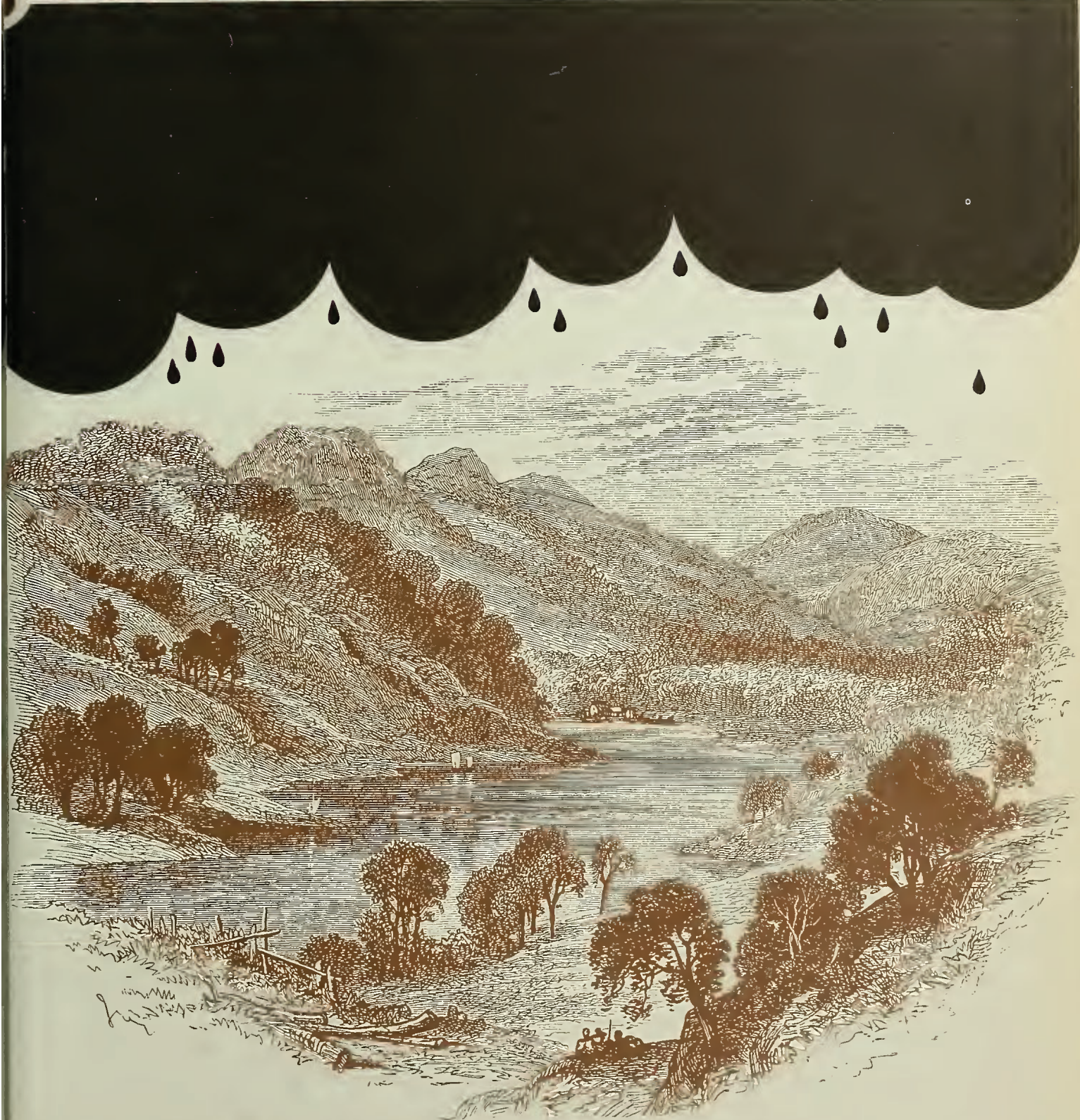


WPI

Journal

FEBRUARY, 1972
VOL. 75, NO. 3



Wyman-Gordon is the country's outstanding producer of forged components for America's key industries. Wyman-Gordon has supplied forgings for virtually every aircraft in the skies today, as well as for the Saturn and other space boosters. Equally important is its production of vital components for nuclear and turbine power plants, sea and undersea vessels, trucks, tractors and construction equipment.

Research is a hallmark of Wyman-Gordon; its research and development teams have long been recognized as industry leaders in the development of new techniques for advanced materials such as titanium and other space-age alloys.

**Forging form and function
into metal**



WYMAN - GORDON

WORCESTER

NORTH GRAFTON MILLBURY

Midwest Division: Harvey, Illinois

Subsidiaries

REISNER METALS, INC.

South Gate, California

ROLLMET, INC.

Santa Ana, California

CAST TECHNOLOGY, INC.

Schenectady, N.Y.

WYMAN-GORDON INDIA, LTD.

Bombay, India

Sales Offices Worldwide

WPI

Journal

Vol. 75, no. 3
February, 1972

H. Russell Kay
Editor

Ruth A. Trask
Alumni Information Editor

Publications Committee
Walter B. Dennen, Jr., '51, Chairman
Robert C. Gosling, '68
Enfried T. Larson, '22
Rev. Edward I. Swanson, '45
Richard DeChard, '56

Published for the Alumni Association
by Worcester Polytechnic Institute.

Copyright © 1972 by
Worcester Polytechnic Institute.
All rights reserved.

WPI Alumni Association Officers

President:
I. J. Donahue, Jr., '44

Vice Presidents:
B. E. Hosmer, '61
W. J. Bank, '46

Secretary-Treasurer:
S. J. Hebert, '66

Past President:
R. E. Higgs, '40

*Executive Committee,
Members-at-Large:*
C. C. Bonin, '38; F. S. Harvey, '37;
C. W. Backstrom, '30; L. Polizzotto, '70

Fund Board:
G. F. Crowther, '37; A. Kalenian, '33;
R. F. Burke, Jr., '38; L. A. Penoncello,
'66; W. J. Charow, '49; H. I. Nelson, '54

The WPI Journal is published five times a year
in October, December, February, April, August.
Entered as second class matter July 26, 1918,
at the Post Office, Worcester, Massachusetts,
under the act of March 3, 1879. Subscription
two dollars per year. Postmaster: Please send
form 3579 to Alumni Association, Worcester
Polytechnic Institute, Worcester, Mass. 01609.

In This Issue

The Prospects for Our Environment page three
Russell Train, Chairman of the President's Council on Environmental Quality, takes a probing look at the role of the private citizen in the fight to save our environment.

WPI: A Center for Environmental Studies page nine
Dr. Edward N. Clarke, WPI Director of Research, discusses the wide range of environment-related programs at WPI.—

Whither the Automobile? page twelve
A brief but incisive rundown by ME Prof. Roger R. Borden of the problems caused by the automobile — environmental, sociological, and technical — with a summary of emission requirements and results.

Art Smith, Man At the Top page twenty-seven
A profile of the new President of United Aircraft, WPI '33.

Alumni Fund Progress Report page twenty-nine

DEPARTMENTS

Completed Careers 23
Your Class And Others 25

A Note on the Cover: The cover for this issue has been printed on 100% recycled paper. It costs approximately 44% more than our usual paper, which is itself a fine and expensive paper.



The Prospects

for our Environment

by **Russell E. Train**

Chairman, Council on Environmental Quality

THE CAUSE of the environment is one which the citizens have made. No political leader, no government official can take sole credit for putting the environment on the national agenda. Citizens identified problems, organized to influence governmental actions, made themselves heard at public hearings, brought actions before administrative agencies in the courts, and helped the press to interpret their concerns.

They did all this in the face of the massive lethargy of business-as-usual bureaucracy. Some citizen leaders were ridiculed for their efforts, mocked as the "birds and bunnies people," the butterfly chasers, the old ladies in tennis shoes. In many subtle and not so subtle ways they were made to feel that they were not in the American mainstream of bread and butter progress, that theirs was the voice of reaction, that they were callous to the people's need for jobs, that they were soft.

The first hurdle citizens had to overcome was organization. Contrast the situation just ten years ago when three or four national environmental organizations divided up a faithful but small constituency of members, with the situation today which sees innumerable national, State and

local groups with large and growing memberships organized with general, specific and *ad hoc* objectives of every kind.

The second hurdle citizens had to overcome was the refusal of people to take them seriously. This refusal manifested itself in the ridicule of environmental leaders, the inability to attract press attention. Most significantly, there was a barrier between the concerned citizen and the processes of law. Although the contractor hired to bulldoze a woodland or level a hillside could go to court to keep people from standing in his way or delaying his work, the lifelong resident distressed by the impending destruction of a valued part of his community could not even be heard in a court of law because of constricted legal concepts known as "standing" or "government immunity." The law, truly reflecting the older values of the society at large, put greater stock by the immediate economics of a situation than it did by the longer-term aesthetic and cultural implications. Everywhere it seemed as though the part was afforded greater rights than the whole, and while there was no lack of advocates for specific dams, airports, highways and power plants, the fellow who dared to speak out for the environment could scarcely be heard above the roar of the "engine of progress."

By and large the citizens have won their battle to be taken seriously, and few courts turn them away today. The number of speeches and articles exhorting environmentalists to be responsible, and claiming environmental requirements are delaying needed projects and putting people out of jobs, suggests that citizen environmentalists are now being taken very seriously indeed.

Russell E. Train is a graduate of Princeton with a law degree from Columbia. In 1970 WPI awarded him an honorary Doctor of Engineering degree in recognition of his concern for the environment and his leadership in making the technical man compatible with the natural world. In 1969 President Nixon appointed him Under Secretary of the Interior. He was appointed to his present position in 1970. Russell Train is our country's environmental ombudsman.

The measure of citizens' strength today is the government's respect for them.

Finally, citizens have had to learn how things really work, how divergent views are heard and reconciled in administrative tribunals and courts and in the political forum. Shut out for so long, it has been difficult to adjust to a role where citizen opinions are solicited and considered, where recommendations are invited. But this obstacle has also been largely overcome, and there is less shrillness among environmentalists today, and more sensitivity to the complexity of government, the economy, and the needs of the environment.

The measure of citizens' strength today is the government's respect for them. It is simply inconceivable that any agency of government or elected official could turn back the clock and ignore the environmental concerns of citizens for very long — the courts, the press, and the people simply would not allow it.

Now that some of the great battles have been won by citizens, the time has come to ask "What does it all mean?" and "Where do we go from here?" Let me offer some tentative answers.

It is almost a third of a century since the beginning of World War II, and over 40 years since the start of the Depression. Many, if not most, of those years were characterized by deep insecurity. The insecurities of the post-War period were of both foreign and domestic origin, for the instability of the world outside was mirrored by social divisions here at home. Since then much has changed, and the themes that people once marched to no longer stir them. Where once we were confident, aggressive, unified and outward bound, now we can only look back and wonder at those days. We have passed through several revolutions — of rising expectations, civil rights, consumer rights — and we have witnessed the coming of the new politics, the new technology, the new consciousness, the new everything.

Now we are in the midst of yet another revolution, a turning inward. How much the war has been the cause, or whether we are just entering another cycle of history is debatable. We are, however, internalizing our ambitions, and questioning our purposes. One can measure our current mood in any number of ways, and the conclusion is unmistakable. We are showing by our visits to parks and museums, our purchases of books and sporting goods, our responses to polls and elections that we are more and more concerned with personal fulfillment, with productive uses of leisure, with the life of the mind and spirit and with the outdoors.

At a time in our national life when we are questioning traditional goals and redefining our purposes, we have come to a new concern with the quality of life. I do not believe that this concern is a temporary development. In the words of Jean Revel:

There is a good deal more to the ecological movement than the effect of a practical determinism. After all, for thousands of years mankind has lived (and for the most part still lives) by drinking contaminated water, and he has survived the resulting dysentery and typhoid epidemics. Suffering apparently is not enough to move one to fight for a better environment. Malaria has never caused a revolution. In order to fight, one must be able to see a clear relationship among nature, technology, economic power, and political power.

One must also be able to rise to the belief that nature belongs to every man, and to the realization that an oil slick on the ocean affects one's own good or better, one's own happiness. The development of such a belief therefore implies the existence of a political awareness that calls for the reshaping of intra-social relations, for co-proprietorship, for co-dependence, for co-responsibility.

We are in the midst of a fundamental reordering of our values, and the citizens who have worked to stimulate the debate are now being invited to contribute to it. They must display a maturity, a responsibility, and a staying power in the face of the inevitable testing of the depth of the nation's new commitment by those whose business is pollution or whose values are early American.

The public will ultimately pay these costs, and the public is entitled to know the relationship of the costs it is paying to the benefits it will receive.

There are two arguments that will increasingly be made in one form or another against moves to improve the environment. One I shall call the argument from economics and the other I shall call the argument from equity. It is essential that citizens concerned about improving the environment learn to deal with these arguments, and master the complex language in which they are presented and considered.

There is no question of the continuing need to do a careful and thorough job of economic analysis of environmental problems and programs. This is particularly true as environmental standards rise. Attaining low levels of control is relatively inexpensive but the cost rises rapidly as higher levels of abatement are attained. For example, in one particular industry it costs less than \$1 a pound to reduce BOD — the measure of oxygen required to decompose organic wastes — by 30 percent. But to reduce it by over 65 percent can cost over \$20 for each pound, and to reduce it beyond the 95 percent level it costs over \$60 per pound. Marginal costs of controlling such air pollutants as sulfur oxides and particulates also escalate rapidly at high levels of control. It is important for many reasons that we have a clear understanding of these costs before making far-reaching decisions. The public will ultimately pay these costs, and the public is entitled to know the relationship of the costs it is paying to the benefits it will receive. Second, accurate information on costs is important because there may be more economical and more efficient ways of achieving the same environmental objective. Indeed, there may even be other environmental objectives which should receive a higher priority. Finally, the nation's resources are finite, and an intelligent allocation of those resources

among an almost infinite set of desirable goals demands careful cost analysis. This is not to say that cost must be the determining factor in setting environmental standards. But it is a factor that must receive careful analysis if environmental improvement is going to continue to have the broad support of the American public which I believe essential.

It is perfectly fair to ask an environmentalist to deal directly with these questions, and to indicate what the trade-offs will be for a quality environment. But it is also fair for the environmentalist to insist on a rigorous acknowledgment that a poor environment is, in the crudest terms, costing us money. Part of what we give up by improving the environment is a baggage of unnecessary expenses to which dollar values can be broadly assigned. Let me briefly outline some of these costs we now bear for environmental problems.

To be able to deal comprehensively with the question we really need a better environmental balance sheet than we now have. But we already know that air pollution, for example, is costing us money. There is a growing body of evidence which indicates that the long-term effects of exposure to low concentrations of pollutants can adversely affect health and result in chronic diseases and premature death. Major illnesses linked to air pollution include emphysema, bronchitis, asthma, lung cancer, and even the common cold. One evaluation of epidemiological studies suggested that a 50 percent reduction in air pollution would eliminate damages to health by more than \$2 billion in a single year. The Environmental Protection Agency has estimated the total economic costs of mortality and morbidity due to air pollution is around \$6 billion annually.

One evaluation suggested that a 50 percent reduction in air pollution would eliminate damages to health by more than \$2 billion in a single year. . . . The total estimate in 1968 of the direct costs of air pollution in the United States alone — not taking into account discomfort, anxiety, or aesthetic degradation — was put at \$16 billion annually.

Air pollution also affects property values. Studies of the willingness of people to pay more for residences in areas having cleaner air are persuasive. Data showing that income levels correlate inversely with air pollution levels in large cities — the poorer you are the more you are affected by air pollution — suggest that heavy air pollution may result in lowered property values, and lower housing costs. One study of property values, based on data from three cities, shows that increases of 10 percent in air pollution levels can result in decreases of \$500 per residential property tract.

