

THE HISTORY OF A TECHNOLOGICAL INSTITUTION  
THE MTI

BY  
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MATERIALS TECHNOLOGY INSTITUTE  
OF THE  
CHEMICAL PROCESSES INDUSTRIES, INC.

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## PREFACE

This is a story about people and how they built and set in motion a machine to accomplish an unusual objective. The story starts with five people but as time went on more and more were drawn into the enterprise. The processes of building and operating the machine necessarily entailed a host of decisions and actions by the people which in turn engendered a multitude of events. Naturally the people, their actions and the ensuing events were intimately interconnected. Thus, the focus of the story is on people, their identity and what they did. At the same time, emphasis is placed on dates. Without adhering to a chronological structure the story would be exceedingly difficult to write or to follow. The tone is intended to be reason-ably light and a conscientious effort is made to avoid the recitation of desiccated data.

The group of five started out by coming up with a good, reasonably simple idea for dealing with a situation they had perceived. However, to build and run the machinery necessary to put the idea into practice was something else. It required initiative, imagination and dedication together with more ideas and more people. The five had what it took. Through drive and perseverance they attracted an increasing number of people to work with them and contribute in innumerable effective ways to achieve the success that the endeavor has become. The story, of course, is unfinished. However, it should serve to encourage people with good ideas to carry them forward to fruition even when the going is rough. It can be done.

## CONCEPTION

To be frank about it, the technological institution about which this story is written; i.e., the Materials Technology Institute of the Chemical Processes Industries, Inc., (MTI) was conceived in a bar. The setting was the 1975 Annual Conference of NACE held during April 14-18 in Toronto, Ontario. The bar was in that city's Four Seasons Sheraton Hotel.

That the idea was a sound one attests both to the perceptiveness of its progenitors in selecting a bar as the site for the conception and to the wisdom that can issue from a bottle of Bushmill's Irish Whiskey. The participants were R. B. (Bob) Puyear and A. S. (Bert) Krisher of Monsanto, Warren I. Pollock of DuPont, C. P. (Paul) Dillon and George B. Elder of Union Carbide.

The talk around the cocktail table brought out the fact that a considerable number of CPI firms were faced with, and were conducting projects on, the same non-proprietary problems with structural materials and chemical process equipment. The problems with which they were concerned were those that involved operating chemical plants safely and within environmental constraints, and had little to do directly with the products manufactured by the plants. How absurd for all these companies to be working independently on the same problems: What a waste of money, time and manpower: Couldn't a single entity be set up to tackle industry-wide non-proprietary structural materials problems? Such an entity could be supported by the beneficiaries of the results for a fraction of the price they were paying to attack the problems separately--and the funds and manpower so released could be put to work on each company's special proprietary concerns.

Some potential projects that might appropriately be pursued on such a cooperative basis were discussed at that time and on subsequent occasions. They included evaluation of new structural materials; improved methods, using advanced electrochemical techniques, to identify tendencies toward

- i -

pitting,  
crevice  
corrosion and stress corrosion cracking; improved ways to monitor corrosion in plant; substitutes for chromate and zinc

ions in cooling water treatment systems; and corrosion of structural materials by molten fuel oil ash.

In a memorandum dated May 14, 1975, Warren Pollock summarized the early thinking regarding what at that time was termed a "Chemical Process Industries/Materials Technology Institute" (CPI/MTI). The idea was to embody the Institute in a board of representatives from the major contributing companies, preferably operating within an existing professional or industrial association, for the purpose of sponsoring specific technical programs at appropriate research institutions, such as independent laboratories and universities. The broad objective would be to develop technology on structural materials for the CPI "in order to minimize the cost of new capital investments; to meet safety, health and ecology requirements; and to comply with national resource priorities." Funding would be shared by the member companies. The Institute would be run by a management group drawn from personnel of the member companies.

#### STRUCTURING THE ORGANIZATION

By letter of July 7, 1975, Paul Dillon asked the Manufacturing Chemists Association (MCA) if it would sponsor the CPI/MTI. The MCA greeted the idea of a CPI/MTI with great enthusiasm, but recommended that it be organized as an independent non-profit institute. In fact, MCA offered its administrative and physical facilities to arrange an organizational meeting.

Thereupon, Paul set up a meeting with Bob Puyear, Bert Krisher, George Elder, and Warren Pollock at the Charleston Engineering Center, Charleston, West Virginia, on December 11 and 12, 1975 to prepare a pro-posed structure for the institute, consider the implications of setting it up as an independent entity, arrange for an organizing meeting, and take up such questions as funding and administration.

Using the structure of organizations in the fields of distillation and heat-transfer technology as a guide, not only did the "Gang of Five" turn out an organization document complete with objectives, concepts, structure (including a chart of the organization), operations, financing and even possible projects; they also prepared a proposed certificate of incorporation and a set of proposed bylaws. Paul Dillon packaged all this material for presentation at a "Kick-off", or informational, meeting scheduled for April 27, 1976 at the

Union Carbide Office Building, 270 Park Avenue, New York City.

The legal eagles of Monsanto, DuPont and Union Carbide examined the documents and, as one might suppose, they offered a host of suggestions to modify them. However, the organizational document was entirely suitable as it was, for distribution to prospective members. Accordingly, Paul prepared a letter of invitation to attend the above-mentioned informational meeting, which was distributed to MCA members and others identified by the "Gang of Five." The mailing was done through the good offices of Morgan Hoover, Secretary of the Engineering Advisory Committee of MCA.

Meanwhile, a draft membership agreement was prepared, an agenda for the meeting was put together by Warren Pollock, and the technical press was alerted to the coming event.

The informational meeting, chaired by Paul Dillon, took place on April 27, as planned, with 28 people representing 22 organizations in attendance. The objectives, suggested organization and funding methods were presented by Paul Dillon, Bob Puyear, and T. W. (Tom) Gibbs of DuPont. Examples of projects that might be pursued by the CPI/MTI were discussed by Warren Pollock, Bert Krisher, Tom Gibbs, George Elder and Bob Puyear.

The Institute was conceived as being concerned with materials of construction from the user's point of view; however, interested suppliers and producers would be eligible to participate. A Board of Representatives was visualized, comprising representatives of the member companies. This board would elect a Technical Advisory Council (TAC) to scope and monitor the Institute's technical program, and an Administrative Committee to establish the budget and program. The function of Technical Director would be assumed by the Chairman of the TAC. However, a permanent paid Executive Director was envisioned to work with the Board and the Administrative Committee. The attendees to the meeting are listed in Table 1.

Table 1 ATTENDEES  
 CHEMICAL PROCESS INDUSTRIES/MATERIALS TECHNOLOGY INSTITUTE

April 27, 1976

COMPANY NAME	NAME	TITLE
Air Products & Chem. Inc.	S. W. Dean	Sr. Corrosion Engr.
Allied Chemical	J. D. Wood	Principal Engr.
AMAX, Inc.	J. G. Brown	Sr. Proc. Engr.
ARCO Chemical	Helmut Naumann	Pr. Engr.
Cities Service Co.	R. A. Mueller	Sr. Tech. Adv.
American Cyanamid	R. F. West	Dir., Gen. Eng. Dept.
DuPont	T. W. Gibbs	Consultation Mgr.
DuPont	W. I. Pollock	Materials Engr.
El Paso Products Co.	R. A. Johnston	Met. Eng. Consultant
El Paso Products Co.	J. A. Weir	Engr. Special Manager
Exxon Chemicals	P. E. Krystow	Eng. Associate
Exxon Res. & Engr. Co.	R. D. Merrick	Sr. Eng. Assoc.
Hercules, Inc.	H. B. Fischer	Chief Metallurgist
ICI United States	H. H. Jacobs	Sr. Materials Engr.
Merck Chem. Div.	J. A. McGroarty	Consultant
(formerly)		
Metals Properties Council	E. M. Kloeblen	Consultant
Monsanto Company	A. S. Krisher	Eng. Fellow
Monsanto Company	R. B. Puyear	Eng. Manager

Owens-Corning	S. Anderson	Mkt. Mgr.
Philadelphia Quartz	C. F. O'Brien	Mgr., Process Engr.
Proctor & Gamble	W. R. Hoskins	Mgr., Matls. Technol.
Stauffer Chemical Co.	L. E. Drake	Principal Matls. Engr.
Stauffer Chemical Co.	Leonard Wender	Mgr., Chemical Eng.
Tennessee Eastman Co.	W. J. Litz	Sr. Supervising Engr.
Union Carbide Corp.	G. B. Elder	Group Leader
Union Carbide Corp.	C. P. Dillon	Mgr., Matls. Engr.
VPI & SU	H. A. McGee, Jr.	Head, Chem. Eng. Dept.

Arrangements were made to form an interim Administrative Committee and TAC. Paul Dillon said he could serve as Acting Executive Director through 1976 and would search for a permanent Executive Director to come aboard by early 1977. He would also seek legal counsel regarding bylaws and articles of incorporation.

The response of the CPI community to the concept of an entity established to deal specifically with its structural materials concerns was heart warming and greatly encouraged its protagonists to go forward. However, the incubation period of the embryonic Materials Technology Institute did not pass without a lot of hard work on the part of the little group of advocates, and without occasional rough going. One piece of correspondence, evidently engendered by the "kick-off" meeting, contained this remark: "Apparently, the Institute will move ahead and become a continued, unneeded burden on industry."

The Metal Properties Council (MPC) in mid-March of 1976, expressed concern that establishing a materials technology institute serving the chemical industries would invite considerable duplication of effort vis-a-vis the MPC. In response to MPC's position, it was pointed out that the proposed institute would develop non-proprietary materials engineering technology emphasizing the direct application of that technology to chemical industry problems, rather than the generation of materials property data per se. In fact, joint pursuit of specific projects by the two organizations could be visualized, depending on the nature of the project.

In June, MPC tendered the recommendation that the two organizations join forces. This suggestion led to a meeting between representatives of the CPI/MTI and the MPC at the United Engineering Center in New York City on July 29, 1976. MPC was represented by A. O. (Ad) Schaefer, Executive Director; *L. S. (Roy) Moody* of General Electric Company, and Paul M. Brister of The Babcock & Wilcox Company. The CPI/MTI delegation comprised Bob Puyear, Warren Pollock, Paul Dillon, R. A. (Rich) Mueller of Cities Service Company and John D. Wood of Allied Chemical Corporation. The upshot of the meeting was agreement by both organizations to provide each other with full cooperation and support, but not to recommend melding of them.

Meanwhile, on the recommendation of the MPC, Paul Dillon approached Thomas G. (Tom) O'Brien of Carter, Ledyard and Milburn (C, L and M) on May 25, 1976 concerning the possibility of his firm's serving as counsel for the CPI/MTI. As a beginning, Paul requested that the proposed articles of incorporation and bylaws be reviewed and that a suitable state for incorporation be suggested.

There followed a meeting on July 28 at the offices of C, L and M in New York City, attended by the people shown in Table 2. At that meeting, a revised certificate of incorporation and bylaws were reviewed, and again revised. The former provided for incorporation in the State of New York, a Board of Directors, Technical Advisory Council, and an Executive Director--the foundation, if you will. The latter document served as the engine and drive train for the machine. The earlier concept of a Board of Representatives and an Administrative Committee was altered so that these bodies become in fact the Technical Advisory Council and the Board of Directors. However, the name of the organization remained Chemical Process Industries/ Materials Technology Institute, Inc.

Table 2. Attendees at Meeting to Review Proposed  
Articles of Incorporation and By-laws

J. H. Van Sciver	Allied Chemical Company
John Wood	Allied Chemical Company
R. B. Leonard	Cabot Corporation
R. A. Mueller	Cities Service Company
R. D. Forest	Dow Chemical Company
Warren Pollock	DuPont
R. A. Johnston	El Paso Products Company
R. B. Puyear	Monsanto Company
C. P. Dillon	Union Carbide Corporation

At that meeting, Paul noted that eight companies had declared their intention to join the organization, while representatives of nine more had recommended membership to their managements. The eight companies were: Allied Chemical, Cities Service, DuPont, El Paso Products, ICI United States, Monsanto, Philadelphia Quartz (PQ), and Union Carbide. As agreed at the April meeting, the dues would range from \$2,500 to \$15,000 depending on the gross annual sales of the member.

The following temporary Board of Directors was appointed: Bob Puyear, Chairman, John Wood, R. B. (Bob) Leonard (Cabot), Ed Wilson, C. F. (Chuck) O'Brien (Philadelphia Quartz), George Elder, H. B. (Hugh) Fischer (Hercules) and Warren Pollock (for the TAC).

Also, a temporary Technical Advisory Council (TAC) was constituted with the following members: Warren Pollock, Chairman, Bob Johnston (El Paso), Jack Van Sciver (Allied Chemical), Rich Mueller, Bert Krisher, R. D. (Bob) Forest (Dow), H. H. (Harvey) Jacobs (ICI United States), L. E. (Larry) Drake (Stauffer Chemical) and S. W. (Sheldon) Dean (Air Products).

In August, Paul Dillon took the opportunity to retire from Union Carbide and accept a three-month assignment in Turkey, which launched his career as an independent consultant. George Elder took over as Acting Executive Director.

- The newly constituted temporary TAC swung right into action, setting up a meeting at the O'Hare Hilton in Chicago on September 30, 1976. The attendees were Warren Pollock (Chairman), Sheldon Dean (Air Products), Larry Drake (Stauffer Chemical, Harvey Jacobs (ICI Americas), Bob Johnston (El Paso Products), Bert Krisher (Monsanto), Rich Mueller (Cities Service), and Jack Van Sciver (Allied). Also present were George Elder (Acting Executive Director) and Fred Thompson (DuPont) who was invited to discuss problems with refractories.

The purpose of the meeting was to identify, scope and estimate time and funding requirements for projects on issues of great concern to the group. The intent was that some or all of these projects would be pursued by the CPI/MTI as soon as, or shortly after, that organization became an actuality. The group was unanimous in recommending the following three projects for approval and authorization: Identify and develop corrosion and

fouling data on nontoxic cooling-water inhibitors; develop procedures to qualify fabricators, installers, and repair personnel of fiber-reinforced plastics for chemical plant use; and develop acceptance tests, selection guidelines, and design criteria for refractory bricks and brickwork for incinerators. A number of other possible projects were brought up, but reserved for detailed discussion at future TAC meetings.

Meanwhile, the corporate lawyers got back into the act. There were more of them than before: They re-reviewed the re-revised bylaws and certificate of incorporation, and called for more revisions. Also, the "gang of five advocates" contributed to the revision syndrome. In their case, the revisions reflected largely the on-going process of molding and refining the functional aspects of the organization. As acting Executive Director, George Elder, found himself inundated with the massive pile of paper which this exercise generated.

Among the problems being wrestled with were: What member companies are to be represented on the TAC? How will the members ensure that at least some of the projects being undertaken will meet each company's interests? Rich Mueller was one of those who voiced concern about these issues. Another issue: should the bylaws include a provision for indemnifying individuals for costs incurred by them in defending themselves for actions they had taken on behalf of the Institute? This question was addressed particularly by H. J. McCauley of DuPont's Legal Department.

- The first meeting of the temporary Board of Directors (BOD) took place on October 13, 1976 in New Jersey at the Allied Chemical Morris Township Center. At the meeting it was agreed that about \$150,000 in membership dues must be committed before the Institute could proceed with organization, the Institute would not have its own investigative facilities, the bylaws would require the BOD to prepare a tentative budget in the fourth quarter of each year, the section of the bylaws pertaining to indemnification would be stricken, plus numerous other modifications of the bylaws. The attendance at this Board meeting is shown in Table 3. It comprised 33 persons representing 26 companies, one consultant, and the Institute's counsel.

