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ARE THERE OTHER WAYS?

Smoke is pouring from the windows of a vacant apartment on the third floor of a tenement. A passerby runs to the nearest fire alarm box and pulls the lever. Instantly a gong sounds in the fire station eight blocks away, the pattern of its ringing indicating the location of the alarm box. Firefighters jump into their heavy boots, don their helmets and canvas coats, and sprint aboard a pumper. Other men board the ladder truck sitting next to the pumper. In less than a minute after the sounding of the gong, the pumper and the truck are racing down the street toward the fire, their sirens wailing. Simultaneously, engines from other fire stations head toward the fire.

This is a scene that is repeated hundreds of times a year in every city. Except that internal combustion engines have replaced horses, this is the way fire departments have responded to fires for as long as anyone can remember. Seldom does the question arise : Is this the best way to respond?

It is the duty of every fire department to save lives and reduce injuries and property losses when fires occur. Our Nation's record in each of these areas needs vast improvement. Because human carelessness accounts for most fires, it is the public, not the fire departments, that must shoulder the

major burden of improving the Nation's fire record. Moreover, the vast majority of firefighters are volunteers who take grave risks without compensation, and they are giving all the time to their fire companies that their busy lives permit. Many fire departments, both paid and volunteer, are performing as well as their resources allow. Yet the Nation's fire record gives them no ground for complacency.

How can fire protection be improved? The easy answer is to augment the budgets of fire departments by 20, 30, or 40 percent so that more equipment can be bought and more firefighters hired. But it does not follow that increases of 20, 30, or 40 percent will be matched by like reductions in losses of life and property. Nor is it realistic, at a time when most local governments are financially squeezed, to speak in such terms.

The more realistic solution, for most communities, lies in careful assessment of what future investments (whether in men, equipment, or new programs) will maximize effectiveness, then a gradual shift of priorities toward the most cost-effective measures.

In such an assessment, basic questions need to be asked. Communities for which the scenario at

the beginning of this chapter is typical might ask : How many firefighters should respond to every single-alarm fire? How many pieces of equipment? (One study shows that less than 1 percent of all calls for service require greater effort than can be handled by two or three men and one fire engine.) On the other hand, does sophisticated and expensive equipment make a critical difference in the time it takes to suppress a fire? Does it save more lives and reduce property losses?

Paid fire departments typically spend most of their money and efforts on fire suppression; usually less than 5 percent of the budget is devoted to fire prevention. If part of the money spent on responding to the tenement fire had been spent instead on enforcing a tough fire prevention code, would the fire have occurred at all?

Other questions for communities to ask: How should firefighters be scheduled and deployed to ensure effectiveness and efficiency in fire department operations? When a volunteer or paid department has recruited all the members it can (or can afford), might help be found elsewhere? Should a town or small city have its own fire department? Or should it consolidate fire services with neighboring communities to avoid duplicating costs?

As communities undertake a basic reassessment of their fire services, they will have to find solutions best suited to their conditions. Some communities are at an early stage of growth where they can consider a number of alternatives to their present system of fire protection. Others have a heavy investment in their present system and can consider only a gradual shift of priorities. Solutions appropriate to large cities are not likely to work for small towns and bedroom communities.

For years fire chiefs and local governments have been listening to one outside voice telling them how to improve their fire services. That outside voice has been the score their community receives on the Grading Schedule of the Insurance Service Office (formerly of the American Insurance Association). The Grading Schedule was devised as a tool to assist in setting fire insurance rates for each community. It was not intended as a guide to fire department decisions, though circumstances have invited that kind of use. When a community's score has indicated that two or more fire engines would earn it a lower insurance rate,

local governments have felt pressed to buy them.

Now local administrators are beginning to recognize that their community's interests and those of the Grading Schedule do not necessarily coincide. The Grading Schedule, for example, is directed primarily toward preventing property losses. Deaths and injuries are also prevented as a result of this concern, but they are not the foremost consideration.

The Grading Schedule attaches only small importance to fire prevention. Ironically, few local governments expend as much on fire prevention as the Grading Schedule recommends. As we discuss in Chapters 11 and 16, more attention by fire departments to fire prevention--through fire safety education, building inspection, and approval of the fire protection features of building plans--would significantly reduce life and property losses and injuries from fires.

