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Cover illustration by Allen Carroll. Opposite: Commencement 1982;
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Science for Humanists
Editor: One of the questions in the George Strichman interview (April '82) betrays one of the problems with our society's attitude towards science and technology. The interviewer refers to a "well balanced, well rounded" education. Mr. Strichman defends RPI by saying that if a student is more interested in the humanities and social sciences then he/she should not go to a technical university.

Why is it assumed that a person with knowledge of the physical, real world is not fulfilled without humanities courses, while a humanities student is allowed to go through school (and life) with no real understanding of that real world? Many of those people who derogate science do not even understand the simple physics of billiards or the reason for different gear ratios on a bicycle (if they know what gear ratios are). Perhaps we should make some effort to change that attitude. If more people understood the realities of science and technology, the products thereof might be used a little more carefully and wisely.

Harlan Rosenthal '76
Hackensack, New Jersey

A Former Cadette Recalls
Editor: We thoroughly enjoyed the article on the Curtiss-Wright Cadettes (Dec. '81). I am occasionally in contact with about four of the girls, two of whom married RPI men. I married Henry Cook, who was one of our metallurgy instructors and was Class of '42.

Lots of recollections: President Low was a freshman the second half of our term there. Six girls in a room was a shock... $10 (pay) per week seemed adequate until you tried to do the New York round trip every week... It was wartime, but Prof. Gus Jones would round up some of us and we'd go to Lake George for a steak cook-out. I remember girls welding, dismantling airplane engines, and Mr. Merrill—math and bridge. I've never been awed by what people say women can do now. Seems to me we did it all then.

Jean (Schaaff) Cook
London, England

Brrr... .
Editor: I want to express my appreciation of the new At Rensselaer. It is interesting and well done. The photo and story on the Curtiss-Wright Cadettes was nostalgic, if not quite accurate. The Navy V-12 program didn't begin until July 1943, so there weren't 1,500 Navy men on campus in February of that year.

However, I do remember the cold snap that froze the Southern belles just after they arrived—30° below zero is my recollection. Indeed, I remember some of them wearing cotton-battling stockings to protect their frozen legs for some time thereafter. Keep up the good work.

Edward F. McKie '48
Washington, D.C.

True, the Navy's V-12 program did begin in July 1943. When the Curtiss-Wright Cadettes arrived in February, contingents of Navy men on campus included NROTC units and several hundred Naval aviation cadets.

Sic Transit Gloria...
Editor: Sure I remember learning to use a transit ("Remember" photo, April '82). But why a picture of all those guys learning to use a level? Thanks for your nice magazine.

Art Hildebrant '30
Peekskill, New York

Whoops. The editor was off line.

The Bennington Connection
Editor: The gentlemen on the bicycle ("Remember" page, April '82) are Ron Posner (front) and Mike Greene, both RPI '64. Posner became very active on campus, was a member of Phalanx, etc. Greene left RPI after his sophomore year. I suspect—since the scene appears to be in front of the old Union—that they might have tried to peddle to Bennington.

As for the reason, how soon you forget! There were probably 20 female students at RPI at that time—hardly enough to go around. And most girls' schools had strict rules about liquor and closed doors—except Bennington, a veritable haven for the horny, just over the state line. As I remember, girls could stay out until 7 a.m.!

As to why they are pedalling, even though gas was 19.9 cents a gallon on Congress Street, not a lot of us had cars. I would be unpleasantly perplexed if this sort of thing doesn't go on now!

Thanks for an interesting magazine.

Rod Blumenau '65
Penfield, New York

That Old Gang of Mine
Editor: I believe the picture was taken one Saturday morning in early fall 1962 on the steps of the old Student Union, the location of the Bachelor office.

The people in the background include Martin Shapiro '62 and Millie Martin (now Shapiro's wife). Marty was a Bachelor editor. Alex Sobel '62 and Gil Wexler are among those wishing the bikers good luck on their journey. Sobel, Shapiro and Wexler were members of Kappa Nu fraternity.

Mike Greene also was a member of Kappa Nu. Ron Posner was a member of Phi Sigma Delta.

Bobbi Schwartz Sobel
Russell Sage College '63
Oceanside, New York

Posner was feature editor of the Bachelor, Greene the fiction editor. Their objective, besides Bennington College, was a story in the magazine about their travels. Today, Posner is chairman of National Training Systems, Inc., of Los Angeles, a company that specializes in developing instructional materials for other companies.

A salute to all others who helped identify the picture and the people: Sam Cohen '62, Bob Oberle '60, Ted Frank '62, John Schumacher '66, Joel Gittelson '68, Michael Wellner '64, Doug Pessoni '63, Kurt Kucsma '69, Howard Wainer '65, Mike Fischer '66, Allan Berman '63, Joseph Covello '63.

Getting Our Bearings
Several engineers were among readers who noticed a lack of precision in the account of ball bearings included in "An Illustrated Compendium of Commonplace Objects." First, same-size bearings meet much more exact standards than indicated, differing from each other by as little as one tenthousandth of an inch. (Worse, the metric conversion provided did not match the incorrect English figure.) Also, the article marveled at a ball bearing's load capacity—which should have been given in square inches.
Composites Research—Materials Engineering. RPI's experimental glider program continues. The pioneering RP-1, built with lightweight, high-strength materials, has been flown from area airports. Nineteen feet long with a 38-foot wingspan, the RP-1 weighs but 137 pounds—20 of that is paint. A new, lighter glider, the RP-2, is under way. Here, Raymond Valicenti, who received a master's degree last May, adjusts controls. Below, with a wing section, are (from left) Dr. Francis Bundy, an authority on glider flight and research professor in materials engineering at RPI; Tom Michael, a junior majoring in mechanical engineering; and Volker Paedelt, master technician and manager of the glider lab.

Engineering in the High Bay:

From Robots to Gliders

In a cluster of rooms in the Jonsson Engineering Center stands an array of modern interactive computer graphics equipment, part of a sophisticated system that for many symbolizes the "push button" technology of the 1980s. Just a few paces down the hall, though, there is a marked contrast. It is a high bay robotics. The Cincinnati Milacron T° 6-axis industrial robot is one of the world's most advanced. RPI's Center for Manufacturing Productivity and Technology Transfer uses it to test new tracking programs, new types of grippers and safety features and procedures. Here, Project Engineer Jack Meagher controls the T°.
area: two rooms that total some 13,200 square feet and present a wholly new dimension of engineering in this decade.

Walk into the first high bay space. The ceiling is 21 feet high and up there is a 7½ ton American Monorail crane. The area is a concrete rectangle, about 9,000 square feet, with sections of eight-foot-high mesh fencing that neatly compartmentalize separate work areas. When lots is going on, sound reverberates and it is noisy. The place feels cavernous. Most people here work with their sleeves rolled up. If the computers just around the corner are “push button” technology, then this high bay area is “heavy engineering.”

Machines are here that pull and crush and twist to determine just how much stress certain materials can withstand.

A robot, larger than man-sized and one of the newest models in existence, can be programmed to pick up a bulky steel part from one worktable—or a delicate fresh egg from another.

An experimental glider that in test flights has been piloted to 1,000 feet is being improved with new, ultra-light composite materials.

A familiar internal-combustion automobile engine is revved up to its limit to measure its peak capacity and efficiency.

There is more: two venerable hydraulic testers that defy obsolescence; a large high-speed, highly instrumented lathe for cutting metals; plus an assortment of other equipment, machines and instruments.

A second room, of about 4,200 square feet, contains RPI’s plasma dynamics laboratory. Here, plasmas and nuclear fusion are studied with a tokamak, a research device that uses magnetic fields to contain high temperature plasmas long enough for fusion reaction to occur. It is used with an ion beam probe to measure what happens in plasma under certain time, temperature and density conditions. The process is designed to teach more about how to make controlled fusion a practical energy source.

The high bay brings together many different engineering disciplines and is administered by David Hansen, a chemical engineer and associate dean of the School of Engineering.

“This,” he says, “is some of the most expensive large space on RPI’s campus.” He gestures above to the overhead crane that is used to move heavy equipment; and, pointing to the reinforced concrete flooring, he notes isolation pads built into sections of the floor to absorb shock from equipment that vibrates.

“It is absolutely essential space for a quality engineering program,” he says. “Whereas years ago small-scale equipment was used for testing and research, it is clear that there are certain procedures today that can only be done on a real-life scale.”

Here is RPI’s high bay area. Photography by George Burns.

—RMW
Energy Systems Laboratory—mechanical engineering, aeronautical engineering and mechanics. A General Electric dynamometer is linked to an Oldsmobile automotive engine (circa 1965) and to a 1980 Cadillac engine (under the mesh safety net). Technician Ralph Hartzell (in checked shirt) oversees Kerry Sutton '82 (left) and Paul Tallo '82 at the instrumentation panel. Research centers on fuel efficiency, engine load testing, noise and pollutions controls.

Plasma Dynamics (left). A closeup of RPI's tokamak and its doughnut-shaped vacuum chamber. At lower left is Andy Papa, an engineering assistant in the lab; above is PhD candidate Kourosh Sadamand; at right is Dominic Ciardullo, who received his bachelor's degree in electrical engineering in May.

Composites. This Instron, operated by laboratory manager and master technician Volker Paedelt, tests composite materials for their strength and stiffness—by pushing or pulling.

Civil Engineering. These hydraulic testers, apparently immune to obsolescence, are about 50 years old, have been retrofitted with new hydraulics and controls, and are used today for testing tension and compression of steels, concrete and other building materials. The unit at right can apply 100,000 pounds of pressure; the one at left, 300,000. Geologists sometimes use them to compress modern sediments, to see how they change under extreme temperatures and pressures.
It was a very rich experience," says Lee Pomeroy '54. "We sometimes wondered if we were getting through to anybody," adds Jerry Lenaz '63. "We put a lot of hard work into it, and the results were worth the effort," claims Mike Miller '79.

These three alumni have something in common: they were all editors-in-chief of *The Rensselaer Polytechnic*. A student newspaper distributed to the entire Rensselaer community, *The Polytechnic* has changed greatly within just the last 30 years. From what Pomeroy calls "a mirror of the '50s," it has evolved into an award-winning, highly respected campus newspaper.

Rensselaer still felt the effects of World War II in 1950, when Gen. Omar Bradley delivered the winter commencement address to 575 graduates, 80 percent of whom were veterans. In addition, nearly half of the graduates were married.

In the February 15, 1950 issue, the editors of *The Poly* published the results of a survey designed to determine if the campus wanted changes in the newspaper's appearance. Although 71 percent favored reducing the size of the paper from an unwieldy full-sheet to a tabloid, 65 percent rejected any name change for *The Poly*. Suggested new titles which garnered little support included *The RPI Windtunnel*, *The RPI Crib Sheet* and *The Slip Stick*. The basic five-column tabloid format has not changed since.

Later that spring, an anticipated drop in enrollment for the fall of 1950 led to a stern editorial warning that students could expect a decline in services funded by the Rensselaer Union Activity Fee, then just $10 per semester. "All budgets will be examined very carefully, new activities will have difficulty getting started, old activities with ideas of expansion will be curtailed, and the athletics program will be cut wherever possible," the editorial stated.

The newspaper was big on social and athletic news back in the early 1950s. *The Poly* devoted pages to such things as Soirée dance lists, which named each participant and his date. Big sporting events frequently made the front page.

"There weren't many women students at RPI," recalls Dick Hartfield '53, who was Poly editor in 1952. "But one incident

Jon Kessler '79 is a former editor-in-chief of *The Polytechnic*. He earned his master's degree in technical writing from RPI last spring.

Some things do not change: All-nighters, for instance. And *The Poly* keeps winning awards.

By Jon Kessler

that involved a freshman woman stands out. She was proofreading in The Poly's office one Sunday night when I suddenly exploded with expletives over the telephone to a writer who was past deadline. I had forgotten she was there, and when I put down the phone, everyone in the office was strangely silent. I wanted to hide. She was red-faced, but continued proofreading.

