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Brief summary of correspondence from the files of G. Swarup that has been scanned and is available in the Library of the National Centre of Radio Astrophysics, Pune 411007

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TATA INSTITUTE OF FUNDAMENTAL RESEARCH

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NCRA • TIFR

Prof. G. Swarup, F.R.S.
Professor Emeritus

GS/PU/96

April 30, 1996

Professor Vasant Gowarikar,
Vice Chancellor,
University of Pune,
Ganeshkhind,
Pune - 411 007.

Dear Professor Gowarikar,

1. Please refer to our discussions concerning the possibility of starting a five year integrated M.Sc. course in several branches of science at the Pune University, with the following objectives:

   i. to attract highly talented students from across India soon after their H.S.C.
   ii. give them best possible education through dedicated teachers and well-equipped laboratories
   iii. inculcate in them a sense of innovation, entrepreurship and leadership; and
   iv. prepare them for a challenging career ahead, which is matched with their abilities and aptitude : each one to his / her best.

2. You have been stressing the need for improving the science teaching at the Pune University by building up firm linkages with selected industries and leading research institutes. With the economic liberalization and resulting international competition, Indian scientists and engineers will have to work together much more closely for pursuing intensive R&D at the frontiers in a variety of areas. On the other hand, there seems to be a slackening of interest among young students to join the science stream.

3. I enclose a note discussing a potentially viable educational programme in the Pune University which is designed to meet the above objectives. This note has resulted from discussion with you and many teachers in the University and elsewhere, but any additions or omissions are mine!

   Briefly, the first three years are to be devoted for learning fundamentals in various subjects. In the fourth year students are branched into a few selected disciplines to suit their aptitudes, and the educational programmes are branched accordingly. For instance, in the field of Physics, these could be *(a)* Academics (research and teaching), *(b)* Engineering Physics and *(c)* Information Technology (a rich field for tomorrow). In order to impart the much needed practical training, it may be

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beneficial if students could devote a major part of their fifth year working on research project(s) for an M.Sc thesis at the University, or other collaborating institutions and industrial establishments.

4. It is certainly not the intention of the enclosed note to convass for a programme strictly as outlined therein. Only a possible scenario has been presented. There is no doubt that we need to undertake much more interactive science teaching in some of the universities in India, in order to prepare students for a good career opportunity. Several alternative approaches need to be discussed. In spite of numerous difficulties we must not deter from our main objective of making India a great nation and should take up bold initiatives in that direction to ensure success.

5. Under your guidance, the Pune University can show the way towards achieving excellence in science education. Urgent steps are needed to be able to launch the programme in the 9th five-year Plan.

With best regards,

Yours sincerely,

Govind Swarup

G. Swarup

Doc 1/2

02

A proposed scheme for a five-year integrated M.Sc. teaching programme at the Pune University

OBJECTIVES

1. The main objective of this proposal for starting a five year integrated M.Sc. course in several branches of science, at the Pune University is as follows:

   i. to attract highly talented students from across India
   ii. give them best possible education through interactive teaching and well-equipped laboratories
   iii. inculcate in them a sense of innovation and entrepreneurship and leadership; and
   iv. prepare them for a challenging career opportunity matched to their abilities and aptitude : each one to his / her best.
   v. To foster a closer relationship between science, education and technology, in order to meet the ever increasing needs of India to compete internationally.

2. MOTIVATION :

   There have been many discussions concerning the need for improving the standards of science teaching at the University by building up firm linkages with selected industries and leading research institutes. With the economic liberalization Indian scientists and engineers will have to work together much more closely and pursue intensive R&D in a variety of areas. On the other hand, there seems to be a growing lack of interest among young talented students to join the science stream.

3. METHODOLOGY .

   After discussions with experienced teachers in the University and many scientists in various institutions in India, a possible outline of a bold new initiative is suggested as follows, in order to initiate debate and chalk out a suitable scheme.

   A) To start a 5-year integrated M.Sc. programme in about a year from now and to admit about 150 students every year on an All-India basis, soon after their 12th year exams in 5 branches of sciences viz., Physics, Chemistry, Mathematics, Life Sciences and Earth Sciences. Select a syllabus with a large self-development component. Entrance exam for the 1st year may be coupled with the IIT entrance exam or to be held concurrently at the same centres.

   B) At the end of the 3rd year an aptitude-cum-ability test is to be held after which students will be branched into areas which are best suited to their aptitude and abilities and to the needs of India over the next decade, so that the students are motivated for pursuing a challenging career in those fields in which scientific training provides them attractive opportunities.

   C) For example, let us consider the field of Physics in which the candidates may be branched from the 4th year onwards into the following three major areas:

   i. Academics (Basic research and teaching) : For students admitted to this stream, the course work will lay emphasis on subjects such as quantum mechanics, electromagnetic theory, relativity, nuclear physics, condensed matter physics, astrophysics etc.

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ii. Engineering Physics : Continue advanced teaching in various areas of modern physics but start laying emphasis on certain areas of engineering physics (with possible tie-up with COEP and IIT, Powai) in order to prepare students to pursue an attractive and challenging career in modern industries, such as TELCO, Thermax, Tata Consultancy Services, Motorola, WIPRO, BPL, etc. (or even smaller industries), or institutions under DAE, ISRO, CSIR, DRDO, IMD. etc. Under the leadership of the Vice-Chancellor and senior faculty members, the Pune University can easily approach selected research institutes and industries for building up firm linkages needed for this programme.

iii. Electronics and Information Technology : With courses in electronics, optical fibre and microwave communication, computers and software and system integration and marketing (possible tie-up with Symbiosis). Students may specialize in one or the other area of Information technology in their 5th year.

D) In the 5th year, students should spend 8 to 10 months at selected industries and / or research institutes, including various science departments of the Pune University for working on suitable projects towards their M.Sc. thesis, based upon their aptitude assessed at the end of the 3rd year. The industries and institutions should pay an attractive honorarium to the students and also to the University faculty for interacting with these agencies identified for the R&D projects. Vice-versa, the university may invite some teachers or research workers for giving short-term courses, or a set of lectures in selected areas by experts from the industry/research institutes, or visiting scientists from across the world.

E) In order to fulfill the needs of the state and various departments in the university, it may be desirable to admit several students directly to the 4th year of the programme after they have done B.Sc. elsewhere, after selection through an entrance exam. Alternatively, the present M.Sc..program may continue but with reduced intake, in order to simultaneously bring up the new 5-year programme. In due course, it may be preferable to have only a single M.Sc. programme.

F) Separate academic grades may be given for the 4th year academic programme and the 5th year thesis project.

G) Industry or research institutes participating in the programme should be encouraged to offer a 2-year project appointment with an appropriate honorarium to one third or upper-half of the successful students, who may have taken training in those institutes, in order to attract good students into this programme, with an assurance of a good career opportunity.

H) Since the programme is aimed to train students for attractive career opportunities, no certificate should be given to those wanting to quit the programme in between, say after 3 years.

I) Students who are interested to pursue a Ph.D programme could start their work in the 5th year itself and thus may expect to get a Ph.D. degree in another 3 or 4 years.

J) Students should be brought into personal contact with the best of our scientists and engineers right from the first year of the programme, so that they become aware of the tremendous number of challenging opportunities in the field of science and technology in India, e.g., from submarines to satellites; from textile machinery to solid state electronics; from agriculture and medicine to bio-technology; from mining to oil exploration, etc.

K) In order to ensure success of the program, it would be necessary to have a Monitoring Committee with dedicated experts selected from the University and outside institutions. This would ensure that the programme has requisite flexibility with adequate academic discipline. This will also motivate students to rise up to the best of their abilities. As in many universities abroad, it is highly desirable that each student is assigned an Academic Adviser (not his teacher or Ph.D guide) who discusses the progress of the student and tries to solve his / her difficulties right from the first year of the programme. Multi-media approach may allow closer interaction between students and teachers outside the lecture timings.

4. Economics

The proposed 5-year program would need substantial new resources in the form of teachers, research scientists, lecture halls, laboratories, library, computer networks, multi-media facilities, hostels and teaching-staff accommodation, etc. Roughly speaking an area of about 30 m^2/student will be required for supporting the above activities, including the associated infra-structure. One would, therefore, need to construct about 30 × 450 students (for 3 years) m^2 = 13,500 m^2 × Rs.7000/m^2 (including inflation) = Rs.10.0 crores over a period of about 2 to 3 years. The existing facilities may be sufficient for the 4th and the 5th year students. One may have to seek another Rs.6 crores over a 5-year period for increased research activities in the University in order to attract talented new faculty from across the world. This may seem to be quite a large sum considering the tight budgets of the UGC. On the other hand, some of the national centres of UGC have projected additional budgets exceeding Rs.15 crores for their new activities in the 9th Plan.

Considering the utmost urgency for creating well-trained scientific cadre in India which is the main objective of the programme, the above investment will be worth every penny. Although UGC should provide a major part of the required funds, it should be possible to seek additional support for the laboraroty equipment and research activities of the programme from agencies such as DST, DAE, CSIR, ISRO etc. Industry and some philanthropists may also give donations for construction of some of the buildings. Industry may sponsor projects in certain areas of mutual interest and benefit. In due course, the Pune University and other engineering

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institutes, such as COEP, may be able to interact much more widely with industry in Pune, through an Interactive Educational Training Programme, using computer networks, similar to the very successful interactive programme of the Stanford University. Educational training through Satellite networks is the next plausible step.

NEED :

5. Over the last 20 years, there have been numerous debates stressing the need for building up a strong science base at several Indian Universities. In spite of the severe resource crunch, it is highly creditable that some of the universities including the Pune University have built up active teaching and research programmes. However, it is imperative that new activities are undertaken to meet the ever-increasing national needs and global challenges. As is known that the quality of students entering M.Sc. has gone down over the last decade, because the undergraduate teaching is done in degree colleges with little laboratory equipment and almost nil research activities. However, undergraduate education is very important, as it lays foundation for the learning of fundamentals of various subjects of science. It is a common practice in leading universities across the world, such as Cambridge, Stanford or Berkeley that some of the most outstanding scientists teach undergraduate classes. We need to create new initiatives in science teaching not only at Pune but also in some other universities in India.

WHY PUNE ?

6. With C-DAC, IUCAA, NCRA-TIFR, NFTRC on the University campus and many other major scientific institutes including NCL in the vicinity of the campus, the Pune University is well poised to undertake a major initiative to attract talented students from across India and prepare them for becoming the scientific leaders of India in the coming years. The great tradition of education and culture of the city of Pune and the existence of many major hi-tech industries in Pune-Bombay region should allow close interaction of the University with the industry, thus providing the students with the opportunity to work on practical projects at these places. Pune is already growing as one of the centres of Information Technology. With proper interaction between the University and industry it can become another Silicon Valley, in the growth of which the Stanford University had played a vital role.

7. It is certainly not the intention of this note to convass for the specific package as outlined above. Only a possible scenario has been presented. There is no doubt that we need to undertake under-graduate teaching in the field of science in some of the leading universities of India. The interest of the students in having a good career opportunity has to be kept in mind. The Pune University can show the way! Several alternative approaches need to be discussed. However, in spite of numerous difficulties we must not deter from our main objective of making India a great nation and should take up bold initiatives in that direction to ensure success.

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Enclosure 3

MINUTES OF THE 4TH MEETING ON 5 YEAR INTEGRATED M.SC. COURSE

Date : 8th June 1996.

Venue: Dept. of Electronic-Science, University of Pune, Pune-7.

Time : 10.30 a.m.

The meeting was attended by following members:

Professor Govind Swaroop	(GMRT)
Professor S.R. Gadre	(Dept.of Chemistry)
Professor S.V. Ghaisas & Dr. A.D. Shaligram	(Dept.of Electronic-Science)
Professor P.L. Kanitkar & Dr.A.D. Gangal	(Dept.of Physics)
Professor A.M. Patwardhan	(Dept.of Environmental Sci.)
Dr.(Miss) Dixit	(Biochemistry, Pune University)

Professor Govind Swaroop briefed the members about the concept of the five year integrated M.Sc. program and the progress made towards preparation of the draft proposal through the previous three meetings (including one with Vice Chancellor, Pro Vice Chancellor and the Registrar and another with the Registrar). We proposed a financially and academically autonomous advanced research center in different sciences.

Dr.Shaligram presented the proposed structure for physical sciences (copy attached), considering the vast amount of career development opportunities in physical sciences. The basic structure consisted of common two years and trifercation from third year onwards into Electronics and Information Technology, Engineering Physics and Basic Research Oriented Physics. This structure was proposed assuming that the students passing out from 12th Std. will be opting for Physical Science as the branch. The required basic portions from mathematics, statistics, chemistry, biology and earth sciences would be covered with the necessary orientation for physical sciences.

Dr.Gangal and Professor Gadre criticised the 2+3 structure and subscribed to 3+2.

Professor Ghaisas seconded the pattern presented by Dr.Shaligram.

Dr.Gangal opined that whatever structure may be adopted, the students should have flexibility in the number of courses to be taken per semester. He further added that the courses be taught giving a view of totality independent of the level.

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Professor Gadre presented following points. He stressed that certain conditions must be met before executing his form of structure:

a) A complete autonomy indepedent of present university administrative structure.
b) Requirement of homogeneous core faculty working in harmony.
c) Minimum motivation required from the core faculty excellence in teaching.

He proposed 5 to 6 semesters common courses to all sciences in which there should be about two skill based courses (such as glass blowing and communication skills etc). The faculty would consist of a core + borrowed. The core faculty would be of minimum 15 by the end of fifth year.

He further stressed that efforts should be made to get a concrete participation from the personnel from National Institutes like C-DAC, NCL, IUCAA, NCRA etc.

All India admissions will be considered along with directives for reservation and state seats.

The basic courses at the first 5-6 semesters would have an approximate breakup as follows:

4 mathematics, 3 physics, 3 chemistry, 3 biology, 2 earth sciences, 2 skill based, 1 strong course in electronics and 1 in computers along with adequate practical courses to the total of about 30. Branching in respective desciplines be done at 4th year. However, much of super specializations should not be done even at the 4th and 5th year. He suggested the project work of 1 semester accompanied by a simultaneous teaching program.

Later on Professor Patwardhan presented his views. In his opinion earth science courses need to be strengthened in the first two years. Otherwise he agreed to the 3+2 pattern proposed by SRG.

Professor Swaroop described briefly his discussions with Professor Joshi and correspondence with Professor Sitaraman who has gone abroad. Professor Kolaskar and Professor Modak are also abroad. Professor Ghaisas was requested to correct the contact the Computer-Science Department.

It was further decided that actual structure and details of syllabus would be worked out in due course in consultation with other faculty. For the preparation of the draft proposal responsibilities were deciminated as follows:

Introduction + Objectives : S.V. Ghaisas

Administrative Structure : To be coordinated by
Infrastructure P.L.Kanitkar

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Syllabus structure for first three years	:	To be coordinated by S.R.Gadre Members will be : Professor A.D. Joshi Professor A.M. Patwardhan and Dr.A.D. Gangal

The last two years Syllabii will be formed with the staff of various departments by following members:

Chem-Science	:	Professor Gadre
Life Science	:	Professor Deobagkar
Earth Science	:	Professor Patwardhan
Mathematical Science	:	Professor A.D. Joshi
Physics Science	:	Professor P.L. Kanitkar

The Industry interaction will be decided by Dr.Shaligram, Prof.Wadia and Professor Gadre.

Next meeting is scheduled on 29th June 1996 where this draft proposal will be discussed.

Approximately 2-page writeup according to the above responsibilities is to be given before 20th June to Professor Swaroop to initiate the program.

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ROPOSAL FOR FIVE YEAR INTEGRATED M.S. PROGRAMME

HIGHLIGHTS OF THE PROGRAMME PREPARED BY THE CDC IN PHYSICS

The Curriculum Development Center in Physics was operative in the Physics Department between 1988-90 and the report of the same was published by the UGC in 1991. Some of the highlights of the same are illustrated below.

1. The National Committees of the CDC, had identified the following three possible patterns at the undergraduate level.

1.1 B.Sc. (General)
1.2 B.Sc. (Honours)
1.3 B.Sc. (Physics)

The first two are relatively wellknown and exist in number of Universities. The third one is patterned on the existing professional courses like BE or BCS. Compared to the first two patterns where the motivation is fixed as late as the III year of the programme, students get motivated in the third pattern from the beginning itself. Thus it is a training programme against the first two, which are educational programmes of different degrees. The B.Sc. Physics programme has a fixed orientation viz. to motivate the students to undertake research at an early level. The CDC report had given the details of this programme to the level of individual lectures and practicles to illustrate that the concept is feasible.

2. Fortunately all the CDC reports in other subjects were available to the Pune group, for their critical examination. We noticed that Physicists need the support from all the other areas but the reverse is not equally true. Thus we decided that the help needed from the other subjects be decided by the physicists and included in the format prepared for the Physics. It has reduced not only the duplication in different subjects & courses, but also developed a complete coherence throughout the entire curriculum.

Doc 2/4

3. The extra space and gaps created through these processes, have been useful in a major way, to enrich the laboratory component, which other

wise is a major lacuna, from the research point of view. For existing patterns, the lboraotory/theory contact hours are in a ratio of 1:2. For the new pattern in principle, the ratio is improved to 1:1. With the introduction of new revolutionary concept of laboratory tutorials, qualitative improvement for the laboratory education is expected to be much higher (The new concept was tried out in 1991-1992 in the Physics Department and does have the expected potential).

Besides the new programme envisages to teach/learn theory and laboratory as an integral part of a same module, rather than two independent entities as present. e.g. Module at B.Sc. Physics consists of 3 theory lectures + 1 theory tutorial + 1 laboratory tutorial + 1 experiment of 3 hours duration of workload/week. It is envisaged and worked out that for a given topic/area/concept, only the most suitable mode (any 1 of the above 4) be chosen for instuction & it will not be repeated in the different modes. The exercise saved a lot of time in the overall stucture and the end result was that the material covered presently upto M.Sc. can be completed within three years or in 21 common modules.

4. This provided a sufficiently large space for students, to undertake a optional subject in the IV year, instead of V year as present, and also provides a full year for an M.Sc. project, as against few months, as present. Both of these activities shall be enhanced by a factor of 5-10 depending upon the different practices at the different universities. One can say for sake of comparison, that student reaches a level of the M.Phil in the present, at the M.Sc. in the new programme.

5. This will permit a Ph.D. programme of much shorter duration usually two years or so as the students available are already well groomed for the area of their research. Besides the early Ph.D will provide, relatively longer period of creative productivity, which is generally upto the age of 30 or so. This will be a great boon for the national human resource development programme.

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~~Doc 3/8~~

SUMMARY OF SELECTED
DISCUSSIONS BY ~~THE~~ FACULTY
OF THE UNIVERSITY OF PUNE
REGARDING THE PROPOSED 5-YR
PROGRAMME BY G. SWARUP
(JUNE - 1996)

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ENCLOSURE 2

SUMMARY OF DISCUSSIONS ON THE ADVANCED REESARCH CENTRE IN SCIENCE OFFERING FIVE YEAR INTEGRATED M.SC. COURSE

By an Adhoc Group of some senior Faculty members of the Pune University

Over the last 20 years, there have been numerous debates stressing the need for building up a strong science base at severl Indian Universities. In spite of the severe resource crunch, it is highly creditable that some of the universities including the Pune University have built up active teaching and research programmes. However it is imperative that new activities are undertaken to meet the ever-increasing national needs and global challenges. There have been many discussions concerning the need for improving the standards of science teaching at the University of Pune. With the economic liberalization this has become the need of the hour. About six weeks ago, the Vice Chancellor had discussed a preliminary proposal in a meeting attended by a few faculty members and some of the senior of the senior and some of the senior authorities. Subsequently, an adhoc group of the faculty members from various science disciplines had three meetings and has discussed this issue along with Professor Govind Swaroop of TIFR-NCRA. Following is the summary of the discussions.

OBJECTIVES

A general concensus of the faculty members was to establish financially and academically autonomous Advanced Research Centre in Science which would offer a five year integrated M.Sc. course as well as have its own research programmes in various science disciplines. The main objectives of the five year integrated M.Sc. program would be as follows:

i. to attract highly talented students from across India
ii. give them best possible education through interactive teaching and well-equipped laboratories
iii. inculcate in them a sense of innovation and entrepreneurship and leadership; and
iv. prepare them for a challenging career opportunity matched to their abilities and aptitude: each one to his / her best
v. to foster a closer relationship between science, education and technology, in order to meet the ever increasing needs of India to compete internationally.
vi. The programme aims at training enthusiastic young boys and girls in a creative atmosphere so that they become highly trained and motivated scientists confident of tackling problems in the rapidly advacing frontiers of their chosen field.
vii. The programme will be so designed that its product will be a through disciplined professional with detailed knowledge and understanding of his own subjects and having an awareness of current trends in other disciplines. The product of this

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programme will be made sensitive and appreciation of the social millieu in which he would spend his working life, its socio-political structure, resource and growth problems and possibly their solutions.