Table 3 ATTENDANCE LIST  
BOARD OF DIRECTORS MEETING

October 13, 1976

<u>Name</u>	<u>Company</u>
A. T. McCarrick	Air Products & Chemical Inc.
J. H. Van Sciver	Allied Chemical Corporation
J. D. Wood	Allied Chemical Corporation
J. G. Brown	Amax, Inc.
J. A. McGroarty	C-P Chems. Inc.
R. B. Leonard	Cabot Corp. - Stellite Div.
G. P. Gladis	Carpenter Technology
Ned Hetherington	Carter, Ledyard & Milburn
T. G. O'Brien	Carter, Ledyard & Milburn
R. A. Mueller	Cities Service Company
J. A. Rolston	Consulting Engineer
G. L. Brigham	Dart Industries
R. D. Forest	Dow Chemical Company
T. W. Gibbs	DuPont
W. I. Pollock	DuPont
E. E. Willson	DuPont
P. E. Krystow	Exxon Chemicals
J. A. Plumstead	Exxon Chemicals
J. R. Valbert	Halcon International

H. B. Fischer	Hercules, Inc.
E. A. Herzog	Herzog Hart Corporation
H. H. Jacobs	ICI United States
J. B. Guernsey	Jessop Steel
R. B. Puyear	Monsanto Company
J. F. Bates	Olin Corporation
W. J. Service	The Pace Companies
C. F. O'Brien	Philadelphia Quartz Company
E. D. Montrone	Sandvik
B. Ostrofsky	Standard Oil Company
L. E. Drake	Stauffer Chemical Company
D. L. Colson	Sterling Drug
W. G. Ashbaugh	Union Carbide Corporation
G. B. Elder	Union Carbide Corporation

At that meeting, the name of the organization was re-versed. Instead of being the CPI/MTI it became, in effect, the MTI/CPI--the Materials Technology Institute of the Chemical Process Industries, Inc., or MTI for short. And this name has stuck.

Also, at that meeting, Bob Puyear appointed a search committee to find an Executive Director. The committee was composed of Ed Wilson, Chairman, Bob Leonard, Chuck O'Brien, and Leonard E. Wender of Stauffer Chemical Company.

One would think that, at this point, the certificate of incorporation and the bylaws had been massaged enough. No way. The lawyers went right back at it with hammer and tongs:

- By letter of November 9, 1976 to Warren Pollock, John Guernsey of Jessop Steel Company brought up a somewhat sticky point. He interpreted that his company's dues would be based not on Jessop's sales but on the larger sales of Athlone Industries of which Jessop was a division. Under Athlone's umbrella were entities involved with ladies' wear, sporting goods, etc. whose connection with the chemical process industries could only be conceived as being extremely remote at best. Thus, Jessop probably would not join the MTI. At their next meeting, December 8, 1976, the temporary BOD took up this matter.

That meeting took place at the O'Hare Ramada Inn, Chicago, with Bob Puyear as acting Chairman. As a result of John Guernsey's communication, the method of determining membership dues was discussed at length and spelled out in appropriate detail. Among other things, it was decided that, for conglomerate organizations such as Athlone, the dues would be based only on the gross annual sales of all the chemical-industry-related products and services. In addition, a job description for the executive Director was agreed upon; it was decided to go forward immediately with the incorporation process; and it was agreed to accept the changes in the certificate of incorporation and bylaws recommended by C, L and M and H. J. McCauley of the DuPont legal department.

- Warren Pollock reported that, at their second meeting, which took place at the O'Hare Hilton, Chicago, on December 2, 1976, the temporary TAC

had confirmed their desire for a project on cooling-water inhibitors. Larry Drake (Stauffer), Bert Krisher (Monsanto) and Bill Ashbaugh (Union Carbide) had prepared a write-up on the subject. Great interest was shown in developing a handbook on new corrosion-resistant alloys, with Galen Hodge (Cabot), Gene Montrone (Sandvik), John Bates (Olin) and Jack Van Sciver (Allied) making important contributions to the discussion. A write-up on the subject was prepared later by Warren Pollock. Another topic of great interest was the development of guidelines to control stress-corrosion cracking. Sheldon Dean (Air Products) and Rich Mueller (Cities Service) each had prepared presentations on this topic. Gene Montrone was elected Vice Chairman of the temporary TAC.

#### ACTIVATING THE INSTITUTE

It was now the beginning of 1977. The group of dedicated advocates had put in almost two years of hard work developing objectives, organizational structure, technical program, method of operation, legal services, and commitments of memberships. But with all that, they still had not yet produced a corporate entity.

That event occurred on January 20, 1977. It was on that day, after the necessary consents had been obtained and the final modifications had been made, that the certificate of incorporation was filed with the Department of State in the State of New York.

As an outcome of the numerous contacts, meetings, and public relations activities that had taken place during 1975 and 1976, commitments to join the MTI had been received from 16 companies as of late February 1977. They are listed in Table 4. Olin Chemicals was the first to pay its dues (November 23, 1976) followed shortly by Dow Chemical (December 29, 1976). Indeed, this was an encouraging sign. Before the end of 1977, four more companies had joined: Betz Laboratories, Union Carbide, Zimpro, Inc. and Rohm and Haas Company. Zimpro joined in large part through the encouragement of Mars Fontana. Even though Sandvik had been actively involved in the MTI since the fall of 1976 and their Gene Montrone had been elected Vice Chairman of the Temporary TAC, the company did not join until some years later.

Table 4

## COMPANIES COMMITTED TO MEMBERSHIP

February 1977

Air Products and Chemicals	Halcon International
Allied Chemical	Hertzog-Hart Corporation
Cabot Corporation	ICI United States
Cities Service Company	Jessop Steel Company
Dow Chemical Company	Monsanto Company
DuPont	Olin Chemicals Company
El Paso Products Company	Philadelphia Quartz Co.
Exxon	The Pace Companies

Those well-intentioned companies that sent their dues in early, i.e., before MTI was officially incorporated, created a minor problem for George Elder. The MTI did not yet have a tax-payer's identification number. What to do with their checks? He decided to deposit them temporarily in his personal checking account which, of course, suddenly showed a large-and increasing-balance. Would the bank think he was operating some sort of "shake-down" scheme victimizing chemical companies? Apparently, the bank did not--George emerged unscathed from the experience:

On February 23, 1977, the membership held a very important meeting at the United Engineering Center in New York City. The purpose was to set the organization in motion officially. The attendees are shown in Table 5.

Table 5 ATTENDANCE AT FIRST MEMBERSHIP MEETING

February 23, 1977

<u>Name</u>	<u>Company</u>
J. G. Brown (Guest)	AMAX, Inc.
G. H. Dittmeier	BASF
T. W. Gibbs	DuPont
G. P. Gladis	Carpenter Technology
J. E. Guthrie	Exxon Chemical
R. A. Hahn	Jessop Steel Company
Earl Hoxie	Inco
E. M. Kloebler	MPC
R. B. Leonard	Cabot Corporation
J. Mannon	Chemical Engineering
Gene Montrone	Sandvik
C. F. O'Brien	Philadelphia Quartz Company
W. I. Pollock	DuPont
L. G. Posey, Jr.	The Pace Companies
R. B. Puyear	Monsanto Company
E. E. Wilson	DePont

The meeting was chaired by Bob Puyear. George Elder reported that the corporation's net assets were \$14,102.00. Warren Pollock reviewed the activities of the temporary Technical Advisory Council. Ed Wilson stated that the Search Committee had received six proposals from organizations and individuals relative to the directorship of the MTI. By motions made or seconded by George Elder, Hal Huckins, Dorm Swartz, L. G. Posey, R. A. Hahn, Rich Mueller, Bob Forest, and Harvey Jacobs the bylaws were whipped into final form. By motion of Bob Forest, seconded by Bob Leonard, the dues schedule for 1977, 1978 and 1979 was adopted.

The number of directors was set at nine, with the first official BOD being composed of the following:

- G. B. Elder, Union Carbide
- R. D. Forest, Dow Chemical
- H. A. Huckins, Halcon
- R. B. Leonard, Cabot Corporation
- C. F. O'Brien, Philadelphia Quartz
- W. I. Pollock, DuPont
- R. B. Puyear, Monsanto
- D. J. Swartz, Allied Chemical
- E. E. Wilson, DuPont

The first official Technical Advisory Council (TAC) was composed of the persons listed below. The number of members of the Council was established at 14.

W. I. Pollock (Chairman), DuPont  
E. D. Montrone (Vice Chairman), Sandvik  
J. F. Bates, Olin Chemicals  
S. W. Dean, Air Products  
J. B. Guernsey, Jessop Steel  
E. A. Herzog, Herzon-Hart  
F. G. Hodge, Cabot Corporation  
H. H. Jacobs, ICI United States  
R. A. Johnston, El Paso Products  
A. S. Krisher, Monsanto  
K. J. Loescher, Dow Chemical  
R. A. Mueller, Cities Service  
L. G. Posey, Jr., The Pace Companies  
J. H. Van Sciver, Allied Chemical

Immediately after the Members Meeting, the now officially constituted Board of Directors held its first meeting. It was brief and to the point. Bob Puyear and George Elder were elected Chairman and Vice Chairman, respectively, of the BOD. Bob then officially appointed an Executive Director Search Committee composed of Ed Wilson, Chairman, Bob Leonard, *Chuck O'Brien* and Bob Puyear. Arrangements were made for establishing banking facilities for the Institute, whereupon the meeting was adjourned.

The Executive Director Search Committee soon encountered all kinds of perceptions, both inside and outside the ranks of the MTI, regarding the nature of the position for which it was seeking candidates. There were those who figured the job could be handled by a person working half time in his basement. To

judge from his general attitude, one university professor appeared to think he could manage the MTI out of his back pocket, presumably with occasional assistance from one or two graduate students. In addition, a contract research institution offered to operate the MTI.

On March 13, 1977, the first meeting of the official Technical Advisory Council (TAC) took place. It was a Sunday afternoon in San Francisco. The attendees are listed in Table 6. Topics for MTI to consider pursuing, additional to those brought up at earlier meetings of the Temporary TAC, included a project leading to commercial development of a cell to monitor occluded-cell corrosion; sponsorship of a short course on electrochemical corrosion; a manual on the newer special corrosion-resistant wrought iron- and nickel-base alloys; quality assurance of high-alloy corrosion-resistant castings; and a project on practical means to control stress-corrosion cracking in iron- and nickel-base alloys.

Table 6 Attendees

Materials Technology Institute of the

Chemical Process Industries

First Meeting of the Technical Advisory Council

March 13, 1977

Name	Company	TAC Status
Warren I. Pollock	DuPont	Member
William G. Ashbaugh	Union Carbide	Member
John F. Bates	Olin Chemicals	Member
Raymond Kochanctyk for Sheldon Dean	Air Products	Member
John Guernsey	Jessop Steel	Member
Marvin Boethwell for K.J.(Bud) Loescher	Dow	Member
Harvey H. Jacobs	ICI United States	Member
Robert A. Johnston	El Paso Products	Member
A.S. (Bert) Krisher	Monsanto	Member
Paul E. Krystow	Exxon Chemical	Member
Eugene D. Montrone	Sandvik	Pending Member
Richard A. Mueller	Cities Service	Member
Lloyd G. Posey	The Pace Companies	Member

Jack H. Van Sciver	Allied Chemical	Member
J. E. Guthrie	Exxon	Member
E. J. Westerman	Kaiser Aluminum	Guest (MPC)
D. R. Augood	Kaiser Aluminum	Guest (MPC)
David Graver	Huntington Alloys	Guest
J. C. Bovankovich	DuPont	Guest
Ralph M. Davison	Climax Moly	Guest
Earle C. Hoxie	INCO	Guest
George H. Dittmeier	BASF	Guest
George P. Gladis	CARTECH	Guest
S. E. Doughty	CARTECH	Guest
George B. Elder	Union Carbide	Member

- The potential project on quality assurance of high-alloy castings possessed a unique aspect. A few days before the TAC meeting, on March 10 to be exact, Bud Loescher of Dow, Bob Smallwood of DuPont and Warren Pollock met with Peter Wieser, Research Director of the Steel Founders' Society of America (SFSA) to discuss the project and ways by which the two organizations might cooperate in conducting it. Ultimately, it was agreed that MTI would provide the funds for the project while SFSA would provide guidance and pertinent unpublished information from its files. The work was done in part at The Ohio State University under the direction of F. H. (Frank) Beck and in part at Battelle Memorial Institute under D. B. (Don) Roach. In effect, SFSA became the prime contractor while the other two participants became subcontractors. The program, designated Project No. 4, got under-way in December of 1977.

Thus, very early in its career the MTI made use of the idea of actively involving other organizations in the pursuit of projects which it had generated. For example, the second phase of Project No. 4, initiated in December 1979, was jointly sponsored and equally funded by MTI and SFSA. Likewise, MTI's efforts, starting in 1978, to obtain a quality assurance code for custom fabricated fiberglass-reinforced plastic chemical process equipment led to the formation of a Joint Task Group with the Society of the Plastics Industry to draft the document on which the code would be based, and to the involvement of the ASME for actual preparation of the appropriate standards. Among other such efforts was joint sponsorship with the Metal Properties Council and the American Society for Metals of a Symposium on Shell and Tube Heat Exchangers. This symposium was held in September 1979. Such endeavors have enabled MTI to benefit from information, perspectives and expertise provided by other groups and also have extended the influence of MTI in directions important to the Institute's interests.

- In his letter of May 17, 1977 to the members of the TAC, Warren Pollock summarized the projects, agreed upon at their meeting on March 13, which constituted the beginning of MTI's ongoing technical program. In this letter, he set forth his plan to assign a few TAC representatives to each project in the program to coordinate and monitor

the progress of the projects. Since that date, this procedure has been used with great effectiveness for every technical project undertaken by the MTI. In fact, it soon became common practice to include staff of member companies on these task groups who were not TAC representatives, but possessed specific pertinent knowledgeability.

- Meanwhile, at their meeting on May 12 in New York City, the BOD approved inviting Dr. Mars G. Fontana to fill the position of Executive Director of the MTI on a half-time basis beginning on June 1, 1977. An employment agreement to that effect was approved along with a budget of 146,188 to cover operations to the end of the year. Mars had discussed the position with Bob Puyear on March 16 at an NACE meeting in San Francisco, and had been interviewed by the Search Committee in Chicago on April 15. Additionally the principal office was set up in Columbus, Ohio.

Mars Fontana, who had become well-known world wide in metallurgy and corrosion technology through 40 years of teaching and research, was drawn to MTI largely because of the unusual concept upon which the Institute was based as well as by the challenge the position offered. Mars received the degrees of B.S., M.S. and Ph.D. in metallurgical engineering from the University of Michigan, then served as Metallurgical Engineer and Supervisor at DuPont in Wilmington, Delaware, from 1934 to 1945. In addition to work in metallurgy and corrosion he promoted industrial uses of Nylon\* and Teflon\*. He joined the faculty of the Department of Metallurgy of The Ohio State University (OSU) in 1945 and soon became Chairman of the Department and Regents Professor of Metallurgy.

Mars developed the CD4MCu cast corrosion-resistant alloy and suggested high-silicon iron for impressed anodes for cathodic protection. He was first editor of CORROSION journal, 1962-1973; had published some 200 technical papers and authored two books--Corrosion: A Compilation and Corrosion Engineering, the latter being used as a textbook by many engineering institutions.

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\* Registered tradenames of the DuPont Company

Dr. Fontana had been President of the National Association of Corrosion Engineers (NACE); received the NACE Speller Award in 1956; became an Honorary Member of the American Society of Metals (ASM); elected to the National Academy of Engineering in 1967; a Campbell Lecturer (ASM) in 1970; was given an Honorary Doctorate of Engineering by the University of Michigan in 1975; established the Mars G. Fontana Professorship and the Mars G. Fontana Laboratories at OSU; and was Chairman Emeritus of the Department of Metallurgical Engineering at OSU.

Mars hired Catherine G. (Cathy) Ward to be his secretary. She checked in for work on June 15, 1977 and turned out to be a very good worker. Previously, she had been a secretary for Roger Staehle in the Department of Metallurgy at OSU. She departed in September 1978 to be near her parents who lived in Norfolk, Virginia, her father having become quite ill.

- By letter ballot of the BOD in July of 1977, the project on guidelines for control of stress-corrosion cracking of iron-base (nickel-containing stainless steels) and nickel-base alloys was approved. The effort, designated MTI Project No. 1, was started on August 1, the contractor being C. P. Dillon and Associates. This project was one of the potential projects that had been discussed at the March 13 TAC meeting.

During the remainder of 1977 four additional projects were tendered to the BOD and activated. They were: Project No. 2 Electrochemical Monitoring of Occluded-Cell Corrosion let to Battelle-Columbus Laboratories; Project No. 3 Non-Destructive Testing of Fiber-Reinforced Plastic Pipe Joints placed with Peabody Testing/X-ray Engineering Company; Project No. 4 Quality Assurance of Corrosion-Resistant Alloy Castings, with Steel Founders' Society of America as the prime contractor as mentioned earlier; and Project No. 5 Quality Assurance of Custom-Fabricated FRP Equipment, the first phase being handled by Winston J. Renoud, Professional Engineer. These five projects constituted the beginning of a strong, ongoing technical program.