Signs of the political times came from the occasional story or news item that mentioned the "Red Menace." In an article warning of "Commies in Teachers' Robes," a prominent American educator is quoted as remarking that "members of the Communist Party should not be permitted to teach in American schools." Lee Pomeroy, editor during spring and fall 1953, recalls that "it was the Age of McCarthyism. There were professors who, through past political affiliations, were particularly vulnerable to criticism." Once, The Poly's printer made a terrible mistake by setting the wrong professor's name in a headline over an article dealing with investigations into another professor's political leanings. The substitution of one name for another was, says Pomeroy, "so serious we had to recall all of the issues already out and have a corrected reprint distributed."

The mood of the campus then was definitely conservative, as exemplified by the results of a mock Presidential election between Dwight Eisenhower and Adlai Stevenson—both of whom spoke at RPI. Eisenhower won the campus-wide election despite Stevenson receiving The Poly's endorsement.

Advertisements were scarce in the early '50s—"irrelevant," says Pomeroy. "We never worried about money"—but the number of employer recruitment ads increased as the decade passed. The paper held steady at 12 pages or less throughout the 1950s and early 1960s.

1954 was the year of the greatest achievement in RPI intercollegiate athletics history: the national hockey championship. The Poly published a special "extra" edition on Sunday, March 14—printed totally in blue ink—to celebrate the victories in Denver against Michigan and Minnesota. "Welcome Back Champs," with a big number "1," appeared on the front page.

Plenty of news about faculty and administration appeared in The Poly in the mid-to-late 1950s, but compared to today little student government news was printed.

Even though The Poly bemoaned the
introduction of “modern trendy” music into the Field House, a 1957 show featuring Fats Domino, the Everly Brothers and Paul Anka was a big success. The character of American pop music and cultural tastes was changing, although Lester Lanin and his group played at the IFC Weekend that year.

Jerry Lenaz, editor during spring and fall 1962, says that his editorial board often debated The Polytechnic’s role on campus. “We wanted people at RPI to be interested not only just in news, but also in politics, cultural events and other areas that would increase student awareness. We tried to lead student opinion on such topics as the new Student Union, the Honor Board and fraternities, in addition to calling for more lectures on social issues. “Whenever we touched controversy,” Lenaz adds, “it was a very delicate situation. We were looked at as the major voice of the school, so we sometimes had to be careful.”

Throughout the 1960s, The Poly gradually became politicized, as students paid more attention to the world outside RPI. The new Rensselaer Union was completed in 1967, proving the students’ capability for self-governance, and symbolizing their increasing independence. By the late 1960s, The Poly was radically different in tone from earlier in the decade.

In that troubled but exciting time, The Poly branched out into national politics. News stories and opinion pieces covered such topics as the military draft and Vietnam War protests. Bob Cunningham ’71 remembers one particularly hectic week during his term as editor in spring of 1970.

“The Kent State shootings occurred on a Monday, after we had already finished laying out the paper. We managed to put out a four-page wrap-around for that Wednesday’s edition. Then on Wednesday night several dozen RPI students occupied the Student Affairs Center. We published a special two-page issue that Friday devoted to the sit-in and other protests.”

Editorials also argued for increased RPI administration sensitivity toward the changing needs of the campus. Under President Grosh’s term, plans were initiated for three major academic buildings which have reshaped RPI—the Communications Center, the Folsom Library and the Jonsson Engineering Center. These structures satisfied Rensselaer’s academic, but not spiritual, needs.

In the late 1970s, The Poly started lobbying heavily for “student life” concerns. Mike Miller, editor from fall 1978 through spring 1979, recalls several campus-wide referenda to set priorities for spending the excess money accumulated by the Rensselaer Union. “Each time we had a vote for giving the money for either an artificially-surfaced athletic field, a new performing arts center or a new swimming pool, someone who was unhappy found a way of disallowing the referendum results. The students really wanted all three projects. After several tries stretching over a couple of years, the performing arts center finally came out on top.”

But, as Miller points out, “The Poly was always there to help people consider the options on the referendum. It was a great campus service.”

Over the last 30 years, The Poly has greatly increased its size, budget and scope. Older alumni may remember The Poly as an eight-page newspaper that sold for 5 cents a copy. Today the paper is free, partially subsidized by the Rensselaer Union activity fee, and runs an average of 24 pages per week. Every Wednesday (a Poly tradition) the newspaper is delivered to 23 locations on campus, where it is picked up and read by students, faculty and administrators.

Under Hartfield, Pomeroy and Lenaz, The Poly was printed using “hot type” composition, a process that Lenaz discontinued in favor of “cold type” and offset printing. According to Lenaz, this speeded production of the paper. A change that occurred every three or four years was the installation of new banners, as new editorial boards experimented with graphic design.

With a suite in the Rensselaer Union consisting of an office, conference and layout rooms, The Poly has come a long way from its days in the old Clubhouse (now the Lally Management Center). “When we had our office in the basement of that building,” recalls Lenaz, “the heat never worked. Once it was so cold that we had to work in our overcoats.”

Many of the more odious tasks of the past have been simplified for today’s Poly editors. RPI’s main computer is used to maintain and print advertising files and subscription lists. A microcomputer, added to the office in 1977, helps simplify and speed up headline writing. Light tables, used to help “proof” the paper before publication, also were installed in 1977.

With expenses close to $76,000 and advertising income approaching $70,000, The Polytechnic has grown tremendously over the past few years. As recently as 1976 national employment recruiting ads accounted for only $2,000 in income. Today, with the demand for young engineers, that total has ballooned to $40,000. If this trend continues, The Poly may soon turn a profit.

As the voice of RPI students, The Polytechnic has changed very much over the years, although some things have remained constant. Any alumni who worked on the newspaper does not have to be reminded of the all-day Sunday layout sessions—an integral part of any editor’s memories. Miller recalls several very late night sessions, which culminated with someone barely awake pointing out the obvious: “Hey look—the sun’s coming up!” “People tended to get silly around three in the morning,” says Cunningham. “Sometimes we threw our shoes off the second-floor balcony into the McNeil Room for no particular reason.”

“The dedication of the staff was, and still is, very high,” states Miller. “One time when we wanted to publish the results of GM Week’s Tuesday primary elections in the next day’s issue, we had to drive two hours to our printer in central Massachusetts, get the results over the phone, and write the story at the plant while the pressmen waited. Then we had to drive back to Troy along the Mass. Turnpike almost at dawn. It was worth all that effort—the timeliness of the story appearing in that week’s issue was impressive.”

For all the efforts of its editors and staff, The Polytechnic has been rated “All-American” by the Associated Collegiate Press, an organization that judges student newspapers across the country. “All-American” is the top rating, and The Poly has achieved it almost continuously since the mid 1960s.

The record shows that despite all the changes over the years, The Poly has remained the sole source for, by and about RPI students. This is unlikely to change in the future, since the newspaper is on firm financial ground and is expanding to fit the needs of the ever-diversifying campus. In that regard, The Poly does not waver from its original charter, published in Volume I, Number 1, February 16, 1885: “... to furnish the means for more friendly interchange among our fellow students... to treat all matters in a fair and impartial manner, and to increase the present bonds of regard felt by undergraduates and the alumni for the Rensselaer Polytechnic Institute...”
Fire. Thick, choking smoke billows up through a high-rise hotel in Chicago. "A classic, one-room mattress fire" touched off by a smoldering cigarette, says the local fire commissioner. It kills four people, injures 20.

In Baltimore, a candle tips over in a rowhouse where the gas and electricity had been shut off just the day before. The city's worst fire in 30 years claims 10 lives.

Three days later, across town, seven people are left dead in another rowhouse fire. Again, careless smoking. The children, all five of them, die of smoke inhalation. A next-door neighbor remembers, "You could just hear them screaming... right through the walls. It was really a hurting thing."

The U.S. has the highest per capita fire death rate among industrialized nations—quadruple, for example, that of Italy. Some 600 Americans a month die by fire. Thousands more are hurt, some of them being grossly disfigured or left in unrelenting pain. "You want to die," says a burn victim. "There is nothing that makes that kind of pain worthwhile." Flames consume billions of dollars worth of property each year. Billions more go to fire departments, or are spent on alarms and sprinklers, extinguishers and standpipes, to limit the toll.

But not all the billions are wisely spent. Well-meaning people meet in committee rooms to hear manufacturers, suppliers, contractors, unions, and civic groups lobby for particular points of view, then vote on safeguards—like insulation and sprinklers and fire doors—they think ought to be part of the building code. And sometimes they vote wrong.

Other people conduct tests, often at $25,000 a shot, to rate how well various building components stand up to heat, or how well particular materials promote or retard the spread of flames. But sometimes the tests designed for old materials don't work for new ones.

All in all, much time and money goes into reducing the toll taken by fire. Much of it is worthwhile; some is not. In any case, the problem could certainly be tackled more systematically. A more analytical approach might yield reduced costs, greater benefits. The age-old scourge of fires burning out of control and causing loss of property and of life—You could hear them screaming... right through the walls—could, in short, become an area of, well, serious study.

And that is what the people at the Center for Firesafety Studies at Worcester Polytechnic Institute in Massachusetts have

in mind to do. They're trying to gather up the scattered mass of scientific research and folk knowledge, the gritty experience of generations of firefighters and the accumulated wisdom of the building codes, and make of it all a discipline.

David Lucht, director of the WPI firesafety center, has a model for how he'd like to see firesafety engineering make its mark in the world. His model is an allied discipline that's already respected, professionally "mature." His model is the specialty known as structural engineering.

"Go ahead, open up a building code," urges Assistant Director Jonathan Barnett. He's referring to the bulky volume in which each town or city sets forth its special requirements for new construction. Typically, the code will be three or four inches thick, with fire safety provisions occupying most of it. Rules governing structural design may take up barely a finger's width.

Plainly, it's no less life-threatening for a building to collapse than to be consumed by fire. It's just that when it comes to how thick a structural column should be, Barnett observes, the building codes trust the engineer: We won't tell you how to do it, they say. Just assure us it will be safe, affix your signature and your seal as a professional engineer to that effect, and that's good enough.

Back at the turn of the century, before structural engineering came into its own, Barnett goes on, this wasn't the case at all. Then codes dictated every structural detail. The code-writers would hear that a 6-inch concrete slab had collapsed? Well, they would demand 12-inch slabs—no matter that careful analysis might reveal eight inches to be enough.

Though well-intended, it was a cumbersome way of doing things, and one ultimately discarded as structural engineering's predictive powers grew more respected. Yet fire safety for buildings today, lament Barnett and Lucht and others at the WPI firesafety center, is mostly handled in the same, too-rigid way. Apply so many inches of insulation to a column, says the code. Or, Space the seats in the auditorium just so widely. Or, Make the wall sheathing material just so thick. The code becomes a mass of detail, piled up over the years, varying immensely from community to community, the product of innumerable local battles lost and won.

"It's design by committee," says David Lucht.

The codes, of course, came about for
a reason. In 1871, Mrs. O'Leary's cow kicked over a lantern and Chicago burned, the fire taking 250 lives and obliterating three-and-a-half square miles of the city. The next year, Boston burned. After a succession of big, costly fires around the turn of the century, the insurance companies were, as David Lucht says, "going broke. . . . The way those cities were built, they had all the ingredients for tremendous conflagrations." Periodically, they got them.

So beginning in 1905 came the first of the underwriter-inspired "model codes." Wood construction was out, firewalls in. And the fact is, Lucht points out, "We don't have Chicago burning down anymore."

But people are still dying in building fires, in brick, concrete, steel, and glass structures no less than in wood ones. How come? For one thing, as Dougal Drysdale, a visiting professor from Scotland, points out, "It's not the building that burns, it's the contents." Carpet and drapes and furniture and paper do burn, and architects exert no control over them.

Another factor is the heavier use of plastics. As Lucht recently told viewers of the Nova television documentary "Why America Burns," the new plastics have "caused problems that the fire codes haven't caught up with yet." Plastics-fueled fires burn faster, with more smoke, and churn out prodigious quantities of poison gases like phosgene, chlorine, and cyanide. Of course, adds Lucht, "the carbon monoxide kills you in any case."