METHODOLOGY

To start a 5-year integrated M.Sc. programme in about a year from now and to admit about 150 to 180 students every year on an All-India basis, soon after their 12th year exams in 5 branches of sciences viz. Physics, Chemistry, Mathematics, Life Sciences and Earth Sciences. To Select a syllabus with a large self=development component. Entrance exam for the 1st year may be coupled with the IIT entrance exam or to be held concurrently at the same centres.

The course would consist of 10 semesters. The academic schedule would be as follows:

Semester 1 to 4 :	Common for all including courses from Physics, Chemistry, Mathmatics, Biology and Earth Science.
Semester 3 to 4 :	In Semesters 3 to 4 some options may be considered
Semester 5 to 6 :	The students would be branched to one of the five basic science disciplines
Semester 7 to 10 :	Further specialization, Project work for two semesters

There will be active involvement of personnel from various R & D labs and industries in the teaching programmes.

Students should be brought into personal contact with the best of our scientists and engineers right from the first year of the programme, so that they become aware of the tremendous number of challenging opportunities in the field of science and technology in India, e.g. from submarines to satellites; from textile machinery to solid state electronics; from agriculture and medicine to bio-technology; from mining to oil exploration, etc.

Industry or research institutes participating in the programme should be encouraged to offer a 2-year project appointment with an appropriate honorarium to one third or upper-half of the successful students, who may have taken training in those institutes, in order to attract good students into this programme, with an assurance of a good career opportunity.

This will be a totally residential programme with students and the faculty staying on the same campus.

Doc 3/3

Each student will be paid a suitable stipend good enough to meet his expenses and fees. During 4th and 5th year, students will be paid decent training fellowship from an endowment created for the purpose through donations from participating industries and institutions.

Those students who wish to pursue their research for Ph.D. degree could be given JRF automatically. With this training and research experience in the fifth year, these students would be able to do good research and obtain their Ph.D degree in 3-4 years.

The proposed 5-year program would need substantial new resource in the form of teachers, research scientists, lecture halls, laboratories, library, computer networks, multi-media facilities, hostels and teaching-staff accommodation, etc. Roughly speaking an area of about 30 to 35 m / student will be required for supporting the above activities, including the associated infra-structure. One would, therefore, need to construct about 15,000 m x Rs.7000/m = Rs.10.5 crores. Some of the existing facilities will be sufficient for the 4th and the 5th year students, but one may have to seek another Rs.10 to 15 crores over a 5-year period for increased research activities in the University including staff salaries and in order to attract talented new faculty from across the world.

summer.msc/courses/sks/-

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Enclosure 1

UNIVERSITY OF POONA

V. G. BHIDE F.N.A. F.A.Sc. F.N.A.Sc.
CSIR Emeritus Scientist
Emeritus Professor, University of Poona.

School of Energy Studies, Physics Department,
Pune - 411 007. India, Phone - 335201, 336061
Res.: 382920
Fax : 91-0212-333899

Ref.:

Date :

June 13, 1996

Dear Professor Swaroop,

I am sending you herewith a brief note on proposed Programme for a Five Year Integrated M.Sc. Teaching Programme at Pune University. We will meet on 24th.

With kind regards,

Yours sincerely,

(V.G.Bhide)

Professor Govind Swaroop,
Director, GMRT
Pune University Campus,
PUNE - 411 007.

Encl.: as above.

For meeting on 24th June 96
at 12.00 noon.

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Doc 4/1

Career. Oriented

Proposed Programme for a Five Year Integrated
M.Sc.Teaching Programme at PUNE University

A need for such a programme :

1.(i) India is today at the cross road. The country has won the battle of survival. Scarcity and starvation deaths reminiscent of early years of independence are over. Today, it is a question of walking abreast of developed nations, by contributing to the store of human knowledge and participating fully in the inexorable march of science, by innovating technology and remaining at the cutting edge of technology.

(ii) India's decision of globalization of economy is an expression of a desire to become a very active player in international markets and participating in world trade commensurate with our human and material resources, geostrategic position, our size, potential and capabilities. Globalization of economy would necessarily imply globalization of our education, science, technology and management.

(iii) The emerging world economic order will predominantly be determined by what happens at the market place which in turn will be dominated by science, and technology based on science. With exponential growth in knowledge connected with science and technology, there is a continual shrinking of the time of obsolescence and more importantly the continual decline in the time gap between a major discovery and its industrial applications for economic growth. No country much less the size and potential as that of India can even survive unless it innovates, exploits these innovations for economic growth and leads the world in its chosen fields.

Doc 4/2

(iv) The most important element in the alchemy of innovation is the talented, well trained, highly motivated man power. Today, India is brimming with a number of young boys and girls full of enthusiasm and vitality. This is our most precious national resource. It is our moral obligation to subject them to an educational system which will equip them, train them and enable them to flower to the maximum of their potential.

2. (i) In the early 50's top 32% students used to opt for science after 10+2 stage. Today, it is the 19% of the lower middle level who opt for science. Brighter boys and girls seem to shy away from science.

(ii) The students who opt for science after 10+2 level are trained for their first degree in affiliated colleges who do not have adequate and adequately qualified staff, do not have the requisite laboratory and library facilities etc. The academic environment in these colleges is so dampening that even the highly motivated are driven away from science.

(iii) Methods of teaching, almost total disappearance of experimentation and demonstration, rigidity of syllabi, examination system laying more stress on memory rather than on understanding have all been responsible for continual decline in the standard of education. There is a sharp and precipitous fall in the standard at the B.Sc. level.

In view of the increasing role, science and technology play and are bound to play increasingly in future in international relations, in shaping our view of the universe, in economic development and social transformation, it is essential that the country makes a deliberate and conscious efforts to produce a

Doc 4/3

band of young boys and girls who would contribute to the growth of science, innovate technology, exploit technology for economic development and in a sense provide leadership in science, technology, industry and agriculture. There is an urgent need to produce the highly talented, passionality motivated and thoroughly dedicated scientists and technologists.

This urgent need has been reflected in recent years in different forms such as a proposal to set up National Science University, proposal submitted by Bhide Committee to the Planning Commission etc.

3. (i) Poona University wishes to accept this responsibility and proposes to establish a unique five year Integrated course, integrated in time and in terms of disciplines leading to M.Sc. degree. On completion of their training, these young boys and girls will lead the creative efforts in various research groups, in R and D Labs , in industry, educational institutions, defence etc.

(ii) Poona University is one of the leading universities in the country and has a proud record of initiating a number of innovating programmes in education, in coupling research and industry, in research and development etc. It is the only university which has four national research and development institution on its campus. These national agencies are

i) NCRA - National Centre for Radio Astronomy (ii) Inter University Centre for Astronomy and Astrophysics (IUCAA) (iii) Centre for Advanced Computation (C-DAC) (iv) National Centre for Animal and Cell Tissue Culture (NAFTCC)

Doc 4/4

(iii) Poona is a unique place in the country. It has been in the vangaurd of political struggle for independence, has been the cradle for a number of social reforms and been at the centre of philosophical and spiritual endeavors. In the process, it has produced such stalwarts as B.G.Tilak, Veer Savarkar, G.K.Gokhale, Jyotiba Phule, B.R.Ambedkar, D.K.Karve, V.R.Shinde, Jayakar. Wr.Paranjapye, Mahajani etc. There is tremendous regard for education and scholarship in Pune and it is perhaps the only place where people pay to attend evening lectures.

Simultaneous with the its growth as an educational centre, it has grown industrially. Pune has the distinction of having the largest number of technologically oriented entrepreneurs who have set up their flourishing small scale industry. This local ethos plays a significant part in the growth and culture of any institution.

Consequently, one can not perhaps find a better place than PUNE to locate an educational complex which will be responsible for turning out highly trained passionately motivated, thoroughly dedicated, highly skilled young boys and girls who would provide future leadership in science technology, industry in the country.

4. <u>objectives of the Programme</u>

The objectives of this programme are

(i) To devise and operate a five year integrated programme leading to M.Sc. degree. It will be integrated in time and in terms of discipline.

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(ii) The programme aims at training enthusiastic young boys and girls in a creative atmosphere so that they become highly trained and motivated scientists confident of tackling problems in the rapidly advancing frontiers of their chosen field.

(iii) The programme will be so designed that its product will be a through disciplined professional with detailed knowledge and understanding of his own subjects and having an awareness of current trends in other disciplines. The product of this programme will be made sensitive and appreciative of the social millieu in which it would spend his working life, its socio-political structure, resource and growth problems and possibly their solutions.

5. Broad Features of the Programme:

(I) It will be an integrated science education programme leading to the M.Sc. degree. An attempt will be made to integrate the programme in terms of time and disciplines.

Emphasis will be laid on the unified structure of science as man's quest for an understanding of Nature and Natural laws and the utilization of this understanding for the benefit of the people.

It will seek to create a sound foundation in Mathematics, physics, chemistry as they have become essential for further development of any branch of science.

It will seek to create an awareness and significance of life processes, their complexity and vast technological potential.

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It will seek to lay stores on both intellectual ability and acquisition of various kinds of skills such as computational, communicational, design and fabrication, modeling and simulation etc.

It will seek to produce potential scientists and innovative technologists.

II. The input to this programme will be restricted to an intake of 400 students distributed amongst (1) Physical sciences (2) Computational Sciences (3) Earth Sciences and (4) Life Sciences.

Admission to this programme would be highly selective based on performance at a well designed national competitive examination to be conducted along with IIT entrance examination. The examination will be open to students who have passed 10+2 examination from all over the country. The admission will be based on no consideration other than merit and merit alone.

First year will be common to all the students. In the first year, students will be exposed to basic mathematical and computational techniques, basic physical principles and exciting developments in life sciences.

After the first year, students will branch off for various streams such as (1) Physical sciences (2) Computational Sciences (3) Life Sciences and (4) Earth Sciences.

Although students will branch off into these streams, the choice of courses will be totally free and optional. A student could for example take physics, Mathematics and life sciences or chemistry, physics and life sciences. There will be a large menu of courses from which the student will be allowed to choose.

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At the end of 3rd year, an aptitude cum ability test will be held and based on the performance at these tests, students will offer areas which are best suited to their aptitude and abilities, keeping at the back of mind the country's man power needs.

Right from the second year, students will be allocated to various research groups in the University, IUCAA, NCRA, NCL, NIV, C-DAC etc. so that they are brought up in creative atmosphere in which they see sparks of creativity oozing out as it were.

In the Fourth and Fifth year, the students would devote themselves to their chosen field of specialization, such as Physics, Chemistry, Microbiology, Biotechnology etc. In the fourth year, they will be exposed to some basic but advanced topics in the respective subjects. Thus for example a student opting for physics will be given courses on (a) quantum mechanics and quantum electro-dynamics (b) Statistical mechanics (c) Solid state physics and Material Science (d) Nuclear and Atomic Physics.

After this basic grounding the student could opt for one of the following specialization for preparing him for a career. Such as (1) Teaching and Academic Career (2) Engineering Physics (3) Material Science (4) Communication and Information technology.

During 4th and 5th year, the student will perform open ended experiments, and undertake investigations. During these two years, he will pursue a research project and will submit a thesis on the chosen project. The research project could be carried out in the university department or in any of the research

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021

laboratories or in an industry.

There will be continuous assessment of the students in addition to the semester end examinations which will be so designed so as to test (1) the ability of a student to analyse a situation, (2) Comprehension (3) Reasoning and logic (4) Memory (5) Creativity, innovativeness and model building capacity and (6) Communication skill.

This will be a totally residential programme with students and the faculty staying on the same campus.

Each student will be paid a suitable stipend good enough to meet his expenses and fees. During 4th and 5th year, students will be paid decent training fellowship from an endowment created for the purpose through donations from participating industries and institutions.

An assurance may be sought from various agencies such as CSIR, DAE, ISRO, etc. collaborating in this programme, assuring students that those who successfully complete this programme would be given an appointment in the institutions at a level of Scientist B. This is necessary to attract bright students to science stream who would otherwise migrate to engineering, banking or administrative careers.

Those students who wish to pursue their research for ph.D. degree could be given JRF automatically. With this training and research experience in the fifth year, these students would be able to do good research and obtain their Ph.D. degree in 3-4 years.

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6. Logistics of the Programme

This will be a National Programme participated in by UGC, CSIR, DAE, DRDO, ISRO and several industries through CII,FICI etc., and University of Poona.

Although on the campus of the University of Poona, this programme will be operated under a National Coordination Council consisting of representatives of the participating institutions. Vice-Chancellor, University of Poona will be the Chairman of the Co-ordination Council. This programme will have its own academic programme committees, own examination Board etc.

It must be realized that while opting for a career, a young student essentially asks himself two questions namely (1) Whether his choice will enable him to live a comfortable life and (2) whether his choice is so exciting such as to make it his life's mission. By assuring successful students a scientist B position, the first question could be answered. The second question is equally important and its answer will predominantly determine his choice. It shall therefore be the responsibility of the organizers of this programme to make it exciting by creating an atmosphere conducive to free thinking, promoting creativity and innovativeness. The students must see every moment sparks of creativity and solid contributions to science and technology originating from the faculty. In a sense, the success of the programme will depend critically on the quality of the faculty as well as on the facilities and the infrastructure that prevails in the institution.

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Deliberate and conscious efforts will have to be made to attract the very best from all over the world to man the faculty. It will be equally necessary to create research and training laboratories fully equipped and suitably endowed. In much the same way the whole complex, housing this institution, should be aesthetically designed and fully furnished.

All this will cost money. Following are the tentative estimates

1.	Building and other infrastructure	Rs.5.0 crores
2.	Equipment for Labs	Rs.5.0 crores
3.	Staff salaries	Rs.2.0 crores a x 5 year
4.	Fellowships & stipends	Rs.1.0 crore a x 5 year
5.	Chemicals etc.	Rs.1.0 crore a x 5 year
6.	Endowment	Rs.15.0 crores
	Total Financial Implicator for five years.	Rs.45.0 crores.

Out of this the share of financial burden to be borne by the collaborating agencies will roughly be as under :

Industries	Rs.20.0 crores
CSIR,DST,ISRO,DAE etc.	Rs.10.0 crores
Government of India Ministry of Education	Rs.10.0 crores
State Government	Rs. 3.0 crores
Public Donations	Rs. 2.0 crores
Total	Rs.45.0 Crores.

Doc 4/10

After first five years, the recurring expenditure of Rs.4.00 crores will be borne by Government of India, Ministry of Education/ Industries on 50:50 sharing basis.

8. Preparatory Action:

1. A meeting be immediately convened under the chairmanship of the Vice-Chancellor, University of Poona. The Committee shall have senior scientists from Pune (10); Representatives of the three Science Academies (3), Representatives of UGC, Ministry of Education (2); Representatives of Industries (10), Representatives of Science Agencies such as CSIR, DAE, ISRO etc. This meeting will discuss the proposal (broad reliefs and contours), its aims and objectives.

2. After the approval in principle by such a representatives gathering, a steering committee should be formed to prepare a detailed project document. This document should be ready by October, 1996. Another meeting of the representatives as indicated earlier in (1) should be held by Middle of July. A small group of 4-5 senior scientist could prepare a theme paper for such a meeting. The theme paper should be ready by 4th week of June so that it can be circulated to the member invited for the meeting under (1).

Another meeting of representative as in (1) be convened to seek approval in principal to the project document sometime in Nov.1996. In the light of suggestions made at this meeting, the project document should be finalised. It should be then printed and widely circulated.

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One copy be submitted to the Planning Commission for inclusion in the 9th Five Year Plan.

A small group of 4-5 eminent scientists/industrialists be constituted to canvass support and seek assurances for participation in the programme. This exercise should be completed by end of February. It should be the endeavor of this committee to see that token provision is made for this programme in the yearly budget of 1997-98.

These are mere suggestions and do not constitute a blue print. This could be modified,amended etc. at a bigger meeting reflecting a wider cross-section of scientists.

Date : 12.6.1996 (V.G.Bhide)

Doc 4/13

DRAFT

From: Professor Vasant Gowrikar.
Vice-Chancellor, Pune University

To be sent by fax and also copy by speed post

July 1996 ?

Professor N.C. Mathur
Vice-Chairman
University Grants Commission
Bahadur Shaf Zafar Marg
New Delhi 110 002.

Fax: (011) 3315288

Dear Professor Mathur,

The Pune University is actively considering a proposal for starting a 5-year integrated M.Sc. Programme in various major disciplines of science in order to provide a well-balanced theoretical as well as practical education to motivated students. The students will be selected competitively from across India. It is planned to forge a close interaction with some of the leading research and industrial establishements during the 4th and 5th year of the programme. Attempts will be made to give a sense of leadership and entrepreneurship to the students so that they can contribute to India's growing needs in the field of science and technology. This is of importance in view of the globalization of our economy.

It is planned to submit a detailed proposal to the U.G.C. for supporting the above programme during the IXth Plan. The proposal will be finalized in about 2 months. In the meantime, I am enclosing a copy of a note by Professor G. Swarup which describes some of the essential aspects of the programme. An invesment of about Rs. 20 crores will be required for the programme during 1997-2002. Although the University will seek part of the funds from various agencies such as CSIR, DST, DAE, DOE, DOT, DRDO, ISRO etc., UGC's support will be essential for meeting the required infra-structure etc. for teaching part of the programme. Considering the importance of strengthening science education in India, we hope that UGC will make a tentative allocation in its IXth Plan formulation.

With best regards,

Yours sincerely,

Vasant Gowrikar

[Doc 5 / 3 pages) 5/1]

DRAFT

A Background Note for a new initiative in science education at the Pune University

It is now a common knowledge that the quality of manpower inputs to our national programmes in the fields of modern science and technology is deteriorating rapidly. While there can be several reasons for this state of affairs, the main reason appears to be the conflit between the established patterns of the process of education and the needs of the changing times. The modern times lay an emphasis on issue-based development and deployment of manpower, while our education systems are still imprisoned into expertise-based discipline-partitions. Obviously our educational structure fails to excite the imagination of our youngsters and to give them confidence about themselves and their own discipline in the modern context. They are made to gropple in the dark without any sense of what and why they are made to learn what they learn. Also, the systems are said to be designed for the so called "average" student without realizing that such systems serve more to convert a student who could be much "above average" into an "average" student. Although every system should put an emphasis on the elevation of the quality of the average level of competence, it must provide avenues to locate and promote excellence, because it is the excellence which creates new frontiers and shapes our future. The aim of elevating the average level should not be counterproductive to the process of promoting excellence; in fact, it should be supportive of the latter. All the preceding comments go to show that a great deal of effort is required by way of overhauling of our thinking patterns about education in general and higher education in particular.

While several models could be suggested, the multidimensional aspects of the problem suggest that we develop a few models, experiment with them at some places where a will and infrastructural strengths to absorb the changes exists and to evolve them dynamically based on the feedback from all sectors. Some of us felt that Pune University and the multiinstitutional structure which surrounds and supports it can together take a

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lead in this respect. Initially, an experiment could be undertaken in the faculty of science for which the University already enjoys leadership at the national level. We have enclosed a very brief theme paper to initiate discussion and dialogue amongst all of us, who together form the academic community of Pune. There can be many more such theme papers on different subject areas. A debate must constantly go on.

Doc 5/3

NCRA • TIFR

National Centre for Radio Astrophysics
TATA INSTITUTE OF FUNDAMENTAL RESEARCH

NCRA, PUNE UNIVERSITY CAMPUS, POST BAG NO. 3, GANESHKHIND, PUNE 411 007, INDIA
Telephone: Dir. (0212) 356111; Gen. 357107, 351382, 351384-85; Res. 351632; Fax: 355149
Telex: 0145-7658 GMRT IN; Gram: RASTRON; Email: gswarup@gmrt.ernet.in

Prof. G. Swarup, F.R.S.
Professor Emeritus

TFR:Pu:GS: :96
Dated: 6th August, 1996

Dr. V.S. Ramamurthy
Secretary
Department of Science & Technology
Technology Bhavan, New Mehrauli Road
New Delhi 110 016.

