

KAON FACTORY STUDY

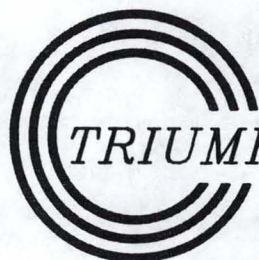
KAON INTERNATIONAL CONSULTATIONS

TRIUMF LIBRARY

TRIUMF

4004 WESBROOK MALL VANCOUVER, B.C., CANADA V6T 2A3

TRIUMF LIBRARY



TRIUMF-KAON PROJECT

KAON FACTORY STUDY

KAON INTERNATIONAL CONSULTATIONS

TRIUMF LIBRARY

TRIUMF

4004 WESBROOK MALL VANCOUVER, B.C., CANADA V6T 2A3

STRUMF LIBRARY



UNIVERSITY OF TORONTO

NEW PASTORAL STUDY

NEW INTERNATIONAL CONSULTATIONS

STRUMF LIBRARY

STRUMF

UNIVERSITY OF TORONTO

452 Princeton Avenue
Ottawa, Ontario
K2A 0N1

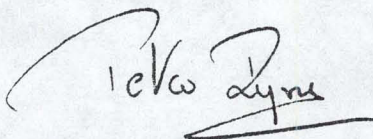
Dr. John Elliott
Chairman, Steering Committee
KAON Factory Design and Impact Study
R.R. #2
Carp, Ontario
K0A 1L0

Dear Dr. Elliott:

Here is a copy of the report on the international consultation exercise for the KAON Project Definition Study. This is a report of the whole team and has been agreed in detail with all the participants. I hope you will find it helpful for the whole exercise.

It was a pleasure working with you on this report.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'Peter J. Dyne', with a stylized flourish at the end.

Peter J. Dyne, Consultant
Head of Delegation
International Consultations
KAON Factory Engineering Design
and Impact Study

Attach.

PJD/bk 27.02.90

INTERNATIONAL CONSULTATIONS

Foreign Government Interest in Participation in KAON

Report by the KAON international consultations delegation:
Dr. P.J. Dyne (ex Energy, Mines and Resources Canada) Head
of delegation, Dr. Erich Vogt (TRIUMF), Ms. T. Burke-Smith
(Industry, Science and Technology Canada) and
Dr. Craig Greenhill (British Columbia), with
Dr. J. Rae (B.C.) and Mr. Philip Gardner (B.C.)

February 28th, 1990

TABLE OF CONTENTS

<u>INTERNATIONAL CONSULTATIONS: EXECUTIVE SUMMARY</u>	i-iv
<u>INTERNATIONAL CONSULTATIONS</u>	1
1. <u>Objectives</u>	1
2. <u>Historical Background</u>	2
3. <u>Alternative Modes of International Participation in Major Science Projects</u>	2
4. <u>Sequence of Consultations and Negotiations for International Participation</u>	4
5. <u>TRIUMF/KAON Proposals for Levels of Foreign Participation</u>	4
6. <u>The Organization of KAON Consultations</u>	5
7. <u>The Consultations - General Observations and Issues</u>	7
7.1 General Observations	7
7.2 Major Issues	7
8. <u>An Overall View of the Responses</u>	7
9. <u>Country-by-Country Consultations</u>	9
9.1 <u>The United States</u>	9
9.2 <u>The Federal Republic of Germany</u>	11
9.3 <u>France</u>	14
9.4 <u>Italy</u>	16
9.5 <u>The United Kingdom</u>	17
9.6 <u>The European Communities</u>	19
9.7 <u>Japan</u>	19
9.8 <u>Korea</u>	22
9.9 <u>Other Countries</u>	24
10. <u>General Summary</u>	24

APPENDICES

- Appendix I Long Range Plan for U.S. Nuclear Science:
Budget Requirements (Graph), 1989
- Appendix II Letter from the Director,
Institute for Nuclear Study, Japan

KAON INTERNATIONAL CONSULTATIONS

Executive Summary

Foreign participation is essential for KAON to proceed. Of the 800 scientists expected to work at KAON, two-thirds would come from abroad, and one-third would be from Canada. TRIUMF/KAON staff had estimated that foreign participation in components valued at \$200M was a reasonable target. Based on the number of foreign scientists expected to be working at KAON, it was proposed that about one-half of foreign contributions (\$100M) would be appropriate from the United States; the balance would be roughly split between Europe and Japan.

The proposed mode of participation, contributions in the form of components manufactured by the participating countries, was successfully used by German (FRG) scientists for their HERA accelerator. This mode is appropriate where the facility has unique characteristics attracting wide international interest, and where scientists from the host country would be in the minority. KAON falls into this category.

A delegation, established under the Canada-British Columbia Agreement on the proposed KAON Factory Engineering Design and Impact Study, visited selected countries to determine their interest in the project; formal indications of participation were the desired outcome.

Given that Canada had not made a commitment to KAON, the delegation might only have expected to obtain expressions of general interest from foreign partners. The physics communities in several of the countries consulted, however, had shown strong support for KAON and had expressed this support to their own funding agencies. As a consequence, government officials in a number of countries provided substantive responses, far more than expressions of interest. It must be emphasized, however, that all the responses express intentions; commitments can only be obtained after Canada has committed to KAON. Extensive negotiation will be needed to transform intentions into commitments.

Written responses to proposals for participation have been obtained from the governments of all countries consulted, with the exception of Japan. Responses from Germany and the U.S., two key participants, are as positive and substantive as could be expected in the context of these consultations. The U.S. Department of Energy has indicated its intention to request in its budget submission, funding for KAON at \$100M (Cdn.) over five years. German laboratories intend to participate in KAON at a level which at least matches Canada's earlier contribution to the FRG HERA accelerator. With these two key responses, other letters and communications, there are reasonable expectations that the

total participation which can be negotiated could be close to the \$200M target.

During the KAON consultations, the British Columbia members of the delegation emphasized the provincial interest and commitment to KAON. At the same time, it was made clear that KAON was not, at this time, an approved, committed project, and that the Government of Canada would make its decision following completion of the KAON Engineering Design and Impact Study which includes this analysis of the potential for foreign participation.

In broad outline the consultations confirmed:

- that KAON would be a unique, world-class facility addressing important areas of nuclear and particle physics. Worldwide, only one such facility would be built.
- that some two-thirds of the scientists working at KAON would come from the countries consulted.
- that international participation in the project was both appropriate and necessary.
- the need for Canada to make an early decision on KAON construction.

The principal issue in all countries was the extent to which the funding sought was available in current budgets and, if not, whether there was a reasonable probability of obtaining increased funding for participation in KAON.

Because Canada has not made a commitment, written responses received are cautiously phrased and conditional. Clearer and more positive answers would probably be obtained when Canada has made a commitment to KAON. The responses, summarized below, nevertheless set clear terms of reference and boundary conditions for negotiations with participating countries, following commitment by Canada.

The positions established were, in brief:

United States

The U.S. Department of Energy has indicated its intention to request in its budget submission, funding for KAON at \$100M (Cdn.) over five years. This response is the strongest possible within the context of these consultations. The U.S. budget request requires early Canadian commitment to KAON. Budget approval may require political representations at several levels.

Germany

With the endorsement and support of BMFT (FRG research and technology ministry), the two key German laboratories are prepared to contribute to KAON at a level which matches Canada's earlier contribution to HERA. Skilled manpower, a crucial element, would form an additional part of German participation.

France

Participation at a low level could be funded from current budgets. French estimates of the number of their scientists who might work at KAON suggest that participation at a more significant level might be justified and funded if other projects currently under consideration were deferred or cancelled. A more substantive response could be expected if KAON is approved.

Italy

The Italians face severe budgetary constraints and have to plan for a number of proposed projects which compete for funds with KAON. Participation at a low level could be funded out of current budgets. This amount could be increased if some of the key competing projects were delayed or cancelled. Again, a more substantive response might be expected if KAON is approved.