To make matters worse, standard tests developed on older building materials like cotton, wood, and wool often fail to reveal the dangers of the synthetics. In one demonstration aired for the Nova documentary, for example, a plastic rated high by one such test—the "Steiner tunnel test," originally developed to rate the fire potential of wood panels—was consumed by flames within a minute and a half. A low-rated plywood, on the other hand, would have taken 20 minutes to become similarly engulfed. This kind of thing, says Jonathan Barnett, is a classic example of a test being used "poorly, blindly."

Still another problem ignored by the old code-restricted approach to fire safety is the change in building construction since World War II. Modern materials make for lighter, cheaper construction—but for poorer fire containment, too. And while architects often do specify fire-resistant flooring materials, for example, builders sometimes poke holes in them for air conditioning and other building-wide sys-

There is no shortage of research on how fires start, catch, and spread, says David Lucht. "You could fill this building with papers about fire." The National Bureau of Standards has a Center for Fire Research, and key work has been done in Japan, Germany, and Sweden. But the material is scattered. The problem is getting at it, making sense of it, applying it. As a matter of fact, declares Lucht, there is "not a single hardcover text on fire behavior, anywhere."

That lack is precisely what Dougal Drysdale has been trying to overcome, and why the University of Edinburgh professor has been at WPI for the past months. Working under a grant from a New England insurance company, the sandy-haired, woolly-looking Scot, whose temporary office in the basement of WPI's Higgins Lab was graced with bicycle and loaded backpack, has been putting together the first comprehensive text on fire dynamics. Not surprisingly, he's awash in the chemistry, physics, and mathematics of fire that he's been trying to distill into the book. "Fire is really a feedback process between the flame and the surface" of the burning material, he says. It represents "quite a delicate heat balance."

Heat balance. It's not just how hot something gets that determines whether it will sustain a flame; it's whether the burning generates enough heat to offset that carried away by heat transfer processes like conduction and radiation. (Water extinguishes a fire, notes Drysdale, by absorbing its heat.) You are apt to have trouble igniting a log with just a match—however hotly it may burn—because a match simply doesn't supply enough heat to make up for that conducted away by the log's considerable mass. You need kindling, burning furiously, to get your fire going.

A haystack, on the other hand, can burst into flames spontaneously, with no external source of heat at all. In a slightly moist haystack, Drysdale explains, bacteria find an ideal setting for growth. And as they multiply, they generate heat—not much, but the mass of the haystack itself serves for insulation, and the temperature slowly climbs. Finally, the hay may start to smolder—and, upon finding enough oxygen to support combustion, to burn.

Assistant director of the firesafety cen-
ter Jonathan Barnett has been using computer modeling to study the structural burdens fire imposes on buildings: When a steel structural member gets up to about 1100 degrees Fahrenheit, it weakens markedly, losing its structural integrity. Or this, as Barnett says, has been the rule of thumb behind code provisions specifying how much insulation structural members must have, the idea being to ensure they never reach the forbidden temperature.

But this is just the kind of rigid formulation Barnett wants to see replaced with a "rational engineering approach to design similar to that used in all the other engineering disciplines." Such an approach, he says, can pay substantial dividends. Swedish researchers who pioneered the techniques he hopes to refine have found that through them they routinely "save 10 per cent on the cost of fire protection for a building."

The fact is, steel does not simply turn to jelly upon reaching 1100 degrees Fahrenheit. For one thing, it responds differently depending on whether it's heated quickly or slowly. Moreover, fire not only weakens it, but may apply additional loads. For example, a column not free to expand is squeezed by heating. And a beam subject to one-sided heating may bend out of shape. But perhaps such loads are small compared to others the building faces and may thus be safely ignored? No, says Barnett. "You don't know beforehand which are negligible." So all must be factored into the computer model.

Because fire is inherently so complex, the analogy to structural engineering, he admits, is not a perfect one. Still, "We have all the tools we need to design for structural fire loading," he says. "Now we just have to put it all together." With the computer, he believes, the problem will ultimately be rendered "manageable." Calibrated on test data already available, Barnett's computer model may help make such costly tests of structural assemblies unnecessary.

Barnett feels strongly that "every significant building should have a firesafety engineer on its staff," just as now it will have a structural engineer, an architect, a mechanical engineer, and so on. "I envision a day when we won't have building codes, when we'll start to trust the fire engineer's seal, just like the structural engineer's," he says. Specifically trained to handled firesafety problems that today get short shrift, and no longer hamstrung by unduly restrictive codes, this new species of engineer will likely come up with innovative, cost-saving solutions.

Barnett tells of a high-rise hotel in Boston that has an atrium broken up into intimate seating areas separated by handsome concrete planters. A renowned interior designer at work? No, it seems the design was heavily influenced by the building's firesafety engineer. Since sprinklers wouldn't work at that location, he decided to limit the fuel available to feed a potential fire. Dispersed furniture and concrete planters were the aesthetically pleasing result.

Robert Fitzgerald, who helped found the WPI Center, calls fire-safety engineering "a primitive field just emerging into the twentieth century."

The Center conducts research, a masters program—the only one in the country—and what Fitzgerald calls "technology translation." That broad heading will ultimately include short courses and video programs intended to reach everyone from fire commissioners to architects, and a steady stream of textbooks (Drysdale's being the first) on aspects of firesafety.

One day, Fitzgerald believes, the field will progress to the point where it is seldom viewed, as it typically is today, as a luxury. It's simply not true, he declares, that "good fire protection always costs more money." In fact, he says, "instead of restricting the architect it opens him up," making possible imaginative solutions like the hotel atrium to which Barnett referred.

Future buildings will be "fine tuned," he says, to fight fire. The city-wide and building-wide focus will be obsolete; buildings will be designed so a fire simply can't go on. Even the arsonist, in this safest of all possible worlds, will be foiled in his task. "We want to design so that even if somebody intentionally starts a fire, the building," Fitzgerald says, "responds appropriately."

**Fire.**

A source of almost universal satisfaction as flames flicker in the fireplace, safely contained. But a source of terror when they're not, of excruciating pain among fire's survivors, of nightmares. And of revulsion, too, at the sight of those disfigured by fire—like the beautiful child scarred beyond recognition whose before-and-after pictures in a 1973 federal report I forced myself to view every time I needed to remind myself what this article was really all about.

Fire must be tamed.
Power shifts uneasily in the world. Little wars break out like brush fires, not always for obvious reasons. Brash young empires assert themselves, leaving older ones caught off balance. Can any sense be made of it all?

We asked a panel of historians, political scientists, and economists, from Alumni Magazine Consortium schools and elsewhere, to try. You may eavesdrop on their discussion.

Bryant Cureton, political scientist, Hartwick College, moderator of the discussion: I will start with an utterly simple definition: An empire is a supernational political system created and governed more or less centrally by one of its parts; it is held together either by the exercise of power or by the threat of power. That is extremely simplistic, and I offer it primarily for you to enlarge, attack, or whatever.

Let me suggest that we begin by just going around the table, from a roughly chronological perspective. Paul?

Paul Rahe, classicist, Franklin and Marshall College: All right. I'd like to read briefly from the Melian Dialogue. At one point in Book V of Thucydides, the Athenians respond to the Melians:

So far as the favor of the god is concerned, we think we have as much right to that as you have. Our aims and our actions are perfectly consistent with the beliefs men hold about the gods, and with the principles which govern their own conduct. Our opinion of the gods and our knowledge of men leads us to conclude that it is a general and necessary law of nature to rule wherever one can... we know that you or anybody else with the same power as ours would be acting in precisely the same way...

The view that's expressed is that it's a general and necessary law of nature to rule wherever one can. If that's the case, then our choice is not between empire and no empire; it's between holding an empire and being part of someone else's empire. The secondary choice might be between a decent empire and an indecent empire.

Paul Thibault, medieval historian, Franklin and Marshall College: In the medieval framework, the basic question was not the fact of rule, which was taken for granted, but the purpose of rule, which was viewed from two perspectives. The earlier idea was that we have governments to rule us as punishment, as a direct result of the fall from grace, of expulsion from the Garden of Eden. Later, particularly after the 12th century, the view pointed out by Thucydides was revived: that is, that you find rule everywhere. And because God created a good world, rule must therefore be good.

The question still remains—what is good, what is the purpose? The purpose is salvation. All government, in this view, must ultimately lead its subjects to salvation. In the medieval mind, however, the overarching framework is not any specific political unit, such as the Holy Roman Empire, but Christendom in general, which is the perfect society.

Michael Vlahos, diplomatic history and military strategy, School of Advanced International Studies, Johns Hopkins University: I'd like to discuss the way Americans responded to images of empire, images which by their very nature define...
our deeper identity as a state, or a people, or a race. 

So far, we've been talking about one important question: How did the first concept—of authority—implied for early empires? Certainly transnational corporations have a fully developed ideology about global efficiency in use of resources. It's a highly debateable one—efficient for whom, mainly, what ideology justifies the existence of these so-called transnational corporations. These complex organizations do have a few things in common. There are built-in contradictions in the process of empire-keeping up, so the question of guns versus butter cannot be avoided for long. The U.S. today is in this situation.

One, the imperial country must enforce a particular ideology, based on two propositions: A, everything associated with the imperial country is good and desirable, and B, everything associated with the colony is bad and undesirable. Everything involves virtually everything, religion, food, dress, habits, customs, manners, education. This is the basis for the transfer of resources and maintenance of privilege. Even today, the existing international order is perceived to encourage the transfer of resources from the South to the North. In that sense, the imperial order has similarities with an empire: no doubt there are also differences. There are built-in contradictions in the process of empire-keeping up, so the question of guns versus butter cannot be avoided for long. The U.S. today is in this situation.

Two, the imperial country must enforce a particular ideology, based on two propositions: A, everything associated with the imperial country is good and desirable, and B, everything associated with the colony is bad and undesirable. Everything involves virtually everything, religion, food, dress, habits, customs, manners, education. This is the basis for the transfer of resources and maintenance of privilege. Even today, the existing international order is perceived to encourage the transfer of resources from the South to the North. In that sense, the imperial order has similarities with an empire: no doubt there are also differences. There are built-in contradictions in the process of empire-keeping up, so the question of guns versus butter cannot be avoided for long. The U.S. today is in this situation.

Three, the imperial economic arrangement distorts the production system. For example, the U.S. developed a whole production structure based on cheap labor. Inevitably people realize that. Inevitably people realize that.

Robert Kargon, historian of science, Johns Hopkins University: I agree with Remesh that the essence of the imperial situation is group advantage through some kind of domination. It's a means of technology, I'd like to call attention to the fact that science and technology have played an important role in the development of empire. But the rulers of empire usually have other rationales for their action as well. There is only one purpose for empire: to enrich the imperial country at the expense of the colonies. And the similarties among empires, both in the past and the present, lie in the transfer of resources and maintenance of privilege. Even today, the existing international order is perceived to encourage the transfer of resources from the South to the North. In that sense, the imperial order has similarities with an empire: no doubt there are also differences. There are built-in contradictions in the process of empire-keeping up, so the question of guns versus butter cannot be avoided for long. The U.S. today is in this situation.

Louis Wolf Goodman, economist, American University: I've focused my research for the past 15 years on transnational corporations, which some people like to talk of as types of empires. These complex organizations do have a few things in common. There are built-in contradictions in the process of empire-keeping up, so the question of guns versus butter cannot be avoided for long. The U.S. today is in this situation.
Paul Thibault pointed out, Christianity was the central rationale for empire—salvation of the pagans or barbarians or whatever. They would be saved at the cost of their lives and their families. But in the late 18th and early 19th centuries, increasingly there was talk about bringing good government to sort of anarchic parts of the world—particularly among the British, who prided themselves on a talent for government. And the rulers of empire also claimed they were bringing advanced technical civilization to those benighted parts of the world who had not had them. That is, empire was still rationalized as for the good of the ruled, but now the uncivilized would become civilized as we understood it, which meant modern medicine, public health measures, improved means of communication, train travel, and so on.

