims there was little sympathy among Europeans.

Our questions did not attempt to range broadly across the entire spectrum of issues which comprised the European political environment. Rather, as the political opinion questions were limited to approximately 40% of the interview and questionnaire format, they sought to deal with a small number of important issue clusters.[1] These issue clusters are the themes around which this and the next two chapters are organized. This chapter deals with European integration--its political and economic aspects, the shape which is envisioned for it, the choices involved, and the motivations behind it. Chapter IX treats certain aspects of East-West relations and security. In particular, it is concerned with the détente, economic relations with Eastern Europe, problems of nuclear weapons and disarmament, and integration of military forces. Chapter X, finally, is devoted first to broader problems of international relations--the future of the United Nations and world government--and second to a number of politico-technological issues--the "technological gap," the

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[1] As a condition of our being allowed to carry out this study within the various organizations, we also agreed to avoid matters of a highly controversial nature--such as, say, the Vietnam War or the personality of Charles de Gaulle--which might have created undue hostility or suspicion among some staff members and which might have in turn embarrassed the administrations of the organizations.

"brain drain," and the "space race."

Our approach to the treatment of the political opinion data is analytical and to an extent quantitative, but makes no pretense at definitive quantification. We feel that this is appropriate in view of the exploratory nature of the study and our limited objectives in dealing with this material. In essence, what was done after delimiting an issue-cluster was to define the range of views observed on facets of this cluster, establish the consensual view (to the extent it exists), examine the deviations, relate views on various facets of the issue cluster to each other, and look for the differences produced by cross-cuts of the prime independent variables (laboratory, nationality, and seniority) as well as other variables. We rely largely on marginals and cross-tabulations of quantitative data while drawing freely from the richer interview texts and write-in comments. The numbers are empirically derived, but those who have no experience with this sort of survey analysis should bear in mind that the ways in which they are combined and interpreted are dependent on the judgement and experience of the author.

B. Economic and Political Union

1. Enlarging the Economic Community

Support for the common economic institutions which have developed in post-war Europe is so widespread among the elites in the major nations that "favoring" these institutions is no longer a relevant choice. In their report on the TEEPS project, Lerner and Gorden write:

> The success of the appeal . . . for collective prosperity meant that, by 1959, we stopped asking panelists about the European economic organizations. The consensus that had been built since the early years of the TEEPS surveys became so strong that the idea of collective economic growth had ceased to be a matter of controversy.[2]

We felt sufficiently confident that this assertion should be valid for scientists and engineers working in joint European organizations to take it more or less as a base and go on from there in our questioning. The choices which were examined thus concerned the geographic extension of the European economic institutions as well as the potential movement of integration from the economic to the political realm.

The problem of expanding the European Economic Community--choosing between "little Europe" and "big Europe"--which has been at issue since the early 1960's clearly hinges on the admission of Great Britain. Admission of Britain, whose application has twice been rejected by the French government, would undoubtedly be followed rapidly by the entry of several of Britain's smaller EFTA partners, leading to a European Community of not six, but perhaps ten or even thirteen members. It is the evaluation of this choice which was sought in the question: "Would you favor the formation of a wider European Economic Community that would include the present EEC (Six) and other Western European nations?" This choice was expected to be most crucial to EURATOM scientists whose personal fortunes were directly tied to the political structure of the European Community. Some nationality differences were also anticipated

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[2] Daniel Lerner and Morton Gorden, Euratlantica: Changing Perspectives of the European Elites (Cambridge: M.I.T. Press, 1969 in press), pp. V-2,3. (Page numbers refer to manuscript.)

on the basis of differing national involvements in such a venture. In fact, the degree of unanimity with which the scientists approved expansion of the EEC (90%) was rather impressive. Table 8.1 presents the

Table 8.1

Extension of the EEC in Western Europe, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
	(35)[a]	(19)	(20)	(7)	(25)	(13)	(17)	(19)	(25)	(35)	(39)
Yes	83%	68%	100%	100%	88%	100%	100%	95%	84%	91%	85%
No	11	26	0	0	12	0	0	5	12	3	10
DK	6	6	0	0	0	0	0	0	4	6	5

[a] These "n"s are identical for the remaining tables in this chapter (except where indicated) and will not be repeated.

nationality/laboratory cross-tabulation for this question. Out of a total of 384 respondents, only 26 (7%) disapproved of extending the EEC to other countries of Western Europe. Within this lop-sided distribution lies, in one sense, an even stronger unanimity, but in another sense, a definite ambivalence. The finer structure is revealed through analysis of write-in comments, interview transcripts, and cross-tabulation with other questions.

It is first of all evident that virtually all of the scientists, whether or not they are officially affiliated with the European Community (EURATOM), approve of the "big Europe" scenario.[3] Even among the 26

[3] The author's earlier analysis of data from CERN alone--Daniel Lerner and Albert H. Teich, "International Scientists Face World Politics: A Survey at CERN" (M.I.T. Center for International Studies Document No. C/68-2, January 1968), pp. 20-22--reached this same conclusion.

dissenters, more than a fourth qualified their negative responses by annotating comments which indicated that they would approve of extension at some time in the future. Further, it is apparent from individual examination of the questionnaires that about half of the remaining disapprovers were motivated in their disapproval by a desire to foster rapid political unification of the Six, but were definitely interested in eventual expansion.

The fear that expanding the EEC might slow the process of political integration is at the root of an ambivalence which we suspect underlies the apparent unanimity of this response. Consider the following interview exerpts, all responses to the above question:

> In a way yes. This means that I think it's necessary to reach a political union [in Europe] and I would like to see this union as big as possible. On the other hand if there was a union between the Six and the Seven but purely on an economic basis, then I would be against such a union.
>
> --EURATOM Dutch physicist

> These are difficult problems . . . it is quite difficult for different nations to--even when there are not too many--to reach a common point of view. Now if you take a really strong union and add more nations you make things more difficult. I mean it may turn out like the United Nations: people discuss and discuss and nothing comes out of it.
>
> --CERN French physicist

> Basically I would prefer a larger community, but again I have in mind this idea of reaching as fast as possible a political union. Now if the political union becomes more difficult by getting other nations into the Common Market, if the Common Market would gradually develop into an organization of only economic cooperation and assistance, then I would prefer to have only six nations.
>
> --EURATOM German physicist

Our question was not phrased in terms which might force this hard choice between expansion of the economic community and political integration of the present grouping, and perhaps it will not be necessary for Europe to decide between these alternatives, but it appears that some misgivings of this nature underlie the nearly unanimous desire among our respondents to create a "big Europe."[4]

Naturally, three of the four main nationalities are able to view the question of expanding the Community from a different perspective than the fourth. To the British, the choice is between joining the EEC and remaining outside of a European union. While the overwhelming majority of British respondents did approve of expanding the community--by implication including Britain--it is noteworthy that the British accounted for a significant proportion of the disapprovers. The meaning of this British response will become clear shortly.

2. Political Integration: Preferences

a. Approval of Union. The thrust of the above analysis suggests that is is necessary to look to the matter of political unification for further definition of this opinion-cluster. The questions "Are you in favor of the formation of a political union among the 'Six'?" and "Would you favor a political union on a wider scale in Europe?" probe this matter. Their tabulations are presented in Table 8.2 (see following page).

Again one may observe a strong consensual response approving the concept at issue. Aside from the British and French at ESTEC, more than

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[4] Similarly Lerner and Gorden, Euratlantica, p. V-9, report that their national elite panels "had not yet achieved a consensus among themselves as to the next steps for the European Community, nor even to the direction these steps might take."

Table 8.2

Approval of European Political Union, by Laboratory and Nationality

	ESTEC				CERN				ISPRA			
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It	TOTAL
Union of Six												
Yes	57%	79%	95%	100%	88%	100%	100%	90%	88%	97%	97%	85%
No	34	16	5	0	12	0	0	5	4	0	3	11
DK	9	5	0	0	0	0	0	5	8	3	0	4
Wider Union[a]												
Yes	61%	56%	90%	83%	86%	87%	100%	94%	85%	91%	83%	81%
No	32	25	5	0	14	0	0	6	10	3	11	12
DK	7	19	5	17	0	13	0	0	5	6	6	7
n=	(31)	(16)	(20)	(6)	(21)	(8)	(16)	(18)	(20)	(32)	(35)	(342)

[a]The pretest interviews led the author to believe that the subject of wider political union would arise so naturally out of the discussion that it would not be necessary to include a separate question with regard to it. This expectation was not borne out in 42 of the later interviews. The number of those for whom data is available is given in parentheses, and the percentage for the "wider union" question is based on this number.

four-fifths and up to 100% of each group favor a political union of "little Europe" and nearly the same proportions favor wider political integration. Even among the deviating ESTEC respondents there are healthy majorities in favor of political unification and relatively small numbers directly opposed. Looking briefly at the smaller laboratories which are not shown on the table, the EURATOM centers of PETTEN and FONTENAY show 100% favoring union of the Six and 80% and 100%, respectively, favoring broader union; ESDAC shows a response pattern parallel to ESTEC, while HALDEN and—

IAEA, the least "European" of the centers are weakest with 65% and 36% favoring union of the Six (IAEA has 36% DK) and 66% and 55% approving wider union.

Such strong approval as was found at the large centers was not unexpected of course. Political integration--despite its apparent lack of progress in the realm of government action--has met with favor among the elites of Western Europe for some time. Elite opinion surveys in the major European nations give evidence of this trend. Deutsch *et al.*, for example, report that in their 1964 study of elites in France and Germany, 67% of the French elite favor "some kind of 'supranational dominance'" in European integration, and virtually all of the German elite do so as well.[5] The TEEPS study, report Lerner and Gorden, discovered similar attitudes in France and Germany, but not in Britain:

> The political interpretation of Europe was given by the continental panels alone; we can now see that the politics they desired were those of close European supranational cooperation. The British . . . did not have such an orientation in mind.[6]

The ambivalence which some of the respondents showed toward the expansion of a purely economic community is apparently based on a strong desire for rapid strengthening of political ties between the European nations; confirmation can be seen in the political union

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[5] Karl W. Deutsch, Lewis J. Edinger, Roy C. Macridis, and Richard L. Merritt, *France, Germany and the Western Alliance* (New York: Charles Scribner's Sons, 1967), p. 74 and pp. 160-163.

[6] Lerner and Gorden, *Euratlantica*, p. V-24.

response. The phrases "building Europe," "making Europe," "when Europe is done" are clearly part of these scientists' lexicons. The concepts arose naturally within the interviews, not only with respect to the specific questions with which we are dealing here, but in all sorts of other contexts. Only a few individuals did not speak in this vocabulary or were not quite at ease with it. Indeed, paralleling the TEEPS findings, these individuals were primarily British; most were from ESTEC.

The cross-tabulation of the two political union questions, distributed by laboratory and nationality, bespeaks this conclusion even more vividly. Here (Table 8.3, below) it is clear that outside of the ESTEC

Table 8.3

Approval of Both, One, or Neither Form of Political Union, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Approve Both	52%	47%	85%	83%	81%	87%	100%	83%	90%	94%	83%
Only Six	7	33	10	17	5	13	0	6	5	6	14
Only Wider	14	13	5	0	5	0	0	11	0	0	0
Neither	27	7	0	0	9	0	0	0	5	0	3
n =	(29)	(15)	(20)	(6)	(21)	(8)	(16)	(18)	(19)	(31)	(35)[a]

[a]Excludes those who were not asked about wider union and those DK on both parts.

British, the number of respondents who approve of neither form of political union for Europe is miniscule. Small numbers of respondents are unwilling to see a political union of only six countries; others see wider political integration as unrealistic, but most evidently do not want one form to the exclusion of the other.[7]

b. Functionalism Revisited. There is a distinct consensual position on the issue-cluster described so far. Over the entire sample, some 85% of the respondents approve both geographic expansion of the European Community[8] and some form of political union. These 85% are the "Europeans"--they hope that the political boundaries separating the existing nations will someday give way to a supranational community and they realize that--in the words of one interviewee--"the Six is not Europe yet, it is just Six." They differ among themselves as to means, being undecided about whether to seek a political community on a smaller scale first and then expand geographically, or to enlarge the community first as an economic community. The data is incapable of distinguishing various types according to their schedule of priorities, but one feels intuitively that this is not a crucial failing, as it seems that the respondents themselves are quite undogmatic on this point and most would be willing to follow whichever course appears more pragmatic for the goal of "making Europe."

The deviates are found in several categories: the British (13 in number) and the French (4) at ESTEC, the French (5) and Italians (6)

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[7] It is worth noting parenthetically that some respondents interpreted the question of wider political union as including the Eastern European nations and responded to this. So broad a union was not intended in the question, but its consideration as a possibility is certainly significant.

[8] Including the "yes" as well as the "no, but later" response.

at ISPRA. The ESTEC and ISPRA French and the ISPRA Italian deviates are relatively few, comprise 20% or less of their groups, and seem to be, for the most part, Europeans of a more limited sort. Excepting a handful, they are the ones who are most strongly against expanding the economic community on the grounds that it would weaken the ties between the Six nations. Perhaps because of this still European orientation or perhaps simply because they are so few in number it is not possible to distinguish them from their colleagues on the basis of other variables. The ESTEC British deviates, on the other hand, definitely appear to have less enthusiasm for European supranationalism both in the economic and political senses; in the conventional parlance, they are less "European." The tone of this attitude appears, for example, in one Briton's evaluation of the importance of the Economic Community:

> There is this removal of some tax barriers but, again, not a great deal has been done in this way. These Six work together in that their tariffs on some things are a little bit lower than with the rest of Europe, but it's not terribly significant.

Let us make no mistake. The majority of the British scientists in our sample are clearly European, committed to seeing their nation part of a supranational Europe. At CERN and at the smaller laboratories the percentage of British falling outside of the consensus is about the same as that of any other major nationality. In this respect the views of the British scientists differ significantly from those of their compatriots in the national panels of TEEPS. At ESTEC as well, the majority of the British (63%) are also within the consensus. Those whom we have called "deviates," however, are of interest to us due to several other characteristics.[9] They appear to be less interested in political affairs than the other ESTEC British: none of the deviates rank themselves above average while 23% of the consensus group do so. They discuss politics less frequently: only 16% respond "very often" or "often" versus 32% of the consensus group. They also consider themselves more on the right: 9% of the consensual group place themselves on the right on the political spectrum while 38% of the deviates do so.[10] Finally, they have lower seniority: 10 of the deviates come from the low seniority group (n = 24) while only 3 come from the high seniority group (n = 11).

This latter point leads to one of the few "tests" of functionalist theory which can be made with this data and thus requires something of a digression. It will be recalled that we had hoped to find variations in response patterns with length of stay in the laboratory (seniority). It was hypothesized that through experience working in an international laboratory, scientists would develop attitudes increasingly favorable to European unity, thus preparing themselves for a larger role in the integration process. The testing of this hypothesis was one of the important original objects of the study. As analysis progressed, however, it became more and more evident that the data was not likely to allow a real test. Without even considering the nature of political

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[9] We recall that deviates in other laboratory/nationality groups could not be distinguished from their colleagues on the basis of external variables.

[10] Lower interest, less discussion, and "rightness" are related to each other in the whole sample; see Chapter VII.

opinion, it was apparent that the mal-distribution of respondents with respect to seniority would operate as a limiting factor. As outlined in Chapter IV, characteristics inherent in the structures of two of the three large laboratories (ESTEC and ISPRA) made it impossible to obtain a balanced seniority distribution. Beyond such problems with independent variables, the qualitative picture of the respondents' political attitudes (which emerged in Chapter VII) suggested that broad areas of agreement should exist on specific issue-clusters. We have already seen this to be the case. On the matter of European integration, some 85% of the respondents--17 out of every 20--fit into the consensual position outlined above. With such global agreement it is impossible to detect changes over time; there are simply too few non-Europeanist respondents to allow one to see any differences when "slicing" by seniority.

This overwhelming consensus may be viewed at different levels of explanation. It is possible that the choices presented by the questionnaire were not really the crucial ones to the respondents--i.e., that the questions were "too easy" for this set of respondents. Looking at things in this light, one may hypothesize that changes in opinion patterns might still occur as a function of seniority, but that such changes are too subtle to be detected by the questions which were posed here. Alternatively, one might simply take the data at face-value: The bulk of the scientists are highly Europeanist when they come to the laboratories, and they remain that way.

This is where the ESTEC British become interesting. Within this group, those individuals with high seniority are significantly more Europeanist than their colleagues with low seniority. With respect to professional variables (field of training, type of work, level of highest degree, and reasons for coming to the organization) as well as such variables as age and prior foreign experience, the consensual and deviant groups with high and low seniority are reasonably homogeneous (the numbers of course become quite small). In the absence of other "explaining" variables this leaves us with at least a clue to the effect that the experience of working in a European international laboratory may make a British scientist more "European" in his political outlook.[11] The British at ESTEC, farthest removed from their colleagues in original political outlook, may be the ones most affected by the experience.

3. Political Integration: Expectations

It is of limited value to ask abstractly whether one would favor political integration of the European states; a person's preferences in his "best of all possible worlds" may become unrecognizable when extruded through the mold of political reality. For this reason it was considered important to ascertain the extent to which the respondents looked upon European unification as a realistic prospect which they might hope to see within a finite time-period. In other words, were the scientists simply paying lip-service to the ideal of a united Europe, or did they have a concrete notion of its coming about?

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[11] One might hypothesize on the other hand that the non-Europeans tend to leave before they acquire high seniority rather than changing their political views. Mild support is lent to this notion by the fact that the low seniority deviates report a substantially lower level of job satisfaction than low seniority consensuals.