URGENT

Dear Dr. Ramamurthy,

Please refer to my letter to Prof. N.C. Mathur dated 20th July 1996 with a copy to you (copy enclosed) regarding the proposed innovative 5-year integrated M.Sc. Programme in the Pune University with all-India input in order to provide well-trained manpower to the various scientific institutes and R&D laboratories in industries in India. The programme is therefore a National Programme.

Prof. N.C. Mathur has suggested that it may be better if DST organizes an informal meeting in the first instance. Prof. Vasant Gowariker will be in Delhi on 20th August 1996 for a meeting at DST concerning sugar technology.

After discussions with Dr. Vasant Gowariker, Vice Chancellor, Pune University I would like to suggest a meeting at DST on 20th August 1996 between 8:30 to 10:00 a.m. to discuss the aims, objectives and methodologies for launching the proposed programme.

I would like to assure you that considerable thinking has been done concerning the above proposal and we would take all the required steps to make it a success, possibly of historical importance in science education in India, if it is approved. Before we submit a formal proposal to the Planning Commission through UGC/DST/CSIR etc. we need to get guidance from the concerned agencies. Based on the above first meeting we will prepare a document for circulation and then have another meeting in early October 1996 to suit all concerned (I will be out of India from Aug. 26-Oct. 3).

Please let me know your convenience. If it is OK, please request the following to participate or send their representatives. We can seek views of DAE, ISRO etc. in due course.

Dr.(Ms.) Armaity Desai	UGC	Dr. R.A. Mashelkar	CSIR
Dr. N.C. Mathur	UGC	Dr. Manju Sharma	DBT
Dr. Abdul Kalam	DRDO		

Sorry to give this short notice. We would like the proposal to be considered for support during the IXth Plan.

With best regards,

Yours sincerely,

G. Swarup

(G. Swarup)

Doc 6/1 fax only

UNIVERSITY OF PUNE

Ganeshkhind, PUNE - 411 007.

December 19, 1996

Dr.(Smt.) Chitra Naik,
Member (Education)Planning Commission,
Government of India,
Yojana Bhavan,
NEW DELHI

Dear Dr.(Smt.) Chitratai,

Not only science and technology have come center-stage in the thinking and living of man but have also become the most powerful instruments for economic growth and social transformation. In the emerging world scenario, the competitive advantage of a nation will increasingly be determined by its scientific and technological capabilities.

Science education is perhaps the most important element in the alchemy of scientific research and technological development. Realising the urgent need to turn out a band of highly talented, highly motivated and highly creative young boys and girls to lead research and development groups in our science agencies, national laboratories and universities, we critically analysed the present system of science education. We share almost the unanimous belief expressed by various individuals and agencies, that decadence and apathy reign supreme as never before in the present System. With extreme rigidity unimaginative teaching, almost total disappearance of spirit of exploration, the present system is totally unable to create scientists with capabilities and motivation comparable to their counterparts in advanced countries. The situation has indeed become alarming and if we do not do something radical and very soon, as the Indian Academy of Science report concludes, the country is heading for a disaster.

Relaising this urgent need to create a band of highly motivated, highly talented and highly creative young boys and girls and more particularly the total inability of the present system to meet this tall order, we are proposing a new and novel initiative totally different and distinct from the present system. We sincerely believe that setting up of Advanced Center for Science and Technology (See enclosure) will serve as a beginning of almost total revolution in the field of science education. We do hope and trust, that in years to come such centres will not only be

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duplicated with some local variations at few other places but will also serve as a model for the existing colleges and universities to emulate and transform themselves to meet the requirement of emerging scenario.

In proposing this center, we are indeed voicing the anxiety and strong feeling of almost the entire scientific community that revolutionary changes are called for in the present system of science education.

The proposal has been informally discussed with heads of various science agencies who are not only favourably inclined but feel that the suggested transformation is urgently necessary.

We do sincerely hope and trust that the Planning Commission will seriously consider this proposal and accord its approval in principle so that the master plan of the proposed center, financial implication etc. could be worked out. We may humbly urge that the present situation is so alarming and the need for change is so great that we must act and act very soon.

With our highest regard,

Yours sincerely,

(N.K.Thakare) Ex.VC NMU	(V.G.Bhide) Univ. of Pune	(V.R.Gowariker) V.C. Univ. of Pune
(J.V.Narlikar) IUCAA, Pune	(G.Swarup) NCRA TIFR,Pune	(P.Ratnasamy) NCL,Pune.
(G.N.Sharma) NCCB, Pune	(K.Banerjee) NIV, Pune	(V.Bhatkar) C-DAC,Pune.
(A.S.Kirloskar) Kirloskar Group	(N.K.Firodia) Bajaj Tempo	(P.Chabria) Finolex

Doc 8/2

ADVANCED CENTER FOR SCIENCE AND TECHNOLOGY

A new initiative in the field of Science Education to train and create a band of highly talented, highly motivated and highly creative young boys and girls to man and lead research and development groups in our science agencies, national laboratories, industries and universities.

CONCEPT AND STRUCTURE

Doc 7 (37 pages)

ADVANCED CENTRE FOR SCIENCE AND TECHNOLOGY

SYNOPSIS

Need of the emerging scenario :

A.1 The world is passing through a phase transition in which international relations will not be governed so much by military might and political considerations but essentially by economic power. The new economic world order has not only been primarily initiated by the exponential growth in Science and Technology but its nature and structure will be determined by Science and Technology. In this emerging scenario, the competative advantage a nation will be determined to a large extent by its technological capabilities.

A.2: Having won the battle of survival India is in the process of becoming an active player in international trade in technology techniques, goods and services. Indeed globalization of our economy is an expression of our desire or rather determination to participate in world trade and commerce commensurate with our manpower, material resources, capabilities and potentialities. Globalization of economy necessarily implies globalization of our science, technology etc. This calls for our participating fully and actively in the inexorable march of Science and continued innovation of technology.

A.3: All this would require an adequate supply of highly trained, highly motivated and highly creative scientists and innovative technologists.

Present State of Science Education :

B.1. Inspite of the fact that India possesses second largest scientific manpower, has one of the finest scientific infrastructures in the world in form of science agencies, national research laboratories, IIT's, universities, our contribution to basic research leading to expansion of the horizon of human knowledge is marginal and to the innovation of technology barring a few exceptions hardly any. The lack of quality science education is perhaps the most important factor of our overall unsatisfactory performance in creative and innovative research. Science education, the very source of tommorrow's science has been left to places and to people who are almost totally incapable of fulfilling the tall order.

B.2. The present system of science education has neither the desired selectivity nor the atmosphere conducive to motivation, innovation, exploration, intellectual adventure and creativity. There has been a continual decline in standards in science and science education. Recent report in nature indicates 33% decline in citations to scientific work done in India during the last five years. This decline in the standards and the poor quality of the graduates and researchers coming out of our system is felt by industries, research institutions, universities, science agencies. In the words of the Indian Academy of Sciences, "the standards in all respects have declined rapidly and alarmingly and unless something is done soon to remedy the situation, the country is definitely heading for a disaster".

B.3. The present system is too rigid. Even at best of places, students opting for physical sciences are never exposed to the fascinations in life sciences. Neither are the students opting for life sciences acquainted with basic

physical principles on which life processes operate. They are also never exposed to the mathematical rigour.

B.4. Demonstration, experimentation, exploration which are at the core of scientific pursuit have almost totally disappeared from our schools and colleges. Science is taught as prose or poetry and learnt by roat. Developing pupil's mind to reason or to question is never encouraged and is even frowned upon.

B.5. Examination system with its emphasis on memory further complicates the situation. Those who teach do not evaluate in the present system; those who teach are seldom involved in framing curricula. This leads to lack of attachment of teachers with the taught and also to what they teach.

B.6. Even in their heyday when decadence and apathy did not reign supreme as of today, the best of our universitiesf were examination shops, presiding over a collection of colleges where memory based learning leads to the craze for a piece of paper called the degree.

B.7. Students emerging out of the system lack curiosity, have never experienced excitement of doing science, lack creativity and innovativeness, suffer from lack of confidence in themselves. Learning in any true sense has never been emphasized. A system of this description can never, without revolutionary changes, meet the challenges of creating Indian Scientists who will be equal to their counterpart in technololgically advanced countries.

Advanced Centre for Science and Technology:

C.1. In view of the demand of the emerging scenario for ensuring adequate supply of highly talented, highly motivated and highly creative scientists and realizing the total inability of the present system of science education, it is

proposed to take a novel and new initiative in establishing a system of education totally different and distinct from the present system, with a view to create a band of highly talented, highly motivated and highly creative young boys and girls who through their contribution to the growth of science and to the innovation of technology ensure technological competitiveness of India in the emerging economic world order. This is sought to be done through the establishment of Advanced Centre for Science and Technology.

C.2. Advanced Centre for Science and Technology will bring teaching and research under the same roof; bring learning, exploration and intellectual adventure in close physical contiguity and in intimate intellectual relationship. In a sense Advanced Centre for Science and Technology will provide an atmosphere of creativity in which young minds will be excited to perform to the limit of their capabilities.

C.3. Advanced Centre for Science and Technology will offer five year integrated course leading to the M.Sc. degree. The integration will be both in terms of time as well as discipline. Emphasis will be laid on the unified structure of Science as man's quest for an understanding of Nature and for the utilization of this understanding for the benefit of man.

C.4. The programme will seek to lay stress on both intellectual ability, acquisition of skills of all types and on imbibing spirit of exploration and intellectual adventure.

The input to this programme will be through National Open Competitive examination supplemented by discussion with a group of faculty members.

C.5. The input to this programme will be restricted to 300 annually distributed amongst four streams namely, (1) Physical Sciences, (2) Life Sciences, (3) Mathematical and Computational Sciences and (4) Earch Sciences.

It will be a totally residential programme for the students and the faculty.

C.6. First year will be common to all. In the first year, the students will be exposed to basic physical principles, mathematical rigour and the excitement of Life Science. In addition to demonstration packed class room activity, the students will be exposed to open ended experiments and will be groomed in various skills.

C.7. At the end of the first year, students can opt for any of the four streams. There will be total flexibility in terms of choice of courses from amongst a large menu of courses.

Every student will have a faculty adviser who will advice him on choice of courses, monitor his progress, solve his difficulties.

C.8. At the end of third year, an aptitude cum ability test will be given to the students and based on the performance of this aptitude test, the student in consultation with his guide offer for any speciality which could be of basic nature or of applied nature.

During these two years, each student will be attached to acknowledged research groups in his speciality so that he can become a part of a research programme and imbibe the spirit of exploration.

C.9. In the fourth and fifth year, the student will devote himself to his chosen field of specialization. There will be some core courses and some

selective courses related to his chosen field. In the fifth year, the student will carry out major investigations or undertake developmental work in research laboratories and in industries. This internship programme will be a distinctive feature of the system.

C.10. The faculty will be very carefully chosen so that only the best will teach these talented students.

Faculty will be encouraged to evolve workable alliances with industry. This coupling of the Centre and the industry will be another distinctive feature of the new system.

D.1. Location of the Centre:

Taking into consideration the existence of a large number of very prestigious research institutions both in civilian sector (NCL, IUCAA, NCRA, TIFR, NIV, CWPRS, IITM, IMD, ARI, University Departments) and in Defence Sector (ARDE, IAT, CME, NDA etc.) as also a large number of industries, (TELCO, Bajaj Auto, Kirloskar Group, Bajaj Tempo, Kinetic Engineering, Alfa Laval, Sandvik Asia, Garware and several others, more particularly, a large number of technology oriented small enterpreneur's enterprises) on and around the Pune University campus, it is proposed to locate this Centre on the campus of the University of Pune. This decision is influenced by the offer of the University to provide laboratory, library and other infrastructrural facilities as well as some of its senior staff in the initial period. The Centre will be required to develop close linkages with the University of Pune through participation both in teaching and research programs (by the faculties of each organization).

E.1. Administrative Set-up:

Advanced Centre for Science and Technology will be a National facility. It will be registered as autonomous society under Society

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Registration Act. It's Governing Body will consist of representatives of Industry, National Science Agencies and Laboratories, eminent academicians and the UGC. It will have the status of Institute of National importance and the authority to award its degrees. Detailed administrative set-up will be worked out later.

F.1. Financial Implications:

Although detailed financial estimates and the master plan for the proposed center are in the process of being worked out, the financial allocation necessary for the five year period (1997-2002) covered by ninth five year plan is as under:

	Capital (Rs.)	Recurring (p.a.)	Total for five years
1. Building and other infrastructure.	12.00		
2. Equipment	08.00		
3. Staff salaries	-	2.0	10.00
4. Fellowship & stipends	-	1.0	05.00
5. Chemicals and Consumables	-	1.0	05.00
6. Endowment	25.00	-	-
	45.00		20.00

Grand Total Rs. 65 crores.

F.2. Sharing of Financial Burden :

The financial burden will be shared by the beneficiaries of this programme namely, industries, Government etc. The sharing pattern as under seems reasonable and feasible on the basis of preliminary discussion.

		Rs. in Crores
1.	Industries	25.00
2.	CSIR, DST, DAE, DOE, DBT, DOS, DRDO etc.	15.00
3.	Government of India, Ministry of Human Resource Development.	15.00
4.	State Government	05.00
5.	Public Donations	02.00
6.	U.G.C.	05.00
	Total	67.00

G.1. Prayer:

In view of the importance of the project and the urgent need to take meaningful initiatives in the field of Science Education so as to turn out a band of highly talented, highly motivated and highly creative young boys and girls who could satisfy the demand of creative scientists as required in the emerging scenario, the Planning Commission could kindly approve in principle the establishment of Advanced Center of Science and Technology as a ninth five year plan scheme. Once this approval is accorded, one can enter into a serious dialogue with industries and start detailed planning of the Center.

ADVANCED CENTER FOR SCIENCE AND TECHNOLOGY

CONCEPT

Preamble :

India is today passing through a phase of transition and is standing at the cross-road. The country has won the battle of survival. Searcity and starvation deaths remniscent of our early years of independence are over. Today, it is the question of walking abreast of developed nations, by contributing to the store of human knowledge and participating fully in the inexorable march of science, by redeening our pledge of providing decent standard of living and quality of life to every citizen, by innovating and developing technology, by remaining at the cutting edge of technology and by transforming technology for the production of goods and services.

India's recent decision of liberalisation of its economy and globalising it is in a sense an expression of its desire and indeed determination to become a very active player in the international market space, and to participate in world trade in technology, in products and processes, and in goods and services, commensurate with its rich human and material resources, geostrategic position, size potentialities and capabilities. Globalization of economy necessarily implies globalization of our education, science, technology, industry and management. We must envision that the next century belongs to India, and consistently work for realising this vision.

In the contemporary world, science and technology have become the most powerful instruments for economic development and social transformation. This was realised by Pandit Jawaharlal Nehru even before India attained its independence. Indeed at the convocation of Allahabad University he said " It is science alone that can solve the problems of hunger and poverty, of insanitation and malnuitrition, of illiteracy and blind faith, of superstition and deadening custom and tradition, of vast resources running to waste of a rich country inhabited by starving millions". While presenting Science Policy Resolution to the parliament and expressing India's determination to pursue science and participate in the inexorable march of science, he said " It is an inherent obligation of a great country like India with its tradition of scholarship and original thinking and its cultural heritage to participate fully in the march of science, which is probably mankinds greatest enterprise today." Under his visionary leadership, India set about establishing one of the finest scientific infrastructures in the world in form of national laboratories, scientific agencies. Indian Institutes of Technology, Universities etc. Occaisonally, feelings were voiced to say that instead of developing sound scientific infrastructure, the country should import technology and rapidly industralise. Fortunately, the country evolved a very judicious balance between stress on developing sound scientific infrastructure and import of technology. Homi Bhabha, father of India's atomic energy programme while addressing the General Assembly of the International Council of Scientific Unions, just before his death said " What the developed countries have and the developing countries lack is modern science and an

economy based on ageold practices to the one based on modern technology developed elsewhere without at the same time establishing science in the country as a live and vital force. If the answer to the question is in the negative and I believe our experience will show that it is, then the problem of establishing science as a live and vital force in the society is an inseparable part of the problem of transforming an industrially underdeveloped country to a developed country", While these statements are as relevant today as they were when they were first made, problems of national development and the nature of science itself as well as that of the world economy have assumed greater dimensions and complexity and call for not only a restatement of our conviction but also pose a challenge for appropriate, immediate and effective action.

Just as the country is passing through a phase of transition, the world itself is in a state of transition. With the dismanteling of the Soviet Union and cessation of cold war, the emphasis is rapidly shifting from military power and political domination to economic power and controls. The nature and the structure of the new economic order will be more and more determined by what happens at the market place which in turn will be determined by technological capabilities. This change in the paradigm must reflect in our perception of science, technology and economic power. We have to manage efficiently a change from restricted and controlled economy to free and competetive economy, from protective market strategy to competetive market forces. In this process, we must keep at the back of our mind that not only the new economic world order has been initiated by tremendous growth in science and technology but its nature and structure will be determined more

and more by science and technology. In the new economic order, intellectual property will not only be protected but zealously guarded. This is evident even now through the insistence of developed countries on new patent regime.

One must also realize that science is growing exponentially and technology is developing rapidly. There are very many implications of this exponential growth of knowledge connected with science and technology. One of the most obvious one is the continual shrinking of the time of obsolescence. The time of obsolescence was about 50 years at the beginning of this century. Presently, it is about three to five years. A situation is fast approaching when a graduate will become obsolescent the day he gets his degree and a research paper will become out of date the day it is published. This calls for a transition from one time learning society to a continually learning society.

Another consequence of this exponential growth in the knowledge connected with science and technology is that the time gap between a major discovery and its industrial exploitation for economic growth is also continually shrinking. Faraday's laws of electromagnetic induction remained seventy years to be exploited to establish power stations to generate power to fuel economic growth. Presently, within a couple of years, major discoveries are exploited to revolutionise the related field. Thus for example, the discovery of transistor action in Bell Labs, USA revolutionalized the entire electronic industry within a couple of years. The discovery of lasing action is another instance in point. In view of these momentus changes, no country

much less the size of India can even survive let apart grow unless it innovates continually and transforms these innovations to accelerate economic growth.

There is yet another factor whose significance we can ill afford to neglect. Man's relationship with Nature has undergone profound changes over the centuries, since he stepped on this planet a million or more years ago. In the hunting societies, man was totally parasitic on Nature. In agricultural societies, he started imitating nature. After the discovery of steam engine, man started dreaming about the conquest of nature. For a man who lived in the eighteenth and the nineteenth centuries, it appeared to him to have found through science a sure way of unlimited progress and affluence. This led to severe exploitation of nature resulting in fast depletion of raw material and energy resources as well as to unaffordable pollution and ecological degradation. The same trend has continued in the present century happily with growing realization of coexistence with Nature and the realisation of the urgent need to strike harmony with Nature.

The developed countries who enjoyed the furits of exploitation of Nature in raising the standard of living of its people have suddenly become vocal in impressing and insisting upon the need to develop ecologically friendly technology. This insistence is not wholly due to pious desire to preserve Nature but is also partly an expression of their desire to curb the growth of developing nations.

It is against this very complex world scenario India will have to wade its way to the top. The path is not simple but the goal is surely attainable. However, this calls for tremendous effort to create situation where we contribute to the store of human knowledge commensurate with our

capabilities and develop newer and innovative technology so as to lead the world in some chosen fields. We must realize that in race of excellence there is no winning post and that the finishing line continually receeds. In this endevour, the importance of science education and technological training can not be overemphasized. Indeed the Science Policy Resolution passed by Parliament in 1958 commits Government of India inter alia to (1) ensure an adequate supply, within the country of research scientists of the highest quality and to recognize their work as an important component of the strength of the nation and (2) encourage and initiate will all possible speed programmes for the training of scientific and technical personnel on a scale adequate to fulfill the country's need in science, education, agriculture, industry and defence.

Present status of Science Education in the country.

Since the time of Jawaharlal Nehru and essentially because of his dominating influence in shaping India's policies the vital importance of science education in creating science as a live and vital force for economic growth and social transformation was echoed and recchoed in the pronouncements of various commissions (Kothari, Radhakrishnan and other Commissions) and policy formulations. The National Policy on Education approved by the Parliament in 1986 restates the pivotal role of science education in the context of developing scientific temper and in promoting economic development. There can not be two opinions as to the need for establishing highly efficient and stimulating science education programmes. so that the growing need of highly qualified and motivated scientists and technologists can be met effectively.