The effect of air pollution on vegetation and materials was estimated at just under \$5 billion in 1968. The total estimate in 1968 of the *direct* costs of air pollution in the United States alone — not taking into account discomfort, anxiety or aesthetic degradation — was put at \$16 billion annually. This total is far in excess of abatement costs.

Economists have also attempted to put dollar costs on water pollution, taking into account reduced fishery

if such an engine were not required by law; that 85 percent would be willing to purchase only returnable bottles and pay a five cent per bottle deposit.

In a broader sense, however, while the balance sheet approach to environmental gains and losses may be suggestive, I think it is inadequate. Environmentalists were among the first early to sense the hidden costs of technology, to see that better automobiles and highways and dams and power facilities do not necessarily add up to a better life — that the sum of the parts was worth less than the individual values of each one of them would suggest. Economics has not yet become subtle and refined enough to allow us to account adequately for this phenomenon, but we know it is true. We know that the plight of the modern middle-class American compares to the dilemma of the fellow who always gets what he wants — for a while he goes on asking for more — more appliances, more power, more comfort — until some dark night alone with himself

More. More power. More comfort. Until some dark night, alone with himself man is moved to ask Why? What is it all worth if the animals have been decimated, the forests reduced, the air befouled, and the broad oceans themselves debased?

harvests, diminished recreation opportunities and the like, but my point is that those concerned about what environmental reforms are costing us should look *beyond* the jobs provided by the marginal industry which is allegedly squeezed out by strict environmental standards to the broader economic interests of the communities who share their air and water with those enterprises. I am personally confident that we would find a net economic gain; indeed, that we would also find that many more will gain than will lose as a result of pollution abatement.

It is important that people understand that protecting the environment is going to entail costs and that it is they who will pay those costs — not someone else. At the same time, I think it equally important that the public not be scared away by inflated descriptions of the sacrifices involved. It has been my strong impression that those who talk the loudest about the heavy costs the public must bear for environmental quality are often those who are providing the public with products most closely associated with environmental problems. Could it be that they are trying to discourage the public from exercising consumer preferences that might adversely affect their own market? A Harris poll reveals that the people of New York are willing to pay to improve the environment, that 60 percent would pay an additional \$200 for a car with a pollution-free engine even

he is moved to ask Why? What it is all worth if the animals have been decimated, the forests reduced, the air befouled, and the broad oceans themselves debased?

Intuitively, we have always understood this to a degree. While we have historically worked hard to increase goods and services, we have at the same time chosen to take a portion of the rewards of economic productivity in the form of reductions in the work week. In the span of several decades, the average U.S. work week has declined from 60 hours with virtually no vacations to less than 40 hours. No one has been moved to complain about what we have given up since 1900 in productivity foregone because they agree so readily about the value of what we have gained — 20 or so hours more of leisure.

The movement to a shorter work week challenged our economy to increase hourly productivity, to mechanize and become more capital intensive. The economic challenges posed by environmental quality objectives are similar in nature but far less in scale than such earlier demands as shorter working hours, paid vacations, pensions and health care. Yet it is true that environmental reforms pose challenges to technology. For example, we have designed our proposed tax on sulfur emissions so that the tax will become more burdensome with time, rewarding enterprises which develop new techniques for eliminating sulfur, and penalizing those which resist change.

The reason perhaps why we are slower to perceive that our continued progress as a people now demands that we improve environmental quality just as a quarter century ago social justice demanded a better deal for the working man, is that the benefits we are now striving for are public, not private. Environmental quality generally has no interest group, no lobby to whom the cause means dollars and cents, days off, or sick pay. Americans have been slow to

What about the poor — what's in it for them? What about social justice and equal opportunity?

differentiate between individual goods and communal goods. Many of this country's problems have been aggravated by our historical misunderstanding of the communal nature of air and water. Now that there is some consensus in those areas, the task of the environmentalist is to persuade Americans of the communal nature of much private land use, of distinguished historic buildings and architectural masterpieces and valuable ecosystems.

Our system has always functioned well where adversary interests have had specific objectives and a strong constituency. Where the cause is the public estate, and we all stand to gain, some of our institutions do less well. But we are adapting them. Reduction of bond requirements and abandonment of the rule that litigants must have a direct economic stake to contest public agency actions are instances where the courts have made room for what Edward Banfield has called "the public regarding citizen." The citizen is more and more being invited to scrutinize the quality of service he is receiving from agencies of government and to challenge it directly, by commenting on its proposals through its public participatory processes, or by challenging it directly in the courts when he finds it wanting.

All very well, some may say, but the public regarding citizens who stand to gain from environmental gains are the affluent middle classes. What about the poor — what's in it for them? What about social justice and equal opportunity? We have heard talk recently of "environmental escapism," and suggestions that as a people we are abandoning social objectives and priorities — a decent home for every American family, the elimination of poverty — in the name of less exacting goals such as cleaner air and water and more parks. This I refer to as the argument from equity, and since it questions the very legitimacy of environmental reforms it is essential that environmentalists confront and deal with it.

I believe that the view that we are now escaping into a world of middle class concerns which benefit only the affluent makes three false assumptions:

1. That alleged neglect of social priorities is in some way a consequence of increased support for environmental programs. We are simply not playing a zero sum game where my gain is your loss or vice versa. Economically and politically, it is simplistic to argue that better air for all of us has meant less money for the poor.

2. That although the poor may not define environmental improvements as their primary objectives, they do not stand to gain by them. On the contrary, we have data that indicate that the poor suffer most from air pollution, poor waste management, and inadequate recreational opportunities. For example, in our annual report on the quality of the nation's environment last year we cited data from Chicago showing that the lowest income neighborhoods are in the areas of highest air pollution concentrations. Studies in several other cities show a similar close correlation between low income and high air pollution levels.

3. Third, I believe it is specious and perhaps a trifle guilt-ridden to argue that the interests of the great majority of Americans who are showing in polls and in other ways that they care very deeply about the quality of their natural surroundings are to some extent illegitimate. Galbraith could rationally argue in the *Affluent Society* that the amount of money Americans lavish on chromium auto fixtures and cosmetics was a misallocation of resources in view of the needs of the public estate. But the environmental movement is precisely directed at benefiting the society at large.

Citizens organized in the public interest have been so successful that they now are virtually a fourth branch of government when they care about an issue. If this new status calls for a new sophistication and maturity in the face of subtle and sometimes persuasive skepticism, it also calls for a spirit of conciliation and cooperation with others in the society who see some things differently. And it calls for a realistic appraisal of what is involved.

It is important for us to understand that many of the problems we have — poverty, pollution, inflation, the urban crisis — we share with all the world. Often because we face them first, our solutions and our performance become the measure, mould the expectations, of what is possible. As Revel has pointed out the fundamental changes that are occurring in our society amount to "the first revolution in history in which disagreement on values and goals is more pronounced than disagreement on the means of existence."

While so much proceeds at geometric rates of increase these days, time is still linear, and people are still people. Although our mood may have changed and our needs have become more subtle, our older institutions are moving along with years of momentum behind them. Institutions are less flexible than people, their turning arcs are wider, and it is more difficult to move them through periods of maximum transition. The regular scrutiny by citizens of

It is important for us to understand that many of the problems we have — poverty, pollution, inflation, the urban crisis — we share with all the world. Often because we face them first, our solutions and our performance become the measure, mould the expectations, of what is possible.



governmental agencies is serving to energize the agencies themselves, and to discourage their becoming overly preoccupied with themselves and the world of government. In the midst of uncertainties over which areas to emphasize or which priorities to favor in an era of information overload, strong citizen concerns have the effect of focusing attention and clarifying alternative options.

It is the task of the national administration to chart an orderly course through a disorderly time, to accommodate the need for institutional change as quickly as possible without wrecking what is essential and useful in our processes of government. We in this administration are fully committed to the revolution in values now underway, and to the reappraisal of the goals of technology and its consequences. At a time when there is so much that divides people, the cause of the environment is vibrant, youthful and full of hope for young and old, rich and poor.

Moving forward together in this very complex time will require not only sophistication but also conciliation, moderation, and respect for each other's deeply felt wishes and desires. A posture of disciplined application to the business at hand is difficult to maintain in an atmosphere charged with passion, but it is the only approach capable in the long run of achieving the broad goals and the better quality of life we seek.

Last February, when President Nixon sent to the Congress his Environmental Message proposing a comprehensive and wide-ranging set of environmental initiatives, he declared:

"... Far beyond any legislative or administrative programs that may be suggested, the direct involvement of our citizens will be the critical test of whether we can indeed have the kind of environment we want for ourselves and for our children."

There is no question in my mind but that an informed, concerned, and responsible citizenry is the crucial factor upon which ultimately all environmental progress must depend.

WPI: A Center for Environmental Studies

by **Dr. Edward N. Clarke**
Director of Research



UNTIL RECENTLY *ecology* was a professional word used and understood only by biologists. *Environment* was a word connected with the study of human behavior to describe the influences which, along with heredity, make people behave as they do.

Today, these terms are household words even though the full comprehension of their meaning is often little understood.

Is the current concern for our environment a fad which will be replaced next year by something else? Or is there a real problem which has finally been recognized by the masses to the extent that they are now willing to support the programs necessary to improve the environment in which we live? The broad-scale involvement of WPI faculty and students in environmental studies and projects described in this issue of the *WPI Journal* provides evidence that these problems are both real and critical.

First of all, what do we mean by the environment? Prof. B. Allen Benjamin of civil engineering answers that. "The term 'environment' means different things to different people, even here on campus. Some equate it with 'pollution' (which is, rather, an environmental *problem*), others with 'air and water resources' in general; still others with *all* natural resources, of which land (with what is under and on it) is a major component. But in the broadest view, and the one I favor, is that the 'environment' includes the physical works of man as well as the elements of nature. Stated another way, our environment is composed of interdependent systems, both natural and man-made. The abuse of one system jeopardizes the quality of the others and ultimately the survival of all."

It is easy for the public to point a finger at technology, saying "you are to blame for the mess in the environment." While there is an element of truth in this accusation, it is no more applicable to technology than to every other segment of society. All of us businessmen, politicians, farmers,

educators, and the rest of the citizenry have been looking at the world around us through blinders which prevented us from seeing beyond our own special interests.

The municipalities which dumped raw sewage into rivers without passing it through treatment plants should not blame technology when new government regulations demanded treatment to improve water quality for those living downstream. Although technology was available to correct the problems years ago, elected officials with few exceptions could see no advantage to their own community in undertaking such an expensive public works project. Even if they had, they would have been faced with the difficult job of convincing the citizens to increase their taxes to pay for the project.

The businessman who found it economically desirable to dump his wastes and by-products into streams or through stacks into the air was suffering from the same limited vision. If approached by local officials about stopping the practice, his answer was often a threat to leave town, eliminating jobs for local citizens. His claim was that he was faced with the necessity of making a profit or going out of business. For the marginal business, this might have been the only alternative. However, prosperous businesses often took this same attitude.

It's easy to point to the city sewage plant or the smoking stacks of industry as sources of pollution, but until each of us recognizes his own contribution to the overall problem we cannot hope to solve it. Fortunately, the public is being made aware of the individual's responsibilities.

The nation's college students picked up the torch to crusade for a better environment sometime between their crusades for civil rights and the end of the war in Vietnam. Then the politicians began to speak on the perils of pollution with the result that new laws were enacted to protect the environment. The remaining wetlands received a reprieve from the real estate developers as people finally

realized that they are a part of the natural ecosystem in which man lives. Federal standards on automotive exhaust emissions were applauded by the people, if not by the auto makers. They couldn't be met, said Detroit, but teams of college students from all over the country including five WPI teams proved the standards could be met in the 1970 Clean Air Car Race.

WPI faculty have provided national leadership in environmental research. Worcester Polytechnic Institute is, in fact, a center for environmental studies. It does not have a separate "environmental" discipline under a department head. Rather, these studies permeate the entire program and curriculum. Because the problems of correcting the misuse of the environment cut across the lines of the traditional academic disciplines, this represents a logical approach.

Environmental problems and WPI's response to those problems have had a major impact upon education and research at WPI. There has been a nearly ten-fold increase in sponsored research since 1965 at WPI, with much of the growth in fields related to the environment. A major portion of the sponsored research at Alden Research Laboratories is concerned with the thermal pollution of rivers and other water systems. Nearly half of all the sponsored research on campus is related to air, water, and solid waste problems.

WPI's faculty and facilities were in the right place at the right time to work on environmental problems when WPI made the decision to expand its research program. Instead of following the more traditional engineering college path of becoming heavily involved with defense and space research, WPI was alert to the then (1965) growing awareness of environmental problems and proceeded to grow in this particular socially-oriented direction.

The present concern for the pollution of our environment was first brought to the attention of most people by the late Rachel Carson in her book, *The Silent Spring*. However, the problem has been of concern to others for much longer. For example, research into the problems of thermal pollution of streams was begun in 1952 at WPI's Alden Research Laboratories. This first model study of the Schuylkill River was the forerunner of twenty-five studies on the problems created by returning heated water to streams from power plants, both conventional and nuclear powered.

The faculty at WPI recognized the dangers of continued pollution before it became a national concern. In 1967, the theme for a day-long, "Scientific Briefing for Tomorrow" seminar for business leaders was entitled "Pollution: Danger in our Time." This program featured a number of eminent authorities describing the problem of pollution and steps already being taken to correct the problems.

Perhaps that Scientific Briefing program was before its time for the topic was not then of popular concern. However, for the businessman who attended, it was a practical forewarning of the public clamor which was about to descend on business everywhere.

WPI's early response to the need for solutions to environmental problems created such an impression on the Sloan Foundation that it provided a three-year grant of \$200,000 to establish an Environmental Systems Study Program for undergraduate students. This is the first grant of this type ever given by the Sloan Foundation. The ESSP program seeks to develop the methods for teaching students to approach the solution of environmental problems as an interdisciplinary effort. The program, co-directed by Drs. Zwiebel and Keshavan, deliberately seeks a cross-section of participating students and faculty from many departments.

Students in ESSP are first exposed to the theoretical aspects of environmental problems to help them recognize, understand and integrate environmental and social considerations into a project. A key element is the actual project which brings students and faculty into a close working relationship with those people in industry and government who are trying to solve a real problem.



Working in small groups, ESSP students study every aspect of their selected project . . . technological, economic, and social. Only by recognizing the interrelationship of all these areas in an acceptable solution can they effectively act on the problem.

A typical project now in progress involves the discharge of sewage treatment sludge into Boston Harbor. Another concerns air pollution in Worcester.