United Kingdom

The U.K. has severe budgetary constraints, and in addition, KAON does not fit within current U.K. scientific priorities. The U.K. is consequently unable to contribute to components for KAON construction. It is anticipated, however, that design assistance will continue.

European Communities

There are possibilities for participation; discussions are still at a preliminary stage.

Japan

No response can be expected until Canada has made a commitment. The KAON Factory project has strong support from the Japanese nuclear physics community. Based on the consultations, it is possible that, with clear expressions of intentions to participate in KAON from other countries (which we now have), and a commitment by Canada, Japan might be prepared to participate in

KAON. The proposed level of participation itself (\$50M) did not seem to be an issue. With careful negotiation by Canada, following its commitment to KAON, there appears to be a reasonable possibility of obtaining Japanese support at the proposed level of \$50M.

Korea

The Korean response indicates possible participation in the range of \$6M-12M, but support is conditional on a contribution from Korean industry. Korean officials are commissioning a study to assess relevant Korean industrial expertise and benefits to Korean industry from participation in KAON. The results of the study are expected within a few months.

Other Countries

Scientists from other countries not included in the consultations, such as Israel, China, or the U.S.S.R., are interested in KAON science. These countries could be approached at a later date for possible contributions.

Summation

The dollar (current) values of possible support as estimated by the KAON delegation, can be summed as: U.S.A. \$100M; Europe \$17M to \$31M; Japan, some \$50M; for a total of \$167M to \$181M. This summation excludes: possible contributions from Korea (\$6M to \$12M), from the EC, and from other countries not included in the consultations; the possibility of increased participation from Italy; the substantial value of seconded design staff from Germany; and, contributions for experimental equipment.

It must be recognized that there are still many uncertainties inherent in the present consultations by Canada, which will be resolved only by negotiation. None of the contributions are assured in any absolute sense. There is, nevertheless, reasonable expectation that the total participation which can be negotiated could be close to the \$200M target. This outcome, a success in the context of these consultations, is a consequence of the interest and support for KAON science by the nuclear physics communities in other countries.

INTERNATIONAL CONSULTATIONS

1. Objectives

Foreign participation is a key element of the KAON proposal. The intent (purpose) of the international consultations was:

- a) to inform foreign governments, scientists, and the private sector, of the KAON Factory Engineering Design and Impact Study (Project Definition Study), and keep them apprised of its progress;
- b) to communicate to potential international partners and interests the specific requirements for parts of the facility/operation that could be provided from non-Canadian sources; and,
- c) to determine the extent of foreign governments' interest in participating.

Under the terms of reference of the Canada-British Columbia Agreement on the proposed KAON Factory Engineering Design and Impact Study, "Formal indications by foreign governments that they would be prepared to participate in this project would be a desirable output of these consultations".

The objectives of the three partners to the consultations, TRIUMF, the technical advocates for KAON, the Government of British Columbia, which considers KAON as its major science and technology priority, and the Federal Government also had to be represented. These additional objectives were:

TRIUMF

- to generate the expectation that the project would definitely proceed, cultivating the interest of foreign scientists; and
- to obtain support for the project from foreign scientists and governments.

Provincial Government

- to encourage commitments from foreign governments towards the capital costs of the facility, which would encourage the federal government to provide the balance of the funding needed for the project to proceed.

Federal Government

- to ensure that potential foreign partners were informed of the Study and its progress; and,
- to ensure that potential foreign partners were aware that no decision to proceed to build KAON had yet been made, although both levels of government would give this serious consideration upon completion of the Study.

2. Historical Background

Canada, in 1985, was the first country to propose a KAON factory. Similar proposals soon followed from the U.S.A., Japan and Europe. It quickly became clear, however, that, world-wide, only one KAON Factory would be needed. In addition, because of the international interest in KAON science, international participation in construction of the facility was essential. Recognizing this, Canada's first KAON review committee in 1986 recommended that foreign participation at a level of \$75M (about one-eighth of the construction costs) be required for a Canadian KAON Factory to proceed.

In reviewing the potential for foreign participation, TRIUMF/KAON staff noted that the German HERA project, which had similar, unique features attracting international interest, had set a target of an international contribution, one-third of the construction costs, in the form of components (not cash). This higher target was felt to be appropriate also for a Canadian KAON. Civil construction, for which offshore participation is inappropriate, accounts for one-third of the total costs. The remaining two-thirds, mostly high technology items, would be balanced equitably (\$200M each) between domestic and foreign contributions.

Preliminary international discussions on a Canadian KAON Factory by the Hanna Committee in 1987 indicated to the KAON advocates that there was a reasonable prospect for gaining international support at the \$200M level proposed. The objective of the current consultation process was to determine, with greater precision, foreign interest and possible commitment to participation.

3. Alternative Modes of International Participation in Major Science Projects

Three models of international participation were open for discussion. They were:

- a) The "CERN MODEL" in which a number of countries pool resources, through some appropriate formula, and jointly have legal and financial control. This model was pioneered by European countries for CERN, but has since been used for the European Space Agency (ESA), the French-British-German high-flux reactor at Grenoble (ILL), the large European fusion project (JET), and other science projects. Member countries have a long-term and relatively open-ended commitment to the continuing project.
- b) The "NATIONAL PLUS MODEL". In this model a single host nation dominates the science but invites other nations to participate. Because the host nation dominates, it usually does not require commitments from foreign partners before making its own funding decision. There are many examples: the Superconducting Supercollider (SSC) project in the United States, the existing TRIUMF project in Canada, UNK in the USSR, KEK in Japan, Gran Sasso in Italy.
- c) The "HERA MODEL", developed by the Federal Republic of Germany, applies to projects which are intrinsically international - no nation dominates the science; it is an alternative to the CERN model. The host country provides the bulk of the construction and operating costs of a major new project while retaining legal and financial control. The majority of scientists and experiments are from abroad. Foreign countries are invited to make substantial contributions to project construction and are invited to participate in advisory bodies relating to the construction phase and the experimental program.

Since the Canadian KAON factory would be a unique, world-class facility, and Canadian scientists would be in the minority, the 'National Plus' model would be inappropriate for KAON. The 'CERN' model, which requires long term commitments to operating and infrastructure costs, was seen as being difficult to launch internationally at the present time. The HERA model emerged as being plainly most applicable.

Countries which have a substantial number of scientists engaged in the subfields of atomic physics which the new facility will address are most likely to participate in KAON. In an ideal world, the amount of support should be roughly proportional to the number of foreign scientists expected to be active participants.

4. Sequence of Consultations and Negotiations for International Participation

The sequence of events for consultation and negotiation in establishing a project under the HERA model, the basis of the approach to be used for KAON, is as follows:

- . A host country proposes a large new project originating from its existing excellence in the field.
- . The host country explores the interest of foreign partners in the project. (Canada did this with the Hanna Committee which visited the U.S.A., U.K., Italy, Federal Republic of Germany (FRG), and Japan in 1987.)
- . The host country indicates its serious intention with regard to the project. (In the case of KAON, the G7 Working Group in High-Energy Physics said in May 1988 that a commitment by Canada to the Project Definition Study would be such a statement of intent and would serve as a basis for engaging foreign participation.)
- . With this statement of intent, the host country consults in some detail with potential partners on the form and extent of their participation. The present consultations constitute this step for KAON.
- . On the completion of its consultations and other necessary studies, the host country makes a decision about whether or not to proceed with the project.
- . After a final decision to proceed, the host country formally negotiates the contributions from abroad, based on earlier consultations.

5. TRIUMF/KAON Proposals for Levels of Foreign Participation

Following visits by the Hanna Committee, and on the basis of continuing discussions between TRIUMF and scientific communities in various countries, all G7 countries were approached in a two-round formal consultation process undertaken as part of the Project Definition Study (PDS). Korea and the European Communities (EC) were approached in the second round.