Fire departments can't be blamed for the ignorance and indifference that cause unsafe buildings to be built, that account for shoddy wiring and hazardous storage, that contribute to people's carelessness with matches and cigarettes, that explain the counterproductive behavior of people when a fire breaks out. But if the tides of ignorance and indifference are to be turned back, as surely they must, then fire departments are the natural place for the effort. As educators and enforcers, fire departments can do much to lessen the incidence and destructiveness of fire. The importance of the prevention role is underscored by the fact that fire departments can do so little when fires have gotten out of hand before they were notified. **The Commission recommends that local governments make fire prevention at least equal to suppression in the planning of fire department priorities.**

The Present System

One reason large cities and smaller communities are likely to arrive at very different solutions to enhancing fire protection is that they tend to have distinctly different fire departments. Most large cities have paid fire departments; many smaller communities are protected by volunteer departments.

About 1 million Americans serve as volunteer firefighters-five times the number of paid firefighters in the Nation. By one estimate, based on



The Nation's fire departments range from large metropolitan ones to small volunteer companies serving rural areas.

what it would cost to replace volunteers with paid firefighters, the Nation's volunteers are rendering a public service worth at least \$4.5 billion annually.

The huge diversity among volunteer fire departments makes generalization about them difficult. While some are strapped for manpower, others are endowed generously enough to send all of their active members to State firefighter school each year. Some serve isolated rural towns on budgets as low as \$3,500 a year. Others are called upon to serve a densely populated area of 50 square miles with substantial budgets and manpower. The hazards they protect against range from widely scattered houses and barns to heavily populated urban areas.

The striking aspect of volunteer departments, of course, is that they cost far less than paid departments. Then, too, volunteers are often people of standing in the community, are dependent on other citizens for contributions to the department, so that a broad segment of the community is sup-

portive of the department and conscious of the fire problem. On the other hand, volunteer departments often can afford only a low level of training and an inadequate dispatching and communications system. When a fire occurs, turnout can be uncertain. Their part-time members usually lack the experience of full-time firefighters. They also, in many cases, lack the manpower to do building inspection and other fire prevention work.

Since paid departments are generally larger, and have more men on duty more of the time than volunteer departments, they tend to be more complex organizations. In addition to having specialized companies, e.g., engine, ladder, snorkel, rescue-of from two to seven firemen, paid departments often have special staffs for training, fire prevention, communications, purchasing, community relations, and other purposes.

With such complexity, typical problems of bureaucracies emerge: lack of coordination among separate units, the subordination of central purpose---public service---to petty rules and red tape,

the stifling of innovation. Presiding over this tenuous alliance is the fire chief, who wears two hats—one, the administrative hat required to run the organization; the other, the helmet he dons when the alarm is sounded to lead his firefighters in the suppression of a fire. Since the fire chief usually has come up through the ranks, the second hat probably fits comfortably. It is the administrative duties of today's complex municipal department for which the chief is less likely to be adequately prepared.

Alternatives for the Future

Whether the fire department is volunteer or paid, fire prevention and protection can be improved in every community in the Nation. Few, if any, communities can say they have reduced life and property losses from fire to the extent humanly possible.

For most communities, improving the effectiveness of the fire service calls for gradual changes within the present structure: a shift of priorities toward fire prevention, better deployment systems, improved management practices. Other communities will want to consider a major shift from their present system. In the next few pages we explore some of the alternatives open to them.

Part volunteer, part paid. Communities that have grown in size or complexity beyond the capabilities of their volunteer fire departments need to consider a shift toward paid departments. Among the advantages of a paid department is the fact that, if it replaces several volunteer companies, it can ensure that fire protection resources are spread equitably in the community. One source of criticism, of course, is the increased cost of paid manpower. But the shift need only be partial. For example, many volunteer departments can summon adequate manpower during evening and nighttime hours but are hard pressed for manpower during daylight hours when volunteers are at their jobs. In such instances, it would make sense to have paid firefighters on duty during the daytime.

Auxiliary firefighters. An alternative source of supplemental manpower sometimes used is municipal employees who can be called away from their main jobs without serious detriment to the chief function they perform. Reliance on such personnel for first-alarm capability would certainly

be ill-advised. However, if adequately trained as firefighters, they can be a source of secondary manpower.