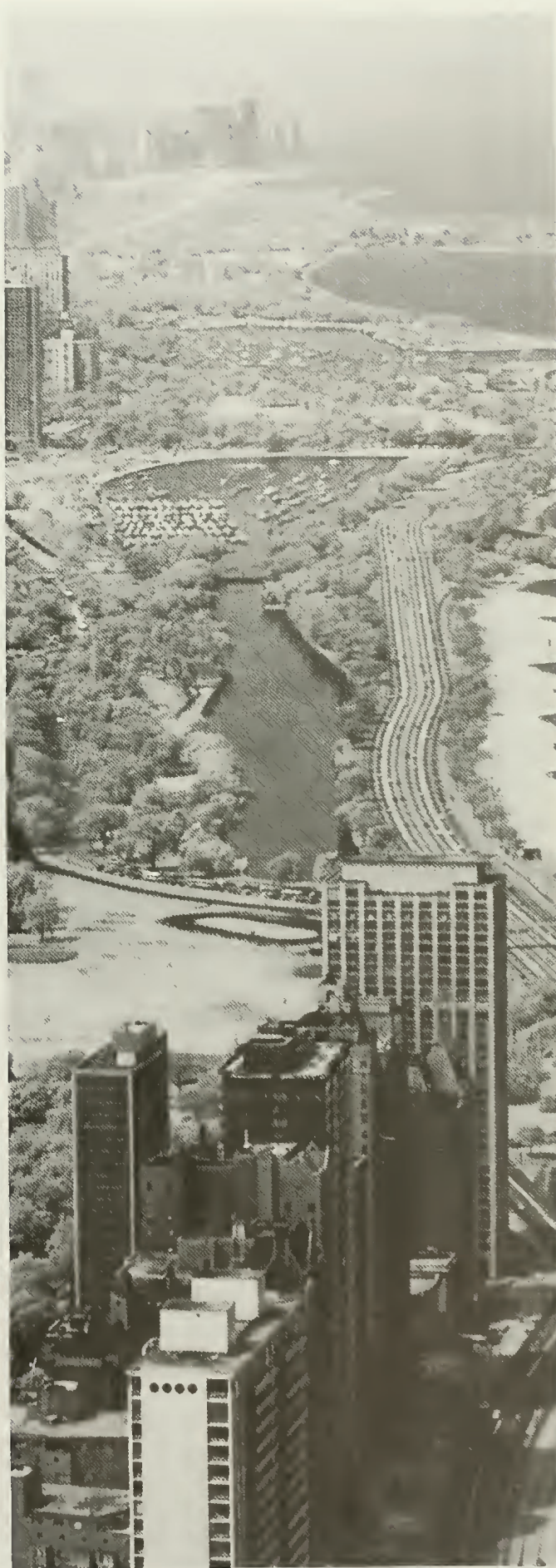
Initially, the environmental programs on campus were primarily in the hands of chemical, civil, and mechanical engineers, and chemists, often with a single-discipline orientation. The electrical engineer, however, has come roaring into the picture recently, primarily because of an ability to work on problems involving large systems.

Professor James Demetry has a new sponsored program to educate selected health boards, planning and conservation commissions, and other town and city decision-makers on the environmental issue. Professor Clements has submitted a new proposal to NSF to use dynamic state estimation techniques (originally applied to aerospace and defense problems) on electric power systems in order to minimize fuel consumption (and hence pollution) and to avoid system instabilities, brown-outs and black-outs. Professor Harit Majmudar is serving as program manager of a newly developing proposed program concerned with power-plant siting, a subject of considerable environmental concern. In the latter program, Professor Majmudar will manage the program and the use of research results obtained from the coordinated efforts of political scientists, sociologists, and economists, as well as engineers.

The civil engineers have generally viewed the environmental issue in its broadest sense, i.e., the aggregate of all external conditions and influences on society. Housing, transportation, and conditions of poverty are part of the broadly conceived environmental problem. Professor Carl Koontz is planning a major study of the community impact of interstate highways I-91 and I-291 in the Springfield, Massachusetts, area. In the past, new highway location has largely been determined by cost-benefit analysis. Currently, and more so in the future, social effects will play a dominant role in highway planning. Professor Koontz's research will provide knowledge for better highway planning in the future.

Today, it's impossible to watch television or listen to radio without hearing advertising claims for washday products which proclaim the low pollution virtues of the sponsor's product.

The claims, the speechmaking, the advertising, and the recently enacted laws have all served to arouse the public to the need to protect the environment while there's still time. At the same time, the claims and counterclaims have confused people to the extent that it's often difficult to determine what is truth. It is at this point that the spokesmen for technology must speak out. For too long, this group has been silent. To engage in public controversy was "unprofessional" according to the ethics of a generation ago. Not so today. Perhaps college students of the past decade have helped to change this attitude and for good. In the change from the apathetic students of the fifties to the concerned students of the sixties, students have raised the searching questions which demand that professional people take a stand.



Whither the Automobile?

by Roger R. Borden '61

THE AUTOMOBILE, of all the technological innovations of the twentieth century, has most profoundly affected our pattern of living. The family car, once a luxury, is now taken for granted as a necessity of life. The urban sprawl of most North American metropolitan areas is the inevitable result of an economy based upon motor vehicles (cars and trucks) as the principal form of available transportation.

Even though the passenger car and a host of recreational vehicles have made it convenient to pack up the family and travel for several hundred miles on vacations for relaxation and enlightenment, the automotive vehicle as the dominant form of transportation has created many environmental problems:

1. Before the automobile the city was planned along the trolley line and the rich and the poor often lived within walking distance of one another. It would be naive to think that there was once a "golden-age" when the rich and poor socialized with one another, but at least there was no geographical separation.

Today the suburban youth is reared with others of a similar socioeconomic and racial background. Many youngsters going through the typical suburban high school have almost no contact with a poor person, especially a poor black person. This geographical separation is one of the by-products of the automobile. But we have to decide whether it is the best way to raise our children. On the broader plane, can such economic and racial isolation really foster a democratic society?

Roger R. Borden is associate professor of mechanical engineering. He was faculty advisor to two of WPI's entries in the 1970 Clean Air Car Race — the two entries which took first place in their respective classes.

2. Many suburban communities are so situated that a second car is a necessity, not a luxury. The man needs a car to get to work, and the woman needs a car to chauffeur the children and run errands. As one cynic has said: "If you don't buy your wife the second car, you'll pay the same money to the psychiatrist, because she will go stir crazy confined to her suburban house."

3. In addition to the more than 50,000 Americans killed each year in automobile accidents, there are several groups that are victims of the automobile explosion — the poor,



N. E. Patriots Stadium/Worcester Telegram

the young, and the aged. The poor are affected in several ways. First, many do not have cars, and when they do the vehicles are unreliable and break down frequently. In addition, many of the urban poor have been forced to leave their homes as their communities are disrupted to build new highways that will bring more cars into the already congested cities. The young, particularly in the suburbs, become overly dependent on their mothers, who function as chauffeurs. These youths do not have an opportunity to express their independence until they reach driving age, and for the suburban teenager the automobile has thus become a symbol of liberation. It can also mean a third or fourth car for the family. The elderly who cannot or do not want to drive are unable to live in the burgeoning suburban areas, where life necessitates constant access to the automobile.

4. One of the chief contributors to air pollution in urban centers is the automobile. Yet rather than designing convenient forms of mass transportation, we encourage further pollution and congestion by building new super-highways leading into our cities. In addition, the automobile is a key contributor to space pollution, since much urban land is used for streets and parking.

We should stop treating the automobile as a god. It is one mode of transportation, not the only one. There are ethical implications to the secondary consequences of the automobile, and a host of questions should be dealt with: Is it just that the federal government gives huge subsidies to states to build highways but pittances to develop mass (public) transit? Cannot the highway fund be diverted to mass transit? What about the effects on health from air pollution?

5. In his 1965 book *Unsafe at Any Speed*, Ralph Nader, the consumer advocate, claims that most of our family automobiles have inadequate mechanical and/or structural designs for safe operation. Although there is much controversy centered on the details of Nader's charges, we must admit that many of today's cars leave much to be desired from the standpoint of safe operation at our current pace of living. It would appear that Detroit has sacrificed mechanical and structural integrity for the sake of styling and pseudo-luxury.

The Dilemma of the Automobile

The U.S. Environmental Protection Agency specifies the emission requirements for all passenger cars and eight trucks under 6000 lb. gross vehicle weight. In 1970 there were 85 million motor vehicles in this category in the United States. The projection for 1984 is 144 million. Each year we have a net gain in the U.S. population of 2 million people, but we add 4 million passenger automobiles.

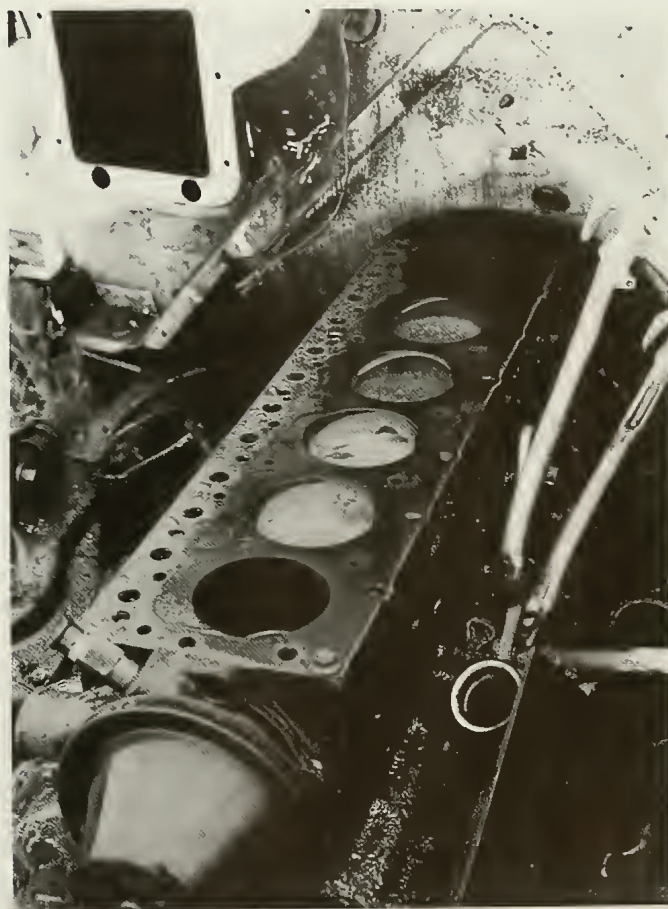
The installed horsepower, in 1971, for all motor vehicles under EPA regulation is 16 billion hp. For comparison, the installed capacity of all the electric utilities

and industrial power plants in the U.S. in 1971 is 400 million hp. This is a ratio of 40 to 1. Thus, the U.S. with 6 percent of the world's population uses 30 percent of the world's energy.

The air pollution from this energy generation and use is costly. Dirty air costs the average American family \$309 per year: health, \$117; residential property, \$100; materials, \$90; vegetation, \$2.

Deaths from air pollution are rising: about 100 deaths per 100,000 of the population.

Our climate is changing. Winter temperatures are up 2 to 3 degrees. Cloudiness is up 5 to 10 percent. Winter fog is up 100 percent. Average wind speeds are down 20 to 30 percent.



Clean fuel is scarce. We have left a 13-year supply of natural gas, a 35-year supply of oil, and a 35-year supply of uranium.

Our known mineral reserves (at present consumption) are being rapidly depleted. We have left:

- Zinc for 20 years
- Lead for 25 years
- Tin for 30 years
- Copper for 35 years
- Iron ore for 350 years
- Coal for 450 years

The Contribution from Automobiles to Air Pollution

The 1969 statistical mean values for automotive engine air pollutants are as follows:

	Emissions in pounds of pollutant per pound of fuel consumed				
	<i>Carbon Monoxide</i> <i>CO</i>	<i>Unburned Hydrocarbons</i> <i>HC</i>	<i>Oxides of Nitrogen</i> <i>NO_x</i>	<i>Solid Particulate Matter</i>	<i>Oxides of Sulphur</i> <i>SO_x</i>
Spark-ignition internal combustion engines					
Los Angeles	0.500	0.093	0.024	0.00022	0.00014
New York	0.972	0.104	0.018	0.00018	0.00014
EPA average for all U.S. cities	0.560	0.072	0.031		
Diesel Engines					
Los Angeles	0.0045	0.018	0.018	0.0045	0.0045
New York	0.0067	0.020	0.025	0.0125	0.0045
Proposed Clean Air Power Plants					
Rover Gas Turbine	0.020	—	0.0003	—	0.002
Thermo-Electron RCE	0.0002	—	0.0030	—	0.00045

When using volatile fuels such as gasoline, 7 to 10 percent of the total fuel input is vaporized and lost before reaching the engine.

Environmental Protection Agency Emission Requirements as of July 1971

	<i>Pre-1966 Base Line</i>	<i>1971</i>	<i>1973</i>	<i>1975</i>	<i>1976</i>
CO gm/m	86 <u>0.44</u>	23 <u>0.1176</u>	39* <u>0.20</u>	3.4	3.4
HC gm/m	15 <u>0.007</u>	2.2 <u>0.0113</u>	3.4* <u>0.0174</u>	0.41	0.41
NO gm/m	5 <u>0.0256</u>	4.0 <u>0.0205</u>	3.2 <u>0.0164</u>	3.0	0.4

The underscored values in the table give the number of pounds of pollutant per pounds of fuel consumed at an average of 15 miles per gallon.

*A change in the testing procedure allows a higher numerical value indicating lower emissions.

Resource References:

The National Wildlife Federation: *National Wildlife Magazine*, Oct.-Nov. 1971 and Dec.-Jan. 1971-72.
The U.S. Environmental Protection Agency
Moody's Industrials

Textual Concepts:

Tech-nethics by Norman J. Faramelli, Friendship Press.

These are some of the problems. Now we must turn and search diligently for the answers.

This Is Where the Action Is!

These brief descriptions of some of the work being done on the WPI campus in the area of environmental studies describe typical studies and are by no means a complete listing. They are included here to indicate the scope of interest at WPI in using the real problems of environmental pollution as a means to provide a sound learning experience.



thermal pollution

According to Prof. Lawrence C. Neale, director, the Alden Research Laboratories have been involved in studies concerned with environmental problems since the Schuylkill River study of 1952. A large percentage of these studies have involved the thermal effect of steam power plants with "once through" cooling systems. From this single study the laboratory activity in this area has expanded to include a total of over twenty-five studies, of which nine are active at the present time. The scope of these studies has ranged from a simple scale model with a single heated discharge to automatic tidal models including several individual plant installations. The Indian Point III model, as an example, reproduces a 14-mile stretch of the Hudson River estuary and includes plant sites for four different installations with modeled warm water discharges. Instrumentation has advanced from mercury thermometers read infrequently by the model operator to data retrieval systems which digitalize data from as many as 300 sensors every 15 seconds of model time and record all data on magnetic tape for remote data processing.

In all of the thermal studies Alden Research Laboratories is working with the power industry to develop combinations of operating procedures and structural design in order to meet various government standards for water quality. In the final analysis the studies provide environmentalists with predictions in three dimensions of the temperature distribution in the receiving body due the plant operation. In the same category of thermal problems a presently active study involves a combination of pumped-storage (hydroelectric) with nuclear power to utilize the upper reservoir as a heat sink and thus protecting the lower reservoir and the associated river from heavy heat loads. Other studies are involving straightforward river situations, natural and artificial reservoirs, and in some cases open seacoast.

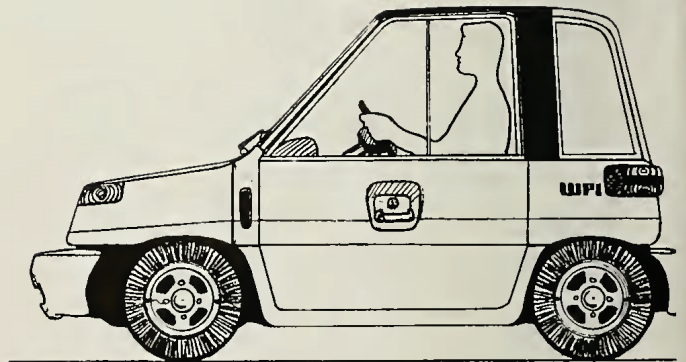
A variation from the river model type of study, but still aimed at the heated effluent problem, has been several

studies of spray cooling. One study for a Gulf Coast utility was directed at the optimizing action of spray cooling of a flow from a steam power plant and involved an experimental review of nozzle design and operating conditions. A recent study (both laboratory and field) for New England Power Company has covered a wider range of parameters associated with spray cooling. In addition to temperature reduction efficiency the amount of spray drift interaction of a number of nozzles and associated phenomena have been studied. This aspect is particularly important in situations using brackish water or sea water and thus can produce an impact on adjacent land areas and the possible uses of neighboring lands.

Associated with a number of the pumped-storage projects the flow patterns in the reservoirs have been studied to insure minimum velocities compatible with migratory fish movements. Clear passages have been maintained or developed for the particular design of intake/outlet structures. This has also been developed in terms of other uses of the water body, such as navigational and recreational. Water velocities at the bar racks and other intake sections have been studied and patterns developed to minimize the entrapment of fish and other swimming life forms.