Technology served two functions. It helped the rulers enforce physical domination. The way the British used very small numbers of soldiers to rule India, for example, was absolutely a brilliant use of technology, in that respect. But the application of modern technology also gives a psychological domination. There is a French film called Black and White in Color that was put out a couple of years ago, about German and French squabbles in 19th-century Africa, and it has a brilliant scene where French missionaries are trying to convert Africans to Christianity. What they do is bring out a bicycle, and they ask the Africans to ride this bicycle. They all try, and they all fall down. Then the missionaries bring out an African who has been converted to Christianity. He gets on the bicycle and rides around. So the unbaptized heathens flock to be baptized. It is the power of technology.

Michael Vlahos: The way you’re talking, any state that oppresses its own people or some other people is an empire, or any state that has any kind of influence beyond its own borders is an empire—well, that’s ridiculous. Then every state becomes an empire and the word becomes useless. We should try to decide what empire means. Is empire authority, or is it space? If it’s space, what kind of space?

Louis Goodman: I personally would prefer to be in a discussion in which we settle for some kind of hazy definition, then go on to address important human issues like the ones Romesh brought up. I’d like to discuss whether empires are withering away or not.

Paul Rahe: What if the alternative to empire were war? The Greeks would have said so. In one of Pericles's speeches he says to the Athenians, “Your empire, your arche, your rule, is tyranny. It may have been wrong to take it up; it is not safe to lay it down.”

Nationalism is a primary force, and to ignore nationalism is to ignore the fact that when empires go, you get the Dark Ages.

Vlahos: I agree. The overriding reality today is that we’re involved in a major struggle between the same forces that some of you seem to think are withering, namely conflicting ideologies that are embodied in large imperial-like or quasi-imperial structures. The tension of that confrontation is the overriding reality of life today, not some hazy and hopeful schema.

Goodman: I really disagree. The conflict may appear in the press in terms of conflict between ideologies, but I think the conflict has to do with distribution of goods and services.

Vlahos: This is the fundamental issue. I think culture overrides economics.

Rahe: That would be the question of nationalism versus economics as well.

Romesh Diwan: When you talk of nationalism—what in the last analysis is nationalism? Many times it’s nothing more than the commercial interests of some groups who have been ruling.

Rahe: The Iranian revolution, which is a rather important event, cannot be explained in terms of economic domination. But it can be explained as a nationalist uprising. In particular, it is a defense of a way of life that’s based on religion—and definitely threatened by modernization in general. Especially modernization that comes in a Western guise.

Diwan: But it’s not independent of economics, either. You look at the depth of the revolution and who supported it, and it got its basic impetus because the economic deprivation of the masses was so large.

Vlahos: I’m sure that helped, but it doesn’t explain the nature of the revolution, which is a profound cultural rejection.

Robert Kargon: The form the revolution takes certainly has tremendous cultural overtones, but I don’t see how you can separate the economics from culture.

Vlahos: You don’t, you don’t. I think they flow together, in the same way that you talk about technology replacing Christianity. It didn’t. Technology was an expression in very palpable form of the values and larger behaviors of the West.
Rahe: I'm wondering about the medieval empires—how they would fit into all this.

Paul Thibault: Let me take the very simplest example, the Holy Roman Empire. It's essentially a Germanic institution, not by nature expansive—with certain reservations, for it will expand towards the east, and in a colonizing way. But it primarily reflects domination, a cultural view that anything brought by a Christian is better than what it finds outside its frontiers. They are convinced that they are the perfect society, and it is part of their mission to bring perfection to other people.

The Crusades and the establishment of the Latin kingdom of Jerusalem, I think, were very much an imperial expansion. Jerusalem was an outpost of a few colonists who dominated another culture, while remaining segregated from it.

We could argue the same for Israel today, that it is a similar expression of Western superiority, that Israel is a Western outpost in an alien land dominating a large region with a relatively small number of Western colonists.

Kargon: What's the mother country?

Thibault: Europe, or the West in general—

Kargon: That's bizarre.

Bryant Cureton: In general, how essential is crusading to the idea of empire?

Rahe: Utterly absent before Christianity, I think. When the Romans think of their empire, in time they begin to think about the benefits of peace, the Pax Romana. But there is no crusading concern at all. Their concern is solely with security, and in fact, in the early Roman empire, there is no extraction of resources. All the Romans ask from their subject allies is troops in times of need. They tax only their own citizens; they do not tax their allies. In time, when they begin to absorb areas outside Italy, they impose a tax, but usually almost all the money is used to support the army that protects this area against invasion.

Goodman: If we accept your assertion, I can think of two hypotheses why extending good to others only became more important later. One idea might be that in the time of the Greeks, the world was so chaotic that people didn't have time to think of justifying things. They just had to get security, and that's all they worried about. Another hypothesis might be, given mass communications, that today the dominated are much more aware of what's going on. Given that greater intensity of knowledge, it gets dangerous not to pay attention to what the people you're dominating think of you, so you try to do them good.

Rahe: Perhaps, but I would argue that the coming of Christianity marks a watershed in human history. What Christianity does is establish itself as a catholic or a universal religion. It goes beyond Judaism, which had taken the line that the chosen people were to be a light unto the nations and therefore had a universal role, but which didn't seek to proselytize. The effect is that, if you're a Christian, the most important thing in your life is salvation, and if you have a friend, the most important thing you can do for him is save his soul. That leads to the crusading instinct.

Goodman: All right, what about non-Western empires? Do you get the same—

Rahe: No. The Persian Empire, for example, did not impose its religion, and it practiced great respect for the local customs, laws, and habits, as well as religions, of the people. Its religion was a kind of unifying factor only among the Persian ruling class. They did enforce some token public expressions of respect for the imperial ruler, but fundamentally, the crusading instinct is absent.

Goodman: As we're talking about it, it seems that the Christian world view leads to a much more totalitarian imposition of a way of doing things.

Vlahos: What about Islamic empires?

Diwan: In Iran—there had been no Islam there. There had been an earlier religion that was completely wiped out, and Iran is purely a Moslem country now. Not only that, Islam even destroyed whatever culture Iran had, whatever language they had. Everything was destroyed.

Rahe: I take it back. Maybe monotheism is the watershed, because Islam behaves in a fashion similar to Christianity.

Goodman: That's a fascinating hypothesis, that it's monotheism that projects an absolutist view of things, which translates itself into a cultural totalitarianism.

Vlahos: I think this is a positive aspect of imperialism, because once you do enter in and impose a kind of homogeneity, you can develop on the basis of the new ethos. In other words, the cultural imperialism embodied in Christianity—and its development in the form of modern technology and mod-
ern Western ideology—does create a common ground. Once the entire set of values is accepted by everyone, then you can begin to develop on that basis, and I think this is positive.

Kargon: You say that once Christian values permeate a society, then some kind of homogenization of this empire will take place. Isn’t that what you said? I want to comment on that, because when the Spaniards converted the Indians in the New World, no Indians were permitted to become rulers.

Vlahos: No, only now are you beginning to find Indians in Mexico in high positions in government, and not that many. But what I’m saying is that ultimately the way to eliminate empire is to create cultural homogeneity. That allows people to avoid insoluble conflicts, and I think that’s one problem today. We still have conflicting worlds, and the world view that’s embodied by the Soviet empire is a major factor preventing the post-imperial phase we all so long for.

Thibault: Would you describe the Soviet system as an empire?

Vlahos: Yes. I think the U.S.S.R. is very Byzantine in the way it handles its legitimacy. The emperor was proclaimed the representative of the people, and you can follow that strand through the czars. Today, the true word is interpreted through the head of the Soviet party.

Thibault: I think that’s important, the true word. The link to a world view which is seen as intrinsically correct and therefore merits imposition on others.

Kargon: When it gets down to it, I believe there is a Soviet empire because the Soviet army enforces Soviet policy.

Thibault: Simply like that? The ideology doesn’t matter?

Kargon: Simply like that.

Diwan: What you are saying is that the force is there, and people are not really persuaded by Marxism. I accept that. I think Marxism is a rationalization rather than an ideology.

Rahe: Nevertheless, it gives the U.S.S.R. an enormous power in the rest of the world, in the sense that they have an ideological following in virtually every country that is vital to them.

Diwan: That occurs where people see their current system as oppressive, and the only alternate system is a Marxist one. It’s an escape route.

Kargon: Many regimes which are really military cliques call themselves Marxist, and we have to be careful of relating that description to an ideology.

Cureton: I’d like to go beyond this question. Do we see anything approaching a world view sufficient to support a new world order?

Rahe: My view is that we’re going to have a new world disorder; that we have been very fortunate since the second world war in that the U.S. has had a rather loose hegemony, not quite an empire, throughout much of the world. As American power declines, what you will see is the reassertion of traditional regional hostilities. To put it in a nutshell, I think that if the Argentines had not landed on what the British call the Falkland Islands, and what the Argentines call the Malvinas Islands, Argentina would have gone against Chile.

Goodman: I think you’re absolutely right that there has been since World War II a sort of Pax Americana. But I hope you’re wrong about the new world disorder. What if we have a different kind of world order, with consultation among allies? My favorite remark from President John Kennedy—to whom I don’t give a lot of credit in other areas—was that the purpose of the United States is to make the world safe for diversity. That is, to make the world a place where we don’t need a common culture to get past empire, where we can respect each other’s diversity, and work out international problems in a more imaginative way than imposing our will.

Diwan: I think we certainly will muddle through towards a better order. We’ll muddle because we have serious conflicts, no doubt of that. The reason I believe we will muddle through is that we have developed over the past two or three hundred years in a way you can describe as Christian. If you go to India, if you go to Mexico, you can find Christians, even though there won’t be any one culture that one would consider Christian. So a certain humanism is developing.

Also, we have put in place in the international system some institutions, like the U.N., in which we can talk together. Talks may not solve the Falklands problem, it’s not an easy problem, but one can take a hopeful view. So, regional conflicts can reasonably be resolved because a forum exists.

Vlahos: Right. For small conflicts of interest.

Elise Hancock, editor of the Alumni Magazine Consortium: But what about BIG conflicts of interest?

Diwan: In big conflicts, I accept that maybe the best we can
Through the process of human development, all empires will eventually wither away. We are entering a new world order.

do is maintain a stalemate. But if the U.S. government decides it is not going to accept compromises, my feeling is the U.S. population is recognizing that they are not prepared to fight—and so are the Russians, so are the Russians. They have suffered 20 million deaths in war. People who have seen their parents die, their sisters die, don’t fight easily. There is in the whole world today a feeling that we have to solve the problems. There is a sense of equality.

Vlahos: In 1914, in Europe, the trendy analysis was that there could be no war because financial markets would collapse in a few weeks. A society that had strong cultural bonds, that had the Hague, that had international courts to settle problems, that had reached conventions about limiting certain methods of war, and—

Thibault: —had cultural unity—

Vlahos: —They tore each other apart. I don’t think we can discount that happening again.

Goodman: Well, no one’s saying there’s a zero possibility. There are different kinds of probabilities. I make the assertion that if we keep our balance of power in the world by one nation imposing it, that lessens the probability that we’re going to move on to a better system.

Vlahos: It also lessens the probability of war. In other words, you had more stability in the early post-war period because you had two superpowers who were able to really police their own areas. And now that has broken down. You have much more fragmentation.

Rahe: Except that there is one empire that’s growing. As the American empire, or the rather loose hegemony we’ve exercised, begins to fall apart, there’s one empire that’s expanding. It’s an empire that does not exercise a loose hegemony. I’m thinking of Soviet troops in Afghanistan. I’m thinking of the use of East Germans and Cubans in Ethiopia.

Kargon: The question is whether in the long run the Russians will encounter the same problems that the British and Americans have. I think they will. Ultimately. It may take them more time than we’d like.

Goodman: It’s debatable whether the Russian empire is expanding or contracting. You could go from country to country around the world and tot up more Russian losses than Russian gains. I think that this casting the world in a bipolar confrontation, Russia and the United States—

Rahe: I didn’t do that. I wouldn’t think in bipolar terms if for no other reason than the existence of China, and because Europe in some sense, I’m not sure in what sense, is emerging as a pole of its own.