Womanpower. When a small Florida community organized a volunteer fire department several years ago, it faced the classic problem: The 15 male members were not available during the daytime. The solution: Nine wives took over the daytime obligations. They have responded to as many as six brush fires in a single day, and the fire chief describes the system as working "beautifully." In a suburb of Columbus, Ohio, wives are similarly organized as a daytime rescue squad.

Fire departments that face physically strenuous tasks day in and day out will understandably be reluctant to hire women as firefighters. But reluctance to hire women for less taxing duties, such as dispatching, ambulance-driving, and inspecting buildings, is harder to defend and, indeed, is likely to be challenged legally with increasing frequency in coming years. **The Commission recommends that communities train and utilize women for fire service duties.**

Police-fire consolidation. A small number of communities have consolidated, partially or fully, their police and fire departments. One recent source¹ lists 23 cities and towns with fully consolidated departments (usually called public safety departments), 10 with partial consolidation, and two with "selected area" consolidation—that is, confined to certain neighborhoods.

Of the cities with fully consolidated departments, 17 of the 23 are in communities with fewer than 10,000 residents. Generally they are affluent residential communities, lacking the hazards associated with aging urban centers or large industrial districts. They do not have the crime problems of urban areas; hence, the absence of patrolmen during a fire is less risky than it would be in larger cities.

The 23 communities all have some form of cooperative patrolmen or public safety officers—that is, men with some firefighting training who are primarily police officers, but who respond to fire alarms and provide various forms of assistance. In one city, for example, neighborhood patrols carry resuscitators and large fire extinguishers in their vehicles. Patrolmen are *not* called away from

¹Harry W. More, Jr., *The New Era of Public Safety*, Springfield, 111.: Charles C Thomas, 1970.

crime control if a fire occurs. In another, public safety units staffed by two firefighters, cross-trained as police officers, patrol an assigned area in station wagons equipped with firefighting equipment, first aid equipment, and protective clothing. Two additional firemen are assigned to each piece of equipment at the fire station; hence, total manning is four men per company. Ninety percent of the time the station wagon arrives first at fires in its district, and one-third of the time its patrolmen are able to handle the fire unassisted.

Consolidation appears to work in areas where

neither the crime problem nor the fire problem is serious. As either problem rises in seriousness, so does the potential for conflict of purposes, with the result that attention to one problem will be sacrificed to attention paid to the other. Indeed, the more serious is either problem the more important it is to have personnel specially suited for attacking the problem. Fighting fires and fighting criminals call for very different skills; they also call for men with very different motivations and very different assessments of the kinds of risks they are willing to take. That firemen and policemen

PROMETHEUS SCORNED



From colonial times down to the twentieth century, fire was a dreaded threat to the advancing American civilization. Fire wiped out farms; time and again, conflagrations leveled whole sections of towns and cities.

But citizens organized fire companies, and they fought back. Proud of their roles and the risks they took, volunteer companies became true fraternities of men. Often a community was served by several different companies, each trying to be the best in town—the strongest, fastest, shiniest. Rivalry sometimes led to brawls and even sabotage.

The shift to paid departments in the larger cities came only gradually. Boston established the first, after a great conflagration in 1679, but for the next 200 years separate volunteer companies survived in most cities.

With their strong fraternal traditions, the volunteer companies resisted change. They fought against relinquishing their place at the tow line in front of the hand pumper to a horse; they fought against efforts to reorganize the companies into a municipal organization,

But inevitably, change came to the fire services. Hand-drawn pumpers gave way to horse-drawn steamers, which gave way to gasoline engine pumpers. Coordinated municipal fire services were established. Fire laws were enacted to give some responsibility for fire control to the citizenry. Technology reduced the risk of major fires.

But the risks to firemen themselves have not diminished. They still push themselves to the outer edge of endurance—and sometimes beyond. Even with advances in technology, there still comes a moment when the fireman must turn away from the lashing tongues of fire. The struggle is still there, and it is still a heroic struggle.



One result of regional cooperation can be an improved dispatching system to reduce response time significantly.

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are different kinds of people is attested to by studies which find that firemen make much better paramedics.