Levels of participation (contributions) in KAON proposed by TRIUMF/KAON staff for individual countries, roughly proportional to the anticipated number of their users, were the basis of all consultations. The following table shows the estimated percentage of KAON users for each country, and the corresponding proposed level of participation (in \$1987 Cdn.).

TABLE I

Estimates of Percentages of KAON Users
and Proposed Levels of Participation, by Country

COUNTRY	ESTIMATED % OF KAON USERS (a)	PROPOSED LEVEL OF PARTICIPATION (Canadian \$)
CANADA	30 - 35	400 M (b)
UNITED STATES	30 - 40	90 M
JAPAN	8 - 10	50 M
GERMANY	6 - 8	30 M
ITALY	5 - 7	30 M
BRITAIN	1 - 3	(c)
FRANCE	1 - 3	(c)
KOREA (d)	1 - 2	10 M
EC (d)	1 - 2 (e)	10 M (e)
OTHER	8 - 15	10 M

- (a) Total number of users estimated to be about 800.
- (b) Includes funds already committed by the Province of B.C.
- (c) Amount to be suggested during consultations.
- (d) Korea and the European Communities (EC) were included in the second round of consultations only.
- (e) Not discussed during consultations.

6. The Organization of KAON Consultations

The delegation, appointed jointly by the Federal and British Columbia governments, consisted of Dr. P.J. Dyne (ex Energy, Mines and Resources Canada) Head, Dr. Erich Vogt (Director, TRIUMF), Ms. Tricianne Burke-Smith (Industry, Science and Technology Canada). The B.C. Government was represented by Dr. James Rae (Europe 1st Round), Dr. Craig Greenhill (Japan 1st Round, Europe 2nd Round and the U.S.A.), and Mr. Phillip Gardner (Japan 2nd Round, and Korea). Dr. Vogt and the B.C. representatives played the advocacy role.

The consultation meetings were organized through Canadian Embassies and High Commissions in the countries visited. Science counsellors and commercial counsellors played a key role in organizing meetings, establishing contacts with senior officials in the responsible ministries and agencies, briefing the KAON delegation, and participating in the consultations.

The purpose of the first round of consultations was to inform prospective participants about KAON, to establish their possible level of interest, and to learn of the issues they faced in responding to our proposals.

For these consultations to have any value in the ultimate decision on KAON, the delegation's report had to be based on written responses from prospective partners. An account of verbal responses only would be inadequate. At the same time, this requirement had elements of risk: prospective partners could, in an international context, be extremely reluctant to make any written response to the hypothetical question posed "If Canada were to make a commitment to KAON would your country contribute \$XM?"

The purpose of the second round was to solicit a written response to the proposals tabled in the first round. The letter sent to all interlocutors prior to the second round of consultations included the following paragraphs:

"We would like to hear your assessment of the interest in KAON of your scientific community and the possible level of participation which it might merit.

In discussing your possible response we fully realize that any participation proposed at this time would be conditional. It could only indicate the nature and scale of the participation which your country could offer once Canada has made a formal commitment to proceed. For our purposes it would be most helpful if, after the meeting, a letter could be sent to Dr. John Elliott, the Chairman of the KAON Factory Engineering Design and Impact Study Steering Committee, summarizing your position. Such a letter would, doubtless, outline some terms and conditions of your own. To avoid future misunderstanding we would like to discuss any such conditions when we meet."

As will be seen, all countries, with the exception of Japan, were able to provide a written response.

7. The Consultations - General Observations and Issues

7.1 General Observations

In the broadest terms, the conclusions of the consultations included the following general observations, confirmed in the letters of response:

- The KAON Factory is regarded as a high quality, timely project for particle physics;
- The need for and value of international collaboration in KAON is recognized;
- The key for any commitment for foreign participation was a clear expression of interest and support from the nuclear and particle physics community in each country;
- The need for Canada to make an early decision on KAON construction; and,
- For the most part, agreement with TRIUMF/KAON estimates of the number of scientists from each country likely to work at KAON.

7.2 Major Issues

While there was agreement on the preceding generalities, three major issues faced prospective partners:

- i) Whether the dollar amounts asked for were reasonable, and whether they would be cost effective, relative to the country's interest in this field of physics.
- ii) Whether or not the amount of funding requested was available from current and/or planned budgets.
- iii) In cases where such funding was not available from current or planned budgets, whether there would be any chance, in the political arena, of getting it.

Most of the countries consulted could respond positively to the first issue. The second, the availability of funds, was a major concern. Only one country, the U.S.A., indicated that it intended to ask for new funds for KAON outside current budgets.

8. An Overall View of the Responses

Our opening position in these discussions was that Canada had made no commitment to KAON and that, as a consequence, we were consulting, not negotiating. With these constraints, the prospective outcome of these consultations seemed to be

circumscribed. The delegation might only expect to obtain, at best, cautious, qualitative expressions of interest. There would be a reluctance, in the sensitive international environment, to provide the specific written responses we sought.

In addition, all our prospective partners were contemplating the construction of other, possibly competing, nuclear physics facilities at home. Countries would face internal political difficulties if they were to propose support for an additional project offshore. These factors would make it even more difficult for them to provide positive expressions of support for KAON. Positive responses were, however, the desirable output sought under the Canada-British Columbia Agreement.

These concerns did not take into account the scientific merits of KAON and the unequivocal expressions of interest and support for KAON made by the nuclear and particle physics communities in other countries to their funding agencies. Because of this internal support, the responses from Germany and the U.S., in particular, are as positive and specific as could be obtained in the absence of a Canadian commitment. Responses from other countries consulted are positive and supportive but, for different reasons, less specific than those from the U.S. and the FRG.

While Japan's present position corresponds only to the KAON delegation's minimum expectations (cautious interest and no written response), the support of its scientific community is explicit. With this support, the responses we now have from other nations, and a commitment by Canada, there is a reasonable possibility that Japan will be prepared to support KAON.

In the opinion of the KAON delegation, the sum of the variously expressed intentions of foreign partners could come close to the \$200M target. Considering the constraints noted above and the desirable output sought, this can be viewed as a successful outcome.

Because Canada has not made a commitment to KAON, all the written responses received are necessarily conditional. They express intentions, not commitments. These written responses will, however, form a basis for future negotiations, setting the terms of reference and boundary conditions for agreements on participation following a positive decision by Canada to proceed with KAON.

9. Country-by-Country Consultations

9.1 The United States

Context

The U.S. Department of Energy (DOE), the funding agency for large nuclear and particle physics facilities, develops programs and priorities in consultation with the Nuclear Science Advisory Committee (NSAC), which represents that community. The Feshbach Committee was established by NSAC in 1988, following the 1987 Hanna visit, to provide advice on the technical potential and capability of KAON in the context of existing and projected facilities in the U.S.

The Feshbach Committee, besides recommending support for domestic projects CEBAF and RHIC, to be funded out of currently approved allocations, recommended that DOE seek from Congress additional funding for KAON as a "new initiative". The Committee identified expenditure on KAON as being "cost effective"; in supporting KAON, the Committee recommended against funding the U.S. competitor to KAON. The Committee estimated that some 275 U.S. scientists might be interested in working at KAON (TRIUMF/KAON estimates were in the range of 240 to 320).

The Feshbach Committee recommendations were included in NSAC's Long Range Plan for Nuclear Science, submitted to DOE. The recommendation on KAON, one of the three dealing with major facilities, reads as follows:

"NSAC recently endorsed the fundamental and exciting scientific opportunities that will become available with a high-intensity, multi-GeV hadron facility. These opportunities will extend our knowledge both of the strong force, which determines nuclear dynamics based on quarks and gluons, and of the electroweak force, which provides stringent tests of the basic laws governing subatomic phenomena. The Canadian invitation for U.S. participation in the construction of an international research facility, KAON, with Canada providing full support for the operation of the facility, provides an exceptionally cost-effective way for the U.S. nuclear science community to address this important physics in a timely fashion. We recommend with very high priority that the U.S. enter into negotiations with Canada to participate in the construction and use of KAON."