•At the same time, satisfactory procedures had been worked out for identifying and scoping potential

projects, evaluating their importance to the chemical process industries, preparing requests for proposals for presentation to a growing stable of candidate contractors, and evaluating the proposals offered by the respondents. A remaining problem was effective communication between the TAC and the BOD regarding approval by the BOD of projects desired by the TAC. In a word, the BOD tended to operate to a considerable extent like a second, or "superior", TAC in this matter: This was entirely natural, considering that the BOD, like the TAC, was composed of technical people. However, a fairly smooth working relationship was developed, although the problem was never entirely resolved.

It should be noted that, in financing the activities of the MTI, the funds obtained from member-ship dues were pooled. Thus, each member company contributed funding to each project undertaken irrespective of the extent of the company's interest in it. The premise was that, very shortly, a sufficient number and variety of projects would be undertaken to speak to every member's concerns. At the same time, no project would be funded in which the membership as a whole expressed a comparatively low level of interest.

At year-end, the MTI comprised 20 member companies, could look toward funding of \$312,600 for 1978, and had identified at least eight additional projects for activation during the coming year. Clearly, the MTI had made an excellent start toward fulfilling its objective of generating important developments relevant to the materials of construction and process equipment used by the chemical process industries.

## THE INSTITUTE GROWS

As 1978 started out and rolled forward, the MTI experienced a steadily increasing amount of activity. Considerable attention was directed toward refining the structure of the Institute as well as firming up procedures and policies. To a large extent the various operational and structural changes reflected needs and stresses arising from the growth of the organization. The intensity of the various activities is attested by the fact that, during the year, the BOD met five times while the TAC held four meetings. Added to that, there were numerous task group meetings. It's a wonder the participants had time left over to attend to their employers' concerns:

The Board of Directors established a Finance Committee, a Membership Development Committee and a Publications Committee. A membership dues basis pertaining to design-type companies, e.g. engineering companies, was formulated. Also a policy for distributing reports to the members was established--one copy for each \$1000 of annual dues or fraction thereof, with the privilege of purchasing additional copies at reduced prices. The members of the BOD are listed in Table 7; those of the TAC are shown in Table 8.

During the year, the TAC introduced 7 new projects which the BOD duly approved for funding: Project No. 6 on nonchromate corrosion inhibitors for cooling water systems, Project No. 7 on field installation and repair of fiberglass-reinforced plastic equipment and piping, Project No. 8 a symposium on shell-and-tube heat exchangers, Project No. 9 to develop guideline information on new wrought iron- and nickel-base alloys, Project No. 10 on refractories for the chemical process industries, Project No. 11 to prepare a hand-book on fracture control in the process industries, and Project No. 12 on detecting corrosion under insulation. Together with the five projects set up the previous year, the MTI now had developed a broad technical program speaking to many important concerns of the membership.

Table 7 Directors Elected at the First Annual  
MTI Membership Meeting, March 10, 1978

Robert B. Puyear, Monsanto Company

George B. Elder, Union Carbide Company

Robert D. Forest, Dow Chemical Corporation

Harold A. Huckins, Halcon Research and Development  
Company

Robert B. Leonard, Cabot Corporation

Charles F. O'Brien, Philadelphia Quartz Company

Dorman J. Swartz, Allied Chemical Corporation

Edgar E. Wilson, E. I. du Pont de Nemours & Company

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Warren I. Pollock, E. I. du Pont de Nemours &  
Company

Table 8 Representatives Elected to the Technical  
Advisory Council at the First Annual MTI  
Membership Meeting, March 10, 1978

Warren I. Pollock, Chairman, E. I. du Pont de Nemours  
& Company

Karl J. Loescher, Vice Chairman, Dow Chemical

John H. Ahern, Philadelphia Quartz Company

William G. Ashbaugh, Union Carbide Corporation

John F. Bates, Olin Chemicals Group

Sheldon W. Dean, Jr., Air Products and Chemicals, Inc.

John M. Donohue, Betz Laboratories, Inc.

John B. Guernsey, Jessop Steel Company

Ernest A. Herzog, Herzog-Hart Corporation

F. Galen Hodge, Cabot Corporation

Harvey H. Jacobs, ICI Americas, Inc.

Robert A. Johnston, El Paso Products Company

A. S. Krisher, Monsanto Company

Paul E. Krystow, Exxon Chemical Company

Richard A. Mueller, Cities Service Company

Thomas P. Oettinger, Zimpro, Inc.

Lloyd G. Posey, Jr., The Pace Companies

L. G. Scharfstein, Mobil Research and Development  
Company

Jack H. Van Sciver, Allied Chemical Corporation

Nelson Zetterberg, Rohm and Haas Company

- The increasing burden being placed on the TAC and the task groups as the technical program expanded stimulated a search for ways to alleviate the situation and make it tenable. Certainly, arrangement for the TAC to have a Vice-chairman together with a Chairman was called for. Also, for several reasons it was deemed that each member company should have a representative on the TAC, the number being limited to 20 in 1978. In the same vein, it appeared desirable to increase the number of Directors from 8 to 10. A very helpful step was the engagement of consultants to assist task groups in monitoring those projects which demanded a great amount of attention, such as Projects No. 5 and No. 8. R.M. (Bob) Webster was employed for the former, while John A. ("Polecat") Moore was asked to handle the latter.

In June of 1978 Mars Fontana expressed a desire to either retire from the position of Executive Director or to reduce the scope of the position. The job was becoming too ramified to be handled by one person and, in addition, Mars was experiencing increasing difficulty with his hearing. Accordingly, at their June 14 meeting, the BOD agreed to offer the position to Walter K. (Walt) Boyd on a 3/4 time basis. If Walt declined the offer, then a Search Committee composed of Bob Puyear (Chairman), Bob Leonard, Warren Pollock, Ed Wilson, and Mars would go into action. At that time Walt, who was prominent in corrosion circles and was a former President of NACE, was employed by Battelle Memorial Institute in its Houston, Texas operation. As it turned out, Walt declined the position.

The idea of bringing a Project Manager or a Technical Director on board in addition to an Executive Director was discussed at the September 13, 1978 BOD meeting. The positions could be either part-time or full-time; the "Technical Director" could be either a person or an organization. The Search Committee was activated in November.

In the meantime, Mobil Research and Development Company had joined the MTI in February of 1978, while by June Drew Chemical Corporation had joined. ARCO/ Chemical Company, Hatch Associates Ltd., Standard Oil Company (Indiana) and Wisconsin Centrifugal, Inc. all committed themselves to join the MTI on January 1, 1979. Thus, the number of

members had increased to 27. Also, the Institute moved into 1979 with a budget of 1334,100 a modest increase over the 1978 budget.

On October 1, 1978, Mrs. Helen Z. DeLong replaced Cathy Ward as Administrative Assistant. Helen brought with her a great deal of secretarial experience, having been in the employ of Chemical Abstracts from 1959 to 1966, in the Aeronautical-Astronautical Engineering Department of The Ohio State University from 1972 to 1975 and in the Department of Metallurgy of that university from 1975 to 1977. In the spring of 1978 she substituted briefly for Cathy Ward at MTI. In the fall of that year, she quickly added bookkeeping to her list of capabilities and later became adept in the use of the computer for word processing, bookkeeping and other office functions. Before joining Chemical Abstracts Helen had attended Capital University.

Toward the end of October 1978, Don Roach, Manager of Battelle's part of Project No. 4, mentioned to A. M. (Al) Hall, then Assistant Manager of Battelle's Department of Metallurgy, that the MTI had decided it needed a Technical Director. Why not apply for the position? Don was aware that Al was making plans to retire from Battelle soon but also intended to remain active professionally. By letter of November 2 to Bob Puyear, Al applied for the position with the understanding that it would be on a part-time basis.

In February 1979, Mars Fontana advised the BOD of his decision to retire completely from the MTI as soon as feasible. Thereupon, Bob Puyear telephoned Al stating that the position of Executive Director was now open along with that of Technical Director. Would Al take both positions? Al declined, saying that he felt his experience qualified him better for the position of Executive Director than that of Technical Director and that, among the other applicants, there undoubtedly was one better suited to be the Technical Director than he was. Indeed that was the case, Edward A. (Ed) Kachik of DuPont.

At their meeting on February 15, the BOD approved hiring Al as Executive Director and Ed as Technical Director, each on a half-time basis. At the same time, they appointed Mars Fontana to the

position of Executive Director Emeritus. Al and Ed assumed their duties on April 1 and May 1, respectively.

Like Mars Fontana, Al Hall was attracted to MTI by the concept upon which it was built and the challenge of the position. Al received an A.B. degree from Columbia College (1935), a B.S. from the Engineering School (1936), and a Metallurgical Engineering degree from the School of Mines (1937), all units of Columbia University. Until 1945 he served as Research Metallurgist with INCO Products, Huntington, West Virginia, where he developed procedures for the manufacture of platinum-clad nickel and monel-clad carbon steel sheet and was the first to roll Hastelloy C sheet on a commercial scale. He joined the staff of Battelle Memorial Institute in 1945 becoming Assistant Manager of their Metallurgical Department in 1969.

With co-workers he developed several stainless steels, high-alloy wrought and cast steels, electrical resistance and thermocouple alloys, and superalloys, along with a substantial amount of the physical metallurgy and production technology that forms the basis for today's heat-resistant alloy casting industry. Among other programs, he directed the investigation that led to the silver-free "sandwich" coinage now minted by the U.S. Government.

Al was the author of the Alloys of Iron Monograph on Nickel in Iron and Steel (John Wiley and Sons, 1954). He was the author or co-author of two other books and over 130 technical papers and articles. He and co-inventors held 7 patents. Al was a former President of the Columbus Technical Council (Columbus, Ohio) and a former Secretary of the Joint ASTM-ASME-MPC Committee on Effect of Temperature on Properties of Metals. He was a member of Tau Beta Pi, Epsilon Chi, Sigma Xi, AAAS, The Metallurgical Society, ASTM, and the Ohio Society of Professional Engineers; and was a Fellow of the American Society for Metals.

Ed Kachik came to MTI as Technical Director after 36 years of service with DuPont where he started as a materials engineer in 1942, progressed to supervisory and managerial assignments in materials research and development, and became

Supervisor of Materials Consultants in DuPont's Engineering Service Division in 1964. Two years later he moved to DuPont's Engineering Test Center as Manager of Materials. In 1970 he was made Manager of the Engineering Test Center with a staff of 110 people. Five years later he became Manager of DuPont's Mechanical Engineering Consultants. In this assignment he was responsible for managing 40 consultants specializing in virtually every aspect of mechanical engineering in the chemical industry.

Ed received a B.S. in Metallurgy from Penn State University in 1942. He was an active member of ASM for many years, especially in the affairs of the Wilmington, Delaware, chapter, as well as being a member of NACE. He directed much effort toward community and church concerns including the Boy Scouts of America. Ed published articles on various aspects of corrosion and gave numerous talks to university groups, mechanical engineers, and technical personnel of the chemical process industries.

- Beyond the above-noted changes in the MTI staff, substantial progress was made on most of the twelve projects which had been activated before the first of the year, 1979. During the year, Winston Renoud's proposal for improvement in the quality of custom fabricated fiber-reinforced plastic piping and equipment subject to severe service, Project No. 5, was published as MTI Technical Report No. 1. This was followed by MTI Manual No. 1 "Guidelines for Control of Stress-Corrosion Cracking of Nickel-Bearing Stainless Steels and Nickel-Base Alloys" by Paul Dillon (Project No. 1). This publication was very well received and, ultimately, more than 1,000 copies would be distributed and a second printing run off. The publication filled a pressing need for guidance in minimizing the incidence of this insidious and costly corrosion problem. Also printed and distributed in 1979 were MTI Bulletin No. 1 "ISGHO Guide Notes on the Safe Use of Stain-less Steel in Chemical Process Plant" by Paul Dillon (Project No. 1), and MTI Manual No. 2 "Recommended Procedures for Field Installation and Repair of Fiberglass Reinforced Plastic Equipment and Piping for Chemical Service" (Project No. 7) by R. M. (Bob) Webster. These publications marked the beginning of a steady out-pouring of

valuable information on structural materials important to the chemical and allied industries that would result from a stream of projects conceived and supported by the MTI.

In Project No. 2 a concept was developed that showed promise as the basis for an instrument to detect and monitor occluded-cell corrosion (OCC) on-line in process equipment. The work was done at Battelle Memorial Institute under the direction of Dr. R. B. (Ron) Diegle. In a second phase of the program, arrangements were made with Petrolite Corporation to manufacture 8 prototype instruments based on that concept, for round robin trials by MTI members. Battelle monitored the field trials. The results were reported in MTI Technical Report No. 8 "A Sensor for Monitoring Crevice Corrosion--An Analysis and Evaluation" by A. K. Agrawal and J. H. Payer, issued in 1983. The field tests showed that the device required modification. Accordingly a second generation of instruments was manufactured and tested in the field during the 1983-84 period. With some additional modifications an effective device for detecting OCC could be made available.

Project No. 3 was undertaken in response to the need to determine nondestructively the quality of reinforced thermosetting resin pipe (RTRP) joints that are adhesively bonded. Specifically, an inspection procedure was required that would indicate how much of the joining surface, in such a joint, was actually bonded by the adhesive. The method chosen was ultrasonic examination. In the project, this method was used on three types of commercial pipe and joining systems. The assemblies also were tested hydrostatically and lap-shear tension tests were made of specimens cut from the pipe joints. The specific inspection procedures that were developed during the program were contained in MTI Technical Report No. 2 issued in the spring of 1980 as prepared by E. G. Wood and E. L. Jain of Peabody Testing/X-ray Engineering Company.

As mentioned earlier, Project No. 4 was a joint effort by MTI and the Steel Founders' Society of America, part of the program being conducted by Don Roach at Battelle and part by Frank Beck at The Ohio State University. The objective was to attack the problem of premature failure of

corrosion-resistant high-alloy castings in chemical plant service which had resulted in unexpected shutdowns, needless extra costs and lost production. Phase I dealt with the metallurgy and production of high-alloy castings and the types and causes of defects found in them. MTI Manual No. 5, released in 1981, covered these issues. Phase II was directed at specifications, inspection, examples of casting discontinuities, repair of castings and the costs entailed in producing castings to stringent specifications. This phase was reported in MTI Manual No. 6 which was distributed early in 1982. An important result of the study was establishment of better communication among chemical plant engineers, foundry metallurgists and valve manufacturers. Another outcome of the study, as reported by Karl Loescher at the TAC meeting, May 21-22, 1981, was that ASTM Subcommittee 18 on Castings was encouraged to process a document to cover casting quality control.

Numerous unexpected failures of custom-fabricated fiberglass-reinforced plastic (FRP) equipment, which had detracted from the otherwise excellent potential of FRP for chemical plant service, led to the initiation of Project No. 5. Phase I of the project, handled by Winston J. Renoud, defined the critical factors. The results of that effort demonstrated the need for a code to assure that custom-fabricated FRP process vessels possessed the required level of quality. Accordingly, a Joint Task Group was formed of representatives of MTI and The Society of the Plastics Industry (SPI) to oversee preparation of a document which would serve as the basis for formulating the desired code. ASME agreed to act as the code-writing body and accepted the Joint Task Group as their Code Committee. R. M. (Bob) Webster was engaged to chair the committee and assemble the document, which was published in 1981 under the title, "Quality Assurance Report: RTP Corrosion-Resistant Equipment". However, Bob was so accustomed to dealing with standards, codes and specifications that his draft read uncomfortably like a standard. As Bob McTamanev, MTI's counsel, had made loud and clear to the BOD and the staff on numerous occasions, publication of the document in that form by the MTI was a big "NO: NO:" be-cause the Institute was not set up to write codes. After a couple of editorial sessions, including

one in McTamaneys office, the draft was pronounced ready for publication.

Obtaining FRP equipment of the necessary quality from the vendor is extremely important, but the performance of the final installation in the plant depends also on the subsequent handling during shipment and at the plant site, on the installation or assembly practices used and on the repair strategies selected. Until 1979, a comprehensive guide to deal with these matters did not exist. Bob Webster was commissioned to fill this need, the undertaking being designated as Project No. 7. The result was MTI Manual No. 2 mentioned earlier.

Like Project No. 2, the subject dealt with in Project No. 6 had been discussed by Bob Puyear, Bert Krisher, Warren Pollock, Paul Dillon and George Elder during their historic meeting in mid-April 1975, at which they conceived the basic ideas that ultimately led to the establishment of the MTI. That subject, the matter of finding substitutes for chromate and zinc ions in cooling-water treatment systems, was of considerable concern to the chemical industry. The highly effective chromate-type additives have toxic effects when discharged to the environment. As a consequence, the quantities permitted in chemical plant effluents are severely restricted. Project No. 6 was initiated to assemble the available information on non-toxic additives. The results were re-reported in MTI Manual No. 4 which was prepared by David E. Simon, II of NUS Corporation and issued in 1980. At the suggestion of the Task Group, NUS Corporation also prepared a standardized form by which users and producers of non-toxic additives could report their experiences in a uniform manner. The form was identified as MTI Technical Report No. 6, which was issued toward the end of 1981.