Since independence, there has been a phenomenal growth in the number of universities and colleges imparting science education as well as in the enrolment of students in the science stream. The enrolment in the science stream was about 1,27,168 in 1950-51. This increased 7,25,328 in 1986-87 and today it stands at about a million. Thus there has been about eight fold increase over the last 45 years.

Though the actual enrolment has steadily increased over the years, there has been a decline in the percentage of students opting for science. In 1950-51, 32.1% of the students who passed the higher secondary examination opted for science. However, this percentage has dropped over the years and is today around 18%.

It is not only the decreases in the percentage that should concern us but the fact that the students offering science today are perhaps the lower middle level 19% in contrast to upper 32% who offered science in 1950-51. Both these facts show that students particularly the bright ones seem to shy away from science.

The reasons for this decline in percentage and the quality of students opting for science are not far to seek. Unlike in 1950-51, the facilities for technical and professional education such as engineering and medical have increased considerably siphoning brighter boys and girls to the technical and professional streams leaving only medicores to opt for science. The preference of the students for the technical and professional streams is primarily because of the better employment opportunities for technically trained graduates as compared to that available for science graduates. In no

small measure, the migration of students away from science is due to dull and drab teaching of science in our schools and colleges. The dismal fact is that persons who do not get admission in professional schools namely medical and engineering schools gravitate towards science, not because they are interested or motivated in doing science but because they must do something and they do not know what else to do. The brighter ones out of even those who opt for science at the graduate level appear for the competitive examinations like IAS,Banks and other secure professions. It is thus the "distilled left over residue" which forms the major input of our higher science education programme.

In order to attract bright boys and girls to basic sciences, a science Talent Search and National Science Talent Search awards were introduced at the instance of Prof.D.S.Kothari in 1964. The selected students were given the awards only if they pursued science as a career. The awards were in the form of scholarship right upto the doctorate level. Initially there were 350 awards in the entire country. However, in 1973 or thereabout the scope of the scheme was enlarged and the restriction that the award would be given to only those who opted for science was dropped and the number of awards was increased to 750. With this change, the input of brighter students in science further decreased. It is with some concern that one may mention that hardly 10% of the awardees of National Talent Search undertake education upto the first degree in science, and not more than 2% pursue their post graduate studies in science.

This clearly presents two related problems. A large number of talented students simply do not opt for a career in science because they do not

consider it as a rewarding and satisfying career. At the same time a large number of unmotivated and uninterested students seek a career in science. Ideally one would like to have a situation where a large number of talented students are motivated to seek a career in science and then one could selectively choose a smaller number namely those who demonstrate a creative bent of mind so essential for higher science education and a productive career in scientific research.

To make matters further worse, most of the students who opt for science after higher secondary examination are taught for their undergraduate course leading to B.Sc. degree in colleges. In fact recent UGC report shows that nearly 88% of the undergraduate science students are taught in some 1800 affiliated colleges. Many of these colleges are underequipped, over crowded, and poorly staffed. Laboratory and library facilities are generally inadequate. Even proper text books are not available. In such an environment, it is almost impossible for a student to experience excitement of doing science and to get motivated to opt for science as a career. Any person faced with a choice of career will ask typically two questions, namely, (1) Is a career in science going to provide comfortable life ? and (2) Is a career in science going to be sufficiently challenging and fulfilling as one's life's work? The second question is very important and one should not underestimate its value in moulding and influencing young minds. If our kids see our working scientists' fulfilled lives with a high degree of job satisfaction, many of them will be motivated to take up careers in science. If not, even the motivated few will be repelled by such a choice. When our kids look at our working scientists and their teachers, they should not see them as people plodding

away like cogs in a wheel, frustrated because they are not getting anywhere, indulging in escapism and ego gratification. They should instead see fulfilment of honest variety resulting from solid contributions made to the development of science, technology etc. within the country. They should see sparks of creativity in action. They should feel inspired by the dedication and creativity oozing out of such peers. The situation in affiliated colleges is far from what should be and is indeed such that even those who are fascinated by science in the school days are repelled by a career in science.

Thus the present system has neither the desired selectivity nor the atmosphere conducive to motivation, innovation and creativity. The consequence of all this is obvious and unmistakable. There has been a continual decline in the standard of our first degree in science. The level attained by our B.Sc. today is very much inferior to that of a graduate in advanced countries. It is at the undergraduate level that we see a sudden and steep full in the quality of education. The students emerging out of our colleges lack curiosity, are devoid of creativity and innovativeness, lacking confidence in themselves, unexcited, totally unmotivated and frightful of their future.

The examination system, laying as it does more emphasis on memory rather than analytical skill, comprehension and innovativeness, further deteriorates the situation. The situation is alarming. It is becoming increasingly difficult to find adequate numbers suitably qualified and motivated to man our research laboratories, industries. Weak undergraduate programme leads to still weaker post-graduate programmes and poor research output. The signs of this alarming situation are clear for any one to see.

The Department of Atomic energy initiated a scheme to select some 300 trainees for their training school. Thse trainees eventually man the various departments and divisions in atomic energy establishments. It is becoming increasingly difficult to get even half this number. The experience of the department of space, CSIR and other research organizations is much the same. The University grants Commission recently introduced an eligibility test for college and university teachers. The performance of college teachers and those who have done their post graduation is indeed pathetic. Hardly 5% of the candidates qualify in this National Eligibility Test. Recent reports published in Nature (October, 1996) have shown that Indian Science both in terms of quality and quantity is sliding down. Over the last five years or so, there has been a 33% decline in citation of contribution by Indian scientists. Numerous such examples can be cited to indicate the alarming situation in science and science education.

There are several other drawbacks and lacunae in our undergraduate science education programme. Undergraduate curricula are too rigid. Even in the best of places, combinations such as Physics, Chemistry, Mathematics and Chemistry, Botany and Zoology, are the only two combination (options) available to the students. Both these lack in depth and content. The absence of flexibility has made it impossible for a student opting for physics, chemistry etc. to be exposed to the present excitment in life sciences. Likewise, a student in life sciences is never acquainted with basic physical principles on the basis of which life processes function. Nor are they exposed to the mathematical rigour, necessary to understand modern biology. The

compartmentalization of disciplines is too rigid to bring out unity and universality of science.

Undergraduate and post-graduate science education programmes depends entirely on chalk-talk concept, doling out uncorrelated information without bringing out basic concepts and the unity of science. Science is exploration, an endless quest to understand Nature and laws of Nature. However, science is taught as a closed book. Demonstrations and experimentation which is at the core of science has almost disappeared from our Schools and Colleges. The experimental culture and the spirit of exploration is getting extinct.

A teacher who teaches at the undergraduate or post-graduate level has hardly any say, in the present system of affiliated colleges, in formulating curricula or in evaluating his own students. This results in the lack of attachment of a teacher to his teaching as well as to the taught. The system of affiliated colleges has the greatest of stifling effect on both the teacher as well as on the taught. Experimentation in curricular development, evaluation system is totally absent in our educational system.

The most disturbing feature of our education system is that of evaluation. It is recognised by all that education and evaluation can not and should not be divorced from each other. Indeed they are the two aspects of the teaching-learning process. However, in the system of affiliated colleges, while most of undergraduate education is imparted in colleges, examinations are conducted by the universities, who have no direct interest or control over the educational process itself. These examinations lay termendous premium on memory and fail to test the ability of the students to (a) critically analyse a

situation and to find a way out (2) reasoning and logic (3) comprehension (4) Creativity, innovativeness and model building capacity (5) communication skill etc.

Indian Universities have remained a continuation of the colonial past. Even in their heyday (some of them had such times) where decadence and apathy did not reign supreme as of now, the best of our universities were examination shops, presiding over a mere collection of colleges where memory based learning led to the end product namely a piece of paper called the degree. Learning in any true sense has never been the primary objective. Educational institutions of this nature can never, without almost revolutionary changes, meet the challenge of creating scientists in India who will be equal to their counterpart in developed countries in all aspects. In view of the above analysis, it is not difficult to explain a seeming paradox that inspite of the second largest scientific manpower in the world, our contribution to basic sciences in terms of broadening the horizons of human knowledge is marginal and to the innovation of technology, hardly any. In the context of the changed global scenario, emergence of the primordial role science and technology will play in determining world economic order, exponential growth in the knowledge connected with science and technology with the corresponding shrinking of the time of obsolescence and the time lag between a major scientific discovery and its exploitation for economic growth, it will be at our peril if we do not take urgent and effective steps to stem the rot and make science education programmes productive, exciting and capable of turning out highly talented, dynamic and motivated young boys and girls who

would contribute to the advancement of science and to the application of science for national development.

It is no denying that modern India is brimming with young people full of vitality, talent, enthusiasm and aspirations. This is our most precious resource. It is a fundamental right of these young boys and girls to go through an educational system which motivates them in the right direction, trains them and prepares them for life to come and help them to unfold their potential to the limit of their capabilities. It is our duty and inherent obligation to provide them with such a system.

Recognition of the need to change :

The urgent need to change the present system and the need to try different models and experiment on them has been felt by various organizations and individuals.Indeed various novel programmes have been suggested. However, things have not moved and not even a single experiment has been tried. We may urge that there is not much time to loose as because the situation is so alarming that if we do not do something to change pretty soon, the situation may indeed become irretrievable. We may mention of a few initiatives that were suggested during the last four-five years.

1. Planning Commission Initiative.

A meeting was held on 10th March, 1989 under the chairmanship of Prof.P.N.Srivastava, the then Member, Planning Commission, to discuss ways and means to improve science education at Indian Universities/Colleges. The meeting was attended among others by Prof.M.G.K.Menon, Prof.S.Chrakravarty (Both members, Planning

Commission), Prof.C.N.R.Rao, Prof.Yash Pal (the then Chairman, UGC), Prof. R.P.Bhambha, Prof.A.Gnanam, Prof.V.G.Bhide, Prof. P.L.Srivastava (Director, NCERT). The meeting discussed the then existing situation and noted that " the situation has assumed alarming proportions and is causing grave concern". The meeting appointed a working group under the chairmanship of Prof.V.G.Bhide to prepare a detailed report for the consideration of the Planning Commission. The Bhide Committee report was submitted to Planning Commission in July, 1990. A copy of the report is appended. It is reported that the commission approved of the report in principle and forwarded to the UGC for implementation.

(2) UGC Curriculum Development Centres Programmes:

The UGC set up these centres in 1988 for various subjects. They undertook the assesment of the quality and context of existing curricula and evolved new curricula. These were circulated to various universities.

(3) Quality University Education for Scientific Talent: QUEST Programme.

This programme was similar to the first tier programme suggested in Bhide Committee report.The programme was sponsored by Punjab University, Chandigarh.

(4) INSA report on the National Status in Sciences:

As a part of its Diamond Jubilee activities, the Indian National Science Academy commissioned special studies on the status of education in various sciences. These study reports also drew attention to the alarming situation in science education and pleaded for a change.

(5) **Indian Academy of Sciences Initiative:**

The Indian Academy of Sciences appointed a panel consisting of (1) Prof.V.G.Bhide, (2) Prof.J.Chandrashekar, (3) Prof.M.K.Chandrashekharan (4) Prof.S.Datta Gupta (6) Prof.B.M.Deb (6) Prof.R.Gadagkar (7) Prof.N.Mukunda (8) Prof.A.Sitaram (9) Prof.V.Srinivas and (10) Prof.R.Srinivasan to prepare and academy paper on the status of science education and to suggest appropriate measures to improve the quality of science education in our colleges and universities. The panel recorded that "the standards in all repects have declined rapidly and alarmingly and unless something is done soon to remedy the situation, the country is definitely heading for a disaster". The panel recommended among other things "we urge the adoption of a three-stream approach to undergraduate education in science in the spirit of the framework proposed by the working group of the Planning Commission (Bhide Committee Report).

(6) **National Science University:**

While analysing the status of Science in India, and recording the alarming situation, a group of NRI's proposed the setting up National Science University on the lines of great Universities in the United States. UGC appointed a Committee to scrutinize the proposal. The UGC Committee accepted the proposal in principle and recommended the setting up of National Science University to Government of India. However, finally, the proposal seems to have been shelved.

ADVANCED CENTER FOR SCIENCE AND TECHNOLOGY

Noting that the world is passing through a phase of transition from politically and militarily dominated international relationships to economically governed international relations,

Realizing that the new economic order which is evolving has not only been initiated by the growth in Science and Technology but its nature and structure will be determined by the state of Science and Technology in various countries,

Appreciating the exponential growth in knowledge connected with Science and Technology with the corresponding shrinking of the time of obsolescence and the continual decline in the time gap between a major scientific discovery and its industrial exploitation,

Recognizing that in the emerging scenorio, no country much less the size of a country like India with its rich material and human resources, its capabilities and potential can not even survive let apart grow unless it innovates and uses these innovations for promoting industrial growth and economic development,

Noting the desire and indeed the detemination of India to participate fully in the inexorable march of Science and development of technology, and participate in international trade in technology, techniques, goods and services commensurate with its population and resources, rich heritage and tradition of original thinking and scholarship expressed recently through the globalization of its economy.

Appreciating the pivotal role of science education in alchemy of scientific research and technological development.

Alarmed by the present decadence and apathy in the field of science education and its total inability to train a band of young boys and girls with requisite motivation, skills and capabilities.

It is proposed to set up Advanced Center for Science and Technology. It is a new initative, new in every respect, in the field of science education designed to turn out a band of highly talented, highly motivated and highly creative young boys and girls who will lead research and development groups in scienctific agencies, national laboratories, industries and universities. They are expected to be the best and comparable to the best anywhere in the world who would not only contribute to the store of human knowledge but will innovate new and novel techniques and technologies to promote and accelerate economic growth.

The Advanced Center of Science and Technology will be a radical departure from the existing college and universities as it will bring teaching and research under the same roof ; learning, exploration and intellectual adventure in close physical contiguity and in intimate intellectual relationship. It would seek to create an ambiance of creativity, innovativeness, intellectual adventure where young minds will see constantly sparks of creativity, exciting them and inducing them to be creative, dedicated and motivated. The twin roles of conventional teaching university and a research institute would be performed by this single entity. This assigned role to the proposed Advanced Center for Science and Technology is a result of the realization that the most efficient form of teaching is the discovery itself and is when teaching and learning are viewed as an adventure in discovery. There is

perhaps no greater stimulant for the young minds than discoveries and inventions occurring in his surrounding.

Advanced Center of Science and Technology will provide for five year integrated science education programme leading to the M.Sc. degree. An attempt will be made to integrate the programme in terms of time as well as discipline with a view to both optimally use the time available, avoiding duplication and also for presenting the unity of science. Emphasis will be laid on the unified structure of science as man's quest for an understanding of Nature and Natural laws and for the utilization of this understanding for the benefit of the people.

The programme will seek to lay stress on both intellectual ability, acquisition of skills (such as computational, communicational, design, fabrication, modelling, simulation) and on imbibing spirit of exploration and intellectual adventure.

The input to this programme will be restricted to an intake of 300 students distributed amongst (1) Physical Sciences, (2) Mathematical and Computational Sciences, (3) Life Sciences and (4) Earth Sciences. In fact, the students will be offered a large menu of courses from which they could choose. Admission to this programme will be highly selective based on performance at a well designed national competitive examination supplemented by personal discussion with a group of faculty members. The examination will be open to all students, who have passed 10 + 2 examination from all over the country. The admission will be based on no consideration other than merit and merit alone

First year will be common to all the students. In the first year, the students will be exposed to basic mathematical skills, basic physical principles and exicting developments in life sciences. Supplementing this demonstration filled class room activity, the students will perform open ended experiments and acquire a variety of skills.

At the end of the first year, the students will opt for any of the following streams (1) Physical Sciences, (2) Mathematical and Computational Sciences, (3) Earth Sciences and (4) Life Sciences. Although students will branch off into these streams the choice of courses within the stream and in other streams will be totally free and optional with only condition that they opt for some stipulated core courses. Indeed, there will be a large menu of courses from which a student could make his choice.

At the end of the third year, an aptitude cum ability test will be given to the students and based on the performance of these tests, students will offer areas best suited to their aptitude and abilities. Thus, even within a given subject such as physics, a student could opt for courses useful for making basic science as his career or such courses as are more application and industry oriented. Right from the second year, students will be allocated to acknowledged research groups in areas of their choice. They could then participate in research activities while doing their undergraduate studies. This will be an essential component of the programme as this will enable them to be brought up in creative atmosphere in which they see sparks of creativity oozing ,out as it were ,from their mentors and colleagues.

In the fourth and the fifth year, the students would devote themselves to their chosen field of specialization, such as Information Science, Material

Science, Nuclear Physics, Biotechnology, Microbiology etc. In the fourth year, they will be exposed to some basic but advanced courses related to their chosen field. Every student will have a faculty adviser who will guide the student in relation to the choice of courses, monitor his progress, solve difficulties. During fourth and fifth year but more particularly in the fifth year, the students will not only do open ended explorations but will pursue a research or developmental project. This could be carried out in house or in an industry or in national laboratory. A couple of courses in economics and management will also be given to those who opt for application areas so as to acquaint them with economic theories and modern management practices.

There will be continuous assessment of the students in addition to the Semester end examination. The evaluation of the students will be carried out by the teachers themselves who will not only grade the performance of the student but will indicate to him his strong points and weak spots. The Semester end examinations will be carefully designed with a view to test (a) capacity to analyse a situation and find a way out (b) ability to reason logically (c) ability to comprehend what he sees, reads, hears and use this comprehension to tackle an unknown situation (d) memory (e) creative and innovative or model building ability and (f) communication skill.

At the end of five year training programme, a student will become eligible for M.Sc. degree.

This will be a totally residential programme with students and faculty staying on the campus. Each student will be paid a suitable stipend good enough to meet his expenses and fees. During 5th year, the students will be

paid decent fellowships through an endowment created for the purpose from the donations from participating industries and institutions.

Advanced Center for Science and Technology has been proposed as a possible mechanism for beginning a transformation so badly and urgently needed to raise qualitatively the standard of scientific research and technological innovations. Needless to say, the level of science and technology and of science education are intimately and inextricately linked. This ia a new innovation and we are conscious of the number and magnitude of the problems one will have to face. But notwithstanding these problems, we must act and act soon and decisively for we can no longer condemn our future scientists, our future science and technology and possibly our future economic well being by subjecting our youth to the dismal education available to them as of today.

This Advanced Center, it is hoped, will serve as a model to be replicated at few other places in the country and to influence neighbouring colleges and universities.

Faculty:

The best of our students deserve to be taught by those who have achieved distinction in their line of work and who are actively engaged in research and investigations. It is well known that the sheer presence of an active eminent scientist can trigger the imagination of young minds. A continual, vigorous and intimate intellectual relationship between the faculty and the students can work wonders for both. It is always, a dialogue between an inquisitive student and experienced teacher that has led to the advancement of human knowledge. The faculty will thus be very carefully

chosen. The new institution will scrupolously avoid heirerchial approach to scientific administration. There will be no scientific leadership by appointment but essentially by attainment. All the academic matters and policies will be decided collectively by the faculty and administrators even scientific administrators will have no place because of the administrative positions they hold.

The faculty will be encouraged to evolve workable alliances with industry and in the process become self sufficient in terms of research grants. It will be a constant endeavour to build strong links with industry so as to develop synergy between faculty and industry. This relationship between faculty and industry will be one of saliant features of the Advanced Center for Science and Technology.

When fully operational after five years, the faculty will be around 200-250.

Location of Advanced Center for Science and Technology:

The location for the proposed Advanced Center for Science and Technology has to be very carefully chosen as local ethos will be very critical to the success of this endevaour.

Taking into consideration the presence of a large number of prestigious national science organizations in the civilian sector, such as National Chemical Laboratory, Inter University Centre for Astronomy and Astrophysics, TIFR, National Center for Radio Astronomy, Centre for Development of Advanced Computation, National Centre for Cell Sciences, National Institute of Virology, Indian Institute of Tropical Metereology, India Metereology Department, Central Water and Power Research Station, and a

number of research organizations in defence sector such as Armament Research and Development Establishment (A.R.D.E.), Institute of Armament Technology (I.A.T.), National Defence Academy (N.D.A.), College of Military Engineering (C.M.E.) etc., on and near the campus of one of the leading universities in the country namely, Pune University as also the presence of a large number of industries namely, Kirloskar Group of Industries, TELCO, Bajaj Auto, Bajaj Tempo, Garwares, Sandvik Asia, Alfa Laval, Crompton Greaves and several others and more particularly, the well known traditional atmosphere of regard for scholoarship and learning in Pune, we feel that Pune is an ideal location for setting up this proposed center. Furthermore, University of Pune have indicated its willingness to house this proposed Center on the Campus of the Unviersity. Additionally, it has indicated its willingness to provide all cooperation in the initial phase in relation to laboratory and library facilities, staff etc.