This strong endorsement by the U.S. nuclear and particle physics community provides DOE with the internal support needed to request additional funds from Congress for participation

in KAON. The impact of this additional funding for KAON on the total U.S. nuclear physics budget is shown in Appendix I.

TRIUMF/KAON had proposed U.S. participation in KAON at a level of \$Cdn.90M (\$1987), equivalent to \$U.S.75M (\$1987). U.S. authorities recognize that the level of their contribution must be negotiated taking inflationary increases into account, thus the \$U.S.75M (\$1987) would be equivalent to some \$Cdn.100M (\$1991). This would form the basis for negotiations.

Response

From Dr. J. Decker, A/Director, Office of Energy Research, U.S. Department of Energy:

"Following the meeting held in Washington, D.C. on January 18, 1990, with the Canadian delegation headed by Dr. Peter Dyne, I would like to inform you of the current position of the Department of Energy (DOE) on the KAON Factory Project.

From the time of the first formal DOE contact by a Canadian delegation in October 1987, it has been our perception that the proposed KAON Factory would be a valuable world-class research facility. We also learned at that time that, for Canada to proceed, rather significant construction contributions would be needed from foreign partners. It was then determined that DOE should consider whether, scientifically and logistically, participating in such a partnership would indeed be appropriate and desirable. As an important component of our deliberations, we and the National Science Foundation asked for the advice of our Nuclear Science Advisory Committee (NSAC). After a most careful and thorough consideration of the matter, NSAC concluded, "...a high intensity 30 GeV proton beam and the secondary kaon, pion, neutrino and antiproton beams will provide fundamental and exciting opportunities in nuclear and particle physics. The relatively modest cost associated with U.S. participation in KAON and the timeliness of a near-term start make such participation a very attractive option." In the course of these deliberations, we have seen that there is a substantial body of U.S. scientists interested in the kind of physics that can be addressed at KAON, and that estimates of potential U.S. use of the facility ranging upwards of 30% of the total use are well founded. NSAC also addressed the KAON question in the context of preparing its new long range plan for U.S. nuclear science, Nuclear Science in the 1990's, released in December 1989. NSAC again endorsed U.S. participation in KAON and recommended with high priority that additional funding be sought for this purpose.

I understand that Canadian planning for possible foreign contributions to the KAON project assumes U.S. support of

approximately \$75 million, with a presumption that the contribution would probably be "in kind". I also understand your assumption that, if KAON proceeds, responsibility for detectors and apparatus for specific experiments would rest with the experimental teams, and that U.S. scientists would be responsible for providing an appropriate share of such devices. Further it is my understanding that the full operating costs of the facility would be borne by Canada and that you are planning to operate KAON in accordance with guidelines set by the International Committee on future Accelerators.

The issue of support for U.S. participation in KAON will be addressed in DOE's budget deliberations for fiscal year 1992, with full awareness of your planning assumptions as outlined above. In addition to financial considerations, the question of U.S. participation in the construction of a facility owned by another country will require policy attention to the special circumstances that are involved. No decision could be made, however, before Canada's commitment to go forward with the project.

It appears to us that the KAON Factory is an exciting and important project, and clearly of interest to the U.S. nuclear physics community. I look forward to further interactions with you regarding this project."

9.2 The Federal Republic of Germany (FRG)

Context

A review group, the Specht Committee, was established by the FRG Ministry responsible for research and technology (BMFT) to review the whole German nuclear physics program. In the context of international activities, the Committee report placed first priority on German participation in KAON, and recommended against construction of the then, competing, European Hadron Facility.

FRG scientists and officials were, in both rounds of consultations, strongly supportive of participation in KAON. The FRG understands the dynamics of the consultation process used for KAON, as the process had been pioneered by the FRG for its own HERA project. Officials were also cognizant of the early commitments made by Canada to participate in the HERA facility.

The results of a BMFT poll of its nuclear physics community (particle physicists were not included) did not seem inconsistent with TRIUMF/KAON estimates of a total of 40 to 60 FRG scientists interested in working at KAON. FRG authorities were not concerned with the actual number of German scientists likely

to work at KAON; the FRG contribution would be based on other considerations and validated by German interest in KAON physics.

Scientists in two German laboratories, DESY (HERA) in Hamburg and KFA in Juelich (COSY), and a number of university scientists have interests in the scientific program at KAON. Participation in KAON could be arranged through the mandate for international collaboration held by both laboratories. BMFT officials emphasized that, as part of the laboratories' programs, FRG support for KAON would be a continuing and growing commitment.

Response

From Dr. J. Rembser, Director General, Bundesministerium fur Forschung und Technologie:

"Following our various consultations, the most recent one having taken place at the BMFT on November 21, 1989, I should like to make the following points which outline the position and commitment of the Federal Ministry for Research and Technology (BMFT) with respect to the planned "KAON Factory" at TRIUMF in Vancouver:

1. *The importance of KAON for particle physicists all over the world is being reflected by the strong interest of the scientific community, world-wide as well as in the Federal Republic of Germany. BMFT regards KAON as an important complement to the world-wide spectrum of particle accelerators and as an outstanding Canadian contribution to this fascinating field of experimental sciences. Similar projects in various countries have been shelved hoping for Canada's decision to undertake KAON.*

In view of German experts' impressions formed during discussions with their international colleagues and of their resulting positive recommendations, BMFT is convinced that KAON would be a world class facility worth strong international support.

BMFT feels that the research opportunities which would be offered by KAON would be beneficial for German particle physics research. Therefore, BMFT would welcome an early decision of the Canadian authorities to proceed with the construction of KAON.

2. *Provided that this decision be taken, the German side will commit to contribute to the construction of KAON by experimental equipment and other components as well as by skilled man-power. In the construction phase, the research centers DESY and KFA Juelich will be the partners of TRIUMF.*

In addition, BMFT is willing to include experiments at the KAON factory into the national programme in nuclear and medium energy physics.

3. *Details of the German participation still have to be discussed on a technical level between the participating laboratories. In this respect DESY and KFA will act as major agents for BMFT. I am enclosing a letter of those two labs to Professor Vogt outlining their commitment which is hereby endorsed by BMFT.*

Based on our past consultations and taking into account the discussions referred to in para. 3 above, we will then have to define in detail our commitment mentioned in para. 2 above. To this end the Canadian contribution to HERA could serve as a guideline."

As cited in the letter from BMFT, the KAON Study Steering Committee Chairman received the following letter which outlines, in more detail, the role to be played by the two German laboratories.

From Dr. V. Soergel, Director of the DESY laboratory, and Dr. J. Treusch, Director, KFA Juelich:

"With this letter we would like to let you know that our laboratories, the Forschungszentrum Juelich, KFA, and the Deutsches Elektronen-Synchrotron DESY, are prepared to collaborate with TRIUMF in the construction of the KAON-facility. This should be seen as a continuation of the excellent collaboration between Canadian institutions and DESY in the construction of HERA with important contributions from Canada.

KAON will in our opinion provide unique research possibilities, and there is definitely a strong desire in the physics community worldwide for a facility with its characteristics, providing the potential for a number of fundamental experiments. Several groups in Germany have expressed their interest to perform experiments at KAON. The size of that community and a concrete research program will only emerge however, once proposals for experiments can be submitted for the approved facility.

We are delighted by the progress towards realisation of the KAON-project which has been achieved over the last year and about the positive reactions from the Governments of Canada and of British Columbia, communicated at the meeting on International Collaboration on KAON on October 27/28, 1989 in Vancouver. The approval of KAON will hopefully come soon so that experimental teams can begin to concentrate their work on the preparation of experiments.