In an effort to find answers to critical problems being encountered with shell-and-tube heat **ex**-changers in chemical process service, a symposium was organized jointly with the Metal Properties Council under MTI Project No. 8 to provide a forum where industry people could exchange information on their experiences. The symposium was held in Houston, Texas, September 17-19, 1979. ASM handled the arrangements and AIChE also joined in the

sponsorship. This somewhat different way of pursuing MTI's objectives turned out to be a great success; 300 people were in attendance. The papers ran the gamut from codes and design concerns to operating procedures and field repair. J. "Polecat" Moore assisted MTI as a consultant in organizing the symposium, while Martin Prager of MPC prepared a comprehensive report on the proceedings which was issued in August 1981, as MTI Technical Report No. 5 "Narrative Summary of First Symposium on Shell and Tube Heat Exchangers."

Project No. 9 was undertaken with the objective of developing and presenting guideline information, in a concise manner, on new wrought iron and nickel-base corrosion-resistant alloys. The intent was to readily permit evaluation and comparison of the critical properties of each of the alloys with one another. As a first step, Richard S. (Dick) Treseder identified and developed in detail five standard laboratory procedures covering general corrosion, pitting corrosion, inter-granular corrosion and stress-corrosion cracking. The purpose of Dick's standardization of critical test details was to permit data from different laboratories to be compared directly and with confidence. The format of the five tests was issued in 1980 as MTI Manual No. 3 "Guideline Information on Newer Wrought Iron- and Nickel-Base Corrosion-Resistant Alloys; Phase I Corrosion Test Methods." Since then a number of alloy producers have provided data obtained using the procedures described in Manual No. 3. T. F. (Tom) Degnan of DuPont assembled the information in a database format for use with a computer as well as for distribution in loose leaf form. Control testing was done by Lehigh Testing Laboratories, Inc.

Satisfactory operation at the extremely high temperatures called for in a variety of chemical processes depends on proper selection of the refractory materials, design of the installation and fabrication of the components. Chemical plant service is a small outlet for refractories and a guideline manual on refractories for chemical process applications had not been available heretofore. Project No. 10, contracted to Edwin (Ed) Ruh of Carnegie-Mellon Institute, was established to produce such a manual. The document, MTI Manual No. 9 "Refractories for the Chemical Process Industries," was issued in two volumes in 1984.

Project No. 11 was directed at preparing a hand-book on fracture mechanics and fracture control especially for materials and corrosion engineers involved in the design and reliability of process equipment. The project had been suggested by Rich Mueller. The objective was to provide a document that would elucidate the principles of fracture mechanics in terms of the chemical industry's needs and thus encourage wider use of this important analytical and diagnostic tool. David Broek, Consultant, with contributions by George T. Hahn, Vanderbilt University, prepared an excellent treatise which was entitled MTI Manual No. 8 "Fracture Control for the Chemical Process Industries" and released in 1983.

The twelfth project on the books at the beginning of 1979 was aimed at identifying or developing nondestructive techniques for detecting external corrosion of steel piping and process equipment under wet insulation, without removing the insulation. Methods in current use generally required removal of the insulation--often time consuming and costly. In a Phase I study, carried out at Battelle, possible approaches were reviewed. In that study, radiation gaging was identified as showing promise for piping, while low-frequency ultrasound was a possibility for process vessels. The study was described in MTI Technical Report No. 4 "Investigation of Nondestructive Testing Techniques for Detecting Corrosion of Steel Under Insulation" by George J. Falkenbach, John R. Fox and Robert P. Meister of Battelle Institute, issued in 1981. In Phase II, the capability of radiography, when coupled with image intensification and closed-circuit TV, was evaluated in the laboratory at Battelle. Feasibility was demonstrated. The results of the laboratory tests were reported in MTI Technical Report No. 7 "Investigation of an Approach to Detection of Corrosion Under Insulation" authored by O. A. (Ozzy) Ullrich and distributed in 1982. However, development of a practical inspection device based on this technology appeared very difficult. As an alternative approach, MTI initiated a project with Babcock and Wilcox to determine if electromagnetic principles, as exemplified by the Hall effect, could provide a practical means for measuring the extent of corrosion under insulation in the plant. This investigation became Project No. 30.

- At their meeting on February 21, 1979, the BOD re-elected Bob Puyear as Chairman and elected Chuck O'Brien as Vice Chairman, respectively. The composition of this body had changed somewhat since 1978, as shown in Table 9. The members of the TAC are listed in Table 10. Also, Robert A. (Bob) McTamanev had replaced Thomas G. (Tom) O'Brien, III, as MTI's legal counsel. Both men were of Carter, Ledyard and Milburn, New York, N.Y. They contributed enormously to the soundness and good health of the MTI from the legal perspective.

Table 9. Board of Directors as of February 21, 1979

Robert B. Puyear, Chairman, Monsanto Company  
Charles F. O'Brien, Vice Chairman, PQ Corporation  
William G. Ashbaugh, Union Carbide Company  
F. Galen Hodge, Cabot Corporation  
Harold A. Huckins, Halcon Research and Development  
Company  
James M. Macki, Dow Chemical USA  
Richard A. Mueller, Cities Service Company  
Thomas P. Oettinger, Zimpro Incorporated  
Dorm J. Swartz, Allied Chemical Company  
Edgar E. Wilson, DuPont

Table 10. The Technical Advisory Council, 1979

Warren I. Pollock, Chairman, E.I. du Pont de Nemours &  
Co., Inc.  
Paul E. Krystow, Vice Chairman, Exxon Chemical Company  
John R. Ahern, PQ Corporation  
A. I. Asphahani, Cabot Corporation  
John F. Bates, Olin Chemicals Group  
Joseph J. Concordia, Herzog-Hart Corporation  
Russ L. Davisson, Union Carbide Corporation  
Sheldon W. Dean, Jr., Air Products and Chemicals, Inc.

George A. Dmitroff, Dart Environment and Services  
Company

John M. Donohue, Betz Laboratories, Inc.

John B. Guernsey, Jessop Steel Company

Joerg Gutzeit, Standard Oil Company (Indiana)

Robert J. Hoenigke, FMC Corporation

Harvey H. Jacobs, ICI Americas, Inc.

Robert A. Johnston, El Paso Products Company

A. S. (Bert) Krisher, Monsanto Company

Karl J. (Bud) Loescher, Dow Chemical

Arlin L. McKim, Eastman Kodak Company

John E. Meinhardt, Wisconsin Centrifugal, Inc.

Nick Monsour, Polysar Limited

Richard A. Mueller, Cities Service Company

Emil H. Nenniger, Hatch Associates

Thomas P. Oettinger, Zimpro, Inc.

E. Rousses, Jacobs Engineering Group

Lawrence R. Scharfstein, Mobil Research and  
Development Company

David R. Sexsmith, Drew Chemical Corporation

Jack H. Van Sciver, Allied Chemical Corporation

Gary C. Wolf, ARCO/Chemical Company

Nelson Zetterberg, Rohm and Haas Company

- At the BOD meeting of June 21, Warren Pollock suggested that Dr. Costi Edeleanu of Cambridge University, England, was well qualified to interest British, and perhaps other western European, chemical process industries in joining the MTI. Warren volunteered to contact him. In the same vein, Al Hall offered to explore the matter of approaching the Japanese CPI through Mitsubishi. In due course, Al's attempts to establish representation for MTI in Japan through Mitsubishi were abandoned because mutually agreeable contractual arrangements could not be worked out. However, agreeable arrangements were readily reached with Dr. Edeleanu and a contract with him was established during the BOD meeting on May 14, 1980 which Dr. Edeleanu attended. Warren Pollock soon solicited Costi's assistance in TAC's forward planning activities and, at the May 1981 TAC meeting, Costi provided a succinct critique of MTI's operations. In the years that followed, Costi played an important part in attracting BASF, Sandvik and VDM to join the MTI.

Apropos of membership development and public relations, the practice of inviting nonmember guests to attend TAC and other meetings was established at the beginning of the MTI and was vigorously pursued thereafter. It proved to be an effective way to attract new members. Al Hall routinely sent press releases to NACE, ASM, and a variety of technical journals describing each new publication issued by MTI. Early in 1980, he prepared a "mini-brochure" highlighting MTI's objectives, structure and program. During 1979, both Bert Krisher and Bud Loescher prepared technical papers that made reference to projects carried out under MTI sponsorship.

- Two additional projects were started in 1979, Projects No. 13 and No. 14. The objective of Project No. 13 was to develop guideline information on Ti, Zr and Ta and their alloys in a manner similar to that of Project No. 9. Somewhat later the scope of the project was extended to include niobium and its alloys. And again, Dick Treseder was engaged to carry out the project. The key factor in the effort was selecting and obtaining acceptance of a series of corrosion tests by the producers that would provide the users with the information they needed. In particular, difficulty was encountered with a pitting test.

Project No. 14 was concerned with the use of small-diameter carbon-steel pipe at low temperatures. Existing specifications limited use of this material to -20 F, but operating temperatures of -50 F and below were common in chemical plant service for which the codes required specialty steels. Use of such steels entails considerable extra costs. At a TAC meeting on October 25-26, 1978, Paul Krystow described work that Del Re-search had done for EXXON indicating that small-diameter carbon-steel pipe could be used at much lower temperatures. The problem was to secure the appropriate code changes. It was learned that ASME would be willing to consider the desired code changes if it were presented with sufficient supporting data. Accordingly, in December 1979, MTI contracted with Del Research to develop the required test data. The data obtained showed that such pipe behaves in a tough manner at temperatures down to -100 F (-73 C) and below. Analysis based on fracture mechanics, done by Fracture Proof Design, Inc. confirmed that small-diameter carbon-steel tubular goods can be safely used within certain stress limits at very low temperatures. The investigation was described in MTI Publication No. 20 "Evaluation of the ANSI B31.3 Impact Test Requirements for Small Diameter Piping" by Keyren H. Cotter and Hiroshi Tada, distributed in 1986.

## ONWARD INTO THE EIGHTIES

Toward the end of 1979, Professor Digby Macdonald of The Ohio State University contacted the MTI with an approach to the measurement of velocity effects on the corrosion behavior of materials that might overcome the limitations of the methods then in use. The problem with other methods had been that they did not necessarily predict performance in plant and were limited to a narrow range of velocities. MTI agreed to support a 3-year research effort and work began in January 1980 to construct the required laboratory equipment. The method, which made use of a loop apparatus, showed itself to be a greatly improved quantitative procedure for measuring velocity effects. The research, which was identified as Project No. 15, was described in MTI Publication No. 23 "The Development of Controlled Hydrodynamic Techniques for Corrosion Testing" by Tzu-Yu Chen, A. Moccari and D. D. Macdonald. This publication was distributed in May 1986.

Late in 1979, Ron Diegle of Battelle also approached the MTI with a concept for a device to monitor chemical plant equipment for the onset of stress-corrosion cracking, which is always a possibility in spite of care taken in design and operation of the plant. Changes in process conditions or contamination of the process stream can lead to catastrophic failure from this form of corrosion. In the spring of 1980 MTI set up Project No. 16 at Battelle to investigate the concept. The results were encouraging but considerable further development work would be needed to produce a practical instrument for use in the field. The investigation was described in MTI Publication No. 12 "Development of a Cell for Monitoring Stress Corrosion Cracking" issued in 1984 and authored by T. K. Christman and J. H. Payer who took over the project when Ron left Battelle.

Also in the fall of 1979, the TAC began to consider funding an effort to determine whether E/pH diagrams could be developed for alloys. These diagrams, developed by Dr. M. Pourbaix of CEBELCOR, had proven very useful in understanding the corrosion behavior of metals in various aqueous environments. A contract to investigate the possibility was let to Professor R. H. Heidersbach, then of the University of Rhode Island, with work to commence about July 1, 1980. This study was designated as Project No. 17. The research work was summarized in MTI Publication No.

31 "Potential-pH Diagrams for 304 Stainless Steel" by R. H. Heidersbach, released in July 1987. The results indicate that considerably more research is required in this area.

Project No. 18 grew out of a concern expressed at the October 1979 TAC meeting by Bert Krisher regarding the effect of cooling rate from annealing temperatures or after field repair-welding, on the microstructure and hence the probability of sensitization, of austenitic stainless steels. Apropos of this, Gary Wolf called attention to a recently developed nondestructive commercial sensitization detector based on work done at General Electric Company. The upshot was initiation of a project at Southwest Research Institute to evaluate the instrument, which was manufactured by Intruspec, Inc., Walnut Creek, California. The study, which was managed by Fred Lyle of SwRI, validated the electrochemical principle on which the instrument was based as reported in MTI Publication No. 11 "Evaluation of the EPR Technique and the WC-5 Metal Sensitization Detector For Determining Susceptibility of Austenitic Stainless Steels to Intergranular Corrosion" by R. W. Arey and F. F. Lyle, Jr. released in 1983.

Because of the success of the first symposium on shell-and-tube heat exchangers (Project No. 8) held in Houston in September 1979, and because of the critical importance of the subject, the decision was made to hold a second one in the fall of 1981. The process of organizing this second symposium was begun early in 1980 under Project No. 19. Again, the event was cosponsored with MPC and other organizations, with ASM handling the physical arrangements. The meeting, which was held in Houston, Texas, September 14-16, 1981, was well received by the 300 attendees. ASM published the proceedings.

A suggestion that emerged from discussions at Heat Exchanger Symposium No. 2 was to prepare guidelines for using eddy-current technology to inspect nonmagnetic heat-exchanger tubes. The results obtained from on-site eddy-current inspection often were difficult to interpret, especially by operators not well-versed in the technology. Engineers needed guidelines on instrument selection and use as well as on interpretation of results. Accordingly, MTI established Project No. 20 at Conam Inspection Division, Nuclear Energy Service, to prepare the guideline document, which became MTI Publication No. 16 "Eddy-Current

Field Examination of Nonferrous Heat Exchanger Tubing" issued in 1985.

During 1980, the list of potential, but as yet unfunded, projects lengthened considerably. It included bacteriologically-influenced corrosion championed by Art Freedman, corrosion resistance of hard-facing alloys recommended by Harvey Jacobs, corrosion-resistant coatings for the I.D. of heat exchanger tubes suggested by Rich Mueller, a metallographic atlas of corrosion failures introduced by Karl Loescher, computerization of engineering data on structural materials suggested by Joerg Gutzeit, grounding methods for cathodic protection systems offered by Russ Davisson, a project on furan resins similar to Project No. 7 recommended by John Bates and Bob Hoenigke, a second volume of the manual on stress-corrosion cracking, bolting for chemical plant service, and measurement of the surface temperature of tubes in fired process heaters suggested by Bob Johnston.

- The TAC members, organized into task groups, followed up very effectively on the progress of the various projects, even though doing so added to the responsibilities they already had toward their employers. Warren Pollock was both very active and creative in his role as Chairman of the TAC. Ed Kachik handled his function as secretary of the TAC with great effectiveness; he also contributed strongly and constructively to the activities of the various task groups, dynamically catalyzing the MTI's technical program.

By March of 1980, Gulf Research and Development Company and Nalco Chemical Company had joined the MTI. This brought the total number of members to 33.

Several changes in personnel occurred during 1980 in the Board of Directors and in the Technical Advisory Council. Jim Macki of Dow Chemical and Ed Wilson of DuPont retired from the BOD, while F. A. (Frank) Hoagey of DuPont and D. K. (Dave) Winegardner of Dow Chemical took their places. Chuck O'Brien was elected Chairman of the BOD and Bill Ashbaugh was elected Vice Chairman of that body. Tim J. Murnane replaced Nelson Zetterberg as the representative of Rohm and Haas Company to the TAC. New TAC representatives were: Howard B. Bomberger of RMI Company, Dean G. Damn of Gulf R and D Company, Arthur J. (Art) Freedman of Nalco

Chemical, Mark C. Hoffman of Zimpro, and Richard V. Porcelli of Halcon.