The question is already partially answered. The tone in which the respondents employed such phrases as "building Europe," "making Europe," and "when Europe is done" implied a genuine expectation on their part. Nonetheless, the questions "Do you think that it will actually occur?" and "If yes, how many years would you estimate that this might take?" which followed the item asking approval of a political union among the Six, and the question "Do you think that it is possible in the foreseeable future?" which followed the item concerned with a wider political union shed additional light on the issue cluster.

Let us first take up the union of the Six. Over the entire sample two-thirds of the subjects feel that it will occur (67% yes, 24% no, 10% DK). There is a high degree of interaction, however, between preferences and expectations. Among the 325 respondents who favor such a union more than three-fourths (77%) feel that it will occur, while only 16% do not. Among the 44 who stand opposed to a political union, 86% state that it will not occur, while only 11% feel that it will! Clearly those who favor a political union see it as a realistic prospect. Some of the minority of respondents who favor political union but responded negatively (or DK) to the question of expectation, furthermore, may have been giving vent to an expression of momentary frustration as much as anything else, since more than a fifth still responded to the follow-up question and estimated how many years it will take, while a number of others qualified their "noes" by writing in "not for a long time."

The strong interaction between preferences and expectations suggests that those laboratory/nationality groups with the weakest preferences should also have the weakest expectations and *vice versa*, and this in fact turns out to be the case. Going slightly beyond this matter, Table 8.4 presents the distribution of expectations cut by

Table 8.4

Expectations and Preferences on Political Union of the Six, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Favor, expect	46%[b]	79%	55%	86%	64%	92%	76%	68%	76%	83%	67%
Favor, don't expect[a]	12	0	40	14	24	8	24	21	12	14	30
Oppose, expect	6	5	0	0	4	0	0	0	0	0	0
Oppose, don't expect[a]	29	11	5	0	8	0	0	5	4	0	3

[a]Includes DK expect

[b]Columns do not all add to 100% since those few who were DK on questions of favoring union are omitted.

preferences. Across all three laboratories the Europeanist French display the greatest optimism: Very few of those French who favor political union of the Six do not see it coming about. In contrast, the Germans and the Italians evince noticeably more pessimism.

Not unsurprisingly, the estimation of a time scale for political integration of the Six is a matter of some uncertainty among the respondents. The only period clearly ruled out by the scientists is the next five years. Among those who felt it will occur, only 1% estimated "less than five years," while 16% chose "5 to 10 years," 34% chose "10 to 20 years," 32% chose "more than 20 years," and 18% did not know.[12] Variations in this response by laboratory/nationality groups were irregular, but it did appear that the ISPRA scientists envisioned a somewhat shorter time scale than the others--46% of them estimated 20 years or less, while 33% at CERN and 29% at ESTEC made comparable responses.

While ten to twenty years may be a relatively short period in a historical perspective, it evidently seems inordinately long for many of these respondents in view of their strong desires for European unification. A number of typical interviews (which have been reproduced here conversationally) may illustrate this point. First a Belgian engineer at ISPRA:

> A: . . . I have the feeling that political Europe is not made and it will take still many, many years before we arrive at such a concept.
>
> Q: What kind of time scale?
>
> A: I have a feeling of ten years, something like that.

Next an Italian engineer from ESTEC:

> Q: Do you think that the Six will eventually form some kind of political union?
>
> A: Oh yes, but not as early as they say. I think that they will be obliged to do this, but it will be very difficult.
>
> Q: Do you have any idea how far in the future this might be?
>
> A: Oh, at least ten years.

Finally, a German scientist at ESDAC:

> Q: Do you believe that the Six will eventually form a political union?
>
> A: Well I hope so. . . . It is not possible to achieve a political unification in ten years, you see. We have a history of 2,000 years and each country has its own

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[12] The most popular write-in comment on this question was "after de Gaulle."

history and such individualistic people as we have in Europe--Frenchmen, Englishmen and Germans--won't find it easy to do this . . .

Q: Well how many years do you estimate it might take?

A: Oh, I would say 20, 30 years.

Clearly the respondents anticipate unification of at least "little Europe" in the relatively short-term future. Integration on a larger scale is a different matter, however. Only a minority (31%) indicated that they thought wider political union was possible in the foreseeable future; more than half (56%) did not foresee such a possibility, and 13% gave no opinion.[13] There was some interaction between the expectation of union of the Six and that of a larger union. Of those who stated that a union of the Six would not occur, only 13% anticipated the broader union (82% said "no," and 5% were DK). Among those whose expectations _did_ include a union of the Six, nearly half also felt a wider union was possible. Evaluations of the likelihood of this wider union varied widely across the different laboratory/nationality groups. Table 8.5 (see following page) presents preferences and expectations with regard to a wider union in a fashion analogous to Table 8.4.

This table testified to the skepticism about political integration of "big Europe" which most of the respondents displayed. The highest degree of optimism is shown by the ESTEC British, who, interestingly enough, were next to the least favorable to the idea. In other words, of those ESTEC British who do favor a wider political union, most

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[13] This finding, at least with respect to German elites, parallels that of Deutsch, _et al._, _Western Alliance_, p. 165.

Table 8.5

Expectations and Preferences on a Wider Political Union, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Favor, expect	47%[b]	31%	35%	20%	38%	0%	21%	33%	12%	19%	32%
Favor, don't expect[a]	13	25	55	60	43	86	79	60	70	71	48
Oppose, expect	3	0	0	0	6	0	0	0	0	0	3
Oppose, don't expect[a]	30	25	5	0	12	0	0	7	12	3	10
n =	(30)	(16)	(20)	(5)	(16)	(7)	(14)	(15)	(17)	(31)	(31)

[a] Includes DK expect.

[b] Columns do not all add to 100% since those few who were DK on questions of favoring union are omitted.

expect that it will occur, while in nearly all of the other groups the majority of those favoring a union do not feel it will come about in the foreseeable future. A comparison of Tables 8.4 and 8.5 further emphasizes this point. The distribution of the ESTEC British is virtually identical in the two tables, while every other group is more pessimistic about a wider union than a union of the Six. Referring back to the terminology of the last section, most of the ESTEC British who oppose one type of political integration oppose the other and are the deviates, while most who favor one type favor the other and are the consensuals. The added information which we get here is that the picture of Europe envisioned by these British consensuals is substantially more optimistic about "big Europe" than that of the French, German, and Italian consensuals.[14]

C. Integrative Motives

What hopes do the scientists, so committed to the uniting of Europe, place in the accomplishment of this aim? Other studies have attributed various motives to the elites of major European nations in their quest for integration. Deutsch ét al. report the most popular French view of the purpose of European integration as "generally, to give Europeans the means and resources to solve economic, social and political problems currently insoluble by nation-states acting alone." "Economic betterment," "reinforce[ment] of the European bargaining position in world politics," and "strengthen[ing] the European position vis-a-vis the United States," follow in that order.[15] Unification for Germans is seen as all things to all men--economic benefits are stressed by businessmen, political benefits (inside Europe) by politicians, and diplomatic benefits (outside of Europe) by administrative and mass media elites.[16]

Lerner and Gorden, dealing with this problem from the vantage point of their entire vast data set, rather than from separate items, propose a paradigm consisting of three different policy priorities,

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[14] Cf., Lerner and Gorden, Euratlantica, pp. V-7, 8.

[15] Deutsch, et al., Western Alliance, p. 77.

[16] Ibid., p. 164.

"protection, prosperity, and prestige," which are differently ordered under "Euronational, Euramerican, and Euratlantic" scenarios. (The "Euronational" scenario corresponds roughly to the Gaullist design; "Euramerican" to the Monnet model, and "Euratlantic" to such initiatives as NATO and the Marshall Plan.) They conclude that

> there is an emerging consensus within, and a convergent consensus between, the elites of the European nations. Further, that this convergence goes in the direction postulated by our developmental construct: from nationalism to regionalism. The convergence is based on the shared long-run expectations that personal and public values (protection, prosperity, prestige) will be enhanced by the larger community of interest embodied in the Euramerican and Euratlantic scenarios.[17]

While this is a rather general statement of motives, it corresponds well to the overall frame within which our respondents see unification operating. To a large extent it appears, in fact, that within the consensual position of these respondents, the sustaining value of integration is so automatically taken for granted that its specific benefits are not of terribly high salience. Among those who share the "European" orientation, the purpose of "Europe" is beyond question.

We did not attack this facet of the unification issue-cluster directly, but found that the relevant data emerged wtihin the context of interviews mainly in analysis of three questions. While the three are taken up here in varying depth, they all share the aspect of being concerned with United States-Europe relations: the first with an Atlantic Economic Community, the second with "independence," and the

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[17] Lerner and Gorden, Euratlantica, pp. II-58-65.

third with the "technological gap." What emerges from their analysis is a feeling that a best approximation to the respondents' motivations for European unification is implied in the words of one scientist--"If there is a future for Europe as a leading continent, it's only in unity." By this is meant in Deutsch's terms "generally [giving] Europeans the means and resources to solve economic, social and political problems currently insoluble by nation-states acting alone," and in Lerner's terms the enhancement of the public values "protection, prosperity, prestige." Above all, though, there is the impression that particular reasons are not so important as the broad vision of a United Europe.

This vision may be seen in terms of Europe-United States relations. Following the question on expansion of the EEC in Western Europe were two additional expansion proposals, the first suggesting an economic community with the nations of Eastern Europe, and the second suggesting such a community with the United States. Close to two-thirds (62%) of the respondents approved expansion to Eastern Europe, while fewer than one-third (31%) approved expansion to the United States. The latent reason behind this response appears clear--Eastern Europe is "Europe" and the United States isn't.[18] While "strengthening the

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[18] While we do not have quantitative data which might directly support this notion, the interpretation is based on qualitative impressions from the interviews. Virtually none of the respondents appeared to have any real liking for the economic or political systems of the countries of Eastern Europe, but the "Europeanness" of this region--based on cultural and historical ties--is highly valued by nearly all. The logic is expressed well by the British scientist from ESDAC (see p. 306) who speaks of a "viable economic unit and sensible political unit." Relations with Eastern Europe are also treated in the following chapter.

European position vis-a-vis the United States" is not necessarily a primary motivation for these Europeanists, it is certainly a well-perceived outcome of the process. Such thinking is by no means anti-U.S.; it is merely pro-Europe.

The distribution of responses to the relevant question (literally, "Would you favor such an economic community including the United States?") is fairly smooth across the various laboratory/nationality groups. The strongest approval (actually a plurality) is 44% among the CERN British, while most other approval levels range around 20-30%. This question, however, drew an extraordinarily high rate of write-in comments (half of all respondents qualified their answers) and proper interpretation requires taking these into account. Most impressive is the fact that both "yes" and "no" respondents made very similar remarks and qualifications. The bulk of the comments reflected feelings that the purpose of economic integration is the building of Europe, and that the time to talk of stronger Atlantic ties was after Europe was united onto itself. Often the fact that the United States is so much larger and more powerful than the individual European countries was cited, and it was explained that unless Europe was united first, the inevitable result would be American domination of any integrative arrangement. Many comments on both "yes" and "no" responses deferred consideration of the matter to the future and one is led to believe that, while there are variants from this regionally-oriented position (for example feeling as one Britisher did that an Atlantic community would divide the world even more rigidly between the "haves" and the "have-nots"), it is a more broadly shared notion than one might suppose from the marginal alone.

A few interview excerpts may also be illuminating. The words of a British scientist from ESDAC suggest the shape of the position:

> Here I think one has to say why one is interested in extending the Common Market, and it's not simply for economic reasons. It's more for the fact that this gives one sort of a foothold in international cooperation. Well, in Europe, generally, Western Europe, this sort of thing exists to some extent already. Eastern Europe, one has no objections, but it's a much more remote prospect, you know. This could be integrated very readily, given the right political circumstances, into a viable economic unit and a sensible political unit. With the United States, I'm not so sure that this is true to anything like the same extent.

Those of a French physicist from CERN refine it:

> I would be a bit worried by the fact that there is so much difference presently between the weight of the United States and that of Europe which is not at all unified, strongly unified. All the weight would go in one direction and I don't think it's at all the time for this now.

Finally, a Belgian engineer from ESTEC may have put it most concisely:

> This is a funny question. The United States mustn't be included because nothing would be changed in this case!

It is by and large a matter of independence. A unified Europe, regaining its position as a "leading continent," must be able to determine its own destiny. After World War II, the bipolar configuration of military and political power relationships left the individual European nations in a state of dependence to which they were unaccustomed. In recent years, the gradual evolution of a more multi-polar system has opened opportunities for greater independence for a politically united Europe. When asked if they thought Europe "should take a more independent position in the Western Alliance," nearly three-fourths (71%) of our respondents replied affirmatively. This response, which again was shared across the various laboratories and nationalities, is further supported by the fact that a significant proportion of the negative responses were qualified by such comments as "after it is united." Even among those respondents who would approve a U.S.-European economic community, a majority (55%) favor a more independent position for Europe. Here, then, is the "prestige" element of the motivation for building Europe.

Finally, as scientists and engineers, it is perhaps in their own fields that the need to build Europe strikes our respondents closest to home. When asked if they thought "that the 'technological gap' currently being discussed in the press is a serious problem for Europe," the vast majority of the respondents (75%) replied affirmatively. The follow-up to this question was open-ended and asked the respondent to suggest whatever action might be necessary to close the gap. Reponses ranging from short catch-phrases to lengthy proposals were recorded and by far the most frequent (distributed well across nationalities and laboratories) were those which emphasized more European cooperation and integration. Nearly half (42%) of all suggested actions were aimed in this direction. Drawing on the interviews again, one may cite answers such as,

> No, I have no solution for this problem . . . but I have the feeling that making Europe is something which is really necessary, which is a fundamental necessity to arrive at a solution.
>
> --EURATOM Dutch physicist

> Well, I feel that the only type of action that could have a chance to fill that gap would be an action of the Community. I believe if we don't build Europe, at least technological Europe, we have no chance.
>
> --EURATOM Belgian engineer

Essential to remember here is the fact that Lerner and Gorden's so-called "Euramerican scenario" emerges very clearly from a significant proportion of the respondents of all major nationalities without an attempt at direct direct elicitation.

D. The Structure of a United Europe

Beyond the outlines of European unification, which were drawn first in terms of preferences and expectations, and second in terms of the hopes vested in the process, the images of actual structure held by the international scientists and engineers become somewhat more diffuse. In view of the fact that they do not possess the technical skills necessary for sophisticated examination of many of the questions involved and in view of their limited emotional commitment to political matters (we recall the "expert syndrome" described in Chapter VII), such "thinning-out" should not be unexpected. Nevertheless, the questionnaire had moderate success in dealing with two segments of the structural complex: first with the locus of power in a United Europe, and second with the preservation of national cultures. While the response patterns for the two questions can do no more than scratch the surface of a structural image at two widely varying points, it was felt that there should be significant material in these topics. The preservation of national characteristics might be expected to be a source of ambivalence toward European integration: Is there a perceived conflict in the minds of the respondents between the desire for prosperity, protection, and prestige through the elimination of national boundaries and the desire for maintaining the special character of Europe--the individuality of its parts--of which Europeans are so fiercely proud? On the other side, the particular form of government for the Europe of the future, while perhaps a matter which the respondents would adjudge as outside of their competence, will be one of the "hard" choices which the Europeans will have to face in their quest for unity. As part of the debate over "Europe des patries," it has already been the source of controversy between Gaullists and more supranationally oriented Europeans.

Nothing which even remotely resembles a consensus came out of our question on form of government. The proportions favoring a "strong central power" (34%) versus "more power for the states" (47%) give a slight edge to the states. But a large DK (17%), wide variations between the various laboratory/nationality groups (see Table 8.6), and an ambiguous set of comments apparently make it a wide-open issue.

Table 8.6

Preferred Form of Government, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Central Power	31%	53%	40%	14%	20%	31%	35%	26%	20%	40%	54%
More for States	40	32	45	43	64	23	59	48	48	34	36
DK	29	17	15	43	16	46	6	26	32	26	10

The question itself and the choices proffered were apparently themselves ambiguous since there are widely differing conceptions among the respondents of what constitutes strong or weak central power. This makes it impossible to base any firm conclusions on a respondent's choice of one form of government over the other. One may note for example that, in write-in comments, 12 respondents took the United States as an instance of a strong central power, while 10 took it as an instance of a form with more power for the states. The response to this question shows little relation to any other patterns we have found, with one predictable exception. Among those 22 respondents who did not, on earlier questions, approve either type of political union for Europe, "more power for the states" enjoys a wide (68% to 18%) edge over "strong central power." Strong central power, to the extent it exists in France (or Italy), is quite different from the American conception, and it is likely that few respondents envisioned anything quite so drastic for a European government.[19] Probably the most widely shared view--to the extent that we are able to uncover it--incorporates a government largely paralleling that in the United States, with certain powers delegated to a central authority but with substantial local autonomy.

The second aspect of the image of a united Europe is that which must rationalize a desire for political integration with a desire to maintain cultural differentiation. To see if our respondents had succeeded in resolving this difficulty, we asked them "Do you think that the existing cultures of Europe could maintain their individuality within a united Europe?" The response was a resounding "yes" (88% yes versus 6% no and 6% DK). The consensus covered all laboratory/nationality groups with positive responses ranging from 75% to 100%. Only a handful of

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[19] If an author be permitted to second-guess his own work, it seems likely that this question would have gotten more profitable results had it asked directly about supranational versus international government, which is the real heart of the issue.

respondents found any problem at all. A great many pointed to the numerous contemporary European examples which demonstrate that there need not be identity between culture and political structure:

> Look at Switzerland, for instance. This is a nation-state but the provincial characteristics are still there. Everyone still has his own language, his own culture and so forth. We have a very good example in Europe which we can follow.
>
> --EURATOM Italian engineer

> I mean the Bavarians still maintain their individuality in Germany and the North Germans are certainly quite different from them. So there is no difficulty.
>
> --CERN German physicist

There is no desire on the part of the respondents to see a blending of the various national traditions and there is no reason, in their minds, why political integration should lead to this. There is even a mild suggestion that European integration might facilitate the preservation of national traditions by resisting the tide of "Americanization."[20] Such is the image of a united Europe.