From the discussions with Prof. Erich Vogt and his presentations at the Vancouver meeting and on the occasion of the visit of the Canadian delegation, headed by Dr. P.J. Dyne, to the BMFT in Bonn on November 21st, 1989 we understand that sizeable contributions from foreign countries to the construction of the accelerator facility are expected by the governments funding TRIUMF.

In order to promote an early approval of KAON, we declare already now that DESY and the KFA are prepared to collaborate in the construction of the accelerator facility through the contribution of components and also by the delegation of accelerator experts, providing in this way a contribution from Germany to KAON.

The BMFT will support our foreseen collaboration in KAON. For the level of the material participation of our two laboratories to KAON we would use as an initial guideline the Canadian contributions to HERA, this to be better defined once the components to be provided will be discussed. The areas where these contributions should be made will have to be specified at a later stage with the KAON management, after approval of KAON, on the basis of the final proposal. To make our collaboration most effective for KAON, such areas should be chosen where DESY and the KFA have particular technical experience which may not be readily available in Canada, as discussed at the Vancouver meeting. We hope that DESY and KFA will be able to collaborate in the construction of KAON in the same good spirit and style as Canadian institutes have collaborated in the construction of HERA and that our two laboratories can help to bring this important facility for basic research into existence."

9.3 France

Context

France has a budget envelope for nuclear and particle physics. In making allocations, French officials have to assess both the significance and the uncertainties in a number of competing projects (European and French). KAON is, in effect, another competing, as yet uncommitted project. The KAON delegation was advised that a response to KAON participation would be easier and more positive if and when KAON is approved.

There is already significant cooperation between TRIUMF and the French Laboratoire National Saturne (LNS). A five-year Memorandum of Understanding between LNS and TRIUMF, signed in November 1989, specifies that Saturne technical staff will contribute to specific studies for the KAON project.

Response

From Dr. P. Lehmann, Director, Institut national de physique nucléaire et de physique des particules and Dr. D. Cribier, Director, Institut de recherches fondamentales du commissariat à l'Energie Atomique:

(English translation) "When it visited France on April 24 and November 17, the international consulting team which you established described for us the design of the proposed KAON Factory at TRIUMF. We are writing to inform you of the conditions under which the French nuclear physics and particle physics community views and has received this project.

The project is clearly of considerable scientific interest; in our view, this fully justifies the hypothesis that Canada could obtain contributions from interested partners amounting to one-third of total construction costs. For our part, we feel that, under present conditions, some 20 French physicists would likely make proposals and work at a KAON Factory in British Columbia.

This figure is strictly dependent, however, on forthcoming decisions in France and Europe concerning the facilities which will be offered to physicists in the coming decade, both in nuclear and particle physics (e.g., construction of an electron accelerator, a tau facility, LHC at CERN, etc.).

This situation prevents us, at present, from specifying the nature and volume of French participation in the Canadian project. Nevertheless, we expect these uncertainties to dissipate over the coming year.

Similarly, a firm decision by Canada, within the same time frame, to go ahead with KAON at TRIUMF, would obviously change the position of French physicists and would attract more people to the project.

In any case, it can be assumed that any participation by French physicists will be accompanied by a financial contribution from France at an appropriate level. In this regard, the recent agreement between TRIUMF and the Saturne laboratory should be considered the first step in a process that will involve France at a level compatible with the commitment of its physicists.

Finally, we wish to remind you of the very special ties between Canada and France that, in our view, provide considerable assurance of our cooperation in the KAON Factory project."

9.4 Italy

Context

The Italians face three issues in considering their participation:

- 1) The Istituto Nazionale Di Fisica Nucleare (INFN) has a five-year budget cycle (1989-93). Extra funds cannot be requested outside the envelope set in this cycle.
- 2) Within this budget, INFN anticipates having to fund a number of projects, many of which are at the proposal and discussion stage. Projects include a Large Hadron Collider, a European superconducting supercollider (with a \$1.6 billion price tag) which might or might not be built at CERN. Italy is also being strongly pressured by CERN for further support for other projects.
- 3) The future of the Italian Low Energy Antiproton Ring (LEAR) project and the estimates of Italian scientists likely to work at KAON. The majority of Italian scientists who might be interested in KAON science are currently at LEAR. If LEAR is shut down or not upgraded, a total of some 100 scientists might become interested in using KAON to study high energy antiprotons. If, however, LEAR were to be upgraded, these scientists would likely continue to work in Europe, and only a much smaller number, as few as 10 Italian scientists, might then have interest in working at KAON.

TRIUMF/KAON estimated that some 40 to 60 Italian scientists would be interested in working at KAON. Because of the interests of Italian scientists in projected Italian and European projects mentioned earlier, Italian officials did not accept TRIUMF/KAON estimates of Italian interest in KAON. They acknowledged, however, that Italian interest would be greater if Canada were committed to the KAON Factory, and if some of the competing, proposed European or Italian projects were to be shelved or abandoned.

Response

From Professor N. Cabibbo, President, Istituto Nazionale Di Fisica Nucleare:

"Following the meeting held in Rome on November 20, 1989, with the Canadian delegation headed by Dr. P.J. Dyne, I wish hereby to confirm you the present INFN position about the KAON Factory Project.

1. *We confirm our opinion that the KAON Factory, if rapidly built, would certainly represent a first class world facility;*
2. *INFN, therefore, strongly urges Canada to make an early decision to proceed with the construction of KAON;*
3. *We understand that for KAON to go ahead, Canada needs to anticipate receiving about a third of the total construction costs (about 621 million of Canadian dollars in 1989) from abroad.*

Consultations by Canada with its potential foreign partners indicate that such a result can be finally achieved;

4. *INFN welcomes European participation in KAON at an appropriate level of contribution;*
5. *When Canada makes its decision to proceed with the construction of KAON, INFN is in principle prepared to be a partner for the European KAON contribution, providing components for KAON construction on a scale commensurate with Italy's developing scientific interest in KAON."*

9.5 The United Kingdom

Context

U.K. policy in nuclear and particle physics is to concentrate scientific effort on phenomena at the highest energy. This policy is implemented by supporting such activity almost exclusively at CERN. Given current U.K. budgetary constraints, other facilities cannot be funded. As estimated by TRIUMF/KAON, a small number of U.K. scientists would be interested in working at KAON. It was anticipated by the KAON delegation, however, that both policy and a limited budget would likely prevent the U.K. from considering participation in KAON construction.

Response

From Professor E.W.J. Mitchell, Chairman, Science and Engineering Research Council:

"Following several visits of Canadian delegations to the U.K., and informal discussions that have taken place at other times, including my own visit to TRIUMF, I am now writing to advise you formally of the U.K. position regarding the proposed Canadian KAON Factory.

Firstly, I should make it clear that the scientific field of your KAON Factory falls fully within the remit of SERC, and our arrangements in the U.K. are such that as Chairman of SERC I am expressing the views of the relevant authority in the U.K. in relation to the approach you have made.

The SERC welcomes the initiative that Canada has taken in proposing KAON, which fills a gap in the suite of world-wide facilities for research in nuclear and particle physics. It is also good that Canada now intends to join the "club" of nations who provide, either from their own resources or in multinational collaborations, a major facility to which scientists throughout the world can gain access.

However, a KAON machine is not well matched to the interests of the U.K. community. Our nuclear physics community is relatively small, by the standards of continental Europe, and its activities are centred very largely on the Nuclear Structure Facility at our Daresbury Laboratory, together with a small collaborative programme at Mainz (West Germany). In particle physics, the major involvements are in CERN and HERA (DESY Laboratory, Hamburg). All these programmes entail long-term commitments, and the pressures on budgets are now such that the SERC can make very little resources available to support other activities in these areas.