Taking all these into consideration, it is proposed to locate this Advanced Center for Science and Technology on the Campus of the University of Pune. The Centre will develop close linkages with University of Pune through appropriate MOU.

Administrative Set-up:

The Advanced Center for Science and Technology will be a National Facility. It will be registered as an autonomous society under the Society Registration Act of 1860. It will have a Governing Body consisting of representatives of industry, scientific agencies (CSIR, DST, DAE, DOE, DBT, ISOR etc) and eminent Academicians. The detailed administrative structure will be evolved shortly. It will not be affiliated to any of the existing

universities but will be an institution of national importance with an authority to award degrees, certificates etc.

Financial Implications:

The Advanced Center for Science and Technology will in course of time, require its own buildings for class rooms, library, laboratories, hostels, staff quarters etc. This building activity will be completed over a period of two years.

In addition, the Center will require to equip laboratories, create research facilities etc.

Besides there will be recurring expenditure on staff salaries, chemicals, research journals etc.

Although detailed estimates and master plan for buildings are in the process of preparation, the following are the rough estimates on capital and recurring expenditure.

(Rs. in Crores)

	Capital	Recurring	Recurring for five years
1. Building and other infrastructure	12.00		
2. Equipment	08.00		
3. Staff & Salaries		02.00	10.00
4. Fellowship & Stipend		01.00	5.00
5. Lab.components & chemicals.		01.00	5.00
6. Endowment	25.00		
	45.00		20.00

Thus, over a period of five years (1997-2002), the financial outlay will be in the neighbourhood of Rs. 65 crores.

The endowment of Rs. 25 crores is sought to be raised so that interest on this endowment will partially cover the annual recurring expenditure on scholarships, library and working expenditure. This is being done with a view to reduce in subsequent years the recurring expenditure to the barest minimum. Indeed, efforts will be made to generate enough endowments so that the recurring expenditure will be met from interest on endowments.

The beneficiaries of this novel programme are going to be essentially scientific agencies, national laboratories and industries. The proposed financial outlay of Rs. 65 crores is sought to be generated through grants and donations from the beneficiaries.

The Advanced Center for Science and Technology will be jointly sponsored, operated and directed by industries, scientific agencies, science academies and the Government. Consequently, each one of the sponsoring agencies will meet a share of financial burden. on the basis of preliminary discussions, the following sharing pattern seems reasonable and possible.

		Rs. in crores Over a period of five years
1.	Industries	25.00
2.	CSIR, DST, DAE, DOS, DBT etc.	15.00
3.	Govt. of India, Ministry of Human Resource Development	15.00
4.	State Government	5.00
5.	Public Donations	5.00
6.	UGC	5.00
		65.00

It is presumed that Income Tax incentive under Section 35(i)(ii) will be available to the donors who donate to this Advanced Center.

Prayer:

In view of the importance of the project and the urgent need to take meaningful initiatives in the field of Science Education so as to turn out a band of highly talented, highly motivated and highly creative young boys and girls who could satisfy the demand of creative scientists as required in the emerging scenario, the Planning Commission could kindly approve in principle the establishment of Advanced Centre of Science and Technology as a ninth five year plan scheme. Once this approval is accorded, one can enter into a serious dialogue with industries and start detailed planning of the Center.

Rs 5 Crore

AP4

DR. CHITRA NAIK
Tel./Fax No. 371 5932 (O)

PLANNING COMMISSION
YOJANA BHAVAN
NEW DELHI-110001
January 7, 1997.

Dear Shri. Dasgupta,

As you are aware, the state of science education in India, particularly with a view to providing the necessary scientific manpower for the country's development is not satisfactory at present. In this connection some eminent scientists have come together to formulate porgrammes for developing talent with special focus on scientific research. Among this group there are internationally known scientists like Dr. Jayant Narlikar, Dr. Govind Swarup, Dr. V.G. Bhide, Dr. Vasant Gowariker, (at present Vice-Chancellor, Pune University), Dr. N.K. Thakare and others. They propose to establish an Advanced Centre for Science and Technology for providing a five year integrated M.Sc. programme. Several industrialists who have been contacted by this group have agreed to provide substantial finance for this innovative and essential programme.

Facilities required for the proposed Centre for excellence are available with Pune University, the National Laboratories located in Pune, industrial establishment and so on. I had long discussion with this group and found that the proposal is not only crucial for development of scientific research in the country but is ~~not~~ also feasible in the light of the support that has been promised by industry.

Dr. Gowind Swarup's discussions with Dr. Y.K. Alagh, Minister of State for Planning & Programme implementation and Science & Technology were fruitful. Dr. Alagh is enthusiastic about this proposal. He discussed the proposal with Prof. Dr. V.S. Ramamurthy, Secretary, Department of Science & Technology, who agrees that it needs Government support.

Doc 9 (2 pages) 9/1

It is now upto the department of Education, Ministry of HRD, to support the launching of this project. As discussed with you yesterday, I would suggest that a token amount of Rs. 5 crores be included in the 1997-98 Annual Budget proposals of the Department of Education. Enclosed herewith please find for your information a brief note on this proposal signed by Prof. N.K. Thakre and Prof. Govind Swarup. I understand that if more funds are needed, some industrialists would be ready to provide them. Therefore, Government of India need not hesitate to provide the token support requested for the project.

With kind regards,

Yours sincerely,
Sd/-
(CHITRA NAIK)

Shri. P.R . Dasgupta,
Secretary
Department of Education,
Minister of Human Resource Development
Government of India
Shastri Bhawan
New Delhi- 110 001.

Encl: Note from Prof. Thakre and Prof. Govind Swarup.

Doc 7/2

Ap. 2 24. App. 3

भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
विज्ञान और प्रौद्योगिकी विभाग
टेक्नोलॉजी भवन, नया महरौली मार्ग, नई दिल्ली-110016
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
Department of Science & Technology
Technology Bhavan, New Mehrauli Road, New Delhi-110016

PROF. V.S. RAMAMURTHY
SECRETARY

D.O.No.DST/PS/ 669 /97

February 12, 1997

Subject: *Proposal for the Advanced Centre for Science and Technology at Pune*

Dear Dr. Gowarikar,

This has reference to a proposal dated 2.2.1997 submitted to Hon'ble Professor YK Alagh, Minister of State for Science and Technology by some leading scientists and educationists regarding establishment of an Advanced Centre for Science and Technology with 5-year integrated teaching-cum-research M.Sc. programme. It is indicated that Pune University campus could be a good location for starting the said Centre in view of its unique position of having several national centres on the campus and also being surrounded by several other national laboratories, DRDO's research institutes and industrial establishments.

The proposal seems interesting and needs to be pursued. Our preliminary reaction is supportive. This is to request you to submit a detailed project report at an early date.

With kind regards,

Yours sincerely,

(V.S. RAMAMURTHY)

S/C

Dr. V.R. Gowarikar,
Vice-Chancellor
Pune University
Pune-411 007

0212 - 373233

DOC 10 (1page)

Copies to: Dr Govind Swarup
Dr V.G. Bhide
Prof N.K. Thakre
Prof P Ratnaparkhi
Prof S.V. Nadkarni
Dr (Smt) Chitra Naik

6

NCRA • TIFR

National Centre for Radio Astrophysics
TATA INSTITUTE OF FUNDAMENTAL RESEARCH

NCRA, PUNE UNIVERSITY CAMPUS, POST BAG NO. 3, GANESHKHIND, PUNE 411 007, INDIA
Telephone: Dir. (0212) 356111; Gen. 357107, 351382, 351384-85; Res. 351632; Fax: 355149
Telex: 0145-7658 GMRT IN; Gram: RASTRON; Email: gswarup@gmrt.ernet.in

Prof. G. Swarup, F.R.S.
Professor Emeritus

March 31, 1997

Shri P.R. Das Gupta
Secretary to the Govt. of India
Department of Education
Ministry of Human Resource Development
Gate 6, Sastry Bhavan
New Delhi

Dear Shri Das Gupta,

As you are perhaps aware that a group of scientists, educationalists and industrialists from Pune have proposed setting up an Advanced Centre for Science & Technology in a close relationship with the Pune University for carrying out an innovative 5-yr integrated programme leading to a M.Sc. degree. The main objective of this programme is to create skilled and well motivated manpower for industries and scientific institutions.

We enclose a copy of the original proposal and also a short note giving objectives and salient features of the programme. The proposal has been discussed informally with the heads of various science agencies (Dr. Rammurthy, Dr. Mashelkar, Dr. Kasturirangan, Dr. Chidambaran, etc.) Their reaction is favourable and supportive.

We would like to discuss the proposal with you on a date suitable to you, e.g. on any date between 4th to 8th April '97 or on April 10th or 11th. We would appreciate if you could indicate a suitable date and time.

With kind regards,

Yours sincerely,

Govind Swarup

V P Bhatkar
C-DAC

V G Bhide
Pune University

G Swarup
NCRA-TIFR

Encl:a/a

Doc 11 / 1 page only

App. 5

DR. CHITRA NAIK
Tel./Fax No. 371 5932 (O)

PLANNING COMMISSION
YOJANA BHAVAN
NEW DELHI-110001
April 4, 1997.

Dear Shri. Dasgupta,

I am enclosing for your reference copies of a letter addressed to you by Prof. Govind Swarup, Prof. Bhide and Prof. Thakare regarding the proposal for an Advanced Centre for Science and Technology to be to be conducted in close relationship with Pune University and of a write up of the proposal. Prof. Govind Swarup and Prof. Bhide are expected to be in Delhi on 10th and 11th April and they requested me to remind you about this matter. Hence the copies. I should be happy if you give them some time to meet you. This proposal has already been discussed with Prof. M.K. Alagh, Minister of State for Planning & Programme implementation, and Science & Technology in a meeting held at Pune on 28th March, 1997 when a large number of scientists including Dr. Gowariker, Dr. Narlikar, Dr. Tilak, Dr. Ratnaswamy and others were present. There was a general agreement that the proposal for an Advanced Centre for Science & Technology having an innovative 5-year integrated programme leading to M.Sc. degree was a necessity for giving a new direction to higher education in science in the country. A few industrialists are inclined to financially support the programme in case some initial support is forthcoming to indicate national and official acceptance of such an innovative programme. Dr. Alagh is supportive of the project.

2. As a result of extensive discussions held with the scientists who have drafted the proposal, I am personally convinced that this innovation can give the necessary direction for modernization of higher education in science and therefore it is worthy of support from within the allocations for higher education in Ninth Five Year Plan.

With kind regards,

Yours sincerely,
Sd/-
(CHITRA NAIK)

Shri. P.R . Dasgupta,
Secretary, Department of Education,
Minister of Human Resource Development
Government of India, Shastri Bhawan
New Delhi- 110 001.

Doc 12 (1 page only)

D.O. No. MOS (P) 384 VIP/97

योगिन्द्र कु० अलघ
Yoginder K. Alagh
Ph.D.

राज्यमंत्री (स्वतंत्र प्रभार)
विद्युत एवं विज्ञान और प्रौद्योगिकी,
भारत सरकार
MINISTER OF STATE
(INDEPENDENT CHARGE)
FOR POWER AND
SCIENCE & TECHNOLOGY
GOVERNMENT OF INDIA

July 2nd, 1997

Dear Prof Swarup

Please refer to your letter of June 23 regarding the proposal for setting up the Advanced Centre for Science & Technology, as you know I am very supportive of this Project. I have requested Secretary (S&T) to provide assistance from the S&T Ministry. As regards issues relating to Science and Technology, we assure you of our full support. UGC will have to be involved.

With personal regards,

Yours sincerely,

Yoginder K. Alagh

Prof. G. Swarup
Professor Emeritus
National Centre for Radio Astrophysics
Tata Institute of Fundamental Research
NCRA, Pune University Campus
Post Bag No. 3
Ganeshkhind
Pune 411 007

Doc 13 (1 page)

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Telex: 0145-7658 GMRT IN; Gram: RASTRON; Email: gswarup@gmrt.ernet.in

Prof. G. Swarup, F.R.S.
Professor Emeritus

TIFR:Pu:GS: 647 :97
Dated: August 7, 1997.

To

His Excellency Dr. P.C. Alexander
Governor of Maharashtra and
Chancellor of the Pune University
Raj Bhavan, Malabar Hills,
Mumbai - 400 035

Your Excellency,

As you are aware that there has been a serious decline in the standards of science education in the country particularly, at the under-graduate level. This is seriously affecting research and development work in our national laboratories and industries. With the economic globolization, we need talented scientists who can make our industries to compete internationally.

In order to create a large number of highly talented, well motivated and creative young boys and girls in the field of science and technology, a group of senior academicians and industrialists in Pune have recently proposed the establishment of an Advance Centre for Science and Technology with a novel 5-year integrated teaching-cum-research M.Sc programme in Pune. Pune University campus could be a good location for starting such a centre in view of its unique position of having several national centres on the campus, such as NCRA-TIFR, IUCAA, C-DAC & NCCS and also being surrounded by several other national laboratories such as NCL & DRDO's research institutes and industrial establishments. Funds for the proposal will be sought from industries and science agencies such as CSIR, DAE, DST, DBT, DRDO and ISRO. State Governments participation in this programme will be important. A copy of the Project Report is enclosed for your perusal.

The proposal has been discussed with Prof. Y.K. Alagh, Minister for Power and Science & Technology and some other concerned members of the Planning Commission. We enclose copies of two letters, one from Prof. Alagh in which he has stated that he is very supportive of the proposal, and the other from Prof. Ramamurthy, Secretary, DST who shares similar views on the subject.

Doc. 14 (2 pages) : 14/1

A group of senior scientists and educationalists will like to meet you in this connection to seek your guidance. We would be obliged if you could request your Secretary to let us know the time when we could meet you during your visit to Pune.

With best regards,

Yours sincerely,

Govind Swarup

Govind Swarup

GS:jy:c:\swarup\acst

Received
GSarwat
19/8/97

[redacted]

[redacted]

Doc 14/2

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Telex: 0145-7658 GMRT IN; Gram: RASTRON; Email: gswarup@gmrt.ernet.in

Prof. G. Swarup, F.R.S.
Professor Emeritus

August 25, 1997.

Title: Proposal for Advanced Centre for Science & Technology

His Excellency Dr. P.C. Alexander, Governor of Maharashtra and Chancellor of the Pune University has agreed to meet a group of us on 20th August, 1997 at 10.30 a.m. in his office at Raj Bhavan. The following will be attending the meeting.

1. Prof. V.G. Bhide, Dept. of Physics, Pune University
2. Dr. V. Bhatkar, Director, C-DAC, Pune University
3. Sri. P.P. Chhabria, CMD, Finolex Cables Ltd.
4. Prof. V.R. Gowriker, Vice-Chancellor, Pune University
5. Prof. P. Ratnasamy. Director, NCL
6. Prof. G. Swarup, Professor Emeritus, NCRA-TIFR, Pune University

It is requested that we meet at 9.45 a.m. in Prof. Gowriker's office in the main building of the university. At 10.15 a.m. we will go to the Raj Bhavan.

A brief progress report on the proposal for the Advanced Centre for Science & Technology is given below.

1. A proposal was submitted by 12 scientists, educationalists and industrialists of Pune to Dr. Chitra Naik, Planning Commission, New Delhi on January 2, 1997.

2. The proposal was also discussed by several of us with Prof. Y.K. Alagh and Dr. Chitra Naik in a meeting held at the J.P. Nayak Centre in Pune. The proposal has been also discussed with several heads of science agencies in India.

3. Dr. V.S. Ramamurthy, Secretary, DST wrote a letter on February 12, 1997: "The proposal seems interesting and needs to be pursued. Our preliminary reaction is supportive. This is to request you to submit a detailed project report at an early date". (copy enclosed)

4. A detailed project report was submitted to Prof. Y.K. Alagh, Minister for Power and Science & Technology in June 1997. He replied on July 22, 1997: "Please refer to

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your letter of June 23 regarding the proposal for setting up the Advanced Centre for Science and Technology, as you know I am very supportive of this project. I have requested Secretary (S&T) to provide assistance from the S&T Ministry. As regards issues relating to Science and Technology, we assure you of our full support. UGC will have to be involved". (copy enclosed)

5. The 20 copies of the proposal have been sent to Secretary, DST, requesting him to call a meeting of Heads of various science agencies. An advance copy of the proposal has also been sent by me to various science agencies. Dr. R.A. Mashelkar, DG, CSIR has replied "this is a great proposal" and we will discuss it when I next come to Pune. He has agreed to meet a few of us on Saturday, 30th August at 4.00 p.m. at the National Chemical Laboratory(NCL).

G. Swarup

G. Swarup

Doc 15/2

App. 7

Minutes of the Inter-Agency Meeting on the proposal "Advanced Centre for Science & Technology" held on 2nd September, 1997 at 10.00 A.M.

The following were present.

1. Prof.V.S.Ramamurthy, Secretary, DST
2. Dr.A.S.Desai, Chairperson, UGC
3. Shri K.Srinivasan, Principal Adviser (S&T), Planning Commission
4. Prof.D.V.Singh, AICTE
5. Dr.V.R.Gowariker, V.C., Pune University
6. Prof.V.G.Bhide, Ex-V.C., Pune University
7. Prof.G.Swarup, TIFR
8. Dr.S.C.Mehta, DOE
9. Dr.N.C.Mathur, UGC
10. Dr.V.Siddhartha, DRDO, HQ
11. Dr.K.R.Sridharamurthy, DOS/ISRO, HQ
12. Dr.M.Balasubramanian, Adviser, DBT
13. Shri V.Rao Aiyagari, Joint Adviser, DST

At the outset, the Chairman welcomed the participants and initiated discussion on the need of quality improvement in the Science education and shared the concern about the decline in the number of Science undergraduate opting for higher education in Science, in the context of the proposal under consideration.

Dr.V.G.Bhide explained the background, aims & objectives of the proposal and need of the setting up an Advanced Centre for Science & Technology(ACST) in the changed and emerging scenario. Dr.Bhide apprised that ACST will impart a five years integrated proigramme leading to M.Sc. in the areas of Information Sciences & Technology, Material Sciences & Technology and Life Science & Technology with the linkage of teaching with vibrant research base to provide a broad base of education with emphasis on acquisition of knowledge, cultivation of skills of various kinds (computational, communication, design, fabrication, simulation etc.), inculcation of right kind of attitude and outlook to develop a social commiitment which will meet the requirement of refined product to industry and various S&T agencies namely DOS, DOE, DOA, DRDO etc. Dr.Bhide also explained the other salient features of the proposal and the feasibility about the financial support (about 1% of profit) from the industries etc. subject to the benefit of rebate on Income Tax.

The need for a new establishment in view of the already existing infrastructure such as NCRA, IUCCA, CDAC and the Pune University was discussed.

Dr.Desai, Chairperson, UGC endorsed the need for such a Centre for quality improvement in Science education from Academic point of view but at the same time, expressed apprehension about the administrative status and structure of the Centre, funding pattern and other associated issues and the

Doc. 16 (2 pages) 16/1.2

message to other Universities/Institutions. Dr.Desai suggested that Pondicherry University model for five year integrated M.Sc. programme may also be studied in this context.

Representatives from DOE, AICTE, DOS, DRDO & DBT expressed their concern about the decline in the quality of Science education and endorsed the need for a Centre for excellence to improve the quality of Science education to meet the required S&T manpower in the country. Representatives of various S&T agencies also informed about the ongoing efforts and funding under various programmes in this direction. Dr.K.Srinivasan, expressed the views of the Planning Commission that the concept is good but there are many procedural/administrative problems for getting direct funding for such a proposal. Therefore, funds may be pooled from various user agencies and S&T Deptts. and industry but Ministry of Human Resource Development and UGC should take the initiative in this regard.

It was felt by all Scientific agencies that there is a need for creation of such a Centre for excellence and improvement of quality of Science education. This proposal is a new and novel experiment and may be viable as an independent model of Centre of excellence by channelizing the funding from various agencies and industry.

Based on the views of Planning Commission and S&T agencies, Pune University will take follow up actions with MHRD for getting the clearances and finalizing the various modalities etc. A letter received from MHRD (after the meeting) is enclosed with these minutes.

Meeting ended with a vote of thanks to chair.