In the hydraulic machinery field several studies have been performed for filters and screen manufacturers. This work has involved new types of equipment designed to improve the efficiency of such equipment as used in the treatment of water and wastes such as sewage.

The interaction or interrelation of power production and water supply has generated the impetus for another model study. In this case the model (at a rather large ratio — 1/4000) of Quabbin Reservoir, which serves Metropolitan Boston, has been developed to review possible introduction sites of additional water sources — notably the Connecticut River — to the reservoir. The study involves density currents and travel times under a variety of conditions and for a number of points of introduction. The aging of the reservoir as well as water quality are involved in the problems and concerns to which these model studies are addressed.



automotive pollution

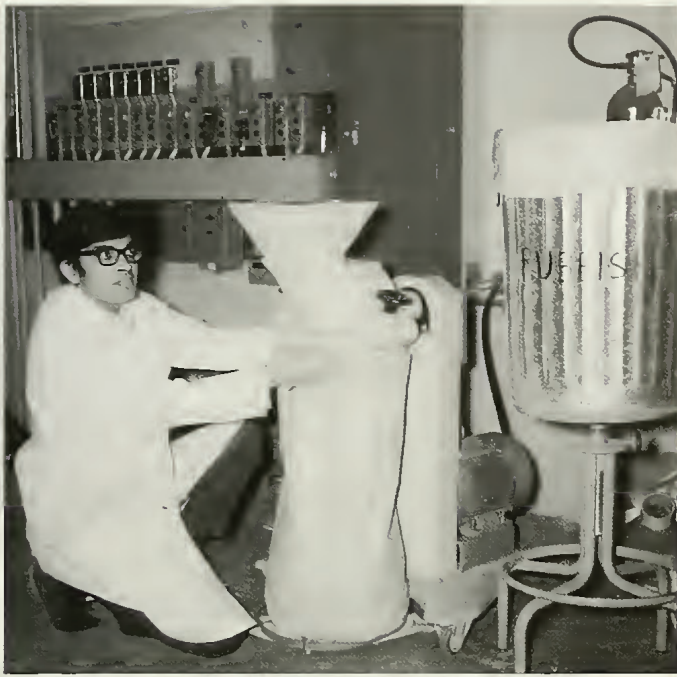
After reading Professor Roger R. Borden's article on page 12, one can readily appreciate why his major research efforts are being directed toward the development of cleaner automobile engines. His first efforts in this field involved about 60 students, who designed and modified the five WPI entries in the 1970 Clean Air Car Race. WPI teams took two first-place awards and the college had more entries than any other participating institution.

Since the 1970 race, a second generation of students has taken over several of the cars and are working to decrease the emissions even further.

The major project in this area today is the design and construction of an entry for the 1972 Urban Vehicle Design Competition. The competition is sponsored by SCORE, Inc., a non-profit organization of engineering schools whose purpose is to promote engineering design competitions in socially relevant areas of engineering. The first competition will judge the efforts of student teams in developing an *urban* vehicle which will be small, safe, and will produce minimum pollution.

Prof. John A. Mayer (mechanical engineering) is faculty advisor for the WPI group, which now numbers about 50 students. Although most are mechanical engineering students, there are several from other departments. Prof. Mayer was also a faculty advisor to the Clean Air SAAB team in the 1970 competition. The UVDC team began its work a year ago, developing an initial design during the spring and summer. The project is now at the construction stage. The former aero laboratory on the top floor of the Washburn Building has been taken over by the team. Here they are doing their final designs, building the molds for the plastic body, and working on smaller components.

The vehicle is being built from the ground up, although many standard automotive components will be used. It will have an internal combustion engine which will drive the car through a hydraulic transmission to the wheels.



food and fuel synthesis

Dr. Alvin H. Weiss, chemical engineering, began his work in this field on an out-of-this-world project. It began with a grant from the National Aeronautics and Space Administration for the development of a process of creating edible food on long space voyages. Simply stated, Dr. Weiss was trying to develop a process for making sugar from the exhaled breath of the astronauts.

Behind this project lies the fact that in the small closed ecosystem of a space ship it becomes impractical to carry large supplies if the recycling of material within the ship can accomplish the same ends. Experimental results have been obtained which show the feasibility of producing not only potentially edible sugars but also a new class of branched carbohydrates that do not occur in nature.

Even with man's space flights to the moon already history, the concern about manufacturing food in space may not seem as important to the average man on the street as some of the more current problems here on earth. However, "current population growth is such that it is predicted that the manufacture of foods will be required within the next generation. The availability of carbon monoxide from natural gas, petroleum, and proposed coal refineries makes CO a preferred raw material for producing both carbohydrates and single-cell protein," says Dr. Weiss. He believes that large-scale food refineries may well be built in the foreseeable future to produce man-made food. These will be used for animal feed, thus releasing farm land for human needs.

Briefly, the process for creating food from carbon monoxide begins with converting the CO into formaldehyde. The formaldehyde can then be converted to "formose" sugars, which in turn serve as substrate for single-cell protein growth.

Dr. Weiss and his team of researchers are also working on a process to make oil from solid waste. "Present methods of solid waste disposal are ineffective and will become more so in the future, due to the sheer volume of materials. Refuse per capita is expected to increase much faster than population growth, and therefore more effective means of disposal must be explored now." His process is to convert the cellulose in solid waste material into useful oil. The great bulk of household refuse is paper and paper products. With the ban on burning in many communities the amounts of waste have multiplied many times. In his process, which Dr. Weiss described on the NBC Today Show in September, the waste is ground up to fine particles. These fine particles are then mixed with a liquid, probably some of the end-product oil, and fed into a reactor where the cellulose is hydrogenated. The resultant product is about the consistency and the grade of crude petroleum.

Dr. Weiss envisions this process being operated in larger municipalities. Solid waste would be collected from the community and processed in a central plant. The resulting crude oil *could* be burned in power plants or certain municipal buildings. More likely, however, the oil would be sent to a commercial refinery where it would be processed in the same manner as natural crude oil to produce the various fractions which might be needed.

His process handles not only waste paper but also garbage, tree branches, and leaves. He envisions a processing plant which will take assorted rubbish and mechanically separate out glass and metal for salvage and recycling. Just about everything else would go through his oil-making process. This will help solve two of man's pressing problems, a declining reserve in fuels and a mounting potential of rubbish and garbage. And about the only by-product of his process would be steam going into the air with no air pollution.



urban planning

Since the principal sources of the pollution of the environment result from the urbanization of man, the civil engineering department's urban planning program, headed by Prof. B. Allen Benjamin and Prof. George E. Mansfield, is deeply involved in environmental studies.

Student projects in the program for the past seven years have involved consideration for the environment as students planned hypothetical new communities, investigated blighted areas suitable for redevelopment, and considered the impact of a new jet port in central Massachusetts (a proposal made and since dropped by public officials).

An important part of the urban planning program involves the study of the political processes by which things get done in municipalities. In this area, members of other WPI academic departments have contributed their special expertise.

A new program has just been funded by the U.S. Department of Health, Education and Welfare to provide off-campus, non-credit courses for public officials concerned with urban planning. Directed by Dr. James Demetry of electrical engineering, the program will involve classes conducted in area communities during the evening for town selectmen, planning board members, and any other public officials faced with the problems of growing communities.

oceanography

The public is slowly awakening to the fact that the seemingly limitless seas of the world are also affected by pollution. The sea has been a vast dumping-ground for many years, and there is ample, visible evidence that man cannot continue this practice without causing possibly irrevocable damage.

The civil engineering department is offering an advanced undergraduate-graduate course in oceanography to acquaint students with basic knowledge of ocean processes. Prof. Armand J. Silva, head of the department, has been involved in research with the Woods Hole Oceanographic Institute for more than two years. He has been analyzing samples obtained by boring into the ocean floor. Knowledge of the ocean's floor is essential if man is to anchor structures to it. At the present time these are mainly oil-drilling platforms, but long-range predictions suggest that man may someday erect bases for the recovery of minerals or for power generation on the ocean floor.

"The assessment of the engineering properties of marine sediments is vitally important to the design of structures to be founded on or anchored to the sea bed," says Prof. Silva. "Proposals have been made to build rather large structures on the ocean floor, and the stability of these depends largely upon the support provided by the underlying sediments. Thus, it may at some time become feasible to place a nuclear power plant on the sea floor."

"Slumping of marine sediments on even very gradual slopes is not uncommon. These submarine movements can impart tremendous loads to structures such as oil-drilling platforms, and the result may be the collapse of the structure, rupture of the oil line, and disastrous oil spills."

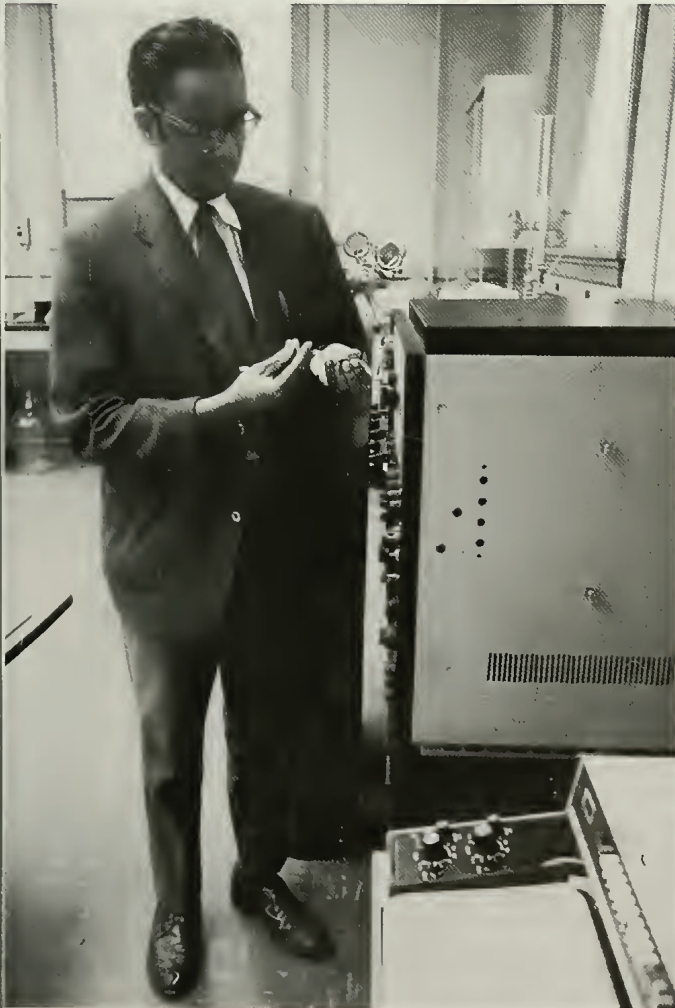


water pollution control

The main thrust of WPI's efforts in the study of water pollution is now centered in the newly built Water Quality Research Laboratory in Kaven Hall, headed by Dr. K. Keshavan, civil engineering. This laboratory was made possible by generous support from the George F. and Sybil H. Fuller Foundation. Facilities are available to both graduate and undergraduate students.

Water pollution studies normally involve an interdisciplinary approach between the civil engineer, the chemist and the biologist. A typical project is one now investigating the possibilities of hazardous chlorinated organic compounds (similar to DDT and other pesticides) being created when natural run-off water is chlorinated in the processing of water for general use or in the treatment of industrial discharges. Dr. Keshavan and Dr. Theodore C. Crusberg, chemistry, are directing the work on this \$44,000 NSF-sponsored project.

Another project involves the development of a mathematical model to determine what happens when both organic and thermal pollution are simultaneously discharged into a stream. Here, the active participation of Dr. George C. Sornberger, mathematics, and the facilities of Alden Research Laboratories have been essential.



the quality of quinsigamond

Worcester's Lake Quinsigamond, once a summer resort for the people of the area, has become badly polluted. In recent years, there has been increasing public concern and awareness of the lake's rapidly deteriorating suitability for recreational purposes. This lake is considered one of the finest courses for crew racing in the East, and for several years it has been the scene of the annual Eastern Sprints regatta. However, crew members are told, only partly in jest, "God help you if you fall in."

During the past summer, a comprehensive study was made of the lake by a team of four students, two from WPI and two from Clark University. Working under Prof. Leon S. Graubard (economics, government, and business) of WPI and Prof. Terrance Moody of Clark, these students (one an undergraduate) investigated the lake's pollution from all aspects, including the economic considerations, to determine what future actions might be recommended.

The project was financed by a grant from the New England Board of Higher Education.

The study was planned to (1) determine the subject and scope of existing studies, (2) determine the nature of the pollution problem, and (3) suggest alternative solutions to the problem and investigate their implications. The first two of these objectives were accomplished without much difficulty.

However, the heart of the project was really to determine the social and economic considerations which would affect any corrective action that should be taken. The students' conclusion was that the development of Lake Quinsigamond and the surrounding region would most probably be residential and recreational. The team recommended that pollution abatement should be directed toward the improvement of water quality to meet standards for fishing and swimming. They determined that this could be accomplished through improved sewage handling in the surrounding area and through aeration of the lake itself to increase the oxygen content for fish and reverse the eutrophication process.

nuclear power and cleaner air

As the nation moves toward a recycle economy, striving to reduce waste and pollutants, there will be an increasing need for electric power. At the present time a 1000 megawatt electric generating station burning coal consumes about 160 railroad cars of coal every day; it discharges up to 250 tons of sulphur dioxide into the atmosphere each day along with 80 tons of nitrogen oxides as well as particulate matter. Nuclear power plants of the same size use only a few tons of fuel *annually* and have negligible discharges to the atmosphere. On the other hand, nuclear plants now under construction will require more cooling water than the fossil-fuel-burning plants. The dangers of a nuclear accident in an atomic power plant are extremely remote though not impossible. The storage of waste is also a major problem.

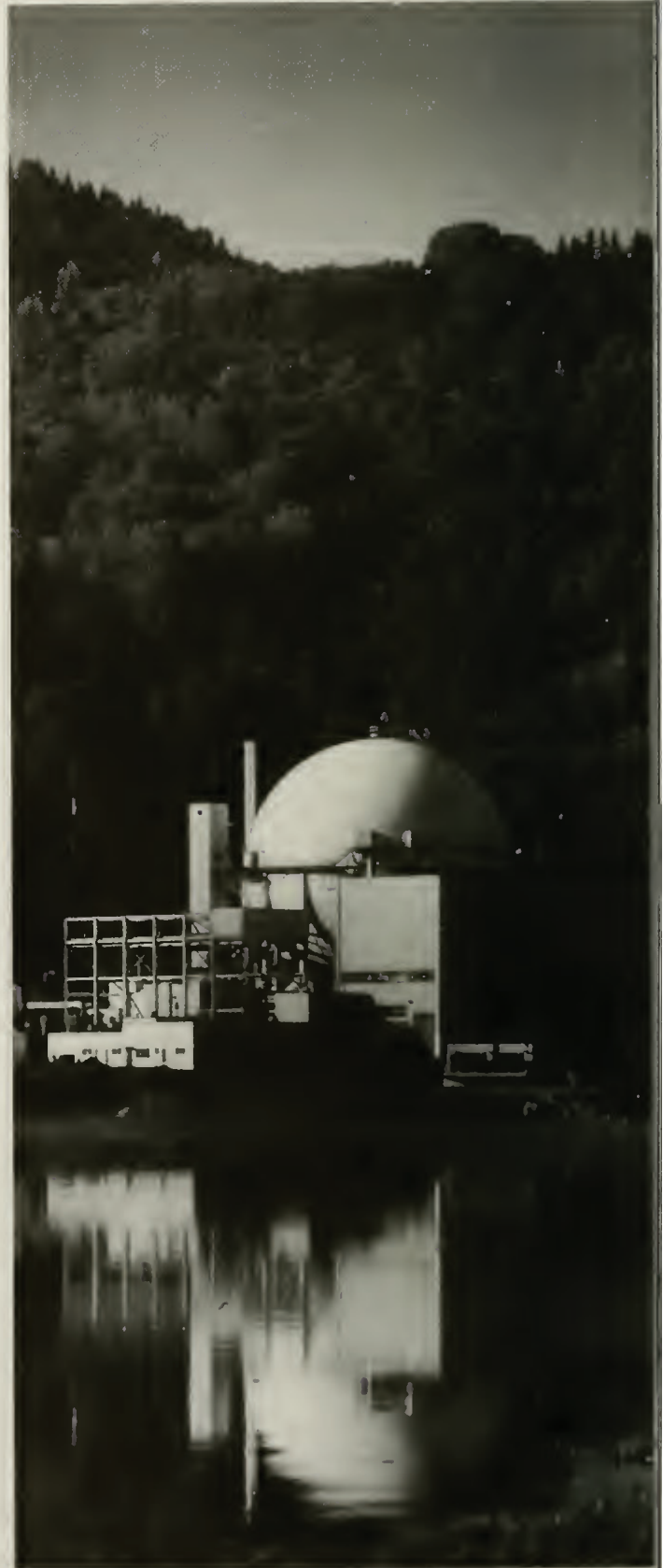
Proposals to build nuclear power plants have generated a storm of controversy in many communities. According to Prof. Leslie C. Wilbur, director of the WPI nuclear reactor facility, some of the arguments advanced are based on technical data. However, all too frequently opposition to the location of a nuclear power plant is based on fear and misunderstanding.