Thus, there are currently only about ten U.K. physicists who might wish to be involved in research at the KAON Factory. They will probably wish to join in proposals for collaborative experiments with colleagues in Canada and possibly other countries too. At the appropriate time they should submit their proposals for consideration by our peer review system. If the proposals are competitive, and the sums required are modest, then they should stand a fair chance of gaining support. I am sure you are aware of the recent success of a small U.K. group at Oxford in gaining support to join in the Sudbury Neutrino Observatory through this mechanism. However, I must stress that the extent of any such support is bound to be modest, and there is no possibility of the U.K. providing a secondary beamline or anything comparable.

As regards the design and construction of KAON, I very much hope that the existing collaboration between the KAON team and our Rutherford Appleton Laboratory will continue. We will be happy for RAL scientists and engineers with relevant expertise to continue to contribute to the physics design through seminars, workshops, etc. We will also be happy to undertake more specific studies, but for these we will need to negotiate formal repayment terms, as required by Treasury regulations.

I am also happy to offer the good offices of RAL to provide an interface between the KAON project team and U.K. firms who may have the expertise and capacity to make competitive tenders for

the supply of equipment and components for KAON. If you want any help in this regard, please write direct to Dr. P.R. Williams, Director RAL.

Finally, I would like to extend my personal best wishes to you and your colleagues for the success of the KAON project. It is an imaginative project and I am not surprised at the considerable interest the proposal has aroused in countries with large nuclear physics communities. Given that we in the U.K. cannot do everything, nuclear physics, as opposed to particle physics, is not an area which we wish to expand."

9.6 The European Communities (EC)

Context

German officials had suggested to TRIUMF/KAON staff that the EC might have interest in supporting scientists from the smaller EC countries (e.g. Belgium, Holland, Denmark) to work at KAON. The EC might accordingly consider contributions to KAON construction.

The KAON delegation met with EC officials in November 1989 to brief them on the KAON Factory and on the status of the international consultations. The officials were interested and supportive. They advised that any proposals for EC participation in KAON would have to be considered by CODEST, the EC advisory committee on science and technology research. For this to happen, nuclear and particle physicists in these smaller EC countries would have to make known to CODEST their interest in working at KAON. Currently, TRIUMF/KAON staff are alerting colleagues in the scientific communities of these smaller EC countries to this possibility, and will keep EC officials aware of such overtures.

Since it is unlikely that substantive developments with the EC would occur before spring 1990, no conclusions for the EC can be included in this report.

9.7 Japan

Context

Japanese scientists have been working for some time at TRIUMF, and making significant, internationally recognized contributions. Their interest in KAON is high. The TRIUMF/KAON estimate of the number of Japanese scientists likely to want to work at KAON is second only to that for the U.S.A. The level of

Japanese participation in KAON proposed by TRIUMF/KAON (\$50M) reflects this interest.

The Japanese Science Council established a review, by the Ejiri committee, of the technical and scientific merits of KAON and of the priority for Japanese participation. In brief, the conclusions were:

- KAON would address important areas of nuclear and particle physics.
- KAON is a large scale project requiring international support. Japan should be a participant.
- KAON and the Japanese Hadron Project (JHP) are complementary. Collaboration between the two projects would be mutually beneficial.

Consultations

The discussions with Japanese officials centred around four issues.

- the relationship or differences between KAON and respectively, the U.S. SSC and the Japanese Hadron Project (JHP);
- the level of interest expressed by other nations in KAON;
- whether KAON was an 'international' project (like CERN) or a 'national' project; and,
- the nature of the Canadian commitment to KAON and the timing of the decisions.

Dealing with these in order:

The U.S. has approached Japan (and a number of other countries with major nuclear and particle physics programs, including Canada), soliciting Japanese participation in SSC. Japanese officials initially saw KAON and SSC as being competing proposals, both seeking international support. The Canadian delegation explained that SSC and KAON had significantly different technical objectives; the projects were not, in the technical sense, duplicating or competing. As regards the JHP, its technical objectives correspond to an upgraded TRIUMF; JHP is not, therefore, a competitor or duplicate of KAON. Independent of any question of the technical merits of these proposals, or of their duplication or complementarity, the Japanese are concerned about

the visibility and consistency of any responses they might make to such international overtures.

The level of interest of other countries in KAON was of considerable interest to Japanese authorities. It appeared from the discussions that any Japanese response to KAON would need to be seen internationally as being consistent with the responses made by other countries. The responses on KAON participation received from other countries have been made available to Japanese authorities to aid them in their deliberations.

On the status of the KAON project, whether it was an 'international' or 'national' project, the KAON delegation explained that Canada would have the legal and financial responsibility for KAON, and that, like TRIUMF, it would probably be operated by a single agency such as the National Research Council of Canada. In Japanese terms, KAON was considered to be a national (Canadian) project. The Japanese also observed that participation in KAON, based on the HERA model, would be breaking new ground for them.

Japanese officials were fully aware that, although the B.C. Government had stated its intention to fund KAON civil construction, the Government of Canada had not yet made a commitment to KAON. The steps in the approval process for KAON were outlined, including the need to assess potential participation by other countries. While Japanese officials understood that the KAON delegation was soliciting conditional responses from prospective foreign partners, they stated that Japan could not provide a written response to the hypothetical question posed by the Canadian delegation. Any such response would be, for Japan, a commitment. Officials would therefore not be prepared to make any response in advance of a commitment to the KAON Factory by the Government of Canada.

Notwithstanding Japan's difficulty in providing a written response at this time, Japanese officials have indicated that they would like to provide every possible assistance to the KAON project, within the constraints imposed by the Japanese decision-making process.

In early February 1990, Dr. Elliott, Chairman, KAON Factory Engineering Design and Impact Study Steering Committee, received a letter of support from Dr. Toshimitsu Yamazaki, Director, Institute for Nuclear Study (INS), University of Tokyo. This laboratory is the sponsor for the JHP and would be the key Japanese laboratory to be associated with KAON, just as DESY and KFA Juelich are the key FRG laboratories. The key items in this letter (attached as Appendix II) are:

- explicit and forthright support for KAON from the Japanese particle and nuclear physics communities.
- recognition of the complementary nature of KAON and JHP.
- the strong interest of INS in KAON as a part of JHP.
- implicit recommendation to the Japanese Government that it support KAON along the lines of the HERA model.
- explicit recommendation to the Japanese government that Japanese support be scaled to that of other countries. This would seem to imply support by Yamazaki for the \$50M participation level proposed for Japan. (It should be noted that the level of support did not appear, from the consultations, to be an issue with Japanese authorities.)

This letter is not an official response. It is, however, an essential prerequisite for any support Japan might be prepared to provide for KAON.

In summary, it is clear that Japan will not give Canada any response before Canada makes its commitment to KAON. With that commitment, however, together with the clear support for KAON from other countries and the internal support from the Japanese particle and nuclear physics community, there is, in the opinion of the KAON delegation, a reasonable possibility that, with careful negotiation by Canada, participation by Japan at a \$50M level might be forthcoming.

9.8 Korea

Context

The Korean government invited the KAON delegation to visit Seoul, Korea in November 1989 to discuss the possibility of Korean participation in KAON. Korean interest was largely the result of efforts by Korean physicists currently working at TRIUMF.

Briefings and discussions were held with officials of the Ministry of Industry and Science and with representatives of universities and the larger Korean industries. It appeared that the Korean government could have an interest in participation in KAON provided that Korean industry was also prepared to share in the expenditures. A participation level of a total of \$10M was mentioned in the discussions. (In the Korean response which follows, a contribution of 1-2% of the KAON construction cost would correspond to \$6M to \$12M.)

Korean officials undertook to assess the interest of their industry and university sectors and provide a response on participation by January 1990.

