NBS SPECIAL PUBLICATION 507

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

Standardization in Support of Development

Standardization in Support of Development

Proceedings of a Seminar
Held at the National Bureau of Standards
Gaithersburg, Maryland

October 17-18, 1977

Edited by

H. Steffen Peiser and John A. Birch

Office of International Relations
National Bureau of Standards
Washington, D.C. 20234

Organized by the National Bureau of Standards
with the cooperation of
The Agency for International Development
The American National Standards Institute, and
The American Society for Testing and Materials

U.S. DEPARTMENT OF COMMERCE, Juanita M. Kreps, Secretary

Dr. Sidney Harman, Under Secretary

Jordan J. Baruch, Assistant Secretary for Science and Technology

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Director

Issued May 1978

Library of Congress Cataloging in Publication Data

Main entry under title:

Standardization in support of development

(National Bureau of Standards special publication ; 507)

Sponsored by the National Bureau of Standards, the Agency for International Development, the American National Standards Institute, and the American Society for Testing and Materials.

Includes index.

Supt. of Docs. no.: C13.10:507

1. Underdeveloped areas Standardization Congresses. I. Peiser, Herbert Steffen, 1917- II. Birch, John A. III. United States. National Bureau of Standards. IV. Series: United States. National Bureau of Standards. Special publication ; 507.

T59.A1S7 602'.1 78-7249

National Bureau of Standards Special Publication 507

Nat. Bur. Stand. (U.S.) Spec. Publ. 507, 163 pages (May 1978)

CODEN: XNBSAV

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON: 1978

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $3.50

Stock Number 003-003-01928-3

FOREWORD

National services in standardization, measurement technology, and product quality control have come to be recognized as essential elements of the technological infrastructure needed for economic and industrial development. In the United States, the National Bureau of Standards is an important component of that infrastructure, working in a complex and ever-evolving relationship with the private sector and with other agencies of the Federal government. Early in the year 1971, our institution began an experiment in cooperation with the U.S. Agency for International Development to explore ways in which we might use our own capabilities to help strengthen the infrastructure of the less-developed nations of the world.

In the intervening period, several different techniques have been employed for this purpose. We have organized workshops such as the one just concluded; we have conducted surveys of the needs and capabilities of selected countries; we have provided written standards of ANSI, ASTM, and other organizations; and we have supplied Standard Reference Materials needed by laboratories in some of the participating countries. This seminar was planned to review and evaluate these and other elements of the NBS/AID program, and also to consider the possible inclusion of standardization as a subject for examination in the forthcoming U.N. Conference on Science and Technology for Development.

In the seminar we have been pleased to have the cosponsorship of the American National Standards Institute and the American Society for Testing and Materials. Participants from the governmental and the private sectors have joined with officials of 14 foreign nations to make our discussions representative of a wide range of views.

The record of the discussions that follows will be helpful to the National Bureau of Standards as we pursue our joint program with the Agency for International Development. Also, I trust, it will be helpful to the officials of this and other countries as we strive to apply the methodology of measurement, standardization, and quality control to the betterment of the global society in which we all live.

E. Ambler.

Ernest Ambler
Director

ABSTRACT

The National Bureau of Standards held a two-day seminar in an effort to appraise the benefits derived from six years of a cooperative program with developing countries designed to improve their standardization and measurement services. With financial support from the Agency for International Development, participants came from Argentina, Bangladesh, Bolivia, Egypt, Ghana, Indonesia, Iran, Kenya, Korea, the Philippines, and Thailand; from regional and international organizations; from key U.S. standards writing bodies; and from industries, professional societies and government in the United States. The papers presented and the discussions were organized around the session titles:

°Six Years of National Bureau of Standards and Agency for International Development Programs, and

°Standardization in the U.S.A.--A Resource for Development.

It was concluded that the developing countries concerned with this program had benefited in a variety of ways from the standards surveys and workshops conducted by the National Bureau of Standards in cooperation with them, and that efforts should be made to continue the program with full support. Questions were raised, but no consensus reached on the desirability of standardization being proposed as a distinct topic for the U.N. Conference on Science and Technology for Development.

Key Words: Africa; Agency for International Development (AID); Asia; developing countries; engineering standards; industrialization; Latin America; National Bureau of Standards (NBS); quality control; standards; surveys; U.N. Conference on Science and Technology for Development; workshops.

TABLE OF CONTENTS

Page

Appendices

SESSION 1 - SIX YEARS OF NBS/AID PROGRAMS

Chairman: Mr. Marcelo Alonso

SESSION 1 - SIX YEARS OF NBS/AID PROGRAMS

Chairman: Mr. Marcelo Alonso

Paper 1.1 - Welcoming Remarks

Dr. Ernest Ambler
Director
National Bureau of Standards

Good morning, and welcome to what I consider to be a most important seminar. We at the National Bureau of Standards are most pleased to have you with us today. We especially look forward to your sharing with us your impressions and ideas concerning standardization and its impact on technology transfer and trade.

People in the United States, people in the nations you represent, people throughout the world, share certain goals. These goals include assurance of basic necessities of life, good health and medical care, national independence and security, and increasing availability of consumer goods. The only known way to meet these goals is through industrial development. Therefore, most nations, including the United States, give high priority to industrial growth.

No nation has the resources with which to be completely independent. All nations need to import certain materials or products, and to export other materials or products in order to help pay for its purchases.

The United States has made good use of its national resources to provide a good life for most of its citizens. Our vast capacity for material goods leads us to import both raw materials and manufactured products. Our purchases from many of the developing countries give them the foreign currencies they need to buy goods in the world market.

Because of the tremendous increase in the price of oil, which has resulted in a large trade deficit, we in the United States see an urgent need to accelerate our economic growth. The National Bureau of Standards plays an important role in this process by providing the measurement competence that is so vital to the smooth functioning of an industrial society. Over the last six years, NBS has played another important role--that of helping developing nations become more active trading partners.

In order for two nations to trade successfully, they must each understand the requirements placed upon the goods being traded. The most rational way to achieve this is through standards that clearly

quantify those requirements. Standards provide a solid foundation on which to build a trade relationship.

But setting useful standards is not an easy task. Rather, it is a job that calls for strong and effective measurement, standards, and quality control efforts on the part of each trading partner. Over the years the United States has developed broad competence in these areas.

The goal of our program through the Agency for International Development is to help developing countries create their own competence. With a broad foundation in metrology and standardization, developing nations can enter the world market with firm knowledge of what is required of products they buy and sell.

We have worked with developing nations for six years, helping them build the supporting structure needed for industrial growth and international trade. At this time we would like an appraisal of how successful our program has been. We particularly seek the observations of participants from developing nations. We want to know how useful the program has been, what lessons have been learned, and what can be done to improve our efforts. In this way more effective trade relations can be established between our nations.

Thanks for coming, and we look forward to your contributions during the next two days.

SESSION 1 - SIX YEARS OF NBS/AID PROGRAMS

Paper 1.2 - Welcoming Remarks

Mr. Henry Arnold
Director
Office of Science and Technology
Agency for International Development

It is a pleasure, once again, on behalf of the Agency for International Development, to welcome the distinguished participants, both from the United States and abroad, to this meeting dealing with standardization in support of development. Many Washingtonians like myself have watched with great pleasure the growing appreciation and interest of developing countries in standardization and metrology. It is a special pleasure to share the platform with Mr. Peiser who, I think, has become "Mr. U.S. Standards" around the world, and thus to mark the six years of association between AID and our National Bureau of Standards in this field.

All fields of science and technology are assuming increasing stature as tools of economic development. A dispatch to the New York Times from Hong Kong last month quotes a directive of the Central Committee of the Peoples Republic of China as identifying "four modernizations" that China wished to achieve: agriculture, industry, national defense and science. The Committee said that of these four, priority should be given to science.

Looking back over the three decades that have passed since the end of World War II, one sees that science and technology were among the first fields referred to when the United States committed itself to the cause of economic development for the non-industrialized countries. In President Truman's 1948 "Point IV" speech there was great emphasis on bringing to the developing world the fruits of our knowledge of science and technology so as to hasten their progress toward higher living standards.

But, with notable exceptions, that 1948 dream has still to be realized. Somehow the "third world" did not rapidly become industrialized, and per capita national income in scores of countries remains far below that of the United States, Western Europe, Japan, and a handful of other developed countries. (While per capita income is certainly a measure of industrialization, it is certainly not an adequate measure of development. I will speak of this point again later.)

We can express this failure to industrialize in two ways: we can look at the World Bank Atlas ratings of countries in terms of average per

capita income between $4,000 and $7,000 per person per year in the United States, Japan, and many of the countries of Western Europe, as contrasted with less than $200 per person per year in some of the countries in Africa and Asia.

But that does not tell the whole story.

The "averages" can conceal broad disparities within developing countries between a limited number of relatively wealthy persons, and a mass of the urban and rural poor.

Even in some developing countries where there have been respectable rates of growth in the "average" per capita income, the gap between the well-to-do and the poor seems to be as great as or greater than it was before.

It has even been argued that U.S. foreign aid contributed to widening the gap between rich and poor. Certainly this was never the intent of the program. But it is easy to visualize how, as part of the dynamics of economic development, this could have been the unforeseen result. I mention this point particularly because AID Administrator Gilligan has forcefully committed our Agency to "growth with equity" and this is the keystone of our present Congressional mandate. "Growth with equity" as defined by the Administrator means trying to raise the economic growth rates of the poorer countries while ensuring that the poorest people within those countries share in the increase.

Let me now bring standards into the picture.

One of my colleagues told me of the "culture shock" he experienced on his first foray into a local market in North Africa. He bargained for a kilo of fruit only to see the merchant produce a crude balance and use, for his kilo weight, a rock, a rusty bolt, and an old sparkplug!

Let's face it. There are still certain parts of the world where the rock, the bolt, and the spark plug may still be tools of measurement for some time to come. Indeed they may be quite adequate within this merchant's immediate community--provided he uses the same rock each time!

But to move beyond village commerce, one needs more widely accepted standards.

It's only fair to note that countries in some instances have gone a long way with relatively little attention to the achievement of particular levels of quality. For example, in the decades preceding World War II, Japan had become a major supplier of cheap, low-quality goods for the American market, but, as everyone knows, Japan made a sharp change shortly after the war. Japanese scientists and engineers, facing the enormous task of reconstruction, and hobbled by

their nation's prewar reputation for shoddy goods, asked for help. They invited Dr. W. Edwards Deming to give a series of lectures to Japanese research workers, plant managers and engineers on the achievement of quality control through the more effective use of standards.

What happened after that is also well-known history. Japanese exports expanded from $2 billion in 1955 to over $19 billion in 1970. Export of engineering products--which depended critically upon the use of standards and quality control--grew from $340 million in 1955, or only one-sixth of total exports, to almost $10 billion in 1970, close to half of all exports.

Returning to the question of "what are the indices of development," we can cite just a few other statistics on how growth in Japan reached the majority of the people. Between 1950 and 1970 life expectancy jumped from an average of around 60 years to about 70 years; infant mortality dropped from 60 per thousand live births to 13; public water supplies which reached only 25 percent of the population in 1950, reached over 80 percent in 1970; health insurance, available to only 50 percent of the population in 1950 covers everybody today; and pension plan participation grew from only 10 percent to over 50 percent.

The Japanese "miracle" has been and is being repeated now by many additional countries--Korea, Taiwan, Israel, Mexico and Brazil. For these countries, exports have been an "engine of growth" that has helped move their peoples rapidly toward economic development and industrialization. It can do the same for other developing countries.

But will this "engine of growth" reach down to improve the lot of the majority of people in the developing countries? We need to give this question increasing attention. I believe specifically that we all have to relate standards to the achievement of this goal. We need to relate standards to urban and rural employment, to the things people eat and wear, the places they live, and their opportunities for leading meaningful and rewarding lives. We need to think in terms of the lot of the average person, not just the professional involved in the most advanced sector of the economy.

For example: Standards and their effective adoption in developing countries not only can help industry but can penetrate to every element of life in these countries--in building homes that can withstand storm or earthquake, in designing better schools and other public works, in giving the urban and rural consumer better value for his hard-earned money, in protecting the health of the children and adults through sanitary facilities, drugs and clinics.

This type of thinking is needed in the standards field. It is required not only in terms of fairness and justice, but in terms of

our ability to convince key decision makers in all of our countries that the effort is worth the investment we wish to put into it.

I invite all of you--whether from the United States or from any other country--to join us in meeting the challenge of proving that better standards can benefit all of the population in the developing countries. I know that the extent to which we are successful will, to a large extent, determine the future of AID support for assistance programs for standards and metrology.

Thank you, and again--welcome to our friends from abroad.

Paper 1.3 - AID/OST Program Leading to Standardization and Measurement Services for Developing Countries

Dr. Edward L. Brady
Associate Director for Information Programs
National Bureau of Standards

Dr. Ambler has pointed out that the long range objective of the NBS/AID program is to make the United States and the less developed countries better trading partners through the application of metrology and standards. He pointed out that being good trading partners requires that each party understand what the other has to offer. Each must know what performance will be delivered by the products that are offered for sale, and each party must have the ability to satisfy himself independently that the specifications for those products are met. Henry Arnold pointed out that for internal purposes within a nation a rock and a sparkplug may be quite adequate standards for measurements. Typically, however, a developing country begins to feel the need for a more sophisticated and elaborate system of standards when it engages in international commerce. The need is felt very rapidly after a few sales are lost because the product doesn't meet specifications or when a product is made and delivered, but is rejected as the purchaser finds it doesn't meet his requirements. Typically, then, the Government passes a law or issues an official decree, and a national standards body is established. Someone is put in charge of that national standards body. Being new in the business naturally his first reaction is, "Well, I've got this job. I had better find out what other countries do. How do they manage this assignment?" A prudent official will want to know how both developed countries and less developed countries manage their own problems.

First he has to analyze the assignment that has been given to him by the government. In most countries, including this one, a national standards body will be assigned one or more of the following tasks:

1. Metrology
2. Standardization
3. Quality control
4. Technological research and development.

Let me clarify briefly what I mean by each one of these terms.

Metrology includes the basic standards of measurement and also the methodology of measurement to ensure that industry can make the measurements that are needed as accurately as the intended application requires. Excessive accuracy is expensive and unnecessary.

Standardization means the development of written engineering and product standards, to ensure that manfacturers and purchasers can have a common understanding of the characteristics and the performance of goods in the marketplace.

Quality control means the operation of a system to ensure that standards are actually followed. Many countries operate such a system primarily to protect the health and safety of their people and to ensure that exports are of suitable quality. The quality control system ensures that the quality mark has quantitative significance.

By technological research and development we mean R&D on new products or processes, or R&D to adapt to local condition technology acquired from other countries. Both kinds of technological research are important in all countries.

Our contacts with other countries show that each country of the world organizes its institutions differently. Each country gives a unique mixture of assignments and organizes its institutions differently to provide these four types of services. Some give all four tasks to a single organization. Some give technological research and development to a separate institution, or the implementation of quality control to a separate institution, and some divide the responsibilities according to the sector of technology rather than according to a particular function.

In the United States, the assignment of the National Bureau of Standards includes some of all of these elements. These assignments are shared with many other institutions of the government and the private sector in a rather complicated pattern. This is the reason that we always say to the standards officials who come here for the annual workshop: "Here is what the National Bureau of Standards does." And we also take them to the private sector and say: "Here is what the private sector does in the United States. We are confident that you will want to provide similar kinds of services in your own country. We are also confident that you will want to organize your system differently from the way we are organized. Take back what you learn here and adapt it to your own circumstances."

We certainly do not recommend that any other country follow the U.S. pattern. Indeed, the U.S. pattern is so complicated that if it didn't exist no one would ever dream of inventing it.

So, taking into consideration the typical assignment given to a national standards body, we have developed a program in collaboration

with AID which is designed to help the standards officials of the participating countries improve their own institutional capabilities (Table 1).

The elements of the NBS/AID program are shown in Table 1. I would like to look at each of these one by one and give a brief review of them.

First, the surveys (Table 2). In the survey program we send a team of NBS people plus a team of people from the participating countries themselves to selected target countries. Surveys have been conducted in all of these countries during the past several years and representatives of some of them are participating in the program today. In these surveys the team examines the needs for a metrological and standardization capability in a particular country, and evaluates the ability of existing organizations in that country to provide the services needed. An important element of this program is the inclusion in the survey team of representatives of the standards bodies of the participating countries concerned. They can themselves see how other people have solved problems similar to their own and they can sometimes contribute their own solutions to help the problems of the country being surveyed. A report has been written on each one of these surveys, and the reports are available to those of you who would like to have them.

Now let's go on to the workshops (Table 3). We have held seven workshops here in the United States, consisting of one week at the National Bureau of Standards, followed by a week of visiting institutions in the private sector to show the participants the distribution of responsibilities within the United States. These workshops have been attended by people from all parts of the world (Table 4). Sixteen Latin American countries have been represented, with 30 participants altogether. From Asia and the Middle East there have been 36 participants from 16 countries (Table 5); Africa, 13 participants from 5 countries (Table 6); and we have had 3 international organizations represented (Table 7).

Another important element of the program is the distribution of literature (Table 8) to the less developed countries. The American National Standards Institute is the overall umbrella organization in the United States that coordinates the preparation of engineering and product standards. Through its cooperation, we have distributed a complete set of ANSI standards to six countries. ASTM standards--either a complete set or a partial set--have been distributed to 29 countries. But these are not the only organizations that have participated in this part of the program. We have received cooperation from many of the approximately 400 standards bodies in the United States.

Table 1

Elements of NBS/AID Program

- Workshops
- Surveys
- Regional seminars
- Standards literature
- SRM distribution
- Long-term institutional development
- Laboratory training
- Consultation
- Equipment specification

Table 2

NBS/AID Surveys

May 1 - 12, 1972	Ecuador
June 19 - 30, 1972	Korea
October 14 - 28, 1972	Turkey
May 22 - June 1, 1973	Thailand
June 9 - 22, 1974	Bolivia
May 4 - 17, 1975	Philippines
July 11 - 17, 1976	Guyana
May 29 - June 11, 1977	Indonesia
(Planned)	Sudan

Table 3

Workshops

- 7 held
- 82 standards officials participated
- 37 countries represented
- 3 international organizations represented

Table 4

Workshop Participants

Latin America:

Argentina	2
Bolivia	5
Brazil	4
Chile	2
Columbia	1
Costa Rica	1
Dominican Republic	1
Ecuador	5
Guyana	1
Honduras	1
Jamaica	1
Mexico	2
Nicaragua	1
Panama	1
Venezuela	1
West Indies	1
Participants	30
Countries	16

Table 5

Participants Workshop

Asia and Middle East:

Afghanistan	2
Bangladesh	2
China, Republic of	1
India	1
Indonesia	4
Iran	2
Jordan	2
Korea	9
Malaysia	1
Pakistan	1
Philippines	4
South Vietnam	2
Sri Lanka	1
Thailand	1
Turkey	2
Yemen Arab Republic	1
Participants	36
Countries	16

Table 6

Workshop Participants

Africa:

Egypt	2
Ethiopia	1
Ghana	3
Kenya	3
Nigeria	4
Participants	13
Countries	5

Table 7

Workshop Participants

International Organizations:

OAS	1
ASMO	1
ISO	1
Participants	3

Table 8

Standards Literature

ANSI standards to 6 countries

ASTM standards to 29 countries

Other standards writing bodies participating:

IEEE

FDA

NEMA

ISA

and many more

We have also conducted Regional Seminars on special topics related to standards (Table 9). We have conducted three of these, one on a System of Standardization and Metrology for Latin America, held in La Paz, Bolivia, one on Testing and Certification for Export Products in Singapore, and a third seminar has been held on OMNITAB II--a special programming language developed here at NBS which has turned out to be quite versatile and useful. It has been adopted by many universities and industrial organizations in the United States and was selected as an appropriate application of computer technology for the developing countries of Latin America. Another regional seminar is planned for Khartoum in March of next year.

One of the important outputs of the National Bureau of Standards is standard reference materials (Table 10). These are well characterized samples of materials, for example, glass, cholesterol, steel, rubber, and many other substances. We have approximately a thousand in all. They are used for tying a laboratory measurement into the national measurement system of the United States in order to be sure that the laboratory is making high quality measurements and that its measurements are compatible with the national standards. Approximately one-third of the sales of these standard reference materials are made outside the United States. Within the AID program, we have distributed approximately 3000 samples to 11 participating countries, with a dollar value in excess of $53,000.

With two institutions, one in Korea and one in Brazil, we have developed long term institutional development arrangements (Table 11). In these programs, we are providing opportunities for the staff of these institutions to come to the National Bureau of Standards to learn about our special capabilities, and to develop their own abilities to provide some of the services that we provide. We are also helping these institutions by providing consultation on such matters as general program directions, building facilities, instrument procurement, and the like. Most of the laboratory trainees represented here (Table 12) have come from these two institutions.

We believe that procurement of proper instrumentation is an important element of the program. Procurement assistance is provided under the long term arrangements previously mentioned, and we have also tried an experiment of running a course at the Denver Research Institute to give selected participants basic training in how to write specifications for complicated equipment (Table 13). It is not a simple task. You do not just sit down and write out something, you have to specify in detail exactly what you want and what it must do.

Now we must ask the questions, "What have we learned from conducting this program? What benefits have we and the other participants received?" I think we have learned a good deal about the operation of the program. We have learned how to plan, organize the activities, and how to make good use of moderate resources. We have learned how

Table 9

Regional Seminars NBS/AID

°Regional Seminar on a System of Standardization and Metrology for Latin America

La Paz, Bolivia June 24 - 25, 1974

°Testing and Certification for Export Products in Industrializing Countries

Singapore May 19 - 20, 1975

°Regional Seminar on OMNITAB II

La Paz, Bolivia May 12 - 25, 1976

°Planned - Khartoum, Sudan March 1978

Table 10

SRM Distribution

Approximately 3,000 samples to 11 countries

Dollar value approximately $53,000

Table 11

Long-term Institutional Development

°Institute for Technological Research

Sao Paulo, Brazil 1974 - 1978

°Korea Standards Research Institute

Seoul, Korea 1975 - 1978

Table 12

Laboratory Training

32 trainees

3 countries represented

Table 13

Training Course on Instrument Purchasing

11 trainees

11 countries

to use NBS resources in this kind of program. We have learned that the experience of the United States is indeed relevant to the developing countries and that our experience can be adapted by the participants to their own conditions. And we have learned that the impact of this program upon activities of the participating countries varies greatly and depends to a large extent on the internal circumstances in that particular country. Some of the countries that have participated have seemed to be on the verge of major action in their standardization programs and the stimulus from the National Bureau of Standards was all that was necessary to get these countries moving rapidly. Other countries apparently have not been ready internally for that takeoff and very little has happened inside the country as a result of the NBS/AID program.

Also we have learned that an important aspect of the NBS effect, when there is one, is the impact on Ministers and other high government officials in the country. In many countries the government officials, and I include this country as well, who have a great deal to say about the development of the programs of the standards bodies, have never focussed on standards problems. They are just not aware of this large infrastructure of activities that is necessary to insure the quality of manufactured products. The program is increasing the level of awareness in the participating countries of the significance of standards and metrological activities. In our own country we would like to be more effective in increasing the level of awareness in Congress and the Administration on the importance of NBS services.

And we have learned a great deal about the developing countries themselves, about their economies, about their problems, their aspirations, their physical resources and perhaps most of all, their resources of competent and dedicated people.

Now, just a few comments on what we have not learned. I believe the most important thing that we have not learned is whether the United States and the developing countries really are better trading partners because of this program. There is no doubt, looking at the statistics, that there has been during the past six years an enormous increase in trade between the United States and many of the participants. How much of this increase could we attribute to the activities of the National Bureau of Standards? It would be very helpful if we could find that some of this increase was due to the NBS program but I don't know how we can trace a causal relationship. If anyone has any suggestions or any qualitative or quantitative information, we would be very pleased to hear it.

In these days of increasing interdependence, and of increasing reliance on international trade to maintain economic growth, there is a growing realization that international equity requires more industrialization in less developed countries. We are confident that

in this program we are making a modest but important contribution to world economic and social development.

Thank you.

Discussion

Mr. Alonso

I certainly agree with Dr. Brady's comment that it will be difficult to establish a causal relationship between NBS programs to assist in the development of standards capabilities and the growth of trade that has occurred between the United States and many of the participating countries. Strengthening of these programs will be most useful for the United States and other countries concerned.

Dr. Goldman

I would like to ask Mr. Arnold whether there are criteria relating to success of the programs, such as an increase in the standard of living in the assisted country or an increase in trade? Are both necessary or is one sufficient?

Mr. Arnold

The objective of the AID programs is to promote the social and economic development of the country, as well as the quality of life of the people. The emphasis is not on trade except as it has an impact of these basic factors.

Dr. Oteng

Mr. Arnold mentioned in his talk a number of factors having to do with the requirements of development. How can one determine that all elements of society can benefit from the programs of assistance? What are the criteria?

Mr. Arnold

I know of no magic formula to deal with this question. To start with, there must be an awareness of the problems by the United States and the country receiving assistance; there must be willingness to aim the assistance program in the direction of all elements of the population. We can apply standards broadly used in the United States, that is the satisfaction of basic human needs as well as the industrialization process. If people enjoy better homes as a result of better metrology, standards, and quality control, this has a direct impact on equalization of the factors involved. I would like to appeal to all of you to think on this problem of how we can determine whether an AID program is reaching all elements of the population.

Mr. Pineda

An individual from a developing country working in the field of standardization can make a real contribution to the knowledge and

development of his country. In standardization one is drawing on a very wide field of knowledge--not just a narrow aspect of science or technology. Standardization will facilitate any field of science or technology for everyones' benefit. Germany was particularly aggressive in expanding its trade in Latin America and used German standards to facilitate the development of markets.

Paper 1.4 - Nature and Value of NBS/AID Programs

Eng. Chaiwai Sangruji
Acting Director
Thai Industrial Standards Institute

I have been asked to talk to you about the NBS/AID programs and I am both flattered and alarmed. Clearly, the best people to do this are the NBS specialists, so in that sense it is flattering that such a comparative newcomer to standardization and certification should be asked to comment. It is also alarming in that my experience is concerned only in collaboration on the Thai survey and as a full-time participant in the Indonesian survey. On the other hand, it is a tribute to the characteristic attitude of both the NBS and AID officials that they would prefer my observations rather than direct statements from themselves.

I think one should recognize that this approach has been appreciated by the countries involved. From the outset, the NBS in its surveys and workshops has shown that it is concerned with helping but has not approached us in a spirit of a large nation of undoubted technological skill bringing its high-powered knowledge to the less sophisticated, but has taken great pains to draw on existing skills in the receiving countries and has even placed the surveys under the direction of a national. It seems to me that these surveys have been conducted with a good balance of highly experienced specialists from the United States and participants from developing countries experience in their various ways in the problems of their own countries. Furthermore, a glance at the members of these survey teams will show that those invited from other countries have been from various nations at more or less similar stages of development.

I thought it worth acknowledging this enlightened outlook before I go on with this paper.

The reasons for these surveys and workshops are self evident to most. They are to bring the fresh light of an independent team of specialists to the problems of industrialization with which most of our countries are engaged; to add another dimension to experience already gained; to emphasize the importance of standardization and measurement stability as a basis for technical development; and, in short, to cooperate with the host nation in identifying priorities in this vexed business of developing technologically but rationally. You may feel as I do, that with the amount of technological transfer being affected, either through the work of foreign multinational companies

or through multi and bilateral aid that the last of these--rational development--sometimes seems to be the most elusive of all.

On acquaintance with the work of these American surveys, the first reaction may be that there is an overlap in intention. Most of us here, I believe, have experienced some sort of assistance in the form of resident experts, consultancies and the like and, in all fairness, someone living in the country and working with us may perhaps have a better grasp of what we are trying to do and the national methods we emplcy to do it. But I believe that these visiting survey teams do have a place in our development--that they can, on occasions, reveal new courses to take, or to avoid, if only for the fact that they look at us objectively and with a fresh mind. The better the resident experts the more they become deeply involved with us and, I might add, just as susceptible to the views of comparative strangers.

The National Bureau of Standards, with the financial support of the United States Agency for International Development has now carried out, if my information is correct, eight surveys of standardization and measurement services in Bolivia, Ecuador, Guyana, Korea, Turkey, Philippines, Thailand and Indonesia. In each case, a national in those countries has been appointed Survey Director (in Thailand, for example, it was Dr. Charoen Vashrangsi of the Department of Science) and the team consisted of some eight NBS and other specialists from countries at various levels of development. Again, to take the Thai example--these consisted of Professor Fahrettin Can of Turkey, Mr. Sang Sup Lee of Korea, Dr. Werner Ning of Taiwan, and, of course, Dr. Charoen of Thailand. All team members had counterparts from various services within the country but a number of department personnel was involved in arranging the rather tight schedules.