* * *

In describing the political opinions of the respondents on the issue cluster most salient to them we find, first of all, a wide sharing of ideas--a finding which is consistent with the overall attitude structure of this group of European scientists described in Chapter VII. Political integration of the European nations is a basic goal, and the preferred framework is one of "big Europe" rather than "little Europe." The widest deviation from this consensus is found among a group of British respondents from ESTEC. Within this group, the frequency of

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[20] See along these lines, Jean-Jacques Servan-Schreiber, The American Challenge (New York: Atheneum, 1968), and Lerner and Gorden, Euratlantica, Chapter I.

deviation is found to be higher among low seniority respondents than among those with high seniority, an indication that to the degree deviation from the general view of European politics exists among these scientists, it is significantly altered over time in the laboratory.

Preferences were found to interact with expectations and those who favored political integration were more likely to see it as actually coming about in the near future. In general, however, integration of "little Europe" (interpreted by a good many, it appears, as including Britain and the Six) was viewed as a likely occurence during the next twenty years or so, while larger integration was clearly more speculative. The desire for economic integration (as a step toward political community) was regionally based and did not extend, for the most part, across the Atlantic. Thus, within the internationalism professed by the European scientific community, a clear and realistically-structured regionalism has developed in the minds of an important functional segment. How the attitudes of these scientists develop with respect to other issues will be seen in the two succeeding chapters.

CHAPTER IX

ISSUES: EAST-WEST RELATIONS AND SECURITY

This chapter describes the political views of our sample of international scientists and engineers with respect to a number of crucial issues involving the larger world of which Western Europe comprises but one part. Although, as has been stated repeatedly, issues of European integration are most salient to these men and most interesting to us in the context of a study of the functional role of technological collaboration in the European arena, such issues do not demarcate the political horizon of the respondents. Of particular concern because of their overriding importance in determining the future of the entire world are problems which involve the continuing confrontation of the "East" and the "West"--the Communist and non-Communist states. This confrontation is probably the most important single political fact of the present age. As a result of the tensions which it has produced, consideration of its attendant issues leads immediately to concerns of military security and nuclear weapons.

The European scientists and engineers working in international laboratories are concerned, to varying degrees of course, with all of these matters. The purpose of this study, however, did not allow for a full treatment of each, and, in fact, after having devoted large portions of the survey instrument to non-political questions, and to political questions about European integration, it was possible only to deal with selected areas of the East-West, military security picture. Thus, this portion of the analysis deals in turn with the *détente*, the building of supranational military forces, and the possession and proliferation of nuclear weapons. Before proceeding with the first of these questions, the reader should be reminded once again that the response patterns under discussion were articulated during mid-1967, and while long-range attitudes may not have been affected by such subsequent developments as the invasion of Czechoslovakia, shorter-term expectations may well be different now than they were at the time of the study.

A. The Détente

As noted in Chapter VIII, the possibility of opening up an economic community between Eastern and Western Europe was welcomed by a sizable majority of the respondents. Table 9.1 (see following page) which presents the distribution of this response by laboratory and nationality, shows that although some dissenters exist in each group, the general feeling is widely shared throughout the sample. Overall (including the other laboratories) Germans were most receptive to the notion while the Italians (except at CERN) displayed the strongest opposition. We suspect that this question and its response pattern reflect a mingling of two distinct but somewhat interdependent attitude patterns: (1) attitudes toward the building of Europe *qua* Europe, and (2) attitudes toward a

Table 9.1

Economic Community with Eastern Europe, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
	(35)[a]	(19)	(20)	(7)	(25)	(13)	(17)	(19)	(25)	(35)	(39)
Yes	43%	53%	70%	29%	72%	69%	88%	79%	48%	57%	41%
No	37	26	20	57	24	31	6	21	32	26	49
DK	20	20	10	14	4	0	6	0	20	17	10

[a] These "n"s are identical for the remaining tables in this chapter and will not be repeated.

rapprochement between East and West. Earlier, in exploring issues concerned with European integration, this response was taken as an indication of a strong desire on the part of the scientists not to exclude the Eastern portion of the continent from integrative arrangements--evincing consciousness of a peculiarly "European" entity. Here it is taken as indicative not only of a desire to see the "Iron Curtain" breeched, but of at least a mild, long-term expectation that something as concrete as an economic (and by implication a political) community may eventually emerge.

Variations in the response are not entirely easy to account for in terms of other response patterns.[1] In part, of course, they reflect

[1] It is noteworthy that the percentage in favor of including Eastern Europe among respondents identifying themselves as leftist (66%) is not far different from that among respondents identifying themselves as rightist (53%).

approval or disapproval of the whole idea of European supranationalism, so some deviance may be explained on these grounds. The low level of approval among the Italians at ESTEC and ISPRA and the French at ESTEC might be based in part on their desire to see tighter integration of the Six precede expansion. (See Chapter VIII, particularly Table 8.3.) The relatively high level of German approval may have been due in part to the overall strong German response toward large-scale supranationalism in Europe, and in part to the fact that such a community with Eastern Europe would have special advantages for Germany in terms of its reunification ambitions.[2] CERN showed the most receptiveness to the Eastern European community and it is not illogical to assume that this is in some way associated with the broad openness which the organization (and the Western high energy physics community) has shown toward participation by Eastern European physicists.

In any case, these are limited variations within a frame of consensual approval of greater cooperation with the East. The whole notion of détente between East and West is so widely taken for granted within the scientific communities of the various Western European countries that we felt it would be superfluous to ask respondents if they favored the

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[2] Our finding is consistent with that of Karl Deutsch, et al., France, Germany and the Western Alliance (New York: Charles Scribner's Sons, 1967), which suggests that German intellectuals, in contrast with other German elite segments, are strongly in favor of accommodation with the East (pp. 170-171).

concept.[3] The survey found no evidence to contradict this assumption. The question which was asked on this topic dealt with expectations of détente rather than preferences and was phrased in the following manner: "Do you feel that the détente which has been developing in recent years between the West and the European Communist countries is part of a lasting trend?" The response was an overwhelming affirmation (75% yes, 8% no, 17% DK) and comments such as "I hope so" followed nearly every positive interview reply. Table 9.2 shows that the unanimity of this among the most widespread of those with which we have dealt.

Table 9.2

Expectation of Détente, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Yes	74%	84%	70%	100%	80%	77%	65%	74%	80%	66%	64%
No	14	0	5	0	12	0	6	5	0	11	15
DK	12	16	25	0	8	23	29	21	20	23	20

Expectations that the détente is part of a lasting trend range from 64% to 100%, and in those groups where optimism is weakest, it is replaced not by pessimism but rather by uncertainty. About one quarter of the respondents (if one may extrapolate motives from the interviews to the

[3] Deutsch et al., make it clear that this is not the case in his broader German elite sample (Ibid., and p. 153), but note that there is "widespread sympathy" for greater contact with Eastern Europe among French elites (p. 66).

entire sample) were simply unwilling to state categorically that their hopes would be fulfilled in the foreseeable future; most chose to say that they didn't know, while a few expressed the equivalent of "no, there are too many fluctuations in East-West relations to be able to project any lasting trends."

The expectation of _détente_ transcends the division of the sample into laboratory/nationality groups. Furthermore, inspection reveals no consistent relation between the response patterns of these groups on the question at hand and on the question of an economic community including the East. Two points should be noted, however, with respect to the _détente_ question. First, it appears that the scientists are not deeply involved in this issue, at least in comparison to the issue of European integration. In the interview situation, the question on _détente_ provoked mainly general or platitudinous responses with few indications of high information level.[4] Second, although expectations of _détente_ reflect a definitely optimistic frame of mind with respect to European or even U.S.-Soviet relations, for at least some of the respondents this evaluation was based on a fear of a growing threat from a common enemy--China. Thus, one must be careful not to project such optimism beyond the immediate stage within which it was expressed.

[4] This, of course, might be attributed as well to the way in which the question was posed.

B. Supranational Military Forces

The atmosphere of détente, even qualified by some vague apprehension over the future role of China in the international power balance, is consistent with a general impression of other elite and public opinion studies which indicate that Europe does not feel militarily threatened. Such feelings go back at least as far as the mid-1950's, as Lerner and Gorden found:

> Consistently, throughout the decade, the fear that the Soviet challenge was primarily military was discounted in favor of a predominantly political evaluation. Thus, while the challenge was perceived throughout the decade . . . it was never evaluated primarily in military terms by any panel.[5]

The absence of a direct military threat, coexistent with a strong alliance involving the nuclear capability of the United States (to counter unanticipated military pressures), makes the military component of European integration a relatively low priority subject. In discussions of European integration, in fact, the military aspect did not arise spontaneously in a single interview. It was evidently not highly salient either as a motivating force for integration or as an outcome of it. In this respect, the scientists do not differ from the vast majority of other European elites whose vision of European integration Deutsch characterizes as "primarily nonmilitary in purpose."[6] This is not to say that European

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[5] Daniel Lerner and Morton Gorden, Euratlantica: Changing Perspectives of the European Elites (Cambridge: M.I.T. Press, 1969 in press), pp. IV-3, 4.

[6] Deutsch et al., Western Alliance, p. 285.

military integration was not discussed at all in the interviews. Rather, the whole concept of integrating national armed forces into supranational forces had to be raised independently, and in this context, Europe was posed as one of a range of options.

Attitudes toward the general concept--"Would you approve the integration of a major part of your own country's armed forces into a permanent supranational force?"--were ascertained first. Then a choice of auspices was proffered: European, NATO, and United Nations. Although--and one risks sounding a trifle repetitious--a broad consensus dominated the responses to the first part of the question, one clear national difference, consistent across laboratory lines, is evident and more differences crop up in the second (auspices) part of the question. Overall, some 78% of the respondents approved the abstract concept of integration of their nation's armed forces into some supranational structure. Only 11% opposed integration and an additional 11% gave no opinion. Table 9.3 (see following page) presents the laboratory/nationality distribution of this question as well as the distribution of the subsequent question on auspices.

The clarity and significance of the national divergence on the first part of this problem is beyond question. The French respondents, in sharp contrast to respondents of all other nationalities (including those smaller ones not shown), show a level of support just barely over a majority. French disapproval is double that of the sample as a whole, while the French DK is also well above all other groups. Further, the response is consistent across the three major laboratories. While it is of course important that the majority of French scientists go along with

Table 9.3

Approval and Auspices of Supranational Force, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Approval											
Yes	80%	53%	85%	100%	84%	54%	100%	84%	60%	97%	77%
No	11	21	10	0	12	23	0	11	24	3	8
DK	9	26	5	0	4	23	0	5	16	0	15
Auspices, if such a force were created											
European	26%	53%	45%	43%	12%	54%	41%	37%	56%	60%	51%
NATO	17	0	20	29	16	0	18	0	0	14	10
UN	37	0	15	29	64	8	18	26	8	20	15
Other, DK	20	47	20	0	8	38	24	37	36	6	23

majorities of scientists of other nationalities, it might be instructive to attempt an interpretation of the reasons behind the weakness of their approval.

Such an interpretation comes directly out of examination of the second half of the question. The three options proposed represent widely differing notions. An integrated NATO force is an entirely different type of animal than a European force, while an integrated United Nations force is even more different from these two than they are from each other. In virtually all cases except the French, however, approval for all three types of supranational auspices is evident. Only among the French, is approval very tightly drawn: if a French scientist approved of a supranational force, he had in mind specifically a European force. It is proposed that two main sorts of attitudes governed the responses to this question, and although they are not mutually exclusive, one or the other tended to show up in a given respondent. On one hand there is the anti-military attitude. For many respondents who held this posture, the particular auspices of integration are not as important as the primary aim of eliminating national armies. Responses such as the following, from an Italian scientist at ISPRA, typify the attitude:

> A: Yes, I would approve [of military integration]. The idea is to eliminate them, so I have no difficulty in approving it.
>
> Q: Under which auspices would you prefer to see it: European, NATO, or United Nations?
>
> A: It's important only that we have an international organization. It is not important which is the organization, only that it is really international.

On the other hand, there is the attitude which views favorably an integrated military force within the structure of a United Europe. Importantly, many respondents mentioned that they would prefer to see the formation of such a force <u>follow</u> the political unification of Europe rather than <u>precede</u> it, since, in the words of one Briton, "sufficiently strong political leadership must come first." In this attitude, the supranational force is merely one somewhat secondary aspect of an integrated Europe.

The two attitudes (and/or their admixture since, we repeat, they are not mutually exclusive) were present in all of the laboratory/nationality groups in our sample. Among the French, however, the anti-military response apparently manifested itself in a rejection of the supranational force concept rather than in approval without strong specification of auspices. Consider, for instance, the response of a CERN French scientist:

> What I am for is the suppression of all military forces, so I don't think this is any good. I would rather suppress all of them, rather than try to make a supranational one.

A characteristic French trait of rejecting questions of too unspecified a nature,[7] combined with a lower French evaluation of the United Nations and NATO as effective international organizations, produced this response pattern. Where the European attitude was dominant, approval of the supranational force with specifically European auspices resulted. (Note among the French the parallel percentages of "yes" in the top half of the table and "European auspices" in the bottom half. Cross-tabulation shows these to be mainly the same individuals.)

Among Germans and Italians at the three laboratories, the European response was more or less of the same magnitude as that of the French, and it consistently led all other choices. Here again is the emphasis on European integration. NATO, the United Nations, and "DK" did draw a certain percentage of those who approved the supranational force concept, and at least the last two of these may be attributed to the effect of the anti-military attitude. Among the British, the United Nations was the number one choice at both CERN and ESTEC and this rather surprising finding is indicative first of the continuing high regard of British intellectuals for this institution, and second of the relative weakness of the European attitude, and hence its domination by the anti-military view. In general, the poor showing of NATO (over the entire sample it drew only 10% of the responses, compared to 25% for the United Nations

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[7] Daniel Lerner, "Interviewing Frenchmen," American Journal of Sociology, LXII, 2 (September 1956), pp. 187-194.

and 44% for Europe) seems to be the result of the fact that little place was left for it between the European and anti-military attitudes. The Atlantic defense scenario was, however, mentioned in a number of write-in comments which suggested joint participation of an American and an integrated European force within the NATO structure.

The qualitative impression which one received from listening to the interviewees as well as from later examination of the typescripts suggests that the scientists' views on the subject of a supranational military force were not nearly as highly-developed as their views on European integration. More vagueness and generality in phrasing, in addition to longer pauses, were taken as indications that the subjects had not thought about these questions in great detail. Further there was a seemingly lesser willingness to get involved in this area of discussion. As few real proposals for an integrated European force (outside of a political union) had arisen since the defeat of EDC in 1954, and as most Europeans never seemed to develop real enthusiasm for the MLF-ANF concept, the lack of saliency of this question may come as no great shock. The lack of real motivation for developing large armed forces--we recall the absence of a sense of military threat mentioned earlier--and the anti-military bent of many scientists no doubt also contributed heavily. It was more than an isolated interviewee who, when asked if he approved integration of his country's army into a supranational force, retorted at first, "For what? To fight against whom?"

C. Nuclear Weapons

1. National Forces

The final matters considered under the rubric "East-West Relations and Security" relate to the complex problem of nuclear weapons. Here, more than in any other area among our questions, the domestic situations of the various nationalities in the sample diverge. Britain, first of all, has been privy to American nuclear technology since 1954 (after it developed its own weapons) and is thus a charter member of the "nuclear club." For various economic and political reasons, however, development of the British deterrent force was virtually halted in the early 1960's and it is no longer regarded by most British as a high-ranking national priority. France, on the other hand, is a relative newcomer to the "club" and its small but independently developed *force de frappe* was, in mid-1967, central to the Gaullist vision of France. While still a controversial issue in France, the *force de frappe* is a very definite fact of European life. The German position with regard to nuclear weapons is based above all on independent renunciation of any intention to build or procure a national nuclear force. In particular, the attitude of the Soviet Union toward German possession of atomic weapons as well as the American guarantee of protection have been important in maintaining the German position. While there have been some German objections to aspects of the Non-Proliferation Treaty, no German government has ever taken a position advocating independent possession of nuclear weapons. Italy, finally, while it is one of the nations with a technological potential for constructing nuclear weapons, has never shown any serious inclination toward such a policy, and, given its relatively low level of military expenditure, is not likely to do so in the foreseeable future.

In light of this range of national positions, wide variations in response among scientists of these nationalities should be expected on questions dealing with national nuclear policy. In fact, the question "As a matter of general policy, would you be in favor of possession of thermonuclear weapons by your own country?" was the only one in the entire questionnaire which drew a strong reversal across nationalities. While the French and British scientists were split around the 50% mark, with a majority (54%) and a plurality (46%) respectively in favor, the Germans and Italians showed overwhelming majorities against nuclear weapons with only a very few (8%, 13%) in favor. (None of the other nationalities--Beneluxers, Austrians, Swiss, or Scandinavians--showed more than a minute percentage in favor.) Table 9.4 presents the distribution of this response by laboratory and nationality.

Table 9.4

Approval of Nuclear Weapons for Own Country, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Yes	57%	58%	5%	0%	40%	38%	6%	11%	52%	6%	13%
No	29	26	80	100	52	62	88	79	44	94	74
DK	14	16	15	0	8	0	6	11	4	0	13

The national situations--controversiality in Britain and France and strong disapproval in Germany and Italy--are echoed in the response patterns across all of the laboratories. It is noteworthy that opposition to the national nuclear forces among the British and the French is stronger at CERN than at ESTEC and ISPRA. Although all three of the laboratories are concerned exclusively with non-military, peaceful research, the proportions of British and French scientists and engineers who have been involved in military and atomic energy research is higher at ESTEC and ISPRA than at CERN. CERN, we recall, has the highest proportion of academically-based respondents, and the political culture of academia with respect to nuclear weapons has likely been carried over to that center. In any case, there clearly _is not_ consensus among the British and French scientists with respect to their countries' nuclear policies, and there clearly _is_ consensus among the Germans and Italians with respect to theirs.