Response

Letter from Kap Taek Kwon, Director General for Technical Cooperation, Ministry of Science and Technology:

On behalf of the Ministry of Science and Technology, Government of Korea, I wish to express my appreciation to you for the visit of the KAON-TRIUMF delegation to Korea, headed by Dr. Peter Dyne. This was, I believe, only one of many examples of bilateral cooperation.

While the Canadian delegates were in Korea, the KAON Factory proposal was presented and opportunities for international participation, particularly for Korea, were discussed. The KAON Factory is an important scientific project, not only for the world as a whole, but also for Korean scientists. We consider the Canadian proposal that Korea contribute 1-2% of the total construction cost to be very cost effective for the dozen or more Korean scientists expected to be involved. As such, I think the Korean Government will enter into negotiations with Canada to participate in the construction of the Factory if there is strong industrial participation.

At present, it appears that Korean industry is uncommitted to participate for two reasons -- first, lack of experience, technology and know-how of manufacturing accelerator components, and secondly, whether the production quantities warrant a new or expansion of the facility beyond the current operation. In this connection, Pohang Institute of Technology (POSTECH) has been requested to conduct a detailed study and report to the Government within the next few months. If this study shows that our industry is willing, I am prepared to endorse the recommendation by the "ad hoc" committee (that Korea contribute a major portion of the A-ring and the injection line). The provision of funds by the Government will probably take at least one year from the conclusion of a successful negotiation with Canada.

In the meantime, we hope to maintain communication through the channel developed during the visit of your delegation, and look forward to increased scientific cooperation in this and other areas of mutual interest.

9.9 Other Countries

This report covers only the countries visited by the delegation. In addition, many other countries (including some of the European countries under the aegis of the EC, and Israel, China, and the U.S.S.R.) are expected to participate actively in KAON science, and some might reasonably be expected to contribute manpower and components of some value to KAON. We cannot estimate the net total of such smaller contributions, but the KAON advocates who set the target figures for the countries visited by the delegation believe that a conservative total for such extra foreign contributions (as shown earlier in Table I) is about \$10M.

10. General Summary

A delegation representing the interests of TRIUMF/KAON and of both the Governments of Canada and British Columbia, consulted with senior officials in seven countries (the U.S.A., Germany, France, Italy, the U.K., Japan and Korea) and with officials of the European Communities, on the possibility of their participation in the construction of the KAON Factory.

TRIUMF/KAON had proposed that foreign participation in components, valued at \$200M, one-third of the total estimated KAON construction costs, was a reasonable target. This total was divided between prospective partners in proportion to the number of their scientists expected to work at KAON. About one-half (\$100M) of the proposed foreign participation was seen as appropriate for the U.S.A. The balance was roughly split between Europe and Japan.

The consultations confirmed:

- that KAON would be a unique world-class facility addressing important areas of nuclear and particle physics. Worldwide, only one such facility would be built.
- that some two-thirds of the 800 scientists expected to work at KAON would come from the countries consulted, in addition to one-third from Canada.
- that international participation in KAON is both appropriate and necessary.
- the need for Canada to make an early decision on KAON construction.

Officials from all countries visited were asked to provide written responses to the KAON delegation's proposal, indicating their country's interest in KAON in the specific

context of the participation levels proposed by TRIUMF/KAON. Because Canada has not made a commitment to KAON, these responses are cautiously phrased and necessarily conditional. Canada's own commitment is an absolute prerequisite for substantive commitments from abroad.

The responses, nevertheless, set clear terms of reference and boundary conditions for subsequent negotiations between Canada and participating countries. In the opinion of the KAON delegation, responses indicate that the total participation which might eventually be obtained could be close to the \$200M estimate.

The responses, country by country, are summarized below:

The United States

The U.S. Department of Energy indicated its intention to request, in the U.S. budget submission, funding for KAON as a new initiative at \$100M (Cdn.) over five years, following commitment by Canada. Because the U.S. intends to formally ask for new funds, the level of its support has to be specific (the U.S. is the only country in this position). This proposal has the clear and unequivocal support of the U.S. nuclear and particle physics community. The ultimate approval of this request may require political representation by Canada at several levels.

The U.S. response is as strong an expression of intent as could be expected in the context of these consultations.

Germany (FRG)

Following Canadian commitment to KAON, FRG participation would be funded, on a continuing basis, through the two principal government laboratories, DESY (Hamburg) and KFA (Juelich), as an international component of the German national program. The two laboratories would act on behalf of BMFT in technical discussions on participation.

The Canadian contribution to the FRG HERA accelerator is given as a guideline for the FRG contribution to KAON. In addition, the FRG would provide skilled manpower which, given the complexities of KAON construction, would constitute a significant contribution. Moreover, the proposed start-up for KAON coincides with the freeing up of FRG manpower from construction at HERA and COSY.

The FRG response is also as strong an expression of intent as could be expected in the context of these consultations.

France

Participation at a low level could be funded from current budgets. The most recent French estimates of the number of French scientists likely to work at KAON suggest that participation at a more significant level might be justified and funded if other projects currently under consideration were to be deferred or cancelled. A more substantive response could be expected if KAON is approved.

Italy

The Italians face serious budgetary constraints and have to plan for a number of proposed projects which compete for funds with KAON. Participation at a low level could be funded out of current budgets. This amount could be increased if some of the key competing projects were delayed or cancelled. Again, a more substantive response might be expected if KAON is approved.

United Kingdom

The U.K. has severe budgetary constraints, and in addition, KAON does not fit within current U.K. scientific priorities. The U.K. is consequently unable to contribute components to KAON. It is anticipated, however, that design assistance will continue.

European Communities (EC)

The EC was added to the second round of consultations to explore the possibility of participation by some of the smaller EC members. (Such participation would be independent of possible bilateral agreements with larger members.) There are possibilities for participation, but discussions are at a preliminary stage. A response is not expected prior to completion of the KAON Factory Engineering Design and Impact Study in March 1990.

Japan

Japan's position is that it can only respond when Canada has made a commitment. The Japanese scientific community, in particular the Director of the key laboratory likely to be responsible for Japanese participation, has indicated strong support for Japanese participation in KAON. With this, and the clear expression of intentions to participate in KAON from other countries, and a commitment by Canada, Japan might be prepared to

participate. The proposed level of participation itself (\$50M) did not appear to be an issue. With careful negotiation by Canada, following its commitment, there appears to be a reasonable possibility of obtaining Japanese participation in KAON.

Korea

The KAON delegation visited Korea in the second round of consultations at the invitation of the Korean government. Officials stated that Korea would support KAON if Korean industry were interested in participating in KAON construction.

The Korean response indicates possible participation in the range of \$6M-12M, but support is conditional on a contribution from Korean industry. Korean officials are commissioning a study to assess relevant Korean industrial expertise and benefits to Korean industry from participation in KAON. The results of the study are expected within a few months.

Other Countries

Scientists from countries which were not included in the consultations, such as Israel, China and the U.S.S.R., are interested in working at KAON. These countries could be approached sometime in the future for possible participation in KAON.

Summation

The dollar (current) values of possible support, as estimated by the KAON delegation, can, with the caveats noted above, be summed as follows: U.S.A. \$100M; Europe \$17M to \$31M; Japan, some \$50M; for a total of \$167M to \$181M. This summation excludes: possible contributions from Korea (\$6M to \$12M), from the EC, or from other countries not included in the consultations; the possibility of larger contributions from Italy; the substantial value of seconded design staff from Germany; and, contributions for experimental equipment.

It must be recognized that there are still many uncertainties inherent in the present consultations by Canada, which will only be resolved by negotiation. None of the contributions are assured in any absolute sense. There is, nevertheless, reasonable expectation that the total participation which can be negotiated could be close to the \$200M target. This outcome, a success in the context of these consultations, is a consequence of the interest and support for KAON science from the nuclear physics communities in other countries.