Goodman: Right. I apologize. But the point is, I don’t think that even the Russian empire is expanding today.

Diwan: If you look at the relationship between Cuba and Russia, I don’t think there is an imperial relationship. I think that Cuba is a cost to the U.S.S.R.

Rahe: Arguably the 19th-century British Empire cost Britain, and certainly I do not believe that the United States gained economically from its colonial holdings in places like the Philippines—in comparison with the cost of those holdings.

Kargon: Quite true, but some people in the United States made money. Some people in Britain—

Rahe: —Some people always make money in war—

Kargon: —and those some people had a lot to say about policy. What I see happening now is that foreign policies do not exist in the Western states. What we have is trade policies.

Cureton: Louis, do you see transnational corporations as an independent force that supports an optimistic view?

Goodman: Well, I think that transnational corporations are forces that serve their own purposes, and to the extent that they reinforce global interdependence, they diminish the possibility of global war. That’s because war is not in the interests of those corporations.

But to think that those forces are more powerful than nationalism or other forces in the world, sovereign forces, is an illusion. Taken in themselves, corporations can be a force for peace. They can also, on other levels, create increased inequality. And viewed on a global scale, I think they cause income concentration rather than distribution. But they have also promoted a transnational set of interests.

Vlahos: What’s your prescription, then? For a better world, I mean.

Goodman: I think the most important thing would be for the most powerful nation in that world to deal with world problems in a broadly consultative process whenever possible, rather than trying to impose solutions all by itself.
Vlahos: Rule by committee has its own drawbacks.

Elise Hancock: What about minding our own business?

Rahe: One problem with minding our own business is that since 1960 our involvement in international trade, and our dependence on resources outside our own continent, has become so great that we no longer have much choice about minding our own business. That is, minding our own business means minding other people's business.

Kargon: I disagree. I have an optimistic scenario which goes along what you might call the Japanese model. They mind their own business.

Rahe: Japan can mind its own business because we do the security for them—essentially. It strikes me that one effect of the decline of American power will be a breakdown in trade relations, because of the equivalent of piracy. In other words, the Japanese prosper and are able to mind their own business only because they're a protectorate.

Goodman: What’s your analogy to pirates today?

Rahe: One analogy might be what Khaddafi has been trying to do in the Mediterranean.

Vlahos: That’s the traditional pirate—there’s also the greater pirates in terms of cartels and groups of nations that seek to impose their needs on others.

Diwan: On the other hand, consider transnational corporations. These are the only groups which can afford to be pirates today, and it would be in their interests to maintain order in the seas. So do you think they will allow any piracy? They have their own armies.

Goodman: I think the problem lies in the regional areas, regional ekomes that are growing in the world. You’re going to have regional powers, and they’re going to become empires—Brazil, India, Iran—and that’s going to cause conflict—

Rahe: Yes, and that’s why we’ll have a breakdown in trade. If there were a war between Argentina and Chile, that war would be raging over an area that is in fact a choke-point for world trade.

Vlahos: How about the Congo, too? Strategic minerals could be cut off.

Perhaps it’s no longer possible for the U.S. to avoid the true imperial mantle.

Diwan: You’re forgetting the history. Immediately when there’s a war between two small powers, you said it yourself, the U.N. exists to stop them. It’s only when the war takes place between the U.S. and the U.S.S.R. that the U.N. becomes useless.

Vlahos: I think the Pax Americana still obtains, and Saudi Arabia is a nice illustration. The U.S. has to maintain not only our own interests in the Gulf, but those of Japan and the Western alliance. Alone—in spite of all the consultations we’ve made asking Europe and Japan to help us out. And they’re the ones who are so dependent on Middle Eastern oil. Now, were America to find itself in a position where we were no longer reliant on that petroleum, we might see fit not to extend our security enforcement to that area. That could create a very sticky situation.

Goodman: But we would still stay in the area, even if we didn’t need that oil, because we’re also dependent on Europe and Japan to be healthy economies to buy our goods.

Kargon: I think the case of the Shah of Iran demonstrates that there are tremendous limits on what we’re able to do to guarantee the security of a region.

Vlahos: I’m wondering whether we might be in transition to a world like before 1914, with power fragmented. Then who’s going to stop the Soviets if they want to extend their influence into Iran?

Diwan: We have baited ourselves with the idea that the U.S.S.R. is really a bully, that they’re just out to do us in. But the reason we are losing our empire is because of its own internal stresses, and when the U.S.S.R. steps into that worldwide dimension, they will have their internal problems, which will denigrate their capacity to be the pirates of the future world.

Vlahos: Or inflame the situation, that’s the point. The stresses in the Soviet Union and the conflicts there may create such powerful pressure that the Soviets will respond with the only implement they know how to use, and that’s their military.

Goodman: That’s scary.

Diwan: In this scenario there is one possibility and that is the end of the world.

Rahe: That’s the Pax Atomica.
Vlahos: Pax or Pox?

Rahe: Ambiguous. The point is, if it weren't for the existence of atomic weapons after the second world war, we would have had a third world war long ago.


Rahe: The question then is, what is the prerequisite for continued restraint? One of the things that has helped restraint is that atomic weapons have been in very few hands, which is to say very few people have had to exercise restraint. As those weapons spread—and they will spread—we will be in a situation where a good many more nations have to exercise restraint. I think there are very few grounds for optimism.

Diwan: I think we in America have a certain feeling that we are somehow superior. We have this atom bomb. We are responsible. They have the atom bomb. They are irresponsible. I don't accept that argument. We are responsible because we recognize the atom's power, as I think every nation does.

Goodman: There's another kind of global disaster which could have been inflicted on the world throughout the whole century, by almost any nation, and that's chemical or bacteriological warfare. We certainly do read in the newspapers about the uses that the Soviet Union is alleged to have made of that particular weapon, but nevertheless no catastrophe has occurred. So that's grounds for optimism.

Thibault: Given the circumstances, how would you go about building an empire today? Can you build an empire? I mean, a good, old-fashioned empire on the late 19th-century British model. Can it be done?

Kargon: Everything has a cost, and even the British Empire may have cost more to maintain than it brought in—but the costs were perceived as worth it. The question is, in the 20th century, does anybody conceive the costs as worth it? Obviously, the Soviet Union does, in terms of security, especially in areas that are physically contiguous to it. They conceive of Afghanistan as worth it. But if they have problems in Angola, or problems in Cuba, are they going to continue to see it as worthwhile? That's problematic.

Vlahos: I think if we had a real disruption in one region a successor empire could form. I can't see African colonial demarcations remaining forever, for example. Why can't you have a new Caliphate, too, with the upsurge of Islamic fervor? I'm sure Khaddafí dreams of that already. He may not be the one to realize the dream, but I could see that kind of thing happening soon. The U.S. is receding from that area, while Islamic power and wealth are growing.

Diwan: Power is growing, but what have the Mideastern countries to have power over? If you take their money away, what have they? Nothing.

Vlahos: But we're not talking about taking their money away. The trade continues.

Rahe: He's right, though. They lack industrial infrastructure.

Goodman: Furthermore, a charismatic leader has not emerged. Khaddafí, you know, is hated—

Hancock: You think a charismatic leader is essential?

Goodman: A charismatic leader is important for setting something up—then you need to institutionalize it to keep going.

Rahe: A charismatic leader always begins with one nation. He gains leadership over one nation, which then develops some kind of military superiority that allows them to establish an overall hegemony. Now, the reason I suspect an empire will not happen in the Islamic world is that I cannot think of a candidate for military superiority. You have to be able to build your own weapons, that's the first priority.

Vlahos: That's why it won't be Libya, for example. But let's draw another illustration. I think that India will be the one to dominate the Indian Ocean. Already, with its relation to Bangladesh and some of the Himalayan princedoms, it's a regional system. I think that India is already an empire, and I think India is a perfect example of the empire we'll see in the future.

Goodman: We're getting back to a point that Michael raised in the beginning. When is it useful to pull out our definition of empire? Do we want to say that these different spheres of influence are empires? Is it useful to use the same term as we would to talk about the Holy Roman Empire, the Greek empires, or whatever? I don't think that it is, myself. These past empires as we conceive them aren't going to happen again, but there will be other forms of rule. The British Empire might not go on, but we do have transnational corporations, and we have other forms of complex international organizations that exercise power worldwide.

Vlahos: But that's influence. Influence is different from legiti-
mate authority. Our stereotype empire is the loose British one, and I agree we’re not going to see that. What we’re going to see are the true empires of the past based on authority, not rooted to nationality, and having a direct and legitimized administration over those different peoples.

Kargon: Legitimized by military power.

Rahe: He’s put his finger on something, though. The Soviet empire’s foundation in legitimacy is radically different from the Persian Empire’s foundation. It’s not the divinity of Brezhnev that is the ideological foundation—it’s a certain vision of the future.

Thibault: Which is an absolute vision—

Rahe: —and is universal rather than national in character.

Goodman: And that’s what’s spreading in the world! That type of vision! That’s the thing you see in Vietnam, you see it in Iran.

Thibault: Can I throw something in, just to see if it clicks? Is nationalism the antithesis of empire?

Goodman: I think it would be either a prelude to empire, or a reversion from it.

Thibault: So, as long as nationalism is a strong force you can’t have empires in the classic sense.

Rahe: We never did agree on a definition of empire, but I think we may agree that there are stages of empire, in the sense that the ancient empires seemed to lack the universal religious claim of the medieval empires. If one moves to a third stage, progress becomes the justification for empire. The question then is whether, since World War II, we have entered a fourth stage.

I’m not sure we would reach agreement on the character of the fourth stage. Is there room for empire within the fourth stage? Is there room for loose hegemony in the fourth stage—by which I mean the existence of client-states. Or is our future one in which empires no longer exist? Or there might be a future not unlike that envisaged by George Orwell, in which you have a number of regional empires emerging and in conflict, and likely to remain in conflict.

Kargon: I see this period as a period of the passing of empire as we have known it. And despite the capacity of people to inflict great suffering on other people, I think the passing of empire is still a good thing. I think there will still be areas of hegemony, spheres of influence. But I think we’ll see much more evidence of the limitations of power.

Cureton: Doesn’t that suggest the decline in power of both ends of the spectrum, both empire and nationalism? You’ve talked about national entities being less able to control their destinies because other nations get in the way more.

Rahe: I think radical nationalism today requires socialism: which is to say you must nationalize the economy, or else be penetrated by the economic structures of outside powers.

Thibault: But do you think it will be successful, or is it simply a flailing of one’s arms in front of an onrushing train?

Rahe: The Soviets have done it very successfully, I think. The Nazis did it rather successfully.

Goodman: I think we have to distinguish between recently and years ago, because the costs of cutting yourself off grow greater and greater. The Soviet Union may have done it successfully in 1917, but to the extent that they’re autarchic today, it’s costing them.

Diwan: I think nationalism has two phases. First, a phase when nationalism also becomes a struggle against empire. Nationalism becomes a vehicle to throw your yoke away.

But once you have achieved some form of national independence, then nationalism is not such a strong force. As I see it, more and more countries have become nationalistic in recent years simply because they were leaving colonial status. Once they become independent, by and large, they are joining other countries. Interdependence has become much more important.

Goodman: There were changes on the other end, too. If you look at the behavior of transnational corporations today, compared with 1970, they’re adapting much more efficiently to local situations, putting up much less rigid conditions.

Thibault: I think Romesh’s point is very well taken, because nationalism is not an historical constant. It’s a product of particular circumstances, and I wouldn’t be surprised to find our form of nationalism simply evolving into a union, or a similarity of outlook, among English-speaking peoples.

In the Falklands, for instance, I would posit that one thing tilting us in favor of the British was language. Because with that strong link of language, we also have similarity in political institutions.
If you look at America, we fear—not global involvement—but rather the corruption that seems to come with kingship. We do not wish to rule.

Goodman: If instead of England and Argentina, those two powers were France and India, I bet we’d side with France.