Several other cautions are in order. While consolidation plans make valuable use of firefighters' non-emergency time, there are functions related to fire protection that deserve higher priority: fire prevention inspections, fire safety education, rescue and paramedic services among them. Moreover, no community can say with full assurance that its fire problem is small.²

An additional consideration : If firefighters also have law enforcement duties, they will be bad choices for conducting residential fire safety inspections. Suspicions about their true intentions will make them unwelcome in many homes.

Reduced services. An additional alternative for communities is to freeze suppression services of the fire department at the present level, while at the same time placing more of the future burden for fire protection on the residents of the communities. This is not as novel as it may sound. Many communities require buildings of a certain size or type of occupancy to have sprinkler systems, in whole or in part, and many require that major industrial plants have their own fire brigades. By spreading such requirements to other classes of buildings, communities can reduce fire losses without further taxing the capabilities of the fire department. In many countries, we might add, preventing destructive fire is regarded primarily as the responsibility of the property owner, not the fire department.

Private contracting. A further choice, laden with controversy, is to contract for fire services with a private firm. Many of the Nation's early fire companies were incorporated under State law and provided their services on a contract basis. Private contract companies exist in parts of Tennessee and Arizona.

Some city managers have been attracted to the idea of private contracting on the grounds that a private company is more likely to exhibit sound management practices, efficiency, and innovation

²Crescent City, Ill., learned this painful lesson in the summer of 1970. when a derailed tank car filled with propane gas tore open and burned. and six other tank cars exploded in a chain reaction, sometimes hurtling like rockets hundreds of feet. Despite the efforts of 250 firefighters and 58 pieces of apparatus, 64 people were injured, 24 living quarters were destroyed, and 90 percent of the business district was wiped out.

than an arm of the government. On the other hand, the pressures to make a profit run counter to the fundamental aims of the fire services---to save as many lives, and to reduce as many injuries and property losses, as possible. A community considering contract service must define its requirements and standards of performance very carefully. It must have continuing proof, through the company's records of performance, that community expectations are being met. (Once it has drawn a contract with adequate provisions, a community must face the possibility that no entrepreneur will come forward to assume the risks.)

Governmental contracting. Many communities have mutual-aid agreements with neighboring communities so that they work together to cope with major fires. A more formal banding together occurs when a community pays a neighboring or encompassing political jurisdiction to provide it fire protection. The Los Angeles County Fire Department serves 35 communities on this basis. Services provided range from paramedic teams to forest fire suppression. Communities benefit from the availability of equipment and specialized services that they could hardly afford on their own.

Regionalization. Contracts between governments are but one route to a very successful method of improving the fire services. Another route is through regionalization.

The experience of Great Britain with regionalization is instructive. During World War II, that country's fire services were nationalized for the sake of defense. After the war, the fire services were denationalized but, rather than being divided into the 1,500 jurisdictions that had existed before the war, they were consolidated into about 150 fire jurisdictions. Resources were pooled, and economic efficiency was gained through the elimination of duplicated services. In particular, the advantages cited of the British experience were:

- More efficient manning through the combining of small companies;
- Greater operational effectiveness through better manned companies, uniform fire suppression methods, direct control of response of all companies (rather than depending on mutual aid arrangements like those in many American communities), and the ability to concentrate manpower rapidly at major fires;

- Better communications;
- Better training facilities as a result of a larger tax base supporting them;
- More uniform regulatory code enforcement;
- Economies effected through large volume purchases and standardization of parts;
- Better recordkeeping with less total effort.

While regionalization has succeeded in some areas of the United States, it has been stoutly resisted in other areas. Fire departments, especially volunteer departments, have developed an esprit de corps and a pride in their achievements, and they are understandably reluctant to sacrifice the measure of autonomy that regionalization would require. Having raised, through donations, \$50,000 to buy a fire truck, they are reluctant to relinquish any control of it. Companies that have developed personnel and operational policies which they feel are superior to those of other companies in the region fear they might have to give them up for the sake of regional uniformity. Others argue that enlarged jurisdictions put control in the hands of people not familiar with local conditions, lessen civic interest in the fire services, and introduce morale problems as a result of less personal relationships in the larger organization. And some fear that regionalization would phase out some companies in the name of efficiency, thereby increasing response distances to fires in some areas.