There is a certain amount of emotional opposition to nuclear weapons among scientists at all the laboratories, and many of the British and French who did favor nuclear possession by their own country said that they did so reluctantly or noted (particularly the French) that they had not favored the initial decision to build a nuclear force, but now that the government had spent the money there was no sense in simply throwing away the results. Overall, however, the commonly held view of strong scientific opposition to nuclear weapons was not substantiated by this data.[8]

[8] This finding differs from the one reported in Daniel Lerner and Albert H. Teich, "International Scientists Face World Politics: A Survey at CERN" (M.I.T. Center for International Studies Document No. C/68-2, January 1968), p. 34, where strong British sentiment for unilateral disarmament was found and the difference is probably accounted for in terms of the larger proportion of non-academic types in the present sample.

It is suspected that this view pertains more to academic scientists than to others. Although acceptance of national nuclear policy by scientists of those nations which already possess nuclear weapons was far from universal, and weakest in the most basic research-oriented institution (CERN), there was substantial support for national weapons.

2. <u>A European Force</u>

With regard to possession of nuclear weapons by "Europe" rather than any single European nation, the picture is quite different. Proportions favoring possession among the British and French contingents in all laboratories are reinforced, the Germans do a complete about-face and show heavy majorities in favor, and the Italians also follow suit, although not as strongly. Table 9.5 shows the distribution for this

Table 9.5

Approval of Nuclear Weapons for Europe, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Yes	60%	58%	75%	43%	52%	62%	53%	37%	60%	71%	49%
No	29	11	10	57	40	38	24	47	16	17	31
DK	12	32	15	0	8	0	24	16	24	11	20

question, which read literally, "Would you favor possession of such weapons by a future European military force?"

It is apparent that while healthy minorities of three nationalities at CERN, and even small majorities in the Italian groups at ESTEC and CERN still oppose nuclear weapons, much of the opposition to national nuclear weapons does not carry over to a European force. We may take this as an indication that for many of the scientists opposition to national weapons is based not only on moral grounds but also on grounds of scale, cost, and utility--all of which make national possession a less attractive proposition for individual European states.

Although there is a recognition that possession of nuclear weapons would be inevitable and probably necessary in a unified Europe, the scientists' approval of the concept tends to lack enthusiasm. There is a feeling that an integrated Europe would probably act more responsibly than any single nation in handling such a force, and that its possession is part of regaining the status of "a leading continent." A few quotations from the interviews might suggest the tone of this response:

> Well, I told you I am very reluctant to consider these questions. Basically I would say nuclear weapons as such are very undesirable. As there are certain nations who have nuclear weapons in their possession, however, we have just to face the fact and in this respect I think that if we have a European political community and a European force, this force would have to be equipped with nuclear weapons because otherwise . . . well, the politicians wouldn't be in a position to argue with other politicians who have nuclear weapons.
>
> --German ESTEC scientist

> If there was really a European force, as I was telling you previously, an army is meaningful only if it is powerful at an international level and as for being powerful at an international level, well, you need nuclear weapons.
>
> --Italian engineer at CERN

> I would like to see all nuclear weapons destroyed. In the event they are not, and there should be nuclear weapons, I think that a European force should have them--but not any individual country.
>
> --French engineer at ISPRA

This is another aspect of the independent role for Europe which was first discussed in Chapter VIII. Reluctant acceptance of nuclear weaponry is a price which must be paid for genuine independence.

3. Non-Proliferation

There is a school of strategic thought among diplomats and strategists in the United States and a number of Western European nations which holds that since two of the major European nations already have nuclear weapons, possession of nuclear weapons by a future integrated European force would not contradict the letter or the spirit of non-proliferation. This school appears to be adhered to, consciously or unconsciously, by a large number of the scientists in our sample. As we have seen, a majority (54% overall) of the scientists favor nuclear possession by an integrated European force, while only a minority directly reject it (31%). Simultaneously, an overwhelming majority--86% versus 4% against--approve the notion of non-proliferation. The question--"Do you think that the present nuclear powers should try to limit the further spread of nuclear arms in the world?" drew an almost unanimous verdict across the various laboratory/nationality groups, as may be seen in Table 9.6.

Table 9.6

Approval of Non-Proliferation Concept, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Yes	94%	58%	85%	100%	92%	85%	88%	89%	68%	100%	79%
No	0	16	0	0	8	0	6	0	16	0	5
DK	6	27	15	0	0	15	6	11	16	0	15

The strongest dissent came from the French, and rather than direct opposition, the response was more often DK. France is, of course, the one nation among the four which has indicated that it will not sign the recently concluded Non-Proliferation Treaty, and the disapproval of the French scientists toward the concept tended to be phrased in terms similar to the government line, namely that non-proliferation alone was meaningless, that it aimed at perpetuating the position of the two superpowers, and that real reduction of tensions should involve at least some sacrifices by the United States and the Soviet Union. This position was more often expressed at ESTEC and ISPRA than at CERN, probably for reasons similar to those discussed with respect to national nuclear policy. Comments of the same nature as those voiced by the French were also given (and annotated on the questionnaires) by scientists of other nationalities. In these cases, however, objections were overriden by feelings that some progress toward disarmament was better than none.

Generally, questions concerning nuclear weapons were treated more articulately and in greater depth than other aspects of East-West relations and military security. The scientists, in all laboratories and across all the nationalities, seemed to have devoted more thought to such matters and had better structured ideas about them. Nevertheless, the interviewer could often sense a certain coldness which developed when this area was brought up. The respondents seemed almost relieved when the interviewer went on to the next subject area. If there is an area of political and international life which the scientists would prefer not to think about, this is evidently it.

* * *

This chapter has been a rather brief discussion of several aspects of the scientists' views on East-West relations and military security. It is evident that the broad transnational consensus developed in the previous chapter which dominates attitudes toward European integration does not extend into all other areas of policy. Facts of life, based on varying national situations, dictate differing orientations on primarily domestic matters such as possession of national nuclear weapons. Chapter X, which concludes Part Three of the dissertation, brings together a number of diverse issues where this same pattern--consensus on European as well as more international issues, punctuated by diversity on certain types of domestic issues--is further developed.

CHAPTER X

ISSUES: INTERNATIONALISM AND TECHNOLOGY

This chapter draws together two somewhat disparate sub-topics in concluding the discussion of scientists' political attitudes. First, having built up a case for a regional orientation among the respondents, it is now necessary to place this orientation in perspective. The general conception of the scientific viewpoint incorporates an internationalism of much broader dimensions than has been documented thus far. Such idealistic yet important notions of world-wide community as one often hears from eminent academic scientists (for example in the celebrated manuscript of the Russian physicist A. D. Sakharov[1]) have not yet been seen in the images of our respondents' political thought. The first portion of this chapter attempts to evaluate the extent to which this wider internationalism exists among the scientists in the European international laboratories. Further, it examines the ways in which wider internationalism might interact with European regionalism.

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[1] First published in this country in the New York Times, July 22, 1968.

The second half of the chapter assumes a much more limited task. It aims to explore the thinking of these scientists on several issues which intermingle technological and political content. To what extent are the scientists particularly interested in such matters and what special viewpoints are they able to bring with them? Three such politico-technological issues which the European press has given substantial coverage were selected for exploration: the "technological gap," the "brain drain," and the "space race." Varying national and professional emphases on these issues are treated.

A. Internationalism and Regionalism

A preference for supranational European forms over individual nation-states is evident beyond question in the data which has already been reported. In their strong consensual approval of transnational activities in the economic, political, and military domains, the respondents testified to their recognition of the growing interdependence of the various Western European countries.[2] Aware, however, of nationalist trends, even at the subnational level (as visible during 1967 in Brittany, Wales, Scotland, and Flemish-speaking Belgium, for example) and desirous

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[2] An item on the questionnaire which asked directly if the respondent thought that the "nation-state is becoming obsolete" appeared to suffer from a high degree of ambiguity. The scientists interpreted it variously as normative and evaluative, and responses ranged accordingly. Misuse of the terms "nation-state" and "obsolete" compounded difficulties, and so, while 58% of those asked responded positively against 27% negatively, this question has been omitted from our analysis.

of preserving the unique character of Europe which is based on the cultural individuality of its parts, they envision a federated formation for the region, maintaining common policies toward external affairs, developing the economies of economic and technological scale, and yet retaining considerable local autonomy.

In opting for transnational solutions to the major political and social problems of the age, the scientists do not differ qualitatively from other influential classes in European society. To quote once again from the conclusions of Lerner and Gorden's elite panel survey:

> Indeed, there has been a convergent consensus in Europe, over the last decade, that national options are not viable and that transnational choices are the only realistic alternatives. We have witnessed the passing of nationalism in the form which was familiar to previous generations and even to the early years of the generations now in charge.[3]

It is not any wild idealism that has shaped this consensus; it is merely pragmatism--a realistic appraisal of the desirable and the possible. The scientists differ from the non-scientific elites mainly in the intensity of their desire for closer integration, and the breadth of their consensus on the shape of Europe, which transcends, for the most part, differences in national viewpoint. A "Europeanist," that is, regionalist, outlook permeates their political thought.

We have already seen, however, that with regard to supranational military integration at least, a certain degree of interest in the United Nations (and hence extra-European internationalism) exists. Indeed it

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[3] Daniel Lerner and Morton Gorden, Euratlantica: Changing Perspectives of the European Elites (Cambridge: M.I.T. Press, 1969 in press), p. X-1.

was among the British--that nationaity whose attachment to the visions of European integration was relatively weaker than the others--that interest in the United Nations was strongest. One is tempted to inquire, on the basis of this finding, about the degree to which European regionalism and wider internationalism represent conflicting loyalties, or at least competing scopes of interest. Two questions dealing with extension of the United Nations into a world government were asked of the respondents, and analysis of their numerical tabulation enriched by consideration of the oral interview responses provides some insights into this matter.

The first question demanded an evaluation of the prospects for international organization on a world-wide scale. Unwittingly, however, it related the general problem to the fate of a particular body--the United Nations--whose fortunes were at a relatively low ebb at the time of the survey. The question read: "Do you think that the United Nations can be transformed eventually into a world government?" Expectations were not very strong. Less than one fourth of the total number of respondents (24%) thought that it could. Fourteen percent rendered no judgement, while almost two-thirds responded negatively. Part of this pessimism reflected a low evaluation of the United Nations as a viable organization rather than skepticism of the world government idea. A large number of write-in comments (35) to this effect testified to the strength of this feeling.

On the other hand, despite their low expectation, the willingness of the scientists to approve such a world union was high. Responding to the question "In principle, would you favor your own national government giving up a certain amount of its sovereignty to participate in some form of world government?" nearly three-quarters (74%) of the scientists said yes, while only 15% opposed the idea.

Table 10.1 presents the laboratory/nationality distributions of

Table 10.1

Expectation and Approval of World Government, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
	(35)[a]	(19)	(20)	(7)	(25)	(13)	(17)	(19)	(25)	(35)	(39)
Expect world government:											
Yes	51%	16%	10%	43%	40%	54%	18%	26%	20%	9%	10%
No	43	53	75	29	40	31	65	58	76	77	69
DK	6	32	15	29	20	15	18	16	4	14	20
Approve surrender of sovereignty to world government:											
Yes	83%	42%	55%	100%	76%	100%	82%	79%	68%	63%	82%
No	9	37	35	0	20	0	6	11	16	17	8
DK	9	21	10	0	4	0	12	11	16	20	10

[a] These "n"s are identical for the remaining tables in this chapter (except 10.3) and will not be repeated.

both of these questions. The greatest optimism about world government comes from the British and Italians at ESTEC and the British and French at CERN. These groups show 40% to 50% believing that the United Nations will eventually be transformed into a world government. Elsewhere, expectations are much lower, generally ranging from 10% to 20%. Responses to the notion of surrender of sovereignty to a potential world government are more consistent, with at least a plurality and usually a strong majority in favor. The weakest approval is found among the French and Germans at ESTEC.

Since, outside of these two ESTEC groups, approval is quite strong, the distribution of the cross-tabulation of these two questions is easily predictable. (See Table 10.2.) Most laboratory/nationality groups are divided between those respondents who would favor a world government but don't expect to see one, and those who would favor it and do expect it. Differences between laboratory/nationality groups tell us little: The British, as usual displaying greater confidence in the United Nations than most other nationalities, are relatively more optimistic. The optimism of the CERN French does not seem to relate to any other attitudes on their part. More important is the finding that of those who would not approve the surrender of sovereignty to a world government (primarily French and Germans at ESTEC), virtually none feel that it is a realistic possibility. These respondents seem to be saying,

Table 10.2

Approval and Expectation of World Government, by Laboratory and Nationality

	ESTEC				CERN				ISPRA		
	Br	Fr	Ge	It	Br	Fr	Ge	It	Fr	Ge	It
Favor, expect	49%	16%	10%	43%	36%	54%	18%	26%	20%	6%	10%
Favor, don't expect	34	27	45	58	40	46	65	53	48	57	72
Oppose, expect	3	0	0	0	4	0	0	0	0	0	0
Oppose, don't expect	6	37	35	0	16	0	6	11	16	17	8

in effect, that they would rather concern themselves with more concrete matters.

One must bear in mind, of course, the fact that these two questions measure only a very limited aspect of what has been called here "wider internationalism." Even an incomplete understanding of this concept of "internationalism" would require a much broader range of questioning than has been employed in the present study. Rather than attempting to make measurements of this nature, we have chosen to deal with the elements of receptiveness to and expectation of a political community roughly analogous to a European community but on a world-wide scale. Approval of such a community evidently implies formal surrender of a major part of the power of national self-determination to a body in which the majority of nations do not share either the culture, the values, or the historical traditions of Europe. This, one might argue, is as good a heuristic indication of internationalism as any. The general willingness of the respondents to see their nations surrender sovereignty to such a hypothetical community is a profound statement indeed. Despite the fact that we have no other elite (non-scientist) data with which to compare these responses, we cannot help but be impressed by the strong vote of confidence given the notion of world-wide political community by these scientists. The impressiveness of this response is qualified only by the fact that such a world government is so obviously an ideal under present conditions, that constraints of reality, which might otherwise shape response patterns into more conventionally nationalistic forms, are relaxed, and internationalism might be relatively easier to express at this level of abstraction than on more mundane issues.

In any case, it is necessary to ask what, if any, relation do these patterns have to the patterns of approval and expectation with regard to European integration? First of all, for most respondents there appears to be little interaction between receptiveness to European unification and approval of world government. Among those respondents who approve either union of the Six or a larger type of European political integration or both, 75% would approve surrender of sovereignty to a world government. Among those who oppose any type of political union in Europe, the proportion favoring world government was nearly the same (68%). This is one very good indication that European regionalism and world-wide internationalism do not conflict in the minds of the respondents. Further, it suggests that most of the small minority of respondents who did not display strong regionalist sentiment were nevertheless not narrowly nationalist in their outlooks. The absence of interaction was found within the ESTEC British (where the greatest number of non-Europeanists came from) to the same degree as in the sample as a whole. Examination of other questions concerning acceptance of European integration yields parallel results.

On the other hand, expectations of European integration--not of the Six, but of "Big Europe"--do seem to be linked with expectations of world government. Table 10.3 (see following page), from which those respondents who were not asked about larger European integration have been eliminated, shows the cross-tabulation of the two questions (in raw numbers, not percentages).

The hope that the United Nations might someday be transformed into a world government is much stronger among those who believe a wider

Table 10.3

Expectation of Wider European Union
by Expectation of World Government

		Expect World Government		
		Yes	No	DK
Expect European Union	Yes	33	55	8
	No	26	125	20
	DK	8	14	18

European union is feasible (33 out of 96) than among those who do not (26 out of 171). This linkage appears as well within those laboratory/nationality groups which are most skeptical of world government. Otherwise, within and across these groups, no evident differences (such as by seniority, professional level, etc.) appear between those who seem optimistic with regard to the likelihood of world government, and those who do not.

Once again, though, the division is perhaps not as deep as the tabulations make it seem. None of the respondents (judging from interview responses and comments) envisioned a world government with anywhere near the same degree of concreteness as a united Europe, while at the other extreme only a few regarded it as pure wishful thinking, without any possible basis in reality. Most respondents viewed it as a distant goal--something for which to hope, but not expect to see very soon. Thus, while the scientists who were most optimistic about wider European union were also most optimistic about world government, there was no competition in preferences--no need to choose between Europe and the world. Further, there was no evidence to indicate that growing enthusiasm for European integration might affect a scientist's judgements on possibilities for wider unity.

While a very few respondents mentioned that they thought European integration might have detrimental effects on the Third World--if the European countries did not take steps to assure free trade with the developing nations--most saw no conflict between the building of Europe and the development of greater world unity. The most common view expressed in the interviews, in fact, reflected the idea that an integrated European state, rather than the individual European countries, could in some remote future become part of a broader world federation. Thus, the question asking whether the respondent would agree to his country giving up some of its sovereignty to participate in a world government was often answered in the following manner:

> As I said to you, I am already for giving up German sovereignty for a European government. Now if this process could be continued, I certainly would like to have finally a united world and everyone a citizen of this . . . it would really be the ideal. But I do not believe it will happen very soon.
>
> --ISPRA German scientist

> Well, I wouldn't put it like that. I would say that by the time we get to a world government, you're not talking about a British authority or a French authority, you're talking about a European government. And it's the European government that would be giving up some of its sovereignty to a world authority.
>
> --ESTEC British engineer

> This is, I think, the logical development of uniting Europe politically . . . It's just an analogy between the single countries first, then regions, then finally the logical consequence is a political world government.
>
> --ESTEC German scientist

Regionalism is recognized as the more realistic prospect, but not at the expense of broader internationalism.