Thibault: Now wait a second, I think you’re muddying the waters. Let’s use France and Argentina.

Goodman: No, India’s political language is English, and I want the developing nation speaking English.

Hancock: I think he’s right. We would feel a greater commonality with France than with India, which we perceive as exotic.

Goodman: You see, it’s the developed versus the developing, North/South. That is a more important dimension than English/non-English speaking.

Rahe: How about cuisine?

Goodman: Not to say that English isn’t important—and North/South is a variable in itself.

Vlahos: No, wait, wait. I think you have a point. The point I want to add, though, is that there’s a smaller system that America could retreat to, that in my monograph I call Anglo-Oceania. Which is exactly the language bond. It’s got 12 million square miles of land, and it takes in Australia, Britain, the U.S., Canada, and New Zealand. They could create a quintilateral nuclear force, even a formal federation, which could possibly survive in a chaotic world. I think that what we’re seeing in the Falklands is the very beginning of that kind of cultural fallback.

Thibault: Look at what France is doing with its former empire. To whom are those Saharan nations looking nowadays? Right back to France. That’s certainly what the British Commonwealth hopes for, but I don’t think it’s working very well.

Rahe: One thing that’s worth throwing in on this nationalism issue: None of us at this table is really a citizen of an ordinary nation. The United States is a very peculiar place because it draws people from many nations, and to the extent that the so-called melting pot works, it denationalizes people.

Kargon: We seem never to have developed the notion of an American by blood.

Thibault: An American by bluejeans!

Kargon: By being here, we become Americans. A guy steps off a boat—he’s already an American. This is unique in, I think it’s unique in the world.

Cureton: Does any of this suggest that the United States has—if you’ll forgive me—any kind of special mission as a midwife in the emergence...?

Vlahos: I think that we used to, in a very low-key way. We always felt a sense of mission to be a model for other nations, and we opened our doors to others. And I think as a model for what society should be we still have great faith in ourselves, that this is the best place to be, that our model is best. We offer this to anyone to take or reject, and they take.

Rahe: Some do.

Goodman: I think we’re being very ethnocentric. For one thing, the United States did have a hell of a proselytizing period, building outposts like Alaska and Hawaii and the Philippines.

Vlahos: No, no, no, no, no. America has always seen itself as a sanctuary and a refuge. But it took us a long time before we got ourselves sorted out, and a longer time before we thought we’d offer it to the rest of the world. Only through the trauma of World War II, when our very existence was threatened, were we finally brought face to face with the fact that rather than having Britain as a buffer, we had to take upon ourselves this mantle of leadership. We did it only for a short period of time.

Goodman: That’s the ideology. There’s a Uruguayan philosopher named Rodó whose most famous advice is to Domingo Faustino Sarmiento, the Argentine president. He said, “To govern is to populate.”

Vlahos: Trade didn’t follow the flag in the U.S. The flag followed the molecular movement of individuals across—

Goodman: That’s the point. To govern is to populate.

Rahe: Yes, but we’re not colonizing now. We are not exporting Americans to take over places like Hawaii.

Goodman: People would argue that we don’t have to do that anymore, that transnational corporations, or whatever other institutions developed, do that work much more efficiently.

Kargon: In what way are these transnational corporations American? They’re not.
Rahe: They're culturally American.

Vlahos: —agents of our culture—

Goodman: Not exactly. I would argue that we have a new kind of thing going on in the world, not necessarily because America is unique—which it is—but because these complex corporations have evolved. They bring a new kind of ideology. I would say, a somewhat adulterated form of loyalties—

Vlahos: I agree with you in one sense, that the elite members of a lot of Old World countries have entered the United States and are developing a transnational sense. The momentum of the world, though, is with the traditional types, people who heart and soul are identified with indigenous groupings.

Hancock: Would you all say the world is groping for different ways of satisfying—I mean, what did an empire do? It gave you stability, it gave you something to believe in, it gave you military and economic protection—

Goodman: That depends on what side of the fence you're talking about. It gives you something to fear, something to be oppressed by, something to lose money to, and it strips you of your sense of self-worth. If you're not part of the group, you're no one. You're untermensch.

Diwan: She's right, though. The world is groping towards some sort of a—I wouldn't use the word empire—some way of solving interdependence problems which become very complex, and I think some sense of the world government is there already. The problem of the world unit today is that it lacks two basic elements. One, it has no taxing or interfunding capacity. The second is, it doesn't have any power.

Vlahos: Right.

Diwan: Think of the Law of the Sea, which has just been passed—except the U.S. is no longer a participant. If this organization comes into being, it will provide international income capacity, which is quite a step forward. Maybe the next president will go along with it because the Carter administration was agreeable to the Law of the Sea.

And even police functions of the world government are slowly coming into being. In various places, the U.N. has a peace-keeping force.

Kargon: I was going to ask—Do you think the world really is becoming more homogeneous, that increasing communication and intereconomic linkages really are making a world which—

maybe there are reverses—but which in a sense is advancing slowly toward . . . moral homogeneity, let's call it.

Diwan: The world is certainly becoming more homogeneous. You can travel in different parts of the world without feeling lost. That is true.

Cureton: Are we agreed that it's a good thing?

Kargon: It makes empire obsolete.

Vlahos: Or the wave of the future. If world government is to be the universal empire of the future, with all of its attendant ills, as well as its bonuses—

Rahe: The question is, can world government be established short of world tyranny?

Vlahos: That's what I'm wondering.

Cureton: Let me raise a question. Louis, you took a stab earlier today at a specific policy implication, that is, the focus on consultative process. Does our discussion hold any other implications for U.S. policy-makers today?

Goodman: There are four areas that I can think of. One is to be consultative in international decision-making. The second is taking policy steps that make it more and more difficult to get into nuclear conflagrations. The third is taking steps to help limit population growth. Each of these is a kind of cultural imperialism, but I think that population limitation is an important one. And the fourth is encouraging food production research.

I think if these problems were alleviated, we'd have a better environment in which to build a world order.

Rahe: I think your analysis leaves something out, as all economic analysis does, because it assumes that if we do away with poverty, things will be just fine and people will be our friends.

Goodman: I didn't say that was the whole answer. But I don't think beliefs about religion or nationalism or anything else, no matter how deeply held, make solutions impossible. Working to solutions sure is a tough task, but it's not impossible.

Rahe: I very much doubt that, because there is the matter of honor. And honor is tied up with nationalism and sometimes with religion. For example, by the standards of India, north-
As American power declines, traditional regional hostilities will be reasserted.

ern Ireland is prosperous. Yet you have a continuing civil war between two political communities that speak the same lan-

guage, but seem to be grouped by religion. Lebanon is a very prosperous place, by the standards of the part of the world that it's in, and yet they're at each other's throats.

**Cureton:** So, Paul, what do you see as the implication for American policy? What's honor in an American context?

**Rahe:** Well, I think because we lack a civil religion, and because our sense of being a people is based on principles, we are almost ecumenical in those principles. For example, the Declaration of Independence makes a statement not about the rights of Americans, but about the inalienable rights of human beings as human beings.

That makes us very peculiar. We happen to live in a sea of people who do not share that ethos, although we tend to think they do.

**Kargon:** I want to get back to the question of policy that we started to address. From ideas we've been kicking around to­

day, what policy postures do you see for the United States?

**Vlahos:** We've first got to decide where the world's going. If you look at the world as beginning to devolve, and our own control over the world political system as becoming more and more attenuous, then I think it behooves the United States to be as conciliatory and consultative as possible, but to start creating some kind of fallback position. If you have a more optimistic view, then you can take policies on a different level.

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**Kargon:** Any policy program we embark on will have to be consonant with what we might call our national character, which is a complex of politics and culture and economics. I think we do have a secular religion in the United States, and you can see it beginning in the early 19th century—and that secular religion, since we had no past, is the conviction that we have a future. We are probably the most future-oriented country in the world. I have a suspicion that what we've lost is our future. Somehow we don't believe we have a future in the same sense that we used to.

**Vlahos:** That future was the regeneration of the world, ultimately.

**Kargon:** Yes. That was our Messianic thing: We believed that we were a sort of chosen nation. And I think we're going to have to go with that and make the best of it. We're going to have to recapture the future, become a kind of magnet cul-

ture. Put ourselves forward as an example—not by force, but by example—by putting our own house in order.

**Thibault:** Isn't that really what we've always done? We grouse, but the grousing is essential to doing it. Remember in the late '50s, how the Doomsday talk was much worse, right? And vulnerability was felt even more strongly then. And that was Kennedy's message: that we are not weak. That we will help.

**Kargon:** What's happened since Vietnam is that we've de­

clined economically. We've abandoned world leadership in certain aspects of education, and certainly our relative eco­
nomic position has declined.

**Goodman:** And our charismatic leaders have been killed.

**Kargon:** I go along with Brecht: Pity the country that needs a charismatic leader.

**Vlahos:** You're missing the central point. Putting the house in order has to have a higher romantic or emotive vision under which all is subsumed. And this is where the charismatic leader comes in—maybe we don't need him, but we need somebody or some school or some group to come along that will articulate not just the needs, but the vision.

**Diwan:** I think that's what we need, really. Some sort of respect and optimism for the future.

**Cureton:** But isn't this in some perverse and easily misunder­

stood way a kind of new imperial policy?

**Kargon:** The characteristic of empire is force, and I'm not talking about force. If they want to be like us, without our forcing them, why is that bad?

**Hancock:** What nation has the proverb that says, power lasts ten years, influence lasts a century?

**Kargon:** I think power is an illusion.

**Rahe:** I'm much more concerned with the fallback position, and it seems to me it has to be economic nationalism. Those with influence over the economy should foster our capacity to rely on our own resources. We should foster those institutions and skills and capacities that would allow us to fall back on, for example, coal to keep heavy industry running, if we did not have access to oil. We have a withering steel industry, withering coal industry—
Thibault: Right. The old-line industry's just passing away.

Rahe: And I'm opposed to the notion of us as a technological giant in an international economic order where we do grain and micro-chips and get our iron and steel from Korea. I'm worried about that.

Goodman: You don't put all your eggs in one basket, and we do need to figure out which industries we want to foster—but neither can we produce everything.

Diwan: In the last analysis, putting your house in order comes down to developing an economic base rather than a stronger military base, which is the difficult part. A serious problem is that we are losing our industrial infrastructure, and the investment required is unbelievably large. We may not have those resources. Very soon, in five to seven years, the crisis will come, and we may have to choose between our lifestyle and maintaining our world position. They estimate that 70 trillion dollars is the investment needed just to maintain the existing bridges, highways, tracks—that's a huge investment.

Thibault: Well, perhaps we'll let the elderly starve.

Diwan: I'm not convinced we need to make those choices. We can do everything we need to do—it's just that we spend too much on defense. If you were to look at all the objectives of national defense—A, security, B, the security of our allies, C, influence in various countries, and D, you can add anything else you want—the expenditures we are incurring are far, far larger than are necessary to satisfy our objectives.

Vlahos: Not by the standards of the rest of the world.

Diwan: Why should we worry what the rest of the world thinks?

Vlahos: Nations spend as much as they can on defense not only because they live in an apparently chaotic and insecure world, but because it’s very difficult to spend what you consider enough on defense. You’re always putting in those extra marginal bucks, just in case. That’s why a lot of very poor countries who can’t afford it at all, are killing themselves, because that extra margin of expenditure may be the margin that nets them security in the future.

Goodman: If we’re engaging in futuristic scenarios, there’s the theory that one reason for this focus on defense is to create a world economy in which the only way to stimulate your economy is through defense expenditures. Since Russia and the United States are the only nations big enough to make that work, this would make the whole rest of the world dependent on the United States and Russia.

Rahe: Nevertheless, if you look at current military expenditures, they are meant to serve the transnational economic order. Most of the money that the Reagan administration proposes putting into the military is being put into the Navy, and the function of the Navy is freedom of the seas.

Thibault: What do you vote for, lad?

Goodman: Survivalism.