With careful planning, however, fears can be abated and the real problems overcome. Furthermore, if the protection of the public is not first-rate, then the effort needs to be made. It behooves county governments, and municipal governments in which several independent fire companies still exist, to explore means of effecting regionalization of their fire services. At a minimum, such explorations should cover formal arrangements for mutual aid, especially during large fires; the sharing of management and of specialized functions, such as arson investigation and fire safety education; centralization of purchasing and training; uniformity in all important practices; standardization of reporting procedures; and the institution of an area-wide communications and dispatching system.

State governments have an obligation to promote regional approaches to fire protection. As it is now, many States have laws that hamper co-

operative arrangements among local jurisdictions. **The Commission recommends that laws which hamper cooperative arrangements among local fire jurisdictions be changed to remove the restrictions.**

Fire Protection Planning

Which, if any, of the foregoing alternatives is appropriate for a community will depend on its careful analysis of present conditions and directions of future growth.

Fire protection is only one of many community services. Not only must it compete for dollars with other municipal needs, such as the education system and the police department, but, in planning for future growth, the fire protection system must take into account the changes going on elsewhere in the community. For example, if a slum area is to be torn down and replaced with high-rise apartment buildings, that will change the fire protection needs of the area. Changes in zoning maps will also change the fire protection needs in different parts of the community.

To cope with future growth, local administrators are turning increasingly to the concept of *muster* planning of municipal functions. Such plans include an examination of existing programs, projections of future needs of the community, and a determination of methods to fill those needs. They seek the most cost-effective allocations of resources to help assure that the needs will be met.

A major section of a community general plan of land use should be a *Master Plan for Fire Protection.*, written chiefly by fire department managers. This plan should, first of all, be consistent with and reinforce the goals of the city's overall general plan. For example, it should plan its deployment of manpower and equipment according to the kind of growth, and the specific areas of growth, that the community foresees. It should set goals and priorities for the fire department. Not only is it important to set objectives in terms of lives and property to be saved, but also to decide allocations among fire prevention inspection, fire safety education, and fire suppression as the best way to accomplish the objectives.

Having established goals, the plan should seek to establish "management by objectives" within the fire department. This operates on the principle

that management is most effective when each person is aware of how his tasks fit into the overall goals and has committed himself to getting specific jobs done in a specified time.

Because fire departments exist in a real world where a variety of purposes must be served with a limited amount of money, it is important that every dollar be invested for maximum payoff. The fire protection master plan should not only seek to provide the maximum cost-benefit ratio for fire protection expenditures, but should also establish a framework for measuring the effectiveness of these expenditures.

Lastly, the plan should clarify the fire protection responsibility for other groups in the community, both governmental and private.

The Commission recommends that every local fire jurisdiction prepare a master plan designed to meet the community's present and future needs in fire protection, to serve as a basis for program budgeting, and to identify and implement the optimum cost-benefit solutions in fire protection. Wherever possible, this should be a regional jurisdiction embracing several political jurisdictions—for example, county-wide or larger in rural areas and metropolis-wide in urban areas. (In Chapter 4 we discuss the tools to carry out this program.) In other chapters we recommend Federal assistance, in the form of grants for equipment and training, to local fire departments to improve their reduction of fire losses.

Such assistance should be in response only to well-substantiated needs. Hence, **the Commission recommends that Federal grants for equipment and training be available only to those fire juris-**

dictions that operate from a federally approved master plan for fire protection.

The Commission recognizes that the planner who sets out in search of the most cost-effective solutions to his local fire problems is faced with scanty data on which to make such decisions. What is the difference in performance, if any, between a fire station that serves a 12-block radius and one that serves a six-block radius? How is performance affected by the addition or subtraction of one man on a pumper? What are the hazards most important to eliminate through building and fire prevention codes and enforcement?

There is a 'dearth of systematic studies of methods of fire protection. We have advocated that master plans include provisions for evaluating various approaches to fire protection, but until such time as evaluation can be made, master planning will be a very inexact approach to rationalizing fire protection. The need is not only for more systematic studies of methods of fire protection, but for a centralized office to collect and disseminate evaluation data, so that communities can learn from each other. **The Commission recommends that the proposed United States Fire Administration act as a coordinator of studies of fire protection methods and assist local jurisdictions in adapting findings to their fire protection planning.** In this endeavor the U.S. Fire Administration should work closely with other Federal agencies, such as the National Bureau of Standards, the Department of Agriculture, and with private fire protection groups such as the Joint Council of National Fire Service Organizations and the National Fire Protection Association.