To help provide background information for the public, Prof. Wilbur is now giving a course called "The Nuclear Power Controversy." This is an evaluation of the risks and benefits associated with nuclear power plants. Topics include the governing principles of nuclear reactors and matters of public concern such as radiation effects, thermal pollution problems, and accident potentials.

According to Prof. Wilbur, "the active participation of the public in controversial, technologically based issues deserves recognition and educational support. High school teachers are often no more knowledgeable than the general public concerning the basic principles, terminology, and constraints involved.

"WPI has the staff expertise to readily offer evening graduate courses for consortium students and high school teachers in topics such as air- or water-pollution control, urban planning, power generation, etc. This new course dealing with the nuclear power controversy is intended to be a pilot course for others to follow." A unique feature of this course is that James Hensel, associate professor of English, will assist Prof. Wilbur, who will handle the technical aspects of the issues. Prof. Hensel's primary function will be to insist on lucid and objective presentation compatible with the academic backgrounds of those not specifically trained in science and technology.

The new course is being assisted by a grant from Yankee Atomic Electric Co. However, under the terms of the grant, Yankee Atomic is not influencing course material, classroom discussions, or conclusions.





Reunion Weekend 1972 June 9, 10, and 11



**Make Your Plans Now to Attend
 and Enjoy the Fun and Festivities**



1907	1911	1912
1913	1917	1922
1927	1932	1937
1942	1947	1952
1957	1962	1967
Reunion Classes		





COMPLETED CAREERS

GILBERT C. LAMB, SR., '08

Gilbert C. Lamb, Sr., former navigator of the USS Enterprise, died July 6, 1971 in Milwaukee, Wisconsin at the age of 87 years.

Mr. Lamb was born in Franklin, Connecticut on April 17, 1884 and was educated at Worcester South High School and WPI. As a youth he was a cadet on the Enterprise when it navigated the Neva River in Russia and at that time he was permitted to visit the winter palace of the Czar. Among his superior officers were Admiral "Fighting" Bob Evans and Rear Admiral Robert E. Coontz.

After eight years at sea he worked for the Wisconsin Electric Manufacturing Co. and later headed Gilbert C. Lamb, Inc., (Manufacturers' Representatives). He was a member of A.I.E.E. and was active in Masonic organizations.

Among his survivors are three daughters, Mrs. Lorraine MacDonald, Brown Deer, Wisc.; Mrs. Douglas Paust, Wauwatosa, Wisc.; and Mrs. Lee Price, Newport News, Virginia; and one son, Gilbert, Jr. of Milwaukee.

JEROME W. HOWE, '09

Jerome W. Howe, 85, dean emeritus of students and admissions at WPI, passed away on November 16, 1971 in Worcester, Massachusetts.

Dean Howe was born in Worcester on October 12, 1886, was educated at English High School, and graduated from WPI in 1909 with a degree in civil engineering. Prior to World War I he taught at Pennsylvania Military College in Chester, Pa., and was a bridge draftsman for Phoenix Bridge Co., Phoenixville, Pa. He was in the U.S. Army from 1913 until 1924 when he retired with the rank of Major. While in the service he received two Silver Star citations.

In 1924 he joined the WPI staff as an assistant professor of civil engineering. He was promoted to professor in 1926 and became head of the department in 1933. He

was appointed dean and assistant director of admissions in 1937, posts from which he retired in 1953. In 1944 he was awarded an honorary doctor of engineering degree from WPI.

Dean Howe was a frequent book reviewer and authored his own book "Campaigning in Mexico, 1916". He was past president of the Worcester Society of Civil Engineers, Sigma XI, Friends of the Library, Tech Old-Timers Club, and was a developer of the WPI Techniquiest program. He was also a former deacon and treasurer of the Central Congregational Church.

Besides his widow, Mrs. Helen C. Howe, Worcester, he leaves a son, Jerome W. Howe, Jr., of Baltimore, Md.; a daughter, Mrs. Beverly Osborn and a sister, Mrs. Florence Andrews, both of Worcester; and four grandchildren.

HAROLD C. HICKOCK, '16

A retired sales manager of the Westinghouse Electric Company, Harold C. Hickock, died in La Jolla, California, November 3, 1971.

He was born in North Adams, Mass., on June 7, 1894 and graduated from WPI in 1916 with an electrical engineering degree. Ten years ago he retired from Westinghouse after 45 years of service, and moved to La Jolla where he was a trustee of the Presbyterian Church and chairman of the Town Council's Mini-Bus Committee. He was a Navy veteran of World War I.

He leaves his wife, the former Ethel M. Howard; a daughter, Mrs. Graves of Denver, Colo.; and five grandchildren.

FRED B. CARLISLE, '17

Fred B. Carlisle, '17, who aided in the secret development of an armored personnel carrier scheduled to be used during World War II, died on October 13, 1971 in Los Gatos, California.

Born in Hillsboro, Ohio, he was educated at Hillsboro High School and gra-

duated from WPI with a Degree in Mechanical Engineering in 1917.

Mr. Carlisle was a retired design engineer for Studebaker-Packard Corp. and played a major role in the development of the controversial post-war car, the bullet-nosed Studebaker Champion. He was with Studebaker for 35 years until his retirement in 1959. He was a member of Alpha Tau Omega.

Among his survivors are his widow, Mrs. Dolly Holladay Carlisle; a son, Dr. Frederick B. Carlisle, Jr. of Los Gatos, California, and a sister, Mrs. Ferris Hughes of Ohio.

HAROLD W. THOMPSON, '19

Harold W. Thompson passed away on October 13, 1971 in Needham, Mass. at the age of 76.

Born in Brockton, on Sept. 25, 1895, he attended Brockton High School and graduated from WPI in 1919. In 1960 he retired from the New England Power Service Co. where he had been an electrical engineer for over 42 years. He was a member of the Massachusetts Society of Professional Engineers and was a Mason. He sang with barbershop quartets in Waltham, Wellesley and Newton.

He is survived by his widow, Mrs. Ruth Ives Thompson; three sons, Donald W. Thompson of Shrewsbury, John Ives of Schenectady, N.Y., and Frederic Ives of Hartford, Conn.; a daughter, Mrs. Nancy Quinlan of Framingham; a brother, Joel Thompson of East Bridgewater, and three grandchildren.

HOBART A. WHITNEY, '19

Hobart A. Whitney, 74, passed away on October 7, 1971 in Pensacola, Florida.

He was born on October 21, 1896 in Leominster, Mass., and attended Leominster High School, Phillips Exeter Academy, and WPI. Mr. Whitney, a retired agent for the Metropolitan Life Insurance Company, was a member of Theta Chi.

Among his survivors are his widow, Mrs. Margaret Brown Whitney; two daughters, Mrs. Betty Boll of Pensacola and Mrs. Claire Ehlers of Atlanta, Georgia; two sons, Hobart A. Whitney, Jr. of Atlanta, Georgia; and Lt. Col. Richard A. Whitney, USAF, Vandenburg AFB, California.

WALTER SMITH, '20

Walter L. Smith, deputy director of Quincy City Hospital from 1951 to 1964, died suddenly in West Harwich, Mass., on September 30, 1971. He was 72.

Born on January 3, 1899 in Whitinsville, Mass., he attended Northbridge High School and WPI. He served with the U.S. Army in World War I and was later employed as an auditor by Kaufmann's Department Store, Pittsburgh, Pa.

HAROLD F. TOUSEY, '21

Harold F. Tousey, Branford (Conn.) park commissioner, died November 11, 1971 in New Haven, Connecticut. He was 73 years old.

Born at Cowes, Isle of Wight, England, on April 27, 1898, he attended Bridgeport (Conn.) High School, Lafayette High School, Buffalo, N.Y. and graduated with a degree in mechanical engineering from WPI in 1921.

For over 25 years he was with the Malleable Iron Fittings Co. of Branford. He retired after serving as office manager in 1967. At the time of his death he was with Ben Nek Holder, Inc., Branford.

Mr. Tousey, a past member of Alpha Tau Omega, is survived by his widow, Mrs. Adeline C. Tousey; a son, Richard C. Tousey, Guilford, Conn.; a daughter, Mrs. Richard F. Kilburn of Vestal, N.Y.; a sister, Mrs. W. Sherwood Wilmont, Bridgeport, Conn.; and five grandchildren.

EVERETT E. JESSUP, JR., '26

Everett E. Jessup, Jr., 68, died on December 5, 1971 in Worcester, Mass.

He was born in Bridgeport, Conn., on September 25, 1909, studied at North High School, Worcester, and WPI. A Navy veteran of World War II, he served as a First Class Carpenter's Mate with the Seabees in the Pacific area. He retired in 1967 as a cabinet-maker for the former Franklin Window Co.

Besides his father, he leaves two cousins, Charles Platt of Milford, Conn., and William Platt of Stratford, Conn.

CLYDE W. HUBBARD, '26

Clyde W. Hubbard, 6B, a former assistant professor of hydraulics at WPI, died in Nahant, Mass., on November 12, 1971 after a brief illness.

He was born in Holden on February 11, 1903, attended North High School, Worces-

ter, and graduated from WPI in 1926 with a degree in mechanical engineering. From 1926 to 1941 he was an assistant professor at WPI. During World War II he was employed in the research department at the David W. Taylor Model Basin, Washington, D.C. and later served in the Navy as a lieutenant commander in ship salvage operations in the Pacific theater.

After the war he was affiliated with the Great Northern Paper Co., Millinocket, Maine. In 1949 he joined the Boston firm, Stone and Webster Engineering Corp., as a hydraulic engineer.

Mr. Hubbard was a fellow of the American Society of Mechanical Engineers and was a commander of Mortimer G. Robbins Post, American Legion, Nahant. He was a member of Sigma Alpha Epsilon.

Among his survivors are his widow, Mrs. Virginia Haley Hubbard; two daughters, Dr. Dorothy Gampel of Weston and Mrs. Nancy Marden of Ticonderoga, N.Y.; a brother, Edward, of Endicott, N.Y., and five grandchildren.

FLOYD C. HUNTINGTON, '28

Floyd C. Huntington died October 12, 1971 in Denver, Colorado. He was 64.

A native of Hardwick, Vermont, he attended Hardwick Academy and was graduated from WPI in 1928 with a degree in mechanical engineering. He was employed as a fire protection engineer and insurance broker. At the time of his death he was vice president of Hiram C. Gardner, Inc.

He was a member of the Denver Athletic Club, Society of Fire Protection Engineers, Rocky Mountain Chapter of the Chartered Property Casualty Underwriters, Honorable Order of the Blue Goose International, National Association of Mutual Agents, Colorado Independent Insurance Agents, and Phi Sigma Kappa Fraternity.

Among his survivors are his widow, Mrs. Florence Ellanson Huntington; two sons, Richard R. of California and Clinton W. of Grafenoehr, Germany; a brother, Carroll Allen of Dover, Mass., and four grandchildren.

CHARLES S. O'BRIEN, '32

Charles S. O'Brien passed away suddenly of a heart attack on February 9, 1971 in Palos Verdes Peninsula, California at the age of 61.

He was born in Worcester, Massachusetts on July 29, 1919, attended Springfield Technical High School and graduated from WPI in 1932 with a degree in mechanical engineering.

A member of Sigma Alpha Epsilon, he worked in various capacities for the U.S. Envelope Company and Milton Bradley Co., both of Springfield, Mass., before becoming associated with the Bemis Co., Inc., Wil-

lington, Calif., in 1946. He served as manager of the company prior to his death.

Mr. O'Brien is survived by his widow, Mrs. Mary Kelly O'Brien of Palos Verdes Peninsula, California.

RICHARD L. GOODWIN, '34

A recently retired building contractor, Richard L. Goodwin, died in Bay Pines, Florida, on September 30, 1971. He was 58 years old.

Mr. Goodwin, a native of Springfield, Mass., was educated at Springfield Technical High School, and graduated from WPI in 1934 with a degree in Electrical Engineering.

During his working lifetime he was employed by the Worcester Industrial Power Survey Co., Graton & Knight Mfg. Co., and Logan, Swift & Brigham Co., all of Worcester. During World War II he was a Lieutenant Commander in the U.S. Navy. In later years he was president of Vega Bolt & Nut Supply Co., Worcester, and also associated with the Dayton Rubber Co., Dayton, Ohio. He was a member of Phi Sigma Kappa.

Among his survivors are a son, Clifford R. Goodwin of Worcester; a daughter, Mrs. Susan E. Anderson of Concord, N.H.; and a brother, Ross W. Goodwin, Hadley, Mass.

MARTIN G. CAINE, '37

Martin G. Caine died on October 25, 1971 in Maplewood, N.J.

He was born in Worcester, Mass., on February 1, 1916 and attended Classical High School. After graduating from WPI in 1937 with a Degree in Chemical Engineering, he served as a chemist for the Sionon Co. and later for Monsanto Chemical Co. He joined Tenneco Chemical, Inc., in 1967 and in 1968 was made president of the Tenneco Plastics Division.

Mr. Caine was a member of Alpha Epsilon Pi, the Society of Plastics Engineers; American Chemical Society; and the Society of Naval Engineers.

EDWARD J. CAVANAUGH, '46

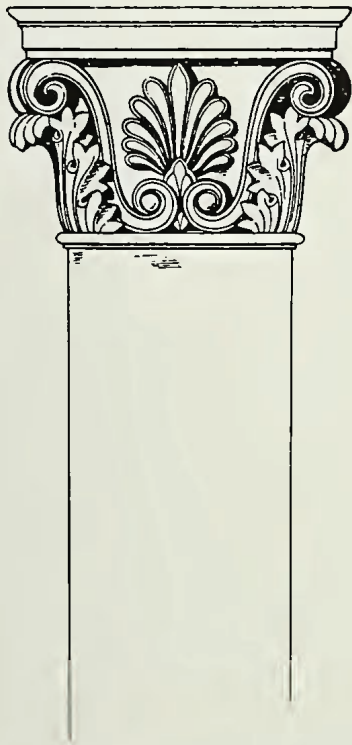
Col. Edward J. Cavanaugh was killed in Vietnam on July 29, 1971.

Born on November 27, 1923 at Worcester, Mass., he attended South High School and WPI. He was a graduate of the United States Military Academy and the Army War College at Carlisle Barracks, Pa.

In 1968 he received his second Legion of Merit award. The distinction came while he was on duty at the Vietnam Headquarters of the U.S. Army near Long Binh. The citation was for "exceptionally meritorious conduct."

Col. Cavanaugh had previously been awarded the Silver Star, the Bronze Star and the Purple Heart while serving in Korea.