Vlahos: I’m getting pretty pessimistic. This endless litany—not litany, but the frequent announcement of American decline makes me wonder whether the post-1945, 1950 world was in fact the high stage of the West. Then we came closest to creating not simply an imposed ecumenical order but the one that was accepted. I wonder whether we’re facing a period of collapse and crisis, in which regional empires will become the political canvas of the future, if not the economic structure.

I even wonder if it’s no longer possible for the U.S. to avoid the true imperial mantle. I don’t think America has been an empire in the classic sense, but rather the leader of a worldwide federation. But now that we are in some sense declining, that very loss of ascendancy may lead us to formalize our structures, so that we go into a period of real empire.

Kargon: I think we are coming to see that the urge to rule is a snare and a delusion that’s more trouble than it’s worth. We’re not going to be the only ones to come to that conclusion in the next half-century or so.

Rahe: I began with Thucydides and I’m going to end with Thucydides. This is another passage from the Melian Dialogue, where the Athenians address the Melians. They say, “Hope, that comforter in danger! If one already has solid advantages to fall back upon, one can indulge in hope. It may do harm, but it will not destroy one. “Hope is by nature an expensive commodity, and those who are risking their all on one cast find out what it means only when they are already ruined. . . . Do not let this happen to you, you who are weak and whose fate depends on a single movement of the scale, and do not be like those people who, as so commonly happens, miss the chance of saving themselves in a human and practical way, and when every clear and distinct hope has left them in their adversity, turn to what is blind and vague, to prophecies and oracles and such things, which by encouraging hope lead men to ruin.”
Humans<->Computers

Just before the second space shuttle mission was postponed last fall, project technicians could be overheard on network television complaining, "We just can't get number one to talk to number four!"

Although the computer revolution is no longer new, there is still a mystique attached to these machines; we tend to endow them with human characteristics.

"Most people still don't grasp what a computer can and cannot do," says Dr. Linnda Caporael, assistant professor of psychology at RPI. "No one has been able to document what goes on in people's minds when they are thinking of computers or are working with them."

Caporael, a social psychologist, has joined forces with Dr. Sandra Newsome, a cognitive psychologist and assistant professor at RPI, to study human-computer interaction. Their subjects for this project are 50 to 60 RPI freshmen entering in 1981 and 1982. "This way," explains Caporael, "we will be able to follow the development of two classes during their four years at RPI."

Some questions the researchers hope to answer: How does programming change our methods of problem-solving? Does learning a computer language tend to influence how we approach other kinds of problems? Do computers encourage social isolation, or do they actually help shy but computer-wise students to socialize? Does a student understand a friend's program better than the program of someone from outside his or her social network?

Observes Caporael: "Doing this kind of work in the RPI environment is like looking into the future. In terms of computer technology and its impacts on psychological and social issues, RPI is well ahead of most of the outside world. And we expect that these impacts will spread to the rest of the culture in the decades to come."

Art Sleuths

A mysterious oil painting—damaged, unsigned and undated—has art experts puzzled. Is it or is it not the work of a 17th-century master? One tiny stroke of red paint in the painting could hold the answer.

Using new analytical techniques, RPI Professors Fred Billmeyer and Ivor Preiss can help identify artifacts by unveiling hidden characteristics. Drs. Billmeyer and Preiss have perfected non-invasive procedures to pinpoint the chemical compositions of paints (both acrylic and oils), dyes, pigments and other components of such artifacts. Their methods are also useful in identifying key inorganic elements in bronzes, clays and glazes.

Billmeyer identifies the organic components of the red paint using a technique called reflectance curve analysis. First, he projects colored light onto areas as small as one to two millimeters in diameter. Using a spectrometer, he measures the curve of light reflected from the object. This curved wavelength is the signature of the organic pigment or dye in the paint.

Should this technique not work, Billmeyer could turn to a more sensitive method called solution spectrometry. He would dissolve a paint flake in selected solvents, then measure the solution on a visible range spectrometer. The resulting curve would be compared to the curves in a Reference Curve Library, an RPI-developed computerized compilation of 500 pigment and dye names. The library would help him identify the organic com-
ponents from a sample of pigment weighing less than one milligram.

After Billmeyer finds that the stroke of red paint contains the organic material alizarine crimson, Preiss supplements the information by identifying the paint’s inorganic components. Directing radiation at small areas of the painting, Preiss excites atoms of the red paint’s inorganic elements, causing them to emit X-rays in characteristic patterns. These patterns not only help Preiss identify the inorganic elements, but they also help him determine the relative amount of each element.

The X-ray pattern emitted from the mysterious painting may indicate that the artist used iron oxide as a colorant.

Such complete information provided by the two scientists could give art historians and conservators just what they need to be able to attribute the painting to a particular 17th-century artist known to have used paints of this composition.

Poison-Proof Plants

Traditionally, research into weed-killers has focused on developing poisons that are safe to crops but deadly to weeds. Dr. Carl McDaniel, plant research scientist at RPI, attacks the problem differently: “Instead of creating a poison to fit the plant,” he asks, “why not develop a plant that will grow in the presence of an acceptable poison?”

Following this reasoning, McDaniel and graduate assistant Susan Singer are developing tobacco plants resistant to two herbicides, glyphosate and amitrole.

He adds, “My ultimate goal is to develop an herbicide-resistant plant to match an environmentally safe poison. If that can be accomplished then society will have choices as to which herbicide it wants to use.”

McDaniel grows the plants from cells in flasks and petri dishes, using a method that is substantially less expensive than growing plants in the field and that allows him to search among billions of cells for the rare mutant capable of flourishing in the presence of a herbicide toxic to most plants.

After leaf cells or pith tissue are left to divide in petri dishes, he places the resulting “calli” into flasks, agitating them, and adding a toxic concentration to the suspension of growing cells. When he pours the suspension back into petri dishes, he adds another toxic dose of the herbicide. A month or more later, calli may reappear in some of the petri dishes. To confirm that the calli are indeed resistant to the poison, McDaniel applies more herbicide. Then the calli are regenerated into whole plants.

“As a final test, we apply the herbicide to the mature plant to see if it will survive and produce second-generation plants with an inherited resistance,” says McDaniel. “We’ve had some encouraging results.”

Molecular Clouds

RPI’s Dr. Marc Kutner made international headlines when the National Science Foundation announced his discovery of molecular clouds outside the solar circle. The discovery provides new insights into the structure of our galaxy and how the stars within it are formed.

The discovery was made while Kutner, an associate professor of physics, and graduate student Kathryn Mead were calibrating the 36-foot radio telescope at Kitt Peak, Arizona. Although the telescope was aimed at a supposedly empty region of space for the calibration, Kutner and Mead observed a cloud of molecular hydrogen, the raw material of stars.

The observation was puzzling because such molecular clouds were previously thought to exist mostly inside the solar circle—that region of space between the sun’s orbit and the galactic center.

“We have since found that, in fact, the outer part of the galaxy seems to contain as many of these molecular clouds as does the inner part,” said Kutner, who reported his discovery at a meeting of the American Astronomical Society and in the November 1981 issue of The Astrophysical Journal Letters. “We have, in a sense, uncovered a piece of the galaxy that nobody knew existed before.”

When the discovery was announced to the general public, more than 100 newspapers and magazines across the nation picked up the story, as did several publications abroad.
An RPI Engineer Comes to the Rescue

As consumer advocate for Dade County, Florida
Walter Dartland '57 fights for the customers' rights.

By Michael Ross

Friends and well-wishers of Walter Dartland '57 compare his contributions to the cause of consumer protection in Dade County, Florida, to those of a Superman. In fact, not long ago they presented him with a cartoon Superman—armed with a rolled-up petition.

As far as Dade's consumers are concerned, and by objective standards as well, Dartland's accomplishments as consumer advocate for this densely populated county that includes the city of Miami have been nothing less than superhuman.

At first glance, Walter Dartland doesn't look like a Superman. In fact, with his steel-rimmed glasses and dressed in a conservative suit and tie, he looks rather like Clark Kent. But faced with a situation in which considerable numbers of Florida's citizens maintain that a manufacturer or service is taking advantage of them, Walter Dartland wields clout that is very formidable. Dartland owes his effectiveness, however, not to superhuman powers, but to a personal commitment to hard work, an ability to innovate and a strong sense of civic responsibility.

How did he become interested in consumer activism? "For as long as I can remember," he replies, "I have been attracted to community issues. Questions such as 'Do all the trees in the neighborhood have to be cut down to provide access for power lines?' and 'Why are utility rates rarely adjusted downward?' have always intrigued me."

After graduating from RPI, Dartland spent two years in the U.S. Marine Corps and then attended the University of Louvain in Belgium where he studied philosophy on a Fulbright Scholarship. "I needed to round out the humanities side of my education," he explains. He then attended the University of Michigan Law School, graduating in 1964, after which he started in the private practice of law in Houghton, Michigan. He was elected County District Attorney in 1964 and served in that capacity for four years.

In 1970, Dartland and his wife, Diana, in search of a warm climate, moved to Florida, where he opened a private law practice in Palm Beach County. In 1975, Dade County, with 29 different companies supplying water to its citizens, found it advantageous to establish an office of consumer advocacy, to represent consumers in matters of water quality and rate cases. Dartland drafted the ordinance that created the consumer advocacy role.

He points with pride to the major achievements in his public advocacy career. The most famous case, in what might be called the automotive area, involved
Dartland teaches at the University of Miami.

Customers who sustained damages from the Florida Telephone Company proposed to the Florida public service commission of local telephone service, but the courts ruled against the request, 5-0. Dartland affirms, "The expertise of other RPI graduates in the area helps also."

Besides his office responsibilities, Dartland teaches at the University of Miami Law School and Florida International University. In recognition of his achievements as a consumer advocate, he was recently nominated to the Consumers Union, the organization that publishes Consumer Reports magazine.

The engineering I learned at RPI gives me a grasp of the scientific and engineering aspect of cases and situations—the chemistry of rust, for example—and helps me understand industry's side of issues," Dartland affirms. "The expertise of other RPI graduates in the area helps also."

In addition to hard work and patience, what's the most important quality a consumer advocate can possess? Dartland smiles. "A lot of tenacity doesn't hurt," he says.

An Advocate for RPI

Walter Dartland is the father of three children. Mark, the eldest, is a student at Stetson University in Florida. Dottie, 18, will enter Mount Holyoke this fall. Christopher is in the tenth grade at Palmetto High School, academically one of the top secondary schools in Florida. Christopher has an interest in mechanics, and his father speaks proudly but guardedly about the possibility of his youngest son attending RPI.

As a matter of fact, for the last five years, Walter Dartland has helped recruit Florida high school graduates for RPI as part of his activities in the Rensselaer Alumni Association's South Florida club, which includes Dade, Broward and Palm Beach counties. This is at a time when the Institute is seeking to increase the geographic diversity of its student body.

"The programs RPI has instituted over the last five years make us increasingly competitive with other top technological universities for attracting these outstanding students," Dartland says.

"Recruiting for RPI makes you appreciate the importance of student aid. If, let's say, there is a stand-off between RPI and MIT for a top student, the size and nature of the student aid package offered often will make the difference. As tuition and fees rise in response to inflation, student aid becomes more and more important for maintaining excellence."
Eyes on the Skies

Five hundred or so astronomers from all over the country converged on RPI June 7–9, giving papers and exchanging tips at the semiannual meeting of the American Astronomical Society. Thomsen Hall in the Communications Center was temporarily transformed into a mélange of colorful textbook displays, refreshment tables and people sporting nametags.

Along one wall was a particularly interesting photographic essay. Upon close inspection it was apparent that the essay was, in fact, three collage strips of over 650 small photographs. Labeled “The Milky Way,” it was pieced together to form a 360-degree sweep. One of its creators, Dr. Theodore Gull of the Goddard Space Flight Center in Greenbelt, Maryland was there to explain.

“Imagine you’re in a theatre-in-the-round,” he said, “and these strips surround you.” The purpose of having three different renditions of the complete circuit of the Milky Way, he said, was to bring out different sets of emission lines, one for each of three different elements.