It is a testimony to the interest shown in these surveys in the various countries that the visiting teams had to be split up into various groups in order to cover the considerable schedules laid on by the host country. In Thailand, the team had to cover no fewer than 80 visits and meetings in 12 days, a Herculean task which I am sure must have caused NBS to ask who had ever suggested Thailand in the first place! I was, in fact, feeling rather smugly amused about this until I myself was invited to become a member of the team visiting Indonesia, where a similar program put me very firmly on the receiving end. In this respect I would suggest a little more time for future surveys. No one wants to see one single dollar wasted and the type of people joining the team certainly have little enough time to spare from their own offices, but it does put considerable pressure on members who have to be analytical and objective in the course of being rapidly transported from place to place.

It is clear that, even by splitting the team into specialist groups, the survey could not cover every type of factory or organization within a multisectorial industrial growth that most of us are

developing today. For that reason, NBS wisely decided that these surveys could not go into an analysis of conditions in every industrial and research sector, but should confine themselves to the national infrastructure whereby a potent use of standardization and full appreciation of measurement and calibration could more widely become effective. Many relevant ministries, departments, and other relevant organizations were visited and many individual factories too, but the latter were, if you like, end-of-the-line confirmation or otherwise of how well the infrastructure was geared to their needs.

I do not think myself that anyone can argue with this line of reasoning. Both by logical assumption and on our own experiences, it is clear that industries--perhaps not even in existence a decade or so ago--may not clearly be aware of the economics of standardization or of the advantages in terms of production efficiency of more closely controlled measurement systems. And perhaps it is only fair to say that if they appear to be making satisfactory profits, why should they? But in the interests of the country's long-terms economic stability and in the face of constantly changing market conditions, it is a prerequisite that Governments themselves must set up institutional infrastructures which can impress entrepreneurs with the weakness of this thinking.

The report on Thailand, and I suspect, the forthcoming report on Indonesia, will show very much of what we have come to expect--a patchwork of achievement and regression, a cloth of unawareness trimmed by sharp perception. In my own country, for example, you will find scanning electron microscopes and a Hitachi-Perkin-Elmer molecular weight apparatus and you will also find that the tests for the lead content in glazing are carried out by rather out-moded chemical processes when there is now excellent equipment for doing this job in a fraction of the time.

As far as standardization is concerned, my small experience with these surveys has shown the same type of splintered acceptance--some sectors appreciating the value of standards in terms of export viability and production efficiency, economy and sheer time-saving, others as yet disinterested and unwilling to institute a program of standardization. It is also clear that there is some uncoordinated activity in these fields. I have no intention either of prejudging the NBS report on Indonesia nor of criticising the structure in my own country because I feel that the drawbacks are well known and some solutions will be attempted. But I would like to make this observation: the overlapping and confusion in some areas which obviously exists and which is so readily in evidence for the visitor should be viewed against the background of industrial development in the post-war period. Industrial, commercial and sociological changes have moved at a speed far exceeding any period in history and the lesser developed countries have been caught up in this. They have had to move at this bewildering pace themselves not only to catch up, but simply to build

virtually from scratch an efficient industry as a backbone to a traditional agricultural economy. It is worth remembering, I believe, that the present industrial giants had a long period of gestation in which to formulate industrial policies and work towards an integrated, efficient industrial production pattern. We in Thailand, for example, have been plunged into the 20th century in less than 50 years whereas in the United States over 100 years have been used to draw the people from the land, equip them with a new technological social awareness and transform an agricultural into an industrial society.

With this in mind, it is perhaps hardly surprising that, under the urgency of the age, systems grow in parallel and associations with this ministry or that have caused the critical appraisals now going on.

All this is not new. Many forward looking Government officials and industrialists have seen the irrationality which is often revealed in these reports. What perhaps these surveys are doing is to sharply define the shape of this malformed baby we have grown in our midst in one document. And, in these days of very influential officials having too much paperwork to read, synthesizing detailed problems across the board into one readable report for all affected ministries to read is very useful.

While I am talking irrational growth, however, I cannot resist the temptation to take a sly dig at our hosts by saying that, while the teams have seen very little to appreciate in Thailand's seven different standards making bodies and Indonesia's 108, they were ignoring the fact that America's dependence upon standardization is based upon the work of some 400 independent organizations! But perhaps it would at least be kinder to say that they are interdependent rather than independent!

I believe that these surveys have been--and are--extremely useful for our countries. They may even be useful to the United States in conveying the difficulties under which some of us have to work. But what of the future?

I am essentially a practical man so you will forgive me if I make suggestions which come from our needs, rather than from a sense of diplomacy.

There exists in written form, either in the files at ESCAP, the technical information at UNIDO, the reports of many authoritative consultants who have visited our countries, and in these NBS reports, some very sound advice. Some of this concerns the nature of our peoples and the economic structures under which we have had to develop and this we ourselves can do something about, either in gradually changing the outlook of those around us or when the economic situation

changes. But the practical, technical advice affords us little if it is not to be interpreted into some sort of action.

I think that we are all here conscious of the genuine interest of the United States in seeing us get off the ground with a healthy industrial program. We don't have to be told they join us in appreciating that standardization and integrated metrology are one of the basic stones on which such development can be built. This being so, it with some reluctance that I say that we would like, if it is possible, for these survey reports to be followed up as a portion of the U.S. AID program. I will offer no detail here of in what areas this should be offered because an analysis of each of the reports for each of the countries involved would possibly show clearly where such assistance could be given, in expertise, training, equipment or all of these. I should say that this is a matter for Governments and I am only a civil servant trying to do a job, but my personal observation is that the surveys have helped to identify problems and crystallize the opinions of people specialized in their fields. May I suggest that active and practical follow-up would indeed enhance the value of the reports considerably? It isn't much use telling a man that he ought not to eat so much rice and fish, if you are not going to show him how to hunt for meat and grow vegetables.

My only other comment is that perhaps the nature of these surveys could change in due course. I am sure that we would all welcome the visit of American teams of specialists to comment on specific areas of our industrial and agro-industrial economy. I could think of many fields in our own work where there is a need for impartial, objective and expert appraisal--the furniture industry, construction, food processing industries are only some.

I have perhaps been more open and frank in my description of the NBS/AID survey work than the situation warrants, but I know that Mr. Peiser and the other U.S. officials will take this as a compliment--that I feel that they are as open to receiving opinions from the less-developed countries as they are to imparting their own knowledge and undoubted skills.

Notwithstanding what I have said which tried to throw a constructive viewpoint on the surveys, these surveys are the result of American generosity and the U.S. desire that we should do as well as they have done. My country is grateful for the effort put into them and I feel sure that I express the sentiments of the other nations who have been lucky enough to host them.

Thank you.

Paper 1.5 - Nature and Value of NBS/AID Surveys

Eng. Raul Estrada Albuja
Director General
Instituto Ecuatoriano de Normalizacion
Quito, Ecuador

Preface

Under the auspices of the U.S. Agency for International Development, the National Bureau of Standards has directed several programs of technical assistance in countries in process of development. The NBS has contributed with its experience and capability within the field of physical and engineering sciences, in order to see if their knowledge may be useful to hasten the process of development of those countries.

I had the privilege to be invited to participate in the respective teams of study during the surveys carried out in Ecuador, Bolivia, South Korea and Indonesia. These teams of study were comprised of NBS experts, other specialists and interested technical personnel organized for this purpose.

I was also invited to participate in the surveys of Thailand and the Philippines, but unfortunately I was unable to participate due to pressing commitments. Consequently, the points of view exposed here are only the result of the four surveys previously mentioned.

The Need for Standards and Measurement

Sooner or later a country in the process of development needs to organize, in an effective manner, the delivery of services and products for good use of its natural and monetary resources and also for the various and ever increasing needs of the people. Organization inevitably leads to an increasing specialization of production and to the necessity of diverse technological materials of increasing complexity. It becomes imperative to develop domestic technological production wherever foreign technology is not directly applicable to the country, or when, due to local circumstances, different technical solutions are required. Specialization in production establishes major horizontal and vertical interdependence of industry and commerce. This interdependence makes demands on the quality of products. For this reason a technical definition of quality is required. Such a definition can only be obtained through an effective system of technical standardization (see Figures 1, 2, and 3).

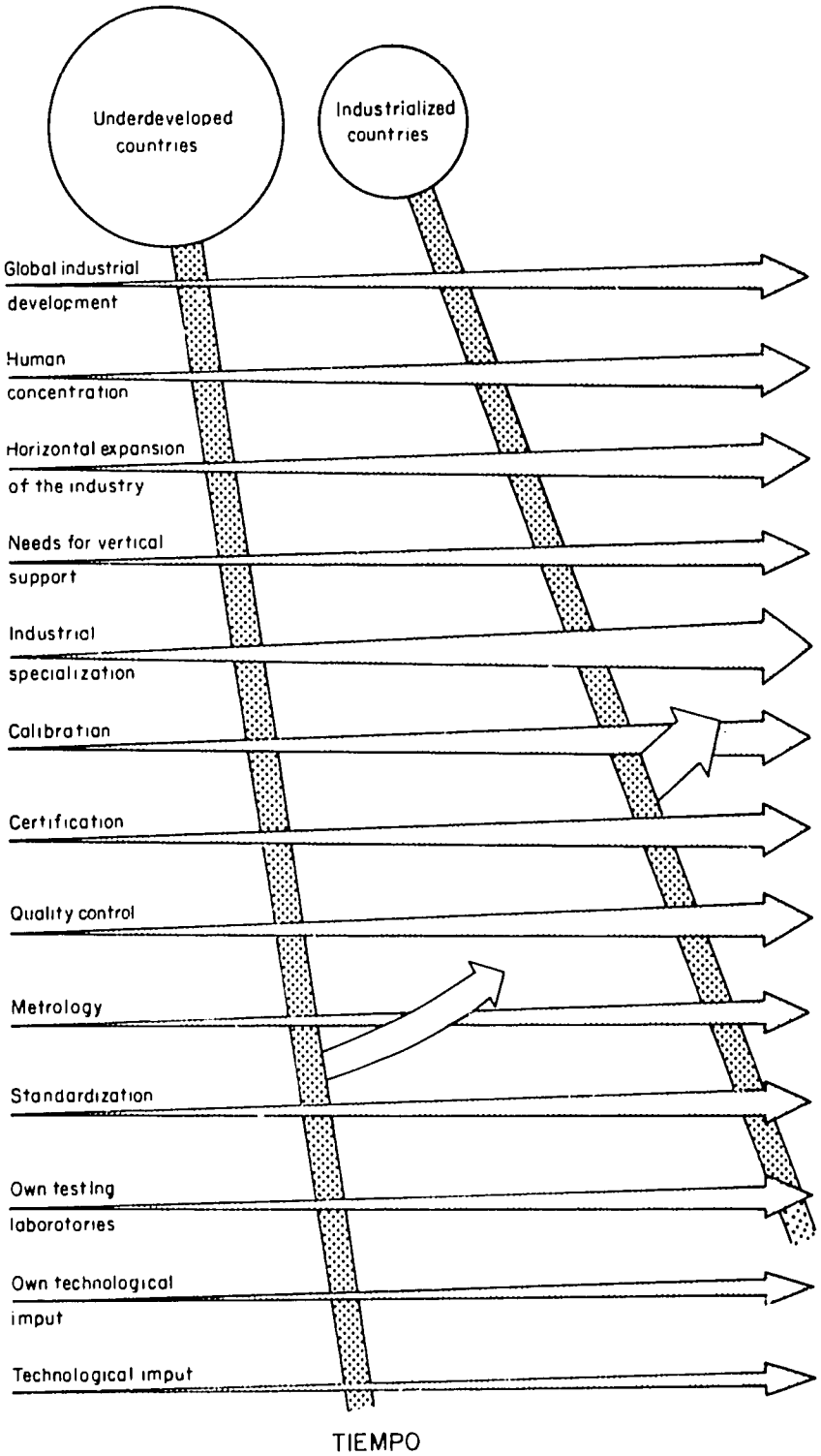
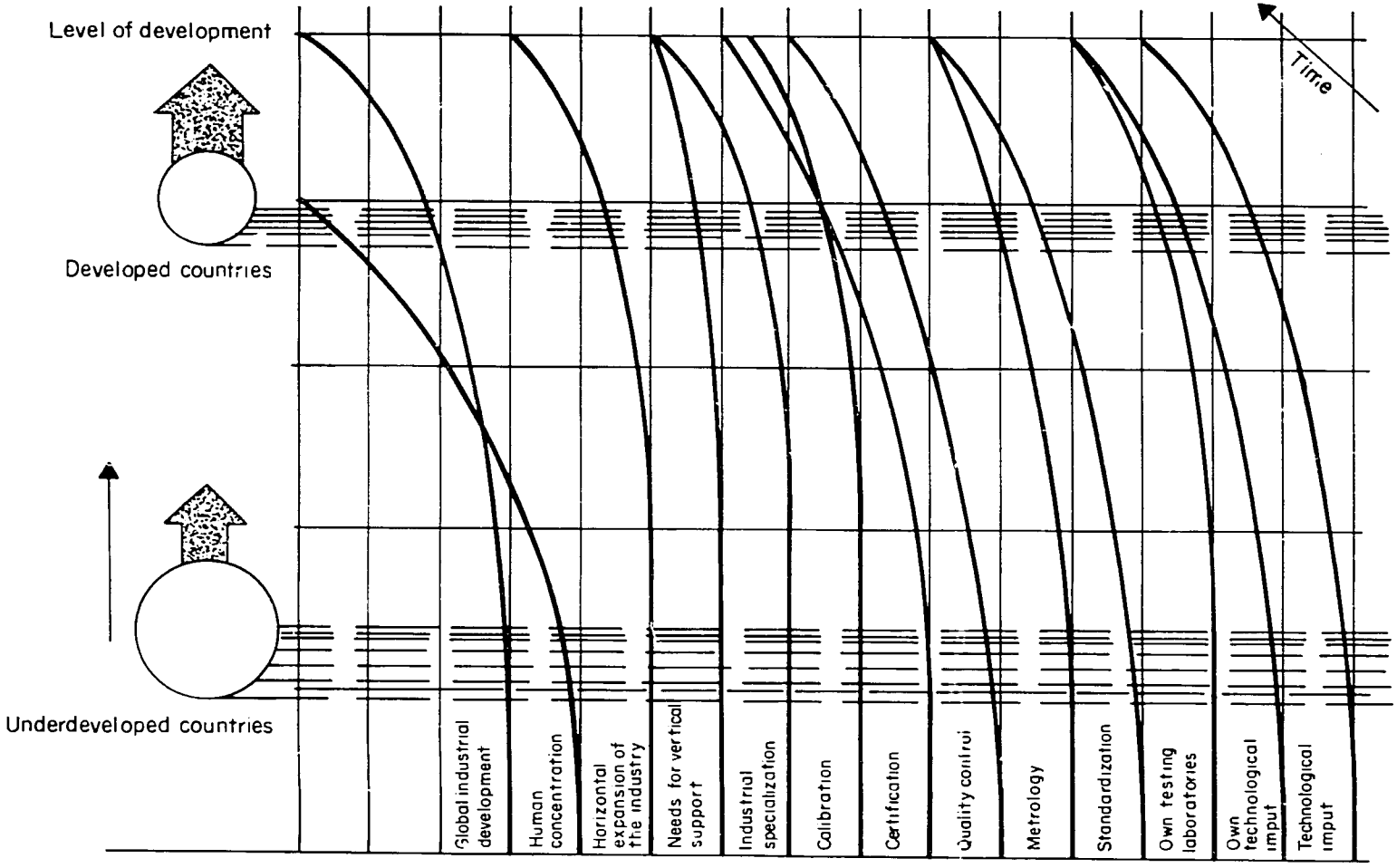

Underdeveloped countries
Industrialized countries
Global industrial development
Human concentration
Horizontal expansion of the industry
Needs for vertical support
Industrial specialization
Calibration
Certification
Quality control
Metrology
Standardization
Own testing laborotories
Own technological imput
Technological imput
TIEMPO

Figure 1



Note: No dimensional graph

Figure 2

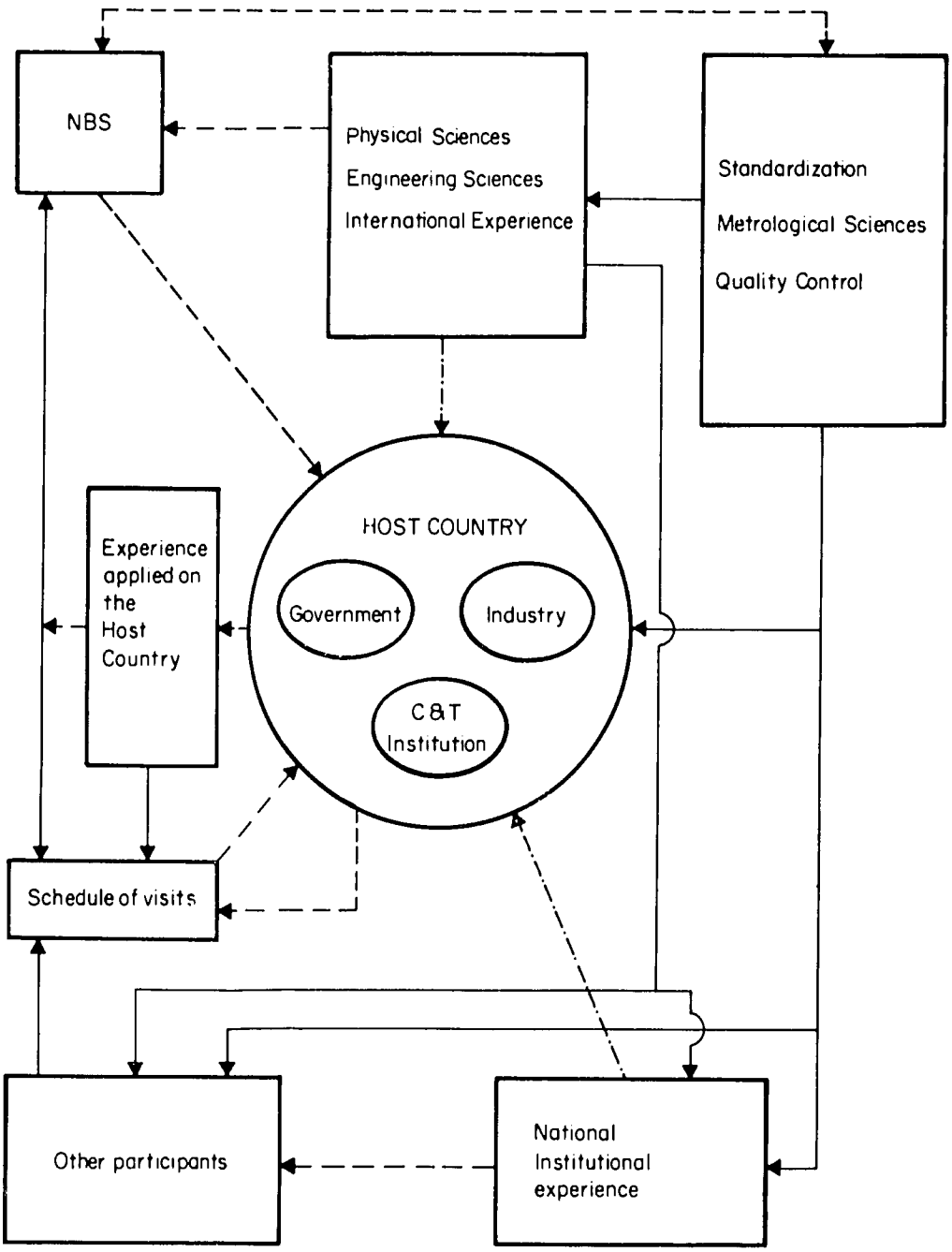

NBS
Physical Sciences
Engineering Sciences
International Experience
Standardization
Metrological Sciences
Quality Control
HOST COUNTRY
Government
Industry
C&T
Institution
Experience
applied on
the
Host
Country
Schedule of visits
Other participants
National
Institutional
experience

Figure 3

The degree of definition and identification of products supplied by technical standards is related to the engineering characteristics which should be measured. For this reason no technical standardization process can be effectively developed without consistent parallel progress in virtually all metrological fields.

In short, the quality control systems which are needed in manufacture and commerce cannot operate without an increasing number of technical standards, which are necessary not only for the inspection processes performed prior to acceptance of the merchandise but also to verify the quality of products within the laboratories concerned with control of production.

The Problems of Development

Unfortunately, in underdeveloped countries the essential scientific and technological capabilities for orderly development and progress in production facilities do not exist, or are scattered or do not reach the level required for the solution of particular problems. Moreover, the available scientific and technological facilities, especially at university level, are not guided towards an efficient contribution to the efforts in standardization, metrology and quality control.

In the several NBS/AID surveys which have been carried out, it has been found that existing scientific and technological efforts are mainly directed towards the solution of theoretical problems considered within the immediate grasp of the investigators. For many scientists and technologists in these countries, standardization tasks actually seem to demand a technical level below their own capabilities. It is also true that often capable scientists are not involved in the technical solution of problems of quality because the quality consciousness appears in people only when a certain level of their own industrial development has been reached. In some cases, this industrial development has not yet been attained.

In these countries there does not exist at the government level a clear understanding about the work that needs to be accomplished by technical standardization, metrology and quality control technologies as a prerequisite for the general development of the country. In almost all cases this lack of understanding is reinforced by lack of legal and institutional mechanisms without which it is difficult to apply standardization and measurement programs.

In many cases, plans and programs of development at government level do not mention concrete goals in technical standardization, metrology, quality control or certification. Consequently, it is not strange that adequate financial support does not exist. Sometimes, such lack of financing has impeded technical standardization carried out by private efforts, especially within the industry (as, in my view, is the case of Turkey and Indonesia).

The aforementioned circumstances greatly limit the possibilities of a consistent and orderly development. The failure to fund standardization programs exposes the economy to an adverse influence which is greater than the funding required for standardization. This adverse influence is of great significance because of the limited overall financial resources of such countries.

In Figures 1, 2, and 3, I try to represent graphically these relationships. Major concentrations of people motivate industrial development with a high level of vertical dependence. It also helps horizontal growth of industry and its degree of specialization. All these advances require considerable progress in certification, calibration and testing services which are not possible without considerable efforts in standardization, metrology and quality control. The great concentrations of people lead to corresponding levels of industrial competence. As a consequence, a "quality consciousness" appears in the people, which is a principal requirement for industrial development. Evidently, some of our countries are already facing these requirements. This situation will then perhaps be recognized at the government level, and bring about an effective search for solutions to these problems which are directly related to quality of life of the population.

The AID/NBS Surveys

By this analysis, all the visited countries present the same common problems although they do not have the same degree of development. In all cases we observed an enthusiastic effort towards technical standardization, metrology and quality control, but this effort has had inadequate attention in comparison with the actual needs of development of each country. The lack of adequate financing (from government or private sources) provides insufficient technological resources in technical personnel, test laboratories and up-to-date scientific and technical documentation. The understanding of these problems in general seemed very limited by governmental authorities and even by leaders in commerce and industry.

Under these circumstances, the several surveys succeeded in bringing together in the surveyed country a number of persons representing various interested sectors who, in some cases, have for the first time seriously considered the whole system of related problems. This newly found awareness may be one of the principal achievements of the NBS/AID surveys, because it has motivated the participants to common action; it has facilitated the identification of problems and technical planning and, in general, it has eliminated certain barriers in inter-institutional understanding which made coordinated action difficult. The present team members who were highly competent and experienced in the engineering field strengthened and gave authority to the discussions and conclusions within the survey team, and served

to eliminate doubts and prejudices which may have been maintained for a long time.

It is nevertheless evident that the short time (2 to 3 weeks) that the different surveys lasted cannot give a complete image about the situation of development of each country, but it is also evident that with the collaboration of local technical personnel, good progress has been made in encouraging the participants from the countries surveyed towards the fulfillment of improved actions. This was so in the case of Ecuador, the most familiar example to me, where the NBS/AID Survey served to persuade the government authorities to give better support to the Ecuadorian National Standards Institute, not only in the form of financial support but also in interinstitutional collaboration which is essential for the development of standardization.

Furthermore, during prior discussions on a variety of technical problems, during the performance of the survey itself, and during a special review meeting carried out two years later, it was possible to verify advances made and to improve the concepts which served as a base for the Ecuadorian development in standardization.

Conclusions

1.) The NBS team has always been selected on the basis of technical and scientific capability and experience. This fact is of key importance in order to assure the wisest consideration of the many problems faced by the survey teams.

2.) The invitation to other country specialists (generally to directors of standardization institutes from underdeveloped countries) to participate in the NBS/AID teams has contributed important technical and institutional experience. This feature of the surveys led to adaptation of international technical concepts in standardization, metrology and quality control. It was a good approach to seek relationships and understanding of the problems in related countries. The NBS experience is in many ways unique and cannot be directly assimilated by underdeveloped countries.

3.) Success of the surveys depends on the character of the national technical group acting as a counterpart. Its active participation, in close contact with the team, assures an adequate transfer of experience and knowledge which may be very valuable.

4.) The schedule of visits is very important in order to have a better knowledge of the applicable experiences of the host country, but sometimes the heavy schedule of visits has militated against the depth of insight into the problems of the country surveyed. It would be desirable to have an appropriate reduction and selectivity of visits in the future.

5.) It would be desirable to follow up on the surveys by short review missions, to study the outcome of the recommendations and their positive or negative effects on the country. This evaluation is, of course, very difficult, but it may be carried out in terms of the overall progress achieved in technical standardization, quality control, certification, and metrology.

Discussion

Mr. Alonso

I thank Eng. Estrada for his paper. I understand that the purpose of this part of the seminar is to appraise the effectiveness of the country surveys. I suggest that in the discussion to follow we concentrate on three major points: the methodology of the survey, the objective of the survey, and the follow-up of the survey.

Dr. Brady

I would like to ask Mr. Chaiwai to amplify on the kinds of activity that would be appropriate in the follow-up.

Mr. Chaiwai

The survey was made four years ago. Many developments have taken place since and a discussion of our progress would be beneficial. We do not know what other help might be available and offered. For example, we receive complaints relating to our inability to carry out special tests. We need help in establishing test and calibration facilities which at the time of the survey we were hardly ready to receive. Would NBS be able to help us now?

Eng. Estrada

In Ecuador we had bottlenecks in our administration. We, therefore, began to look for better solutions to our problems. The expert advice we received from NBS and other members of the survey team was very helpful. Continuing follow-up advice is most valuable to us and in my judgment it would also help other developing countries.

Dr. Goldman

Following the surveys in Ecuador and other countries, experts from NBS have spent some time in the country surveyed working with their counterparts. Is this kind of activity useful and desirable?

Eng. Estrada

Yes, I think it is important for very specific projects for experts from NBS to help us to consider various options which may be available to us. The experience of NBS is unique and the lessons learned by other developing countries can also be beneficial to us.

Mr. Peiser

We have told all directors of surveys to request a review activity at an appropriate time after the survey in order to permit adequate time

for follow-up discussion. Ecuador requested this and we spent one and a half days discussing the outcome and influence of the survey. A publication is available describing that method of review. We have not done similar reviews in the other countries so far. As Dr. Goldman pointed out, the follow-up has often concentrated on specific areas to be strengthened by an expert in a particular field visiting a particular country following the survey.

Mr. Alonso

What has happened between the time of the survey and the visit of the follow-up team? Is NBS satisfied with the nature of the follow-up or would it like to see a different kind of follow-up activity? Is greater support necessary?

Mr. Peiser

I am impressed in all cases that each country has analyzed all survey recommendations very carefully. Eng. Estrada and his colleagues in a very self-reliant way have adopted some recommendations and rejected others. This is an excellent way for the country itself to decide the extent to which particular recommendations are appropriate and desirable. In Thailand it is impressive to observe that careful attention has been focused on committees for standards development. These committees have many well attended meetings in which representatives from industry and other private sectors discuss standards matters with Government officials. This very effective method results in the transfer of important technology to small-scale industry.

Dr. Brady

NBS is not fully satisfied with the nature of its own follow-up. We have not had the resources to go to each of the countries a year or two later, nor have we had the resources to follow Mr. Chaiwai's suggestion that we identify special areas for further examination to determine the kind of assistance we might be prepared to render. The question is one of a lack of resources rather than any lack of interest on our part. We are reasonably optimistic that we may be able to increase our follow-up activity over the next several years.

Mrs. Mascarinas

I have not taken part in the survey in the Philippines but read the report of the survey team. We have tried to follow the recommendations and our staff, for example, has grown from 100 to 300 members. It would be a most regrettable loss if NBS through lack of resources could not revisit our country.

Mr. Arnold

I agree that the question of follow-up is necessary. Let me clarify a few points. The NBS/AID program we are discussing is funded through the central office of AID. It is partly exploratory and it is intended to apply to more than one country. We cannot apply this program to only one country. AID missions abroad are concerned with programs and projects applying to the countries to which they are accredited. If you have needs over and above normal follow-up activity, your needs must be made known to your own planning body and your Ministers so that they in turn can make your needs known to AID missions. This is the correct procedure.