- Early in the year, the BOD pressed forward with plans to hold membership development seminars to be attended by selected groups of invitees from the chemical process and allied industries. The seminars would feature slide presentations by Ed Kackik and Al Hall plus commentaries by "satisfied customers." One was scheduled for May 21 in Houston, Texas and another for June 10 in New York City. The Houston effort fizzled out before it got off the ground. Only two companies responded out of 45 that were invited; they were Uddeholm and VDM. Needless to say, that seance was cancelled. However, the presentation in New York City could be considered a success. One of the attendees was Steve Seelinger of BASF Wyandotte who became instrumental in that company's joining the MTI the following year. Hal Huckins, Frank Hoagey, Galen Hodge and Paul Krystow had campaigned vigorously to assemble a good group of prospects. Jack Van Sciver also participated in the role of the "satisfied customer." Ed and Al were encouraged to try another presentation--this time on October 14 in Toronto, the day before the TAC meeting in that city. Nick Monsour helped set it up. However, no new memberships resulted from the effort.
- Going into 1981, the projected budget stood at \$740,000 including the sum of \$251,600 available to fund additional projects.

At the beginning of that year, in the interest of enhancing its effectiveness and reducing the time commitments of the TAC representatives, that body organized itself into **six** sections spanning the technologies with which the MTI was concerned, as follows:

Corrosion Engineering, Aziz Asphahani, Manager  
Corrosion Monitoring and Control, Bert Krisher,  
Manager  
Mechanical Properties and Fabrication, Rich  
Mueller, Manager  
Quality Assurance and Inspection, Nick Monsour,  
Manager  
Nonmetallics, Jack Van Sciver, Manager  
Castings, Karl Loescher, Manager

Also, a Procedures and Planning Section, chaired by Warren Pollock, was established to identify means to improve TAC operations and stimulate important long-range projects.

- Two additional agenda items were introduced to the meetings of the TAC, both strongly promoted by Paul Krystow. One was a forum, generally held on the second day of the meeting, where the representatives could discuss technical problems and exchange experiences with their peers. The other was the inclusion of seminars on the agenda, the subjects usually being selected from the list of funded projects or from the forum topics. In the case of the former, contractors' representatives generally were invited to make the presentations. These innovations quickly proved themselves to be extremely worthwhile. Discussion leaders at the first forum, which was held during the March 19-20, 1981 TAC meeting, were Dean Damin, Nick Monsour, Karl Loescher, Arlin McKim, Russ Davisson and B. J. Sanders of Monsanto. The first seminar was given at the May TAC meeting by Ron Diegle of Battelle on the occluded-cell corrosion monitor project and on the SCC monitor project. At the October 14-15, 1981 meeting of the TAC, O. A. Ullrich of Battelle gave a seminar on radiographic inspection for corrosion under insulation while John Flora of Babcock and Wilcox presented a proposal for an investigation of the use of the Hall effect to detect corrosion under insulation.
- During 1981 the number of members increased from 33 to 36. New members were BASF Wyandotte, Diamond Shamrock, Engineers India Ltd., and Occidental Research Corporation. Dart Environment and Services Company resigned from membership during the year. A visit by Galen Hodge to the offices of Engineers India, Ltd., while in India in March, certainly must have intensified that company's interest in the MTI. These changes engendered changes in the make-up of the TAC. New representatives were George H. Dittmeier for Diamond Shamrock, Harold E. Kyle for Occidental Research, A. K. Lahiri for Engineers India Ltd., and Steven M. (Steve) Seelinger for BASF Wyandotte. Richard L. Flood replaced Jack Meinhardt for Wisconsin Centrifugal and R. N. Kapoor replaced Emil Nenniger for Hatch Associates, while the TAC lost George Dmitroff because of the resignation of Dart. Paul Krystow was elected Chairman and Warren Pollock, Vice Chairman, of the TAC.

The composition of the Board of Directors remained the same as in 1980 with Chuck O'Brien continuing as Chairman and Bill Ashbaugh as Vice Chairman.

In the spring of 1981 the BOD engaged in two actions of outreach toward the academic world. One was a \$10,000 contribution to a Mars G. Fontana Professorship in Metallurgical Engineering at The Ohio State University. The other was appointment of a BOD standing committee to establish and supervise a program to provide awards for excellence in corrosion engineering to outstanding university students, whether graduates or undergraduates. An award would generally consist of a plaque and an honorarium of \$1,000. The purpose was to encourage students to take up corrosion or materials engineering as a career. This action was an outgrowth of suggestions made by Bob Puyear the previous year and mulled over by him and Mars Fontana in the interim.

At the annual meeting of NACE in Toronto, Canada, April 6-10, 1981, MTI set up a booth displaying MTI's activities and publications, and providing information regarding membership. The booth was staffed by Helen DeLong. Arrangements for the booth had been made by Galen Hodge. The booth elicited 53 written enquiries about the MTI. The idea of an MTI newsletter surfaced at the October 1981 TAC meeting. No action was taken at that time. Later in the fall of 1983, it became a reality with Al Hall assuming the function of editor.

- As reported at the October 1981 TAC meeting, the Procedures and Planning Section reacted favorably to Costi Edeleanu's request that MTI hold a technically oriented meeting in Europe. Shortly there-after, Costi arranged for the meeting to be held in London, April 29-30, 1982. It was established that the purpose of the meeting would be to stimulate interchange of technology among structural materials specialists of the European and North American chemical process industries. The conference was entitled "Planning and Technical Meeting." Letters of invitation were issued in January. The two-day four-session meeting attracted 79 people representing 15 member companies and 33 nonmember organizations located in 10 countries of Europe, Asia and North America. The session

chairmen were Paul Krystow, John M. Truscott of ICI, Professor Heinz Spaehn of BASF, and Asiz Asphahani, while Al Hall acted as General Chair-man. Other member company representatives were: Alex Condliff, Sheldon Dean, John Donohue, Joerg Gutzeit, John Hines (ICI), Galen Hodge, Ed Kachik (staff), Bert Krisher, Paul Krystow, Chuck O'Brien, Larry Scharfstein, Jack Van Sciver, Dick Schillmoller, T. J. Callaghan (RMI), and J. S. T. Raaphorst (Dow Chemical). The speakers were Professor Spaehn, George Swales (INCO), R. Atkinson (APV Paramount), John Truscott (ICI), Professor Pourbaix (CEBELCOR), B. Shone (Shell), H. Campbell (British Nonferrous Metals Association), Professor Dr. Rahmel (DECHEMA), Professor T. Hancock (CIT), T. Gooch (British Welding Institute), John Hines (ICI), Dr. Costi Edeleanu, and V. Heubner (VDM). The meeting was very successful in contributing to technology interchange and in generating suggestions for new MTI projects.

- A number of new topics were added to the list of potential projects in 1981. These included eddy current testing of magnetic tubing, stress-corrosion cracking of stainless steels in water systems suggested by Sheldon Dean, acceptance criteria for fireproofing materials championed by Jack Van Sciver, erosion by solid particles, and corrosion in flowing sulfuric acid offered by John Bates. Meanwhile, two topics on the list became funded projects during the year.

Project No. 21 was established for preparation of a manual on bolted closures for the chemical process industries, there being no comprehensive publication available on the subject. Many problems with selection of materials for bolting as well as with corrosive attack on bolted assemblies could have been avoided had a manual existed. The project was contracted to Packer Engineering Associates, Inc. who prepared MTI Publication No. 14 "Manual on Closure Bolting for the Chemical Process Industries" issued at the end of 1984. It covered materials, environments, design, maintenance, installation, inspection, failure modes, and specifications, among other things.

Solid particle erosion can be an unexpected cause of failure of piping, valves, pumps and other equipment in chemical plant. It was agreed that a concise monograph on the subject would be useful

to materials specialists in the process industries. Accordingly, Dr. Ian M. Hutchings, University of Cambridge, England, was commissioned under Project No. 22 to prepare such a document. The result was MTI Publication No. 10 "Monograph on the Erosion of Materials by Solid Particle Impact" which was issued in the fall of 1983.

Project No. 23 was set up to support preparation of a report by Costi Edeleanu on organic coatings to protect the inside surface of heat exchanger tubing. The emphasis was to be on European practices. Costi's search revealed "Sacaphanizing" as the principal coating in the field.

- Toward the end of the year, Teledyne Wah Chang Albany and VDM Technologies Corporation joined the MTI. Thus as 1982 dawned, the membership in MTI stood at 38 companies. The budget totalled \$845,000 with a fund of \$353,400 available for additional technical activities.

1982 turned out to be an extremely active year for the MTI in many ways. The Planning and Technical Review Meeting held in London, England, April 29-30 helped greatly to familiarize the European technical community with the MTI. Arrangements were made with NACE to distribute a number of MTI's publications, thus reducing the burden on MTI's headquarters office and increasing the Institute's contacts and visibility. The student award program got underway with Michael A. Rocazella receiving the MTI Award for Excellence in Corrosion Engineering for his academic performance and master's thesis in metallurgical engineering at The Ohio State University. He described his research at the Annual Members Meeting on March 18.

Because of the good exposure provided for MTI by having a booth at the 1981 Annual Meeting of NACE, arrangements were made to again have an MTI booth at the March 1982 NACE Annual Meeting in Houston. And again the booth, staffed by Helen DeLong, drew a gratifying amount of interest.

- A total of 7 projects were initiated during the year. Of them, Project No. 24 was directed at preparing a manual on the technology of elastomeric linings for process equipment. Such linings often are vitally important corrosion barriers in

the handling of corrosive process streams which otherwise could not be dealt with economically. The document, entitled MTI Manual No. 7 "Practical Guide to the Use of Elastomeric Linings" was authored by A. F. Hall, Stockton-on-Tees, England, and issued in the spring of 1983.

Because furan resins have unique properties that suit them for specific applications in the chemical process industries and because guidelines for the specification and use of these resins did not exist at the time, MTI funded Project No. 25 to produce the needed guideline manual. The contractor was Webster-Atkinson Associates. The manual, MTI Publication No. 21 "Furan Reinforced Thermoset Plastics for Chemical Process Equipment," which was issued in May 1986, covered virtually all aspects of the subject.

Not until a few years ago had microbiologically influenced corrosion (MIC) been thought of as a possible problem in the chemical process industries, although it had been recognized for many years in plumbing and sewer systems. Consequently, the process industries had much to learn about its incidence and characteristics before measures to deal with the problem could be considered. Project No. 26 was initiated to define what was known about MIC and to identify areas where research was needed to help the industry minimize or avoid the phenomenon. To bring the process industries up to date, Dr. Daniel H. Pope and associates prepared MTI Publication No. 13 "Microbiologically Influenced Corrosion: A State of the Art Review" which was distributed in June 1984. From this review, it was evident that means of identifying the microorganisms involved in specific instances of MIC would need to be developed if effective control measures were to be devised. Project No. 36, set up in 1983, was directed toward that objective.

The usefulness of the first manual on stress-corrosion cracking covering austenitic stainless steels and nickel-base alloys encouraged MTI to fund preparation of a second manual encompassing additional metallic materials used in the chemical process industries. Accordingly, MTI set up Project No. 27 with Dale R. McIntyre of Cortest Laboratories, Inc., Cypress, Texas, and Paul Dillon to prepare a manual dealing with all types

of stainless steels and nickel-base alloys as well as carbon steels, copper alloys, aluminum alloys, titanium alloys and zirconium. The result was MTI Publication No. 15 "Guidelines for Pre-venting Stress Corrosion Cracking in the Chemical Process Industries" which hit the streets in March of 1985.

Unexpected failures of structural materials under heat-transfer conditions had occurred frequently in process equipment. The selection of materials for such applications was difficult because the laboratory tests then available tended not to replicate plant conditions. As a first step in attacking this problem, Project No. 28 was initiated with Neil Thompson and Joe Payer of Battelle Memorial Institute to review the state of the art of evaluating materials subject to corrosion when the surface of the material is a heat source. At about the same time, A. D. Mercer of the National Physical Laboratory, Teddington, England was invited to define the requirements that should be considered in developing a test method and apparatus for corrosion under heat transfer conditions. In addition, MTI asked Professor Euan F. C. Somerscales of Rensselaer Polytechnic Institute to prepare an interpretive report covering a Symposium on Corrosion in Heat Transfer Conditions held at Teddington, November 3, 1982. The documents resulting from these three activities were collected in MTI Publication No. 17 "Corrosion Under Heat-Transfer Conditions--Review of Test Procedures and Some Recent Experimental Work" is-sued in August 1985. With the background provided by these reports, the MTI Project No. 28 Task Group, led by John Bates, developed a concept for an improved heat-transfer test loop. Project No. 40 was established to design, construct, and test a prototype system based on that concept.

Project No. 29 was instituted for the preparation of an atlas of corrosion failures pertinent to the chemical process industries. A catalog of illustrated case histories of failures including key factors for identifying and analyzing corrosion failures under plant conditions was not available. Such a document was needed as a training aid for engineers and as an authoritative reference. Fulmer Research Laboratories, Ltd., Stoke Pages, England was the contractor, Dr. Martin A. Moore

serving as principal investigator. After an in-credible series of mishaps and misadventures related to typesetting and proofreading, including the production of a cover of the wrong dimensions, the atlas finally became available in January 1988.

As noted earlier, Project No. 30 was a follow-on to Project No. 12 which had been directed at investigating radiography as a means of detecting corrosion of steel equipment under insulation without removing the insulation. Development of a practical inspection device using radiography proved to be a stumbling block. In Project No. 30, which was contracted to Babcock and Wilcox, the objective was to determine whether electro-magnetic principles, as exemplified by the Hall effect, could provide a practical means of doing the job. John H. Flora was the principal investigator. A hand-held device, using deep eddy-current principles, was constructed and tried out in the field where it gave encouraging results. However, modifications in the equipment would be required. As this story about the MTI went to press the jury was still out on the best way to proceed from that point.

- The TAC meeting of January 6-7, 1982 featured an unusual number of lively and informative presentations by contractors and TAC representatives. Joe Payer of Battelle reviewed Project No. 2 on a monitor for occluded cell corrosion. Liberty Chen, graduate student at The Ohio State University, described the experimental work he was doing on Project No. 15 on hydrodynamic corrosion testing. Fred Lyle of SwRI talked about the sensitization-detector evaluation being done on Project No. 18. B & W personnel made a presentation of a program on refractory linings they were pursuing for the DOE. Professor Edwin Ruh of Carnegie-Mellon re-viewed the manual he had prepared on Project No. 10, refractories for the CPI. John Bates outlined a project that he strongly recommended on corrosion by sulfuric acid under flowing conditions. His company, Olin Corporation, had recently **ex**perienced a fatality from the failure of a cast iron fitting in sulfuric acid service. Rich Mueller presented a problem statement regarding rerating vessels for low-temperature service, while Bert Krisher emphasized the need for a re-liable method for predicting stress-corrosion cracking.

The BOD started the year with the same group of members as in 1981. However, on June 1, 1982 Dorm Swartz retired from Allied Corporation and at the same time resigned from MTI's Board of Directors. Sheldon Dean was elected to take his place on the Board. Chuck O'Brien and Bill Ashbaugh were elected Chairman and Vice Chairman, respectively, of that body.

During the year, several changes occurred in the make-up of the TAC. Representing new member companies were: E. Charles Brown for Ethyl Corporation, Alex F. Condliff for Teledyne Wah Chang Albany, and C. M. (Dick) Schillmoller for VDM Technologies Corporation. The TAC lost Joe Concordia when Herzog-Hart Corporation withdrew from the MTI. Art Freedman left Nalco Chemical Company to become a private consultant; Roger Nass replaced him on the TAC. Likewise, E. L. (Gene) Liening replaced Karl Loescher for Dow when Karl resigned from Dow to join the C. F. Braun Company. Paul Krystow and Nick Monsour were elected Chair-man and Vice Chairman, respectively, of the TAC.

Toward the end of the year, John M. Truscott re-placed Harvey Jacobs on the TAC when the ICI Engineering Department replaced ICI Americas, Inc. as the entity representing the ICI complex at the MTI. Also, near year-end, Polysar, Ltd. withdrew from membership in the MTI which, of course, caused Nick Monsour to resign from the TAC. There was hope that Polysar's withdrawal would be short lived. Gary Wolf replaced Nick as Manager of the TAC's Quality Assurance and Inspection Section.

Another interesting and encouraging late development in 1982 was the decision by A B Sandvik Steel to again consider joining MTI after a lapse of several years. It will be remembered that the company had shown active interest back in 1976 and 1977 through one of their U.S. representatives, E. D. (Gene) Montrone, who in fact had been elected Vice Chairman of the temporary TAC. How-ever, when the matter of the basis for the assessment of membership dues arose, agreement could not be reached between Sandvik and MTI. Perhaps the attendance of Mr. Jan Christer Carlen, then General Manager of Sandvik's Steel Division, at the presentation on the MTI made by Ed Kachik and Al Hall in New York City on June 10, 1980 may have had something to do with the company's renewed

interest. Some 10 years earlier, Al had visited Mr. Carlen and the steel works at Sandviken, Sweden, and had struck up an acquaintanceship with him.