YOUR CLASS AND OTHERS



These items are based on information received at the Alumni Office by December 15, 1971.

1908

ROYAL W. DAVENPORT's permanent address is South Leisure World Blvd., Silver Spring, Maryland.

1917

CHARLES HOLLERITH has moved from Jackson, Michigan to Columbia, S.C.

1923

HAROLD H. JUDSON is retired and living in San Antonio, Texas.

1926

RANDALL P. SAXTON has moved from Shelton, Conn., to Green Valley, Arizona.

1927

Having retired as a Rear Admiral, USNR, BRADFORD M. BOWKER is now self-employed as a civil engineer in Las Vegas, Nevada. . . RUSSELL G. WHITTE-MORE was the author of an article entitled: "The Nonlacerative Windshield: Not an Impossible Dream" which appeared in the

JAMES J. SHEA, SR., '12, announced his retirement as chairman of the board of Milton Bradley Co., East Longmeadow, Mass., at the quarterly board of directors meeting held in December. He is 82 years old.

The internationally known manufacturer of educational toys was elected chairman emeritus by the board of directors assembled at the meeting. In 1968 when he was elevated to chairman of the board, his son, James J. Shea, Jr., was elected president.

Mr. Shea is credited with saving the firm from bankruptcy after joining it as president and chief executive officer in 1941. He built the games, puzzles and educational materials business into a worldwide corporation. Included in the corporation are Playskool Manufacturing Co., Chicago, Illinois; South

Bend Toy Manufacturing Co. of Indiana; Amasco Industries, Inc., Warminster, Pa.; and Lisabeth Whiting Co. of Jamaica, L. I., N.Y. Under his leadership the company founded MB International in Holland and subsidiaries in West Germany and France.

In 1963 he received an Honorary Doctor of Engineering Degree from WPI. Always a strong supporter of the WPI Alumni Association, he was awarded the Herbert F. Taylor Award for outstanding service to the Alumni Association in 1967. He served as president of the Association for two years and was on the Board of Trustees for ten. He was active as a Connecticut Valley Chapter Officer, as a member of the Alumni Council, Fund Board, Techni-Forum and as a program chairman of WPI's Centennial Gifts Campaign.



October issue of the magazine, *Glass Digest*. In the article the author states, "It is our best judgment that future safer windshield developments will not alter the present replacement market." He also went on to say, "The newest windshield does have to be handled somewhat more carefully. We should all realize that strength and safety in windshield performance are not necessarily related, and our purpose has been primarily to develop a safer windshield." Mr. Whittemore is director/product development/automotive sales, Glass Division, Pittsburgh Plate Glass Industries, Inc., Pittsburgh, Pa.

1928

Now living in retirement, JAMES A. MacNABB is located in Palo Alto, California.

1930

HERBERT D. BERRY has retired as vice president of the Thomas Smith Co., Worcester. He lives in Westboro, Mass. . . At Southeastern Massachusetts University, North Dartmouth, Mass., it was recently announced that DR. ELLIS H. WHITAKER of the biology department has been promoted from associate professor to full professor. Dr. Whitaker has been at SMU since 1964.

1931

IDOF ANDERSON, JR., writes that he is retired and living in Sandwich, Mass. . . Having retired as Boston district manager of the Jones & Lamson - Waterbury Farrel division of Textron, JOHN H. HINCHCLIFFE now resides at Hilton Head Island, South Carolina. . . HARRY N. TYLER presently makes his home in Pocasset, Mass.

1932

DR. WILLIAM E. HANSON has retired as senior scientist and executive of the Gulf Research & Development Co., Pittsburgh, Pa., and is planning to move to the state of Washington. Bill, the immediate past chairman of the WPI Board of Trustees, was a leader in the development and adoption of the WPI Plan for education. He served for eleven years as a trustee of the College, three of which were as chairman of the board.

1934

E. LOVELL SMITH, JR. resides in Farmington, Conn.

1935

The director, secretary and treasurer of Gilbarco Canada Ltd., Brockville, Ontario, is HAROLD A. LeDUC.

1936

EDWARD V. MONTVILLE has moved from Pittsburgh, Pa., to Madison, Conn. . . JOHN H. WYMAN writes that he has retired from his position as sales engineer with Durakool, Inc., Elkhart, Indiana. He now lives in Augusta, Maine.

1937

Brewsters of Hartford has named ROBERT S. DENNING as sales manager. He makes his home in Windsor, Conn.

1939

Associate Professor of mechanical engineering HOWARD DUCHACEK is on leave from the University of Vermont, which is located in Burlington. Until August of 1972 his address will be Fort Collins, Colo. . . Allen-Bradley Co., Framingham, Mass., employs JOHN C. HARVEY, JR., sales representative. He resides in Wellesley Hills. . . JOHN P. MOLONY, manager of technical services for Wyman-Gordon's Eastern Division, Worcester, Mass., has been named chairman of the Technical Council of the American Society for Nondestructive Testing.

1941

NORMAN G. KLAUCKE reports that he has three sons in college this year. Doug is now at the University of Vermont Medical School; Jeff is a junior at Cornell and Brad, the youngest, started Dartmouth last Fall. Norm, an executive with the Acme Chain Division of North American Rockwell, resides in Granby, Mass., and has a summer home in South Dennis. . . WILLIAM R. HIGGINS serves as head mechanical engineer for Dresser Machinery Ltd., Tokyo, Japan.

1944

JOHN E. ("Ned") BIGELOW, manager of the Terminal and Display Program of the Information Physics Branch of the General Electric Co., in Schenectady, N.Y., celebrated 25 years of service with the company on November 5th. Ned joined GE in 1946 as a development engineer. Later he became senior engineer in the X-Ray Department and manager of the department's Advanced Engineering and Consulting Lab. A registered professional engineer, he is a senior member of IEEE and a member of the Society for Information Display and Sigma XI. He holds 24 patents. . . A Des Plaines, Illinois resident, CHARLES S. COOPER, works as product manager (development) for Precision Scientific Co., Chicago. . . FRED S. MOULTON has changed his address from London, England to Denver, Colorado.

1945

EUGENE C. LOGAN of Trenton, N.J., has been promoted to chief engineer in the gas department of Public Service Electric & Gas Co., Newark, N.J. Prior to his promotion he served as assistant chief engineer.

1946

JOSEPH J. CONROY reports that he has been plant manager at Whitney Blake (a Superior Continental Co.) since March of 1971. The company is located in Hamden, Conn. . . It was recently announced that JOHN E. LAFFEY has been named vice president and general manager of the Austin-Western Division, Clark Equipment Company, Aurora, Illinois. The new vice president has had an extensive background of experience in the heavy construction equipment industry. He served as eastern regional manager of the Harnischfeger Corporation, manufacturer of cranes and shovels, and general sales manager of the J. I. Case Construction Equipment Division, manufacturer of crawler tractors and wheel loaders. The Clark Equipment Company manufactures construction and material handling equipment. . . The Farrel Co., Rochester, N.Y., employs ROBERT C. TAYLOR, manager-process development, who resides in Fairport, N.Y. . . CARL F. SIMON, JR., has moved to Erie, Pa., where he is program engineer for the General Electric Company.

1947

ROBERT C. MARK, manager of employee and community relations at General Electric's Lynchburg (Virginia) operations since 1960, was recently made manager of non-union and new plant relations. He has been with the company for nearly 25 years. . . In December PAUL D. O'DONNELL, director of Manufacturing Planning and Controls for the Westinghouse Corporation of Pittsburgh, was graduated from the Advanced Management Program of the Harvard University Graduate School of Business Administration in Boston, Mass. . . A Needham, Mass., resident, EDWARD F. SUPPLE, has been awarded the Chartered Life Underwriter designation at National Conferment Exercises of the American College of Life Underwriters in Chicago. He is a special agent for the Prudential Insurance Company.

1948

Ingersoll Rand Co., Mayfield, Ky., recently named ARNE A. KELLSTROM as marketing manager. . . JEROME ECKERMAN writes that he is technical manager at NASA/Goddard S.F.C., Greenbelt, Md. His home is in Potomac.

Art Smith, Man at the Top

by Lesley E. Small, '72

Over the years there has evolved the popular misconception that WPI graduates seldom achieve professional success greater than the level of "middle management." Possibly this notion stems from the belief that a Tech engineer's education is too parochial, too practical. However, the careers and achievements of many Tech alumni serve to dispel this myth. Indeed, WPI boasts a truly impressive list of eminent alumni.

Among the noteworthy of Worcester Tech's highly successful graduates is Arthur E. Smith, Chairman of the Executive Committee of the United Aircraft Corporation in Hartford, Conn. Mr. Smith, who received his Bachelor of Science degree in Mechanical Engineering (aero-option) in 1933, began his career as a test engineer for International Motors in Allentown, Pennsylvania. Two years later he joined the Pratt & Whitney Aircraft Company, a division of United Aircraft. By 1956 he was the Executive Vice-President of Pratt & Whitney. After serving as president of the division for one year, he became in 1968, the executive vice-president and then president of the entire United Aircraft Corporation. Mr. Smith's latest achievement, appointment to the position of chairman of the executive committee, became effective as of September 27 of this year.

In 1967 WPI presented Smith with the Robert H. Goddard Award, which is given annually to an alumnus for "outstanding professional accomplishment in his field." On June 8, 1969, he was awarded an honorary degree of doctor of engineering by Worcester Polytechnic Institute.

In a recent interview with Mr. Smith, he indicated that he feels the WPI Plan is the "right approach to an engineering education" but like many others, he seems to be withholding enthusiasm until the Plan has substantially proven itself. He noted that the success or failure of the Plan rests largely with the individual advisors — and most especially with the problem of motivation. Mr. Smith also indicated that communication must play a key role in the success of the Plan. He feels that the school has a responsibility to better acquaint both the alumni and the business world with the workings of the Plan.

As far as the role of the alumni is concerned, Arthur Smith maintains that they have an obligation "to give



financial support" and "to take part in the direction of the school." He feels however that the alumni should not attempt to "run" the school. On the other hand, he feels that the students should not run the school either. When asked how he felt about having a student member on the Board of Trustees, Mr. Smith said that "a student does not belong as a voting member," but that there should be a student advisory group to insure that the Trustees are aware of student concerns and opinions. He stated that it is "hard (for students) to be objective about the long-term interests" of the school.

In another vein of conversation, Mr. Smith expressed the belief that athletics play an important role in the shaping of the individual, for it is through organized sport that one learns not only how to get along with people but also to accept failures along with success.

When asked to what he attributed his great success, Mr. Smith said, "I suppose you'd like me to say my education from WPI? After assuring him that, all that was wanted was an honest answer, he agreed that WPI had given him an excellent background but that he attributed his success to a lot of hard work and a little bit of being in the right place at the right time.

Smith further stated that five years after graduation, where you are is determined largely by what you have done on the job and not so much by what you did in school. He feels that the education itself is of greatest importance in getting offers and opening the right doors.

Mr. Smith does not feel that the engineers should have to take all the blame for the ecological problems of today. "Engineers have always responded to what the public wants." Now that the emphasis is on clean air and clean water, Smith is assured that the engineers will respond, but that there is bound to be a time lag. According to Smith, "People know what they want but are not able to evaluate what they want to pay for it."

Smith is a warm and personable man who remains unaffected by his tremendous achievements. Talking to Art Smith is like talking to the man next-door. He is truly a credit to himself and a credit to WPI.

Reprinted from Tech News.



ROBERT F. STEWART, '50, former vice president of Litton Industries, Inc., Hartford, Conn., has been named president of the Industrial Products Group of North American Rockwell Corp., Pittsburgh, Pa. In addition to being president of a group, Mr. Stewart will also be nominated as a corporate vice president at the next meeting of NR's board of directors.

The Industrial Products Group which he now heads had sales in the fiscal year ended September 30, 1971 of about \$435 million, or nearly 20 per cent of total company sales. It is one of four major groups at NR, the others being the aerospace, automotive and electronics groups. It makes and markets a wide variety of products including printing and textile machinery, gears and other power transmission products, mechanical controls, filters, general aviation aircraft and pleasure boats.

Mr. Stewart was president of Royal Typewriter Co., Hartford, Conn., a Litton Industries company, in 1969 and 1970. He left Royal to take charge of Litton's Machine Tool Group in Hartford, which included New Britain Machine Co. Prior to joining Litton in 1964 he had been president of the Gabriel Electronics Division of Maramont Corp., Millis, Mass.

The WPI Alumni Association awarded him the Robert H. Goddard Award for his outstanding professional achievements in June of 1971. It is the highest professional achievement award given by the Association.

Active in community affairs, Mr. Stewart is a director of the Greater Hartford Chamber of Commerce, the Manufacturer's Association of Hartford County, and the Society for Savings in Hartford. He is also a member of the Economic Club of New York and a corporator of the Institute of Living, Hartford.

1949

Attorney EDWIN E. KAARELA was officially notified in November that he had been appointed as a Finnish consul. He was informed of his appointment by the Finnish Ambassador to the United States, Olavi Munkki, the document of appointment being accepted on behalf of the United States by Secretary of State William Rogers. Mr. Kaarela, who has served as honorary vice-consul of Finland since 1963, lives with his wife and three children in Westminster, Mass.

1950

HAMMOND ROBERTSON, a member of the Queensbury (N.Y.) Town Board since 1964, was honored at a testimonial dinner in October. The affair was co-sponsored by the Queensbury Republican Committee and Republican Club. Mr. Robertson, who is now located in Lincoln, N.H., had served as a director of industrial relations for Finch, Pruyn and Company, Inc., of Glens Falls, N.Y.

1952

H. BURTON RENDALL has employment as a product service engineer with Ethyl Corp., Houston, Texas. . . GEORGE H. SANDERSON writes that he is still with Sperry Gyroscope, Great Neck, N.Y., and enjoying his job as senior research section supervisor. His two daughters are now in school and he and his wife are interested in helping to make their local educational system more "creative". . . The vice president of Incoterm Corp., Marlboro, Mass., is EDGAR L. VAN COTT, who lives in Weston.

1953

G. RAYMOND POLEN resides in Parsippany, N.J., and serves as senior development engineer for Boonton Electronics Corporation. . . The board of overseers of the Foundation for the Advancement of Graduate Study in Engineering at Newark College of Engineering announced in November that DR. ARNOLD ALLENTUCH has been appointed director of research at the college. Dr. Allentuch is a professor of mechanical engineering at NCE and will maintain that rank on the faculty. Active in research and the development of graduate courses at the college, he has centered his personal research in the area of hydrostatically-loaded, stiffened cylinders. His work has been supported by the Office of Naval Research under contracts totaling more than \$100,000 since he joined NCE. . . JOHN F. MITCHELL, a science teacher at North Attleboro (Mass.) High School, has been hired by the North Attleboro Board of

Health as the town's new full-time health agent. His duties will include responsibility for the administration of local and state health regulations and laws.

1954

DONALD E. ROSS, operations manager of the Split Ballbearing Division of MPB Corporation, Lebanon, N.H., has been named to the Board of Directors of the National Bank of Lebanon. Mr. Ross, who has a background in manufacturing sales, production and management, is a past president of the Lebanon Chamber of Commerce, member of the executive board of the Daniel Webster Council, Boy Scouts of America, and Mary Hitchcock Memorial Hospital Corporation. He is also a director of the New Hampshire Technical Institute in Concord, N.H., and holds memberships in the American Ordnance Association and the American Helicopter Association.

1955

It was recently announced that CHARLES F. McDONOUGH of Bridgewater, N.J., would be chairman of the special gifts department for the 1972 United Fund, Somerset Valley campaign. Mr. McDonough has been associated with the American Cyanamid Co., Bound Brook, N.J., for the past 14 years and is currently assistant to the manager, Refinery Chemicals Department.