Responses to your needs will be proportional to relationships with your basic requirements, especially those of the poorest elements of your society. A recent carefully constructed loan for Indonesia had to be revised in order to ensure that its principal impact would be on the poorest classes of the population. There are, of course, sources of assistance other than AID.

There is another matter of considerable importance. The U.N. is now planning a Conference on Science and Technology for Development in 1979. Each country has been asked to prepare its own assessment as to how science and technology can help them. The only way that the subject of standards, metrology and quality control will get into your country paper is through your own efforts. I urge you to make contact with officials in your countries who will be responsible for preparing these papers. This is an excellent opportunity for discussion of these subjects and should not be missed.

Eng. Estrada

In the standards bodies there are only limited opportunities to follow the wider recommendations of the surveys. There is sometimes a lack of coordination in direction at the most senior levels. However, a key person is the head of the standards organization. Unfortunately, there are often changes in these positions and, therefore, a lack of continuity in response to recommendations of NBS surveys. One way of improving the use of the survey recommendations would be to invite new heads of the standards bodies to come to NBS to discuss proposed solutions with scientists of similar backgrounds. A different proposal is for the heads of standards bodies in all countries surveyed to be invited to NBS for consideration of common problems with NBS specialists and with each other.

Dr. Hadiwiardjo

I participated in the part of the recent Indonesian Survey that deals with calibration, instrumentation and metrology. We have so far only a preliminary report. Looking at the final reports of other countries

surveyed I am struck by lack of clarity of the recommendations. I hope that in our final survey report we will be given clear recommendations. The USAID Mission Director has indicated her receptiveness to follow-up implementation projects provided they followed AID criteria of direct services to the poor which are difficult to document. I agree with Eng. Estrada that discussion of common problems in seminars would be of great benefit.

Mrs. Mascarinas

The surveys appear to be very well organized. When the team went into my country it separated into different groups. For example, Mr. Raufaste advised on building technology, while other specialists interacted with different sectors. On the spot advice was most important and effectively given. If there were shortcomings in the recommendations of the final report the fault may be largely on our side because there is so much that needs to be improved.

Dr. Oteng

I have a point relating to Mr. Arnold's observations about preparations for the U.N. Conference on Science and Technology. I am happy to note his comment that the developing countries should prepare themselves and to assess their standardization needs. Last June, when the development committee of ISO met, the question of including standardization on the agenda for the U.N. Conference was discussed. Eighteen directors of standards bodies were asked to seek collaboration of their authorities to ensure that standardization would be on the agenda. A follow-up letter has thus far produced only one response. This is a matter of considerable importance and interest to ISO.

Mr. Alonso

I feel certain that preparations for the UNCSTD are proceeding well in the United States under the capable direction of Ambassador Jean Wilkowski and I am sure that this matter will be carefully considered. Since we are now discussing the surveys, I would like to ask Dr. Brady if he is satisfied with the number of surveys, and whether he would inform us of the basis on which a country is chosen for a survey and how a country prepares for a visit of the survey team.

Dr. Brady

I do not think we could expand the number of surveys. We might be able to manage two surveys per year rather than one, but the main problem for us is the limitation of available manpower at NBS.

Mr. Peiser

A country chosen for a survey must first be an AID assisted country. Secondly, the country must be willing to invite an NBS team and be prepared to do certain things:

a.) appoint a director and staff for the survey;

b.) program the visits of the team to governmental, industrial and academic facilities;

c.) be prepared to receive participants from third countries (in addition to NBS members) in order to benefit from the experience of countries with similar experiences;

d.) be willing after the survey to make a senior standards official available for a similar survey of another AID country.

I am aware that two weeks is a very short time for a competent survey. I, therefore, prefer a small, uniform country with a culture that is not too diverse.

Paper 1.6 - Workshops in the United States

Dr. Robert Oteng
Director
Development Program
International Standards Organization, Geneva

It is indeed flattering for me to be asked to talk about "Workshops in the United States." I have attended workshops elsewhere, and I have visited the United States on more than one other occasion, but this is the first time that I have had the privilege of taking part in a workshop in the United States and certainly the first one organized by the National Bureau of Standards. You would no doubt agree that whatever comments I offer can only apply to this one which has just ended and in which I have participated.

Let me first of all begin by commenting, if I may, on the organizational arrangements for the workshop. In order that you may appreciate the sentiments that I shall express at the end of this chapter, let me remind you that this workshop started from Colorado with visits to the Hewlett-Packard Company, Loveland; the National Bureau of Standards, Boulder; Solar Energy Research Institute; and the Colorado School of Mines, Golden.

We then went to Ohio with visits to the Dana Corporation near Toledo; Chemical Abstracts Service in Columbus; Toledo Scale; and to the Department of Food Science and Nutrition, Ohio State University.

We continued to Massachusetts with visits to GenRad, Inc., Concord; and MIT, Cambridge, Massachusetts.

We then went to Pennsylvania where, in Harrisburg, visits were arranged to the Technical Services Division of AMP, Inc., and the Bureau of Weights and Measures, Department of Agriculture. Finally the whole crowd moved to Gaithersburg, Maryland, where papers were presented by participants and lectures were given by celebrities, alongside with visits to various NBS laboratories.

In each of these places arrangements were made to the last detail and it was, literally speaking, impossible for anyone to get lost or default or be left behind however hard they tried to achieve any of these feats. The timing throughout was perfect and every activity checked into position with marvelous precision. Those of you who are used to the system may take all this for granted, but to some of us it is a great lesson in organization. This is why I think that the organizers deserve special commendation and I think that at this stage

we can do no better than offer our appreciation, for this example in splendid organization to Mr. Steffen Peiser, Mr. Chris Raley, Mrs. Odar, and all those who worked behind the scenes to achieve this feat.

If nothing else had happened after these visits I would still feel that a great lesson in organization has been taught to the participants who are all in such a position as to be required at one time or another to organize many matters including seminars and workshops. You may have a good program or a good project in hand but remember it is the type of organization that you lay on which will determine its success or failure. I think that these arrangements have been good and I recommend the lessons thereof to you.

And now to the workshop itself. Let me begin by recalling the type of participant who was invited to the workshop. The notice for participation, if my memory serves me right, expects for attendance people who are not more than one level removed from top management in their organizations; in other words participants should be leaders or leaders' deputies. And in response to this we have such distinguished delegates as Abu Hossain Khan from Bangladesh, Chaiwai Sangruji from Thailand, Mrs. Mascarinas from the Philippines, Dr. Bambang Hadiwiardjo from Indonesia and so on, just to mention a few. My view on the selection is that during these initial stages of the seminar and workshop, this is right and desirable. However later on, and based on experience gathered, it may be necessary to take a look at the level of person required for participation.

Now among these top people there are areas of special interest: Firstly, there are those who apart from their general managerial interests, are specially interested in user standards; secondly, there are those who are interested in basic standards and thirdly, there are those who are interested in legal metrology. How about the subject areas? The subject areas, as I saw them, ranged from quality control in consumer products as evidenced by Hewlett-Packard and Toledo Scale activities--fidelity search and establishment of basic standards as evidenced by activities at the NBS both in Boulder and in Gaithersburg, and the practice of legal metrology as evidenced by what is done in the Bureau of Standard Weights and Measures, Department of Agriculture, Commonwealth of Pennsylvania, just to give examples of each type of activity.

And there is yet another category--as exemplified by the visits to the Colorado School of Mines, Ohio State University and to the MIT. Why do I say that these belong to another category? I call that group another category because the institutions symbolize the place where the training for the various groups of participants was intensified. To me it suggests the notion of continuity in learning--the notion that learning should go on all the time and that without it we cannot

hope to be on top of our jobs whether we are members of top management or members of assistant top management.

What was the relevance of the various subject areas as indicated earlier to participants? To all the participants I am of the opinion that the general exposure to the various aspects of the work which they are doing is absolutely essential.

Good management is useful to all of us in our activities and there was plenty in evidence for people to notice and think about. In addition those interested in the control of quality in relation to user standards had an opportunity to see the control of product quality being practiced, (Hewlett-Packard and Toledo Scale, for example). I am sure that the intention is not for them to copy what is being done exactly; but what I think they should do is to note what is happening so that they can develop their own ideas as to what is most suitable in their particular environment.

The same can be said for those who are interested in the pursuit of establishing basic standards and also for legal metrology enthusiasts.

Now let me touch briefly on the time scale as it relates to the program. This program started on October 1, and ended on Friday, October 14. One might strongly be tempted to call this a period of two weeks. A look at the program indicates that except for Saturday, October 8 and 15 and Sunday, October 9 and 16 each day was packed with activities from 9 a.m. till quite late sometimes. This could be interpreted to indicate a concern on the part of the organizers to make available to participants as much exposure and experience as possible within the 14 days available for the workshop. No doubt there are very good reasons why it may not be immediately possible to extend the period for the workshop. And in this connection I would like to make a suggestion for serious consideration: I am wondering whether it would not be possible to arrange the workshop, certainly the visits aspects, in two parts.

Part one could consist of a visit by all participants to organizations where a general overview of what is happening over as wide a field of standards work as possible for an appreciation of all the inputs that go into standards evolution and application: planning, management, evolution and application of standards for the benefit of the population, and also for an appreciation of the need to engage in continuous learning so that one can always be in a position to innovate. For this exercise one can think of such organizations as Toledo Scale, the various university departments and NBS laboratories in Gaithersburg.

Part two could consist of specialized visits so that participants interested in particular fields would be able to spend a longer time in establishments of interest to them, thereby gaining maximum benefit

from the exercise. For example, people interested in quality control in relation to user products and standards could visit such places as Hewlett-Packard and the Institute for Basic Standards (NBS) while those interested in legal metrology could visit and spend more time in places similar to the Bureau of Weights and Measures such as was visited in Harrisburg in the Commonwealth of Pennsylvania. The basic standards people can then seek their fortunes at the NBS both in Colorado and Gaithersburg as well as in other similar appropriate places. I feel that if this approach is tried it could give everybody an opportunity for a general overview as well as a lot more insight into areas of their choice; who knows it may even happen that as far as the individuals are concerned the whole program may not then seem so tight.

During our visit one participant commented: "This visit may be useful, but the matters being shown are not in my line. I don't understand any of what is happening." The participant did not condemn that particular visit out of hand, but was concerned about what can be derived from it as far as that participant was concerned.

Now this is a good program being organized by the NBS and every encouragement by way of useful suggestions should be given to it so that it can continue to offer assistance to members of the developing countries who need all the help that they can get to improve their standard of living by systematically improving those activities which will enhance their technological advancement.

One of the participants in trying to rub home the usefulness of this program suggested that Congress might be persuaded to use the NBS for the transfer of technology in developing countries. I don't know what that means exactly but I think that he was emphasizing the need to help other countries. I do know that other organizations are interested to work with such organizations as the NBS which are helping the developing countries in their development efforts. The ISO, for example, is very keen on helping developing countries to improve their own standing at home so that they can make meaningful contributions to their countries' development efforts. At its last General Assembly meeting held in Geneva in September of 1976, certain guiding principles were enunciated upon which a program was approved for helping the developing countries to achieve their objectives. In summary the program envisages among other things:

1.) Frequent contacts with directors of standards bodies in developing countries to assess their needs.

2.) Strengthening of relationships with the various United Nations and other aid agencies.

3.) Making use of the facilities of the entire membership of the ISO to assist its developing country members.

4.) Making use of its contacts with the regional groups in the developing countries to assist the members.

These and other objectives of the program are to be carried out by the Development Program Unit of the ISO. It is in the light of its program as partly listed above that the ISO views with great interest the workshops and seminars such as this one that are arranged by various bodies from time to time.

In particular Dr. Brady's overview statements last week are interesting and attractive and merit consideration by bodies really interested in assisting the development efforts of developing countries. Among other things he mentioned such projects as:

1.) Infrastructure Development, e.g.,

   a.) The type of activity engaged in now by the NBS.

   b.) Technological research and development.

   c.) Improving the infrastructure for technological research.

2.) Dissemination of technical information so that it can be applied.

3.) Provision of a focal point for various kinds of contacts and so on.

These are coincident with the ideas of the ISO, and it will coordinate her efforts whenever practicable with the NBS and such bodies as are willing to help the developing countries in their development efforts.

Contacts with directors of standards bodies in developing countries has begun, this will continue systematically and you should expect some form of an effective contact within the very near future.

Relationships with the various aid agencies is under way, and it is hoped that very soon some results will be achieved. The National Bureau of Standards is running a good program and every encouragement should be given to it to render more service to the developing countries.

Paper 1.7 - Institution Building

Mr. Ricardo G. Florez
Instituto de Pesquisas Tecnológicas
São Paulo, Brazil

Preface

In 1899, the first laboratories in Brazil for testing structures and materials started their operations, as part of the University of São Paulo campus. They would soon nucleate a number of pioneering research activities that would be put together in 1934 as the Instituto de Pesquisas Tecnológicas (IPT). A state government institution until 1975, IPT is today a public corporation, with 1500 staff members and a broad spectrum of activities.

The signing of a Memorandum of Understanding (MOU) with the National Bureau of Standards in 1974 was for IPT a very important event. Together with three other major research institutions, IPT was joining the efforts to operate the first comprehensive science and technology program in the state of São Paulo, "PROCET". The "Programa de Ciência e Tecnologia" was the result of a long negotiation between Brazilian and American research institutions, universities and agencies and was made possible by a Loan Agreement from the United States Agency for International Development (AID) to the State of São Paulo. The $15 million loan ending in October 1978 (5 years) is primarily intended to pay for training of Brazilian scientists and engineers in American institutions. A counterpart cruzeiro budget from the State of São Paulo is approved each year to pay for special research projects in São Paulo to provide new and better services to Brazilian industry. Management of both budgets and the relationship between the operations they foster are key issues to understand PROCET.

To evaluate a program that big is a difficult task. Goals and objectives tend to be broad, with a long time for results to show and the indicators of success not always easy to verify. To do that a clear understanding of the social and economic background of the participant nations is necessary in order to filter registered results and to adjust technical and management activities properly. In the case of Brazil and the United States, for example, it is not enough to realize we have a "developed" nation on one side and a "developing" one on the other. That doesn't explain the mechanisms and expectations involved. A more precise and effective picture may result when an assessment is made of how the various national systems evolved in both countries, of the different pools of technology they

draw from, and how their respective sciences and economies got to be what they are.

A country like the United States has reached its present situtation via what we might call "harmonic development," in which all national systems such as transportation, communications, education, etc., have grown together, assisted by strong science and technology plus a dynamic economy. Brazil has always had a very dependent economy due to circumstances beyond the issues discussed. That, plus the fact that industrialization started in Brazil at least 50 years later than in Europe and the United States, indicate some of the constraints the country has to face today when trying to bridge technological gaps. In order to respond quickly to specific needs, different technical areas have developed to different levels at different rates in recent years. Selective government support for national priority areas increase that tendency. We can call that "development by leapfrogging." In trying to find badly needed shortcuts, an inherently unstable situation is attained, frequently resulting in big technical, economic and even social gaps. Scientific development, for example, may be badly hurt in such an environment where quick and easy solutions may prevail over long-range planning, sound policies and careful and competent execution of technical services. One of the most critical aspects of the problem is the ever increasing dependence on a poor government to subsidize and orient basic sectors of the economy.

The training programs and special projects under PROCET have two main goals: to find a shortcut to provide Brazil with needed new technology and to prepare the research structure in São Paulo to bypass some of the gaps caused by leapfrogging.

The evaluation of a program like PROCET has to deal with the differences between harmonic and leapfrogging developments and also the performance of institutions and individuals as well as the quality of technical services provided. To get indicators of success the evaluation has to focus on individual institutional operations. A good one to analyze is the MOU between NBS and IPT.

It is a very important opportunity for IPT to participate with NBS in the collaborative program on standardization, quality control and certification of industrial products. By updating itself technically in the area IPT is trying to regain the position it maintained before the multinationals and galloping industrial development occurred during the 1950's in Brazil.

AID Loan Agreement - PROCET

In 1967, a technology council for the State of São Paulo was created under the State Secretariat for Economics and Planning. CET (Conselho Estadual de Tecnologia) operated until 1975 when its functions were

transferred to the State Secretariat for Culture, Science and Technology. CET was responsible for planning and operating PROCET. A Loan Agreement with AID was signed in May 1973.

PROCET was originally designed as a set of programs in the areas of: science and technology policies, marketing of technology, research management, technological information, metallurgy, quality control and standardization, and food technology (see Annex 1). With time new programs and new areas were added to PROCET, such as railroad, wood and paper, and energy technologies, while others, such as science and technology policies, and marketing of technology, were dropped.

The main PROCET strategy was to implement the hardware related programs with "demonstration projects" and the software related programs as support for them. This appeared to be a wise approach at the planning stage but didn't materialize fully. Two changes in the State administration, followed by modifications at the Secretariat level and CET itself, weakened the PROCET manager position, his support services and his policy-making activities at the State level. Thanks to a lot of freedom given each program manager, individual programs were not too much affected by those changes in the beginning, but the very important communication channels between them were truncated and crossfeeding of inputs and results are almost nonexistent.

This situation interferes with the coordination of technical training abroad and the projects in São Paulo that utilize their results. Moreover, this coordination suffers also from the fact that the training programs (dollar budget) are pluriannual, as opposed to the special "Demonstration Project" (cruzeiro budget) that cannot be longer than a year. Without strong coordination and policies, as well as continuous evaluation and adaptation, the results can be appraised at the level of the involved institutions only. New indicators have to be found in order to come down from broad expectations and analyze more immediate results. With three-fourths of the alloted time gone, the last year of PROCET has to be used properly. Individual institutions like IPT and the Food Technology Institute ITAL(Instituto de Tecnologia de Alimentos) are reviewing their projects carefully, trying to identify promptly the activities that show good perspectives.

Most of the technical training has been very successful (60%) and some of the projects they generated are steadily producing good outputs, and results are beginning to show at the industry level. It is necessary though, to disseminate the results between the institutions and survey industry in the State to check for the amount and quality of services delivered. Very specific technical areas such as measurement collaborative reference programs and certification should be given proper priorities in future government plans in the area of science and technology.

IPT - The Standardization, Quality Control and Certification Program

As a public company since 1975, IPT does not have a very definite and specific charter. The great number of diversified services that IPT provides can be grouped in six big internal programs: technological assistance, technological research, information, standardization and industrial quality, human resources and pioneer projects. Located in São Paulo, the center of industrial activity in Brazil, IPT is probably one of the better equipped laboratory facilities. In Brazil, the basic industrial know-how is centered in the area of production engineering such as substitution of raw materials, detailing of production methods, quality control, etc. Research in the areas of process and product engineering have high priorities in IPT strategies as indicated by the technical groups that were nucleated in recent years. Since 1974 a collaborative program on standardization, quality control and certification of industrial products is being implemented between the National Bureau of Standards in the United States and IPT. A Memorandum of Understanding was signed under the USAID Loan Agreement (512-L/86) with the State of São Paulo.

Four major activities are taking place:

a.) Training of IPT staff at NBS and other agencies in the United States.

b.) Consulting services by NBS staff at IPT.

c.) Projects being carried out at IPT in support of industry in the State of São Paulo.

d.) Purchase of laboratory equipment in the United States in support of c.).

Activities a.) and b.) are managed directly under the Memorandum of Understanding (September 1974) by one American program manager from NBS and one Brazilian program manager from IPT. A budget of $730,000 has been designated by AID to pay for activities under a.) and b.) for the four-year duration of the MOU as amended in August 1976 (previously 2 years). A yearly approved cruzeiro budget from the State of São Paulo Government pays for costs of projects under activity c.). The 1977 cruzeiro budget was 14 million ($1,155,000). The 1978 budget is estimated at 32 million ($2.3 million). Operations under c.) are managed by the Brazilian manager from IPT and use the results of training at NBS as inputs for IPT special projects.

A special contract has been signed (June 1977) between the State of São Paulo Government and the Denver Research Institute (DRI), Denver, Colorado, to purchase laboratory equipment for IPT in support of the program of standardization, quality control and certification of industrial products. A budget of $400,000 has been approved by AID

for this contract under the same Loan to the State of São Paulo. DRI is providing assistance in the selection, procurement and actual purchasing of laboratory equipment for IPT. The Brazilian manager from IPT is responsible for this contract also. (IPT Organization Chart--see Annex 2.)

The MOU between NBS and IPT has been a successful joint operation. The training program and related activites in the United States and in Brazil have provided IPT with clear benefits already. Some of the more general expected outputs are still to be achieved, but some unexpected ones, verified recently, more than compensate for those and give IPT a breath of fresh air to continue, as well as an indication of new levels of achievement possible in the near future.

The proposal by NBS to sign with IPT a "Memorandum of Intention" to guide the relationship of the two institutions after the present MOU expires, is gratifying to IPT, if nothing else because it gives a clear indication that some benefits to NBS have also been achieved. If not fostered, at least by common interest, any future relationship is bound to fail. The possible constraints are very well known by now.

IPT has a very broad charter as a public corporation and has to deal with a loose budgeting policy at federal and state levels all the time. No long range plans are available and there is a tendency to perform more and more trouble shooting services to industry only. Previously independent technical divisions are required now to draw together from common existing capabilities in order to perform specific services to industry. As a result of the previous mode of operation, and other reasons, a gap exists in the staff. IPT has most of its Ph.D.'s and technically experience people occupying bureaucratic and management positions, coordinating the bench level operations performed by inexperienced and very young personnel (staying less than four years at IPT), with practically nothing in between.

Even tough technical training has always been very high in IPT priorities (even if the individual trained is lost to industry prematurely), there is still the logistical problem to solve on how to build its own team. The scenario at IPT then, is one in which most of the project proposals come from above in the structure and are worked out if possible at the bench level, where technical and laboratory capabilities should reside.

It was in this environment at IPT that the NBS/IPT collaborative program started. The MOU was discussed by top management of both institutions to a point where an agreement was reached and training tasks started without full awareness from Divisions and bench level personnel at IPT. The resulting match was always easier whenever the IPT trainee had technical background in the training area and his

activities at IPT were close enough to the ones he would be exposed to at NBS. In the cases where completely new areas were started at IPT under the umbrella of the MOU, and the trainees had no good technical background, many problems occurred. The decision to go for individual training though, was a good one. It provided the basis for technical and laboratory improvement, even if uncontrolled, during two years, up to a point where it is possible now to organize the resulting scattered available skills around some central policies.

Always aiming to serve the São Paulo industry we have now a situation where we can use some outputs from the MOU with NBS to understand our own internal needs first.

Three areas have already been identified to receive extra support during 1978:

- Standard Reference Materials
- Measurement Services
- Collaborative Reference Programs.

For those areas, negotiations have been started with the State Government to assure that a subsidy will be available for at least two more years, 1979 and 1980, in cruzeiros.

It is under those three areas also that the discussions on long-range collaboration between NBS and IPT should be focused from now on. NBS could clearly serve as a master station to which IPT could slave in various levels within the three areas. Those activities would provide NBS with proper channels through which a follow-up on IPT activities could be performed. A follow-up for five to ten years should be planned. A Memorandum of Intention should be drafted by the two institutions indicating the technical aspects and some of the modifications to be followed, even if not relying on any special financial arrangement, in support of and within the framework of the bilateral agreement between Brazil and the United States.

NBS could benefit from such an agreement by maintaining close links with Brazil's science and technology environment and by using IPT as a temporary matching interface to other laboratories in South America and Africa, when needed.

The benefits for IPT would come for continuous contact with the world's scientific development via a capable institution like NBS, complemented by an active exchange of published technical documents.

Note

The author thanks Dr. Robert D. Huntoon, National Bureau of Standards, for his contribution in defining the framework of this report.

Annex 1

PROCET PROGRAM AREAS

SOFT TECHNOLOGY

1.) Scientific and technological policy

FCAV - University foundation named after Carlos Alberto Vanzolini (Fundação Carlos Alberto Vanzolini)

MIT - Massachusetts Institute of Technology

2.) Research Management

FUNAD - Research foundation for the School of Administration of the São Paulo University (Fundo de Pesquisas do Instituto de Administração da FEA)

Vanderbilt University

3.) Marketing of Technology

FCAV - Fundação Carlos Alberto Vanzolini

SRI - Stanford Research Institute

4.) Technological Information

CET - (without unique counterpart institution)

HARD TECHNOLOGY

5.) Metallurgy

IPT - Instituto de Pesquisas Tecnologicas

DRI - Denver Research Institute

6.) Quality Control and Standardization

IPT - Instituto de Pesquisas Tecnologicas

NBS - National Bureau of Standards

7.) Food Technology

ITAL - Institute for Food Technology (Instituto de Tecnologia de Alimentos)

CODOT - Consortium for the Development of Technology, University of Rhode Island

ANNEX 2

INSTITUTO DE PESQUISAS TECNOLOGICAS
ORGANIZATION CHART

Director's Office

Executive Board

Board of Directors

Assistants

Culture and Science

Energy

Machines and Equipment

Standards and Quality

Legal

Financing

Committees

Human Resources

Investments

Organization

Commercialization

Strategic Planning

Documentation

Data Processing

Support

Human Resources

Control

Finances

Supplies

Buildings & Grounds

Methods & Systems

Installations

Scientific Recommendation

Printing, Publications

Industrial Economics

Technical Divisions

Mines & Applied Geology

Civil Engineering

Naval Engineering

Mechanical Engineering

Metallurgy

Wood

Chemical Engineering

Ore Treatment

Paper and Pulp

Information Research

Fertilizers

Discussion

Mr. Alonso

I thank Mr. Florez for his discussion of the exceedingly interesting relationship between NBS and IPT. It has been very useful to both parties. We will now return to discussion of the country surveys.

Mrs. Djaprie

I want to ask a question and, unrelated to it, make a comment. The question is whether the USAID projects are coordinated with assistance from other organizations such as UNDP. The comment is on the methodology of the surveys. I, myself, was responsible for organizing the program for part of the recent survey in Indonesia, and arranged for a collection of information papers to be presented by various experts in Indonesia concerned with representative standardization problems. This introduction to the Indonesian scene should have been of great usefulness to the visiting team.

Mr. Peiser

We at NBS see no obstacles to such coordination and cooperation. It is my impression that most organizations giving development assistance try to avoid unproductive overlap, but tend to rely for the coordination function on the host Government, which should carry the principal responsibility for it. With reference to Mrs. Djaprie's comment about the methodology of the survey, I think this was a very good idea, and it was very helpful for the visiting team to have such clear proof that the technical people in Indonesia had reached a wide understanding that good standardization was essential for effective development. It was made clear in this way that support from industry and government, also a key factor, was deficient. In summary, therefore, I agree that this was a very important part of the methodology of the Survey of Indonesia and that it was a rather successful feature.

Mr. Alonso

Collaboration between NBS and the OAS in the field of metrology has always been very constructive. We could welcome an expansion of this cooperation, which is subject, of course, to the limitation of resources on both sides.

Mr. Florez

To Mr. Peiser's comment, I could mention that we have had a number of people from UNIDO in Brazil assisting us in setting up a national measurement system. This is not a direct responsibility for IPT, but we are building, with the help of NBS, some specific capabilities so

as to be able to act in partnership with this system. In this way we hope to close the loop.

Mr. Pineda

Enough has been said about the follow-up activities which individual countries take on their own and about the useful later reviews of progress by international teams. What should also ensue is some U.S.-sponsored program that could help in implementation. U.S. investors will require the use of some of our standards. Countries cannot be assumed to understand ANSI and ASTM standards and we should not take it for granted that they do. Perhaps NBS and AID could organize an exchange program under which LDC's could obtain the standards of our country. ANSI and ASTM standards, as well as the fine publications of NBS, should be available through the U.S. embassies, consulates, and missions. Conversely in the U.S., NBS should be the repository of standards issued by other countries. This kind of an exchange could be very beneficial to all those concerned with standards questions. A great deal could be done on both bilateral and regional levels in translating standards as required, so that they become available to all concerned. Then there is the area of regional development of standards such as OAS supported from the start in Latin America. Finally, training courses are also exceedingly valuable.

Mr. Alonso

Let us continue to concentrate on the topic of surveys.

Dr. Wolynec

What dissemination has been made of the survey results internally and otherwise?

Eng. Estrada

We in Ecuador, for example, distributed the survey results in Spanish translation to government offices, industries and universities. They were well received and utilized.

Mr. Montano

In response to Mr. Florez' question on distribution and implementation of the recommendations of the Bolivian Survey, we could do very little in Bolivia because of internal problems, including staff changes leaving only two survey participants out of twelve who were involved in the survey.

Dr. Salama

I have listened with great interest to this discussion. It seems to me that we may need to develop some criteria for the conduct of these surveys to be followed by NBS on the one hand, and the receiving country on the other. Before the survey begins the various participants should be familiar with objectives of the survey, possible problems and solutions, as well as the nature of contemplated follow-up activity. It would also be desirable to identify subjects of special concern prior to the beginning of the survey. If AID cannot provide financing, other sources should be considered. Every effort should be made to document the importance of standardization so that governments and assistance organizations understand the needs. These actions together can guarantee success of the surveys. Returning to a point made earlier by Dr. Brady, I am very interested in the subject of SRM's. The matter of the correlation of tests on materials is very critical in petroleum development in the Arab region. ASMO has an important program in this field to assist our member nations. Help from NBS on any relevant SRM's would be appreciated.