Though 1983 started out with the joining of A B Sandvik, the MTI lost Cities Service Company, Drew Chemical Corporation, Jacobs Engineering Group, Hatch Associates, Ltd., and Nalco Chemical Company in short order, in addition to Polysar Ltd. Cities Service had been bought by Occidental Petroleum, while Drew Chemical was bought by Ashland Chemical. Occidental Petroleum, already being a member, did not see fit to continue the Cities Service membership in the MTI. As to Ashland Chemical, neither Dave Sexsmith of Drew Chemical nor Al Hall were able to persuade that company to join the MTI. However, PPG Industries, Inc. joined the MTI on April 14 effective January 1, 1983. With these changes the roster of members stood at 34 during the year. The 1983 budget amounted to 092,400 of which some 1268,500 was available for additional technical projects.

The 1983 Board of Directors was composed of Bill Ashbaugh, Chairman, Galen Hodge, Vice Chairman, Sheldon Dean, Frank Hoagey, Hal Huckins, Chuck O'Brien, Tom Oettinger, Bob Puyear, Dave Winegardner and Gary Wolf. Toward the end of the year, Dave Winegardner resigned from the BOD; thereupon, the Board invited Paul Krystow to fill the term thus vacated.

As would be expected, a number of changes occurred in the make-up of the TAC largely as a result of the changes that took place in the membership of the MTI. With the withdrawal of Polysar, Drew Chemical, Jacobs Engineering, Hatch Associates and Nalco Chemical, the TAC lost Nick Monsour, Bruce Libutti, Ed Rousses, R. N. Kapoor and Roger Nass, respectively. As we shall see, a couple of years later, to MTI's great pleasure, both Polysar and Nick turned up again: Meanwhile, through some legerdemain, Rich Mueller emerged as the TAC representative and, a year later, as the designated representative for the Occidental Petroleum complex. As to the new members, Sandvik was represented on the TAC by Sven Bernhardsson, while Jim Nelson represented PPG Industries.

Other changes in the TAC were as follows: Dave Thomas replaced Howard Bomberger for RMI; Leon Calvit replaced Charles Brown for Ethyl; Ken Baumert took over from Sheldon Dean for Air Products; B. Clayton Brooks replaced Russ Davisson who had just retired from Union Carbide; Ed Self re-placed Rick Flood for Wisconsin Centrifugal; Tom Weedon took over from George Dittmeier for Diamond Shamrock; and Bruce McLaughlin took over from Larry Scharfstein for Mobil R and D. Russ Davisson would shortly reappear as MTI Staff Consultant.

At the Annual Meeting of the MTI on March 9, Paul Krystow was elected Chairman of the TAC while Rich Mueller was elected Vice Chairman.

- During the year, the BOD directed considerable attention to the important matter of planning for the future, especially with respect to the types of projects to be funded and the degree of emphasis to be placed on the various technologies with which the CPI materials engineer must deal. As Al Hall put it, "We have to be sure we know who we are and where we're going." Bob Puyear spearheaded this activity. Correlative items also taken up were: development of effective means to coordinate the activities and responsibilities of the BOD and TAC regarding establishment and monitoring of projects, and improved communication both within the MTI and between the MTI and other entities in the world of materials technology.

As a result, a statement of policy on long-range planning was formulated which also defined the roles of the BOD and the TAC; a list of weighted criteria was established for evaluating ideas/ problems offered for investigation by the MTI (presented by Bert Krisher); a flow diagram was prepared to show the sequence of steps to be taken from idea/problem identification to project funding and monitoring (described by Rich Mueller); Al Hall increased his emphasis on issuing press releases to NACE, ASM and other organizations regarding MTI activities and publications; Ed Kachik planned several presentations as described below; the decision was made to publish a newsletter; the wheels were set in motion for arranging another international technical exchange meeting in Europe; and the student award program for excellence in corrosion engineering was expanded.

As to the student award program, at the Annual Meeting on March 9, this time two awards were presented--both to graduate students. The recipients were Stephen J. Lenhart of The Ohio State University and Randall J. Smith of the University of Florida. As was the case the previous year, the awards consisted of an honorarium of \$1,000 and a plaque. Effective the following year, the program was expanded to include both undergraduate as well as graduate students. The undergraduate award was to be based on solving a problem in materials selection for chemical process equipment prepared by the Board's Student Award Committee. As before, the graduate student award was to be based on a report or paper on a corrosion-related topic of the student's choosing. In June Al Hall sent notices about the expanded student award program to 180 chemical engineering departments in academic institutions of the U.S. and Canada.

A mock-up for the newsletter was tendered by Al to the BOD in the spring of 1983. It was an 11" x 17" sheet folded in half to make four pages, carrying the MTI logo and printed in black on ecru paper with light blue highlights. The contents were selected to interest both members and non-members. Obviously, with regard to the latter audience, the intent was to encourage them to join the MTI. In addition to text there was a fair sprinkling of photographs, photomicrographs and line drawings. The BOD approved the general format and it was agreed to print two issues per year beginning in the fall of 1983. In fact, the first issue came off the press in September 1983 and was well-received.

Ed Kachik increased MTI's visibility during the year by making a presentation on the functions, organization and projects of the Institute at a combined meeting of the New York and Philadelphia Chapters of NACE on May 19 and by presenting a paper co-authored with Dick Treseder entitled "MTI Corrosion Tests for Iron- and Nickel-Base Corrosion Resistant Alloys" at an International Symposium on Laboratory Corrosion Tests and Standards, November 14-16, sponsored by ASTM. The meeting was held at Bal Harbour, Florida. The paper was based on MTI Project No. 9. Ed and Al also attended an INCO Chemical and Petrochemical Materials Conference which was held at Wrightsville Beach, NC, September 19-21. At that conference Al discussed

membership in the MTI with W. Edward (Ed) Clayton of Proctor and Gamble Company among other people. Ed would also give a talk on the MTI to the Brandywine Valley Chapter of ASM on February 14, 1984 and to the Niagara Frontier Chapter of NACE on February 21, 1984.

In addition MTI, with ASTM and the Thermal Insulation Manufacturers Association (TIMA) as co-sponsors, held an International Symposium on Corrosion of Metals Under Thermal Insulation, in San Antonio, October 11-13. Warren Pollock took the lead in structuring the meeting and served as chairman with Jack Barnhart, President of TIMA, acting as cochairman. Paul Krystow promoted the symposium strongly. The meeting which was the first one held in the U.S. on this subject, drew 150 attendees and was highly successful. The proceedings were published as ASTM STP 880 "Corrosion of Metals Under Thermal Insulation," issued in 1985. As one result of the symposium, NACE established a Task Group to monitor developments in this area on a continuing basis. This symposium along with the others promoted by MTI are good examples of the constructive and far-reaching influence that the Institute exerted on the general community of CPI materials engineers.

Briefly, concerning the international technical exchange meeting that was to be held in Europe, preliminary agreement was reached to hold the meeting in connection with the nextACHEMA Exposition in Frankfurt, West Germany, scheduled for June 1985. The theme would be "Extending the Life of Chemical Plant Cost Effectively." Professor Rahmel of DECHEMA would make the on-site arrangements.

- 1983 was another strong year for the initiation of technical projects. A total of eight were funded. Project No. 31 was directed at providing CPI engineers with a document on current practices, equipment, and capabilities relevant to the measurement of the wall temperature of tubes in direct-fired process heaters. Clearly, accurate measurement of the temperature of tubes operating in such equipment as pyrolysis furnaces, ammonia and methanol reformers, feed heaters and super-heaters is essential to operating them at maximum efficiency. The temperature range of interest was 800 to 2200 F (425 to 1200C). The contractors for

the project were Professors D. P. DeWitt and L. F. Albright of Purdue University. Their comprehensive treatment of the subject was recorded in MTI Publication No. 24 "Tube-Wall Temperature Measurement in Fired Process Heaters," issued in the summer of 1986.

The designation, Project No. 32, was assigned to cover activities related to the above-mentioned International Symposium on Corrosion of Metals Under Thermal Insulation. No MTI funds were used.

Development of data on the corrosion of carbon and stainless steels in sulfuric acid under flowing conditions was undertaken on Project No. 33. In spite of the widespread use of sulfuric acid, data were lacking on these structural materials in certain important ranges of flow velocity and acid concentration. Arrangements were made for the re-search to be done at Cranfield Institute of Technology, Cranfield, England, under the direction of Dr. J. E. Strutt. A revised report was scheduled to become available in 1988.

Project No. 34 covered preparation of a report on erosion by liquid flow which is often encountered in pipelines, pumps, valves and process vessels. The project was conducted by Dr. Ian M. Hutchings, University of Cambridge, England. His report en-titled MTI Publication No. 25 "The Erosion of Materials by Liquid Flow" and published in 1986, dealt with erosion by cavitation, erosion by slurries and erosion-corrosion, discussed laboratory test procedures and the parameters control-ling the phenomena involved, and presented erosion data on numerous metallic and nonmetallic materials.

In Project No. 35 the current state of knowledge on corrosion of reinforcing steel in concrete was collected by Earl Schellenberg, St. Louis, Missouri. For information, considerable reliance was placed on the experience accumulated with bridges and highways.

As mentioned earlier, Project No. 26 had shown that microbiologically-influenced corrosion (MIC) could occur in the chemical process industries. As the next step, Project No. 36 was set up in 1983 to try to develop test kits for engineers to use to identify MIC in the field. Indeed, such

kits were developed. The contractor was Dr. Daniel H. Pope, Grafton, New York.

Considerable variation had existed in the design and performance of systems for cathodic protection of tanks and tank bottoms. Some systems were trouble-free, while others were not. Because of these discrepancies, information was collected on the prevailing practices and their effectiveness. The work was done by John H. Fitzgerald, III, Professional Services Group, Inc., The Hinchman Company, Detroit under Project No. 37. The report produced was entitled "Cathodic Protection of Tank Bottoms."

The performance of fireproofing compounds after 20 or more years of exposure to chemical plant conditions had been a matter of considerable uncertainty and concern to the industry. Millions of dollars are spent on fireproofing chemical plant. Replacement of these materials is expensive, but lack of protection can be even more expensive. Accordingly, after much consideration and discussion of ways by which to proceed, arrangements were made with the Underwriters Laboratories, Northbrook, Illinois for establishment of a protocol by which suppliers of fireproofing compounds could have their products tested after exposure to simulated chemical plant service. The effort entailed in bringing this about was made under Project No. 38.

The wear resistance of the hard-facing alloys used by the CPI is quite well known, but there are few reliable data on their corrosion resistance. As a first step, procedures would be needed for preparation of uniform test specimens, after which corrosion studies could be undertaken. Under Project No. 39, Battelle Memorial Institute developed the required specimen preparation procedures.

- As MTI left 1983 behind and entered 1984, the organization could feel that it had reached a state of considerable maturity. From the beginning of operations, the MTI had enjoyed steady growth both in size and in the number and variety of its activities which, in turn, required ongoing reappraisal of staff, BOD and TAC responsibilities and operations. The objectives of the MTI had certainly proved to be sound as well as the ways and means by which they were being honored. The

members were being well served through a wide variety of projects pursued by means of the contract research mechanism; through forums and seminars held at the TAC meetings; and through projects, meetings and symposia of a domestic as well as an international nature, carried out in cooperation with other materials-oriented organizations. Information transfer was being achieved through the preparation of manuals and reports, and a newsletter. The student award program represented a substantive outreach toward academia. In addition, effective approaches were being used to make the community of materials specialists increasingly aware of the MTI and its activities.

During 1984 Project No. 40 was initiated to design, construct and test a prototype loop to evaluate the corrosion behavior of materials under the combination of heat transfer and flowing conditions. As mentioned earlier, the concept for the loop was developed by John Bates and the Project No. 28 Task Group. A satisfactory loop was designed, constructed and tested. The details are given in MTI Publication No. 29 "Evaluation of Heat Transfer Corrosion Test Apparatus" which was issued in 1987. At that time, a commercial version of the apparatus became available from the contractor who was Cortest, Inc., Willoughby, Ohio.

Unexpected failures of bellows expansion joints in process plants often have resulted in expensive downtime and costly repairs. These joints may fail from fatigue, stress-corrosion cracking, corrosion fatigue or other mechanisms. Reliable nondestructive inspection techniques were not available. Project No. 41 was initiated to determine, in the laboratory, whether a suitable approach toward nondestructive inspection of such configurations could be identified. A technique using Lamb ultra-sonic waves was developed. Field tests of the system showed that, with some modifications, it could be used successfully in plant. The investigation was recorded in MTI Publication No. 28 "Ultrasonic Inspection and Failure Analysis of Expansion Bellows", issued in the spring of 1987. The work was done by Anmol S. Birring and A. McMinn of Southwest Research Institute, San Antonio, Texas.

In spite of all the literature that was reviewed in pursuing Projects Nos. 1 and 27, important gaps

remained regarding the behavior of austenitic stainless steels in aqueous media containing low concentrations of chlorides with varying pH, temperature and oxygen content. Project No. 42 was undertaken to fill these gaps. The findings, which were recorded in Publication No. 27 "Experience Survey--Stress Corrosion Cracking of Austenitic Stainless Steels in Water", were based on 273 case histories plus pertinent recent literature. The report was published in early 1987. Dale R. McIntyre of Cortest Laboratories., Cypress, Texas, conducted the project.

- During the forum held at the October 18-19, 1983 TAC meeting, John Donohue of Betz Laboratories had called attention to cracking problems being encountered with deaerators in the pulp and paper industry. The Technical Association of the Pulp and Paper Industry (TAPPI) had broadcast an alert on the problem. At that time some 68 deaerators in that industry had been found to be cracked; three of them had ruptured, one resulting in fatalities. Ed Kachik communicated with TAPPI to obtain details and Russ Davisson, MTI's Staff Consultant, started collecting and reporting information pertinent to the interests of the CPI in the matter.

Russ presented his findings at the TAC's forum on May 31, 1984, at which he reported that wet fluorescent magnetic particle inspection was judged to be the best NDT technique for detecting cracks in deaerators. This was confirmed by J. D. Ridgeway, Jr. of Industrial NDT at the same forum. Paul Field of Metal Improvement Company discussed shot peening as a method of preventing fatigue failures. Among numerous failure analyses that had been made, Mike Hubbell of Eastman Kodak reported on one he had conducted. The mechanism appeared to be a form of corrosion fatigue. Shortly after the May meeting, Russ Davisson issued a report to the membership on the deaerator investigation. All in all, the attack on the deaerator issue showed how the MTI could take effective action in making the industry it serves aware of an insidious structural materials problem and in pointing the way toward controlling the problem.

- Diamond Shamrock discontinued membership in the MTI in 1984. However, Carpenter Technology Corporation, Chevron Corporation, Proctor and Gamble

Company, Rolled Alloys, Inc. and Shell Research, Ltd. joined the Institute, thus increasing the membership to 37. The budget for the year stood at \$738,900.

At the Annual Meeting on March 6, 1984, Rich Mueller and Bert Krisher were elected Chairman and Vice Chairman, respectively, of the TAC. The following persons were elected to the BOD:

W. G. Ashbaugh	P. E. Krystow
S. W. Dean	C. F. O'Brien
F. A. Hoagey	T. P. Oettinger
F. G. Hodge	R. B. Puyear
H. A. Huckins	G. C. Wolf

The membership of the TAC is shown in Table 11. Matt Tiivel of CIL often represented ICI, as he did at this meeting, when John Truscott was not available. Ron Bailey replaced John Guernsey for Jessop Steel Company, John having passed away during the year.