1956

RICHARD N. BAZINET is currently located in Houston, Texas, where he is employed by Singer, General Precision, Inc. . . EDWIN B. COGHLIN, JR., of Shrewsbury, Mass., has been elected commissioner of the Mohegan Council, Boy Scouts of America. Also elected to the council board of directors was DR. RICHARD BESCHLE, '50, of Auburn, Mass. . . HENRY J. DUMAS, JR., is the new senior vice president of MFE Corporation, Wilmington, Mass. . . In November 1971 the Hatco Chemical Division of W. R. Grace & Co. announced the appointment of JOSEPH G. WAHL as sales manager. The firm is located in Fords, N.J.

1957

DR. JOHN M. MATUSZEK, JR. has been named director of the Radiological Sciences Lab., New York State Department of Health, Albany, N.Y. He resides in Delmar.

1958

JAMES K. KARALEKAS, East Providence City Traffic Engineer, presided at the Rhode Island WPI Alumni Chapter meeting held in November at Seekonk. He lives in

Alumni Fund Progress Report

Richard F. Burke, Jr., '38, Chairman of the Alumni Fund Board, reported at the mid-winter meeting of the Board that the 1971-72 Alumni Fund was well organized with over 300 alumni volunteers visiting or calling alumni throughout the country. Burke further explained that this is a unique year in that every fund gift which shows an increase will be matched to the amount of the increase by the Challenge Fund. He said early returns show:

- Total Cash: \$107,666.30
- Total Additional Pledges: \$29,376.08
- Total Contributors: 1,409
- % Participation: 14.7%
- Average Gift: \$97.26

Burke went on to comment that several leadership gifts have been received from several groups, including:

Alumni Trustees:

- % Participation: 76.2%
- Average Gift: \$1,179.94

Alumni Association Executive Committee:

- % Participation: 77.8%
- Average Gift: \$600.00

Alumni Fund Board:

- % Participation: 100%
- Average Gift: \$206.00

Faculty Alumni:

- % Participation: 82.6%
- Average Gift: \$73.82

Walter J. Charow, '49, Chairman of the Special Gifts Program which has organized personal solicitation in the Northeast and Los Angeles, reported that his program showed the following level of activity:

- % Participation: 27.4
- Average Gift: \$447.13

When interviewed, Charow stated that the Special Gift Committees were seeking gifts at the \$300 level and above. He went on to state that when alumni fully understood the priorities before WPI and the need for alumni support that his volunteers were met with warm and generous support.

Special Gifts Region

Chairman

Worcester	Francis W. Madigan, Jr., '53
Boston	James E. Rich, '51
Connecticut Valley	William W. Asp, '32
Hartford	Robert M. Taft, '38
New Haven	Charles W. McElroy, '34
Rhode Island	Manuel Renasco, '46
New York	Spiro L. Vrusho, '57
Northern New Jersey	Waldo E. Bass, '33
Washington	Leonard G. Humphrey, Jr., '35
Los Angeles	Donald R. Bates, '40

Phonothons were reported as being a new mechanism of follow-up solicitation and Mr. Burke noted that this program was being organized by Howard I. Nelson, '54. Nelson briefly noted that an enthusiastic team of volunteers had been enlisted and would be conducting phonothons on the following schedule:

<i>Date</i>	<i>Location</i>	<i>Chairman</i>
February 7-8	Worcester	Peter H. Horstmann, '55
9-10	Boston	Daniel J. Maguire, '66
14-15	Springfield, Mass.	Gabriel O. Bedard, '28
16-17	New Haven	Joseph J. Conroy, Jr., '46
22-23	New York City	Spiro L. Vrusho, '57
23-24	Washington	Kenneth A. Homon, '62
28-29	Buffalo	John H. Geffken, '63
March 1-2	San Francisco	Clifford H. Daw, Jr., '59
6-7	Pittsburgh	Donald M. McNamara, '55

In conclusion, Burke praised the hard work of the alumni volunteers working on the program, and voiced his opinion that their hard work would produce a fund of record size by its completion date.

Riverside... ROBERT P. MICHAUD works as associate airport development specialist for the New York State Department of Transportation, Albany. His home is located in Guilderland, N.Y. . . Kewaunee Scientific Engineering Corp. of Adrian, Michigan, has announced that J. CLIFFORD WIERSMA is now vice president and sales manager of the corporation.

1959

Born: To Dr. and Mrs. JOSEPH D. BRONZINO, a daughter, Marcella Jo ("Marcy"), on October 27, 1971. Joe is an associate professor in the engineering department at Trinity College, Hartford, Conn. He and his family reside in Simsbury.

1960

Shell Chemical Company, Industrial Chemicals/Petrochemicals, has made JAMES R. BUCHANAN district manager. The new manager makes his home in Cherry Hill, N.J. . . WILLIAM J. PALMER writes that he is manager of engineering for Jewell Electronic Instruments, Manchester, N.H. He lives in Bedford.

1961

Born: To Mr. and Mrs. LARRY ISRAEL, a daughter, Ilana Beth, on October 6, 1971. Larry is president of Visualtek which is located in Santa Monica, Calif.

The University of Virginia Reactor Facility, Charlottesville, Va., has added HAROLD W. BERK, physicist, to its staff. . . DR. JAY A. FOX, who received a PhD in Physics from the University of South Carolina last year, has employment as a physicist on the staff of the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia. . . A Glastonbury, Conn., resident, RICHARD L. HOLDEN, has been appointed Chairman of District II for the Republican party. Employed as a research engineer at United Aircraft Research Laboratory, he is currently vice-chairman of the Citizens Advisory Committee and is a radio officer for Glastonbury Civil Defense. . . SVEND E. PELCH serves as manager of business planning for the International Paper Co., New York, N.Y. His residence is in Northport.

1962

Born: To Mr. and Mrs. BRADFORD J. BOOKER, their first child, a daughter, Pamela Jean, on October 4, 1971. Brad is a design engineer with Hamilton Standard, a division of United Aircraft Corporation in Windsor Locks, Conn.

RICHARD W. FROST has been promoted from assistant to superintendent underground lines to assistant superintendent overhead lines at Narragansett Electric Co., Providence, R.I. . . ROBERT R. CASSA-

NELLI of Yorktown Heights, N.Y., has been awarded a patent of his work in the development of a process for multiple layered gelatin desserts. He is a group leader in the Jell-O research division at General Foods' technical center in Tarrytown. . . THOMAS J. MERCHANT is appointed to a newly created position of environmental and safety coordinator at Bay State Abrasives Division of Dresser Industries, Westboro, Mass. Company officials say that Mr. Merchant's assignment puts the firm in a position to act directly on all legislation relating to pollution control, occupational health and safety and other related fields. The Westboro resident is also a town selectman and previously served as chairman of the advisory finance committee. . . Texas Instruments of Attleboro, Mass. employs PAUL L. WESTERLIND, manufacturing engineer, who resides in North Attleboro.

1963

DOMINIC J. BUCCA who is manager of purchases at Jamesbury Corp., Worcester, Mass., makes his home in West Boylston. . . The new general foreman of chemical production for the Uniroyal Chemical Division of Uniroyal, Inc., is JOSEPH V. BUCIAGLIA, Beacon Falls, Conn. Mr. Bucciaglia has been with the Naugatuck firm since his graduation from WPI and is past vice president of the Uniroyal Chemical Management Club. . . DAVID R. EKSTROM reports that he is manager-equipment product development for Kenics, Danvers, Mass. . . NORMAN FINEBURG received his law degree from Boston University Law School in 1971 and now serves as a judicial law clerk for the Supreme Court of Connecticut in Hartford. He makes his home in Farmington. . . The Rodney Hunt Co. of Orange, Mass. has appointed MICHAEL A. LITTIZZIO as manager, manufacturing serv-

ices. He will be responsible for directing and coordinating the services of maintenance, inspection, shipping and industrial engineering on a company-wide basis. Until recently he was a unit manager in Ashland at the General Electric plant. . . Raytheon, North Dighton, Mass. employs JAMES J. MAGALDI, facilities supervisor. His residence is in Easton. . . ROBERT M. MALBON writes that he is in the Peace Corps. His residence is in Los Altos, California. . . Among the instructors at the business management seminar sponsored by the Leominster (Mass.) Chamber of Commerce last fall was PETER A. MICHAELIAN, personnel director at Foster Grant Co., Inc. . . KENNETH OLSEN, a student at New York University Law School, also works as an engineer for Ebasco Services, Inc., New York. Kenny lives in Brooklyn. . . Transportation analyst for Washington Metropolitan Area Transit Authority, Washington, D.C. is ROBERT A. PICKETT . . . GORDON M. WARE studies at the School of Architecture at the University of Oregon which is located in Eugene, Oregon.

1964

Married: PETER P. BURKOTT, JR., and Miss Diana A. Blandford on October 9, 1971 in Brewster, N.Y. The bridegroom is a development engineer for the Norden Division of United Aircraft Corporation, Norwalk, Conn.

Born: To Mr. and Mrs. ANTHONY CROCE, a daughter, Daniella, on June 10, 1971. The new father is still employed by the U.S. Army Weapons Command in Rock Island, Illinois. He and his family make their home in Davenport, Iowa.

RONALD J. ANASTASI has been named assistant director of Magnolia Manor, a health spa located in Gloucester, Mass. Previously he was with the Woods Hole

Oceanographic Institute, an assistant executive director for Scientology Coordinated Services, Los Angeles, Calif., and an efficiency expert for Seafood Kitchens, Gloucester. . . ALLEN W. CASE, JR., who was recently promoted to project engineer for General Electric Company, Schenectady, N.Y., lives in Scotia. . . The New York firm of Davis, Hoxie, Faithfull & Haggood employs ALFRED H. HEMINGWAY, JR., patent attorney. Alfred lives on Staten Island. . . DAVID G. LARRABEE is a student at the University of California, Berkeley. He lives in Albany, Calif. . . The vice president and treasurer of Community Information Systems, Chaska, Minnesota, is BRIAN SINDER. . . DR. JOHN A. SPENCER is an assistant chemistry professor at Southern Illinois University, Edwardsville, Ill. . . DR. PETER C. TROMBI writes that he is a member of the Institute for Advanced Study, School of Mathematics, Princeton, N.J. . . USAF CAPTAIN PAUL B. WATSON is on duty at Cam Ranh Bay AB, Vietnam. He serves as an air operations officer and is assigned to a unit of the Pacific Air Forces, headquarters for air operations in Southeast Asia, the Far East and Pacific area.

1965

Akron resident JAMES B. CALVIN is currently working toward a PhD in clinical psychology at Kent State University, Kent, Ohio. . . STEPHEN L. CLOUES now holds the position of regional planner for the Central Midlands Regional Planning Council, Columbia, S.C. He recently received a Master of Planning Degree from Georgia Institute of Technology. . . LAWRENCE A. HILL is a science teacher at Nashoba Regional High School, Bolton, Mass. He lives in Lunenburg. . . The Mechanical Drive Turbine Products Dept., General Electric Co., Fitchburg, Mass., employs KENNETH J. HULTGREN as a turbine controls engineer . . . In 1971 PETER E. OBERBECK was awarded a PhD EE from the University of Illinois. He is associated with the National Cash Register Company in Dayton, Ohio. . . RICHARD S. OLSON, vice president — development for National Realty Enterprises, Inc., Pittsburgh, Pa., resides in Bethel Park. . . DR. DAVID M. SCHWABER, who received his PhD from the University of Akron in 1971, is with Monarch Rubber Co., Inc., of Baltimore, Md. . . MICHAEL D. SHAPIRO serves as a chemical engineer at The Naval Explosive Ordnance Disposal Facility at Indian Head, Md. Oxon Hill is his home.

1966

Married: STEWART W. NELSON to Miss Carol Ann Cruz in November 1971 at Holyoke, Mass. Mr. Nelson is a sales engineer with The Trane Co., Boston.

MORGAN

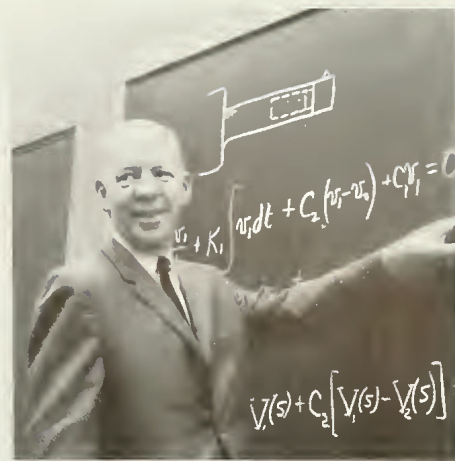
CONSTRUCTION CO.

ENGINEERS & MANUFACTURERS

WORCESTER, MASSACHUSETTS 01605

Engineering for a world in need

As living becomes more competitive . . . more compact . . . and more complex, the world looks with increasing frequency to science and engineering for creative solutions to its wants and to its needs. And at the Heald Machine Division of Cincinnati Milacron, creative research and development engineers thrive on the daily challenge to provide the metalworking industry with more productive, more efficient and more reliable machine tools.



In the past, Heald has traditionally produced machines which have in many cases surpassed industry's needs, but the demands are becoming greater as the challenge continues. So Heald engineers continue to explore new techniques and to design modern machine tools that reflect fresh ideas and creative thinking.

The results of this kind of engineering can be seen in the Heald products of today. Numerically Controlled Acracenters and Bore-matics that literally "think for

themselves" while producing better quality parts in far less time. Heald Controlled Force internal grinders prove themselves as leaders by consistently attaining new levels of productivity and quality.

Heald's newest development, a rotary electro-chemical machining process, offers industry a practical way to perform precision machining operations on "difficult to machine" conductive materials such as high strength, high temperature alloys. Using electro-chemical machining, stock removal rates are

unaffected by material hardness so production rates are substantially increased.

The continuation of this type of creative thinking and fresh ideas will be spurred on by the challenge of the 1970's and the need to meet the ever-changing requirements of our shrinking world.



**CINCINNATI
MILACRON**

**Heald Machine Division
Worcester, Mass. 01606**

EDWARD S. BILZERIAN, Worcester, controller for Bay State Abrasives Division of Dresser Industries, Westboro, Mass., is the new president of the Worcester Area Chapter, National Association of Accountants. . . Speedring Systems — Division of Schiller Industries, Warren, Michigan, has recently given JOHN H. CAROSELLA the position of senior project engineer. John and his family now live in Rochester, Michigan. . . DR. JAMES I. JOUBERT is employed as chemical research engineer for the U.S. Bureau of Mines, Pittsburgh Energy Research Center, Pittsburgh, Pa. . . A native of Whitinsville, Mass., DAVID LONGMUIR, has been named vice president of industrial relations of White Consolidated Industries, Inc., Cleveland, Ohio. Prior to his promotion, Mr. Longmuir was regional director of industrial relations for the corporation. . . DR. MALCOLM A. MacGREGOR was recently awarded a resident research associateship at the Naval Research Laboratory, Washington, D.C. He will conduct research in the chemistry division of the laboratory. Prior to his appointment he was a research associate at the University of Chicago. . . DR. MARTIN J. MASTROIANNI is a postdoctoral research associate for Oak Ridge National Lab., Oak Ridge,

Tenn. . . The new town planner for Vernon, Conn., is JOSEPH J. PASTIC who was until recently a Captain with the U.S. Army in Germany. His work in the Army was learning "how to allocate shortages," he noted, a problem also apparent in civilian life. Pastic has a wife and three children.

1967

Married: DAVID A. SALAD to Miss Bonny Beth Nezvesky on October 17, 1971 in Fairfield, Connecticut. David is an accountant with Drug City of Watertown. . . ROBERT D. RENN and Miss Nancy Diane DelVeche on December 5, 1971 in New London, Connecticut. The groom is supervisor of production and direct labor planning at General Dynamics Corp., Quincy (Mass.) Shipyard.