Mr. Alonso

Let us defer the response to this question until after Mr. Peiser's paper, which deals with SRM's. On the surveys we can say in summary that they should be very carefully planned and organized. There should also be provision for follow-up. I understand and sympathize fully with the difficulties involved in creating national programs and bringing about effective cooperation with international organizations. We will now turn to the subject of workshops in the U.S. and other topics. One question is the selection of topics for the workshops. Did they satisfy your needs? Another question that was raised is whether participants should be at the highest possible level? Should there be workshops organized at a lower level? There was also the question of the organization of the workshops which is very important. It is probably not possible to organize any two workshops in exactly the same way because different topics demand different presentations. To what extent should the programs be tailored to the needs of individual participants? It would be desirable also to know whether NBS is satisfied with the workshops or would they like to see them modified in particular ways. Should there be more than one workshop per year?

Eng. Estrada

I speak as a participant of an earlier workshop and believe the workshops may be too specialized and presentations are by persons who work at a higher level than can be easily appreciated in our countries. It may be desirable to spend one or two days in discussions of the general aspects of standardization, metrology,

quality control, calibrations, etc. Then one could proceed with in-depth consideration of specialized subjects. It is very necessary for our participants to start with a general overview before going into specifics.

Mr. Peiser

My interpretation of Dr. Oteng's proposal, and I liked it that way, was that the workshop be organized in two parts--one week of general topics for all participants while in the second week the group would split up to develop specialities.

Dr. Oteng

This is what I had in mind.

Dr. Steinberg

I could not resist the wonderful but demanding opportunity of attending this year's NBS/AID Workshop on behalf of my Institute, although I had been a participant previously in 1974. One aspect which I consider to be the richest contribution of the workshop program that has not been previously mentioned is the contact I have been able to establish with highly qualified and competent people from other countries.

Dr. Salama

I participated in 1971 when most useful subgroup schedules were arranged after the end of the formal program. I, myself, with participants from India and Thailand, joined a one-week tour on the topic of instrumentation which we found very useful. We visited several companies with appreciable benefit to my work in the subsequent six years.

Dr. Bambang

I agree with the suggestion of subgroup programs, and would favor more discussion of how standardization and measurement services operate in the countries of the participants. Comparisons with the U.S. system would be useful, and I favor separation of participants interested in standardization from those more interested in the physical standards.

Mr. Gikandi

Must participants really come from such a high organizational level? It is my impression that specialists at an administratively lower grade could benefit greatly from workshop participation.

Mr. Alonso

This is a good question.

Dr. Oteng

I agree with the existing criterion, because standards organizations are new in many countries and we must give top-level officials in these new national bodies the best possible opportunity to learn what is going on so that they can make the best decisions for the new national standards bodies that fulfill an important function in development. At a later stage when the organizations have grown, officials less concerned with policy would also benefit from such workshops.

Mr. Peiser

The rule is probably good provided we are prepared to make exceptions, as indeed we are. You must remember, however, that in these workshops we try to give a broad brush overview of the U.S. system of standardization and measurement services. By different series of visits each year we try to illustrate the diverse interactions between regulatory funding and other governmental agencies, industrial companies, research and test laboratories, and private sector standards developing organizations. Other workshops no doubt would be useful but in the type we are attempting the specialist from abroad is less likely to find satisfaction than the participant with senior level management responsibilities in his own country who can judge the usefulness or the inapplicability in his own country of the various activities in the U.S.A.

Mr. Alonso

With one a year you are restricted on the type of workshop you can organize. I see that more might be useful but that will depend on funding.

Mr. Pineda

In the NBS/AID Workshops you are meeting an important need, but the other type would also be most useful in widening the vision of administratively lower level staff.

Mr. Florez

My participation in an NBS/AID workshop was not typical because it followed almost a year of previous exposure to NBS and the U.S. standardization systems. However, even if this had not been the case, I feel that the opportunity to meet colleagues from other countries and to exchange information with them would have been as interesting

as, in fact, it was for me. In my opinion it is almost impossible to adapt the program to individual needs. Participants are better advised to have an open mind to receive the impressions that they can assimilate. I had the advantage of knowing beforehand a little more of what to expect.

Mr. Alonso

The more you know the more you can get out of the workshops.

Mr. Kahn

There are facilities for training of specialists over periods of months, not perhaps at NBS, but elsewhere. Here we are concerned with a concentrated overview course on a complex system, so it is best to have participants who can later implement some of the ideas presented at the workshop.

Mrs. Mascarinas

I agree with Mr. Gikandi that a lower level staff member attending for the chief of an agency should be permitted to attend the workshops and could benefit from the experience.

Mr. Leach

I speak on behalf of a very specialized industrial operation which is concerned with quality control and measurement and which was visited by the NBS/AID Workshop in 1976. Judging by the comments at the closing session this visit was much appreciated though outside the prior experience of virtually all participants. We, as a Company felt privileged to receive such a exceptional group from so many countries.

Mr. Alonso

Did you have follow-up inquiries or benefits from receiving the group?

Mr. Leach

No, although I had anticipated such results. I might suggest that participants might gain even more if they followed up themselves by inquiries or requests for assistance from organizations visited during the tour.

Mr. Alonso

Would such requests be welcome?

Mr. Leach

Certainly by us and at least the larger companies.

Mr. Alonso

Turning to discussion on Mr. Florez' presentation it has become clear that NBS has a very beautiful association with standards organizations in some other countries, particularly because it is not a one shot operation.

Mr. Peiser

As NBS Program Manager, I also believe the NBS/IPT cooperation has become successful although it took us more than a year to find a sufficient number of really productive project areas and to plan a method of deciding on specific well-defined tasks to be undertaken. This seemingly long initiation period led to an innovative approach of cooperation by tasks which go through four phases:

1.) training at NBS

2.) implantation of a new capability at IPT

3.) delivery of a new technical service to industry or government agencies, and

4.) evaluation.

Shortcomings found on evaluation were in several instances turned to spectacular success.

The program as a whole I evaluate as a success because in addition to the sum of individual results of tasks we find a high percentage of IPT staff now works on projects arising from our cooperation and, as Mr. Florez pointed out, the collaboration has had a major effect on IPT and NBS in their modes of association with other Brazilian and third country laboratories. The success of this entire program ultimately depended on the excellent devotion and outstanding professional competence of the IPT trainees who were used also for direct benefit of NBS projects. This statement here is more than a well deserved acknowledgment but a warning against trying to imitate this inter-institutional cooperation without similarly strong correspondence of professional talents between the institutions.

Mr. Kahn

I am interested that Mr. Florez has talked about quality assurance rather than quality policing. We also trust a well proven manufacturer to exercise quality control by himself with integrity. I

would also like to refer to difficulties we find in Bangladesh in transfer of available in-country technology to industrial projects. Pilot plant development capability is needed which in turn is closely associated with standardization. Other national standards are often mutually incompatible and we should favor ISO standards when available.

Eng. Estrada

Does NBS help IPT towards traceability to international standards, as for instance, to the International Bureau of Weights and Measures? Could Mr. Florez tell us whether it is possible to join the NBS/IPT cooperation as additional partners working towards international cooperation?

Mr. Pineda

What is the relation between IPT and ABNT (the Brazilian Association for Technical Standards)? Does IPT work for Brazil as a whole?

Dr. Huntoon

Since I have worked with IPT under the NBS/IPT program, I have been trying to figure out what has happened in São Paulo. What we tried to do was not to lead IPT to imitate NBS but to use the program as a basis for discussion and to open a number of windows through which the people in IPT could look. In looking through these windows IPT personnel could see things that needed to be done. What is important is that there be continuing growth in the country that is aided, rather than repeated infusions of technological assistance, and success should be measured on that basis. I think Mr. Florez' report was essentially one of "looking out of the windows," rather than what NBS had done.

Mr. Florez

IPT is mainly a "state level" rather than a "federal level" organization. It is a public company operating like a private company. IPT has some administrative freedom that government agencies do not have as, for instance, to sell its property or pay higher salaries. We work in a very different environment as compared with NBS and we have a different role. We work in the state that accounts for a high percentage of the manufactured output of Brazil. We have much less infrastructure to count on for support. Brazil does have ABNT, but that organization does not have laboratories. We need measurement for self-assurance on precision and accuracy not for enforcement of legal metrology, not for a policing role referred to by Mr. Kahn, and not only for providing certification to others. When the foreign cooperations started to invest heavily in Brazil, transfer to technology took place, so that most of the universities,

institutions and even small industries were left behind. IPT is aware of this and is trying now, through programs such as the one with NBS, to upgrade its capabilities so as to provide technical services to industry. It took one month of Dr. Huntoon's time to help us understand how we could plan to fulfill that function. In answer to Eng. Estrada's question, NBS helps us to understand and achieve traceability. To join as an additional partner in this collaboration needs funds such as those IPT received through an AID Loan Agreement.

Mr. Kahn

It is my opinion that technical personnel are better in management positions in technical organizations. Why did Mr. Florez see difficulty at IPT in filling management posts with so many qualified technical people?

Mr. Florez

IPT invested a lot of money in technical training of specialists who are needed to define and execute technical programs in their area of specialization. To take a specialist out of the laboratory for higher paid management assignments may not be cost-effective, and he must jump a major gap into management of, say, six programs with all of which he does not identify himself fully on a technical level.

Mr. Alonso

It is always a great dilemma as to how to use people who have reached a very high level. Brazil with assistance from OAS is building up a cadre of people who will be able to discharge management positions.

Dr. Rhee

With regard to Ph.D.'s in management positions, the key question is the quality of the people. The Korea Standards Research Institute is now hiring about 15 Ph.D.'s with experience in the United States. Several of them will have technical and management opportunities.

Dr. Huntoon

We used to observe here at NBS that in a mission-oriented, science-based institution, there are two kinds of people: those who work for as opposed to those who work at an institution. The former identify themselves with the institution and receive satisfaction through its growth and success, and those who are scientifically oriented and obtain most satisfaction from accolades of the scientific community. It takes both kinds to make a good technical organization. For management tasks you should choose the first kind of employee.

Paper 1.8 - Other NBS/AID Activities

Mr. H. Steffen Peiser
Chief
Office of International Relations
National Bureau of Standards

My paper is intended to introduce a discussion on those activities under the NBS/AID program that had not been covered by previous speakers or by the preceding discussion. I want to describe the actual as well as the possible activities which we might pursue under the NBS/AID program.

Dr. Brady, in his speech, pointed out how much countries varied in their needs, their resources, and their national goals. Although there were broad similarities, there were very significant differences and if we wanted to assist in their development programs we would have to learn something about each particular country. Conversely, as you think about using NBS as a U.S. resource for your development, I believe it is important to understand NBS. There are broad similarities with other U.S. laboratories but through its 76 years of history NBS has acquired certain competences, characteristics and resources that are special.

I would like to present very briefly, therefore, a few generalities about NBS which are partially true, say 80 or 90% true. In other words almost every statement I will make will have some exceptions.

1.) NBS is a research and development laboratory of the United States Federal Government. It is not a contract or grant-giving organization. We have authority to give contracts and grants, but on the whole we are not a contracting or granting organization.

2.) NBS work is openly published in the technical literature and most of this work attempts to be at the state of the art. However, NBS is not a university and does not offer degrees.

3.) We are delighted to have technical specialists, particularly those from other countries, visit us for a day to learn about our work and to exchange knowledge and experience. We are equally delighted to welcome guest workers visiting for a long period of time to work with us on NBS projects, provided the visitors are so motivated and have demonstrated the technical background and the capability to benefit from participation in NBS type projects. However, NBS does not offer courses of instruction.

4.) NBS does not formulate foreign policy. However, we try very hard to support the State Department and the Agency for International Development in areas of foreign policy in which they wish our support. NBS also has a self interest in those international contacts which the State Department and AID encourage us to have. Often we recognize a direct programmatic interest. Commonly, individual staff members appreciate these contacts that provide them with opportunities for professional and human growth.

5.) NBS may enter into semi-formal understandings with counterpart organizations abroad but does not commit the United States to agreements with foreign countries. NBS assists in implementation of agreements when called on by State Department or AID but these agencies will not ask NBS to provide regulatory enforcement of, say, internationally agreed standards.

That sketchy background may give you an idea of how best to make use of the NBS resource. I believe it is a considerable resource for development because in its research and development projects it does cover many areas in physics, chemistry, and engineering. How then have you so far used that U.S. resource for cooperation from the developing economies of the world?

1.) As we have heard, you have invited the survey teams that went with third country partners to put themselves and their experience at the disposal of your country as host for an admittedly very short period of time.

2.) You have sent top level experts from your countries to workshops where we show and tell how the U.S. system of standardization and measurement technology works.

3.) Two counterpart institutions with relatively advanced technology laboratories have entered into bilateral understandings with NBS for building up their competences.

We believe that we have today heard you say all these three programs have some merit and you feel that they should continue. There are some other existing programs that Dr. Brady showed in his tabulation.

4.) Let us examine what you have done with NBS in regional seminars. Several less developed countries in a region, wanting to discuss common technical problems related to standardization and measurement services, arranged seminars under discussion guidance by a small team of NBS specialists. NBS published summaries of the output of these seminars. One of these regional seminars had as an eventual result a promising project by the Organization of American States

on a system of metrology in Latin America. The concept was confirmed during one of the earlier NBS/AID workshops. Its current development has been described by Professor R. Steinberg during the NBS/AID workshop just ended. His paper will be published in the workshop report of 1977.

Another very exciting regional seminar, that Dr. Brady mentioned particularly, on OMNITAB II, led to the countries of the region, without the United States, making an agreement among themselves to develop that simple but powerful computer language system and thereby to improve their governments' ability to deliver services to their people.

5.) Next you have tried to use NBS to organize some training programs. We have had some very limited groups of people learning about weights and measures activities. I am convinced, especially after visiting the Pennsylvania State Office of Weights and Measures with this workshop, that we now know how to organize such training if it is needed. The states of the United States have the regulatory authority in these fields and several of them are keen to share with NBS the task of showing our colleagues from other countries how to organize such a regulatory program. The courses would include a short stay at NBS but most of the training would go on in a particular state laboratory.

There has been one other type of training program which Dr. Brady mentioned and I would like to spend a few minutes on this. This is on instrumentation--to help in thinking about the introduction of modern effective instrumentation for carefully chosen key functions. As I have the privilege of visiting many countries I am exposed to a terrible nightmare. I see much good equipment and laboratory apparatus not fulfilling the hopes and dreams of the people who ordered them. It seems not to matter if the funding is from AID or the United Nations or an agency of the recipient country. Unfortunately, there is no single reason why most equipment that goes from highly developed countries to less developed countries ends up being useless within a very, very short period of time. This is a worldwide tragedy of the development process. I am not saying that the fault is only with either the vendor or the receiving countries or that the United States is any worse as a vendor than any other highly developed country with an instrumentation industry. In fact, I think that the U.S. instrumentation industry has a little better record than that of the others, but the problem for us in the United States is immense. This disappointing performance if allowed to continue does not do us any good and it does not do the recipient countries any good. When you analyze the reason for these millions and millions of dollars

being wasted, you come to realize that there is a whole variety of reasons that produce this problem. We have felt that NBS should make some attempt to tackle it and so, on an experiemental basis, NBS has had with the Denver Research Institute a course on how to plan for instrumentation, how to order it, how to specify its features and needed ancillary gear, how to make sure that it gets there, how to check the manual, how it can be installed, housed, maintained and calibrated, how spare parts can be rapidly supplied, and how its results can be delivered to the industry, to private or government laboratories or even individuals. The end effect should be that instrumentation will perform in an anticipated manner for a reasonable period of time. I believe that with this one course NBS and DRI have begun to scratch on the surface of a huge problem of development.

6.) Next you have requested and you have had some rather successful consultation trips from NBS specialists mostly following up on surveys or workshop contacts. NBS favors this type of short-term specific assistance provided that the field mission of AID concurs with such consultation, that the host government wants it and provided it falls within available technical and financial resources.

7.) Dr. Brady also mentioned that you have asked rather cautiously for the distribution of some standard reference materials (SRM's). You ought to know that the only real criticism in the AID evaluation of the NBS program in the very interesting Hubbell report requested by AID concerned SRM's. Hubbell recommends that we should not carry on with the supply of SRM's to AID countries. Now I happen to believe that it is a key program in development assistance from NBS; if not today it should become a key program as soon as possible.

Whenever you make a measurement, when you look at a raw material or aim to control production however primitive, or give yourself any quality assurance, or look at the safety and health of your people it is many times easier, more precise, or more accurate to make such a measurement with an SRM than without it. Widespread understanding of the philosophy of SRM's is relatively new. No one in the major national measurement laboratories of the world now even doubts that this is a powerful and necessary technique. Every measurement can be reduced to a quantitative comparison of a given attribute inherent in two objects. A rule of thumb is that, other things being equal, the accuracy of a measurement is a sensitive function of the difference between the values of that attribute in the objects being compared. The greater the difference, the less the accuracy. It follows that with instruments of given precision, measurements are improved greatly by

measuring an attribute in an unknown sample against that attribute in a closely similar standard reference material that has been certified by an absolute and careful state of the art measurement at or near the highest accuracy. So when we or other organizations distribute SRM's we help you to make accurate, recognized quantitative measurements of some property, be it chemical or physical or mechanical. With sensitive indicating instruments, your measurements will be only slightly less accurate than those that could be made at the primary laboratory where absolute values are derived at much higher cost. So no general measurement stratagem is more effective or more economical for producing results that are compatible with those anywhere else in the world. It enables all very inexpensively to check raw materials uniformly and to control production and assure themselves of the quality of products.

However, as I said, AID advises NBS to cut this program out almost completely and the reason is understandable. Countries have not as yet told us that they are convinced that SRM's are useful to them and that individual SRM's that we sent out have solved specific problems for them. So AID cannot approve further expenditures for SRM's. Already NBS has sent thousands of them and we can only give one or two success stories of only indirect help to the poor. Regretfully, but realistically, I must agree with Hubbell's evaluation because this is how AID should, and does, make a judgment. We have failed despite some systematic attempts by me to find more on how the SRM's had been used.

To some extent, therefore, the continuation of any project is in your hands. If you find something was useful or could have been useful, drop me even a handwritten note why it was useful or failed to be useful. This would help me, NBS, and AID achieve the common goal. The feedback to NBS on the usefulness or uselessness of the NBS/AID program is very important.

8.) I could comment similarly about the standards literature distribution. I should acknowledge the great deal of help received from standards publishing organizations in this country who have made available to us literature free or reduced in price for distribution abroad to national standards bodies. It is doubtful, however, whether the mechanism exists in most countries for appropriate distribution to interested parties of information on the existence of this literature.

9.) Post survey reviews of progress in countries have been discussed to some extent in answer to questions, so I need

only reiterate the willingness of NBS and AID to organize brief return team visits to discuss progress in standardization and measurement services and for resolution of remaining problems.

10.) Most effective in transfer of competences from NBS to countries where they are needed is to send a guest scientist or technologist to work with us for six months or so. Such guests have to be linguistically and technically qualified and well motivated.

I would like to conclude by thanking you, particularly the workshop participants who have participated and thought about the NBS programs to provide services to you as users. We seek your advice. Can you think of more or other activities that we could undertake to support more effectively your programs in your countries?

Discussion

Mr Pineda

Mr. Peiser said that he would like to have reactions as to the usefulness of sending SRM's abroad. In investing abroad U.S. industry must determine both the nature and quality of local materials to be used in a given project. Good test methods are essential and it is here that SRM's are valuable and much needed abroad, both by American industry and the country receiving the investment.

Professor Steinberg

What is the attitude of NBS towards bilateral agreements? Mr. Peiser talked mainly about NBS relations with IPT.

Dr. Brady

As you know, NBS is now undergoing a reorganization. One of the new components arising from the reorganization is expected to be a Center for International Technology. While the program for the Center is yet to be defined, I expect that Mr. Peiser and I will have a great deal to do with its activities. Both Dr. Ambler and Dr. Jordan Baruch, the Assistant Secretary of Commerce for Science and Technology, support the concept of such a Center and I am optimistic that its creation will take place depending, of course, on approvals and funding through the Office of Management and Budget and Congress. We hope that we will in any event continue to have support from AID and that we will be able modestly to expand the kind of things we have been doing abroad.

Mr. Pineda

It should be our goal to gain the widest possible acceptance of international standards. At the same time we should accept the reality that in some practical cases regional or national standards may be more acceptable than ISO standards. International standards with grades of quality is an alternative.

Dr. Rhee

Why is the NBS agreement with IPT rather than INPM--the Brazilian National Institution for Metrology?

Dr. Brady

There are several reasons why the agreement is with IPT, rather than INPM. IPT was ready for technical collaboration and had manpower and financial resources. INPM, on the other hand in many ways is quite a new organization and its mission was still being defined, its

facilities are being built up and its staff is being recruited. In the long run, INPM is an organization with which NBS does very much want to cooperate. Another consideration was that the State of São Paulo had a loan from AID and was ready to proceed promptly. IPT because of its structure is also a natural counterpart for NBS. NBS has throughout its history been engaged in technological research and has been a pioneer in many technical areas, such as aeronautics, radio, building materials, and weather telemetering devices.

Mr. Alonso

INPM has grown rapidly and now has excellent facilities. The staff has also grown and the organization is providing services of different kinds for a variety of industries.

Mr. Arnold

In connection with the last question, one reason why the NBS/IPT program is in existence is that the State of São Paulo also puts substantial resources into this integrated program. This factor played an important part in forging the relationship between NBS and IPT. Would Ricardo Florez agree with my observation?

Mr. Florez

Yes and even much more. The State of São Paulo was initiating a much larger coherent development program (called PROCET) with an AID Loan and more than twice, that is about $40 million, of its own money. Several portions of this huge program involved IPT. In the area of standardization and quality control one of these has the Denver Research Institute as counterpart, the other uses NBS. Some other portions of the PROCET had perhaps broader and "softer" management objectives but they have been terminated by now either because they completed their aims or because the São Paulo Government does not feel further investments are needed. By contrast we have proposed only last week an increase by over $1 million to governmental support of NBS/IPT initiated projects and received a favorable hearing. We must remember, however, that IPT will be expected more and more to operate with financial independence from governmental support, except, of course, when working on specific projects for the governmert.

Mr. Kahn

In response to Mr. Pineda, I agree that there are circumstances under which you would do well to use national standards, but when transfer of technology is offered, reference to international standards is an advantage. With Mr. Peiser I agree that to help us you must make the effort to understand our problems.

Mr. Alonso

Summing up this session, I would like to make a number of observations. First, I wish to express my sincere appreciation to Dr. Brady and Mr. Peiser for giving me this opportunity to serve as your Chairman. I thank all of you for your patience.

Now coming to the substance of our discussions, I will review the major points that have arisen during the day:

1.) The NBS/AID program is clearly a very good and successful one. I hope that it can be continued and increased.

2.) The question of emphasizing help to the poorest sectors in the poorest nations came up several times. Our major concern is development, by which we mean the ability of a society to satisfy the material, social, and cultural needs of its citizens. It is reasonable for outside help to be given to those societies and those elements within them which have the greatest need.

3.) With population increasing continuously, we need to know how to provide the critical needs of a society. These necessary resources must either be produced internally or acquired from outside.

4.) Each country must train people who understand the process of development. Development cannot proceed effectively without knowledgeable people.

5.) In order to assist people to acquire quickly the required knowledge and essential skills, many things are needed. Training in the field of standards, metrology, and quality control is a key factor in promoting efficiency and know-how.

6.) Many differences exist between the standards institutions of different countries because of history and tradition. Some of them are more applied research oriented, others work mostly in technological development and still others are most concerned with engineering and product standards.

7.) Many gaps exist between developed and developing countries--one that can be identified is the difference in the way standards are developed and used. Governments and even industries do not always.

recognize the importance of standards and thus neglect this important area.

8.) It is clear that the standards surveys conducted under the NBS/AID program are extremely useful, but they need very thorough preparation. In some cases, follow-up activity has not been as effective as it should be. I think that this is an area that NBS would like to see improved in the future. NBS capabilities are, however, limited. However, this is very important and ways should be found to enlist the assistance of some of the other well-established standards institutes in follow-up activity.

9.) It seems to be agreed that workshops are extremely useful. However, since they have been aimed at senior policy making officials, their usefulness may be somewhat impaired because of the turnover of officials who have been participants.

10.) There seems to be a general agreement that workshops should commence with a general overview and then proceed to specialized visits and discussions. Perhaps workshops can be organized by NBS to address the needs of standards institutes in Latin America.

11.) With respect to institution building, it is clear that the junior partner involved along the lines of the NBS/IPT arrangement must possess a minimum of resources and competence. An effective two-way arrangement must exist.

12.) Development requires careful planning, persistence and patience, and the harnessing of science and technology. Ultimately the execution and the implementation phase is the most critical.

13.) It is of great importance that instrumentation be purchased carefully and for the purposes intended, so as to avoid non-use and waste. Instruments, when properly serviced, maintained and used, fulfill a critical need for development.

14.) The proper training of technical personnel is of the highest importance so as to serve organizational needs and objectives.

15.) Management of standards institutions must obviously be in the hands of good managers. The selection of

the right man for the job is clearly essential. The OAS is very much concerned with this question, i.e., how to development managers who understand how to apply science and technology for developmental purposes.

SESSION II - STANDARDIZATION IN THE U.S.A. - A RESOURCE FOR DEVELOPMENT

Chairman: Mr. Hamilton Herman

SESSION II - STANDARDIZATION IN THE U.S.A. - A RESOURCE FOR DEVELOPMENT

Chairman: Mr. Hamilton Herman

Paper 2.1 - Standardization in the United States

Mr. Richard O. Simpson
President
R. O. Simpson Associates
Washington, D. C.

Let me begin my discussion of "Standardization in the United States" by acknowledging that there is no standard definition of a "standard." To some it is a prescribed set of rules, conditions, or requirements established by standards-setting bodies, concerning definition of terms; classification of components; specification of materials, performance, or operations; delineation of procedures; or measurement of quantity and quality in describing materials, products, systems services, or practices.

A much more manageable definition states that a standard is simply "an agreed upon way of doing something." And, in fact, much of the political discussion in Washington these days involving standards focuses on "who should be a party to such agreements."

Standards are instruments by which buyers and sellers define their mutual obligations. They also are instruments by which government can assert its regulatory authority on behalf of the health and safety of its citizens. As such, standards are essential for the orderly and efficient conduct of domestic and international commerce and for the protection of the economic and social interest of sellers, buyers and consumers, both individual and industrial.

Standards can favorably or unfavorably affect consumer costs and domestic and international trade. And they are surely significant media for technology transfer both within a country and between nations.

The total cost of standards activities in the United States is in the neighborhood of $1 billion annually. This cost is shared approximately equally by the public and private sectors, and this standards activity involves tens of thousands of people. (One estimate places the number at 55,000 in the private sector.)

In the United States, standards are written by several hundred private organizations and by scores of government agencies at the federal, state and local levels.

Let me briefly describe the private and governmental efforts.

Private-Sector Standards Activities

The national voluntary standards activity in our country includes the standards-writing efforts of several hundred organizations. However, about twenty of these organizations account for the bulk--about 90%--of the estimated 25,000 nationally recognized voluntary standards essential to an economy of the size of the United States. I would like to briefly describe the roles of two of these organizations:

1.) ANSI, the American National Standards Institute, which manages and coordinates the U.S. voluntary standards system, and

2.) ASTM, the American Society for Testing and Materials, probably the largest standards-writing body in the United States.

American National Standards Institute

ANSI is a voluntary, non-profit organization founded in 1918 by five professional societies and three agencies of the Federal Government (Departments of Commerce, War and Navy). Its purpose was to provide a mechanism for coordinating the development of engineering and related standards. From this beginning, ANSI has grown into a federation of 185 professional, technical, trade, labor, consumer, and governmental organizations and approximately 800 individual firms who represent virtually every facet of commerce, trade, and industry.

The purposes of ANSI, as provided in its New York State Charter, are to:

1.) Provide a voluntary procedural mechanism for management and coordination of American National Standards.

2.) Provide criteria for approval of proposed standards as American National Standards.

3.) Provide a clearinghouse for national and international standards and standards information.

4.) Provide for representation of U.S. voluntary standards interests in international, non-treaty standards organizations. The two principal groups are the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), both international nongovernmental organizations headquartered in Geneva.

5.) Provide a focal point for a government-nongovernment interface where this is desired by government and the voluntary standards systems.

All actions of, and by, ANSI are voluntary. Membership, participation, and submissions of standards to ANSI by standards-writing organizations are voluntary. Use of promulgated American National Standards by government at any level, and for any purpose, is a separate and independent judgment or action on the part of government officials. ANSI and its federated members not only encourage but have enjoyed for years active participation by government personnel at technical, administrative, and policy levels of the Institute.