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PLANNING FOR FIRE PROTECTION

Setting sights upon the future of fire protection in this Nation, as this Commission is charged to do, brings into focus a major need underlying many others: *Planning*.

Fire protection has been largely a local responsibility, and for good reasons it is destined to remain so. Each community has a set of conditions unique to itself, and a system of fire protection that works well for one community cannot be assumed to work equally well for other communities. To be adequate, the fire protection system must respond to local conditions, especially to *changing* conditions. Planning is the key: Without local-level planning, the system of fire protection is apt to be ill-suited to local needs and lag behind the changing needs of the community.

Excellent fire protection—for example, in the form of automatic extinguishing systems—lies within technical grasp, and certainly lies within the resources of most communities to provide. Even with considerable public support, this protection would require many years to accomplish. In the meantime, in every fire jurisdiction—whether a municipality, county, or region—standards aiming at a significant increase in fire protection must be set. Among the concepts to be defined:

- *Adequate level of fire protection.* The question of “adequacy” addresses itself not only to day-to-day normal needs, but to major contingencies that can be anticipated and to future needs as well. What is needed is a definition of “optimal” protection—in contrast to “minimal” protection, which fails to meet contingencies and future needs, and “maximal” protection, which is more than the community can afford.
- *Reasonable community costs.* Fire, both as threat and reality, has its costs: property losses, deaths, injuries, hospital bills, lost tax revenues, plus the costs of maintaining fire departments, paying fire insurance premiums, and providing built-in fire protection. Each community must decide on an appropriate level of investment in fire protection. Some costs beyond the public’s willingness to bear should be transferred to the private sector—as when buildings over a certain size or height or with a certain occupancy are required to have automatic extinguishing systems.
- *Acceptable risk.* A certain level of losses from fire must be accepted as tolerable simply because of the limited resources of the community. Conditions that endanger the safety of citizens

and firefighters beyond the acceptable risk must be identified as targets for reduction.

Consideration of these matters helps to determine what functions and emphasis should be assigned to the fire department, other municipal departments, and the private sector, both now and in the future. It helps to define new policies, laws, or regulations that may be needed. Most important, consideration of these matters makes clear that fire safety is a responsibility shared by the public and private sectors. Because the fire department cannot prevent all fire losses, formal obligations fall on owners of certain kinds of buildings to have built-in fire protection. For the same reason, private citizens have an obligation to exercise prudence with regard to fire in their daily lives. But prudence also requires education in fire safety, and the obligation to provide that education appropriately falls in the public sector, chiefly the fire department. The public sector-again, chiefly the fire department-also has an obligation to see that requirements for built-in protection in the private sector are being met.

A fire department, then, has more than one responsibility. Nor are the responsibilities just mentioned exhaustive. At least eight important functions for fire departments can be identified:

- *Fire suppression.* Firefighters need proper training and adequate equipment for saving lives and putting out fires quickly, and also for their own safety.
- *Life safety-paramedical services.* Capabilities needed during fires and other emergencies include first aid, resuscitation, and possibly paramedical services. (By “paramedical services” we mean emergency treatment beyond ordinary first aid, performed by fire service personnel under supervision-through radio communication, for example--of a physician.)
- *Fire prevention.* This includes approving building plans and actual construction, inspecting buildings, their contents, and their fire protection equipment, public education, and investigating the causes of fires to serve as a guide to future priorities in fire prevention.
- *Fire safety education.* Fire departments have an obligation to bring fire safety education, not only into schools and private homes, but also into occupancies with greater than average fire potential or hazard to people, such as restaurants, hotels, hospitals, and nursing homes.
- *Deteriorated building hazards.* In coordination with other municipal departments, fire departments can work to abate serious hazards to health and safety caused by deteriorated structures or abandoned buildings.
- *Regional coordination.* Major emergencies can exceed the capabilities of a single fire department, and neighboring fire jurisdictions should have detailed plans for coping with such emergencies. But effectiveness can also be improved through sharing of day-to-day opera-



Master Planning for fire protection requires consideration of a community's future pattern of growth and its likely needs.

tions--as, for example, an area-wide communication and dispatching network.