EXTRACT FROM "NUCLEAR SCIENCE IN THE 1990'S"
 THE U.S. NUCLEAR SCIENCE ADVISORY COMMITTEE'S
 LONG RANGE PLAN FOR U.S. NUCLEAR SCIENCE, DECEMBER 1989

1989 LRP BUDGET REQUIREMENTS (FY91\$)

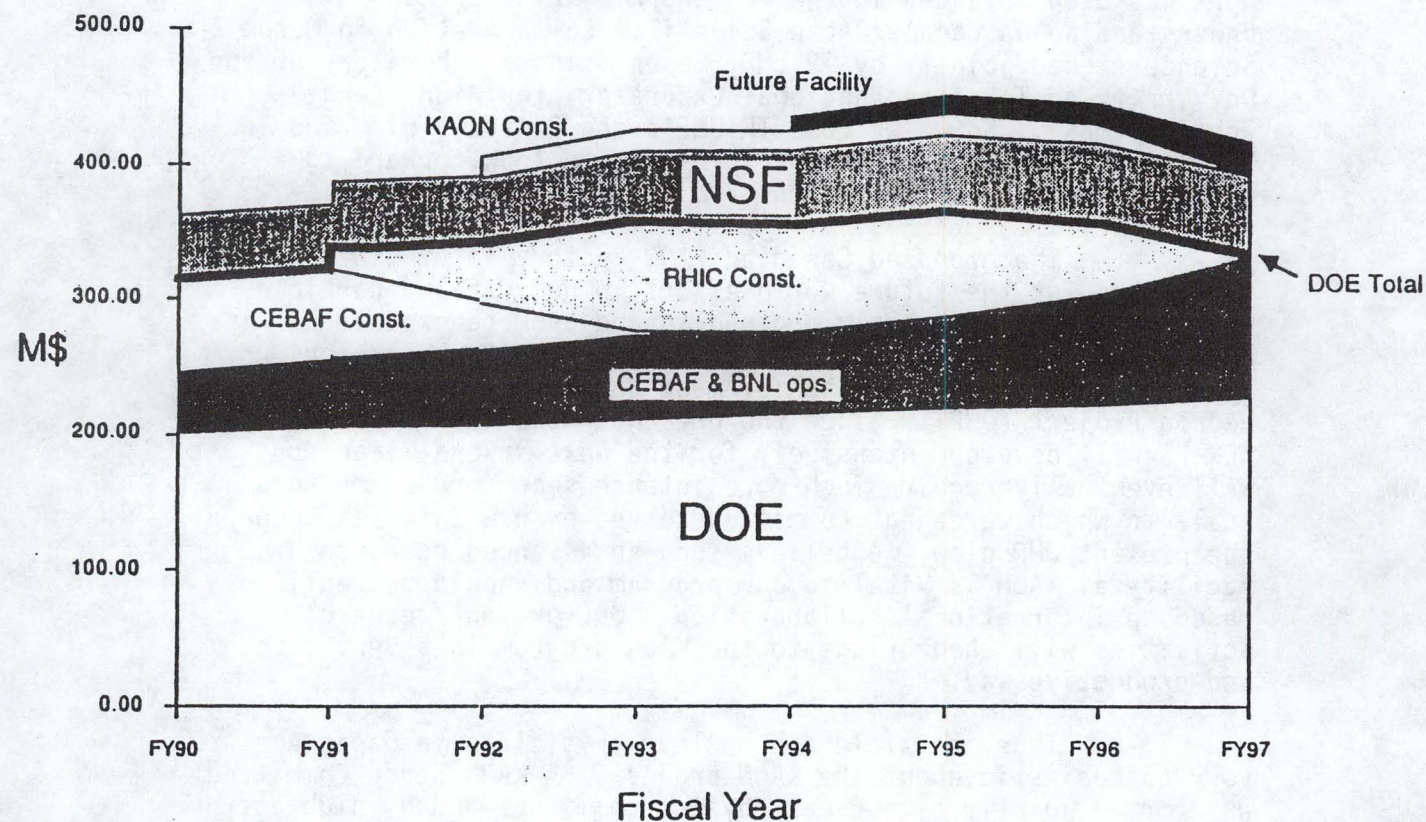


Figure 51: Projected budget needs for the 1989 LRP for U.S. nuclear physics, for the years 1990 to 1997. Amounts are given in FY91 Dollars. The entire area below the solid black line represents the required DOE budget. The cross hatched area above represents the NSF budget needs. Additional needs for KAON and for a future, smaller facility are shown, but not specifically assigned to either agency.

LETTER TO THE CHAIRMAN OF THE KAON FACTORY ENGINEERING DESIGN AND
IMPACT STUDY STEERING COMMITTEE FROM DR. T. YAMAZAKI, DIRECTOR,
INSTITUTE FOR NUCLEAR STUDY, UNIVERSITY OF TOKYO, JAPAN

"In this letter I would like to state our attitude toward the KAON project.

Since the birth of TRIUMF we Japanese physicists have enjoyed various experiments using the high intensity pion and muon beams at TRIUMF. Without this excellent facility together with Canadian hospitality the development of meson science in Japan of the present days would never have occurred. The collaborative work has been advanced in the framework of a Memorandum of Understanding on Canada/Japan Scientific Collaboration in Meson Science signed jointly by TRIUMF, Meson Science Laboratory of the University of Tokyo and National Laboratory for High Energy Physics (KEK). So we welcome TRIUMF's and Canada's plan and invitation for the KAON Factory project and look forward to further expanded collaboration.

The proposed Canadian KAON Factory is of great importance for the future world effort in nuclear and particle physics. We are presently engaged in and promote experiments in nuclear and particle physics based on the KEK 12 GeV proton synchrotron as a part of the movement to the so called Japanese Hadron Project (JHP). Since the present research activities at KEK-PS will develop intensively for the next several years but will eventually require much more intense secondary beams to a scale to which we cannot commit ourselves even within the scope of the present JHP plan, we believe such an advanced research facility as KAON is vital to our program and should be realized based on international collaboration. Our present research activities will then bridge to the KAON program in a very smooth and productive way.

Thus, particle and nuclear physicists in Japan are very enthusiastic about the KAON project. A KAON Study Committee was formed jointly by nuclear physics committee and by high energy physics committee in October 1988 to review the Canadian KAON project and it was headed by Professor H. Ejiri. The Ejiri committee made its final report and strongly recommended the Japanese participation in KAON on September 30th to their parent bodies, which then endorsed the Ejiri report. The Japan National Committee for Nuclear and Particle Physics of Japan Science Council, at its meeting held on November 20th, 1989, discussed the report of the Ejiri committee, and the chairperson, Professor

T. Nishikawa, concluded that the National Committee supports and pushes the KAON collaboration.

So we urge Canada now to make a decision to proceed with the construction of KAON. We understand that in order to proceed with KAON Canada will need to receive about a third of the construction costs from abroad, with major support coming from the United States, Europe and Japan. We welcome the world support which Canada is trying to achieve for its KAON facility.

The Institute for Nuclear Study (INS) of the University of Tokyo is expected to be responsible for this KAON collaboration as a future international part of JHP, which emphasizes intensity frontier of nuclear and particle physics. Once Canada has committed itself to the construction of KAON, I, as a director of INS, would urge our government to participate in the construction of KAON, providing components for KAON at a level commensurate with the growing Japanese scientific interest in the project. Since the HERA type international collaboration as KAON proposes is entirely new to Japan, we also ask the Government to establish appropriate procedures for this international collaboration.

We pledge the continued support of our institute in helping to realize KAON and in Japanese participation in the existing TRIUMF meson factory. We also expect that, once our own future project JHP goes ahead, Canadian scientists will have comparable scientific opportunities in using our facilities (pulsed mesons, pulsed neutrons, exotic nuclear beam, etc.) which are complementary to KAON.

I hope that this letter will help your Government to move toward a decision for KAON."