In the past several years, more and more private standards-writing organizations have been motivated to work within the voluntary system coordinated by ANSI It is estimated that today approximately 90% of the nation's non-governmental standards effort is voluntarily coordinated by ANSI.

ANSI subjects all proposed standards actions submitted to them for approval to a period of public review and comment, and requires that all comments be fully and objectively considered. ANSI's public review--which I personally believe is the most complete and comprehensive of any national standards system in the world--is conducted through a biweekly publication called Standards Action. It is mailed to approximately 8,000 addressees, including 275 government agencies--174 at the federal, 88 at state, and 13 at the local level. Also included among the 8,000 recipients are approximately 1,400 mailings to various segments of the press--general, business, consumer, trade and technical periodicals. ANSI's efforts to obtain the views and comments of affected interests on proposed standards provide a broad national consensus on completed documents.

ANSI derives its income from a variety of sources. Approximately one-third of its annual income is from company-member dues and this is almost equally divided among large, medium-sized, and small industrial and commercial concerns. In fact, 83% of ANSI's company members pay annual dues of less than $1,000. The bulk of the Institute's income is from the sale of voluntary standards at an average price of $2.50 each.

American Society for Testing and Materials

ASTM, the American Society for Testing and Materials, is an example of one of the largest and most prestigious standards-writing organizations in the United States; and in fact, in the world.

ASTM currently has jurisdiction over approximately 5,400 standards. These standards are prepared by some 127 main technical committees of ASTM which are, in turn, broken down into approximately 1,650 subcommittees and literally thousands of additional subgroups, known in ASTM as task groups. There are at present 14,440 individuals active in ASTM standards work who fill about 67,000 positions in the committees and subcommittees.

These participants come from all conceivable societal interests in the institutional structure of the United States relating to the work at hand--government agencies; industrial concerns; universities; research organizations; citizen groups; consulting organizations; labor unions; etc.

The Committees of ASTM operate by virtue of the authority extended to them by the Board of Directors of the Society. The basic condition of use of this authority is that the committees operate strictly in accordance with ASTM's standards-development procedures. Beyond that, the actual work accomplished, the content of work, the emphasis of the work, etc., are wholly in the hands of the committees themselves. ASTM refers to their main committees as "semi-independent tribal groups."

Although the annual operating budget of ASTM is a relatively modest $6 million, it is estimated that the participants in ASTM's committee efforts spend an additional $110 million annually as a result of that voluntary participation.

Over the past ten years, approximately 25,000 standards have been developed by the private voluntary-standards system. A recent review disclosed that no more than 50 of the standards actions during this period were subject to dispute or appeal. All of the 50 were resolved by using the appeals mechanisms available to parties within the voluntary standards system. This record--only 0.02% of its standards actions subject to appeal or dispute--has not been equalled by departments or agencies of the Government.

Federal Government Standards

It is estimated that there have been approximately 50,000 standards written at the Federal Government level.

These standards can be divided into roughly two categories--standards for procurement and regulatory standards.

The General Services Administration (GSA) and the Department of Defense (DoD)--as big purchasers of goods and services--together account for roughly 45,000 of the 50,000 federal standards (40,000 DoD and 5,000 GSA).

Recent events indicate that the trend in federal procurement will be away from the use of government-written standards and increasingly towards the use of privately developed standards, wherever practicable. In fact, DoD estimates that the last few years have seen about 1,000 DoD standards declared obsolete and replaced by voluntary standards.

One of the forces behind the accelerating trend towards the expanded, or preferred, use of "commercial" standards is the direction embodied in a White House directive currently being finalized--the OMB Circular on Standards.

This document was essentially developed over a 2 1/2 year period by the Interagency Committee on Standards Policy (ICSP), a committee with senior representatives from 25 Federal Government agencies and chaired by the Department of Commerce representative.

Under the directive, if private standards-writing organizations wish to have their standards used by the Government and/or if they wish to have Federal Government personnel participate in their standards activities, then the private organizations must meet certain requirements which include:

1.) The private organization will have to employ approved due-process procedures when arriving at a consensus in its standards-writing committees.

2.) The committees must be open and have a fair balance among representatives of all affected interests.

3.) They must provide for an identifiable and equitable appeals procedure.

4.) The private organization must agree to participate in a federally operated appeals procedure to resolve procedural disputes which have not been resolved by the private appeals mechanisms.

In return, the OMB Circular on Standards directs the federal agencies to use private-sector consensus standards, whenever possible, in preference to developing Government standards. The Circular also encourages federal personnel to participate in private-sector standards activities and additionally, it allows for both direct and indirect financial aid to private standards activities.

Although regulatory standards constitute the smaller percentage of Federal standards activity, they account for more than their share of the confusion, dissension, and confrontation between the public and private sectors. There have been over 50 new significant statutes mandating standards in the United States in the last two decades.

During this period, we have seen the creation of new agencies, which include the Occupational Safety and Health Administration (OSHA), the National Highway Traffic Safety Administration (NHTSA), the Environmental Protection Agency (EPA), and the Consumer Product Safety Commission (CPSC) which I chaired. In addition, we have seen the broadening of the regulatory authority of many existing agencies.

Unfortunately, the increased federal activity with respect to regulatory standards, has brought with it a change in the relationship between the private-sector and the Government in standards matters. Cooperation has been more and more replaced by confrontation in standards matters, particularly in the last ten years.

The various statutes, as well as the policies adopted by the regulatory agencies, provide for a complete range of possible relationships between the Government and the private sector with respect to regulatory standards. Let me outline but a few.

OSHA, at the outset, was required to publish as mandatory standards all the existing relevant national voluntary consensus standards. Over 1,200 such standards were mandated by OSHA in the first year.

The Nuclear Regulatory Commission (NRC) has actively encouraged and participated in private-sector standards activities through ANSI coordination for years. The principal nuclear standards-writing organizations in the private-sector are ASTM, ASME, IEEE, and ANSI. NRC publishes these voluntary standards as "guidelines" which inform the eleectrical utilities of acceptable ways to meet NRC's mandatory requirements.

The Environmental Protection Agency (EPA) currently is cooperating with ANSI to identify needed standards in noise abatement and control and solid waste management areas.

There are many more examples of cooperation--or the lack thereof--too numerous to identify and discuss in this forum.

Standards & Technology Transfer

In my opinion, it goes without saying that the standardization process offers one of the more efficient and widespread means of technology transfer. Active participation in the standardization process allows for an exchange among experts of both written and oral views involving the latest technology. Also, one can share in this technology transfer without prior participation by buying, at an extremely low relative cost, the standards which govern the trading in the marketplace, be it national or international.

However, a recognition of the positive role and contribution of standards as a means of technology transfer does not automatically suggest to me that the subject of standards should be included on the agenda of the upcoming U.N. Conference on Science and Technology.

In fact, the founding fathers of the United Nations, in 1946, did consider whether international standardization should, or should not, be a part of the U.N. framework and decided, wisely I believe, that it should not. Consequently, ISO, the International Organization for Standardization, was formed as an international non-governmental body because of the then prevailing opinion that standards and politics were not a good mix.

To realistically discuss the role of science and technology in industrial development, one needs to start with an appreciation and understanding of science and technology in the development of a business enterprise--the process of technological innovation.

This would involve consideration of such things as:

1.) the role of the inventor;

2.) the role of patents;

3.) the role of the entrepreneur;

4.) the role of risk capital;

5.) the role of government regulation;

6.) the role of organized labor;

7.) the role of standards.

Too often, when we talk of technology as a force in our economy, we only focus on the few outward manifestations of technology--patents, technical reports, laboratories, and technical standards.

Also, we often assign far too much importance to these items when we negotiate on the subject of technology transfer between governments. For instance, most students of innovation recognize that for every one dollars invested in acquiring a patent, an additional one hundred dollars will need to be invested to gain the needed know-how during the product development, prototype, and pre-production phases before anything reaches the marketplace.

When we negotiate for the transfer of technology through patents only, we are therefore dealing with about one percent of what the recipient of the technology actually needs. And the problem is compounded if the discussions treat all patents as equal. Too often, in the past,

government owned patents have loomed large in discussions when they embody little of commercial value anyhow.

There are discussions in the United States today over whether we should reduce or modify the present way we treat capital gains taxes from stock purchases. To many, if not most, this would be considered to be a "tax" issue and not a "technology" issue.

And yet, without the incentive of a favorable capital gains tax, will we have the risk capital made available to the entrepreneur? And without the entrepreneur will we really see the continued growth in our new science and technology related enterprises? I think not.

What I'm really suggesting is that perhaps the United States should urge that the U.N. Conference on Science and Technology for Development should include as agenda items subjects such as the tax structure rather than the far too typical subject of patents, standards, etc. Perhaps then I would be more confident that the outcome would be more meaningful.

In my opinion, a review of United States' past performance, where the general subject of technology transfer has been discussed in intergovernmental forums, will show a generally counter-productive result. I would not like to see this repeated.

Paper 2.2 - International Standards Bodies and their Relations with Developing Countries

Mr. Robert N. Johnson
Manager
Industry Standards and Systems
U.S. Steel Corporation
Pittsburgh, Pennsylvania

Thank you Mr. Chairman, Ladies and Gentlemen. I want to start off by saying that on the West Coast of the United States there is an intense rivalry between two universities, the University of California and Stanford University. Dick Simpson represents the University of California, I attended Stanford. I do not acknowledge that because he came first we have given up anything to the University of California. I would also like to say that what I say this morning are my own ideas. They are not company ideas; they do not necessarily reflect ASTM, AISI, ASME, SAE, or any of the other organizations with whom I have worked or have strong relationships. When I was given this subject of international standards bodies in relation with developing countries I was not sure what you really wanted to know. First of all, did you want to know what those relations are or did you want to know what I think they ought to be? There is a difference.

The developing countries, in my experience, which incidentally is mostly in ISO areas in TC17 in steel and TC20 in aerospace, have not shown a great deal of interest in attending or participating in the ISO work. Now this may not be true in the many other ISO committees and it may not be true in IEC work. Leon Podolsky who follows is an expert in that area and would be able to speak more to that point than I. But I have noted that there are only a few countries who participate or are observer members in the work with which I have been involved. Yet in the steel area, almost every country in the world is intensely interested and is usually involved in either producing or purchasing these items. I do not know whether the lack of attendance and participation is because they are not interested or because they lack the funds, or because there is a lack of technical background in the country, or whether we really have not done a good job in interesting those countries in participating. I think there are many reasons why they should participate. First of all, if I were in a developing country I would look over the areas in international standards work where that country has the most interest. For example if the country produces steel I would then certainly expect that we would be interested in participating in the areas in ISO where steel standards are developed. If we only purchased steel, I would be interested from the standpoint of how better to procure that product

at the least possible cost to my country. I think that these are two areas that ought to be considered by developing countries when they look at international standardization work.

There are many areas where one could benefit. I would think that first of all if you had an industry in your country that is covered by an ISO standardization organization you would want to participate from the standpoint that there may be something that you could learn from those nations and better your own industry. I do not mean to say that the people who are participating in ISO work know all the answers, and if you do participate you will readily see that there are many discussions, sometimes heated discussions, between the developed countries regarding what a standard should say, and what a standard should require. I think that this is an area where all of us learn. You would also learn, for example, that in one developed nation perhaps they are not as interested in having very restrictive tolerances as another developing country may desire to have. Bill Andrus, in 1975, mentioned that he did not think one standard was necessarily the ideal situation for the world, and I may be misquoting you Bill, but this is the impression I got, that maybe four or five standards for individual areas would do a better job, and I agree with that.

ISO standards are not always the best possible standards. They are many times watered down so that they will cover all of the countries involved and not restrict any of them too greatly. In that regard, if you are interested in a particular area in ISO and you look at the standards, you could then compare them with the national standards of some of the developed countries involved and you might find in the case of a number of industrial products, in which I have had experience, that the ISO standard, while calling out the proper test and proper chemistry in other areas, may not be as restrictive in tolerances. Therefore, you might benefit by using, for example, in the United States, an ASTM standard. In that case you would be getting the benefit in tighter tolerances that are offered in that particular area in the United States. This is not always true but you would learn that by studying these standards. You would also be able to tell, for example, in the discussions in which you participated (You could do this by correspondence, incidentally. You do not have to attend the meetings; you would receive all the correspondence involved.) what some of the problems are in the areas in which you might be interested and you would find a different approach from different countries. I think those are some of the benefits that you might pick up if you were to participate in the ISO work. I think you could also participate in some of the work in the individual countries, and ASTM, for example, has many foreign members, countries who are members by the fact that they receive all the correspondence. Usually they do not have voting status, not because it is not allowed by ASTM but because of the fact that most of the documents are sent by sea mail and before they would arrive the ballot would be closed, but

comments are always taken into account for the next revision of an ASTM document. There also you can benefit by the transfer of technology through standards. There are many such areas that I think would be a benefit to you.

Another area that I think would be of benefit to a country, particularly a country purchasing a product covered by an international standard, would be that you may be able to purchase that product at a lower cost if your standard, your own country standard, does not call out specialized tests. I'll rely on a little bit of my personal experience in my country for this example. We have had at one time in one of our mills, orders from four different countries for the same product calling for four different types of tests. None of these tests was standard in the United States. Special tests are almost always called for as an extra, that is, you would pay extra for that particular test. It had been determined many years previously by consensus in our country and usually in the ISO groups, that these specialized tests, while gathering good scientific background for research type of knowledge, would not necessarily be of any benefit for a commercial item. If, in fact, you learned this and you deleted such requirements, the cost to your country would be appreciably less for that product. I am sure this multiplies many times in other products because my area, of course, is quite limited. There are so many products in which the same theory must hold true. I think that it should be an area to be considered by developing countries. I know that if you as developing countries wanted to participate in the ISO work, in the standardization work of an organization like ASTM, your interest would be very welcome. First of all, I do not believe any of the developed countries feel that they know all the answers. There are many times when a developing country has a specific knowledge that will be very helpful. I think that this would benefit ISO and it would benefit the standards writing organization involved. It would then give a broader perspective to the entire picture and I believe that is what we really need. I do not know whether these examples I have given hold true across the board and you might be able to cite many examples where they are not true. I do believe that there are many cases where you can benefit. We have also found in some of the ISO work that where a developing country has participated the participation has been generally with the scientific community involved basically from the academic area and their experience and background is not necessarily of commercial experience. And if you are talking about commerical products that are used everyday it would be very beneficial if your group can be represented in part by someone who has commercial experience. I believe that will assist in eliminating some of the requirements that may be very fine from the academic standpoint, but not quite as useful in the commercial world. I believe, therefore, that these things can all balance out and that if you are able to participate you can do a great deal of good for the organizations in which you participate and I believe that they will be able to do some good in your areas. I am not going to be able to be

here for the balance of the morning and, therefore, if there are any questions I would entertain them now Mr. Chairman.

Discussion

Eng. Estrada

I have some doubts as to the use of standards as a means of transferring technology. Standards may represent certain aspects of technology but they do not provide the real essence of all that is needed in technology transfer.

Mr. Johnson

You have an excellent point. The standard itself may not tell you a great deal about the technology. However, I have found through experience in ISO and ASTM that the discussions about standards have been very revealing as to the nature of the technology. Discussions, for example, between country representatives have often been very beneficial in imparting technological knowledge and the reasons for its selection. Informal give and take at these sessions have been particularly informative.

Mr. Pineda

If LDC's do not participate as fully in ISO and IEC as is desirable it is because of financial limitations. Furthermore, the needs of the developing countries are not always reflected in ISO and IEC. These organizations do recognize the need for regional standards. COPANT and ASMO are good examples of regional bodies that perform well.

Mr. Johnson

You have made another very good point. That is why I raised the question of whether ISO is really showing enough interest in doing the things it should. Mr. Andrus, for instance, believes that a few regional standards, that can be effectively used, may ultimately have more acceptance.

Eng. Estrada

What is the real meaning of an "international standard"? Is it one that suits a group of nations? All nations? What is the meaning of the Pan American Regional Organization? I have a feeling that we are often talking only about "European" standards.

Mr. Johnson

I think there is a real interest in Europe now in developing standards that are acceptable in Asia and Latin America. Some countries, such as Denmark, have stated that they are disbanding their standards-writing bodies in favor of adopting ISO standards. Other countries are taking similar action which means that their products using ISO

standards should be acceptable almost anywhere in the world. We may never achieve full international acceptance but a large majority of countries may adopt standards similar to the international norms.

Mr. Allijah

How far has the United States gone in adopting ISO standards?

Mr. Johnson

If the United States has not agreed to an ISO standard as shown in the front of the document we would not adopt it. When specialized tests are accepted by the United States we would use them in the United States. ISO generally calls out tests that are acceptable to all the countries involved.

Mrs. Mascarinas

We in the Philippines cannot afford to take part in ISO meetings. Nevertheless, we try to use ISO standards. In all cases we consider their specific applicability to our conditions and needs.

Mr. Johnson

ANSI has put together a standards conference for the countries in the Pacific area (PASC) which includes the Philippines, so there will be an opportunity for you to have a voice in ISO work. I know that your standards are based on ISO.

Dr. Goldman

It is my belief that the purpose of international standards is to facilitate international trade. When one country buys a product from another, it knows the characteristics to which the product should conform. It is very important for a developing country to have an input into the process of developing standards and to appreciate its value, because their products can then conform to acceptable standards and their trade will be enhanced.

Mr. Norwick

We in the United States also have problems attending ISO meetings due to the lack of funds. For example, we will not be able to attend a carpet meeting in Ghent largely for this reason. In my experience the technology interchange is an extremely valuable part of the standards writing process.

Mr. Pineda

ISO could help by having more meetings in the United States, thus facilitating participation by the Latin American countries.

Mr. Johnson

That is correct and ISO is leaning in the direction of holding more meetings in the United States.

Paper 2.3 - The Mechanism for the Development and Use of Standards to Transfer Technology and Develop Business

Dr. Leon Podolsky
President
U.S National Committee of the International
Electrotechnical Commission
New York, New York

At any given point in time, the state of the art in any technological field can be quickly gauged by the content of the national and international standards that exist or are being developed for that field. It is no accident that in practically all of the industrially developed countries of the world, both western and eastern, free enterprise and socialist alike, there are strong national standards organizations. Through participation in the activities of these standards organizations, the scientists, engineers, and businessmen of these countries keep continuously abreast of the art in their fields of interest.

Why is this so? First, a product standard is, in essence, primarily a document to facilitate commerce by bringing about a common understanding and agreement between buyer and seller. A standard can, therefore, be a powerful marketing tool. A safety or environmental standard, an agricultural standard, or a procedural standard for business or civic activity, all of which may result in legislative action or governmental enforcement, are after all, only means of expressing the common agreement of the most informed persons on what it is practical to impose in the way of limits in the light of existing knowledge. It follows, therefore, that the easiest way to come quickly abreast of the state of the art in any field is to first study the existing and in process standards for that field, both national and international.

Secondly, the well established mechanisms for the development of consensus standards in national, and particularly international, standards-making bodies are such as to expose for discussion technical proposals that represent the best state of the art of interest to trade. Direct participation in the standards-making bodies, therefore, provides the opportunity to listen, to receive the documentation, to meet and question the experts, and to obtain firsthand the scientific and technical rationale for their proposals. No other mechanism can produce more directly practical transfer of technical knowledge at such low cost.

Anyone wishing to buy or sell any commodity, or to develop a market for a product, or to obtain the information on which to establish trading rules, if he is to be efficient and successful, must pay first attention to the existing standards which he must meet. To fail to conform to such standards is to confront a closed door to trade opportunities. Where no standards exist, the opportunity is even greater for accumulating knowledge of a field, a material, or a technology by introducing proposals for standardization in the proper organizations, and participating in their development. The nation or organization which can convince the standards-making body to include the properties or parameters of its material or product in a standard immediately lessens any sales resistance to its material or product, and opens the doors to its offered goods, for it can at once say that its articles meet the established standards.

Any effective standard, whether national or international, contains in some fashion the following basic elements: definitions and terminology; product description; acceptable performance criteria (sometimes in classes or grades); and test methods and procedures. Also, increasingly in recent years, requirements for quality assurance including sampling plans, AQL and reliability limits, and safety criteria are called for, especially on high technology manufactured goods.

In order to be fully responsive to the needs of his customer, a supplier in today's competitive world must thoroughly understand and utilize standards as a means of communication and agreement with the customer. To be able to influence the content of a standard with regard to any of the aforementioned parameters is to control and preserve the opportunity to compete, and to fail to do so is to allow the competition to make trade difficult in subtle and overt ways. A non-understood terminology, dimensions or tolerances only slightly different, performance criteria only slightly more or less rigorous, or non-standard test methods and procedures, can make any product or home technology non-transferable or non-acceptable in a foreign market.

In order to illustrate how the international standardization process operates to educate and facilitate the transfer of technology, let us examine the structure and procedures of the IEC, and the U.S. National Committee of the IEC. In this examination we will see how these structures and procedures serve to inform all nations, large and small, developed and underdeveloped, large business organizations and small ones, on the current state of technology in a field and what level of technology is needed to participate and compete effectively in the marketplace.

The IEC is a 73 year old organization of, presently, 42 participating nations, each of which is required to have a national committee for its participation. The ruling bodies of the IEC are its Council in

which all nations have an equal vote, and its elected Committee of Action, which controls the work of its technical committees.

The IEC has some 186 technical committees and sub-committees, each dealing with a specialized subject. These subjects cover the whole field of electrical and electronics technology as to definitions and terminology, test methods and procedures, materials, component parts, apparatus, systems, and electro-magnetic compatibility. They cover such simple devices as resistors, and the most sophisticated scientific technology of semi-conductors and fiber optics.

For each technical committee there is an official international Secretariat, entrusted by the IEC Committee of Action to the national committee of a specific country. The work of all the Secretariats, and of all the technical committees, is subject to the control of the Committee of Action and is coordinated by the IEC Central Office in Geneva. Any member nation is entitled to, and welcome to, participation in every technical committee and subcommittee, and receives all of the standards proposals, technical documents, and minutes of the technical committees. The IEC technical committees generally meet formally every 12 to 18 months, but the technical work proceeds continuously in working groups and by mail document circulation.

According to a recently adopted IEC policy, new work in a technical committee is only undertaken if it is shown to be of importance to international trade by the voted request of at least three participating nations in a technical committee. When this occurs, the Secretariat invites the technical experts of the participating countries to submit proposed standards on the subject matter, or other technical documentation from which a proposal can be drafted. From these a Secretariat draft standard is prepared and circulated to all national committees, with comments invited. At the next meeting of the committee, the draft and all submitted comments are discussed by the technical expert delegates from the participating countries.

This is a highly educational process, for at once the general state of the art is revealed, and the latest technology on all subject matter is usually discussed and put forward for inclusion in the proposed standard. At this point an underdeveloped nation, or a developed one, can quickly learn what it must have or do to be effective in competing in the marketplace for the material, article, or system being standardized.

Following discussion of the Secretariat draft, which may take place in several successive meetings, a six-months' trial document is produced by the Secretariat which includes all the technical agreements reached in the plenary meetings. National committees comment and vote on the contents and acceptability of the six-months' trial document as a standard for use in their countries. Again, the results of this six-

months' procedure are considered and discussed in a committee meeting, and if necessary, a following two-months' procedure document is processed with final changes. When this document has been voted on and accepted by 80% of the participating nations in the committee, the document is printed and published as an IEC international standard.

The committee meetings, the circulation of the various national comments, the discussion of the technical content, and the personal contacts with the technical experts of the respective countries, are the most rapid and effective way to acquire knowledge of the technology and state of the art on any of the subjects.

The U.S. National Committee of the IEC, which helped found the IEC in 1904 and has participated continuously since, is now a formally integrated body of the American National Standards Institute, (ANSI). It is organized as elected officers, a fifteen member elected Executive Committee, and 172 elected technical advisers. Each technical adviser is the chairman of a technical advisory group of experts acting for one of the IEC technical committees or sub-committees in which the United States participates. Membership in the technical advisory groups is open to any technically qualified person who has an interest and wishes to participate. These advisory group members, and the technical advisers, come from large businesses and many small ones, from agencies of government, colleges and universities, trade associations, professional societies, and knowledgeable individuals. They now total approximately 4,000 persons in the 172 groups.

By this mechanism, the current state of the art in the world on any of the technical subjects is disseminated nationwide to anyone having an interest, even to the smallest enterprise. By participation of experts from many branches of government, information is supplied to and received from agencies which have control of or propose legislative action on subject matter of general national interest such as radiological safety or occupational hazards.

Representatives of small businesses keep themselves abreast of the latest technology of even the corporate giants in their field through their participation.

As can be seen from the foregoing, I believe, from 45 years of industry and professional experience, and almost as many years in national and international standards work, that any business enterprise and any nation can profit, obtain technology, and immensely improve its ability to compete in the world's business by full and effective participation in standards development. To do so requires only a modest investment in qualified manpower and annual financial outlay, and the rewards are great.

The national underwriting of even a few standards internships in the proper organizations can lead to the development of whole new industries, or greater acceptance of indigenous products, for developing nations. The U.S. Department of State could well make it a direct program of bilateral discussion and assistance to many friendly developing nations which can profit from such a program. There are several major U.S. organizations such as ANSI, ASTM, ASME, etc., which can directly assist in a U.S. Department of State program for training in developmental work with the standards organizations of less developed countries, and for participation in international standards bodies that promote membership by less developed countries such as ISO and IEC.

In closing, it is well to point out that the history of the USNC/IEC is replete with examples of small or modest sized companies that have learned from and profited immensely in the development of substantial overseas trade through their participation in our work. The history of the IEC has several examples of nations that have acquired the technological standards for the establishment and guidance of domestic industries through their participation.

If we are to seriously consider the trade benefits that will accrue from the promotion of the well-being of less developed countries, the U.S. State Department should begin now to incorporate the technology of the international (bilateral) use of standards in the Department of State attache training programs.

Discussion

Mr. Herman

A review of patent literature can bring important benefits. If one surveys patent literature it is possible to find out what creative people were thinking. This can be a great educational experience. In the printing industry, for example, a survey of patents showed how the industry progressed from mechanics to electrochemistry and electromagnetics. It also became clear that the traditional companies in the printing industry were not doing the right kind of research for the future. Outside companies were developing processes that would profoundly affect the way the printing industry would develop.

Professor Steinberg

I fully agree with Dr. Podolsky as to the importance of the IEC. Argentina has participated in the IEC from its inception. Mr. George Newbery, an Argentine-born engineer, was a pioneer in this field. We will continue our association with the IEC in a modest way and we benefit from participation in some working groups.

Mrs. Djaprie

Indonesia is also a member of ISO and IEC. We use IEC standards, but regret that some important standards have not yet been promulgated. I hope IEC will take into account the needs of LDC's.

Dr. Podolsky

Until very recently developing countries have not participated in IEC. No one has been there to ask for particular standards such as for rural electrification. The United States has codified its standards for rural electrification and I am sure that its delegate to the IEC would be glad to make the entire book available if asked by IEC in response to LDC interests. In that way the relevant technology could be quickly transferred. This will not happen unless a delegate from a developing country requests the technical material of interest to his country. As a member of the Council of the IEC, I would be pleased to support requests by developing country delegates for technical standards and ancillary material that they might find useful.

Mr. Abulyosr

I would like to ask about a committee on industrial and electrical meters. Is this a committee of IEC or OIML?

Dr. Podolsky

IEC has a long standing committee on standards for measuring instruments and well developed standards for electrical measurement.

Mr. Andrus

OIML is involved with the legal application of standards in national laws and it does use IEC and ISO standards as a basis for the development of model laws and regulations.

Mr. Pineda

The key question here is how to facilitate developing country participation in ISO and IEC. I would propose that the Department of Commerce look into ways of sponsoring such participation and extending financial assistance for this purpose. The United Nations should also consider this question.

Eng. Estrada

We need to achieve a competent level in science and technology to participate in ISO and IEC. Without that, participation is not practical or effective. Also one needs both experience and an economic interest. Economic interest is perhaps the key factor in such participation. Careful planning for participation is also very important.

Mr. Herman

Do you have a shortage of technical people?

Eng. Estrada

That is an interesting question. In some cases we have very good people with adequate technical and scientific knowledge--from universities, for example. However, without commercial experience also and familiarity with production problems, participation in technical committees is not useful. Standardization is basically a practical matter, not a scientific problem.

Dr. Podolsky

I agree with Eng. Estrada that standards must be prepared by competent people who have an understanding of the needs of the business community and the nation. I said earlier that a product standards is a document that facilitates commerce. No country should send its scientific personnel to meetings of standards committees purely for social purposes. Developing countries with scarce financial resources should base their participation on economic need, international trade,

production, and development of domestic standards for specific purposes, etc.

Dr. Kahn

We are not interested in all ISO meetings. Meetings of ISO in Bangladesh would be most welcome and beneficial to us.

I would like to cite an example. When I was in Pakistan, a large order of pig iron was imported from Moscow, but the specifications were not included and the iron received could not be used. There is no doubt in our minds as to the benefit of standards. A standard is also a guideline for national production.