Table 11. Technical Advisory Council, 1984

Richard A. Mueller Chairman	Cities Service Div. of Occidental Petroleum Corp
Ronald E. Bailey	Jessop Steel Company
John F. Bates	Olin Corporation
Kenneth L. Baumert	Air Products & Chemicals, Inc.
Sven Bernhardsson	A B Sandvik Steek
B. Clayton Brooks	Union Carbide Corporation
Leon D. Calvit	Ethyl Corporation
W. Edward Clayton	Proctor and Gamble Company
Alex F. Condliff	Teledyne Wah Chang Albany
John M. Donohue	Betz Laboratories
E. H. (Gene) Edwards	Chevron Corporation
Leonard A. Erlanger	PQ Corporation
John M. Grocki	VDM Technologies Corporation
Joerg Gutzeit	Standard Oil Co. (Indiana)
Robert J. Hoenigke	FMC Corporation
Mark C. Hoffman	Zimpro, Incorporated
Jim Ibarra	Gulf Research & Development Company
Robert A. Johnston	El Paso Products Company
James C. Kelly	Rolled Alloys, Incorporated
A.S. (Bert) Krisher	Monsanto Company
Paul E. Krystow	Exxon Chemical Company
M. B. Levens	Shell Research Limited
E. L. (Gene)Liening	Dow Chemical
Gunvant N. Maniar	Carpenter Technology Corp.
Arlin L. McKim	Eastman Kodak Company
Bruce D. McLaughlin	Mobil Research & Develop- ment Company
Tim J. Murnane	Rohm and Haas Company
James K. Nelson	PPG Industries, Incorporated
Warren I. Pollock	E.I. duPont de Nemours and Co., Inc.
Richard V. Porcelli	Halcon Research and Develop- ment Co.
Steven M. Seelinger	BASF Wyandotte Corporation
Ed Self	Wisconsin Centrifugal, Inc.
David E. Thomas	RMI Company
John M. Truscott	Imperial Chemical Indus- tries, Ltd.
Jack H. Van Sciver	Allied Corporation
Gary C. Wolf	ARCO Chemical Company
James B. C. Wu	Cabot Corporation

Again, at the Annual Meeting, it was mentioned that Al Hall and Ed Kachik Planned to retire in 1985, but not simultaneously. In relinquishing the position of Executive Director, Al expressed the desire to continue to be associated with the MTI in a suitable capacity such as dealing with publications.

Tom Gibbs of DuPont gave a thought-provoking and well-received presentation on "CPI Trends and Challenges" at the Annual Meeting. He focused on product technology, process technology and activity he termed "image" technology. By the latter he meant actions to dispel the perception that CPI is a "smokestack" industry to be blamed for many of society's ills.

As Chairman of the Student Awards Committee, Bob Puyear presented Ying-Li Howard Chiang of the University of Delaware with the 1983 MTI Graduate Student Award for Excellence in Corrosion Engineering. Mr. Chiang won the award for his masters' thesis on Effect of Condenser Design on Stress Corrosion Cracking of Stainless Alloys in Chloride Environments." There were no undergraduate entries. The question of "Why not?" was explored at the subsequent BOD meeting.

During the year, interest increased considerably in automated information systems with emphasis on the so-called "expert systems." In this vein, Bob Puyear, Paul Krystow and Al Hall attended a meeting on the subject in St. Louis on March 14. The meeting was sponsored by ASME. The purpose was to identify limited areas in which to investigate the feasibility of developing expert systems. Two were selected: steam reformer tubing and superheater tubing. Bob also was a member of the Steering Committee for the NACE/NBS information program. Also, at the TAC's forum on May 31, Harold Mindlin of Battelle reviewed the essential aspects of automated information systems emphasizing data-base requirements.

As a step toward furthering the understanding of materials technology in the CPI, the MTI with NACE and MPC as cosponsors arranged a conference on "Advances in Materials Technology for the Process Industries' Needs" which was held in Atlanta, Georgia, on October 29-31, 1984. The conference was put together by Hal Huckins, Aziz Asphahani, Warren Pollock and others. The objective was to establish a dialogue between the process engineer and the materials technologist.

More than 130 persons attended the meeting. The participants came from Australia, Canada, England, Finland, West Germany, Japan, The Netherlands, Sweden and the U.S. Eighteen of MTI's 37 member companies were represented. Session moderators were Hal Huckins, Stanley Margolin of Arthur D. Little and Company, Aziz Asphahani, David Roth of Allied Corporation, and Walter Boyd of Battelle. Luncheon speakers were John Truscott and Warren Pollock.

### THE CHANGING OF THE GUARD

During 1984, the MTI lost El Paso Products Company, Gulf Research and Development Company, and Olin Corporation. The last-named company terminated membership on the death of John Bates. On the other hand, Engineers India Limited and Polysar Limited both returned to membership after lapses of two years, while Westvaco Corporation joined the MTI as of January 1, 1985. Thus, the membership roster continued to stand at 37. In some cases, memberships were terminated because the activities of the MTI turned out to be peripheral to the company's interests. In other cases, the economic recession that the chemical industries were experiencing, along with other basic industries, was the cause. In any event, the capability of the MTI to attract new members to maintain membership at a healthy level was very encouraging. The budget for 1985 was a comfortable 1765,100.

The composition of the BOD remained the same as in 1984, while Bill Ashbaugh and Galen Hodge were re-elected Chairman and Vice Chairman of the Board, respectively. The roster for the TAC was much as shown in Table 11 with the following changes: Clayton Brooks was replaced by L. A. (Tony) Scribner for Union Carbide; John W. Coombs took over from Gene Edwards for Chevron; Max B. Gorensek replaced Richard V. Porcelli for Halcon; Bob Puyear stepped in for Monsanto when Bert Krisher retired from that company; Jim Wu was replaced by Narasi Sridhar for Cabot. The return of Engineers India Limited and Polysar Limited brought back A. K. Lahiri and Nick Monsour, respectively. The joining of Westvaco brought W. B. A. (Sandy) Sharp on board. Finally, the withdrawal of Gulf Research and El Paso Products caused MTI to lose Jim Ibarra and Bob Johnston.

At the Annual Meeting on March 13, 1985, Rich Mueller and Jack Van Sciver were elected Chairman and Vice Chairman, respectively, of the TAC. John Flora of Babcock and Wilcox, the guest speaker, discussed the research B and W was doing for MTI on deep penetration eddy-current techniques for detecting corrosion under insulation (Project No. 30). The concept had been demonstrated in the field; it remained to be translated into a commercial inspection system. Also, at the meeting, Bob Puyear presented LCDR W. D. Needham of Massachusetts Institute of Technology with the MTI Graduate Student Award for Excellence in Corrosion

Engineering for his thesis on "Hydrogen Cracking in Weldments-An Assessment of Current Theories." The MTI Undergraduate Student Award was presented to John Dixon of Florida Institute of Technology for his re-port on "Exterior Marine Coatings for Commercial Ship Maintenance."

During the year, the MTI staff really got scrambled up. As planned, Al Hall relinquished his position on March 31 and Ed Kachik did likewise on April 30. Al was replaced by Dr. Ronald G. Minet, Chairman of the Board of Kinetics Technology International Corporation (KTI), Monrovia, California, while Ed was replaced by Bert Krisher who had recently retired from Monsanto as Senior Fellow. Al became manager of MTI's publications on a reduced-time basis, while Ed retired completely.

In joining MTI, Ron brought with him forty years of process industry experience and a strong managerial background. He had been with KTI in Italy, Holland and California since 1969. KTI is an engineering company that designs and supplies high-temperature processing furnaces and chemical plants for the production of hydrogen, ethylene and carbon monoxide. Prior to 1969 he held managerial positions in such engineering and chemical companies as CTIP in Rome, Italy, FMC Corporation, United Engineers and Foster Wheeler. Ron received a B.Ch.E. in 1943 from City College of New York, an M.S. from Stevens Institute of Technology in 1950, and Sc.D. in Chemical Engineering in 1959 from New York University. From 1943 to 1947 he served in the U.S. Air Force. Ron had authored over 50 publications and held 5 patents.

Bert Krisher had held the positions of Principal Engineering Specialist, Fellow and Senior Fellow in the Corporate Engineering Department of Monsanto Corporation from 1968 to 1985, tackling a wide range of structural materials and process equipment problems. From 1953 to 1968, he was Corrosion and Inspection Engineer at Monsanto's Texas City and Chocolate Bayou plants, while from 1951 to 1953 he served as Technical Service Engineer at the Texas City plant. Bert received a B.S. in Chemical Engineering from Oklahoma State University in 1951. He was a member of NACE, ASTM, AIChE, ASM and the Electrochemical Society; he was a member of the Board of Directors of NACE, author or co-author of 15 technical articles, and co-editor of the Materials Section of the 6th Edition of Perry's Chemical Engineers' Handbook.

After a while it became clear that the gears in the MTI machine were not meshing smoothly, which prompted Ron Minet to tender his resignation from the Executive Directorship effective December 31, 1985. Al Hall accepted the Board's invitation to return to the position until another person could be selected. Accordingly, a new search committee was named and the process of identifying candidates was started all over again. Because of Al's return and Bert Krisher's long association with the MTI (ab initio), the rearrangement of the staff occurred very smoothly. Meanwhile, at year-end, for various reasons Bill Ashbaugh, Rich Mueller, Tom Oettinger and Harold Huckins resigned from the BOD. Thus, a considerable change in the make-up of that body was in the offing.

- During June 10-12, 1985, the long-planned Work-shop co-sponsored by MTI and DECHEMA, the West German Chemical Association, was held in connection with the gigantic exposition of the European Chemical Industry, AICHEMA, which took place in Frankfurt, June 9-15. The three-day session was attended by 8 representatives of MTI North America, 10 representatives of MTI Europe, 4 MTI staff members and 30 guests from 20 different nonmember European organizations. The topics discussed included: corrosion under insulation; corrosion under conditions of fluid flow and heat flux; monitoring of occluded cell corrosion; changes in the process industries which will require new plants to be designed to cope with high energy costs, environmental concerns and high capital costs; new structural materials; corrosion monitoring and control; and automated information systems. In addition, there was a panel discussion on efficient utilization of new structural materials with emphasis on interaction among materials suppliers, users and engineering firms. Speakers and discussion leaders included: Aziz Asphahani, John Truscott, Bert Krisher, Joerg Gutzeit, J. Brown of British Petroleum, R. Gregory of Exxon (U.K.), M. Robinson of CIT (U.K.), U. Steinhoff of BASF (F.R.G.), G. Dathe of VEDL (F.R.G.), M. Swindelle of the University of Liverpool (U.K.), J. M. Bos of Phillips (NL), Costi Edeleanu, Bob Puyear and Warren Pollock. Dr. A. Rahmel of DECHEMA and Bert Krisher served as co-chairmen of the Workshop. The meetings provided an effective forum for the airing of mutual concerns of CPI materials engineers from Europe and North America.

- 1985 also was a busy year for the initiation of new projects--seven in all. Project No. 43 was undertaken to provide guidance for assessing fire and explosion damage to process equipment. When such incidents occur in plant, the materials engineer generally is faced with a multitude of decisions as to what equipment and piping can be re-used, what can be repaired, and what should be scrapped. Cortest Laboratories of Cypress, Texas, was engaged to prepare the required guideline document, a draft of which was submitted to MTI early in 1987 for review. This draft was duly modified and plans were made to make its existence known to the insurance industry before publication.

Some time back, Sven Bernhardsson had suggested collecting information on the application and performance of metals and alloys in seawater-cooled heat exchangers. This suggestion became the basis for Project No. 44 which was directed at preparation of a manual on the design, operation and maintenance of seawater-cooled tubular heat exchangers. Paul Dillon undertook the assignment which was supported jointly by the MTI and the Nickel Development Institute. The result was MTI Publication No. 26 "Performance of Tubular Alloy Heat Exchangers in Seawater Service in the Chemical Process Industries," issued in the fall of 1987.

Project No. 45 was initiated to produce a roster of the various data banks containing properties of materials, which were available for use by the materials specialists of the process industries. The tabulation was to include information on methods of access, cost and the apparent quality of the data in each bank. The project was assigned to the MTI staff. As of early 1987, a total of 52 data bases had been identified, probably no more than 10 of which would be useful to the members. The search for additional data bases continued.

In addition to the alloys which are supplied by producers under standard designations, such as AISI, ASTM, SAE numbers, a large number of alloys are sold under trade names. Often, a single alloy is marketed under more than one trade name. Project No. 46 was established to generate a data base of iron- and nickel-base alloys, listing

AISI/SAE numbers, UNS numbers, trade names, chemical composition and mechanical properties for each alloy. The plan was to report the data in computer data-base format as well as hard copy. Again, the project was assigned to the staff (Bert Krisher), who turned out a "beta test version" (do you follow that?) for interim usage, while work went forward with preparation of a more finished product in a format that could be used in all the systems employed by the member companies.

Because asbestos had been identified as a severe health hazard, asbestos gasket products began to disappear rapidly from the market and a number of substitute products made their appearance. Often, however, the composition and properties of the new materials were not well documented. In addition, qualification methods or standards did not exist which were appropriate for the chemical-process and petrochemical plant environments. As a result, a significant number of failures of substitute gasket materials occurred in the field. Accordingly, Project No. 47 was initiated to develop evaluation tests for gasket materials which could be used to reliably assess their properties. The contractor was J. Payne and Associates working in collaboration with Ecole Polytechnique (University of Montreal), Quebec, Canada.

An incident involving ignition of pyrophoric corrosion products on an item of equipment fabricated of zirconium caused a high level of concern within the chemical process industries. In response to this concern, MTI funded Project No. 48 to collect and report the knowledge available on the phenomenon, the frequency of incidents, and the means at hand to deal with or prevent occurrences. The task was undertaken by Paul Dillon who made a finished draft of a well-written report available to the membership in 5 weeks. The report contained the information needed for each company to evaluate the seriousness of the phenomenon in terms of its own situation, and to take appropriate action. This was a fine example of the rapidity with which the MTI could attack an urgent problem if required. The document became MTI Publication No. 19 "Pyrophoric Surfaces on Zirconium Equipment: A Potential Ignition Hazard."

The duplex stainless steels contain nickel and chromium in such amounts as to produce a metallurgical structure which is composed partly of the austenitic phase and partly of the ferritic phase. Such a structure offers improved resistance to chloride stress-corrosion cracking (SCC). Welding processes can change this structure, possibly leading to increased susceptibility to SCC. Concern about this possibility had limited consideration of the duplex alloys for welded structures in chloride-containing systems. Project No. 49 was set up with Southwest Research Institute (SwRI), Culebra, Texas, to evaluate the effect of welding on the resistance of these alloys to SCC. At the October 6-7, 1987 TAC meeting, Fred Lyle of SwRI made a presentation on the work that they had done up to that time.

At the beginning of 1986 Project No. 48-II was initiated. This project extended MTI's investigation of pyrophoric corrosion products on zirconium surfaces, the subject of Project No. 48, to other reactive metals such as titanium, titanium alloys, Zircalloy 705, tantalum and tantalum alloys. Dale McIntyre of Cortest Laboratories, Inc., Cypress, Texas and Paul Dillon collaborated in conducting the extended study. The findings were reported in MTI Publication No. 32 "Pyrophoric Behavior and Combustion of the Reactive Metals."

It is often necessary to remove operating units from service for a period of time. To prevent deterioration during idle periods, such units need to be carefully "mothballed." In fact, it is not uncommon for deterioration in storage to be more rapid than in service. Late in the year, a project to provide specific guidance to the materials engineer for these situations was launched with Glencor Engineering, Ltd., Nepean, Ontario, Canada, as the contractor. The effort was designated Project No. 50. Emphasis was placed on practical, economic procedures to minimize deterioration and permit reliable re-commissioning when needed.

- Interest in automated information systems steadily increased during the year. At the June 18th meeting of the BOD, John Truscott led a discussion of the Achilles Club program to develop computerized knowledge bases pertinent to the use of structural materials in corrosion service. The Club had identified the areas of cathodic protection and

microbial corrosion for experimentation with development of the program. Later in the year on October 29, Bert Krisher attended a seminar on software systems of interest to corrosion engineers held at the National Physical Laboratories, Teddington, U.K. Of the systems demonstrated, Bert felt that the Achilles Club program held the most promise of meeting MTI's objectives. Then at the TAC meeting, November 10-11, 1986, Chris Westcott of Harwell, U.K., made a detailed presentation on the Achilles Club program which included a demonstration run through the system. At the same meeting, T. S. (Chip) Lee, Executive Director of NACE, outlined a proposal on the development of an expert system for consideration by MTI. NACE and the National Bureau of Standards (NBS) were working together in the area. By motion of Bob Puyear, seconded by Ken Baumert, the MTI staff was directed to have a proposal on development of an expert system ready for consideration at the April 1987 meeting of the TAC. The intent would be for the MTI activity to be coordinated with the NACE/NBS work.

- During 1986 MTI representatives were involved in two important conferences in addition to the one that Bert Krisher attended in the U.K. on computer software. Sheldon Dean gave the keynote lecture at an international conference held during February 24-28 at Cranfield Institute of Technology in the U.K. The conference was entitled "Prediction of Materials Performance in Plants Operating with Corrosive Environments." Sheldon's talk was on "The Challenge of Predicting Process Corrosion through Modeling and Laboratory Testing." The meetings attracted some 50 participants. Bert Krisher and Costi Edeleanu were among the attendees.