The same sort of reasoning which led respondents to the conclusion that integration of the European states is a necessity was extended to a world-wide scope. In the words of one Dutch EURATOM scientist: "I don't believe in a real independence of countries; I think this is impossible." Nevertheless, the problems confronting broader unification are formidable indeed, and respondents' ideas of such unification were necessarily quite vague. This same Dutch EURATOM scientist provides a typical example:

> I can imagine that a world government could exist. I don't know exactly how it would be made and how it would be controlled. At the moment we think that democracy is the best way of government, but if this is also possible with the entire population of the world I don't know. Personally, I hope we will find some way to do it.

Of all the subject areas on the political portion of the questionnaire, this one seemed to evoke the least emotional involvement. The international scientists, without losing the basic idealism of the scientific approach, are too sophisticated to place much stock in this notion. The words of an ESTEC Briton provide an appropriate summary of our discussion:

> I would certainly favor a world government, but I think to work for a united Europe is a far more promising prospect at the moment. That's the only place I would put any real effort into now.

B. Politics and Technology

In concluding this set of four chapters devoted to the political attitudes of international scientists, it is necessary to descend from the somewhat ethereal realm of world federation to a number of more mundane political problems. Under the heading "Politics and Technology," we discuss three glibly-labeled issues which have in common a heavy technological component: the "technological gap," the "brain drain," and the "space race." While the response patterns which these questions produced are not strictly related to the various political issues discussed previously, they nevertheless provide illuminating examples of how scientists think on such politico-technological problems.

1. The "Technological Gap"

The long smoldering problem of differences in the level of technological development between the United States and Western Europe became the subject of heated political debate during 1966.[4] At that time Italian Foreign Minister Fanfani received widespread publicity for his statements on the gap and discussion arose within such political organs as the NATO Council of Ministers, the OECD, the Western European Union, and the EEC, as well as in the American and European press.[5] Underlying this debate are the growing recognition of science and technology as indices of national power, and the continuing American dominance (easily

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[4] See the discussion in Chapter I. The interested reader is also referred to A. Kramish, "Technology: Europe's Enigmatic Gap," The World Today, XXIII, 10 (October 1967), pp. 423-433; Achille Albonetti, "The Technological Gap: Proposals and Documents," Lo Spettatore Internazionale (English edition), II, 2/3 (March-April 1967); Jean-Jacques Servan-Schreiber, The American Challenge (New York: Atheneum, 1968); and for statistical documentation, OECD, Gaps in Technology Between Member Countries (Paris, 1968).

[5] See Albonetti, "Technological Gap," p. 1.

extrapolated into the future) in a number of frontier "glamour" areas such as computers, space exploration, and microelectronics. As increased technological collaboration appears to be one of the best and most obvious European hopes for resolving the gap, the international organizations in this study represent particularly interesting locales in which to sample scientific opinion on the problem.

In the discussion of motivating forces behind the respondents' Europeanist attitudes in Chapter VIII, it was observed that a significant proportion of the scientists spontaneously raised the idea of European integration in discussions of the technological gap. Our treatment of the gap was broader than reported in that context. Since it does mix political and technological factors, the gap was used as the first question in the political section of the questionnaries (and interview format), creating, as it were, a bridge between a discussion of the respondent's professional interests and his political opinions. The question was asked in two parts--"Do you think that the 'technological gap' currently being discussed in the press is a serious problem for Europe?" and "If yes, what sort of action do you think would be required to solve it?"

A broadly-based consensus of three-fourths of the sample (75%) agreed that the gap was a serious problem. (The remainder of the sample was distributed between "no," 20%, and "DK" 5%.) More British respondents (at all laboratories) than others tended to downgrade the seriousness of the problem. While France, Germany, and Italy all showed about 85% in the "yes" column, Britain dipped to 62%. There was not a great deal of variation by laboratory, although CERN (even excluding the British) was slightly less certain of the seriousness of the gap than either of the other major centers.

Despite the relatively high level of agreement among the scientists, there is some evidence to suggest that this question, which was asked with specific reference to Europe, was more narrowly interpreted than many others. In this regard, it is reasonable to suppose that since the issue of the technological gap is more closely related to the respondents' own experience than many of the other political questions, they tended to deal with it on a somewhat lower level of abstraction--that is, in terms of personal impressions rather than more remote opinions. Such a hypothesis would explain the lower level of concern with the gap at CERN--a laboratory quite conscious of its equality with American high energy physics establishments--and among the British--in whose country the gap has not been dramatized as much as on the continent. It is consistent with the qualitative finding that many respondents prefaced their answers about the gap with such qualifying phrases as "I can only (or best) speak about my own field . . ." It is also consistent with the pattern of responses which appeared on the second half of the question, which requested solutions to the gap.

The discussion in Chapter VIII emphasized the tendency to opt for European integration as a solution for the gap. The question was open-ended, so this finding, which is based on an empirically-derived classification of expressed responses, is particularly impressive. More than 40% of the 240 specific proposals put forth by the respondents were directed at increased cooperation and integration.[6] The range of ideas expressed, however, included, besides European integration, "change government policy towards science and technology"(22%), "provide more money for research" (18%), and "modernize management attitudes" (9%).

The European integration response was uniformly strong across the various nationalities (35-45%). Other responses, however, showed some marked differences which seemed to correspond roughly to national situations. Significant concentrations included: French in the "modernize management attitudes" category (15%), Germans in "provide more money for research" (26%), and Italians in "change government policy towards science and technology" (35%). Whether based in folklore or fact these responses probably reflect some basic gripes which French, German, and Italian scientists have directed against their respective nations for some time. This is a fairly rare example in the survey of a parochial interpretation of a question asked about Europe as a whole.

One might observe that the various categories of solutions to the gap appear neither terribly original nor terribly profound. In fact, while the necessity to reduce responses to the lowest common denominator did a certain amount of injustice to individual expression, the responses were neither very original nor very profound. The issue is primarily a political one and outside of its consideration within the context of "regaining Europe's place as a leading continent," and its use as a

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[6] It should be noted, parenthetically, that fewer than one-fifth of these integrative proposals suggested the establishment of more international scientific organizations such as the ones in which the respondents were employed.

figurative club with which to contend for more money and more favorable working conditions, most of the scientists are not deeply involved in the arguments over the gap and have no special knowledge relating to it or its solution.

2. The "Brain Drain"

Closely related to the technological gap--seen by some as effect and by some as contributing cause--is the phenomenon alliteratively dubbed by some unknown British journalist as the "brain drain."[7] (It is known to the French in a literal but picturesque translation as "l'hémorragie de matière grise.") This phenomenon consists in the international (or even intra-national) migration of scientists and engineers in search of better professional opportunities, better working conditions or pay, and/or greater societal recognition. It is known as a "drain" because of the asymmetry of flow direction, primarily out of large areas into a limited number of scientific centers. There is nothing new about this sort of migration of scholars and other highly-skilled individuals--documentation on it goes back hundreds of years.[8] It is, in fact, recognized that governments have had policies concerned with regulating this flow of

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[7] References on this subject include, for example, James A. Wilson, "The Emigration of British Scientists," Minerva, V, 1 (Autumn 1966), pp. 20-29; "L'emigration des scientifiques et des ingenieurs vers les Etats-Unis," Le progrès scientifique, No. 93 (February 1966), pp. 38-53; and Walter Adams (ed.), The Brain Drain (New York: Macmillan, 1968).

[8] See Steven Dedijer, "'Early' Migration," in Adams (ed.), The Brain Drain, pp. 9-28.

talent as far back in history as the period of Ancient Greece.[9] Nevertheless, contemporary emphasis on the ties between technology and the development of national power (economic and military-political) have made the brain drain a controversial political issue. Although the drain afflicts developing nations probably to a greater extent than Western Europe, it is spoken of here primarily as the problem of European scientists and engineers emigrating to the United States.

In the interviews and questionnaires, immediately subsequent to discussion of the technological gap, the brain drain was introduced with the question: "Do you think that the 'brain drain' is a serious problem for Western European science?" The degree of concern shown by respondents over this issue was substantially below that which was shown over the gap: slightly fewer than two-thirds of the scientists (62%) responded affirmatively, while 30% responded negatively, and 8% gave no opinion.[10] The various nationalities in the sample displayed regular variations across laboratory lines and to some extent these variations reflect the severity of the problem in the respective nations. Relatively strong majorities were in evidence among the Germans (74%), British (62%), and Dutch (67%), whose countries lose non-negligible proportions of their

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[9] Ibid., p. 14.

[10] A follow-up question, which asked whether respondents thought international laboratories were capable of stemming the flow is not discussed here. The marginal for the question was as follows: 51% yes, 17% no, and 32% DK.

scientific and engineering manpower to the United States each year.[11] Positive responses were much weaker among the respondents from France (48%) and Belgium (33%), where the losses are much smaller.[12] The only anomaly was among the Italians whose evaluation of the seriousness of the drain was high (69% yes) but whose actual drain is comparable to that of the French.

Aside from the Italians, the responses appear to follow the same form as those concerning the technological gap and the same explanatory mechanism is hypothesized to be operative. The correspondence between national response and national situation--which appears despite the fact that the question was asked with reference to Europe--is accounted for in terms of the proximity of the issue-area to the respondents' personal (national) experience. It is noteworthy, in light of this finding, that responses to the question of personal working preferences ("If you were to leave this organization, have you any preference as to where you would like to work?" See Chapter V, Section C.3) mirrored the data on the brain drain. Frenchmen and particularly Italians showed relatively stronger desires to return to their own countries, while British, Germans, and most of all Dutchmen, showed notably weaker desires.

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[11] The average annual number of scientists and engineers immigrating to the U.S. (years between 1956 and 1961) as a percentage of the total output of science and engineering graduates (1959) for these three countries is astonishing: 8.2%, 7.4%, and 15.1%. (B. Thomas, "Modern Migration," in Adams (ed.), The Brain Drain, p. 34.)

[12] The comparable average loss figure is 0.9% for France, that for Belgium is not available. (Ibid.)

Differential rates of emigration from various European countries were recognized by the scientists and incorporated into a fair number of their answers. Some 22 write-in comments (about 40% of all comments on this question) noted that the drain was more of a problem for some countries than others. Britain, where the greatest amount of brain drain discussion has taken place, was frequently mentioned as having the worst problem. A French scientist from ISPRA summed up the situation more or less accurately:

> I believe it is a problem for the English. Bon. It is absolutely not a problem for the French. There are very few French scientists and engineers going to the United States. I realize that the situation is different in Germany, Holland, and even in Italy. So I would say there is a problem of this type for some countries of Europe, but not for France.

Often respondents related the brain drain to the technological gap, blaming the same root problems--unwillingness of European governments and industry to invest heavily in research, lack of coordination between the various countries--for both phenomena. Interviewees, however, were seldom emphatic about the seriousness of the drain. Frequently expressed was the notion that Europeans really prefer the styles of living, the traditions and the cultures of Europe and the desire to immigrate to the United States permanently was tempered by the factor of "feeling more at home" in Europe.[13] Approximations of the idea that "Europeans would like to work in the United States and live in Europe" were heard repeatedly. Several respondents, furthermore, raised questions about the number of

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[13] Obviously those Europeans who have immigrated to the United States could be expected to give different viewpoints!

Europeans who return from the United States each year.

3. The "Space Race"

The third politico-technological issue with which the survey dealt--the exploration of space--is of a rather different nature than the other two issues and the attitudes which we sought to tap were not restricted to a European focus, but included more general aspects. Space exploration was chosen for inclusion in the survey primarily because of its characterization as a rapidly-growing, future-oriented area of science and technology, which due to its extremely high costs and incompletely recognized benefits has important political consequences. The fact that one of the organizations included in the study (ESRO) is engaged in the field made its consideration doubly interesting.

From its dawn in late 1957 to the time of this survey less than a decade later, the Space Age had progressed at an unprecedented pace. In fact, in mid-1967, the two major space-faring nations were approaching the "home stretch" in what could only be termed a "race" to land the first manned vehicle on the moon. Although the value of unmanned space exploration was widely accepted, criticism of the wastefulness of this manned race was a fairly common theme particularly in intellectual and scientific circles.[14] Furthermore, the record of manned space exploration was blemished for the first time just prior to the beginning of the survey

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[14] See the report on American scientists' views of the space race by Donald A. Strickland, "Physicists' Views of Space Politics," Public Opinion Quarterly, XXIX, 2 (Summer 1965), pp. 223-235, as well as "Space Program: Results of Poll of AAAS Members," Science, CXLV (July 24, 1964), p. 368.

with the deaths of the three American astronauts in December 1966, and once again during the period of the survey with the death of the Russian cosmonaut in April 1967.

A series of four questions was asked near the conclusion of the political segments of the questionnaire and the interview. The first two dealt specifically with the moon race, asking first for prediction of the winner and second for an evaluation of the program's worth. The third question asked respondents' opinions about European space efforts, while the last raised a broader question about space and international relations. Our concern with these questions does not merit an extremely deep analysis of them, so that the following will be simply a presentation and discussion of the marginals for these questions enriched by consideration of selected cross-tabulations and comments.

The scientists were most reluctant to predict the outcome of the moon race.[15] Many stated that the unavailability of data on which to base any rational judgements (particularly from the Russian side) made such guessing fruitless. Generally, the matter was treated as a frivolous question (which in retrospect perhaps it was) and a healthy majority (64%) refused to venture an opinion and were recorded as DK. Among those who did pick a winner, the United States enjoyed a moderate (21% to 14%) edge. The factor of nationality did not appear to enter into this response pattern, but scientists of all nationalities at ESTEC, perhaps because of their professional involvement in space research, were

[15] The question on this topic read: "Which country do you think will win the race to the moon--the United States or the Soviet Union?"

slightly more willing to make predictions than scientists at CERN or ISPRA. The DK percentage was 52% at ESTEC, compared to 72% at CERN and 66% at ISPRA. It is interesting, though, that among those who did make a prediction, there was no more agreement at ESTEC than anywhere else. The weight of the write-in comments dramatized the response: nearly a third of all respondents commented simply, "I have no idea."

Much greater willingness to express an opinion--but no more unanimity--was found on the second question. Asked if they believed "that this moon race is worth the investment of money and human resources that it is costing these two countries?" the respondents showed nearly an even break. A slight majority--53%--felt that it was worth the investment, while 39% felt it was not and 8% gave no opinion. The positive reply among ESTEC scientists and engineers (58%) was only slightly above the average and otherwise the laboratories did not vary widely. British respondents, at ESTEC and particularly at CERN, seemed to place a lower evaluation on the moon race than other nationalities--only 39% of the British said they thought it was worthwhile, while 57% said it was not.

Altogether, the question and consequently the response pattern obtained appear to have mingled at least two separable elements. Opinions about the value of manned space flight and lunar exploration were mixed with opinions about the appropriateness of a "race" between the two superpowers. Indications are that the respondents' attitudes towards manned space flight and lunar exploration were a good deal more favorable than suggested by this marginal. Few comments either on the questionnaires or within the interviews deprecated the value of sending men to the moon. Those who did (20 respondents, comprising 10% of the total number who gave comments) were chiefly concerned about priorities: more pressing problems on earth such as hunger and economic underdevelopment. On the other hand, twice as many of the commentators (21%) maintained that they approve of the idea, but not as a race.[16] This reinforces our conviction that the major negative element in the question was that of a race--duplicative competition on so vast a scale.

In order to relate the issues of space exploration to the European scene, the question on the value of the moon race was followed by one asking if the subject thought that "Europe's efforts in space exploration are appropriate in scale and scope." Here, on a question which in contrast to the first asked for preferences rather than expectations and in contrast to the second was relatively unambiguous, something approaching a more clear-cut division was in evidence. The majority of respondents (59%) clearly felt that Europe's efforts were not appropriate. Only 28% thought they were while 13% were recorded as DK. It was more than evident, too, that by "inappropriate" the scientists meant "too small" rather than "too large." About one-third (37%) of the respondents who indicated that Europe's efforts were not appropriate voluntarily added comments to the effect that the efforts needed to be enlarged; virtually no one gave the opposite comment. While the notion that European countries either individually or together should set up programs of manned space flight was never expressed, European slowness in entering the profitable fields

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[16] Many of these comments came from Britons and if one adjusts the British response pattern accordingly it begins to look more like those of the other nationalities.

of scientific and technological (particularly communications) space applications was repeatedly bemoaned, and often respondents pointed out relationships between inaction in this sphere and the technological gap.

In a predictive (although undramatic) display of self-interest, the respondents (of all nationalities) from ESTEC again differed from their colleagues in the other international centers. Nearly three-fourths of the ESTEC respondents (73%) replied that they did not think Europe's efforts were appropriate; nearly half went on to add (voluntarily) that they ought to be enlarged. Outside of ESTEC (and ESDAC, whose results paralleled its sister establishment) the response patterns of the other centers did not differ greatly among themselves.