Mr. Shapiro

Scientific input is clearly needed in addition to the contributions of people with commercial experience. When test methods are needed in connection with validation of a standard, lack of scientific knowledge could lead to a worthless test method. The use of outdated or absolute test methods simply increases the economic cost of a product. So both scientific and commercial expertise is essential in standards making.

Dr. Podolsky

I agree that scientific expertise is required since a great deal of standards making requires absolute precision for measurement and testing. Developing country representatives can learn a great deal about what to buy and what to sell by participating in the international standards making process.

Mr. Simpson

I have participated in discussions of standards issues in the ECE and OECD and recently as head of a U.S. delegation to GATT in which efforts are being made to develop a code of conduct for international standards, so that standards will facilitate rather than hinder trade. I have also participated in ISO and IEC but I doubt that I have heard anything new in the last five years. There is much discussion in these organizations of the benefits and rewards of participation. I am not at all sure that anyone really uses ISO and IEC standards. About eight years ago a study made for ISO by the German standards organization examined international usage of ISO standards. If they were used more than occasionally they were counted as useful. Under that definition the study found that less than 15% of ISO standards were actually used. A recent Japanese study of standards relating to a good cross section of Japan's import-export trade ranked the applicable standards used roughly as follows: first, ASTM; second,

DIN; third, ANSI; Japan about fifth, and ISO was seventh or eighth. I really do not know who uses these "documents."

Dr. Podolsky

I must take issue with my good friend Dick Simpson. I do not think that it is correct to say that ISO and IEC standards are not used around the world. Please bear in mind that until about two years ago, IEC "standards" were called "recommendations." What they attempt to do is establish the "state of the art" for national committees to the IEC on which national standards could be based. If you look at the national standards of any major country and compare them with IEC standards, you will find that perhaps as much as 65% of national standards are based on IEC. At present under legal requirements, a number of European countries, such as Holland, Germany, Denmark, and France, give legal effect to IEC standards when they vote for them. The situation is changing rapidly and IEC standards which essentially establish agreed levels of technology are being used more widely as a basis for national standards.

Mr. Simpson

I like to debate with Leon Podolsky and I recognize his observations.

Mrs. Mascarinas

In the Philippines, standards committees have representatives from all interested parties.

Mr. Pineda

Chile does use ISO and IEC standards as guidance in the formulation of Chilean standards. One useful action taken by Chile which we might adopt in the United States, is to list the major standards which have been consulted in preparing their national standards.

Eng. Estrada

In my own experience, I have observed that some representatives of consumer interests do not have sufficient scientific and technical background and knowledge to participate in the writing of standards. Our policy is to give all relevant sectors an opportunity to participate in standards writing but the finished standard tends to represent the interests of the producers. It is not possible to separate the standard from the method of measurement. A specification without a method of analysis is meaningless, and the converse is also true. In many cases, the definition of the standard is not scientific but practical as it relates to commerce. The standard should indeed be practical.

Mr. Shapiro

Definitions ensure agreement between buyer and seller. Standards are procuring instruments. When the buyer procures against a standard, he wants to be certain that he is getting what he is asking for. Definitions must thus be expressed very carefully.

Mr. Gikandi

Why is participation in IEC standards developing committees strictly limited to representatives of full member countries?

Dr. Podolsky

Let me clarify in response to your question. In order to have a vote, either in an IEC Committee or the IEC Council, you must be a member. The IEC would, of course, welcome observers from developing countries. I cannot conceive of a situation where a developing country would be refused if it asked to send an observer to an IEC meeting.

Mr. Peiser

I appreciate Dr. Podolsky's clarification. Attendance at IEC meetings is a very good way to be introduced to the standards development system. In our various NBS/AID surveys I have emphasized the points made by Dr. Podolsky. It is the very openness of the system which makes the technology inherent in the standard readily accessible. It might be useful for members of IEC technical committees to give lectures in LDC's on their views of how work of a specific technical committee proceeded and what the value may be to developing countries. This could perhaps be done under an experimental AID program.

Dr. Podolsky

Mr. Peiser has made a very valuable suggestion. Any developing country wishing to send an observer to an IEC meeting should address its request to the IEC Central Office. Please send me a copy and I can assure you that I will see that you receive an invitation to attend.

Dr. Pikus

Mr. Simpson has said that ISO might be strengthened in some way. Would he care to indicate how that might be done?

Mr. Simpson

I have a personal suggestion. When I was in the GATT standards negotiations, we were urging about 70 participating countries to take part in international standards making activities. We wanted to reach

an accord by which we would urge the use in our own country of a standard to which we had agreed. We noted that IEC and ISO were the primary international standards making bodies. We looked at the level of use of standards and their number and concluded that there needed to be a great acceleration in development of useful standards from these two bodies. I think IEC and ISO might adopt an alternative method of arriving at an international standard. Both bodies now use the "consensus" method of adopting standards, as we do in the U.S. standard. There is another method which ISO and IEC could adopt, i.e., the "canvass" approach. If ISO and IEC took existing standards in use anywhere in the world and submitted them to countries for recognition through an agreed balloting method, then I think the number and use of international standards could be accelerated. My personal opinion is that, if the GATT standards code achieves recognition, ISO and IEC must take some action along these lines or go out of business.

Mr. Pineda

COPANT was continually being told that it was desirable to use ISO standards. In discussing ways in which the Latin American countries could participate more fully in ISO and IEC, it was said that the fee structure of these organizations was too high, in some cases exceeding the budgets of the national standards institutes. If greater use of ISO and IEC standards is desirable, a way must be found for all countries to participate and have a vote.

Paper 2.4 - Measurement Science in the United States

Dr. A. O. McCoubrey
Director
Institute for Basic Standards
National Bureau of Standards

Good afternoon. It is my pleasure to represent Dr. Ambler at this time on the final afternoon of your eighteen-day visit to the United States. I'm sure that you have many impressions from your extensive travel in our country, and I hope that your experiences will increase the possibilities for cooperation and collaboration between our countries in the future.

My topic this afternoon is measurement science in the United States. This is, of course, an extensive topic, and I can only try to point out some of the more general features. With this in mind, I will:

- first outline the history of the need for measurement standards in the United States;
- I would like to indicate some of the factors which affect the climate of opportunities for measurement science in the United States;
- I will next describe a few examples of modern advances in measurement science;
- finally, I want to talk about some of the outstanding issues as we approach the end of the twentieth century.

Measurement science is often perceived to be an uninspiring science with most of the important problems solved and few connections with the advancing frontiers of knowledge. This is certainly not the case in the United States, and I hope that I can leave you with the impression that challenging opportunities are increasing even more rapidly than ever before.

Historical Need for Measurement in the United States

The need for accurate measurements as a basis for the exchange of goods in international commerce was present in the earliest years of this nation at the close of the eighteenth century. This need was critical in connection with foreign trade and, therefore, the officials in the customs houses located in the largest shipping ports of the nation were most concerned. To meet these basic needs, a small

Office of Weights and Measures was established in 1836 as a part of the United States Coast and Geodetic Survey.

By 1875, the importance of international coordination of measurement standards had become widely recognized and the United States joined with 16 other nations in signing the Treaty of the Meter and organizing the International Bureau of Weights and Measures. At about this time, some of the large industrial nations established major science based national standards institutions. However, another quarter of a century passed before the United States established a modern National Bureau of Standards in order to assure the use of the latest advances of science and technology to meet the needs of the rapidly expanding electrical industry, the machinery industries, and later on those industries engaged in mass production for growing levels of mass consumption of products such as automobiles. The original Office of Weights and Measures was combined with the National Bureau of Standards and the new agency became responsible for the national measurement standards required by modern industry as well as those required for commercial exchange of goods in domestic and international trade. You have met with Mr. Wollin, Chief of the Office of Weights and Measures. His office continues to be a very important component of the National Bureau of Standards.

During the past 76 years, the National Bureau of Standards has maintained a highly competent and respected scientific staff in order to assure the application of modern scientific advances to measurements. These applications have continued to increase with the growth of our technology intensive economy. You are well aware, I am sure, that some of our most urgent national problems now involve the impacts of the use of technology upon the environment and public safety. As you would expect, therefore, some of our most important needs for new measurement science are dominated by these problems. Thus, today we find that in the United States we must continue to encourage the development of measurement science, not only to meet the needs of commerce and industry, but also to meet increasing needs related to government regulations which protect the environment and safety. In this connection, we need not only new and more advanced standards for measurement and methods of measurement, but we also need higher levels of measurement capability distributed throughout the nation in both the private and public sectors.

The Climate for Measurement Science in the United States

I want to say just a few words about the climate or the conditions for measurement science in the United States. I am sure that you will agree that there are many factors which influence the need for measurement science and the opportunities for productive work in this field. For example:

- As one of the most industrialized nations of the world, we experience all the driving forces which demand an increasing variety of measurements and increasing levels of accuracy and precision.

- Our system of business enterprise creates the conditions for industry to make major contributions to measurement science. In addition, these conditions lead to forces which demand high quality measurements at the lowest cost.

- The scientific research carried out in our widely distributed universities provides a major contribution to our measurement science.

- Our Federal Government agencies which have technology intensive responsibilities also make important contributions. Furthermore, they create demands for new kinds of measurement and new levels of accuracy, thereby stimulating the work of other institutions.

These factors are, of course, also present to varying degrees in other countries. However, they all play such a strong role here that I think it may be said that the climate for measurement science is unique in the United States.

While the National Bureau of Standards has a special responsibility to perform research in measurement science, it is important to emphasize that the advances in the United States involve essential contributions from all of our scientific institutions of our society. We have contributions from the public sector, including all of our government and our state universities' scientific laboratories, as well as contributions from the private sector which include industrial research laboratories and private universities. Indeed, many of the advances in measurement science which are made in the United States are built upon the basic scientific knowledge from laboratories throughout the world.

Some Examples of Recent Progress

During the past twenty-five years, there have been dramatic advances in measurement science which have made it possible to realize some of the basic units of measurement at higher levels of accuracy. Many of these advances have also made it possible to transfer these units from primary national measurement standards to secondary standards at the points where they are needed with increased precision and reduced cost. Our increasing knowledge of atomic and molecular physics leading to high resolution spectroscopy in the radio frequency spectrum and also leading to coherent laser radiation sources has made

some of these advances possible. Our increasing knowledge of the physics of superconductors has made others possible. I would like to mention briefly three examples.

1.) Unit of Time. As you know, the SI unit of time has been defined in terms of a particular resonance of Cs^{133} since the thirteenth General Conference of Weights and Measures in 1967. It is now possible to realize this unit with an accuracy of 13 significant figures in at least three of the principal national standards laboratories of the world and industrial instruments based upon cesium resonance make it possible to transfer the second and maintain it at remote locations with an accuracy of eleven or twelve significant figures. There are now many practical applications of this technology mainly in the field of navigation.

The basic research in radio frequency spectroscopy which led to a new basis for defining the unit of time was carried out in several U.S. universities in the early 1950's. As a matter of historical fact, the first cesium resonance controlled electronic oscillator was demonstrated in 1955 at MIT; one of the stops during the just completed workshop trip.

Research on the application of radio frequency spectroscopy to time metrology was first started at NBS in 1948, and it has been in progress since that time. Such research was also undertaken at an early date in NPL in England. United States industry began the development of commercial atomic frequency standards in the mid-1950's with the result that many cesium frequency standards used throughout the world today were manufactured by Hewlet-Packard, another stop on your tour.

Thus the present state of measurement science for the unit of time in the United States is the result of many contributions by a number of institutions.

2.) Laser Metrology. The development of the optical laser certainly constitutes one of the most remarkable advances in technology. It has, of course, resulted in a very wide range of applications which include the science of measurement.

The basic principles of lasers grew mainly out of the same university research in the United States, which resulted in the modern atomic time standards. These principles were published by Professors Townes and Schalow of Columbia University in 1958. I should mention also, that there were important theoretical contributions by scientists in other countries, including the U.S.S.R.

The practical development and demonstration of lasers was first carried out by United States industrial laboratories. In particular, the ruby solid crystal laser was invented by Maiman at the Hughes Aircraft Research Laboratories in 1959 and the He-Ne gas laser was invented by Javan at the Bell Telephone Laboratories in 1961. The He-Ne gas laser continues to be one of the most useful forms of this device even today.

The importance of lasers to measurement science, in particular the measurement of length, was recognized with the earliest discoveries and laser research has been in progress at NBS since that time. This research has resulted in the most accurate values for the wavelength of Kr^{86} radiation which defines the SI unit of length. It has also resulted in the development and refinement of He-Ne lasers stabilized by molecular resonances in methane or iodine. Such stabilized lasers are now very widely used as de-facto standards of length because they are much more convenient to operate than a Kr^{86} electrical discharge lamp and the highest levels of accuracy are readily achieved.

Continuing laser research at NBS has resulted in the determination of crystallographic lattice dimensions in terms of the SI base unit of length. This work has also been extended to the determination of X-ray wavelengths in terms of the SI units and there appears to be no fundamental limit to further advances toward the wavelengths of gamma rays.

Laser research has also resulted in new methods for the measurement of the largest distances with higher levels of precision. I'm sure that you have all heard about the laser measurements of the distance to the moon with the remarkable precision of about six centimeters. Perhaps there is immediate importance in the use of lasers to measure small strains over large areas of the earth's crust in connection with earthquake studies.

The NBS research leading to atomic time standards in combination with the laser research on improved length standards resulted in an additional important advance about six years ago at our Boulder Laboratories. This work involved the use of frequency multiplication techniques, well known to engineers at radio frequencies but entirely new at optical frequencies. It became possible to measure the frequency of optical radiation directly in terms of the SI unit of time derived from the cesium standard. With this result and optical wavelength determinations, it then became possible to obtain the most accurate value for the velocity of light. There is another way of looking at this important result. Since we believe that the velocity of light is a constant of nature, it is now possible, in principle, to realize the base units for length and time from the properties of a single atomic structure. If this can be done, this would contribute to the important goal of simplifying the International System of Base Units. Research in this direction is continuing in order to refine the techniques.

3.) Quantum Phenomena in Superconductors. I want to mention, briefly, one more example. In 1962 Brian Josephson working in Cambridge University in England predicted what is now universally know as the Josephson Effect, whereby the current-voltage characteristic of specially constructed superconducting junctions would contain discrete quantum voltage steps depending upon the frequency of applied electromagnetic radiation. Josephson, along with two experimental physicists, was awarded the Nobel Prize for his contribution to this work in 1973. The importance of the prediction to measurement science was immediately recognized as a means to define the electrical volt in terms of fundamental constants of nature.

The theoretical basis for Josephson's prediction was worked out at the University of Illinois a number of years earlier by another Nobel Prize winning team. Josephson's research seemed to explain certain effects in superconductors which had been observed earlier. Further experimental work was quickly carried out in university and industry laboratories of the United States. The precision measurements which define the electrical volt in terms of the charge on the electron and planks constant were carried out at the University of Pennsylvania. One of these scientists subsequently came to NBS and developed our present National Volt

Standard. He is now the leader of our research in electrical measurement science. Research in superconductors is also continuing and it has resulted in additional advances which time does not permit me to describe. I am convinced that the contributions to measurement science, in this area, have only just begun to emerge. We can also expect industry-produced instruments based upon the Josephson effect, which will make it possible at modest cost to transfer the volt to remote locations with levels of precision and reliability far exceeding what is now possible on the basis of traditional standard cells.

The Future

Before I finish my talk this afternoon, I want to say a few words about the future of measurement science in the United States.

It will continue to be important, of course, to carry out basic research toward one of the ultimate goals of measurement science--that of basing our international system of measurements upon easily accessible constants of nature relating to the structure of molecules, atoms, and perhaps sub-atomic particles. Much progress in this direction has been made during the past quarter of a century and much promise lies ahead for the next quarter of a century.

However, I feel that there is now a very great additional challenge for measurement science to focus more sharply on the needs for complex measurements at higher levels of quality throughout our technology intensive economy. In other words, our ability to transfer the units of measurement to the points of need must improve. We require an advancing basis for measurement traceability including measurement assurance programs which Dr. Belanger described for you last week. I would like to mention a few examples of the advanced needs which are most evident to us.

- In industry and the practical sciences, there is an increasing number of measurements made at very high speeds under the automatic control of computers. We need to develop the capability to trace such high speed measurements reliably to national measurement standards.

  We also must meet industrial needs for measurements of very small structures. We are just now beginning to provide standards and methods for the measurement of dimensions at the level of a few micrometers which are common in the electronic integrated circuit industry. We can expect in the future to encounter industrial production of structures in the sub-micron region, having dimensions 1/100 of those in common use today.

° In agriculture, there is an increasing realization that accurate and uniform physical and chemical measurements are necessary. In this connection, the factors which affect climate are particularly important and there is a growing need for long term monitoring of solar radiation reaching the earth's surface. Levels of accuracy and precision at least ten times greater than those now possible are needed in the field.

It is widely known that the uncontrolled use of substances such as fluorocarbon gases may result in the inadvertent modification of the atmosphere. It is not so widely known that the use of nitrogen rich chemical fertilizers may lead to similar results. This is a matter of increasing concern.

° In the fields of health and safety, there are important needs for more reliable measurements. This is particularly true in the clinical environment. It is also true in the occupational environment where increasing levels of various forms of radiation create hazards.

° In the case of energy, the intensive development programs create a wide range of new measurement needs. One particularly critical need involves nuclear safeguards and the requirement for accountability for nuclear fuel materials.

° In the case of the environment, we also have a wide range of needs as you know. These problems include the measurement of increasing numbers of trace pollutants in the atmosphere and in our water sources. They also include better methods for the measurement of noise.

Conclusion

In concluding my remarks, I hope that I have been able to give you the impression that measurement science in the United States grows out of the contributions of all of our scientific and technical institutions, as well as many of those in other countries. It comes to a sharp focus here at NBS. I hope that you will also appreciate that our measurement science, an applied science, is advancing close to the frontiers of knowledge. It is an exciting science which has produced many very practical fruits in the past and which contains abundant opportunities for the future.

Discussion

Mr. Herman

An example of Dr. McCoubrey's measurement science applied to practical problems is the use of lasers for accurately levelling agricultural fields to save water otherwise lost by run-off in arid regions.

Dr. Ammar

Is there an industrial need for length measurements to an accuracy of 1 in 10^{11}?

Dr. McCoubrey

This need is more apparent in the field of geophysics. It may, for instance, be one of the ways in which we can map the motion of the big tectonic plates.

Dr. Oser

In positioning of air traffic this type of accuracy is needed with the use of certain satellite systems.

Mr. Herman

Theoretically this accuracy is available but its exploitation may yet be ten years away.

Dr. McCoubrey

I am glad this was brought up as I should have mentioned this application. There are, in fact, some low frequency ground stations where this kind of accuracy is commonly achieved.

Paper 2.5 - Standardization as a Tool for Science and Technology Transfer in Support of Industrial Development

Dr. Mahmoud Salama
Secretary General
Arab Organization for Standardization and Metrology
Chairman, Development Committee of the International
Standards Organization, Geneva

Preface

Six years ago, in February 1971, I had the honor to participate in the seminar held at Airlie House, Warrenton, Virginia, which was organized by the Agency for International Development and the National Bureau of Standards with the cooperation of the National Academy of Sciences and the National Academy of Engineering.

Since that time I was anxious to hear about any progress in the materialization of the important recommendations and conclusions arrived at during the eight sessions of that seminar. I was really pleased and gratified when my friend, Mr. Peiser, kindly conveyed to me, during his short visit to Cairo last June, an invitation to meet again my friends in the NBS and to participate in this important NBS/ANSI/ASTM/AID Seminar which, as I understood, is dedicated for assessment of the follow-up action concerning the outcome of the Airlie House Seminar and also for exchange of views about the role of standardization in science and technology transfer, a subject which is receiving today an increasing worldwide attention.

After my fruitful discussions with Mr. Peiser, I went to Geneva to attend the thirteenth session of the ISO Development Committee, (DEVCO), and was asked, as Chairman of the Committee to introduce a letter addressed to the ISO Secretary General by the Secretary General of the "United Nations Conference on Science and Technology for Development," to be held in 1979. The Secretary General of the Conference was of the opinion that the contribution of ISO and its member standardization bodies could be significant at various levels:

- First, and most important, at the national level through the participation in the preparatory process of any bodies of individuals adhering to ISO in a given country.

- Secondly, at the regional level, by following closely the work to be undertaken by regional commissions and organizations.

- Thirdly, at the global level, by making available to the conference secretariat background papers to be taken into

consideration for the preparation of the working documents on any of the subject items on the conference agenda.

° Finally, by submitting to the conference secretariat candidatures of suitable experts to advise countries in the preparation of national papers.

DEVCO members, being aware of the effective contribution which standardization can make to the establishment and widening of the scientific and the technological base as well as to the support of the "U.N. World Plan of Action for the Application of Science and Technology for Development," emphasized the necessity of projecting standardization as one of the major vectors for a sound scientific and technological growth. In the course of discussions, DEVCO members reviewed extracts of the conference agenda which read as follows:

" 1.) Science and technology for development:

a. The choice and transfer of technology for development.

b. Elimination of obstacles to the better utilization of knowledge and capabilities in science and technology for the development of all countries, particularly for their use in developing countries.

c. Methods of integrating science and technology in economic and social development.

d. New science and technology for overcoming obstacles to development.

" 2.) Institutional arrangements and new forms of international cooperation in the application of science and technology:

a. Building up and expanding institutional systems in developing countries for science and technology.

b. Research and development in the industrialized countries in problems of importance to developing countries.

c. Mechanisms for exchange of scientific and technological information and experiences significant to developments.

d. Strengthening of international cooperation among all countries and the design of concrete new forms of international cooperation in the fields of science and technology for development.

e. Promotion of cooperation among developing countries and role of developed countries in such cooperation.

" 3.) Utilization of the existing United Nations system and other international organizations to implement the above goals in a coordinated and integrated manner."

The above mentioned review indicated clearly that both the preparatory process of the conference and the agenda did not take "standardization" into consideration in spite of the fact that the significance of the various items on the agenda emphasized the necessity of its inclusion among the topics to be discussed by the conference. This was reflected in the following DEVCO resolution No. 7/1977:

"DEVCO, considering that standardization,

° contributes to the elimination of technical barriers to trade and development, and the strengthening of international cooperation

° is a means of transfer of technology which contributes to the technological development of countries, mindful of the ISO contribution to the exchange of scientific and technical information

° invites the Secretary-General of ISO to reply favorably to the proposal put forward by the Secretary-General of the U.N. Conference on Science and Technology for Development, for active participation in the collaboration of the agenda and papers and to recommend the U.N. Conference on Science and Technology to include standardization in the agenda of the Conference, and also requests the Central Secretariat to recommend ISO member bodies to contact their national competent authorities to propose appropriate collaboration in the preparation of the national papers to be submitted to the Conference."

It is my pleasure to say that this NBS/ANSI/ASTM/AID Seminar, which was scheduled early before the date of the above mentioned DEVCO resolution, indicates that the concerned standardization and governmental bodies in the United States are positively convinced that serious efforts should be made to ensure that the effective role of standardization in assisting science and technology transfer would be clearly defined and thoroughly discussed in the forthcoming U.N. Conference.

It is hoped that similar well-studied and harmonized steps would be taken in other countries for the support of such important issues.

Patented Technology:

In the Arab region, an initial step in that direction was taken during last March, when the IDCAS/UNIDO/WIPO Seminar on the transfer of technology to the Arab Countries was held in Baghdad. The Arab Organization for Standardization and Metrology (ASMO) indicated in its paper to that Baghdad Seminar that Arab Countries, as other developing countries, seek the acquisition of advanced technology to support both their efforts and investments which are mobilized for the acceleration of their economic and social development. They usually acquire composite technology, the scope and nature of which demand a wider approach than that of direct transfer of patented or unpatented know-how in order to meet the various technical requirements for the establishment and operation of industrial enterprises.

As for the patented know-how, our experience showed that both the acquisition and use of technology are heavily influenced by the operation of the international patent system, which confers rights of ownership and control of technology on the patent holder, often one of the large transnational corporations. The vast majority of patents registered in our countries and other developing countries relate to technological processes owned by foreign enterprises in industrialized countries. Only a small proportion of such patents is, however, in actual use, most having been registered in order to protect the trading position of the transnational corporation owning the rights to the technology concerned. Where new technology is acquired by means of a licensing agreement, or by foreign investment involving the use of patents, high charges for royalties and technical services are often made, while various forms of restrictive practices normally characterize the operation, imposing heavy indirect cost on the technology importing country.

A revision of the existing patent system, in order that patent laws and practices should complement and strengthen other measures for accelerating the economic and social progress of the developing countries should form an essential element of a strategy for both industrialization and technology transfer.

Appropriate action should be taken to establish national and international systems that will reflect the special need of the developing countries to acquire suitable foreign technology on reasonable terms and also to develop their own scientific and technological capabilities to the fullest extent possible.

Such need for international action to assist the transfer of adequate technology on fair and reasonable terms and conditions has been fully recognized by the United Nations. A big step forward in this connection is being taken within UNCTAD for the formulation of an

international code of conduct for the transfer of technology which would take adequate account of the needs, and the particular circumstances, of the developing countries. The case for such an international approach is strengthened by the fact that countries, both developed and developing, have differing national laws, regulations and procedures relating to technology transfer. Hence the need for integrating the various approaches in an agreed international framework or code of conduct which would not only avoid conflicting regulatory action, but also accelerate the transfer of technology in an orderly manner.

Choice of Technology:

The past experience of developing countries in importing technology in the form of processes, equipment and know-how for the personnel who will operate them, has shown that the in-flow of technology has been an integral part of direct foreign investment. Thus, many developing countries became increasingly concerned about the cost and consequences of such investment, not only in terms of out-flow of profits and dividends, but also in the form of royalties, know-how fees and payments for imported equipment and components.

It should be mentioned also that the problem of the choice of technology does not lend itself to easy solution. The choice is dependent on two factors: technological and economic. To evaluate the technological factor, several alternative designs employing different processes will have to be worked out in detail which would involve accurate information on costs and specifications of machinery and equipment, materials and labor. This type of information is difficult to come by since channels of communication in the technological field are varied and full of obstacles. Therefore, there is a large degree of uncertainty involved in the choice.

The second factor is the economic appraisal of different technological alternatives. The choice may depend on the economic criteria which are given priority in a country, such as large employment generated per unit capital, or lowest capital cost per unit of output, or lowest foreign exchange utilization. One or more of these factors may have to be taken into consideration and choice may be easier if the experience of other developing countries of the technology become available when such information is not available, it leads, in many cases, to a choice made on offers of machinery through salesmen, who are more interested in selling the most costly and sophisticated equipment than in the economic interests of the country. In many cases the offers of machinery and technology are for production levels very much higher than the domestic technological capabilities and the low market needs of the country.

That is why we find that some developing countries prefer to orient the flow of foreign technology through various forms of licensing arrangements, with or without capital participation, while others

encourage joint ventures by contractual arrangement comprising foreign investment and foreign technical know-how.

This, of course, requires a reasonable degree of development in the receiving country and that consideration is taken to benefit from the transfer of technology in developing the capability of technology self-generation in order to realize successful results in the long range.

Standardization and Technology Problems:

As the industrial and technological basis widens in a developing economy and extends to an increasingly diversified range of manufacturing activities, the requirements for technical processes become more intricate and the neccessity for accurate measurements and implementation of appropriate standards increases. Such standardization needs become more pronounced with both the development of multilateral, regional or sub-regional cooperation and integration policies, and with the increase of export-oriented products manufacture. Then, with further progress of industrialization, there arise several problems related to standardization. In some cases the existing industries and workshops which are supposed to furnish parts and services to the new industries do not apply any recognized standardization either in types, specifications, preferred numbers, level of quality or tolerances. To overcome such problems of components and parts, the new industries try, within the general policy and economic relations of the country, to seek the help of other countries where the standards may not be compatible, and thus the situation becomes worse. In other cases where national standardization has started, and the country has political and economic freedom to procure its requirements from any country or manufacturer, there appears the difficulty of selection from the world markets, owing to the diversity of specifications, the non-implementation of the international standards, and the lack of an international certification system or international standards conformity guide which can assist in the selection.

Our experience, in the Arab region has shown that national scientific and standardization activities are unable individually, to solve these and other related problems owing to the limitations in the available scientific and technical capabilities and activities.

It is for this reason and some other economic reasons that our Arab Countries tried to solve such problems by initiating regional cooperation in science and education as well as in standardization and related activities.

Taking into consideration that standardization is instrumental in technology propagation, it was foreseen when the Arab Organization for Standardization and Metrology (ASMO) was created in 1968, as a specialized agency of the League of Arab States, that in addition to

its main objectives for developing, harmonizing and integrating the national standardization and metrology activities and services in the area, it would bridge and interlink, wherever possible, such activities with those of the corresponding international organizations in order to accelerate the flow of technology, to the region. This is usually realized in two ways: receipt of technology during the course of preparation of standards and transfer of technology through the use and implementation of the adopted standards. It is obvious that during the formulation of standards at international or regional level, technology is received from the various member countries, and at national level from the experts in that particular country handling the technical secretariat. When an international standard is published, there is a chain of transfer of technology from international to regional level, from regional to national level, from national to industry level and from industry to company level arising from the use and implementation of the international standards.