He explained that the three strips showed ionized sulfur emissions, ionized hydrogen emissions, and doubly ionized oxygen emissions, respectively. He then pointed out a dark spot, surrounded by a bubble of other speckles. “Stars have very high winds—winds that travel at up to thousands of kilometers per second. We believe these winds, as well as, perhaps, ultraviolet radiation, cause stars to disperse and these bubbles to form.”

The 650 small photographs took him over two years to complete, he said. Some, taken from the Cerro Telolo observatory in Chile, enabled him to capture the skies in the Southern Hemisphere. Others were taken from Kitt Peak in Arizona.

He walked down to another end of his mosaic and pointed out a “runaway.” The luminescent wanderer appeared to be pushing material out of its path as it traveled, “much like an interstellar motor-boat,” Dr. Gull explained. “When two stars form—and they usually form in binary—one explodes and the remaining one is flung out, creating this motorboat effect.”

The display showed other interstellar events as well including a previously undiscovered supernova remnant in the Cygnus constellation, and filamentary gas activity.

“The beauty of this,” he said, is that it cost relatively little—a couple of thousand dollars—to put together, and would be fairly easy for an amateur astronomer to duplicate. “It’s not an in-depth analysis of our galaxy, but it is a glance back at a forest, a glance that ignores the trees.”

RPI’s Dr. Marc Kutner, conference host, said that at least a dozen alumni came back to RPI from their own institutions. The conference, he said, “gave us a chance to show off our campus and our equipment, as well as our growing astrophysical program.”

A Sign of the Times

The results of RPI’s student elections last spring say something about Rensselaer today, especially the women studying here. So, with the understanding that the voting classes—’83, ’84 and ’85—are collectively 26 percent female, consider that:

Of three class presidents elected, two are women. Of vice presidents elected, all are women. Of 48 students voted to positions on the Senate, the Independent Council and the Class Council, more than a third—37 percent actually—are women.

The two highest student offices con-
continue to be held by men: Jim LaPosta '83 of Troy is the Grand Marshal; Paul Scarbrough '83 of Ridley Park, Pennsylvania, is President of the Union.

Oh, another note: the Army ROTC at RPI named its outstanding cadet for 1981-82. She is Laurie Warren of Honeoye Falls, New York, who graduated in May with a degree in mathematics. It was not her first major ROTC recognition. A year ago, at the ROTC advance camp in Fort Bragg, North Carolina she earned an overall leadership and performance ranking of sixth—out of 3,420 participating cadets.

Reconstructive Surgery on an Old Friend

The high-ceilinged, oak-paneled Trustees Room of the Pittsburgh Building is undergoing a facelift. The place where faculty and administrators often met with the president, where generations of trustees charted the Institute's future, is becoming six offices, a conference room and a reception room.

In recent years, officials have tended to meet in conference rooms in the Jonsson Engineering Center or Folsom Library. As a result, the Trustees Room has often been left unused. The trend for meetings to be held on the hill seemed inevitable, and space in the Pittsburgh Building was at a premium. Thus the decision to renovate.

Bill Mumford, the foreman on the project, explained that despite architectural updating, the new area will still look like part of the stately old Pittsburgh Building. "We took pains to save the old trim—it's all oak. Such craftsmanship is difficult to find today at any price." Ron Waite, RPI's project engineer, said that the area will, however, be brought up to the '80s with new wiring, air conditioning and computer cabling for terminals.

By the way, the Pittsburgh Building was built in 1910 with gifts from Pittsburgh alumni. It was designed by architect William Clyde Wilkins '79 (1879, that is).

The Voting Booth of Tomorrow

Someday we may all be casting our political fates—with our votes—via computer. The voting system of the future could end controversies like ballot-box stuffing and incorrect tabulation.

RPI saw this future begin to unfold this spring in what were apparently the first computerized, campus-wide student elections in the country.

About 3,000 students voted for their favorite student government candidates, using 36 of the campus's computer terminals. Poll-sitters sat (reasonably enough) to assist voters during the April primary general elections.

Each vote took about three minutes—no faster than the traditional way of voting. The system's advantages, though, included savings in tabulating time, paper and errors. In fact, the vote tallying itself was practically instantaneous.

The four students who designed the system are members of RPI's student chapter of the Association for Computing Machinery (ACM). They color-coded the terminal keys needed for voting so the procedure would be clearer for the few students who knew little about using a computer terminal. Even color-blind students were at no disadvantage, cued by special lettering on the color-coded keys.

Michael Peirce, chairman of ACM at RPI, was chairman of the voting project. Another student involved in the project, Ed Hastings, said that the four designers spent seven days and 15 hours sitting at terminals—this in addition to the planning and writing.
The Years of Houston and Hemke

by V. Lawrence Parsegian
Rensselaer Professor Emeritus

The recent celebration of the successful $52,000,000 Rensselaer Campaign follows a very impressive list of building achievements: the Jonsson Engineering Center, the new approach to the campus, the Folsom Library, the Cogswell Laboratory, the Communications Center. The campus is alive with activities of many kinds. With George Low at the helm, the forward steps are likely to become almost routine to the students and faculty who now enjoy these facilities.

But for those of us who have lived some decades with Rensselaer, each change is still exciting. Each new development arouses memories of the old Rensselaer, and of the early transitions that paved the way for the successes that were to come. Undoubtedly the most difficult transitions were brought about during the presidency of Livingston W. Houston, whose right arm was Dean of Faculty Paul Hemke.

Their problem was one of redirection. RPI's contributions to the war effort were limited to providing training for military personnel. The vast research and technological programs that produced radar and the nuclear age largely bypassed the Institute. Industrial productivity and aeronautics associated with the war had also achieved vastly greater dimensions and complexity, all of which demanded reassessment and redirection for the character and role that RPI was to assume for the decades ahead.

Enter Livingston W. Houston, an alumnus who became executive director of RPI in 1943 and president in 1944. Although his experience was more in business than academics, Houston was ably supported by Dr. Matthew Hunter on the technical side, by Dr. Ray Palmer Baker, whose vision encompassed industrial and humanities interests, and by Dr. Hemke, who replaced the retiring Dr. Hunter as dean of the faculty in 1949.

Then began the earnest and difficult task of reorienting RPI toward what soon was to be called a technological university. The transition was far from easy, but before they were through, RPI achieved it.

My own association with RPI came in the spring of 1954. I had been heading the Research Division of the New York operations office of the U.S. Atomic Energy Commission for some years, working mostly with universities. It was time to move on to avoid becoming a fixture in government, and education seemed to be the most challenging area for my future. Three RPI people had heard of my intentions and then came a telephone call from Paul Hemke inviting me to visit him.

It was quite a visit. As was his custom, Paul went straight to the point. Faculty committees and Institute trustees had determined that the time had come for RPI to respond to post-war demands. Some departmental changes had taken place, but much remained to be done. Only recently physics had been taken from under the electrical department, and general studies from under the biology department. In 1953 the 22 departments were divided into four groups: engineering, science, general studies and architecture, each headed by a chairman. Engineering was by far the largest, about 83 percent of the whole school's enrollment. For reasons that were soon explained, Paul had retained its chairmanship for himself until an "outsider" could be brought in for the position. It was into this position that I was being invited to come as a candidate.

Paul proceeded to detail the changes that they hoped for. Too few of the faculty members had doctoral level preparation, and many were Rensselaer graduates without outside experience. Some of the courses were being taught at levels comparable to technical institutes. All this threatened the accreditation of RPI.

The research activities were limited to the work of Dr. Paul Harteck in chemistry and to some welding research in the metallurgy department. Research and graduate study had to be increased. There was a need to move into the new age of nuclear science and technology. But these changes were not likely to come about without substantial addition of faculty with research experience.

There was another obstacle: several of the engineering heads were determined to resist the proposed changes, their arguments being that RPI's reputation had been made in undergraduate engineering education, and that diverting to research and graduate study would be bad for its reputation. Nor was there much sympathy for the idea that the science and humanities content of the engineering curriculum needed strengthening at the expense of time for conventional engineering courses.

There was also the problem that four of the engineering department heads wanted to become chairman of the engineering group, and the appointment of an "outsider" would be far from welcome. Paul went on with these details in his straightforward manner, and I remember how his face became tense and discouraged with the telling. But he brightened up when, on the way to the airport, I surprised him by expressing interest in the position. Would I be willing to come again in two weeks and seal the matter with President Houston? So it was that at a second meeting I accepted the appointment, to begin that September. In the meantime, the decision was kept secret.

The beginnings were not difficult. My
first official act was to authorize formation of a committee to study a new education concept called environmental engineering. Its strong proponent was Professor Ed Kilcawley of civil engineering, who had remarkable foresight on the changes coming to that field.

Under Howard Carragan, the physics department initiated a series of conferences on what the content of physics courses given to engineers ought to be. The science departments in general took their tasks more seriously under Clayton O. Dohrenwend as chairman. With encouragement from all the group chairmen, the faculty teaching general studies courses took steps under Ronald A.H. Mueller toward becoming the School of Humanities and Social Sciences. By 1956 the group chairmen had become deans of their schools.

The nuclear area presented a different challenge. My experience with the AEC had convinced me that the future of the nation’s nuclear energy industry demanded support from all science and engineering professions, rather than from a single new department. That concept also offered an approach for modernizing the existing curricula, if only we could persuade the departments to offer courses relevant to the nuclear field.

Dr. Hemke established an Institute-wide committee with the charge that each department consider what courses might be offered that had relationships to the nuclear program. The effort was surprisingly successful. There were proposed nuclear-related courses in heat transfer, reactor control, biological effects of radiation, chemistry, and more. The graduate office had to be persuaded to give the new courses with such limited faculty experience, but nearly every university in the nation was faced with the same bootstrap operation. Indeed, the atomic secrecy rules of the day tended to seriously restrict university participation in the nuclear field. But the pressures were on to release more classified information. My own role was to make several appearances before the Congressional Joint Committee on Atomic Energy and to debate with Admiral Lewis M. Strauss, chairman of the AEC. The debate was published in the Sunday magazine of The New York Times.

Then came an unusual gift from the Atomic Energy Commission. Rensselaer was selected to house a linear electron accelerator, at that time the most powerful accelerator in the world for pulsed neutron research. This installation, costing over $1,500,000 and involving operational support exceeding a half million dollars annually, became our first large research facility. This was followed with large grants of other facilities and equipment, including the sub-critical reactor and metallurgical research equipment. Contracts for these facilities involved financial risk for RPI for their maintenance, but “Liver” Houston was equal to the task. All he asked was that we visit him twice with each request.

Other tasks were not as easy. The announcement that only doctoral candidates would be considered for faculty appointments caused dismay, particularly since fewer RPI graduates would be encouraged to stay. Fortunately, it became possible for some to leave for positions in industry. The curricula required drastic revisions both to improve their content and to reduce the costs for teaching. Each engineering department had its own full curriculum for the four years, with very few courses in common, even for the freshman and sophomore years. There were questions such as: should civil engineering require four courses in surveying? (Earlier graduates recommended keeping the four courses.) Was it not time for the industrial department, a part of the engineering group, to raise its educational goals above time-study and sub-executive capabilities for graduates? The teaching of thermodynamics by the mechanical engineering department had become a scandal among the schools of that profession.

Paul encouraged each school to organize a council to deal with curriculum questions, but the responsibilities being new, it took some years until they could be exercised with success. As Hemke had suspected, the most serious problems came from some department heads who resisted changes. Their gradual exodus relieved the situation over time.

Salary limitations were severe, especially as we sought highly qualified new faculty. Replacing department heads was especially difficult at a time when technological skills were in short supply.

But the direction for the new Rensselaer was well set before they left their posts, Liver in 1958, and Paul Hemke in 1959. The combination of Houston as businessman with a vision for the future, and Hemke with his steadfast academic honesty, made possible the team effort that was needed to manage the transition. The Field House that bears Houston’s name scarcely does him full honor, but the greater pity is the passing of Paul and Edith Hemke with so little to remind us of their great contributions.
Run to Homecoming!
October 22–24