DOE. 16/2

Att-8

28

मानव संसाधन विकास मंत्रालय
शिक्षा विभाग
भारत सरकार
नई दिल्ली - ११० ००१

MINISTRY OF HUMAN RESOURCE DEVELOPMENT
DEPARTMENT OF EDUCATION
GOVERNMENT OF INDIA
NEW DELHI - 110 001

LALMALSAWMA
Director
Tel: 3383214

D.O.No.F.5-9/97-U.I

March 20, 1998

Dear Dr Gowarikar,

Kindly recall the discussions held in the Inter-Agency Meeting held on 2nd September, 97 to discuss the proposal for establishment of 'Advanced Centre for Science & Technology' at Pune University. A copy of the minutes of this meeting is enclosed herewith. It was decided in the meeting that the Pune University will take follow up actions with MHRD for getting the clearances and finalising the various modalities etc. We have not heard anything from you since then.

I shall be grateful if you would kindly let us know the action taken by the University in this behalf so as to enable us to examine the matter further.

With regards,

Yours sincerely

(Lalmalsawma)

Dr. V.R. Gowariker,
Vice-Chancellor,.
Pune University,
Pune -411 007

Doc. 17 (1 page)

A-4

IRHPA

509

No.SP/I3/IU01/97
Government of India
Ministry of Science & Technology
Department of Science & Technology

504

21/9

Technology Bhavan
New Mehrauli Road
New Delhi-110016

Dated 21-9-98

ORDER

Sub: Financial Assistance to Poona University for drafting a Detailed Project Report for setting up the Advanced Centre for Science and Technology at Poona.

Sanction of the President is hereby accorded to the above mentioned activity at a total cost of Rs.10,00,000/- (Rupees ten lakhs only) for a period on one year (1 year).

2. Break-up of the sanctioned budget of Rs.10 lakhs is being given below :-

a)	TA/DA/Working Expenses for meetings of the Steering Group and interaction with special experts	Rs. 3,50,000/-
b)	Consultancy Charges	Rs. 5,00,000/-
c)	Preparation of DPR document	Rs. 1,00,000/-
d)	Contingencies/Miscellaneous Expenses	Rs. 50,000/-
	Total	Rs.10,00,000/-

3. The sanction of the President is also accorded to the payment of Rs.10,00,000/- (Rupees ten lakhs only) to the Registrar, Poona University,Ganeshkhind, Pune-411007 for this activity.

4.
Demand No.75,
DST.
3425 Other Scietific Research (Major Head)
60. Others (Sub-Major Head)
60.200 Assistance to other Scientific Bodies (Minor Head)
13. Programme for Research and Development.
13.03 Multidisciplinary Research in Science & Technology (SERC).
13.03.31 Grant-in-aid for the year 1998-99 (Plan Expenditure)
This release is being made under IRHPA Scheme.

5. The sanction has been issued under the powers delegated to the Ministries and with the concurrence of IF Division of Deptt. of Science & Technology vide their Dan.No. 100/(IFD)/1923/98-99 dated 8.9.98

Doc. 18 (2 pages) : 18/A1

contd...2/-

6. The sanction of the President is also accorded to the performance of Journey by Air/Ist Class/ACC/Road(Car)/Taxi etc.) by the experts and participants as per their entitlement in their parent organisation.

7. TA/DA will be as per Govt. of India Norms.

8. The amount in question will be drawn by the Drawing and Disbursing Officer of the Department of Science & Technology and will be disbursed to the Registrar,Poona University,Pune -411007

(Praveer Asthana)
Principal Scientific Officer

Copy forwarded for information and necessary action to:-

1. The Director of Audit (CW & M-II), AGCR Building, I.P. Estate, New Delhi-110001
2. Copy with two spare copies of the sanction to the Drawing and Disbursing Officer, DST, Cash Section.
3. The Registrar,
   Poona University,
   Pune-411007
4. Dr.Arun Nigavekar,
   Vice Chancellor,
   Poona University,
   Pune-411007
5. PAO, DST, New Delhi
6. Accounts Section, DST, New Delhi
7. SERC Sectt.
8. Head, SERC Division.
9. Sanction folder
10. COA, DST, New Delhi

(Praveer Asthana)
Principal Scientific Officer

RS

Doc 18A/2

UNIVERSITY OF PUNE
Ganeshkhind, Pune–411 007.

Dr. Arun Nigavekar
VICE-CHANCELLOR

Tel. : *Office* : *353868*
VC Lodge : *350765*
Telex : 0145 7719 UNIP IN
Fax : +91-212-353899
E-mail : puvc@unipune.ernet.in

ORDER

Subject: Financial Assistant to Pune University for drafting a detailed project report for setting up the Advanced Centre for Science and Technology at Pune.

1. The Department of Science and Technology has sanctioned a sum of Rs. 10.00 lakhs for the purpose of drafting detailed project report for setting up of the ACST at Pune (copy enclosed).

2. To do this task the following Steering Committee is appointed.

    1. Professor V. G. Bhide - Chairman
    2. Professor Gowind Swarup - Member
    3. Professor D. N. Deobagkar - Member
    4. Dr. P. J. Lavakare - Member
    5. Proessor Y. R. Waghmare - Secretary

3. Professor D. N. Deobagkar would work as Project Coordinator and would have administrative and financial authority to use the funds sanctioned under the project.

A. Nigavekar

Arun Nigavekar
Vice-Chancellor

VC/1142
November 30, 1998

Doc-18/B/1

Copy to: 1. Registrar
2. Finance and Accounts Officer

Minutes of the meeting of the Steering Committee for ACST held at 3.00 p.m. on 22.12. 1998 in the office of the Vice-Chancellor of Pune University.

Members present: Profs. A.S. Nigavekar (VC), V.G. Bhide, G.Swarup, D.N. Deobagkar, Y.R. Waghmare.

Prof. Nigavekar requested Prof. Bhide to outline the steps need to be taken for setting up the ACST.

- Prof. Bhide mentioned the historicity of the earlier (original) document on ACST, which had various Educationists and Industrialists as signatories. The main idea was to set up an autonomous Institution on the Pune University (P.U.) campus which would act as an interactive centre between Industry and Academic curriculum. He pointed out that the Academic Council of the University had approved, in principle, to have the ACST on campus. It will be affiliated to P.U. in the sense that P.U. would confer degrees to the qualified ACST students. The 'Core Faculty Staff' of the ACST would be about 30% of the total required number. Students from P.U. may do projects in ACST for one or two semesters and vice versa. About Rs. 20-25 crore would come from the Industries for setting up and running of ACST. Prof. Bhide mentioned that Mr. Chhabria would seek a quantum of about 1% of the profits of Maratha Chamber of Commeerce for higher education.
- Prof. Bhide also mentioned that we must look for a person who has sound knowledge of DPRS and can assist us in the preparation of the DPR. He mentioned the name of Prof. B.G. Joshi as suitable person and this was accepted unanimously.

Doc. ~~2 1/2 pages~~ 18C/2 pages ~~2 1/2~~ 18C/1

- A resolution needs to be drafted so that PU would recognize ACST model and also provide autonomy to ACST. Prof. Nigavekar envisaged on difficulty in this matter and promised all assistance.

- It was pointed out that 'special waiver' will have to be obtained concerning the problem of reservation amongst students and faculty.
- Provision for Adjunct Professor should be incorporated.
- MoUs will have to be signed between ACST and University Departments for using each other's facilities.
- It is necessary to obtain letters of Interest from various Agencies such as DAE, ISRO, DRDO, DST, CSIR, DOT, etc.
- ACST will be an Independent Society approved by Act of P.U.

Y.R. Waghmare
Secretary

V.G. Bhide
Chairman

Dol. 18 C/2 ~~23~~ /2

National Centre for Radio Astrophysics
TATA INSTITUTE OF FUNDAMENTAL RESEARCH

NCRA, PUNE UNIVERSITY CAMPUS, POST BAG NO.3, GANESHKHIND, PUNE 411 007, INDIA
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Prof. Govind Swarup, F.R.S.
Professor Emeritus

REF:NCRA:PU:MISC:98 5th December 1998

To

Prof. Murli Manohar Joshi
Hon'ble Minister for Science & Technology
Ministry of HRD
22, Gurudwara Rakab Ganj Road
New Delhi

Dear Prof. Joshi,

1. Recently Prof. K. Kasturirangan, Chairman, ISRO had asked me to contact you for discussing a few ideas that myself, Prof. V.G. Bhide, Prof. A. Nigavekar, Vice-Chancellor, University of Pune and several others scientists and industrialists at Pune have been formulating at Pune for making an impact on higher education at Pune. I enclose a short note in this connection. Briefly, some of the steps taken by us are

(a) to introduce computer-aided science education in three under-graduate colleges in Pune to start with

(b) to foster a close relation between national laboratories and the Pune University through a special 5-year integrated M.Sc programme for which we are seeking support of the major Scientific Departments and industry rather than UGC, but will involve UGC regarding academic programmes.

c) to start a major educational programme in the field of Information Technology at Pune in close collaboration with the software industry.

2. I understand that you are planning to visit Pune shortly. Some members of our group would like to meet you for about 15 to 20 minutes. Later we can meet you at Delhi at your convenience.

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3. Although India has made significant progress in the field of science, we have ignored education in undergraduate colleges and universities. We need to revamp the B.Sc and M.Sc programmes in a major way to meet India's need in a variety of fields including the emerging field of Information Technology. I am sure that you must have thought about it deeply. You may have also seen Recommendations by the Indian Academy of Science "University Education in Science" (Academy papers No.1, dated 2nd December 1994, Indian Academy of Science, Bangalore-560080). There is also an urgent need for fostering a closer interaction between national laboratories and universities. We must also take suitable steps to slow down the mass migration of top scientific and engineering talent to USA and Europe, for which we would like to discuss with you some solutions.

4. I know that you have been deeply concerned with education in India at all levels. We would very much like to seek your valuable comments and guidance in this connection.

With best regards,

Yours sincerely,

Govind Swarup

(Govind Swarup)

Encl:as above

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CERTAIN IDEAS FOR THE IMPROVEMENT OF HIGHER EDUCATION IN UNDER-GRADUATE COLLEGES AND UNIVERSITIES IN INDIA

THIS IS A BRIEF NOTE FOR PROJECTING CERTAIN VIEWS

1. We should give high importance to improvement of under-graduate science education using multi-media packages for students as well as teachers. There is a need for developing a cell for computational aided science education. With this aim a programme has been initiated in three under-graduate colleges in Pune as per the Enclosure-I (see enclosed prospectus).

2. Various national laboratories should be asked to adopt certain under graduate as well as graduate colleges in their cities for bringing 30 or 40 students to the laboratories on off-Saturdays. Talented research scientists should be encouraged to teach these students through their self-motivation as well as suitable awards and a bit faster promotion for participating in such a programme. Students evaluation should be used to ensure that the programme is being carried out with responsibility.

3. A brief note is also enclosed regarding proposed Advanced Centre for Science and Technology (ACST) for carrying out a 5-year integrated M.Sc teaching programme (Enclosure-2). It is proposed that ACST be supported by the participating science and technology ministries and also Industries so that there is no burden on the UGC. There has been a favourable response from the Govt. and we are now in the process of writing a detailed project document for the Department of Science & Technology. A similar programme could be carried out in other places in India.

4. It is very important that we should stop mass migration of top talented persons from India. These scientists and engineers are indeed our Kohinoor diamonds. We are exporting tens of thousands of our stars and jewels from India freely. Our scientific

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institutions, laboratories and industries are suffering severely. Prof. Megnath Saha cried in 50s, but we ignored his views. Dr. Bhabha had also proposed Inter-University Centre for closer interaction between DAE and universities for which DAE got Rs. 2.00 crores in the 4th Plan but Dr. Bhabha died soon after.

5. Recently, a great importance has been given by the Govt. for the field of Information Technology in India. This is highly encouraging. Enclosed is a copy of my lecture delivered at an annual conference on Telecommunication organized by all the IITs and IISc, which was held at Bangalore on 30th & 31st January 1998 (Enclosure-3). The title of my lecture was India's 'Grey Gold'. There exists today a rare and unique opportunity for India for generation of wealth using our brain-power. Although C-DAC, NIT, APTEC, TULIP, C-DOT etc. have set up institutions for imparting computer education, very little effort is being devoted for manpower training at a high level. I would like to suggest that the Ministry of HRD, DST and DOE may organise a three day conference for discussing manpower education for generating high level training in the fields of computer software, hardware and application packages.

6. There is a tremendous shortage of manpower in the field of IT in USA. Many industries in USA are likely to be very aggressive for recruitment of manpower from India, China, etc. over the next decade. It is over the same time- period that India wishes and can become a world power in the field of Information Technology. Certainly it cannot be done if we continue to export our stars and jewels in the form of manpower. I would like to suggest that no certificate or degree is given to B.Tech and M. Tech. students from colleges which are well-funded by the Govt., unless the students have spent at least two years after their B.Tech. and one year after M.Tech. working in a recognized industry or research institution in India.

G. Swarup

(Govind Swarup)

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Enclosure - 2

ADVANCED CENTRE FOR SCIENCE AND TECHNOLOGY

AIMS AND OBJECTIVES

This programme is aimed at creating peaks of excellence in various disciplines of science who would flower into leaders in science and technology, contributing through their training to significant advancement of human knowldege as well as to the application of the acquired knowledge to solving many challenging problems which India is facing today.

Salient features of the programme

1. An innovative five year integrated educational programme to produce highly talented and motivated scientists and technologists confident of tackling problems in the rapidly advancing frontiers of their discipline as well as problems facing the society of which they are an integral part.

2. This will be a five year integrated programme leading to the M.Sc degree. An attempt will be made at integration in terms of time and discipline in order to optimally utilize the five year period and to focus on the unity of science as well as the close interaction between science, technology and society.

3. A very important aspect of the programme will be the effort to integrate education and exploration or teaching and research.

4. The programme will lay emphasis on the unified structure of science as man's quest for an understanding of Nature and Natural laws and on the utilisation of this understanding for the benefit of the people.

5. The programme will endeavour to expose the students to the excitment in various fields of science so that they turn out to be not only thoroughly disciplined professionals with detailed knowledge and understanding of their own disciplines but also having an awareness of current and future trends in other disciplines. The programme will endeavour to expose the students to the various facets of the social milieu of our country to its socio political structure, to resource and growth problems and their likely solutions.

6. The programme will lay emphasis on (a) acquisition of knowledge and information (b) acquisition of various kinds of skills - computational, communication, instrumental, design etc. and (c) cultivation of attitudes and outlooks with a view to promoting social commitment.

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7. The programme will attempt to lay strong foundations in Mathematics, Physics and Chemistry as these are essential for further development of any branch of science. The programme will also endeavour to create awareness of the nature and significance of life processes, their complexity and vast technological potential. In other words, a student opting for Physical Sciences will be exposed to the basics of Life Sciences and to the excitement and possibilities they offer. In much the same way, a student opting for Life Sciences will be groomed in the basic physical principles and in the mathematical rigour involved in various life processes.

8. The programme will enable the students to participate in research programmes right from the first year with a view to exposing them to a creative research atmosphere and to instil in them the realization that pursuit of science is an exciting exploration. In the last two years of the programme, the students would be exposed to real life situations in their respective fields by enabling them to gain hands - on experience as well as to become familiar with current live problems and challenges in their discipline. In a sense there will be an internship programme, which will be one of its unique features.

9. The programme will provide for enough flexibility so that students could choose from a large menu of courses, those that suit their aptitude, liking and ability. It will also provide an opportunity for students who wish to take courses not only within the conventional science streams but even outside the science streams. Thus for example, a student could opt for courses in Physics, Mathematics, and Architecture or Physics, Mathematics and Economics or Physics, Biotechnology and Animal Husbandry. Besides, students in the first three years will be exposed to regular lectures by eminent people in various disciplines such as Philosophy, Economics, Sociology, Linguistics, Management etc.

   The programme will also have enough flexibility to cater to the needs of exceptional individuals like Ramanujams who have special insight, ability and commitment to any given discipline. Such individuals will not be bound by the conventional course structure but will have the freedom for full advancement in the field of their choice.

10. Admission to this programme will be strictly based on merit assessed through a well designed examination, personal discussion and references.

11. There will be continuous assessment of the students throughout the five year period, However, there will be rigorous examinations at the end of the first year to assess the suitability of the student to pursue this exciting and exacting programme. At the end of the third year, there will be an apptitude-cum-ability test to assess the student's aptitude for basic or applied research.

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12. Another unique feature of the programme is that it will be funded to a significant extent as well as monitored by the likely beneficiaries of the programme, namely industries, technological institutions, research and development laboratories and agencies etc.

ORGANIZATIONAL STRUCTURE

1. It is hoped that the Advanced Center for Science and Technology (ACST) will be declared by Government of India as an Institute of National Importance.

2. ACST will be an autonomous society registered under Society's Registration Act of 1861.
ACST will also be registered with the Charity Commissioner, PUNE.

3. ACST will be a recognized institution of the University of Pune and will be located on or around the campus of the University. Degrees will be granted by University of Pune.

4. ACST will have close linkages with the University of Pune. Memorandum of Association of ACST will stipulate that (a) About 20% of the visiting faculty of ACST shall be drawn by invitation from amongst the faculty of the University of Pune. (b) Post graduate students of University of Pune will be entitled to take special courses at ACST. They will also be allowed to carry out their project work at ACST, if they so desire. (c) The University of Pune and ACST will share their specialized facilities.

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Enclosure-3

India's Grey Gold
A Rare Opportunity for India

By Govind Swarup

20.3.98

Information technology (IT) is one of the fastest growing industries in the world today. The phenomenal progress in the development of computers and telecommunnications is bringing about a revolution in nearly every endeavour of mankind. The software expertise is an important part of the information technology. Because of skills and abilities of Indian software professionals, many leading firms in the world look at India today for meeting their manpower needs. This has resulted in a rapid growth of the software industry in India. We have now a unique and rare oppurtunity to become an economic world power by utilizing our 'brain-wealth' or the grey-matter or what I call as India's *'Grey-Gold'* or *'Cyber-Gold'*.

The world's total turnover in the IT sector for the year 1997 was about 750 billion US dollars, of which about half was in software products and services. In contrast, the total turnover of India's software industry for 1997 was only about Rs.10,000 crores ($ 2.5 billion) including Rs.6000 crores ($ 1.6 billion) in exports. It is noteworthy, however, that this already represents a significant fraction of India's total annual exports of about Rs.130,000 crores at present. Besides, software exports have seen a growth rate of about 50% every year for the last five years and this is likely to continue over the next five years as a result of the Y2K bug and Euro-currency consolidation opportunities. While it will be a challenging task to sustain this growth rate over a much longer time scale, it seems quite practical, nevertheless, to aim at an annual export target of atleast Rs.200,000 crores ($ 50 billion) in the 10th year and $ 100 billion in the 15th year from today. With a similar turnover in the Indian IT market, one can visualize India's GNP growing at a much faster rate than at present, accelerating all sectors of the Indian economy, and providing employment and a better life to millions of our people.

Fortunately, the required investments in the IT industry are much smaller than those in other industries. It also consumes little energy and is free of pollution. With high returns on

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investments at little risk, every single rupee invested can add two rupees to the GNP within two years. Although many entrepreneurs are setting up new software units in this field in India everyday, these efforts need to be multiplied ten fold. It is important that financial institutions should invest sufficient venture capital which is one of the major contributors to the success of the Silicon Valley in USA.

India has already planned to invest about Rs.100,000 crores over the next decade for building up the telecommunication infrastructure. In order to provide connectivity to millions of computers across India, the tele-network must provide a data rate of at least 32 kilobits per second, which should be upgradable to a much higher bit rate. Internet services must be privatized to ensure sufficient national and global connectivity.

To aim at a software export target of 50 billion dollars per year, we would require a skilled manpower of atleast one million persons by the tenth year from today. For this we need to train alteast hundred thousand persons per year for awarding degrees and diplomas in IT. The capacities of engineering colleges and private computer institutes for training the required manpower will have to be enhanced. The quality of the training is equally important. The syllabii of our engineering colleges must be updated every year in order to keep abreast of the rapid developments taking place in these fields. The training should attempt to inculcate the importance of creativity and innovation through practical examples. There are more than a million students studying in science and commerce degree colleges across India. One needs to introduce about 20 to 25% computer based courses in these subjects in a large number of colleges.

To supplement the conventional class-room teaching, which has its limitations, we need to make use of computers and video teaching packages in our schools and colleges in a massive way. The need for India to have atleast one 24-hour educational TV channel cannot also be over emphasized. With CD-ROM players and Digital Video Recorders expected to become low-cost consumer items in the coming years, we can aim for 'on demand' learning with video graphics to enable wide dissemination of knowledge and skills to a large number of our rural population as well. At a more advanced level, the existing research and educational institutions in the country such as IITs, NCST, C-DAC and the Government departments of Scientific and Industrial Research, Science and Technology, Electronics, Atomic Energy, Space, Defence Research and Development, etc., can be entrusted with the task of training a large number of expert computer programmers.