This technological objective of ASMO was encouraged by UNIDO under a Frame Agreement for cooperation which was signed in 1970, also by UNCTAD and by the international standardization bodies: ISO, IEC, OIML, and Codex Alimentarius.

They cooperate actively with ASMO and have granted it the right to translate their standards into the Arabic Language.

Accordingly, it was possible for ASMO to adopt and publish in Arabic a number of international standards which constitutes about 65% of the 365 already approved ASMO standards.

It was expected that this role of ASMO would assist the acceleration of the transfer to the Arab region of the technology incorporated in the internationally approved standards and would effectively help its member Arab States to solve a significant part of the technical problems facing their economic and industrial development, But, unfortunately this was not fully realized. Our countries, like many other developing countries, are faced with serious problems and complexities in the world markets of technology and equipment as a result of the absence of an international advisory system or body which can easily render neutral advice to assist in the selection of the suitable process technology and the appropriate internationally standardized equipment and material.

It may be said that some experienced consultation bodies of the industrialized countries have proved to be helpful in assisting developing countries to overcome their technical difficulties, but the experience of many developing countries has shown that there are some consultation bodies which do not take into consideration the actual local requirements and capabilities as well as the prevailing climactic, social and economic conditions. Some of these consultation bodies often prefer to supply their pre-packaged or home-tailored technology without any adaptation.

Therefore, many developing countries have tried to draw the attention of ISO, IEC and other international standardization bodies as well as the specialized U.N. agencies, to the importance of the promotion and development of a world-wide system for the implementation of international standards, and the need to orient the main international standardization activities to meet the urgent technical requirements of the developing countries.

It should be also noted that in developing economies where everything industrial has to be started almost from scratch, the inter-linkage between research and standardization activities would be emphasized. In order to be effective, research and standardization should proceed together in parallel with the plarned development in all sectors. Wherever possible, it would even be better if both of them could remain somewhat ahead of the projected development targets. The standards thus formulated could be revised when necessitated by changes in the technology trend so that a uniform quality associated with reliability and adaptability to the conditions prevailing in the country commensurate with inter-changeability becomes a part of the process.

Scientific Infrastructure:

Accordingly, Arab Countries as many other developing countries endeavor to support their economic development and industrialization programs by the creation of scientific infrastructure through the establishment of research and standardization institutions which would draw the specific knowledge from developed countries, make such adaptations as are necessary for local conditions and circumstances, carry out research into raw materials and processes to develop new uses of indigenous materials and new products, disseminate the imported and created know-how to industrialists and enterpreneurs and offer direct technical services towards obtaining more efficient operation and management of both new and existing ventures. It was rightly argued that these functions and services are essential if industrial development is to be accelerated at the rate desired and hoped for in the respective developed country. In order to achieve these objectives, a research and/or standardization institute would require a staff of scientists of high academic background in physical sciences and engineering besides extensive and varied experience in industrial technologies, costly equipment and other facilities.

Developing countries, however, faced with acute shortage of appropriate scientific capabilities seek the assistance of developed countries and various specialized agencies. In most cases they receive standardization and metrology experts and equipment, but there remains the lack or inadequacy of qualified and trained local manpower, capable for implementation activities and for tackling the immense and diverse problems which usually face development.

This shortage exists not only at the top or higher echelons of science, technology and technical administration, i.e., scientists, engineers and technologists at the university, graduate or post graduate levels, but also, sometimes even more critically, at the levels of the technicians, the shop foreman and the technical and scientific assistants.

Model programs and courses for scientific and technical education and training as well as guides for recruitment or selection of appropriate personnel required for standardization, quality control, metrology and scientific instruments should be initiated for the benefit of the developing countries and their national research and standardization bodies.

Hence, the growth of a balanced scientific infrastructure could be assisted in order to cope with both the urgent needs and long range planned national targets.

Conclusion:

Before concluding I feel obliged to mention again that I am thankful to have been invited to this important seminar and to have been given this opportunity to meet such a distinguished gathering. I am sure that I shall benefit much from the experience and views of the eminent speakers invited to the seminar, and sincerely hope that the outcome of our delibrations will positively contribute to the realization of the aims of our meeting.

It is my earnest hope that my discussions and meetings during the next few days with NBS and AID leading personalities, as well as other authorities in this great country will strengthen and expand the already existing technical cooperation between the United States of America and the Arab Countries.

Mr. Herman

I think it would be useful to discuss the question of patents and proprietary know-how in the transfer from a developed to a developing country; the question of price charged. What is a patent worth? What should be the standard for assessing royalties? I would be interested in Dr. Podolsky's comments on these points.

Dr. Podolsky

A patent license is a well-recognized way to acquire and transfer technology. Entire industries have been created through this method. The ways in which to acquire patent licenses are generally well understood. A minimum royalty fee may be paid, or a royalty may be related to sales of a product produced under the license. These royalties will, in general, be quite modest--5 - 6% of net sales. A question may arise as to whether to buy the patent outright. It is more desirable, in my view, to buy the patented technology at usually modest fees then to attempt the research and development involved in creating it again. A developing country that has the indigenous raw materials from which it could make a product for international trade would be far better off to acquire a complete process of manufacture from abroad rather than to attempt to develop its own process. In time a developing country might be successful in developing a better product or process, but valuable marketing time and advantage could be lost in the effort to develop something that could be purchased abroad at modest cost.

Dr. Salama

The problem of acquiring rights may be complicated. There may be several levels of patents. Moreover we usually do not have access to the inventor. Even the negotiator passes a cost on to us.

Dr. Podolsky

I realize that you have a very complex problem. In the United States we cannot legally discriminate. If I issue a patent license to a buyer, I must, in general, legally make it available on the same terms to any other prospective buyer.

Dr. Salama

This is so in the United States but it is different in other countries, and there are exclusive licenses even in the United States

Dr. Podolsky

There are exclusive licenses granted in the United States but if a non-exclusive license is granted to one, it must then be offered to all who wish to buy it.

Mr. Herman

How do you go to a standards committee to develop a standard when you have proprietary technology which you do not wish to divulge?

Dr. Podolsky

It is not possible to write a standard in IEC (and I imagine this is the same in ISO) around proprietary technology unless the patent owner agrees in writing that the technology involved is available to all prospective buyers on equal terms.

Mr. Herman

I can cite an example of many where technology was not patented because the owner company feared that the patent would reveal too much.

Dr. Podolsky

Sure, I myself have made money for 40 years on a secret process withdrawn from the Patent Office.

Mr. Etris

It is the ASTM practice to require the owner of a patented process or product which is intended to be incorporated in an ASTM standard to state in writing that he will not take advantage of this position by charging exorbitant prices for the privilege of its use therein.

Mr. Herman

I take it as agreed that the transfer of technology through standards is indeed a proven and valuable method of transfer.

Eng. Estrada

While concerned with the new patent law in Ecuador, I have thought carefully about the relation between patents and standards. Patents have the purpose of encouraging inventors and deal with process technology, only a small part of which reaches the standards committee discussion in which a consensus is to be obtained.

Mr. Herman

The next subject is the question of whether standards should be a topic for the forthcoming U.N. Conference on Science and Technology for Development. In the absence of Ambassador Jean Wilkowski, Mr. Simon Bourgin will discuss this matter and other issues related to the U.N. Conference.

Paper 2.6 - Standardization as a Possible Topic for the United Nations Conference on Science and Technology for Development

Mr. Simon Bourgin
Senior Adviser to the U.S. Coordinator of
Preparations for the United Nations Conference on
Science and Technology for Development

First of all, Ambassador Jean Wilkowski sends her regrets and apologies. This date coincided with a visit to Washington of Father Theodore Hesburgh, the President of Notre Dame University, who last week was named by the President to head the United States delegation to the United Nations Conference on Science and Technology for Development. It is Father Hesburgh's first visit to Washington in two months, and she was unable to get away. I personally feel that standardization could well be addressed as a subject for the Conference; it is so close to the heart of both the industrialization and development process.

I would like to tell you a little bit about both the Conference and our preparations for it. First some details on the Conference, because I'm not sure whether all of you here are aware of all that is involved. It will take place in August and September of 1979. The site has not been selected; four countries have extended invitations, including the United States. Should it take place here, it will probably be in cities other than Washington or New York. The other invitations have come from Manila, Mexico City, and Austria, and without being a party to the maneuvering that is going on behind the scenes to attract the sites, I can tell you that Mexico City and Vienna are working very hard at it. The United States has extended its invitation and will stand by it, but is not agressively seeking the Conference. That could be a small debate by itself but we will not go into it.

The Conference has a country paper as part of a process, it is a very important part of the focus; there is a deadline of May 1. Both the United Nations and UNESCO, as well as a good many countries have offered technical assistance in the form of specialists to help prepare the country paper. The country paper basically will review the experience of that country in relation to science and technology for development. It will provide essentially the historical experience, and it will provide the topics that country thinks should be on the agenda in relation to its own experience. And it will get some case histories of both success and failure stories in relation to the past, and as opportunities for the future.

The two-year preparations process is very important. The Conference was proposed at the United Nations about two and a half years ago, and a two-year preparatory process was built into it for very obvious reasons. In fact, the time preceding the Conference is accounted by all of us as much more important than the two weeks of the Conference itself. The time preceding it provides a catalytic period when the calendar of events stimulates a great deal of activity and change in this area, and the interaction that takes place between the industrializing and developing countries is both a preparatory process and an education period, and may be the most valuable thing to come out of the whole business.

Now the basic question posed by this Conference is how can science and technology best be used to speed up the development process. I think it is now generally recognized that without science and technology no country can really be successful in industrialization and no country can be competitive in the world's economic system. This is really a relatively new idea, this idea that one can and should apply science and technology directly in order for a nation to modernize. The genesis of this particular Conference in this particular idea, I think, goes back to the debate in the United Nations that began immediately after the quadrupling of oil prices back in early 1974 and the terribly difficult economic position the developing countries began to find themselves in. In the several years that have followed a concept has been developed at the United Nations called the New International Economic Order. The New International Economic Order basically called for readjustment in trade and technology transfer, patents and so on, that will permit the developing country to catch up. The United States, with certain reservations, supports readjustments in the international economic system and I think that these events helped provoke this particular Conference.

But I think that it is interesting to go back and see what the real genesis of this Conference was. It had a predecessor: In 1963, there was a comparable Conference in Geneva--"The United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas." It produced no new institutions; it produced a very useful set of technical handbooks put together by the U.S. Delegation that were a great success at the Conference and have proved to be useful manuals for the development process since. The 1963 Conference produced no follow-on, no set of mechanisms that would provide for adjustments. But in order to understand the 1963 affair, I think, and this a personal intrepretation, you have to go back to the relationship between President Dwight Eisenhower and the Columbia University physicist, Dr. I. I. Rabi, back in the middle fifties. Now it isn't very often that a United States President gets to develop a very close relationship with a scientist. As a matter of fact, it practically never happens, and it might not have happened if President Eisenhower had not been President of Columbia at the same time as Dr. Rabi, the distinguished Nobel Prize winner in physics, was there.

For any adviser to have influence on a President, he has to have constant access. Of course, nobody knew at the time that Mr. Eisenhower was going to be President of the United States and he and Dr. Rabi would become rather close friends. What came out of that friendship after Mr. Eisenhower moved to Washington was the Atoms for Peace Conference in 1954 at Geneva. The Atoms for Peace Conference may have been the first major Conference on the transfer of technology and I think in retrospect that it made the whole process look disarmingly simple. We thought at that time that the developing countries would simply be able to skip the whole business of invention, education, and the development of science and technology, and instead literally absorb the whole process by educating a generation of Ph.D.'s abroad. And indeed, with the nuclear energy process, that seemed to be entirely possible, and there was a whole generation of Ph.D.'s that went to school at different institutions, governmental and private, in the United States, and when the Science and Technology Conference happened in Geneva in 1963, it was looked at in fairly simplistic terms. It was simply presumed that we could transfer regular technology just as we have transferred nuclear technology, and that has turned out not really to be the case in the simplistic sense, and to get an idea of some of the things that <u>are</u> involved, all you need to do is to recall the discussion that just took place here--it is a foretaste of what we are going to hear more of as this Conference grows closer.

Now I would like to list some of the things that are involved in technology transfer in a larger sense, at least as it is regarded by the United States as we prepare for this Conference. I think, first of all, that you get into the question of basic human needs. President Carter has said that meeting basic human needs of the developing world is a major priority of the United States. Secretary of State Vance said some months later in another public address that "we need more focus on that part of the world population that lacks the essentials of food, water, shelter, health, health care, employment and education." So you see, you get a basic focus on the needs of that part of the developing world which has never really benefited by the traditional processes of industrial transfer of technology. This same theme has been quite well developed by various American officials over a period of time. Ambassador Andrew Young at Geneva last summer remarked that the greatest contribution that industrialization and the transfer of technology could make is the realization of the human potential--of development of people in the very broadest sense.

We also see a major role for business and industry, which in fact control most of the technology know-how in this country. We shall be thinking both in terms of technology transfer represented by direct investment abroad by multinational corporations, and of what has come to be called appropriate technology. Technology, that is, which is oriented directly to the needs of the individual or the village or for

a particular job. Now there has been a very considerable debate on whether you go the advance technology route or the appropriate technology route and there has been a great deal of time and energy and intellect spent on it. I think that for the purpose of this Conference that we are very likely to go both the advanced technology route since almost all the developing countries think they need it, whether they do or not, and also I think that very careful attention will be given in planning also to discuss appropriate technology.

Now this presents obviously for anybody who is organizing this Conference from the American point of view a very considerable problem; how are you going to organize a bill of particulars of a variety that I have been describing into one singular viewpoint and present it as a support for foreign policy in order to assist the developing third world? We cogitated about this a lot--"we" meaning Ambassador Wilkowski, her Deputy, and I, who constitute her staff. She was appointed in July and we came on board shortly afterwards and we have had to do a lot of thinking.

Now the country paper process is very essential to such a Conference. It represents basically the philosophy and the possibilities involved; it has to be intermeshed with the needs and desires of the developing world and since the United States is probably the major source of much of the science and technology, what we have to say about this is of considerable importance. Country papers have usually been written in the past for major United Nations Conferences of this kind by setting up an interagency committee that meets weekly and assigns individuals to come up with what an agency has to say about this; and then some man who may or may not be a genius retires to a room for a day or night, or for four or five days and comes up with a country paper.

We felt that we could not do this on this occasion largely because for one thing the know-how on industrial technology really is not chiefly in the government sector, but in the private sector; it is in labor, and we felt that we had to involve the American community in this. We went very early to the AAAS organization and to the National Academy of Sciences to discuss the way to face all of this. We have talked to the business community and after a bit of cogitating we resolved on a set of subjects that were first produced in a letter by President Seitz of Rockefeller University to President Carter on what he thought the basic areas of this administration should be in science. And with your permission I will chalk these down on the blackboard very quickly.

- The first will consider population, poverty, health, food and nutrition.

- The second will be looking at the inter-related issues of energy, natural resources and the environment.

°The third group will study climate, soil, and water.

°The fourth group will look at employment, trade and industrialization.

°The fifth will concern itself with related problems of urban settlements and rural development.

These are the basic study areas that we think have to be tackled in order to decide from the American point of view what the country paper ought to be. I should point out to you that the country papers will be reviewed by various United Nations regional conventions in a year-and-a-half process, where regional conventions in turn will take the country papers and decide what the main agenda for this Conference ought to be. Now our agenda obviously deals with much more than can be crammed into our United Nations Conference, but we felt that we could usefully start with these and sift off the ones that matter less. I think that before we are through, for instance, that the subject of trade, while it will be involved, would not be accepted simply because it has been addressed in other United Nations forums, and that process is still going on. I think we will end up very heavily on the side of food, on the side of health, on the side of energy certainly, and of environment and resources; but very heavily, of course, on the side of industrialization, manpower and employment in the broadest sense, to include training and education as well. There is one other subject that is not included here, that we expect to set up a separate task force on, and that is infrastructure, the whole business of building up an environment by education and training where real innovative development in technology and science can take place.

We expect to set up study groups that will probably number about 12 each, with a Chairman and a rapporteur in addition. These will be made up not only of the best people from the science and engineering community but also from Government, the business community, from labor, from non-governmental and public policy organizations. The attempt here will be to deal with all elements that are useful in looking into these subjects.

The basic substance that comes out of these, by the way, we expect to be a very large part of our country paper, which has a deadline of May 1, 1978. We are just beginning to put these groups together. Now I should point out that in parallel to these we are setting up task forces within the major government agencies that have begun in these areas. We have set up a task force in ERDA that will deal with the question of energy in relation to development abroad, we are doing the same thing with the Department of Interior with particular respect to the U.S. Geological Survey, and these reports should all begin to come in sometime in late March or April and then we will have the agonizing business of putting all of this together into a country paper. In

parallel with this process we expect to have a national debate that will take various forms around the country--both specialized meetings at the universities and others.

I will conclude with mention of the kind of review that has been given by the first United Nations Regional Commission on topics in its area. The U.N. Economic Commission for Africa meeting in Tanzania just about a week ago came up with subject areas that suggest what the priorities are in relation to the area. The first is agriculture, with emphasis on post-harvest conservation techniques, use of improved techniques for new crops; housing with emphasis on technical knowledge to produce low cost houses; health with emphasis on additional plans for human and animal diseases prevalent in Africa; transport with regard to improving and expanding the transport networks in Africa; and energy with emphasis on nonconventional sources of energy for development. This process will go on with other groups with the United Nations Commission which will meet in Mexico at the end of this month. The Economic Commission for Europe meets in December and so on.

So I have today described the process by which our small secretariat in the State Department will deal with the various American sectors in coordinating preparations for the United Nations Conference on Science and Technology for Development.

Discussion

Mr. Herman

In view of the broad scope of the U.N. Conference, where would the subject of standardization fit in?

Mr. Bourgin

Standards would presumably be discussed under the general subject of industrialization. Standardization could be a major option.

Dr. Podolsky

The subject of the U.N. Conference is obviously enormous, covering the entire field of human endeavor; therefore, standards could only be a minimal part of the discussions. I personally do not feel that standards should be a planned part of the Conference. To the extent that U.S. engineers and scientists contribute their knowledge and experience in this area, this should be done under State Department auspices though bilateral and regional agreements with the developing world, and on the basis of a two-way interchange. The United States, in my view, could make a far greater contribution to the transfer of technology through this method of approach, rather than have the subject of standardization made a small part of a large and comprehensive U.N. meeting.

Mr. Pineda

I disagree with Dr. Podolsky only when he says that standardization should not be part of the UNCSTD. I do agree, however, with his comments that the State Department should bring about greater cooperation bilaterally and regionally in the field of standards. In my opinion, standards will play a part in each of the key areas outlined by Mr. Bourgin for the U.N. Conference. I, therefore, feel strongly that standards should play a part in the Conference.

Mr. Herman

Probably the Conference should not spend a great deal of time discussing standards *per se* but standards questions could well come up under the subjects selected for the Conference.

Mrs. Mascarinas

Standardization as a method of transfer of technology to LDC's should be discussed at the UNCSTD.

Dr. Khan

One of the ways of achieving transfer of technology is for the United States to accept trainees who bring new capabilities to their home country. Standardization will then help to maintain quality.

Mr. Roseborough

I am the Program Manager for the Office of Science and Technology of AID, which sponsors the NBS/AID program managed by Mr. Peiser and his colleagues. The problem I have is securing adequate funding and evaluation for this program in terms of AID goals for the poorest people. The question arises as to how this program on standards can be justified in competition with many other projects which are considered of benefit to developing countries. I am looking for the best possible examples that I can use when all AID projects are reviewed. I am asked how many jobs this program has created this year. Can you help me to answer? I believe everybody here believes this is an important program. I need concise reasons why and how it is helping development.

Mr. Herman

It would be helpful if each of you could give Mr. Peiser, in writing or otherwise, your views as to how valuable this program has been to you.

Mr. Roseborough

I certainly agree that the summary of this seminar, and a short abstract should reflect the chairman's suggestion.

Mr. Pineda

I suggest each of the participants here should upon returning home induce the highest level authority in the country to write to Mr. Peiser expressing views on the usefulness of the program. Perhaps it would also be in order for this seminar to adopt an appropriate resolution reflecting the sense of the matters discussed.

Mr. Peiser

I appreciate Mr. Pineda's suggestions. What Mr. Roseborough is asking for is really quite subtle, that is examples that are of direct relevance to the most disadvantaged. We may think that standardization is basic to their needs, but it is not obvious that we have really good examples that are relevant. NBS is probably best in its support of the highest technology in the United States. We are constantly searching for ways to assist smaller and disadvantaged companies here. So I think we must take Mr. Roseborough's search for

justification of this program very seriously. We need good thoughtful responses. It may well be that NBS is not the right agency to help under AID's current terms of reference. Maybe the NBS/AID program might have to be withdrawn. I realize that coming from me, the program's principal and enthusiastic proponent, this is a serious observation. I am aware that next year's workshop is already oversubscribed and you are here asking for two workshops next year. You may believe that if we have a good technical program, we ought to be able to find sufficient financial and other resources. In fact, we must be able to demonstrate the quality of the program in terms of the criteria laid down by AID and ultimately the U.S. Congress. I know there are participants here who have important points to make who have not yet found an opportunity to tell their story. For instance, Dr. Rhee of Korea has a very important report on Korea which unfortunately could not be presented at this seminar. With some support from NBS a survey is now being made in Korea of the real measurement needs of industry, particularly small-scale industry. Dr. Rhee has sent questions to a large number (3,700) of factories and is following this up with group visits by the standards authorities. The results will be analyzed in a very sophisticated way. In the final analysis we need to know who are the users of the measurement services we render.

Eng. Estrada

A good measure of the program's success is the amount of increase in effort and expense for standardization that a country applies after contact with the NBS/AID program. The effect on the country's economy may sometimes be large for little effort and at others little for much effort.

Technology is very expensive, it is needed for industrialization. An industrialization policy cannot be implemented without standardization keeping in step. Take standards definitions alone--without them good technology cannot take hold, you lose the entire investment in technology.

Dr. Rhee

AID programs have been very successful in Korea. Korea intends to develop its own technology now by research and development. I, for one, am learning at NBS how to apply metrology, for example, for safety, quality control, etc.

Dr. Hadiwiardjo

I hope AID will continue its support for this most useful program. Visiting highly industrialized countries can bring about transfer of technology.

Mrs. Mascarinas

To develop and implement a standard for a product takes time. You must show patience and not expect very quick progress. We must more often make use of mandatory standards.

Mr. Simpson

I would like to comment on Eng. Estrada's presentation. He has shown that the principal function of standardization is to facilitate commerce. A by-product of standards, but not its chief purpose, is to transfer technology. Eng. Estrada earlier today commented on the difficulties inherent in transferring technology through the patent process. Again the patent process can be used to transfer technology but its central purpose is to encourage invention. My concern is that if we give too much emphasis to either standards or patents as a means of technology transfer we may "throw the baby out with the bath water!" I agree with Dr. Podolsky that the use of standards as a technology transfer mechanism should not be highlighted at the forthcoming U.N. Conference. Whether or not standardization is responsive to needs of the less developed countries, I think the subject should be addressed but not at the U.N. Conference.

Mr. Herman

Let me outline the Alaskan oil pipeline project as a most interesting example of the relationship between technology and standards on a giant commercial project. To date this has been the largest private construction project in the world. In has been carried out by a group of oil companies who have expended close to $9 billion on it. It stands as a major first class piece of engineering work regardless of some of the criticisms that have been made in respect to it. While it did have problems during its construction and early operation, it is undoubtedly true that any new construction project of such size can expect learning and human failure problems, especially in a difficult environment such as that in Alaska. The following facts will give you a general feeling for the nature of this project:

The pipe is over 800 miles (1,287 kilometers) long, approximately half of this being above ground. It is four feet (1.2 meters) in diameter and has a wall thickness of 1/2 inch (1.27 cm.). It will carry two million barrels (80 million gallons) of oil a day. It was fabricated in Japan in 40 foot lengths. These were welded together in 80 foot lengths in shops in Alaska after which the 80 foot sections were welded together in the field to form the complete pipe. There were approximately 40,000 field welds. Due to the thickness of the pipe a finished weld required seven passes around the pipe--making a total of around 280,000 passes. The U.S. government mandated that both visual and X-ray radiographic inspection of every weld be made and that each weld pass the American Petroleum Institute pipeline welding standard.

The API standard was adopted in this country some 20 years ago. The field welds were often made under extremely difficult conditions since temperature could vary from minus 35 celsius to plus 33 celsius and winds could make the situation worse.

The first point to note in respect to standards is that here is an example of the use of standards to promote international commerce. The Japanese were interested in making the pipe and they could agree on the material and fabrication standards with their U.S. customers.

The second point in respect to standards is that on a project such as this one it was vital that construction quality be consistently high. Construction quality depended to a considerable degree on the quality of the field welds. This quality was established by the API standard. All welders were required to be licensed by the union and were also required to pass strict welding tests set by the oil companies. In addition to these requirements there were the requirements for visual and X-ray inspections on the work site. Despite these precautions it was found during the course of the construction that some of the X-ray radiographs were false. This cast a dark shadow on the quality control. There were, of course, numerous charges and arguments in respect to the falsifications. It is doubtful if X-rays were falsified to hide welds which were likely to fail for no one stood to gain from such failure. It is much more likely that the falsifications were the result of efforts to speed up the work or of human failure under difficult working conditions.

When the falsifications were discovered the question then was, "what do you do about this situation"? Many of the questionable cases involved welds which were now underground. There were those who argued that you did not really need to do anything because: there had been visual inspections; welds had been made by licensed welders; each weld actually consisted of seven passes which could provide a safety factor for a flaw in one pass; the ultimate reliability of the work would be proven by pressure tests of each section of the pipeline; the welding standard had been worked out in earlier days when pipes were smaller in diameter and had thinner walls made of different materials. But the agreements between the government and the oil companies spelled out the standards and the X-ray proof of quality. The National Bureau of Standards was called in to advise the government as to whether the standards should or could be modified. Under the political circumstances it was, however, too late to change requirements. The oil companies uncovered the questioned welds, X-rayed and then repaired where there were questions in respect to quality.

The furor over the welds brought up a third point we can note in respect to standards. That is, "were the standards up to date"? It is now generally felt by those who participated in this project that the current standards need to be re-examined and updated in the light

of new materials, new experience with pipelines, new insight into the mechanical properties of the materials and fabrication techniques used and, finally, new technology for measuring and testing.

The Alaskan pipeline is now operating well. The experience gained in respect to construction, quality control and standards will be invaluable to those anywhere in the world who undertake a project of this type. The standards proved to be an inseparable part of the technology.

Mr. Roseborough

You only mentioned X-ray. Did they not use ultrasonics or magnetic particle methods or any of the other nondestructive tests?

Mr. Herman

All the other methods were considered. They did not adequately meet the Government's criteria on visible physical records of test results.

Mr. Roseborough

Did they X-ray only the finished weld after all seven passes or did they do any X-ray examinations in between?

Mr. Herman

Only the finished welds were radiographed. An inspector also inspected visually each weld for any flaws. If he did not see any, he approved the weld for visual soundness.

Mr. Herman

I will now attempt to summarize what seems to me personally to be the generally agreed conclusions of our two-day discussions:

1.) Standards are highly useful in technology transfer.

2.) The NBS/AID Program is valuable. Suggestions for improvement in the NBS/AID program will be most welcome from each participating country.

3.) The Program should continue and there should be an on-going dialogue and discussion in respect to it as well as feed-back to NBS on what you have learned.

4.) The interchange of standards knowledge and experience between the various countries and between those countries and the NBS is most valuable.

5.) A critical and valuable aspect of standards is in providing the understanding and mechanism for international commerce. Cooperation between nations and between the United States and regional organizations in development of standards, in addition to being a means of technology transfer, improves friendly relations between countries.

6.) The standards committees need people with both practical, applied commercial experience, as well as those with scientific expertise.

7.) Standards may need local modifications or adaptation for a region or a particular country. This can require the use of local people and materials.

8.) The United States (NBS) is interested in helping the developing countries through standards assistance and through our experience, but others will need to modify our U.S. experience to meet their own particular needs.

9.) The United States has a large number of highly useful standards groups. These groups can give valuable advice in commercial development.

10.) The value of voluntary cooperation between government and outside standards groups is to be emphasized. This approach is commended to others.

11.) With new knowledge in respect to materials, technology and applications, standards continue to need periodic up-grading.

12.) The developing countries need to set priorities on standards organization and efforts, since standardization is a key step in development. Implementation of standards also is of special importance.

13.) More participation by the developing countries is needed in standards development. If the developing nation will participate in standards formation, and standards bodies, they can gain valuable state-of-the-art information on technology and they can see where that technology may help their own countries. They must send competent participants to appropriate standards-making organizations.