Responses from these laboratories outside of ESTEC and ESDAC did uncover at least one additional interesting piece of information, however. The question did not distinguish between the national space efforts of the various European countries and the joint efforts represented by ESRO, ELDC (European Launcher Development Organization), and CETS (European Conference for Telecommunications by Satellite). Although their common ethos generally made scientists at each of the international laboratories conscious and knowledgeable about the others, the question on European space efforts revealed a surprising depth of ignorance at the other laboratories about ESRO's activities. Perhaps this could be attributed to the fact that ESRO had not yet successfully launched any satellites. In any case, responses such as the following, showing a virtually complete ignorance of ESRO and ELDO, were not unusual at CERN and ISPRA:

> I don't think they should be doing more unless they join forces to do it. At the present time they do rather little, but I don't see that any of the countries, even Britain or France, could do much more under present conditions . . . until they join in a larger scheme . . . I don't think any European country can really have a space program of any significant size. They could obviously, when they decide to join forces.
>
> --French engineer from ISPRA

The section on space concluded on a somewhat idealistic note. Respondents were asked to take the long view on space exploration and its politics and pronounce their judgement on one of the notions dearest to the hearts of the political advocates of space exploration. The question, in a somewhat leading fashion, read: "Do you think that the cost of space exploration will eventually lead those nations interested in it to cooperate on a world-wide scale in such efforts?" While this item was sufficiently vague to provoke a rather high rate of DK (19%), the majority (62%) indeed did give its endorsement to this expectation. Once again, in an unsurprising deviation, ESTEC scientists displayed greater interest in matters relating to space and their "yes" response (69%) was slightly stronger than that of the other laboratories. Otherwise there was little differentiation among the various groups. Responses to this question were noticeably lukewarm; their tone might be characterized as "yes, it would be nice" rather than "yes, I really expect this to happen." Among the relatively scarce write-in comments, the most frequent followed "yes" responses and fell into an empirical classification amounting to "I hope so."

To summarize the scientists' views on these four aspects of the politics of outer space one should note first that ESTEC scientists displayed the greatest interest. They were strongest in the desire (which was however shared by the other laboratories) to see Europe take a larger part in space research, and they were most convinced of the potential value of such activities. Few scientists from any of the laboratories were willing to make a guess on the outcome of the "race to the moon." Most did consider it to be a valuable enterprise, although not as a "race." Overall, while views on policy relating to outer space were not as consensual as views on many other topics, the nationality and laboratory variables did not reveal many significant differentiations.

* * *

In concluding this survey of the political thinking of a sample of international scientists, we have gone from an analysis of their underlying belief patterns to an examination of some very specific types of opinions. Midway through this process, we uncovered a range of thought on the European integration issue-cluster which bespeaks a highly articulated form of regional sentiment. The first part of this chapter revealed the ways in which this regionalism interacts with the more global internationalism usually attributed to scientists. It was seen that the two "isms" coexist on differing levels of idealism and abstraction and hence do not conflict. The second half of this chapter represents more or less a digression on some politico-technological issues and it was seen that the technological content, through its more direct relation to the scientists' own experience, produces a number of more parochial interpretations.

Looking back at Parts Two and Three of this study it is apparent that three major tasks still lie undone: tying together the various loose ends, stepping back to look at the political role of international laboratories in a better perspective, and drawing such general conclusions as the data allows. It is with this goal in mind that we turn to Part Four (Chapter XI).

PART FOUR

CHAPTER XI

INTERNATIONAL LABORATORIES AND EUROPEAN INTEGRATION

This is not the sort of study at the end of which one may sit back and, with the aid of several statistically-validated key tables or a few well-supported crucial propositions, state with authority: "Thus, the original hypothesis is (is not) supported." The problem-area is too diffuse, the subject-matter is too little explored, the methodology too inexact, and the data too limited to permit such luxuries. Hence one must be satisfied with a series of somewhat imprecise statements whose values lie primarily in the facts that: (1) they are data-based and not merely armchair speculation, (2) they deal with important aspects of an interesting yet unexplored problem, and (3) they constitute bases from which to develop further--much-needed--investigation.

The attitudes and behavior of scientists and engineers in international laboratories have been explored in order to gain some insights into the future societal role which large-scale scientific collaboration may play in Europe. Two avenues of approach have been taken: First the scientific role, that is, what can the laboratories do through performing their intended technical functions to build the scientific and technological capacity of Europe? Second, the political role--what can such laboratories do directly in terms of the functionalist model to foster political integration of the European states? This chapter, without forgetting its apologia, attempts to synthesize, from the findings reported in the body of the work, some tentative answers to the above questions.

A. Scientific Role

Within the concept of the scientific role there are really two functions which an international laboratory may perform. The first consists simply of carrying out its assigned scientific tasks and yielding the sorts of research results which comprise its technical mission. The second function, somewhat more difficult to assess, rests on the laboratory's ability to affect scientific development outside its walls, in a larger sense, through such actions as countering the brain drain and fostering greater scientific interchange among other institutions in the member states.

1. Assets and Liabilities: A Balance Sheet

Part Two of this study examined, through the eyes of the respondents, aspects of the operation of three large international laboratories: ESTEC, CERN, and ISPRA. Each of these may be taken as a model of a distinct form of large-scale scientific collaboration. If one should be asked to summarize the major finding of this portion of the study in a single sentence, it might be expressed as follows: The international nature of each laboratory is largely responsible for the determination of the laboratory's dominant features, but these features are the result of the effect of internationalism at the uppermost levels of organizational structure rather than its effect at the level of the individual scientists.

It has been repeated many times that the international atmosphere of the various laboratories made them similar to each other in a number of respects and in these respects they are distinct from nearly all other research environments to be found in Europe. The basis of most of these similarities is not the international sponsorship but the effect of internationalism at the individual level--the mixture of scientists of many different nationalities and backgrounds in relatively even proportions. The fact that such mixtures occur in present-day Europe only under international sponsorship is the result of various situational factors, the most important of which is the technological gap. In many fields of science and technology, the differentiation in level of advancement between major European countries (from the scientist's point of view) is rather small compared to the perceived difference between the common level of these countries and the United States. In most cases, then, a scientist from a major European nation who wishes to go abroad in search of better opportunities for study or work is likely to see greater advantage in going to the United States rather than another European country.[1] This factor, compounded by the reluctance of universities in many European

[1] This assertion is supported by the data on respondents' previous living abroad and their expressed preferences on future moves.

countries to give academic appointments to foreigners and (at least in the engineering professions) the confusion produced by a welter of degree titles and professional qualifications, has inhibited the growth of real international scientific centers within national European institutions. Hence the uniqueness of the environment of the international laboratories.

The international aspect of the environment--considered apart from the larger organizational context--is similar in all three models and is both pleasant and facilitative for the performance of research. The possibility of recruiting specialists from the broad European constituency rather than a basically national constituency, is one important advantage. The stimulation which diversity of culture and background brings to scientific teamwork, discussed in some detail in Chapter VI, is another. In addition, the personal rewards which participants derive from the cross-cultural experience, although vaguely understood, are universally acclaimed by the scientists. Evaluations of the relative inefficiency of communication resulting from mixtures of national styles of work and different languages varied. The best approximation would seem to be that such inefficiency was nearly universal but relatively minor in its detrimental effect. Finally, there is a virtual absence of conflict based on or related to nationality considerations. In sum, on the individual level, the mixing of nationalities in the scientific laboratory yields, as one might well expect, eminently satisfactory results and a net advantage over the purely national situation.

This advantage, however, is only a second-order effect. Its contribution to the overall research situation is easily overwhelmed by gross characteristics of the intergovernmental context within which the laboratories operate--as demonstrated in two out of the three models with which we have dealt. One is speaking here of the effects of bureaucratic complication and political disruption on professional morale and this is reflected in the responses which the scientists gave when they were asked to compare their present environment to other (national) environments with which they were familiar. Awareness of such particularistic phenomena as "bureaucracy" and "political problems at the top" clearly took precedence over more universalistic aspects of the international situation. At ESTEC, and above all at ISPRA, complications stemming from the international status of the organizations are responsible for the severe difficulties which the laboratories have encountered. In both of these cases, the problems are considered by the scientists to be of a political (irrational) nature, originating in relationships of the member states, and their gravity is such that the advantages of the international environment are all but forgotten. At CERN, on the other hand, where the organization has been relatively free from upper-level disputes between nations, the advantages of internationalism on an individual level take on much greater significance.

Is there a lesson to be learned from these three cases? If so, it is likely to be that from the point of view of accomplishing a given scientific or technological task, the advantages of an international establishment are fragile, and they are easily outweighed by the vastly increased possibilities for political dispute and organizational stalemate opened up through internationalization of sponsorship. This by itself, however, should not be taken as a denigration of the international laboratory concept, since first, the achievement of a purely scientific aim is only part of the value potential of an international laboratory, and second, there are evidently circumstances under which the advantages of the international structure may predominate.

A reasonable approach to proper utilization of the international laboratory concept would seem to be one which makes use of its inherent (albeit fragile) advantages while minimizing the possibilities for disruption from political conflict. Fundamental research ventures which require a certain minimum, critical size--either in terms of equipment or staffing--would appear most suitable under this line of reasoning. Critical size is necessary in order to minimize the potential scope of disputes over means once the needs have been agreed upon by member states. That fundamental research should be the preferred type of activity rests upon a very simple premise--the increased distance of such work from conflicting national interests. In other words, given that one cannot assume political coherence of the member states, one must recognize the likelihood of disruptive conflict or even organizational paralysis resulting from this lack of coherence, particularly if costs are high and/or the work of the organization relates directly to industrial, military, or political profit possibilities. Thus there is greater assurance that a laboratory will be given the organizational environment which will permit it to pursue its scientific mission, if it is devoted to fundamental research, more remote from profit possibilities.

If, of course, political coherence between the member states (defined by conditions outside of the organization) is a reasonable expectation, then more applied scientific and technological ventures are feasible within the international laboratory frame. Smaller but more applied establishments, such as PETTEN, ESDAC, or HALDEN, may prove workable even without assuming much political coherence, since their relatively low costs make them less sensitive to instability. But large applied centers of ISPRA's genre evidently fare poorly under such conditions and are unable to perform adequately with respect to their scientific aims.[2] One might hypothesize that under circumstances where political cohesion cannot be assumed, joint planning and coordination of efforts through some form of central direction would be more likely to yield acceptable results in projects of a technological nature, and much of the international *ambiance* could be duplicated by encouraging national centers to accommodate large numbers of foreign professionals.

2. Institutional Relationships

Consideration of purely scientific (or technological) aims is not the whole story, however, and one must look further into the ways in which international laboratories interact with national scientific institutions in order to evaluate more fully their scientific impact. Conversely, it is evident that institutional relationships may also affect the ability of a laboratory to perform its scientific tasks. The data points to a number of significant conclusions on this matter.

Before outlining these conclusions, however, it is worth mentioning briefly a few of the important aspects of the institutional question which cannot be explored with the data. The internationalization of

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[2] Our sample contains only 3 large laboratories, of course, so it is difficult to make sweeping generalizations; but one must recall that these 3 are the only large international laboratories in existence.

technologically-based industry through the purchasing practices of international laboratories is one such aspect. It has already occurred to some extent in the European aerospace industry as a result of ESRO's influence.[3] Forcing nations to adopt common standards of measurement and performance is another. While the metric system is used quite generally throughout European science and technology, such measures as gauges of metal, sizes of screw-thread, and standards of purity and quality in chemicals and metals still vary from one country to another and the existence of large international laboratories can undoubtedly help to reduce such differences. Direct influencing of the type of work that goes on in national institutes is a third aspect. CERN estimates that it provides research material for some 700 physicists <u>outside</u> of the organization.[4] The facilities provided by CERN and ESRO also serve directly the needs of national groups in the member nations: many scientists come to CERN for short periods to carry out experiments; all of the experiments which ESRO launches belong to national scientific groups. We can only mention these in passing and suggest that there are many other such effects, but our data does not include such matters.

The primary means by which institutional relationships may be approached with this data is via the career patterns of the respondents.

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[3] ESRO contracted out construction of its TD-1 satellite to an international consortium known as MESH, consisting of Matra (France), Entwicklungsring Nord (Germany), Svenska Aeroplan Aktiebolaget (Sweden), and Hawker Siddley Dynamics Ltd. (United Kingdom).

[4] *CERN Courier*, XII, 8 (December 1968), p. 306.

Detailed information was collected about the professional backgrounds, motivations, and future plans of respondents. This information yielded a few insights--at the level of the individual--on the interactions between the international laboratories and national science structures.

An important way to begin exploration of this topic is to ask what is the relation of the international laboratories to the famous "brain drain"--i.e., the international migration of European scientists and engineers? One of the stated goals of the laboratories is to provide European scientists with opportunities to do advanced work in "big science" fields without leaving their continent, and certainly this function was mentioned often enough by the survey respondents. Nevertheless, with respect to the overall magnitude of the drain (which, as was observed earlier, affects different countries to varying degrees) it would seem that the number of positions available in the international centers is not terribly large. Furthermore, the number of respondents who reported direct personal experience with the phenomenon comprises only a small proportion of the laboratories' populations. Within the entire sample, a total of 11 respondents reported that they were "drawn back" to Europe from the United States by an international laboratory. (See p. 177.) This number is so small that it is meaningless to try to project any quantitative trends from it. One may only conclude that a reverse migration stimulated by the international laboratories does exist, but that it is far from massive. A handful of other respondents returned to Europe (to one of the international laboratories) after completing their educations in America. How many of these men would have stayed on in the United States, and how many would have returned to Europe anyway is an open question. On the other hand, fully one-fourth of those respondents who said they were considering alternative positions at the time they decided to come to the international lab indicated that at least one of these job possibilities was in the United States. As this question was only asked on the interviews, the absolute number of such respondents is rather small (13), but despite its small absolute size (which precludes differentiation by laboratory and/or nationality) it may well be indicative of a meaningful trend. In all, it is probably fair to say that all three major international laboratories have given scientists and engineers who might otherwise have been tempted to go to the United States, a relatively attractive alternative.

There is, however, another side to this story. It was observed in Chapter V that commitment--the ability and desire to return home--decreased with time spent in the laboratory. For some scientists the international laboratories may operate more or less as "way stations": they arrive at the labs with full intention of returning to their countries, but as the years pass find that their ties with home grow weaker. When they finally decide to leave, given a continuing technological gap, their probability of going to the United States is much higher than it would have been had they remained at home.[5] This is to some extent speculation, but it

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[5] Although we have little direct data to substantiate this assertion, it is also likely that scientists from countries with relatively low pay scales--such as Britain and Holland--might hesitate to return home from a high-paying international laboratory and face a salary cut of 50%.

should be recalled that nearly half of those respondents who stated that they had a country preference for their next job chose a country other than their own. The United States was far and away the most frequently named country, and few scientists from any major European country chose any other major European country.

It is impossible to state with any degree of certainty how these countervailing migration tendencies balance out. The most reasonable approach to the problem would be to suggest two of the factors which could influence the balance. The internal scientific and technological situations of the individual countries are of central importance, for they are responsible for the drain in the first place. The less attractive this situation is, the more likely a scientist is to look elsewhere upon leaving the international lab. The low commitment of the ESTEC British (including those of low seniority) may be understood in this light. The laboratory's hiring procedures and its degree of stability are also determinants. ISPRA has perhaps the worst-of-all-possible worlds in this respect, since its practice of making career appointments encourages scientists to break ties at home--indeed ISPRA scientists reported the fewest professional ties in their own countries--and its unstable political situation may well encourage (or even force) some of its staff members to depart prematurely. It would be no surprise if many ISPRA scientists end up in American nuclear research establishments.

This factor of career versus short term appointments in international laboratories leads directly into the other major aspect of these laboratories' institutional relationships--that of personnel interchange. Evidently a certain amount of internal continuity is necessary in order to maintain the scientific competence of the center. A core staff with a long-term commitment must exist at any international laboratory. It appears, however, that it is to the benefit of most of the individual scientists and engineers, the laboratory as a whole, and the European scientific establishment to employ the greater portion of the professional staff on a relatively short-term basis. From the individual standpoint, a short-term commitment implies greater independence from organizational instability, and probably leads to a more satisfactory pattern of career development for most. From the operational point of view of the laboratory, individual independence from organizational instability should improve morale, or at least decrease the probability of developing very poor morale. The absence of a career orientation among a large proportion of the professional staff should, furthermore, limit the potential scope of national conflict--insofar as more individuals will gain their rewards through professional achievement rather than position. Finally, in terms of institutional patterns, links between national scientific institutions and the international laboratories should be strengthened to the extent that they are based on a traffic in warm bodies.

The weakness of exchange between national scientific institutions in Europe has been mentioned several times in this study. It was reflected (in Chapter IV) in the surprisingly small number of respondents who reported having studied in a European country other than their own. It was discussed in the present chapter as resulting from a lack of incentives based on low perceived differentiation among European countries realtive to the United States. The international laboratories are in a position to fulfill an important function by encouraging such interchange. How well they are succeeding is quite difficult to judge. The data reveals that all three major centers draw upon the academic, government, and industrial sectors, although in varying proportions. CERN, as one might expect from the nature of its research, has the closest ties to the academic world. ESTEC and ISPRA, on the other hand, draw much smaller proportions of their staffs from university positions. About one-half of the scientists and engineers at each of these two establishments came from industry, and about one-third from government, with the remainder coming from academic posts. Differences by nationality were also apparent, with more Britons and Frenchmen drawn from government posts and very few Frenchmen drawn from universities.

It will be recalled that a large proportion (60%) of the respondents were between thirty and forty years old, and most (85%) had been previously employed rather than coming to the international laboratories directly from their studies. It appears, then, that a large number of the scientists and engineers are at a good stage in their careers from the point of view of promoting personnel interchange between the international laboratories and national institutions. In terms of their future plans, many of those respondents who expressed a preference seemed to display a desire to remain in an international atmosphere. About one-fourth of the respondents said they had no preference, and nearly a third of those remaining gave only vague replies such as "research." Among the others, "international organization" was the most popular choice, followed by industry, government, and universities, in that order. Cross-tabulation indicated that choice of a national sector was determined primarily by the respondent's sector of origin, but respondents originating from all sectors were equally likely to choose an international organization.