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The aptitude and expertise of Indian scientists and engineers in the field of software technology is well recognized internationally. The US President, Bill Clinton, is reported to have told a team of Indian journalists a few months ago "You guys own half the Silicon Valley". He was of course referring to the large number of NRIs who have made it big in the US. How do we ensure that a majority of our talented manpower remains in India? The problem is that most of our graduates who pass out from the various IITs and other engineering colleges have little knowledge of the very valuable work being done in India in many leading research institutes and industries. It is therefore extremely important and timely that the Government should take necessary steps to ensure that engineering students work for at least an year or two in industries and research institutes as an essential requirement of completing their degrees.

Can India shine like a diamond in her 60th year of Independence? It can certainly happen, but will require a strong national will. Let the new parliament unanimously declare the next 10 years to be the decade of information science and technology. We must realize that the world will be controlled in the next century primarily by information technology and we need to launch and sustain a well thought out plan and a national strategy to use our *Grey Gold* to gain world supremacy for India in this emerging field. We cannot afford to miss this opportunity.

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सत्यमेव जयते
P.R. DASGUPTA
सचिव
SECRETARY

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शिक्षा विभाग
भारत सरकार
नई दिल्ली - ११० ००१
MINISTRY OF HUMAN RESOURCE DEVELOPMENT
DEPARTMENT OF EDUCATION
GOVERNMENT OF INDIA
NEW DELHI - 110001

D.O.Dy.No.13722/ES/98

December 18, 1998

Dear Prof. Govind Swarup,

You would perhaps recall that when you met Dr. Murli Manohar Joshi in Pune, you had indicated that you would send him a note regarding your suggestions for the improvements of Higher Education in under-graduate colleges and universities in India. Dr. Murli Mahohar Joshi has asked me to request you to send a note at your earliest.

With regards,

Yours sincerely,

(P.R. Dasgupta)

Prof. Govind Swarup,F.R.S.
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National Centre for Radio Astrophysics
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Prof. Govind Swarup, F.R.S.
Professor Emeritus

REF:NCRA:PU:99

11th January 1999

Shri P.R. Dasgupta
Secretary
Ministry of Human Resource Development
Department of Education
Government of India
New Delhi-110 001

Dear Shri Dasgupta,

Please refer to your letter D.O. Dy. No. 13722/ES/98 dated 18th December 1998 which I got on 26th December 1998. I enclose an original letter addressed to Prof. Murli Manohar Joshi with a Note giving some suggestions for the improvement of High Education in under-graduate colleges and universities in India.

I regret the delay in replying to your letter as I was busy in connection with the Giant Metrewave Radio Telescope, which we have made operational a week ago.

With best regards,

Yours sincerely,

Govind Swarup

(Govind Swarup)

Encl:as above

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ACST: A New and Novel Initiative

The concept of Advanced Centre for Science and Technology as outlined in this project report is a result of collective wisdom of a large number of practicing scientists and technologists, industrialists and science educators. Indeed, the conceptualization and concretization of the proposed Advanced Centre for Science and Technology is a result of in-depth analysis of the present state of scientific research and technological development in state of scientific research and technological development in the country, a critical examination of the lacunae and defects in the educational and evaluation system currently in vogue in our universities and more importantly on the detailed assessment of the needs of the emerging global scenario in which competitive advantage of a nation will be largely dependent on its scientific attainment and technological capabilities.

The Advanced Centre for Science and Technology is aimed at training and thereby creating a band of highly talented, highly creative, highly skilled and highly motivated young boys and girls to man and lead research and development groups in industries, in research laboratories and in the universities. In addition, Advanced Centre for Science and Technology will continually strive to serve as a fountain head of ideas and innovations, techniques and technologies, and constantly endeavor to use the known and the recently acquired knowledge to solve the societal problems and to usher in an era of economic prosperity and the necessary social transformation in the country. In essence, the Advanced Centre for Science and Technology will perform the role of the great universities in the USA such as Harvard, and Princeton, NIT and Cal Tech. etc. who have been in the vanguard of United State of America's industrialization, economic development and social transformation and who enabled the USA to assume the leadership role in both basic and applied science as well as in technology development.

The Advanced Centre for Science and Technology is aimed at generating a highly creative atmosphere with equal emphasis on teaching and research, education and exploration, extension and service, wherein young boys and girls will see continuously sparks of creativity oozing out of its peers, will be educated by the very best that the country can afford, will be enthused to innovative and creative, will flower to the limits of

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their capabilities so that they can contribute to the store of human knowledge and to the innovation of technology comparable to the best any where in the world. Some of the distinctive features of the proposed Advance Centre are as under:

(1) The proposed Advanced Centre for Science and Technology is a major departure, in terms of concept, structure, aims and objects, operation and funding from the existing system of education in our universities and colleges.

(2) Advance Centre for Science and Technology proposes to provide for five year integrated educational programme leading to the M.Sc. degree. The integration is sought to be achieved in terms of both time and discipline, teaching and research with a view to making optimum use of the available time and to presenting science as a unified quest of man to understand Nature and to use that understanding not only to broaden the horizons of human knowledge but also to solve societal problems.

(3) Advanced Centre's educational programme will lay emphasis on (a) acquisition of knowledge and information, (b) acquisition of all kinds of skills such as for example, computational, communication, design and fabrication etc., and (c) inculcation of right kinds of attitudes and outlooks to promote social commitment.

(4) Advanced Centre for Science and Technology will aim at evolving synergy between teaching and research, education and exploration. The educational programmes of the centre will initially centre around three schools namely (a) School for Information Science and Technology, (b) School for Material Science and Technology and (c) School for the Life Sciences and Biotechnology. The choice of these three areas is both deliberate and conscious as it is these areas which are not only highly exciting and challenging but also because these are the areas which will witness rapid growth and which will dominantly inference human civilization.

In every course, teaching laboratories and research laboratories are proposed to be integrated and brought under the same roof and in close contiguity so that the students right from day one can participate in creative endeavors in research laboratories and work in its exciting and creative atmosphere.

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(5) ACST will not only lay stress on basic concepts and their applications but also on pure and applied research. ACST will also provide for a sufficiently strong component of social and moral (value based) and cultural education.

(6) ACST will endeavor to provide for a large menu of courses from which students can choose according to their liking and aptitude. The choice will not only be possible within a given stream such as physical sciences, biological sciences, mathematical and computational sciences but also across these streams. Indeed, choice across or outside the conventional streams such as Architecture, Physics and Computers; computers, economics, physics and electronics, etc will also be made available.

(7) The educational programme of ACST will have enough flexibility to cater to the needs of exceptional individuals such as Ramanujams who have special insight and commitment to any given discipline. Such individuals will not be constrained and abound by rigidity of conventional course structure but will have enough freedom for full and unfettered advancement in their chosen fields.

(8) ACST will provide for a common course in the first year so that each of the students is exposed to basic physical principles, Mathematical rigor and excitement and life sciences. They will also be trained in some basic skills. At the end of the first year, students would, in consultation with the faculty, make a choice of courses. At the end of the third year, there will be an aptitude cum ability test to find out the students aptitude and inclination to pursue pure basic sciences or applied science and technology.

(9) There will be continuous assessment of the students throughout the five year period not only in relation to scholastic attainment but also in terms of acquisition of and competence in various kinds of skills and also in relation to their social outlook and sense of values.

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In addition to the continuos assessment, there will be a vigorous examination at the end of the first year to assess the suitability of the students to pursue this exciting and executing programme. At the end of the third year, based again on an examination, they will ------- in consultation with the faculty a career in basic or in applied sciences.

(10) An essential part of this five year integrated programme will be the internship programme wherein student will spend two semesters in industry or in research laboratories of major scientific agencies such as DAE, BARC, DBT, DRDO, CSIR, ISRO, DOE etc. Alternatively, a student will spend equivalent time with an eminent professor in his field or in a good research laboratory such as TIFR, IISc etc. well motivated and talented students may even be admitted to the Ph.D. programme from the beginning of the 5^{th} year itself.

(11) Admission to this programme will be strictly based on merit assessed through a well developed and designed National Competitive Examination, personal discussion and references.

(12) ACST devolved as it is to the cause of excellence will have a modest size. Excellence will have a modest size. Excellence by definition is not a common commodity and its nourishment and nurturing can be rather exacting and expensive. It is obvious that the proposed ACST is expected to be an elite institutions. But, elitism in this case will come from students ability, his/her interest, in science and research, his/her skills, dedication and commitment. The basic philosophy of ACST is to promote deliberately and consciously peaks of excellence.

Once admitted, students will be nurtured and nourished academically and intellectually and even assisted financially if necessary. Indeed, it will be seen that no student drops out because of financial difficulties. The underlying conviction behind this provision is that a bright young person devoted to learning and scholarship is society's greatest treasure and asset and therefore society must support such a bright boy or girl.

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The intake in the initial period will be limited to 150-200 students every year. This may grow over the years to around 300 but in no case of should exceed this number.

(13) Realizing that any educational institution is as good as its faculty, great care will be exercised in selecting the faculty for tenure position. There will be a core faculty supported by visiting faculty. The ratio of core to visiting faculty will be roughly 2:1 visiting faculty will be drawn from research institutions and industries from all over the country essentially by invitation. There will also be visiting eminent Professors, leaders in their own fields, invited to spend from 3 months to a year. At any point of time there will be at least 5 Professors from abroad.. ACST will be continuously on the look out for induction of peers in the faculty. ACST will not have a fixed number of positions in any particular category. However, the total faculty positions having tenure shall not exceed a certain number to be fixed from time to time by the Institute Council. Appointment to faculty positions will normally be made by solicitation and invitation, although standard recruitment procedure will be followed.

(14) Right from its inception, ACST will attempt to forge strong links with industry. The faculty will be encouraged to evolve workable relations with industry. This intended nexus between industry and ACST is bound to be mutually beneficial and will ensure quick and smooth transfer of technology from laboratory to industry and its commercial exploitation by the industry will also be reflected between ACST and industry will also be reflected between ACST and industry will also be reflected in the participation of leading industrialists in formulating the concept of ACST, its structuring, its management and its funding.

(15) A unique feature of the Advanced Centre for Science and Technology will be its close and intimate relationship with the beneficiaries of its products namely industries, research laboratories of the Govt. of India, universities etc. Indeed, the ACST will be sponsored by the science agencies of the Govt. of India, industries and the University of Pune. It will be autonomous society registered as such under the provisions of the

Society's Registration Act of 1860. It will have its Governing Body and Institute Council and enjoy full academic, administrative and financial autonomy.

ACST will have Academic Advisory Committee consisting of eminent scientists from abroad and from within the country and some representatives of industry. The Academic Advisory Committee will provide valuable academic input in order to keep the functionary of ACST in tune with changing global scenario.

(16) Over the years, ACST will become Institute of National importance with a charter to award its own degrees. Till such time, it becomes Institute of National Importance, University of Pune will award the degrees. A special relationship with University of Pune will be evolved on the basis of guidelines approved by the Management Council of the University which inter alia guarantees full administrative, academic and financial autonomy to ACST.

(17) With a fundamentally different guiding philosophy and with a determined intention of making ACST a non-feudal, non beaurocratic, internally democratic, free and exciting institution devoted to free exploration, discovery and innovation, entrepreneurship, all academic and scientific matters in ACST will be decided by the committees of the faculty. Administration will serve the institution as per the policies and decision taken by the faculty. Indeed it is the academic faculty that will take decisions and the administration sole role will be to implement the decisions and serve the faculty enabling them to perform to the best of their activity.

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1. Prof. V.S. Ramamurthy
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Dept of Science & Technology
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3. Dr. Anil Kakodkar
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4. Dr. Manju Sharma
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5. Dr. A.P.J. Abdul Kalam
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6. Dr. Vikram Kumar
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7. Dr. K. Kasturi Rangan
Secretary to Govt. of India
Deptt. of Space

8. Dr. D.D. Bhawalkar
Director
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9. Dr. Rangarajan
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Master Control Facility.

10. Dr. R. Chidambaram
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Dec 23/5

UNIVERSITY OF PUNE
Ganeshkhind, Pune–411 007.

Dr. Arun Nigavekar
VICE-CHANCELLOR

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Similar letter sent to ~ 50 persons including ~ 26 from Pune.

VC/323
March 3, 1999

Dear Dr. Ratnasamy,

You may perhaps be aware that some senior scientists and industrialists in and around Pune made a proposal for the establishment of Advanced Centre for Science & Technology at Pune. The proposal arose out of indepth discussion of the status of science education and scientific research in the country which incidentally is in grave crisis and the critical analysis of challenges and opportunities offered by the global emerging scenario.

The concept of ACST is a new and novel initiative aimed at creating a band of highly qualified, highly skilled and highly motivated young boys and girls to man and lead research groups in research laboratories, universities and industries. The concept of ACST takes care of the lacunae of the present system of education and evaluation as also caters to the needs of the emerging scenario. Please find enclosed herewith a brief note on the ACST proposal as also the concept document that was submitted to the Planning Commission. The Government of India have evinced keen interest in the proposal and have desired that a detailed report be submitted to the Government early so as to initiate steps to process the necessary administrative and financial sanction.

One of the distinctive features of ACST is that it should not only be conceived but also monitored and evaluated by the beneficiaries of the programme viz. various national research institutes, laboratories, industries and universities. The appended concept document was a result of collective thinking of a few senior scientists and industrialists in and around Pune. It has now been felt necessary that while making a detailed project proposal it

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would be desirable and certainly advantageous if we have the benefit of experience and expertise of a larger cross-section of scientists, educationists and industrialists in the country. In order to facilitate this input we are proposing to organize a One-day Brain Storming Session on 27th March, 1999 at 9.00 a.m. in Shivaji Sabhagriha, University of Pune, Pune. We would be extremely grateful if you could attend this session and give the benefit of your vast experience and unique expertise.

It will be a real pleasure to take care of your local hospitality and local travel in Pune. Possibly, your organization may take care of your travel to and from Pune. In case it is not possible, the organizers would be happy to meet your travel expenses.

Please find enclosed a small form which you may kindly fill and return as early as possible so that your stay and other arrangements could be finalized well in time.

With warm personal regards,

* Labs at IUCCA on 25 & 26 March 1999

Yours sincerely,

V. G. Bhide **Govind Swarup** **Arun Nigavekar**

Encl: as above

Meeting in IUCAA Auditorium

To:
Dr. Paul Ratnasamy
Director
National Chemical Laboratory
Pashan
Pune 411 008

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Apn 12

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DETAILED SUMMARY OF

A Brain Storming Session on the proposal of ACST

A brain storming session on the proposal for establishment of Advanced Centre for Science and Technology at Pune was held at Inter-University Centre for Astronomy and Astrophysics on 25th and 26th March 1999. Seventy five scientists, technologists, science administrators and science agency heads were invited. Out of these, nearly 40 participated in the brain storming session and most of those who could not participate in the brain storming session communicated their views. As a result of the formal and informal discussion, exchange of views and opinions expressed, a following consensus emerged

1. The participants expressed deep concern on the continual deterioration in the standard of education particularly at the first degree level and subscribed wholeheartedly to the view expressed in the Indian Academy of Sciences report on the state of science education in India namely, "The standards in all respects have declined rapidly and alarmingly and unless something is done soon to remedy the situation, the country is definitely heading for a disaster".

2. Unanimous view was expressed that there is an urgent need to launch a new initiative to provide for exciting and stimulating science education programme at a few places so that a band of highly talented, highly skilled and highly motivated young boys and girls could be trained so that they can man and lead research groups in industries, universities, national laboratories etc. It is only such a group of young boys and girls that would be able to meet the challenges of the emerging global scenario and seize tremendous opportunities that will occur in the next few decades.

3. Participants enthusiastically and spontaneously welcomed the initiative taken by the Pune group consisting of scientists and industrialists and indeed congratulated them for making a proposal for establishing the Advanced Centre for Science and Technology which is aimed at training a band of highly talented, highly skilled and highly motivated young boys and girls who would initiate a new ethos the areas of science education, scientific research and technological development

4. Everyone stressed that an important and essential need for the proposed and similar future endeavors ACST and similar future endeavours to have total autonomy – administrative, academic and financial and stressed the points made in the proposal such as making ACST a society to be registered under the Society's Registration Act.

5 Taking into consideration the intellectual ethos, the existence of a large number of research institutions of the State and Central Govt and especially the existence of major national institutions on the campus of Pune University and more particularly the track record of the Pune University and its enlightened management, everyone impressed and indeed insisted that the proposed ACST should be located at and near the campus of the Pune University.

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Everyone congratulated the Management Council of the University of Pune to have passed a resolution guaranteeing the proposed ACST, full administrative, academic and financial autonomy while extending to it all the privileges of the University.

6. It was impressed that the proposed ACST, though not under the administrative, financial and academic control of the University, should be in close proximity of a reputed university such as the University of Pune, the participants had no doubt that the proposed ACST shall succeed and in due course the system of working of ACST will percolate into the conventional University.

7. It was generally appreciated that ACST should be launched by the likely beneficiaries of the ACST such as industries, science agencies, yet it was cautioned that ACST should be insulated from day to day interference of the beneficiaries. This was suggested to be achieved by securing one time grant from the Government and endowment from the industries.

8. It was the clear opinion of the participants that ACST would be a novel and unique training and educational institution with several innovative programmes such as the five year integrated course with one year work experience in the field leading to M.Sc. degree, integrated Ph.D. programme, etc. It was also emphasized that ACST should necessarily have an intensive research programmes so that highly creative and stimulating atmosphere is created in which students are provoked and enabled to be creative.

The proposed research areas around which ACST should be structured namely (1) Information Science and Technology (2) Advanced Materials and (3) Biotechnology, genetic engineering etc. was welcomed by everyone. These are the fast growing research areas and will dominate the research scene over the next few decades was also suggested that in each of these areas, research in basic sciences should be stressed. Indeed one of the suggestions was that there should be fourth area namely basic sciences. In course of time these area may increase in number and may even change.

In its educational and training programme, the concept of integration in terms of time and discipline, integration of teaching and research, education and exploration as indicated in the draft proposal was highly lauded. The students will be given not only academic course work but will also be involved in research projects. Further ACST will invite leading scientists and technologists to have interaction with students The students will also take project work at other institutions. The students will be enabled to develop sufficient appreciation of several challenging problems of India's scientific and technological endeavors.

9. It was generally felt that a five year is a fairly long period for anyone to commit himself to and there should therefore be a provision of entry and exit from and into the system, depending upon case to case

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It was suggested that at the end of three years, an option could be given to a student either to continue in ACST in its basic stream or in its applied stream for two more years so as to qualify for the M.Sc. degree in the first case and M.Tech. degree in the second case. There should likewise be a provision for a student to leave ACST at the end of third year to join any other institution such as IISc or a major university to continue his M.Sc programme. In turn, it should be possible for engineering or technology graduates from other places such as IIT's, regional engineering colleges to join ACST for a two year training programme leading to M.Tech degree.

It was strongly felt that in addition to integrated five year programme leading to M.Sc or M.Tech. degree there should be a provision for integrated Ph.D programme starting at the end of three or three and half years

10. In addition to the autonomy of the system, the essence of this programme should be in its flexibility as very rightly pointed out and emphasized in the draft project proposal. This flexibility could also include the possibility for a student to study for sometime say until the end of three years, dropping out for a while to work in an industry and joining the ACST once again. It was agreed that there should be a common course in the first year before a student makes a choice of a stream. Likewise, the flexibility in choosing from a large menu of courses, exposing students to a wider horizon by organizing regular extra mural lectures on economics, management, IPR, patenting, history and philosophy of science, Science and development etc. as suggested in the draft document was welcomed.

The suggested internship programme, through desirable and novel, should be implemented with due care.

11. It was the unanimous view that admission to ACST should be strictly on the basis of merit and merit alone.

12. It was generally felt that students should be charged suitable fees which are determined by the annual cost incurred on the students. However, to enable the students to pay such high fees there should be a provision of making a soft loan available to the students to be repaid over long period say eight or ten years. It was equally strongly suggested by some that those who leave the country, should be required to pay back the loan with interest and overheads thereon before he or she goes abroad. It may also be mentioned that a few did not agree with this suggestion. For administrating such loans, educational finance corporation may be established

13. It was stressed by everyone without exception that the success of ACST critically depends upon the faculty and extreme caution need to be exercised in recruiting the faculty. As recommended in the draft proposal, there should be core faculty to be supplemented by visiting faculty from other universities, research institutions, industries etc. and for adjunct professors (faculty) from industries. In inviting the visiting faculty, the sole criterion would be that only the best in the country shall teach in ACST.