14.) Be careful when considering special standards since they may unduly increase costs.

15.) It is difficult to document in a detailed way the pay-off from standards utilization in developing countries.

16.) The U.S. Delegation to the U.N. Conference on S&T for Development should thoroughly familiarize itself with the subject of standardization and be prepared to discuss the range of related issues as the need arises. However, no consensus was reached at this seminar as to whether standardization should be introduced by the U.S. delegation as a topic for the Conference.

APPENDIX 1

SEMINAR ON STANDARDIZATION IN SUPPORT OF DEVELOPMENT

October 17-18, 1977

National Bureau of Standards, Gaithersburg, Maryland

Lecture Room B

Monday, October 17, 1977

Session I. Six Years of National Bureau of Standards/ Agency for International Development Programs

Chairman, Mr. Marcelo Alonso, Director, Scientific Affairs, Organization of American States

8:30 a.m.	Registration
9:00	Welcoming Remarks. Dr. Ernest Ambler, Director of NBS
9:15	Welcoming Remarks. Mr. Henry Arnold, Director, Office of Science and Technology, Agency for International Development
9:30	AID/OST Program Leading to Standardization and Measurement Services for Developing Countries. Dr. Edward L. Brady, Associate Director for Information Programs
10:00	Discussion
10:15	Presentations on NBS/AID Country Surveys. Eng. Chaiwai Sangruji, Acting Director, Thailand Industrial Standards Institute; and Eng. Raul Estrada Albuja, Director, Instituto Ecuatoriano de Normalizacion
11:15	Discussion
11:45	Luncheon at NBS
1:00 p.m.	Workshops in the United States. Dr. Robert Oteng, Director, Development Program, International Standards Organization, Geneva

1:30	Institution Building. Mr. Ricardo Florez, Instituto de Pesquisas Tecnologicas, São Paulo, Brazil
2:15	Discussion
3:30	A Discussion of Other NBS/AID Activities. Mr. H. Steffen Peiser, Chief, Office of International Relations
4:15	Discussion
4:30	Summary by the Chairman of the Day's Proceeding
5:30	Dinner at NBS

Tuesday, October 18, 1977

Session II. Standardization in the U.S.A. - A Resource for Development

Chairman, Mr. Hamilton Herman, Industrial Consultant

9:00 a.m.	Lead address. Standardization in the United States. Mr. R. O. Simpson, R. O. Simpson Associates, Washington, DC
9:30	International Standards Bodies and their Relations with Developing Countries. Mr. Robert N. Johnson, Manager-Industry Standards and Systems, U.S. Steel Corporation, Pittsburgh, PA
10:00	Discussion
10:15	The Mechanism for the Development and Use of Standards to Transfer Technology and Develop Business. Dr. Leon Podolsky, President, U.S. National Committee of the International Electrotechnical Commission, New York, NY
10:45	Discussion
11:45	Luncheon at NBS
1:00 p.m.	Measurement Science in the United States. Dr. A. O. McCoubrey, Director, Institute for Basic Standards

1:30	Discussion
1:45	Standardization as a Tool for Science and Technology Transfer in Support of Industrial Development. Dr. Mahmoud Salama, Secretary General, Arab Organization for Standardization and Metrology; Chairman, Development Committee of the International Standards Organization
2:05	Discussion
2:15	Standardization a Topic for the United Nations Conference on Science and Technology for Development? Mr. Simon Bourgin, Senior Adviser to Ambassador Jean Wilkowski, Coordinator of U.S. Preparations for the U.N. Conference on Science and Technology
2:45	Discussion
4:30	Summary by Chairman of the Day's Proceeding and Adjournment

APPENDIX 2

Seminar on Standardization in Support of Development

Participants

Department of State

Mr. Henry Arnold
Director
Office of Science and Technology
Agency for International Development
209 Rosslyn Plaza C
Washington, DC 20523

Dr. Jacob Blackburn
Director
Office of Technology, Policy and Space Affairs
Department of State
Washington, DC 20520

Mr. Simon Bourgin
Senior Adviser
T/CST, Room 1113
Department of State
Washington, DC 20520

Mr. John Dardis
Office of Technology, Policy and Space Affairs
Department of State
Washington, DC 20520

Mr. Roger D. Moeller
Office of Science and Technology
Agency for International Development
206 Rosslyn Plaza C
Washington, DC 20523

Dr. Irwin Pikus
Office of Technology, Policy and Space Affairs
Department of State
Washington, DC 20520

Mr. W. D. Roseborough
Manager, Technology Transfer and Energy
Office of Science and Technology
Agency for International Development
203 Rosslyn Plaza C
Washington, DC 20523

Mr. William J. Trainor, Jr.
Deputy Director
Office of External Research
Department of State
Washington, DC 20520

Department of Commerce

Ms. Gloria Gee
Foreign Business Practices Division
Bureau of International Economic
Policy and Research
Department of Commerce
Washington, DC 20230

Organization of American States

Mr. Marcelo Alonso
Director
Department of Scientific Affairs
Organization of American States
17th Street and Constitution Avenue
Washington, DC 20006

Mr. Carlos Martinez-Vidal
Organization of American States
17th Street and Constitution Avenue
Washington, DC 20006

National Science Foundation

Dr. Eduardo Feller
Program Manager for Latin America
National Science Foundation
1800 G. Street, NW.
Washington, DC 20550

Dr. Osman Shinaishin
Program Manager for Pakistan
National Science Foundation
1800 G. Street, NW.
Washington, DC 20550

Mr. Warren Thompson
National Science Foundation
1800 G. Street, NW.
Washington, DC 20550

American Society for Testing and Materials

Mr. Samuel F. Etris
Special Assistant to the Managing Director
National Affairs
American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

Mr. Paul Van Gieson
American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

Mr. Braham Norwick
American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

National Bureau of Standards

Dr. E. Ambler
Director
National Bureau of Standards
Washington, DC 20234

Mr. W. E. Andrus
Chief
Office of International Standards
National Bureau of Standards
Washington, DC 20234

Mr. J. A. Birch
Office of International Relations
National Bureau of Standards
Washington, DC 20234

Dr. E. L. Brady
Associate Director for Information Programs
National Bureau of Standards
Washington, DC 20234

Dr. S. E. Chappell
Program Coordinator
Office of the Associate Director for Information Programs
National Bureau of Standards
Washington, DC 20234

Dr. D. T. Goldman
Deputy Director
Institute for Basic Standards
National Bureau of Standards
Washington, DC 20234

Dr. K. N. Hartman
Chemical Process Data Evaluation
Physical Chemistry Division
National Bureau of Standards
Washington, DC 20234

Dr. H. Hellwig
Office of the Associate Director for Programs
National Bureau of Standards
Washington, DC 20234

Mr. J. Hilsenrath
Office of Standard Reference Data
National Bureau of Standards
Washington, DC 20234

Dr. A. O. McCoubrey
Director
Institute for Basic Standards
National Bureau of Standards
Washington, DC 20234

Dr. H. E. Morgan
Office of the Associate Director for Programs
National Bureau of Standards
Washington, DC 20234

Dr. H. J. Oser
Scientific Assistant to Director
Institute for Basic Standards
National Bureau of Standards
Washington, DC 20234

Dr. E. Passaglia
Acting, Senior Institute Scientist
Institute for Materials Research
National Bureau of Standards
Washington, DC 20234

Mr. H. S. Peiser
Chief
Office of International Relations
National Bureau of Standards
Washington, DC 20234

Mr. C. C. Raley
Office of International Relations
National Bureau of Standards
Washington, DC 20234

Mr. N. Raufaste
Assistant to the Director for Program Planning
Center for Building Technology
National Bureau of Standards
Washington, DC 20234

Dr. J. F. Schooley
Chief, Temperature Section
Heat Division
National Bureau of Standards
Washington, DC 20234

Mr. G. Shapiro
Electronic Technology Division
National Bureau of Standards
Washington, DC 20234

Mr. R. S. Walleigh
Acting Deputy Director
National Bureau of Standards
Washington, DC 20234

Dr. J. R. Wright
Acting Director
Institute for Applied Technology
National Bureau of Standards
Washington, DC 20234

Dr. S. Wolynec
NBS/IPT Program Coordinator
Office of International Relations
National Bureau of Standards
Washington, DC 20234

Other Participants

Mr. C. Anwar
Industrial Attache
Embassy of the Republic of Indonesia
2020 Massachusetts Avenue, NW.
Washington, DC 20036

Mr. Martin Chen
Collins-Kronstadt
Lealty, Hogan and Collins
1111 Spring Street
Silver Spring, MD 20910

Engineer Raul Estrada
Director
Instituto Ecuatoriano de Normalizacion
Quito, Ecuador

Mr. Ricardo G. Florez
NBS/IPT Program Manager
Instituto de Pesquisas Tecnologicas
Sao Paulo, Brazil

Mr. Hamilton Herman
Industrial Consultant
7316 Masters Drive
Potomac, MD 20850

Dr. Robert D. Huntoon
13904 Blair Stone Lane
Silver Spring, MD 20906

Mr. Robert N. Johnson
Manager
Industry, Standards, and Systems
United States Steel Corporation
600 Grant Street, Room 1749
Pittsburgh, PA 15230

Mr. Roy H. Leach
Hughes Aircraft Co.
P.O. Box 90515
Los Angeles, CA 90009

Mr. Edward V. Pineda
930 Pat Court
Allentown, PA 18103

Dr. Leon Podolsky
President
U.S. National Committee for IEC
77 Windell Avenue
Pittsfield, MA 01201

Dr. Mahmoud Salama
Secretary General
Arab Organization for Standardization and Metrology
P.O.B. 27 Dokki
Cairo, Egypt

Mr. R. O. Simpson
R. O. Simpson Associates
Suite 935
Washington Building
1435 G. Street, NW.
Washington, DC 20005

APPENDIX 3

1977 NBS/AID Workshop on Standardization and Measurement Services

and

Seminar on Standardization in Support of Development

Participants

National Representatives

1. Prof. Rafael Steinberg
   Chief, Department of Physics
   Instituto Nacional de Tecnologia Industrial
   Libertad 1235
   Buenos Aires, Argentina

2. Eng. Abu Hossain Khan
   Director, Bangladesh Standards Institution
   3-DIT (Extension) Avenue
   Motijheel Commercial Area
   Dacca 2, Bangladesh

3. Eng. Hernando Montano V.
   Chief, Engineering Division
   Direccion General de Normas y Tecnologia
   Casilla 4430
   La Paz, Bolivia

4. Dr. Mohammed Mahmoud Ammar
   Director, National Institute for Standards
   P.O. Box 2343, Dokki, El Tahrir Street
   Cairo, Egypt

5. Dr. G. Yao Ahlijah
   Principal Scientific Officer
   Ghana Standards Board
   P.O. Box M.245
   Accra, Ghana

6. Mrs. Sriatie Djaprie
   Assistant Deputy Chairman for Technology
   Indonesian Institute of Sciences
   P.O. Box 250
   Jl. Teuku Tjhik Ditiro 43
   Jakarta, Indonesia

7. Dr. Bambang H. Hadiwiardjo
Deputy Director, National Institute for Instrumentation
Indonesian Institute of Sciences
Complex L.I.P.I., Jl. Sangkuriang
Bandung, Indonesia

8. Eng. Mohammad Mos-hafi
Director, Division of Electrical and Electrotechnical Industries
Institute of Standards and Industrial Research of Iran
P.O. Box 2937
Tehran, Iran

9. Eng. J. D. Gikandi
Senior Electrical Standards Officer
Kenya Bureau of Standards
P.O. Box 10610
Nairobi, Kenya

10. Dr. Rhee, Chunghi
Chief, Temperature Standards Laboratory
Korea Standards Research Institute
C.P.O. Box 156
Seoul, Korea

11. Mrs. Anacleta B. Mascarinas
Chief Standards Officer
Inspection and Certification Division
Philippines Bureau of Standards
P.O. Box 3719
Manila, Philippines

12. Eng. Chaiwai Sangruji
Acting Director, Thai Industrial Standards Institute
Department of Science
Rama VI Street
Bangkok 4, Thailand

International Representatives

13. Eng. Kamal I. Abulyosr
Head, Standardization and Metrology Department
Arab Organization for Standardization and Metrology
P.O. Box 27, Dokki
Cairo, Egypt

14. Dr. Robert Oteng
Director, Development Committee
International Organization for Standardization
Case Postale 56
1211 Geneva 20, Switzerland

APPENDIX 4

Biographical Data of Seminar Authors

Alonso, Marcelo

Born in Havana, Cuba in 1921, Mr. Alonso was educated in Cuba and the United States. His field of specialization is theoretical nuclear physics and quantum mechanics. He was a professor of physics at a junior college in Havana in 1949 and several years later Technical Adviser to the Cuban National Bank for Economic and Social Development. A member of the American Physical Society, and the American Association of Physics Teachers, he is the author of a number of publications in physics.

Mr. Alonso in presently Director of the Department of Scientific Affairs of the Organization of American States, Washington, D. C.

Ambler, Ernest

Born on November 20, 1923 in Bradford, Yorkshire, England, Dr. Ambler received his U.S. citizenship in October 1958. He attended New College in Oxford, England, where he received his B.A. degree in 1945, his M.A. in 1949 and his Ph.D. in 1953.

In 1953, Dr. Ambler joined the staff of the National Bureau of Standards. He became Chief of the Cryogenic Physics Section in 1961 after having been involved in the operations of the NBS. He was appointed Chief of the Inorganic Materials Division in 1965, prior to being named Director of the Institute for Basic Standards in 1968. He served as NBS Deputy Director from June 1973 to June 1975, and as Acting Director from July 1975 to February 1978. On February 3, 1978, Dr. Ambler became the Director of NBS.

Dr. Ambler is the recipient of numerous honors, awards, and fellowships including: the Department of Commerce Gold Medal, the NBS Stratton Award, Nuffield Fellow of Oxford University, the John Simon Guggenheim Memorial Foundation Fellowship Award, the John Price Wetherill Medal of the Franklin Institute, the Washington Academy of Sciences Award, the Arthur S. Fleming Award, the William A. Wildhack Award, and the President's Award for Distinguished Federal Civilian Service. He has authored 51 publications and holds a patent for low temperature refrigeration apparatus and processes.

Arnold, Henry

Mr. Arnold is Director of the Office of Science and Technology, Agency for International Development, Department of State. In 1970 - 1973 he

was Senior Ocean Engineer, National Council on Marine Resources and Engineering Development, Washington, D. C. He holds a B.S. and M.S. from MIT, Cambridge, Massachusetts, and a B.S. from the U.S. Naval Academy, Annapolis, Maryland.

Brady, Edward L.

Born in Charleston, South Carolina, 1919. Undergraduate work at University of California at Los Angeles and Ph.D. in physical chemistry at Massachusetts Institute of Technology, 1948. Nuclear power plant experience with General Electric Company and Gulf General Atomic. U.S. Atomic Energy Commission representative, London, England, 1956 - 1958. Senior Adviser, U.S. Mission to the International Atomic Energy Agency, Vienna, Austria, 1959 - 1961. At NBS, Chief of Office of Standard Reference Data, 1963 - 1968; Associate Director for Information Programs since 1968.

Bourgin, Simon

Mr. Bourgin was born in northern Minnesota and studied at the University of Chicago. He was a correspondent for "Stars and Stripes" in World War II. He was Washington correspondent for the Foreign Policy Association; foreign correspondent for "Time" and "Life", CBS, NBC, Vienna, Austria; Assistant to the President of the RAND Corporation. His governmental experience includes writing for the Department of Agriculture and the War Production Board; Science Policy Adviser for the U.S. Information Agency; and Deputy Director of Public Affairs, Nuclear Regulatory Agency.

Estrada, Raul, A

Eng. Raul Estrada Albuja was born in Quito, Ecuador in 1927. He was graduated from the National Polytechnic School in 1963 with a degree in Industrial Chemical Engineering. Eng. Estrada instructed in Chemistry, Industrial Technology, Industrial Safety, Machine Design, Design and Construction of Industrial Plant, and Industrial Process. Eng. Estrada was Technical Director for the Lionel Laboratory and Chemical Center in 1953. In 1954 he was Technical Director of the INEIA factory. From 1968 to 1970 he was Director of the Institute of Technical Investigations of the National Polytechnic School and in 1970 he was Technical Assistant to the Secretariat of Integration. From 1970 to present he has been the Technical Director of the Ecuador Institute of Standardization.

Florez, Ricardo Guerra

Mr. Florez was born in Santos, Brazil in 1943. He was graduated from Agricultural University in São Paulo in 1969 and later took courses in urban design. He was associated with private industry in Brazil and has attended a number of international meetings on architectural

subjects. He is presently associated with Instituto de Pesquisas Tecnologicas and manages cooperative relations between that organization and the National Bureau of Standards.

Herman, Hamilton

A native of Highland Park, Illinois, Mr. Herman is an industrial consultant. From 1968 to 1973 he was Senior Vice President for Development of the American Can Company, and was earlier President of North American Rockwell's industrial divisions; corporate Vice President and Director of Research and Development at AMF, Inc.

Mr. Herman holds degrees in aeronautical and mechanical engineering from MIT. Prior to his present consulting activities, Mr. Herman was Assistant Secretary of Transportation for Systems Development and Technology.

Johnson, Robert N.

Born in Chicago, Illinois, Mr. Johnson received his B.S. degree in metallurgical engineering from Stanford University and in 1956 studied advanced work in metallurgy at Stanford's Graduate School of Engineering. He is currently Manager, Industry Standards and Systems of the United States Steel Corporation, Pittsburg, Pennsylvania, and recently elected chairman of the new Committee E-43 on Metric Practice of the American Society for Testing and Materials (ASTM). From 1973 - 1976, Mr. Johnson was a member of the ASTM Board of Directors, and served in a position of leadership on many of ASTM's technical committees. His efforts in international standardization include membership on the International Standards Council of the American National Standards Institute (ANSI), the ASTM U.S. National Committee on Steel, and the ISO Technical Committee on Aircraft and Space Vehicles, and Aerospace Materials and Processes Advisory Committee.

McCoubrey, A. O.

Dr. McCoubrey, Director of the NBS' Institute for Basic Standards, received his B.S. in applied physics from the California Institute of Technology in 1943 and his Ph.D. in physics at the University of Pittsburgh in 1953.

Dr. McCoubrey has had considerable private experience both with business and research organizations. He was elected a Fellow of the Institute for Electrical and Electronics Engineers in 1972, with a citation for his contributions to atomic time and frequency standards and to research and development management.

Oteng, Robert

Born in 1925, Dr. Oteng received his university training in London, including a B.Sc., M.Sc. and Ph.D. Following a series of assignments as research assistant, education officer, lecturer in physics, and Administrator Head of the Department of Physics at the University of Cape Coast, Dr. Oteng became Director of the Ghana Standards Board in April 1972, with a staff now totaling 370. His other duties now include Chairmanship of the Metrication Programming and Planning Committee; Coordinator of the Cadet Alimentarius Coordinating Committee for Africa, and Chairman of the Develop Program of the International Organization for Standardization.

Peiser, H. Steffen

Born near Berlin, Germany in 1917, Mr. Peiser became a citizen of the United States in 1963. He attended St. Paul's School in London, and took his B.A. and M.A. at Cambridge University. During 1941 - 1947 he worked for Imperial Chemical Industries, the Atomic Energy Research Establishment, and the Nuffield Cement Research Laboratory. After teaching at London University, he became head of metal physics research at Hadfields Ltd., and principal scientist at the Aeronautical Inspection Directorate's Test House.

In 1957 he joined NBS, and after heading first the Mass and Scale Section and later the Crystal Chemistry Section, became Chief of the Office of International Relations and Manager of the NBS Foreign Currency Program. Diverse scientific missions have taken him to Bolivia, Brazil, China, Ecuador, Egypt, Guyana, India, Indonesia, Israel, Japan, Korea, Malaya, Pakistan, the Philippines, Poland, Thailand, Vietnam and Yugoslavia. Basically he is an X-ray crystallographer, and was Secretary of the IUPAC Commission on Atomic Weights.

Podolsky, Leon

Dr. Podolsky is Vice President of the International Electrotechnical Commission (IEC), and President of the U.S. National Committee of that Commission. As a businessman-engineer, Dr. Podolsky has had broad experience as an executive, consultant, engineer and inventor. Retiring from business early, he has devoted himself to national and international service, and has represented the United States 31 times at international technical meetings abroad. He is a member of the Engineering Executive Committee, and Chairman of the International Standards Committee of the Electronic Industries Association. Dr. Podolsky has received many distinguished honors from the Navy Department for outstanding service in World War II and from the major engineering, scientific, and business organizations.

Salama, Mahmoud

Dr. Salama was born in Cairo in 1915, received a B.Sc. (Hons) in 1937 and Ph.D. (analytical chemistry) in 1943 from Cairo University. As Undersecretary of State for Industry in the Arab Republic of Egypt and Chairman of the Egyptian Organization for Standardization, he contributed to the first and second industrialization programs of Egypt and added significantly to international councils in both standardization and metrology. He was awarded the order of merit for Trade and Industry in 1963. As Secretary General for the Arab Organization for Standardization and Metrology (ASMO) since 1968, he must be congratulated to have achieved a truly international standardization organization on a regional basis. He was unanimously elected by the council of the International Organization for Standardization (ISO) as Chairman of the Development Committee (DEVCO), and was also appointed as Liaison Officer for ISO in the Arab Region, Turkey and Cyprus.

Sangruji, Chaiwai

Eng. Chaiwai was born in Bangkok, Thailand, in 1928 and educated in Thailand and England. He joined the Physics and Engineering Division of the Department of Science, Ministry of Industry in 1957 and became its Chief in 1963. He assumed the post of Acting Director of the newly formed Thai Industrial Standards Institute in 1969, a position he now holds.

Simpson, Richard O.

Richard O. Simpson is President of Richard O. Simpson Associates, Inc., a management and technical consulting firm in Washington, D.C. Prior to forming this firm, Mr. Simpson served as the first Chairman of the U.S. Consumer Product Safety Commission. Earlier Mr. Simpson served with the Department of Commerce where he became Acting Assistant Secretary for Science and Technology.

Mr. Simpson has had extensive experience in private business, having been a Group Executive with the Rucker Company of Oakland, California, an electronics firm. Graduating with honors from the University of California in 1965 in electrical engineering, Mr. Simpson also studied law at Berkley.

APPENDIX 5

Author Index

Glossary

AID	Agency for International Development
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASMO	Arab Organization for Standardization and Metrology
ASTM	American Society for Testing and Materials
CPSC	Consumer Product Safety Commission
DEVCO	Development Committee of the ISO
DoD	Department of Defense
DRI	Denver Research Institute
EPA	Environmental Protection Agency
ESCAP	Economic and Social Commission for Asia and the Pacific
GSA	General Services Administration
IDCAS	International Development Center for Arab States
IEC	International Electrotechnical Commission
INPM	Instituto Nacional de Pesos e Medidas, Brazil (National Institute of Weights and Measures)
IOLM	International Organization for Legal Metrology
IPT	Instituto de Pesquisas Tecnologicas, Brazil (Technological Research Institute)
ISO	International Organization for Standardization
ITAL	Instituto de Technologia de Alimentos, Brazil (Institute for Food Technology)
MIT	Massachusetts Institute of Technology

NBS	National Bureau of Standards
NHTSA	National Highway Traffic Safety Administration
OSHA	Occupational Safety and Health Administration
SAE	Society of American Engineers
UNIDO	United Nations Industrial Development Organization
UNCST	United Nations Conference on Science and Technology for Development
WIPO	World Intellectual Property Organization

☆ U.S. GOVERNMENT PRINTING OFFICE : 1978 O—264-606

NBS-114A (REV. 7-73)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBS SP-507	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Standardization in Support of Development

Proceedings of a Seminar Held at the National Bureau of Standards Gaithersburg, Maryland, October 17-18, 1977

5. Publication Date: May 1978

6. Performing Organization Code

7. AUTHOR(S): H. Steffen Peiser, John A. Birch

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Complete Address (*Street, City, State, ZIP*)

Organized by the National Bureau of Standards
with the cooperation of the Agency for International Development,
The American National Standards Institute, and
The American Society for Testing and Materials

13. Type of Report & Period Covered

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

Library of Congress Catalog Card Number: 78-7249

16. ABSTRACT (*A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.*)

The National Bureau of Standards held a two-day Seminar in an effort to appraise the benefits derived from six years of a cooperative program with developing countries designed to improve their standardization and measurement services. With financial support from the Agency for International Development, participants came from Argentina, Bangladesh, Bolivia, Egypt, Ghana, Indonesia, Iran, Kenya, Korea, the Philippines, and Thailand; from regional and international organizations; from key U.S. standards writing bodies, and from industries, professional societies and government in the United States. The papers presented and the discussions were organized around the session titles:

°Six Years of National Bureau of Standards and Agency for International Development Programs, and

°Standardization in the U.S.A.--A Resource for Development.

It was concluded that the developing countries concerned with this program had benefited in a variety of ways from the standards surveys and workshops conducted by the National Bureau of Standards in cooperation with them, and that efforts should be made to continue the program with full support. Questions were raised, but no consensus reached on the desirability of standardization being proposed as a distinct topic for the U.N. Conference on Science and Technology for Development.

17. KEY WORDS (*six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons*)

Africa; Agency for International Development (AID); Asia; developing countries; engineering standards; industrialization; Latin America; National Bureau of Standards (NBS); quality control; standards; surveys; U.N. Conference on Science and Technology for Development; workshops.

18. AVAILABILITY

[X] Unlimited

[ ] For Official Distribution. Do Not Release to NTIS

[X] Order From Sup. of Doc., U.S. Government Printing Office Washington, D.C. 20402, SD Stock No. SN003-003 - 01928-3

[ ] Order From National Technical Information Service (NTIS) Springfield, Virginia 22151

19. SECURITY CLASS (THIS REPORT): UNCLASSIFIED

21. NO. OF PAGES: 163

20. SECURITY CLASS (THIS PAGE): UNCLASSIFIED

22. Price

USCOMM-DC 29042-P74

112

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH—The Journal of Research of the National Bureau of Standards reports NBS research and development in those disciplines of the physical and engineering sciences in which the Bureau is active. These include physics, chemistry, engineering, mathematics, and computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodology, and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Bureau's technical and scientific programs. As a special service to subscribers each issue contains complete citations to all recent NBS publications in NBS and non-NBS media. Issued six times a year. Annual subscription: domestic $17.00; foreign $21.25. Single copy, $3.00 domestic; $3.75 foreign.

Note: The Journal was formerly published in two sections: Section A "Physics and Chemistry" and Section B "Mathematical Sciences."

DIMENSIONS/NBS

This monthly magazine is published to inform scientists, engineers, businessmen, industry, teachers, students, and consumers of the latest advances in science and technology, with primary emphasis on the work at NBS. The magazine highlights and reviews such issues as energy research, fire protection, building technology, metric conversion, pollution abatement, health and safety, and consumer product performance. In addition, it reports the results of Bureau programs in measurement standards and techniques, properties of matter and materials, engineering standards and services, instrumentation, and automatic data processing.

Annual subscription: Domestic, $12.50; Foreign $15.65.

NONPERIODICALS

Monographs—Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NBS, NBS annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

Applied Mathematics Series—Mathematical tables, manuals, and studies of special interest to physicists, engineers, chemists, biologists, mathematicians, computer programmers, and others engaged in scientific and technical work.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a world-wide program coordinated by NBS. Program under authority of National Standard Data Act (Public Law 90-396).

NOTE: At present the principal publication outlet for these data is the Journal of Physical and Chemical Reference Data (JPCRD) published quarterly for NBS by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements available from ACS, 1155 Sixteenth St. N.W., Wash., D.C. 20056.

Building Science Series—Disseminates technical information developed at the Bureau on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NBS under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. NBS administers this program as a supplement to the activities of the private sector standardizing organizations.

Consumer Information Series—Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

Order **above** *NBS publications from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.*

Order **following** *NBS publications—NBSIR's and FIPS from the National Technical Information Services, Springfield, Va. 22161.*

Federal Information Processing Standards Publications (FIPS PUB)—Publications in this series collectively constitute the Federal Information Processing Standards Register. Register serves as the official source of information in the Federal Government regarding standards issued by NBS pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

NBS Interagency Reports (NBSIR)—A special series of interim or final reports on work performed by NBS for outside sponsors (both government and non-government). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Services (Springfield, Va. 22161) in paper copy or microfiche form.

BIBLIOGRAPHIC SUBSCRIPTION SERVICES

The following current-awareness and literature-survey bibliographies are issued periodically by the Bureau:

Cryogenic Data Center Current Awareness Service. A literature survey issued biweekly. Annual subscription: Domestic, $25.00; Foreign, $30.00.

Liquified Natural Gas. A literature survey issued quarterly. Annual subscription: $20.00.

Superconducting Devices and Materials. A literature survey issued quarterly. Annual subscription: $30.00. Send subscription orders and remittances for the preceding bibliographic services to National Bureau of Standards, Cryogenic Data Center (275.02) Boulder, Colorado 80302.