The other meeting was a seminar on Plant Reliability and Safety sponsored by the Chemical Manufacturers Association and held in Atlanta, Georgia, October 8-10. Of the 53 industrial organizations which participated 20 were MTI members, while 100 of the 175 attendees were from MTI member companies. Again, 71% of the program participants were from MTI member companies. Bert Krisher presented a paper entitled "Plant Integrity Programs --An Overview." The program comprised 20 papers covered in 5 sessions. Several of the topics discussed at the meeting were among those being studied in MTI-sponsored projects.

- Veritas USA, Inc., a division of Det Norski Veritas of Norway joined the MTI early in the year with J. Ray Davies as its representative. Later in the year, EKO-Chemicals Co., AE, of Thessaloniki, Greece became a member, S. Perdikopoulos being its representative. Cabot Corporation **dis**appeared from the MTI ranks, but Haynes International, Inc. a new company spun off from Cabot, emerged to take its place; the personnel inter-facing with the MTI remained the same. Halcon Research and Development Corporation withdrew from membership on the retirement of Hal Huckins. PPG Industries, Inc. and Wisconsin Centrifugal, Inc. also did not renew their memberships. Thus the MTI lost Jim Nelson and Mark Hoffman, respectively. With these changes the membership stood at 36. The budget going into 1986 was 1729,862.

At the Annual Members Meeting on March 6, the membership of the BOD was increased from 10 to 11, the following persons being elected to that body:

Sheldon Dean	Arlin McKim	Steve Seelinger
Frank Hoagey	Nick Monsour	John Truscott
Galen Hodge	Chuck O'Brien	Gary Wolf
Paul Krystow	Bob Puyear	

The members elected Jack Van Sciver, Chairman and Sandy Sharp, Vice Chairman of the TAC. Albert E. (Al) Biggs, Jr. came on board for ARCO, Joseph E. (Joe) Guthrie for Exxon, Michael F. (Mike) Hubbell for Eastman Kodak and Richard A. French for BASF. These people's predecessors had moved to the BOD. Other new faces on the TAC were Vince D. Coppolecchia for VDM, Donald J. Truax for Chevron and R. V. Worboys for Shell Research, replacing John Grocki, John Coombs and M. B. Levens, respectively.

Hal Huckins, recently retired from Halcon Research and Development Corporation, was the guest lecturer at the Annual Members Meeting. He gave a talk on "Advanced Materials Technology."

At the meeting, note was taken of the value of the technical forums which had become a featured agenda item at TAC meetings. The forums gave the

members the opportunity to discuss their problems, concerns and opinions on nonproprietary materials issues. It was remarked that, during 1985, 50 topics had been discussed at forums, 8 of which had become MTI projects.

Also at the meeting, Bob Puyear presented Brian J. Saldanha of the University of Delaware with MTI's Fifth Annual Graduate Student Award for Excellence in Corrosion Engineering for his thesis on "Silicon as an Alloying Element for Enhanced Corrosion Resistance of Iron." The runners-up were Tresa Mador Pollock of Massachusetts Institute of Technology and B. K. Heft of Louisiana State University.

Later in the year, in June in fact, Undergraduate Student Awards for Excellence in Corrosion Engineering were distributed. The winner was Michael G. Ward of the University of Delaware for "Study of Reactivation Polarization of Stainless Steels" and the finalist was D. A. Hartloper of the University of Manitoba, Canada, for "Occluded Cell Corrosion of Standard Austenitic Stainless Steels."

At their meeting on October 7, the BOD decided not to make awards to students for the academic year of 1986-1987, largely because of a growing perception that the program was no longer needed. In-stead, the BOD asked Sandy Sharp to define a new role for the committee which might better be named the University Relations Committee.

In the MTI's ongoing program aimed at attracting new members, increased attention was directed during 1986 at gaining additional European members. Costi Edeleanu was asked to contact certain firms while John Grocki agreed to contact others. Gary Wolf, John Truscott and Galen Hodge were asked to develop a strategy for increasing European memberships. Emphasis was to be placed on forum-type meetings to be attended by representatives of both member and non-member organizations. Such a meeting was being planned for 1988. Al Hall prepared an item for the April Newsletter entitled "MTI-An International Association" which pointed out that already 22 percent of MTI's members were non-U.S. organizations, that three Board members were drawn from non-U.S. companies, that a schedule of MTI-sponsored technical meetings in Europe

had been started, and that non-U.S. contractors were regularly used on MTI's funded projects.

- Meanwhile, the BOD Search Committee, composed of Frank Hoagey, Chairman, Bob Puyear and Chuck O'Brien and activated at the end of 1985, had narrowed the number of candidates for the position of Executive Director to 6, two of whom were selected for interview. Following the interviews, Attilio Bisio formerly of Exxon Research and Engineering Company was chosen to fill the position. He would start September 1, 1986.

Attilio had served the chemical process industries for over 30 years prior to joining the MTI. Among his accomplishments were transferring new technology from the laboratory to the process plant, preparing complete business plans and engaging in acquisition studies, restructuring a central engineering organization, reorganizing the manufacturing and technical departments of a synthetic rubber complex, improvement of an ethylene-propylene elastomer manufacturing facility, organizing the technical aspects of polypropylene licensing programs, and taking responsibility for planning, designing, constructing and startup of a large process facility.

He had held positions in the Central Research Laboratories of ASARCO, the Chemical Laboratory of Sylvania Electric Products, Inc., SOCABU, Inc. of Port Jerome, France, the Fiber Division of FMC, Inc., and various departments of the Exxon Research and Engineering Company. Attilio also had been an instructor in the Chemical Engineering Department, School of Engineering, Columbia University and had taken on numerous educational assignments for the American Management Association, Dean College (New Jersey), Exxon, Rutgers University, Drexel University, VPI, Center for Professional Advancement (East Brunswick, NJ) and Association Nationale de la Recherche Technique (Paris).

Attilio received the A.B. in Chemistry (1952), the B.S. in Chemical Engineering (1953), and the M.S. in Chemical Engineering (1954) from Columbia University. In Addition, he pursued graduate studies in economics at New York University and in executive development at Cornell University. He had authored numerous technical papers and books,

lectured extensively, was active in the American Chemical Society and other professional organizations, and was a member of Sigma Xi and Tau Beta Pi.

As of December 31, 1986, the Ethyl Corporation withdrew from membership in the MTI. In addition, during 1987 Betz Laboratories and Shell Research discontinued membership. On the other hand, Aristech Chemical Corporation, Cain Chemical, Inc., Enthone Incorporated and Mac Milian Bloedel, Ltd. joined the MTI. As a result, there was a net increase in membership from 36 to 37. Funds available for the year amounted to \$963,800 of which \$548,400 was available to finance new contracts.

It was decided not to fill the vacancy on the Board of Directors left by the retirement of Paul Krystow from Exxon Chemical Company. Thus, the membership was reduced from 11 to 10 for 1987. The directors for the year were: Sheldon Dean, Frank Hoagey, Galen Hodge, Arlin McKim, Nick Monsour, Chuck O'Brien, Bob Puyear, Steven Seelinger, John Truscott and Gary Wolf. Bob Puyear and Frank Hoagey were elected Chairman and Vice Chairman, respectively, of the Board.

At the Annual Members Meeting on April 9, Sandy Sharp and Ed Clayton were elected Chairman and Vice Chairman, respectively of the Technical Advisory Council. The composition of that body changed somewhat from the previous year. The TAC lost Leon Calvit (Ethyl), John Donohue (Betz Laboratories), and R. V. Worboys (Shell Research); however, it gained Jerome J. (Jerry) English (Cain Chemical), R. T. (Dick) Jones (Aristech Chemical), Gary J. Shawhan (Enthone) and Donald Wensley (MacMillan Bloedel). In addition, M. E. Howells replaced Jack Van Sciver who had retired from Allied-Signal Corporation. Finally, note was taken that Veritas USA, Inc. became DNV Industrial Services, Inc.

At that meeting, Bob Puyear stated that the Columbus, Ohio office of the MTI would be closed by June 1, 1987, in the course of which the Institute would lose the services of Helen DeLong which had been of great importance to the operation of the MTI for many years. Al Hall would become a consultant assisting the MTI in issuing its publications.

The business of the MTI would be conducted from its new office which opened on April first in St. Louis. On that date, Lu Humphrey (Mrs. Richard S. Humphrey) joined the MTI in St. Louis as a secretary; a short time later Barbara (Mrs. Benjamin M.) Parks came on board also as a secretary. Lu very capably handled the financial records, made arrangements for meetings and dealt with publications and other essential matters. Barb contributed strongly principally in the realm of MTI's correspondence.

Lu was the mother of three daughters all of whom, for a period of time, were in college simultaneously. This, as everyone who has put children through college lately knows, was a considerable financial challenge. Barb and Ben raised three sons, a challenge of equal but perhaps somewhat different dimensions.

Louis Cabano, President of Pathfinder Corporation, was the guest speaker at the Annual Members Meeting. His talk was entitled, "The Process Industry's Changing of the Guard: Are We Prepared?"

Under the aegis of Sandy Sharp, considerable soul-searching and discussion went on regarding MTI vis-a-vis academia at BOD and at TAC meetings during 1987. The BOD had terminated the student award program because of the lessened need to attract young people to the chemical process industries. However, it was agreed that, through efforts by the BOD's University Relations Committee, the MTI should maintain an awareness of the trends in university research pertinent to the MTI's interests. To this end, the idea of having professors speak at TAC meetings met with favor.

In the interest of achieving a greater degree of coordination of activities and of avoiding inadvertent competition, arrangements had been made during the previous year for the Director of the Materials Properties Council (MPC) and the Technical Director of the MTI to attend each other's technical meetings. Thus, Martin Prager, then Acting Director of the MPC would attend TAC meetings and Bert Krisher would go to MPC meetings. In this vein, at the meeting of the TAC on April 9-10, 1987, Martin spoke on a number of upcoming events that might interest the MTI, such as the

workshop set up by the Joint ASTM/ASME/MPC Committee on Effect of Temperature on the Properties of Materials from June 28 to July 2, 1987 to discuss the reliability of structural steels, aqueous hydrogen cracking, and field certification of materials for nuclear and other critical applications.

As in 1986, emphasis was placed on attracting new members particularly in North America and Europe. In the European arena, John Truscott participated strongly as did Galen Hodge. Fortuitously, Haynes International had assigned Galen to set up company operations in Paris. How lucky can you get: In addition, Bert Krisher would visit nonmember companies, as appropriate, during his travels to Europe.

- From the inception of the MTI until mid 1987, printing companies had been used for typesetting (when needed), printing, binding, distributing and storing the Institute's publications. For most of this period these services had been provided by Drennan W. Hart Advertising, Inc. of Indianapolis, Indiana, the points of contact being Jon Hart and Emily (Em) Sylvester. Em was an especially accurate typesetter and proof reader. Later, Rapid Offset Printing of Columbus, Ohio, was used in these capacities. Ken Woodland, their President and Agnes Lucas, one of his associates, provided excellent service. However, largely from a desire to become better known among the technical staffs of the CPI and to gain a wider market but also to reduce costs, the MTI contracted with the National Association of Corrosion Engineers (NACE) in 1987 for that organization to market and sell as well as to print and distribute MTI's publications. NACE would be the publisher, not MTI; the agreement called for MTI to receive royalties.
- During the latter part of 1987, Attilio Bisio made known his desire to resign as Executive Director no later than August 31, 1988. Attilio said that, without having either an academic background or hands-on experience in materials engineering, he had become very uncomfortable in the position. Thereupon, at their meeting on October 7, the BOD decided to seek an Associate Director who could function as Technical Director while Bert Krisher assumed the position of Executive Director. An important consideration was the preservation of continuity during this second transitional period.

- 1987 saw three new projects initiated. One of them was directed at the production of a series of video tapes for the purpose of training plant personnel. In essence, the objective was to increase the availability of information on corrosion and structural materials to the plant personnel who needed it. To get the project started, it was recommended that scripts for three videos be developed, one of which would be produced. The subjects identified were: Detection of Corrosion in Process Equipment, Material Mix-ups, and Nondestructive Test Methods. A consultant would be engaged to prepare the scripts. Proposals were received from several contractors but, as 1987 drew to a close, a contract had not yet been set up. Meanwhile, Ed Clayton had arranged for a P and G employee to make a survey of sources of training videos, which were already extant, that might be of interest to MTI members; also the TAC representatives were asked to contribute information on any tapes with which they might be familiar. This effort became Project No. 51, while the production of videos specifically for the MTI would be assigned the designation, Project No. 54.

The value of the technical forums, first included in TAC meetings by Paul Krystow several years back, was amply attested by the desire of the TAC representatives to be able to have quick access to the information presented therein when the occasion arose. The job of doing something about it was assigned to the staff under Project No. 52. The approach that was favored was to publish the full text of the forum topics in a single loose-leaf book with a key word index. In addition, structured forums were introduced during the year as a mechanism for enhancing the effectiveness of forums as a means of information exchange.

As reported earlier, automated information systems, especially those with built-in diagnostic capabilities (the so-called "expert systems") were receiving an increasing amount of attention from MTI members beginning some time around 1984. The tremendous potential value of such systems, if they could be fully and effectively developed, was thoroughly appreciated. Bob Puyear, Bert Krisher, Paul Krystow and others became strong advocates for participation by MTI in the development of expert systems for use by materials specialists, if a suitable role for the Institute could be

identified. Everyone was aware that the undertaking would be expensive, time-consuming, technically complex, and replete with legal impediments. However, appropriate participation in such a development would afford an excellent opportunity for MTI to make a major contribution to the welfare of the chemical process industries.

It will be remembered that, during 1986, the BOD and the TAC had been introduced to the Achilles Club automated information program developed at the National Physical Laboratory (NPL), Harwell, U.K., and Bert Krisher had attended a seminar in the U.K. on software for the corrosion community. In addition, Chip Lee of NACE had presented a proposal to MTI on the development of an expert system involving assistance from the National Bureau of Standards. Building on concepts derived from these sources, Bert Krisher prepared a proposal which he presented at the April 8-9, 1987 TAC meeting, that involved contracting through NACE to have modules of interest to the MTI generated for use within the Achilles system. The first module was to be on structural materials for hazardous service in concentrated sulfuric acid systems. The second module would cover acetic and formic acids, while the third would deal with dilute sulfuric acid. The funding was to be \$347,000 over a period of 30 months. The BOD approved the proposal and funding on April 10, thus establishing Project No. 53 as the most heavily funded project the MTI had yet undertaken.

A computer expert, JohnPaul San Giovanni, was engaged to review aspects of the expert system, while Paul Dillon was contracted to prepare the resource document on the containment of concentrated sulfuric acid. Charles Sturrock was hired as the MTI/NACE Research Associate to work at the NACE-NBS Corrosion Data Center in Gaithersburg, Maryland, on the MTI Expert Systems Project for its duration.

Meanwhile, Attilio Bisio had described the Project No. 53 program to the Nickel Development Institute staff, who were very favorably impressed by what they heard and graciously provided \$60,000 toward the first year's funding of the project. A committee composed of Tom Degnan, Matti Tiivel and Tony Scribner was appointed to review the first

module. By year-end, it was expected that negotiations with NPL would be completed to permit MTI to participate with the Achilles Club group. In these ways, the stage was set for MTI to push forward with the expert-system project in 1988.

## EPILOGUE

Thus it was that in the 12 years spanning that day in 1975 to the end of 1987, the Materials Technology Institute of the Chemical Process Industries, Inc. had evolved into a well-organized, well-run entity with a strong sense of mission--an entity that was making a steady stream of important contributions to an industry vital to the World's material well-being.

The MTI had undertaken a wide range of technical activities featuring problem solving projects, basic research, development programs and information pack-aging. Its projects had encompassed metals and alloys, ceramics and plastics. The technologies involved included physical metallurgy, fracture mechanics, materials science, materials joining, nondestructive inspection, corrosion engineering, foundry practice, electrochemistry, microbiology and physical chemistry.

The Institute had engaged in numerous technical ex-change events in North America and in Europe and, in fact, had become international in membership and in scope. It had worked in cooperation with other organizations in many of these activities as well as in the pursuit of funded projects. It had shown the capability of quick response to urgent needs by the membership and also the willingness and ability to deal with complex multifaceted problems.

In short, the MTI had demonstrated determination, flexibility and great vitality. It would look forward with confidence to the approach of the last decade of the twentieth century.