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14. Although relevance should not be a throttling constraint on the functioning of ACST, yet it would be necessary for the faculty to work out working relationship and strategic alliances with industry so that such a nexus would be beneficial to both. It was strongly felt that excellence should be the sole criterion in selecting programme, faculty, etc.

15. Although the formation of ACST as an autonomous society with the normal administrative structure such as General Body, Institute Council etc was generally welcomed and stressed as essential There were strong views expressed on the composition of the General Body and that of the Institute Council.

In the case of general body, it was strongly felt that it should be presided over by a distinguished scientist to be nominated by the Prime Minister In the membership of the General Body, it was likewise stressed that secretaries to Govt in various Science departments, be the members in person and that they shall not be represented by their nominees

In the case of Institute Council, also it was suggested that a distinguished scientist/technologist who chairs the General Body could be the Chairman of the Institute Council. The membership of the Institute Council should be limited to at best 15.

Everyone unanimously welcomed the concept of Academic Advisory Committee except item (2) in the relevant clause in the proposal should read as "three eminent scientists from within the country or abroad."

It was also felt that it would be necessary to constitute committees on courses, faculty council and the Academic Programme Committee. Although these would essentially be internal committees consisting of not only representatives of core faculty, visiting and adjunct faculty but also comprising of eminent scientists/technologists

16. Being on and /or near the campus of the University of Pune, a special relationship need to be evolved between the University of Pune and ACST, while not compromising on national character of ACST.

This relationship could be in the form of MoU based on the following:

A. It should be open for students from the University of Pune to take courses in ACST and vice-versa and the University should recognize such courses for the award of the relevant degrees.

B It shall likewise be open to a student from the University to spend one whole semester in ACST and vice-versa.

C ACST could benefit from the expertise existing in the University Likewise University could invite the faculty of ACST to give courses in the University

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D It shall be open for students from the University to carry out his/her project in ACST and vice versa.

E As stated in the resolution of the Management Council of the University, ACST and the University could use each others infrastructure and human resources on mutually agreed terms

F There should be a provision for undertaking joint research programmes, applying jointly for research grants etc.

G. In a sense, ACST should provide a possibility to overcome the constraints imposed by the traditional university system on the growth and academic advancement of the deserving in the university There should a provision of joint appointment, so that the selected faculty from the university could as well be on the faculty of ACST

It was stressed that one should aim at making ACST an institution comparable to CALTECH, MIT in years to come rather than settling down to being merely another, possibly better funded, educational institution.

17. Fortunately, there are a number of prestigious research institutions on the campus and within the workable distance from the campus. ACST should evolve symbiotic relationship with these research institutes by introducing a system of joint appointments for senior scientists from these institutions, by enabling the faculty to evolve joint research programmes etc.

In the history of a nation, opportunities come, but they come very rarely, when a bright idea or a new concept revolutionizes the system. It was strongly felt by everyone that the proposal of ACST is one of those rare ideas which has the potential to bring about the much needed and much desired changes in the education system and to make the system highly exciting, stimulating and creative. It has the potential of overcoming the lacunae and the inadequacies of the present system of education, and the capacity to enable the country by training the required manpower to seize the tremendous opportunities that the emerging global scenario is likely to offer. The participants wished to impress on the authorities that the emergent global scenario is pregnant with immense possibilities and tremendous opportunities and unless the country gears itself up by creating the much needed human resource of the requisite quality to face these daunting challenges and seize these rewarding opportunities, the country may lose for ever the distinct possibility of recapturing its past glory and of recreating an ethos for learning and scholarship and for converting knowledge into wealth. Participants very strongly recommended to the Government, Central and State and the industry to accept the proposal and accord the necessary financial and administrative sanction at an early date

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ACSTE

Date: Tue, 30 Mar 1999 11:43:56 +0530 (IST:)
From: Dr.T.V.Ramakrishnan <tvrama@physics.iisc.ernet.in>
To: vgb@physics.unipune.ernet.in
Cc: gswarup@ncra.tifr.res.in
Subject: ACST

Dear Professors Govind Swarup and Bhide,

I thank you for the experience of taking part in the planning for the ACST. I have been thinking about what various people said, and how best the thing can move forward. Some notes are put down below for your consideration.

1. The proposal document: It could perhaps be less detailed. One needs to stress the basic broad points eg. the urgent need for ACST like institutions, the special strengths of Pune, the administrative prerequisites of autonomy as well as responsiveness, and the academic ones of quality, flexibility, employability or relevance. The details could best evolve.

The reasons for this suggestion are the following. Consistent with the broad goals, there are several routes. Why constrain this freedom by spelling out one route in detail and give room for the literal minded or negative to slow down things? This is specially true for the academic part of the programme. Secondly, the Director and the faculty may have other ideas consonant with the goals. They should have the freedom to chart their courses. So in areas like the size and shape of the core, the details of the course programme, the basic/ applied divide, number and nature of qualifying exams/ other assessments, duration and nature of internship, kinds of specialization, one could, I feel illustrate or suggest possibilities. This is actually close to your basic exploratory philosophy. Such room will give the faculty, Director and others a real and strong sense of creating something, with the mentorship of the founders.

2. Relation with scientists in Pune: (University and Other institutions) Though I said that the relation should be one of equality and mutuality, after listing on Sunday morning to Professor Bhide and thinking a little more I realize that since quality education/ research is the determining motive, there is a real conflict. It cannot be resolved by making all faculty of one institution adjunct in the other. Some choice, depending on commitment and quality may be needed in several areas. This has to be locally worked out in the spirit of a common cause and with consultation; an outsider can only make general remarks, since local realities would not be not well known.

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3. Early Start: I feel that there should be a concrete beginning date, say July 2000 for the first batch of students to be admitted. This will focus thinking about new faculty, teaching labs, courses, participation by labs and departments of Pune University,hostels. Even if the building is not ready, the activity could start in classrooms/ labs here and there on campus, with a small class. Once the proposal is submitted (say in a month or two) and there is some commitment from the Govt., a Director should be identified, and he should be asked to take charge of broad based academic planning with the year 2000 as the goal, and get going with the first batch of students.

With warmest regards,

Yours sincerely,
Ramakrishnan

T V RAMAKRISHNAN

DOC. 26/2

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Ref. No. :
Date : 7-3-99

To: Prof Y R Waghmare from: Sanjay G. Dhande

Subjects: My views about the proposal.

1. There should be a detailed need justification of how ACST "product" will be different IITs, RECs, university graduates and what sort of jobs are expected for them. Are they scientists or engineers? They look like "applied scientists". But so what sort of career options will be available for them?
2. What is the "technology" part in ACST"?
3. I feel that "School of Materials" may not survive. There are not enough job prospects for them. Same is true for "Aerospace Sciences".
4. The schools which will have bright prospects are:
   (i) school of information technology
   (ii) school of environmental sciences & tech.
   (iii) school of biological sciences & tech.
   (iv) school of design.
5. As regards, management, finances, it will have a typical IIT pattern. However, we should look strongly for outside funds right from the beginning. This will give enough freedom from "Babus of New Delhi".

Thanks.

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Dhande

Foreword

In December 1996, some senior scientists and industrialists of Pune conceived **Advanced Centre for Science and Technology Education** as their response to the continual decline in the standards of science education at all levels and the consequent drying up of the source and the resource that feeds the system of scientific research and technological development in the country.

The concept was informally discussed with a large number of scientists, science administrators and eminent educationists. The concept document was formally submitted to Dr (Mrs.) Chitra Naik, the then Member (Education) Planning Commission on 17th December 1996. Copies of the document were also submitted to the Departments of Human Resource Development and Science and Technology on 2nd February 1997. In response, Prof. V.S. Ramamurthy, Secretary, Dept of Science and Technology vide his letter No. D.O. DST/PS/1997 wrote that "The proposal seems interesting and needs to be pursued. Our preliminary reaction is supportive" and suggested the submission of a detailed project report (copy of the letter enclosed).

On 7th February 1997, Dr (Mrs.) Chitra Naik, Member Planning Commission, wrote to Shri. P.R. Dasgupta, Secretary, Dept. of Education, Ministry of Human Resource Development, recommending to the Dept. of Education to support the proposal and in pursuance of the discussion she had with Secretary, Dept. of Education to include Rs. 5 crore in the 1997-98 Annual Plan for **ACSTE**. This was followed by another letter dated 4th April 1997 in which she mentioned that "As a result of extensive discussion held with the scientists who have drafted the proposal, I am personally convinced

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that this innovation (**ACSTE**) can give the necessary direction for modernization of higher education in science and therefore it is worthy of support from allocations for higher education in the Eighth Five Year Plan"

Incidentally, Prof. Y.K. Alagh, the then Minister of State for Power and Science and Technology, Govt. of India publicly expressed his support to the proposal for setting up the **Advanced Centre for Science and Technology Education** in his speech at the inauguration of the Science Congress session held at Hyderabad in January 1997. He followed it up through his letter dated 2nd July 1997 expressing his support to the setting up of **ACSTE**.

Prof. V.S. Ramamurthy, Secretary, Dept. of Science and Technology, Govt. of India convened an inter agency meeting to discuss the proposal on 2nd September 1997 in the conference room of the department. This meeting was attended by the representatives of the Planning Commission, chairperson UGC, representatives of ISRO, DOE, DRDO, DBT etc. There was an unanimous opinion that "there is a need for creation of such a centre for excellence and improvement of quality of science education. This proposal is a new and novel experiment and may be viable as an independent model of centre of excellence by channelizing the funding from various agencies and industry". It was further decided that "based on the views of the Planning commission and S and T agencies, Pune University will take up follow up action with MHRD for getting the clearances and finalizing the various modalities etc."

On 20th March 1998, Dept. of Education, Ministry of Human Resource Development wrote to the university vide their letter No. D.O. F.5-9197-U.I. requesting the university to take follow up action in pursuance of

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the decision arrived at the Inter Agency Meeting held in DST on 2nd Sept 1997.

Pune University requested the Dept of Science and Technology to approve a sum of Rs. Ten lakhs for the preparation of the Detailed Project Report some time in June 1998.

The Dept. of Science and Technology issued a sanction for Rs. Ten lakhs as requested by the University on 21.9.98 for the preparation of the detailed Project Report for setting up of **ACSTE**.

The university vide their letter No. VC/142 dated 20th November 1998 constituted a committee as under for the preparation of the detailed project report:

1. Professor V.G. Bhide – Chairman
2. Prof. Govind Swarup
3. Prof. D.N. Deobagkar
4. Dr. P.J. Lavakare
5. Prof. Y.R. Waghamare

The committee at its first meeting decided to seek confirmation of the guidelines from the university on the basis of which **ACSTE** should be established. A letter was sent by the Chairman of the Committee to the Vice-Chancellor, University of Pune on 29th December 1998 seeking approval of the Management Council of the University to the basic policies on the basis of which **ACSTE** would be set up. These included:

1. The **ACSTE** would be set up under Clause 7(5) (Powers and duties of the University) of the Maharashtra Universities Act 1994 which provides for the establishment on the university campus of autonomous institutions like Inter University Centre, research laboratories, modern instrumental centres and like

Doc. 28/3

centres of learning set up by UGC, Central Govrt. State Govt. which may be used by a university or college or group of universities or colleges.

2. **Advanced Centre for Science and Technology Education** shall be set up as an autonomous society sponsored by Govt of India science agencies, Govt. of Maharashtra and Pune University and registered as such under Society's Registration Act of 1860.

3. **Advanced Centre for Science and Technology Education** will enjoy administrative, academic and financial autonomy.

4. MOU will be evolved between **ACSTE** and **UoP** for use of each others human resource and infrastructure on mutually agreed terms.

5. **ACSTE** will evolve a new model for S and T education and research distinctly different from that used by the university. It will initiate a five year integrated course leading to M.Sc. degree. **ACSTE** will also lay equal emphasis on pure and applied research. Thus, **ACSTE** will play a twin role of a first rate teaching institution and a flourishing research laboratory and will serve as a pace setter in the country. Although **ACSTE** will evolve its courses of study, menu of courses, methods of teaching and evaluation etc, it will seek formal approval of these from the Academic Council of the university as in the case of autonomous colleges.

The Management Council at its meeting held on 4th January 1999 accepted the guidelines for the establishment of **ACSTE** as proposed in the

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above referred letter to the Vice-Chancellor. This decision was confirmed at the council's next meeting held on 27th January 1997.

The Committee held a series of meetings amongst themselves, with the Heads of research laboratories on the campus and with Heads of research and development laboratories such as NCL, ARI, NIV, ARDE, R and D Engineers, IAT etc. to seek their collaboration and support to **ACSTE**. The concept of joint appointment was also approved at these meetings. It was agreed that full support would be extended to **ACSTE** by research laboratories on the campus and by those outside the campus. A meeting with senior industrialists was also held to seek their involvement and support. Having secured the support of various research organizations and industries in Pune, a brain storming session was convened on 25th and 26th March 1999. Nearly fifty eminent scientists, senior science administrators, educationists from all over the country and senior industrialists from Pune were invited for this brain storming session. The consensus arrived at the brain storming session is enclosed.

Based on the guidelines approved by the University, decisions arrived at the meeting of the representatives of research institutes and industries in Pune and the consensus that emerged at the Brain Storming Session, this report has been compiled.

The accompanying report contains.

(I) Executive Summary
(II) Project report in a nut shell
(III) Detailed Project report, and
(IV) Annexures.

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I have great pleasure in submitting this report for onward transmission to Department of Science and Technology and to the Dept. of Education, Ministry of Human resource Development, Govt. of India.

I am voicing the feeling of everyone, whom we had the pleasure of discussing and who kindly participated in the formulation of the concept, providing it a concrete shape and in the preparation of this report, that the Govt. takes very early decision to establish **ACSTE**. We may urge that any delay in taking a new initiative in the field of Science Education will be at our great peril. We express the confident hope of very one concerned that **ACSTE** will result in a new ethos in the field of science education and a resurgence in the area of scientific research and technological development in the country.

V.G. Bhide.

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Executive Summary

1. The proposal to establish **Advanced Centre for Science and Technology Education (ACSTE)** is a well thought out response to the growing concern expressed by the scientific community, science administrators, educationists and industrialists. on the continual decline of the standard of science education at all levels on the one hand and the growing urgency to make available within the country an adequate supply of well qualified and highly motivated scientists and technologists to participate in the national development and strategically important projects and to face challenges and seize tremendous opportunities that the emerging global scenario dominated increasingly by S and T is likely to offer on the other.

2. The proposed **ACSTE** is a new and novel initiative, new in many ways, to produce highly qualified, highly skilled and highly motivated young boys and girls to man and lead research and development groups in national research agencies, national laboratories, industries and universities. **ACSTE** will play a twin role of a first rate teaching institute and a flourishing and exciting research establishment.

3. Besides providing research facilities at the frontiers of science and at the cutting edge of technology in chosen fields, **ACSTE** will offer a five year integrated education programme leading to M.Sc. degree and in some cases to M.Tech. degree. The integration is sought to be accomplished in terms of time and disciplines, education and exploration, teaching and research, acquisition of knowledge and the ability and capacity to use that knowledge for solving societal problems. The assigned role of the

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proposed **ACSTE** is a result of our firm conviction that the most effective and efficient form of teaching comes from discussion with peers and happens when teaching and learning are viewed as an adventure in discovery. There is perhaps no grater stimulant for young minds than to see discoveries and inventions occurring in their midst and in their presence.

4. **ACSTE** will offer a large menu of courses from which students could choose according to their liking and aptitude in consultation with a faculty advisor. The choice of courses will not be restricted to any conventional streams, but will also be available across the streams and beyond. In case of exceptional students like those of Ramanujam type, who demonstrate special insight in any given discipline, the formal course structure will not be imposed and they would be encouraged to pursue their own discipline at their pace.

5. The teaching and research activities of **ACSTE** will be centred around four schools namely (a) School of Basic Sciences, (b) School for Information Science and Technology, (c) School of Advanced Materials and (d) School of Life Sciences and Biotechnology.

6. Admission to the academic and research programmes in **ACSTE** will be based on merit and merit alone. In the case of teaching programmes, merit at the entrance will be determined on the basis of performance of a candidate at a well designed national competitive examination.

7. There will be common course for all students in the first year. In the first year students will be exposed to basic physical principles, mathematical tools and techniques, computers and computational techniques, basics of life processes and the current excitement in life sciences. In the

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laboratory, students will be enabled to learn various skills and techniques and carry out open ended investigations. At the end of the first year, there will be a rigorous year-end examination to assess student's ability to cope with this exacting and exciting programme.

8. In each of the courses, there will be emphasis on (a) acquisition of latest knowledge and information, (b) cultivation of all kinds of skills and development of competence in related techniques and (c) inculcation of desired attitudes and outlooks conducive to social commitment. Besides classroom lectures packed with demonstrations, laboratory courses conducted in research laboratories will lay emphasis on learning of skills and techniques, open ended investigations, projects rather than on stereotyped experiments with known end products.

9. At the end of the first year, students will indicate their choice by opting for courses from amongst a large menu of courses in consultation with a faculty advisor. At the end of the third year, there will be aptitude cum ability test to find out students aptitude for further studies in basic sciences or in applied sciences.

10. After successful completion of the three year programme, a student will proceed to study for another two years in their chosen field of specialization. Unique feature of the **ACSTE's** academic programme is the internship programme in a last semester and in the adjoining summer vacation. During the internship period, the student will carry out a research or development project in any of the laboratories of science agencies such as DAE, ISRO, DRDO, CSIR etc, or in an industry. In case of students pursuing basic sciences, they will spend their internship

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programme with an eminent professor in his discipline and in reputed research laboratory like IISc, TIFR, etc.

11. In some special cases, engineering and technological graduates having B.E. or B.Tech. degree will be admitted for their two year M.Tech. programme in the three schools namely (1) School for Information Science and Technology, (2) School for Advanced Materials and (3) School of Life Sciences and Biotechnology.

12. **ACSTE** will function in the partnership and collaborative mode. Various science agencies, research laboratories, and industries have contributed to the conceptualization and concretization of **ACSTE**. They will also collaborate in the functioning, funding and monitoring of **ACSTE**. **ACSTE** will have a core staff and an almost equal complement of joint appointees from local R and D institutions and the university, visiting faculty from prestigious research laboratories and universities in the country and adjunct faculty from industries. This staff structure has been evolved on the basis of our concern that the students in the **ACSTE** must be taught by the very best that the country can afford.

13. **ACSTE** will be set up on and around the campus of the University of Pune where it will have the advantage of the major national facilities such as IUCAA, NCRA, NCCS and C-DAC and the university itself in its neighbourhood. Initially, the **ACSTE** will be set up as an autonomous society sponsored by its likely beneficiaries such as national science agencies, national laboratories, universities and industries. As in the case of Indian Institutes of Technology which were initially set up as autonomous societies and were subsequently declared as 'Institutes of National Importance' through an act of Parliament, **ACSTE** will also be

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in due course declared as 'Institute of National Importance' through an appropriate act of Parliament. It is recommended that in view of the nature of **ACSTE** and the nodal role played by DST in the Govt. for all matters connected with science and technology, that DST should be the administrative ministry for **ACSTE**.

14. As a society, it will have its General Body, Governing Body, Academic Advisory Committee, Academic Faculty, Committees on courses etc. Director of **ACSTE**, chosen with due care, on the basis of his her eminence and the qualities of academic and administrative leadership, will be the chief academic and administrative head of **ACSTE**.

15. Till such time **ACSTE** is not declared as an 'Institute of National Importance', **ACSTE** will be affiliated and recognized by the University of Pune for its academic and research degrees. Indeed, Management Council of the University vide it's resolution dated 27th January 1999, has approved the setting up of **ACSTE** on and around its campus as an autonomous society with full academic, administrative and financial autonomy.

16. Being on the campus of the university, **ACSTE** will have special relationship with University of Pune. Through mutually agreed Memorandum of Understanding they will use each others human resource and infrastructure on mutually agreed terms. Indeed the symbiotic relation between the University and **ACSTE** will be based on the concept that University will help **ACSTE** to grow and **ACSTE** will enable the University to develop. Indeed **ACSTE**with its flexibility and autonomy will provide a mechanism for the faculty of the University to

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