ROBERT J. BARON has been employed by the Division of Compliance, Environmental Protection Agency, Research Triangle Park, N.C. . . Chief Civil Engineer RICHARD F. DeFALCO is associated with the Commonwealth Survey Corp. and makes his home in Worcester. . . RAYMOND J. FORTIN of the Mitre Corp. (Bedford, Mass.) technical staff lives in Waltham, Mass. . . U.S. Army CAPTAIN EDWARD A. GALLO, who is now serving in the Ord-

nance Corp. in Vietnam, received his MS in mathematics from the University of Texas at El Paso last August. . . GLEN R. PARATH is with Ostrow Electric of Worcester, Mass. . . GARY K. WILLIS is a candidate for one of two three-year terms on the School Committee, Mansfield, Mass. He is president of the Citizens Scholarship Foundation and a sales engineer for Bailey Meter Co., Boston.

1968

Married: VICTOR V. CALABRETTA, JR. and Miss Judith Anne Reynolds in Davisville, R.I. on October 9, 1971. The bridegroom is a graduate assistant at WPI. He and his bride make their home in Attleboro, Mass.

Currently serving as a system test engineer with the U.S. Army Strategic Communication Command at Ft. Hauchuca, Arizona, LT. LUCIANO J. COVATI expects to be transferred to Switzigin, Germany in the near future. . . GEORGE F. GAMACHE is assistant project manager for the Beacon Construction Co., Worcester, Mass. . . Now at the University of Illinois, BERTON H. GUNTER writes: "I wish you (WPI) every success in this new money campaign. WPI — small, unassuming and quiet — has a great

deal to offer, and it would be tragic if, for want of money, it could not continue to provide the sort of education and atmosphere which I found invaluable." Bert resides in Urbana. . . LAWRENCE E. JOHNSON works as a systems programmer for the WPI Computer Center. . . Although he resides in Milford, Conn., GARY N. KEELER serves as a systems representative for RCA, Data Processing Division, which is located in Fairfield. . . DR. ROGER L. LUDIN is presently employed as an assistant professor at Burlington County College, Pemberton, N.J. Medford is his home. . . WILLIAM J. KRICKORIAN has been discharged from active duty in Vietnam and is returning to his previous civilian employer, Metcalf & Eddy, Inc., Boston, where he will serve as a structural engineer. . . WALTER C. LYNICK, who was recently with the U.S. Army Corps of Engineers, has returned to work for the New York State Department of Transportation, Region I, Albany, N.Y. . . ANDREW L. PIRETTI, an MBA student at the University of Massachusetts, resides in Holyoke. . . Still employed by Pratt and Whitney Aircraft as an experimental test engineer. . . WILLIAM D. POULIN has moved from Riviera Beach to West Palm Beach, Florida.

1969

Married: RICHARD C. CARLSON to Miss Judith E. Noyes on November 7 in Walpole, Massachusetts. Richard is a civil engineer with the U.S. Army Corps of Engineers, New England Division, Waltham. The newlyweds reside in North Easton, Mass. . . JAMES L. RICHEY, JR. and Miss Frances L. Bryniarski in Orange, Mass. on October 9, 1971. The groom was a lieutenant in the U.S. Signal Corps in Vietnam and is now employed as an electrical engineer. The bride is a French teacher at St. Mary's High School, Lynn. . . DONALD W. RULE to Miss Carleen Elaine Ruohonen on November 27 in Worcester, Massachusetts. Mrs. Rule attended Emmanuel College and is a graduate of Boston University. Her husband is a candidate for his doctoral degree in physics at the University of Connecticut, Hartford.

Born: To Mr. and Mrs. JOSEPH E. STAHL, a son, Jameson Thomas, on October 24, 1971. Joe is still with Moulded Products, Easthampton, Mass. . . Teaching physics at Shrewsbury (Mass.) High School is CRAIG R. BARROWS who resides in Spencer. . . DOUGLAS E. BROWN of Noank, Conn. is a mechanical engineer with the Naval Underwater Systems Center, Ocean Engineering Division, New London. . . U.S. Army CAPTAIN MICHAEL F. DELLEO, JR. has been awarded his second bronze star medal near Long Binh, Vietnam. Capt. Delleo received the award while assigned as a manpower officer in Head-

quarters, U.S. Army Engineer Command having "distinguished himself through meritorious service in connection with military operations against hostile forces in Vietnam." . . JOHN M. HISCOCK is currently a department engineer for the Second Taxing District Water Dept., South Norwalk, Connecticut. Previously he was with the water and sewer planning unit of the Philadelphia Water Department. . . E. I. du Pont Experimental Station, Wilmington, Del., employs THOMAS F. X. McAULIFFE who lives in Claymont. . . Thiele-Engdahl, Inc., Elizabeth, N.J. recently gave MICHAEL T. NOWAK the position of ink chemist. Michael's home is in Beacon, N.Y. . . PFC. MICHAEL G. OUELLETTE has completed nine weeks of special training at Ft. Jackson, S.C. He learned the techniques and tactics of a rifle squad, patrolling, and individual combat operations. . . MARTIN SURABIAN works as a mechanical engineer for Bechtel Corp., Gaithersburg, Maryland.

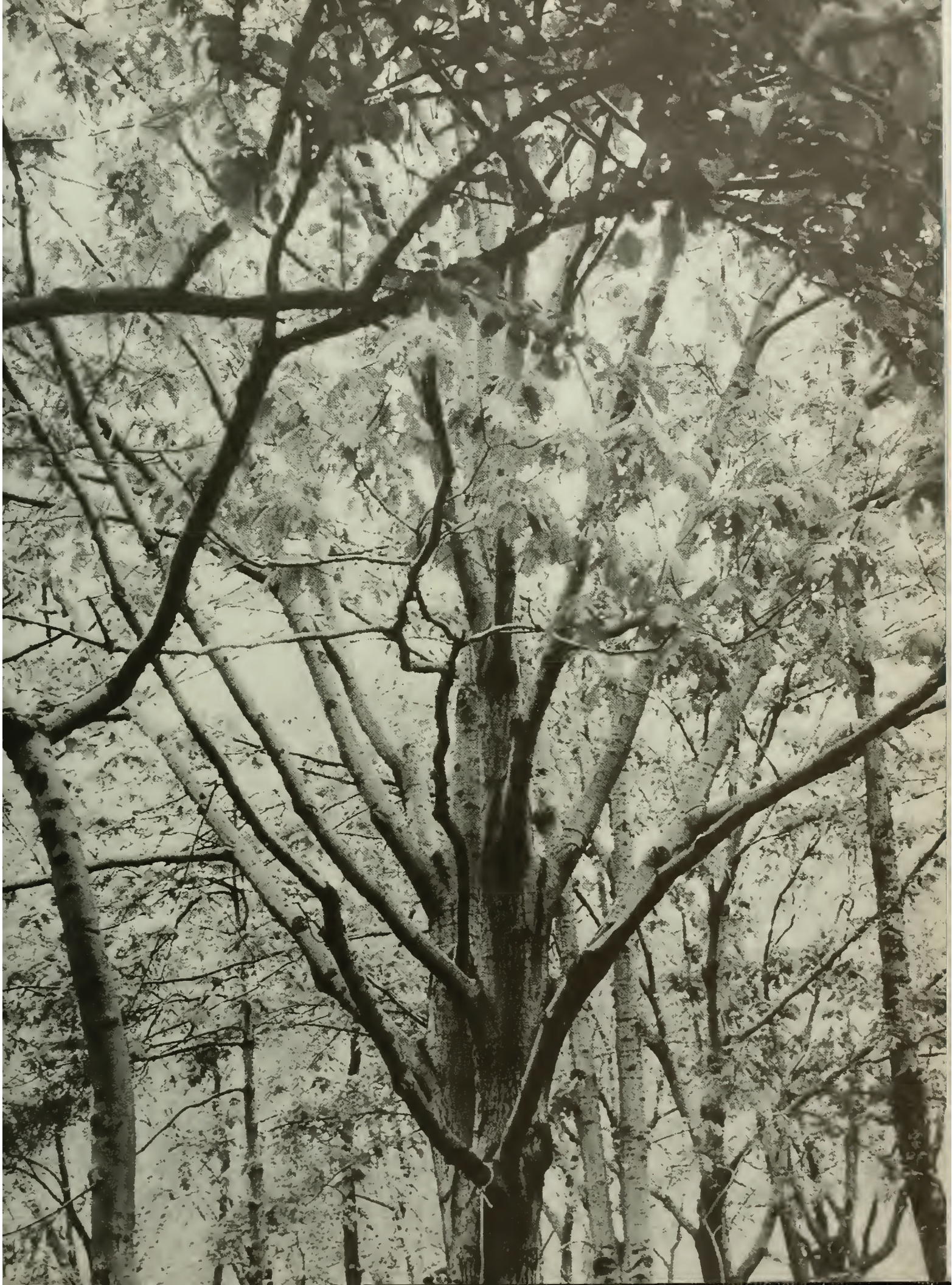
1970

Married: JOSEPH M. CHWALEK and Miss Donna Valerie Longe on October 30, 1971 in Springfield, Mass. The bridegroom is presently serving in the U.S. Army as an electrical engineer in the Foreign Science and Technological Center, Charlottesville, Va., where the couple resides. . . EDWARD E. HOWE to Miss Joyce Essie May Baldwin in Highland Falls, N.Y. on September 20, 1971. They will make their home in Germany where Edward is a first lieutenant in the U.S. Army. . . JOHN A. PELLI and Miss Marcia Karen Mitchell on October 23 in Providence, R.I. John recently joined the Trane Company's Consumer Products Division sales office in Springfield, Mass. Prior to receiving his assignment he completed the Trane Graduate Engineer Training Program, a 10-week course which concentrates on business management. . . PAUL A. PERRON to Miss Mary T. Russell in Springfield, Mass. on November 27, 1971. Paul is employed as a chemist by Scott-Graphics, Inc., in Holyoke. . . RICHARD J. SCHWARTZ and Miss Beth Elyn Goldman on November 27 in Worcester. The groom is a candidate for his master's degree in computer science at WPI.

CRAIG C. CHASE of Clark, N.J., has been named manager of the Friendly Ice Cream and Sandwich Shop on Main Street in Madison, N.J. . . Army 2/LT. JOSEPH D. HENSEL has completed a 12-week field artillery officer basic course at the Army Field Artillery School, Fort Sill, Oklahoma. . . WILLIAM R. NAAS was recently promoted to Army First Lieutenant at Fort George O. Meade, Md., while serving with the Army Security Agency's support group. . . 2/LT. MICHAEL D. VARDEMAN serves as Safety Officer with the U.S. Army at Fort Hood, Texas.

Married: THEODORE A. FREDERICKS to Miss Mary Elizabeth Martin, September 3 in New Haven, Connecticut. The couple is living in Worcester, Mass. . . STEPHEN P. KATZ and Miss Sandra L. Northrop in Schenectady, N.Y., on October 23, 1971. Stephen is employed by the Morse Shoe Co. in Albany. . . GERALD J. KERSUS to Miss Kathleen M. Dorsey in Worcester, Mass., on October 2. Mrs. Kersus received a degree in executive secretarial science from Quinsigamond Community College, Worcester, and was formerly a secretary for The Thom McAn Shoe Co. The groom is employed by the Naval Electronics Test and Evaluation Facility, St. Indigoes, Maryland. . . JOHN A. LIND and Miss Linda Jean Kelley on September 25th in East Haven, Conn. John is with Harry M. Davis Bros., Inc., North Haven, Conn. The couple resides in West Haven. . . ANDREW B. LISTON to Miss Stephanie Ann Bolton October 9, 1971 in Cabot, Vermont. The bride is a senior at the University of Vermont, Burlington, and the groom is a civil engineer for Thompson-Liston Associates, Inc., in Worcester, Mass.

JOHN A. GIORDANO, who is enrolled in the MBA program at the University of Rhode Island, has been chosen to receive a URI Foundation Graduate Fellowship for this academic year. The one-year fellowship will provide \$1,800 at \$200 a month for the next nine months. John was recommended for the award on the basis of his outstanding scholastic record. . . GARY J. LARSON has been appointed assistant chemical engineer, Pilot Plant, Nepera Chemical Company, Inc. in Harriman, N.Y. He resides in Crompond. . . Army PFC RICHARD F. LUKAS is serving with the 5th ADA Regiment at Bristol, Rhode Island. He is a crewman with Battery C, 3rd Battalion of the regiment. . . Graduate Student THOMAS A. McKEON attends the University of California at Berkeley. . . JOHN S. MESCHISEN has employment with the Power Authority of the State of New York. . . ABBAS A. SALIM is studying for a PhD at Polytechnic Institute of Brooklyn, N.Y. . . GEORGE M. SIMMONS reports that he competes in motorcycle races and is working on Long Island. . . Peace Corps member ROBERT M. SINICROPE has been assigned to Montego Bay, Jamaica. He teaches mathematics in the West Indies. . . JAMES H. SNIDER works as a research engineer at WPI's Alden Research Labs. He lives in Worcester. . . STEWART T. STOCKING has joined The Trane Company's Consumer Products Division sales office in Boston, Mass. . . DAVID A. TRUE has been promoted from chemical technologist at Salem Harbor to assistant to chief technologist at the Brayton Point facility of the New England Power Co. The facility is located in Somerset, Massachusetts.



What's Norton doing for the economy?

Let's get down to cases.

Case #1



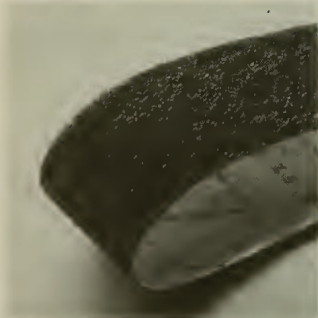
Product: Star Tumblex®... a new line of Norton mass finishing abrasives that substantially reduces mass finishing costs.

Profile: Even as it wears down, Star Tumblex retains its unique tapered shape and the self-sharpening points

continue to smooth and polish small and intricate surfaces with no need for additional smaller shapes or sizes to do the job.

Performance: Surface conditioners throughout industry are using Star Tumblex to achieve faster finishing cycles with less abrasive usage — as much as 2½ times less — and a lower cost per part.

Case #3



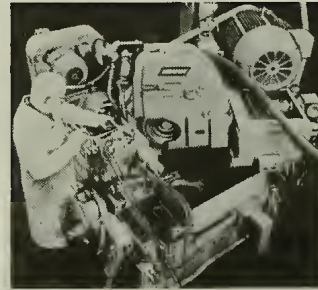
Product: Resinall Metalite® Type LB Belts for grinding stainless steel and high nickel alloy parts such as jet engine blades.

Profile: A special built-in lubricant reduces grinding temperatures up to 500°F., thereby preserving the surface integrity of the metal

and increasing belt life from 2 to 6 times.

Performance: Customers find that this new abrasive belt not only takes the heat off dry grinding but actually cools costs up to 25%. Jet blade production increased by as much as 40%.

Case #2



Product: Norton Abrasive Machining System... a new, high speed machining system for faster, lower cost metal removal.

Profile: This super-powered producer drives grinding wheels up to 16,000 sfpm and increases metal removal

rates to more than 1.00" per minute on diameter.

Performance: This new Norton system delivers up to 1/3 higher metal removal rates than the previous record-breaking Norton system. Castings and forgings can now be ground from the rough with savings in manpower, space, and extra machines.

Case #4



Product: The world's largest commercial abrasive wheel... provides the most economical method for steel mills to convert from steel blades for cutting large, rolled metal shapes.

Profile: Six feet tall and tough enough to cut through jet engine alloy rounds 11" thick in just 17 seconds, this

giant wheel has a cutting speed of around 5½ sq. in. per second.

Performance: Compared with metal blade cold saws, the new Norton cut-off wheel reduced cutting time up to 66% and also provided substantial savings in equipment maintenance costs.

These are just a few examples of Norton's total abrasive capability. They translate into greater productivity and economy. Today, all over the world, wherever metals are removed, smoothed, finished, polished, machined or conditioned, Norton customers are doing it faster, easier, more profitably than ever. Norton Company: World Headquarters, Worcester, Massachusetts 01606.

NORTON

The name for total abrasive capability