Personnel interchange involving the three major sectors of national scientific employment is evidently taking place at all of the large international laboratories. It is strengthened in the government sector in particular by the practice of sending scientists to the international centers on temporary leave, and ESTEC is a major beneficiary of this practice. It is weakened, on the other hand, first by the laboratories' practice of making large numbers of career appointments (such as ISPRA does) and second by the fact that a substantial proportion of the scientists who go to the international labs apparently are not interested either in returning home or in going to another European country. CERN, working in high energy physics--a field with traditionally strong interchange--is clearly the liveliest center in this respect. It has the great advantage of being the foremost European laboratory in a dynamic area of basic research, and it has capitalized on its advantage by maintaining active visitor, fellowship, and summer student programs. Not only CERN, however, but all of the international laboratories have a genuine potential for developing closer ties among the scientific communities of the various European countries.

B. Political Role

It has been proposed that in addition to affecting Europe's future through performance of scientific and technological functions, the international laboratories are capable of producing more direct political effects. The political attitudes of the scientific staff members of the laboratories were explored in an attempt to assess some of these effects from the perspective of the individual scientist. Our conclusions may be treated in two broad categories: those relating to the shaping of attitudes, and those relating to the action potential of the scientists.

1. Attitudes

To summarize in a few words the major findings with regard to the scientists' political attitudes, it appears that an attitude pattern highly favorable to increased political integration in Europe is practically universal among scientists of all nationalities in all laboratories. Because of the strength of this consensus it proved all but impossible to detect variations in attitude structure which might be attributed to effects of the laboratory experience.

Given the demographic homogeneity of the respondents, a broad sharing of political attitudes is not an unreasonable expectation. Most of the major sociological characteristics normally associated with political orientations show remarkably little differentiation among the respondents. The distribution by age is sharply peaked in the thirty-to forty-year old bracket. Ninety-five percent of the respondents are males; nearly all are highly educated. While social class was not ascertained independently, it should be a safe assumption that through their occupational status, all of the respondents can be considered as belonging to the "professional middle class." Religion was also not explored directly, but it seldom arose in interviews and other studies suggest that it is less of a factor among scientists than in the general population.[6] One is left with nationality, scientific function, and exposure to the international situation. Of these, nationality proved to be the most important discriminator--although it must be recognized that certain definitional complications with regard to the other variables made them difficult to work with.

By scientific function is meant the degree to which a respondent's professional interests and activities may be characterized as either abstract/theoretical or applied/practical. Separating the respondents into scientists versus engineers either by title of educational degree or title of present position did not yield differences on most issues. Similarly, the self-report question by which respondents described the nature of their work on a scale ranging from basic research through applied research, development, engineering to technical service turned out to be of limited value. The grossest measure--that is, the laboratory itself--gave the most useful results. This is by no means a pure indicator of what was sought under the heading of individual scientific function, but since the laboratories do have different scientific characters which are of importance in other parts of the study, and since the original expectation of inter-laboratory differences was borne out by the data, substantial use was made of this variable.

With regard to exposure to the international situation, a simple dichotomy about the point of 2½ years was employed. If there are socializing effects which operate very rapidly--over, say, a period of a few

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[6] For example, Bernice Eiduson, Scientists: Their Psychological World (New York: Basic Books, 1962), pp. 217-220.

weeks or months--it is possible that they were washed out by this heavy-handed slice. On the other hand, the highly unbalanced manner in which seniority was distributed at ESTEC and ISPRA (the reasons for which are discussed in Chapter IV) made the use of other dividing points impractical. Furthermore, the size of the sample meant that after division by laboratory and nationality, it was not practical to employ a seniority scale with more than two values. The same reason--small sample size--made it impossible to control for previous international exposure (travel, foreign living, etc.)--a factor which might well have blurred the effects of the laboratory experience on political views. Since the sample was relatively large with respect to the available population (about 20%), this intrinsic limitation suggests that a repeat interview study might have been more successful in measuring attitude change than a study of this form.

In any case, much of this discussion is academic, because the scope of agreement on most of the major European issues was strong enough to overwhelm any internal divisions. Support for the existing organs of European collaboration was so universal that it could easily be--and in fact was--taken for granted. Beyond this, the data revealed nearly unanimous approval for political integration of "little Europe" and expansion of the core group of six nations to include other Western European powers. Expectations on these matters did vary, although not in any regular fashion. Motivations were traced to a common hope--that of seeing Europe regain its world position as a "leading continent." The availability of reported data and conclusions from other elite studies permitted certain comparisons to be made. Evidently it would have been desirable to base such comparisons either on scientists in national establishments or on non-scientists in other international organizations, so as to control independently for the scientific factor and the international factor. Failing this, comparisons with national elite panels did at least demonstrate that the scientists in this study displayed what seemed to be a more intense desire for closer and rapid political integration, and certainly a much more broadly transnational consensus on these European issues than the national elite panels.

Differences between the various laboratories and national groups turned up primarily on issues (such as national nuclear weapons) where national situations diverged widely, or where the character of a particular laboratory suggested a strong influence in one direction or another. On matters concerning European integration, the most consistent deviators were found among the British. While most of the British scientists presented attitude patterns which paralleled their colleagues from other European nations (and thus differed significantly from their non-scientist compatriots), significant numbers of British scientists and engineers, particularly at ESTEC, reflected their domestic political climate in showing a distinctly lower degree of European sentiment. It was in this group that increased experience in the international laboratory seemed to make a difference: as described in Chapter VIII, the proportion of Europeanists was substantially higher among those ESTEC British with high seniority than among those who were relatively new in the international lab.

All of this points to the conclusion--heavily qualified as described above--that among most of the scientists there is not a great deal of room for movement with regard to European orientation. The vast majority were strongly in favor of the European idea before they came to the international laboratory, and thus did not need to be "converted" by the experience. Among the various political issues explored through the survey, European integration is clearly the most salient to the scientists. The international laboratories, however, serve mainly to bring together scientists with similar views on this matter, rather than to take scientists with diverse views and shape them into a consensus. The invariance of this European sentiment was particularly striking in view of the variety of motives which brought the scientists to the labs as well as the profound variations in organizational morale. Apparently the stronger professional orientation of CERN scientists relative to their opposite numbers at ESTEC and ISPRA does not imply a lesser degree of Europeanist sentiment there. Furthermore, the differing experiences which ISPRA, ESTEC, and CERN have had with the politics of European integration--mirrored so clearly in their morale--have not produced measurable effects on the scientists' political views. Despite the fact that ISPRA scientists in particular often pointed discouragingly to the frustrations of trying to "build Europe" and to the irrational behavior of the Six partners, their preferences and expectations were remarkably similar to those of scientists at ESTEC and CERN. Only in the laboratories of IAEA in Vienna and Seibersdorf, where both the population and the sample were really too small to make any precise evaluations, did the Europeanist trend appear rather weak. Indeed, under the very special circumstances of a world-wide body located in technically neutral Austria, this is understandable.

Outside of the sphere strictly concerned with European integration, the range of views expressed by the scientists showed significantly greater differentiation. At the same time the general level of salience on such issues was lower than on European issues. Radically different national situations seemed to be the prime causes for splits such as the one which appeared on nuclear weapons. In effect, the same question--approval of national possession of nuclear weapons--meant quite different things to scientists of different nationalities--for example, Britons and Germans. Varying national orientations to such external bodies and problems as the United Nations, NATO, and the non-proliferation treaty also produced splits between scientists, particularly under conditions of lower salience. Finally, political questions with a technological content which could be related to personal experiences and impressions of the scientists were subject to more parochial interpretations than others.

Before going on to discuss what sorts of actions the scientists who possess these attitude patterns might be likely to participate in, it is worth making a final assessment of the laboratory as an attitude shaping experience. Such an assessment echoes the relationship between political cohesion and technological integration discussed earlier--i.e., that the former should be a basis for the latter rather than a product of it. In the realm of scientists' political attitudes, the cohesion exists and, together with the shared values and methods of science, and a common concern with specific scientific tasks, yields an entirely satisfactory situation of technological integration at the individual level. In general, though, the cohesion cannot be considered a <u>product</u> of the laboratory situation. It normally exists among the scientists prior to their entry into the laboratory, and in the most extreme example, ISPRA, it might be said to persist despite the laboratory's situation.

2. Action Potential

In a pragmatic sense, the degree to which these scientists, so heavily oriented towards European integration, might themselves contribute directly to the process is more important than whether or not they possessed this orientation before coming to their present jobs. Looking at things in this light, it is not necessary to hypothesize an attitude-shaping role for the laboratories at all. The relevant question becomes simply whether the scientists--their political interests possibly but not necessarily shaped or strengthened by the international experience--are willing and able to participate in political activities.

The concept of the scientist's political role is broadly interpreted and is based less on his desire to enter the political arena (since, as we have seen, most scientists appear to be repelled by the "irrational" nature of political activities) and more on the vague (but oft-expressed) notion that since science itself is becoming more and more important in society, those who hold the keys to its power must somehow gain an increased influence on society's decision-making structure.

Don K. Price, in The Scientific Estate, distinguishes two broad ways in which American scientists have participated in political life--as "Insiders" and "Outsiders." The "Insiders," he says,

> are likely to accept the subordination of science to the value systems established by the nation's political tradition and interpreted by the authority of its government,

> and they can get along without much confidence that they are on the road to Utopia. The Outsiders, on the other hand--the scientists who prefer to appear as independent critics of present policy--are less willing to accept the validity of the traditional political ethos, or the necessity for science to be subordinated to a system of organized authority based on traditional values.[7]

For purposes of this discussion, we may consider four types of political activities in which the scientists in European international laboratories might conceivably participate at some stage during their scientific careers. The first of these corresponds loosely to Price's notion of the "Outsider," while the other three are more or less "Insider" roles--implying operation within traditional political values. The first of the activities involves organization into interest and/or pressure groups with the objective of influencing legislation or policy implementation. The second consists of the participation of scientists as individuals in partisan activities. Included here is the possibility of scientists running for office. Acceptance of administrative posts at varying levels in governmental agencies comprises the third form. The fourth type of activity, finally, consists of employment in ostensibly non-political positions as scientific advisors.

The data incorporates a number of factors which might be relevant

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[7] Don K. Price, The Scientific Estate (Cambridge: Harvard University Press, 1965), p. 83. In many ways, as Price is aware, the American situation is rather different from that which shapes the science-politics relationship in most European countries. We have been unable, in this section, to take real account of such differences as good descriptions of the various European situations are not readily available. To the extent that the American experience may be taken as a model for the future by Europeans, however, this fault may be less serious.

to assessment of the scientists' action potential under each of these forms. It is worth looking particularly at several of those items which were used in Chapter VII to delineate the "place" of politics in the lives of the respondents. Before beginning this examination, however, it should be pointed out that the ability of the international scientists to participate in any of the above forms of political activity is to some extent limited by factors implicit in their career patterns. Most activities of a directly political nature are excluded for scientists as long as they remain on the staff of the international laboratory. For them to join in partisan or national political affairs would in most cases be a violation of their international civil servant status. A certain proportion of the respondents--estimated from data obtained over part of the sample as approximately 20%[8]--hope to remain in their present posts indefinitely. An additional group (there is some overlap with those who ideally would like to stay on indefinitely) aims to go to another international body for their next position. All of these scientists would be unlikely to take part in most of the political activities under discussion. Still another group of scientists intends to go to the United States, or at least not to return to their own country. These men, too, will under most circumstances remain outside of the political arena in the sense we are concerned with it. The proportion of respondents who intend to return to the mainstream of scientific and technological life in their

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[8] See Appendix 2, Question 34. This item was used only on the interviews (n = 105). Its interpretation with regard to ISPRA respondents is in doubt since although most are on career appointments and would ideally stay for indefinite terms, a majority gave answers such as "this depends on what happens to the political situation."

own countries may be estimated as something less than one-half. These are the scientists who are at least able to participate through the forms discussed below.

If the ability of the scientists to participate in political activities is limited by their anticipated career patterns, their willingness is limited by their attitude structure. Although an articulate range of opinion--particularly on European integration issues--was displayed by most respondents in their interview and questionnaire responses, these opinions are highly intellectualized and, as was pointed out in Chapter VI, they are not backed by a very deep emotional involvement. A strong commitment to the goals and values of science itself and a distaste for the "irrationality" inherent in political life underlie this phenomenon. One recalls the words of the British scientist from ESTEC cited in Chapter VII:

> Scientists are terribly busy and very interested in what they're doing. They're interested next in their families, in a change of scene, and in their recreation. Anyway, it's only the few who feel very strongly politically among scientists and engineers.

Strong feeling is one of the prerequisites for the type of "outsider" political activity which corresponds to our first category. In the past it has been only on relatively infrequent occasions that scientists have organized themselves into interest or pressure groups--what might be called "lobbies" in the American idiom. These groups have responded to highly specific issues possessing a set of distinctive qualities which stimulated strong feelings among substantial numbers of scientists. Generally, the issues have been perceived as extremely critical ones posing a severe threat to humanity and involving a "special obligation" on the part of scientists. This was the case in the early postwar period in the United States when the famous atomic scientists' movement arose. More recently, large numbers of academic American scientists have been willing to become involved in causes which appear perhaps less critical but which still cut deeply into values widely shared in the scientific community. Obvious examples would be the anti-ballistic missile (ABM) debate and opposition to the Vietnam War.[9] The matter of European integration, although highly salient in the political attitude structure of scientists in international laboratories, has none of these qualities which might stimulate such strong feeling. Consequences of the failure to integrate the European nations might be very undesirable from the scientists' viewpoint, but they do not pose a direct threat to world peace or the existence of civilization. The issue, furthermore, is not tied to a basic and widely shared value--such as opposition to the use of technology for purposes of mass destruction--and scientists cannot really claim either special knowledge or special responsibility. The possibility of meaningful "outsider" political organization among European scientists (including those from international laboratories) focused on this issue hence seems remote.

Partisan activity, including running for political office--the second of our four forms of activity--may be summarily dismissed on similar grounds. Given the set of orientations toward the political world

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[9] There are indications, however, that natural scientists have been less active than other academics in opposition to the Vietnam War. See Howard Schuman and Edward O. Laumann, "Do Most Professors Support the War?," Trans-action, V, 1 (November 1967), pp. 32-35.

discussed in Chapter VII and summarized above, the likelihood of most of the scientists becoming interested in party affairs seems rather negligible. Furthermore, group factors which might legitimate in his own mind and the minds of his colleagues a scientist's participation in an issue-oriented, scientist-dominated campaign (such as the atomic scientists' movement) would not be present in party politics. This study did not inquire about respondents' political party affiliations, but the survey done at CERN in 1965 asked questionnaire recipients to indicate not a direct political affiliation, but merely which party came closest to representing their own views. Only the tiniest fraction of the sample specified a party, and many replied bluntly "none." This is as good an indication as any of how small is the scientists' propensity to join in partisan affairs.[10]

The third form of participation, movement into administrative posts in government, appears to have substantially wider appeal. It is quite likely, however, that among the respondents so inclined, most would deny that this is a form of political participation at all. We are dealing with it here as a result of our rather loose interpretation of political participation which is meant to encompass such roles as might allow the Europeanist attitudes of the scientists to have a direct influence on policies of governments. Certainly, under such an interpretation, government

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[10] A single avowed Marxist was encountered among the scientists included in the present study--although one suspects that there were probably a handful of others about--and the depth of his political involvement was evidently well beyond that of most of his colleagues. Even this individual, however, was a scientist by vocation, and he indicated that his political interests and activities would remain avocational.

administrative posts bear close scrutiny.[11] About one-third of all those respondents who were previously employed came from government posts. While many had been engaged in research, a significant share--primarily British and French--could be classed as middle-level technical executives.[12] These are the individuals on temporary leave (secondment) and those who will return to their former posts, plus those scientists who do not come out of government but will enter its service upon leaving the international laboratory, comprise a major proportion of the scientists with a political action potential.

The factors which might inhibit a scientist from undertaking this type of activity do not depend very much on his general evaluation of politics or on the strength of his emotional involvement in particular issues. Rather they revolve around his willingness to foresake research for administration. Among academic scientists at least, this type of shift takes place most often when an individual feels that he has passed the peak of his research productivity, generally when he passed his mid-forties, and often later. The real influence which the scientists' political views may exert in such a role is difficult to assess. Three limitations on potential influence are, however, worthy of mention. First, the

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[11] Price, in The Scientific Estate, discusses the fact that policy-making and administration are no longer really separable in the U.S. Executive Branch. Although the mixture may not be as complete among European governments, it certainly exists to some extent.

[12] Exact numbers are not available. Since we sampled primarily in research groups at the expense of administrative personnel, the numbers of administrators in the sample are probably not really representative of the laboratory populations anyway.

scientist's non-political interpretation of his role probably decreases his propensity to apply his own political orientations to the problems which he encounters. In addition, the fact that most of the government posts which the scientists would be likely to occupy are in technical agencies, often in the administration of research and development, no doubt limits the scope over which his political influence may be exercised. Finally, international experience is not always positively valued by national administrations. While British respondents often seemed to believe that their domestic status would be enhanced through their participation in an international venture, many Frenchmen reported that their colleagues in government service at home looked down upon those who went abroad to work, particularly in an international organization.

Although the "scientific advisory culture" is not as widely diffused among European governments as it is in the United States, the role of scientific advisor probably has the widest potential appeal of all the various forms of political participation open to the international scientists. This appeal is a function, in large measure, of the fact that becoming an advisor does not entail conflicting role obligations. Advisory work is viewed as technical and non-political, allowing the scientist to retain his virginal, apolitical status as well as his professional commitment to research. Because of these characteristics, it is also a form of activity through which a scientist may exert an influence in his own country while continuing to work in the international laboratory. Scientific advisory roles, however, are generally restricted to a rather small number of individuals, particularly those with strong scientific reputations which were established before they went to the international laboratory. The scientist's ability to develop his domestic reputation, once at the international center, is limited (sometimes enhanced, of course) by the laboratory's scientific standing as well as by the network of personal contacts he is able to maintain.

Through the role of advisor, the scientist is often dealing with broadly based and important issues in which science is a vital part of the context, but whose effects are felt by large areas of society. In the European setting, the presence in such roles of men whose basic political inclination is toward European integration is certain to assist that cause. It is recognized that in providing what is ostensibly technical advice, the scientist is incorporating his own underlying political assumptions. This theme has been much discussed, most often from the point of view of the policy-maker whose job it is to separate the technical content of the advice from its underlying political tone. It would be naive to expect dramatic results from this sort of influence in a short period, but as the science advisory culture grows in Europe, and as international scientists take their places within it, its effects are certain to be felt.

APPENDIX 1

Questionnaire

This appendix consists of the actual questionnaire employed in the survey. Although, for reasons of economy, only the English version is reproduced here, it should be noted that the French and German versions were printed in exactly the same format, with all questions laid out in the same way. The fact that virtually all questionnaires were distributed and collected personally, thus providing a verbal introduction in addition to the written covering letter, should also be noted.

Dear Sir:

I am a doctoral candidate working in the new field of "Science and Public Policy," in the Political Science Department at the Massachusetts Institute of Technology. Before beginning graduate studies in the Social Sciences, I received a Bachelor of Science degree in Physics from MIT. I am presently engaged in collecting data for my thesis, a study of the experience and effects of working in an international scientific organization.

The attached questionnaire, which I am distributing in several international scientific laboratories in Europe, is one of the instruments by which I am gathering my data. I earnestly solicit your help, and I would sincerely appreciate your taking the time to answer my questions.

The questionnaire consists of four parts, covering your professional and personal background, your current experience in this organization, and your views on some current issues. Some questions are rather open-ended and require you to write a brief response in your own words. Others have been written, to save time, in a form where you are asked to select the one response which comes closest to your feelings, from a choice of several possible responses. In these cases, I have left space for you to expand and comment on your choice.

In all cases, I am interested in your personal views and experiences. Your responses will be completely confidential. The administration of this organization has no responsibility for this study, and no connection with it, other than the fact that they have given me permission to gather my data here.

Since many people who have helped me in this study have expressed an interest in my findings, I am planning to compile a short report outlining them, after I complete my thesis. If you would like to receive a copy of this report, please hand a card with your name and address on it to my wife or myself when we return to collect this questionnaire.

Thank you sincerely for your assistance.

Yours very truly,

Albert H. Teich

Albert H. Teich

Date:________________1967

Organization, location:________________________

Division and Group:________________________

Title of position:________________________

Grade:__________

Nationality:________________

SECTION I
PROFESSIONAL BACKGROUND

This section is concerned with your work, technical interests and professional experience.

1-1 Please give a brief description of your present work:

____

____

1-2 In which branch of science or engineering would this work be classified?

____

1-3 Do you consider this work to be: [Please place a check mark (✓) next to the one which applies.]

____a. Basic Research

____b. Applied Research

____c. Development

____d. Engineering and Design

____e. Technical Service

____f. Administration

____g. Other (Specify:______________________)

1-4 In which specific area of science or engineering do your own deepest interests lie?

____

1-5 Please complete the following information about your higher education:

	Degree	Field	Year Received	Name of School	Country
Highest Degree					
Other Degrees					

1-6 When did you begin working in this organization?

Year__________ Month__________

1-7 Reasons for coming to this organization:

For each of the following factors, please place a check mark in the column which describes how important this factor was to you in your decision to come to this organization. Also please indicate which factor you feel was <u>the single most important</u> to you, by placing a check mark in the appropriate column.

	ONE MOST IMPORTANT	Very Important	A Factor	Not Important
a. Opportunity to pursue a particular type of work	___	___	___	___
b. Desire to work with a particular individual or group	___	___	___	___
c. Quality of equipment	___	___	___	___
d. Higher salary	___	___	___	___
e. Desire to work with people of other nationalities	___	___	___	___
f. Location	___	___	___	___
g. Job security, tenure	___	___	___	___
h. Lack of opportunities in own specialty in own country	___	___	___	___
i. Other (Specify:________ ____________________)	___	___	___	___

1-8 Previous employment:

If you were employed in another job immediately before coming to this organization, please complete the following information about that position. If you came to this organization directly after completing your studies, please check here/__/ and go on to the next question.

Type of organization (e.g., government laboratory, industry, etc.):

____

Country: ____________________

Year started: ________________ Year ended: ____________

Brief description of work: ______________________________

____

____

Reasons for leaving: ____________________________________

____

4

1-9 Before coming to this organization, how much previous experience did you have in working with scientists and engineers of other nationalities? /Please check one/

_____ A great deal

_____ Some

_____ Very little

_____ None at all

SECTION II

CURRENT EXPERIENCE

This section is concerned with your personal experience and observations since coming to this organization.

2-1 Compared to your previous experience, would you say the way one does scientific work in this organization is:

_____ Very different

_____ Somewhat different

_____ Generally the same

Comments:

2-2 Are there any characteristics of this laboratory which might make it easier to perform research or other technical activities than in a national or university laboratory?

_____ Yes

_____ No

If yes, please explain:

2-3 Are there any characteristics which might make it more difficult?

_____ Yes

_____ No

If yes, please explain:

2-4 Have you found language to be much of a problem?

_____ Yes

_____ No

Comments:

2-5 Have you found any differences in training among scientists and engineers from different countries which affect the way they approach problems?

_____ Yes

_____ No

Please explain:

2-6 In universities and in some national laboratories, one finds scientists from many countries working together. Do you think it is easier or more difficult for people of many nationalities to work together in an international lab such as this one?

_____ Easier

_____ More difficult

_____ No difference

Comments:

2-7 Do you feel that the atmosphere in this organization is providing you with a reasonable amount of intellectual stimulation?

_____ Yes

_____ No

Comments:

2-8 Considering your reasons for coming to this organization, how satisfied would you say you are with the way things have developed?

_____ Completely satisfied

_____ Very satisfied

_____ Satisfied

_____ Somewhat unsatisfied

_____ Very unsatisfied

Comments:

6

2-9 How satisfied would you say you are with life in this location?

_____ Completely satisfied

_____ Very satisfied

_____ Satisfied

_____ Somewhat unsatisfied

_____ Very unsatisfied

Comments:

2-10 Have you and your family encountered any difficulties in adjusting to life in this community and this country?

_____ Yes

_____ No

If yes, please explain:

2-11 Have you found that the people from this organization and their families tend to form a community after working hours?

_____ Yes

_____ No

Please explain:

2-12 Would you say that the time you have spent in this organization has improved your professional standing in your own country?

_____ Yes

_____ No

Comments:

2-13 If you were to leave this organization, have you any preference as to where you would like to work?

_____ Yes

_____ No

If yes, what type of organization and in which country?

Questions 2-14 through 2-16 apply to those individuals who are not nationals of the country in which this laboratory is located. If you are a citizen of the country in which this facility is located, please go on to question 2-17.

2-14 About how often do you go back to your own country?

_____ Every week

_____ Every month

_____ Every few months

_____ Once a year

_____ Less than once a year

2-15 Do you still maintain professional ties there?

_____ Yes

_____ No

Comments:

2-16 Do you try to keep up with national life in your country through newspapers, radio, or other means?

_____ Yes

_____ No

If yes, how?

(For all respondents)

2-17 Which newspapers and weekly magazines do you read here? _____

_____

2-18 About how often do you discuss current political issues with your colleagues here?

_____ Very often

_____ Often

_____ Occasionally

_____ Rarely

_____ Never

Comments:

2-19 About how strong do you feel your own interest in public affairs (politics, international affairs, etc.) is, compared with that of your colleagues here?

_____ Well above average

_____ Above average

_____ Average

_____ Below average

_____ Well below average

Comments:

2-20 Do you feel that there has been any change in your level of interest in public affairs since coming here?

_____ No change

_____ Increase

_____ Decrease

Comments:

SECTION III

CURRENT ISSUES

This section is concerned with your personal views on a number of current public issues. In most questions you are asked to reply "yes" or "no", or choose one response from a limited number of choices. Please note that there is space provided for you to elaborate on your answers if you wish.

3-1a Do you think that the "technological gap" currently being discussed in the press, is a serious problem for Europe?

_____ Yes

_____ No

b If yes, what sort of action do you think would be required to solve it?

Comments:

3-2a Do you think that the "brain drain" is a serious problem for Western European science?

_____ Yes

_____ No

b If yes, do you think that international organizations such as this one are capable of counteracting it in some fields?

_____ Yes

_____ No

Comments:

3-3a Would you favor the formation of a wider European Economic Community that would include the present EEC (Six) and other Western European countries?

_____ Yes

_____ No

b Would you favor such a community including Eastern European countries?

_____ Yes

_____ No

c Would you favor such a community including the United States?

_____ Yes

_____ No

Comments:

3-4a Are you in favor of the formation of a political union among the "Six"?

_____ Yes

_____ No

b Do you think that it will actually occur?

_____ Yes

_____ No

c If yes, how many years would you estimate that this might take?

_____ Less than 5 years

_____ Between 5 and 10 years

_____ Between 10 and 20 years

_____ More than 20 years

10

d **Would you favor a political union on a wider scale in Europe?**

_____ Yes

_____ No

e **Do you think that it is possible in the foreseeable future?**

_____ Yes

_____ No

Comments:

3-5 **If a political union did occur in Europe, which would be closer to your own preference--a union with a strong central authority, or a union with more power reserved for the member states?**

_____ Strong central power

_____ More power for the states

Comments:

3-6 **Do you feel that the existing cultures of Europe could maintain their individuality within a united Europe?**

_____ Yes

_____ No

Comments:

3-7 Do you think that the idea of a "nation state" is becoming obsolete?

_____ Yes

_____ No

Comments:

3-8a **Would you approve the integration of a major part of your own country's armed forces into a permanent supranational force?**

_____ Yes

_____ No

b **If such a force were created, under which auspices would you prefer to see it, European, NATO, United Nations, or some other form?**

_____ European

_____ NATO

_____ United Nations

_____ Other (Specify:_____________________________)

Comments:

3-9 Concerning Europe's role in the Western Alliance: Do you think that Europe should take a more independent position?

_____ Yes

_____ No

Comments:

3-10 Do you feel that the "detente" which has been developing in recent years between the West and the European Communist countries is part of a lasting trend?

_____ Yes

_____ No

Comments:

3-11 Do you think that the United Nations can be transformed, eventually, into a world government?

_____ Yes

_____ No

Comments:

3-12a In principle, would you favor your own national government giving up a certain amount of its sovereignty to participate in some form of world government?

_____ Yes

_____ No

b Do you feel that the majority of your own countrymen agree with you?

_____ Yes

_____ No

Comments:

3-13a As a matter of general policy, would you be in favor of possession of thermonuclear weapons by your own country?

_____ Yes

_____ No

12

b Would you favor possession of such weapons by a future European military force?

_____ Yes

_____ No

Comments:

3-14 On the other hand, do you think that the present nuclear powers should try to limit the further spread of nuclear arms in the world?

_____ Yes

_____ No

Comments:

3-15 Moving from nuclear issues to space, which country do you think will win the "race to the moon", the United States or the Soviet Union?

_____ United States

_____ Soviet Union

Comments:

3-16 Do you feel that this moon race is worth the investment of money and human resources that it is costing these two countries?

_____ Yes

_____ No

Comments:

3-17 Would you say that Europe's efforts in space exploration are appropriate in scale and scope?

_____ Yes

_____ No

Comments:

3-18 Do you think that the cost of space exploration will eventually lead those nations interested in it to cooperate on a world-wide scale in such efforts?

_____ Yes

_____ No

Comments:

3-19 Judging from your own experience and discussions, do you feel that there are certain political issues on which the majority of scientists and engineers probably share a common outlook?

_____ Yes

_____ No

If yes, on which issues? ______________________________

____

3-20 Do you feel that the experience of working in an international atmosphere has changed your perspective on your home country?

_____ Yes

_____ No

Please explain:

3-21 Have your viewpoints on any issues changed since coming to this organization?

_____ Yes

_____ No

If yes, on which issues? ______________________________

____

3-22 After having worked together with people from the various nations of Europe in this organization, would you say that you are now more optimistic or less optimistic about the possibilities of political unification in Europe than you were before you came here?

_____ More optimistic

_____ Less optimistic

Comments:

SECTION IV

PERSONAL BACKGROUND

This final section contains a number of questions of a somewhat biographical nature.

4-1 Where were you born?

Country______________City or town___________________

Year of birth______________

4-2 Did you live anywhere else before beginning your higher education?

_____ Yes

_____ No

If yes, where?

Country______________City or town__________________

______________ __________________

4-3 Father's nationality __________________

Mother's nationality __________________

4-4 Marital status:

_____ Single

_____ Married

_____ Divorced

_____ Widowed

_____ Remarried

4-5 If married, please complete the following information concerning your wife:

Wife's nationality ______________________________

Wife's present occupation ________________________

Previous occupations ____________________________

4-6 Number of children ________________

4-7 Do your children go to school in this vicinity?

_____ Yes

_____ No

If yes, do they go to local schools, schools for children of your own nationality, or international schools (for children of many nationalities)?

_____ Local schools

_____ Schools for children of your own nationality

_____ International schools

_____ Other (Specify:_______________________)

4-8 Travel: In the following list, please place check marks in the appropriate columns to indicate those areas you have visited professionally and as a tourist.

PROFESSIONAL TRAVEL	TOURISM	
_____	_____	Some of Western Europe
_____	_____	Most of Western Europe
_____	_____	Eastern Europe
_____	_____	Soviet Union
_____	_____	United States & Canada
_____	_____	Middle East
_____	_____	Asia
_____	_____	Africa
_____	_____	Latin America
_____	_____	Other areas (which?_______ _______________________)

4-9 Excluding your present situation, have you lived in any foreign countries for three months or longer?

_____ Yes

_____ No

If yes, which and for how long?_______________________

____

4-10 Which languages do you speak?_______________________

____

4-11 On the following scale, how would you classify your own political feelings?

_____ Extreme left
_____ Moderate left
_____ Center
_____ Moderate right
_____ Extreme right

4-12a Currently, how often do you vote in national elections in your own country?

_____ Every time
_____ Frequently
_____ Occasionally
_____ Rarely
_____ Never

b How often did you vote in national elections while living in your own country?

_____ Every time
_____ Frequently
_____ Occasionally
_____ Rarely
_____ Never

Thank you for your cooperation.

APPENDIX 2

Interview Format

Questions are listed below in the sequence in which they were asked. In cases where the text of an interview question was identical to that used on the questionnaire, the question is not reproduced here, but reference is made to the appropriate number. For these questions, see Appendix 1. For each subject the interviewer noted the following information: (1) Laboratory, (2) Nationality, (3) Date and time of interview, (4) Duration of interview, (5) Place and circumstances of interview, and (6) Miscellaneous impressions.

---

1. Could you please tell me something about your work here at (lab)?
2. How long have you been working here?
3. What were you doing before you came here?
4. How did you happen to come to (lab)?
5. Were you considering any other possibilities at the time?
6. What reasons made you decide to come here?
7. What do you consider to be your primary field of specialization?
8. Is the work that you're doing here pretty much within that area?

9. Where did you do your higher education?

10. Did you work anywhere else between the university and the job previous to this one?

11. Did you have any experience in working with scientists and engineers of other nationalities in your previous jobs?

12. Have you found doing research here at (lab) different from your previous experience?

13. Q2-2

14. Q2-3

(Alternative for 13 and 14: To consider a hypothetical situation, if you could take (lab) and place it in (your own country), staff it entirely with (people of your own country), how would this make working at (lab) different for you?

15. Q2-4

16. Have you noted any differences in training or mentality among scientists and engineers from different countries which affect the way they approach problems?

17. Do you work in a (research) team?

18. Could you tell me a little about it?

19. Do you generally find yourself able to complete your work in a normal office day, or do you tend to take work home or work outside of normal hours?

20. Q2-7

21. Q2-8

22. Q2-9

23. Q4-1

24. Q4-2

25. Q4-3

26. Are you married?

27. Is your wife also (own nationality)?

28. Do you have any children? How many?

29. Q4-7

30. Does your wife have any outside occupation, other than taking care of the home?

31. Has she had any in the past?

32. How happy is she with life in (lab location)?

33. Have you found that the friends you've made here are mostly from the organization, or from the area where you live?

34. Looking for a moment towards the future, you've said that you've been here for (x) years; have you given any thought as to how much longer you would like to remain here?

35. Q2-13

36. Q2-12

37. Could you tell me about the travelling you've done? Living abroad?

38. Q4-10

39. Q2-14

40. Q2-15

41. Do you have much family there?

42. Q2-16

43. Q2-17

44. Do you ever find yourself discussing politics (current issues) with your colleagues here?

45. Could you tell me a little about your most recent such discussion?

46. Q2-19

47. Q2-20

48. Q3-1a, b

49. Q3-2a, b

50. Do you believe that the Six will eventually form some sort of political union? Do you favor it?

51. (If yes) Q3-4c

52. Q3-3a, b, c

53. Q3-5

54. Q3-6

55. Q3-7

56. Q3-8a, b

57. Q3-9

58. Q3-10

59. Q3-11

60. Q3-12a, b

61. Q3-13a, b

62. Q3-14

63. Do you think that your own national government should take serious steps toward the adoption of unilateral nuclear disarmament as official policy?

64. Q3-15

65. Q3-16

66. Q3-17

67. Q3-18

68. Q3-19

69. Q3-20

70. Q3-21

71. Q3-22

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