- *Data development.* Knowledge of how well a fire department is doing, and of how practices should change to improve performance, depends on adequate record-keeping.
- *Community relations.* Fire departments are representative of the local community that supports them. The impression they make on citizens affects how citizens view their government. Volunteer departments dependent on private donations must, of course, also be concerned with their community relations. Moreover, since fire stations are strategically located throughout the community, they can serve as referral or dispensing agencies for a wide range of municipal services.

As communities set out to improve their fire protection, it is not the fire department alone they must consider. The police have a role in reporting fires and in handling traffic and crowds during fires. The cooperation of the building department is needed to enforce the fire safety provisions of building codes. The work of the water department in maintaining the water system is vital to fire suppression. In the realm of fire safety education, the public schools, the department of recreation, and the public library can augment the work of the fire department. Future development and planning will influence the location of new fire stations and how they will be equipped.

These are just the obvious examples of interdependence. So seemingly trivial a matter as the manner in which house numbers are assigned and posted can affect the ability of fire departments to respond quickly and effectively to emergencies.

The Master Plan for Fire Protection

In Chapter 3 we proposed that each local fire jurisdiction in the Nation develop a master plan for fire protection. The master plan, we pointed out, should set goals and priorities for the fire services, designed to meet the changing needs of the community. It should seek to allocate resources for the maximum payoff in fire protection, and it should provide for a data system for continual monitoring of cost-effectiveness.

¹ As we recommended there, wherever possible this should be a *regional* jurisdiction embracing several political jurisdictions—for example, county-wide or larger in rural areas, and metropolis-wide in urban areas.

A look at how one city has developed a master plan is instructive. Several years ago, the city of Mountain View, Calif.,² began to prepare its General Plan of Land Use. As a statement of fire department needs, the city manager's office was prepared to accept the recommendations of the American Insurance Association (which at that time had responsibility for the Grading Schedule). These recommendations called for eight fire stations in Mountain View, with five men per engine company and six to seven men per truck company if the city wanted to improve the insurance grading.

The fire chief interceded to suggest that deeper study would lead to a different set of goals for the fire department. He proposed a "philosophy of fire protection" for Mountain View with two aspects. First, emphasis should be on *preventing* fire losses, chiefly through code enforcement and control of contents and activities within structures. Second, the fire department can cope with emergencies only to a certain level. "Where the normal anticipated potential for emergencies exceeds the planned capability of the on-duty fire force, developers and operators of buildings and businesses will be responsible for providing the balance of fire protection." Usually this would mean some form of built-in fire protection.

In developing a master plan for fire protection, the Mountain View fire chief and his staff took a careful look at recent fire experience. From that study, they were able to project that apartment house and industrial fires would be an increasing burden on the department. By examining the causes of recent fires, they were able to set priorities for fire safety education and code enforcement. They were also able to arrive at a definition of "adequate" fire protection service, which included the provision that firefighting forces arrive within 4 minutes after the emergency has been reported.

The chief and his staff also examined the capabilities of the fire department's equipment to suppress large fires. This led to recommendations that the building code be amended to require all non-residential occupancies over 5,000 square feet to have approved fire detectors, and all over 10,000 square feet to have automatic sprinkler systems

³ Appendix VI contains the Mountain View Master Plan for Fire Protection. This is part of the overall General Plan of Land Use.

DEVISING A FIRE PROTECTION PLAN

The following can serve as guidelines to fire department administrators for developing and presenting a master plan for fire protection:

Phase I

1. Identify the fire protection problems of the jurisdiction.
2. Identify the best combination of public resources and built-in protection required to manage the fire problem, within acceptable limits:
 - (a) Specify current capabilities and future needs of public resources ;
 - (b) Specify current capabilities and future requirements for built-in protection.
3. Develop alternative methods that will result in trade-offs between benefits and risks.
4. Establish a system of goals, programs, and cost estimates to implement the plan:
 - (a) The process of developing department goals and programs should include maximum possible participation of fire department personnel, of all ranks;
 - (b) The system should provide goals and objectives for all divisions, supportive of the overall goals of the department;
 - (c) Management development programs should strive to develop increased acceptance of authority and responsibility by all fire officers, as they strive to accomplish established objectives and programs.

Phase II

1. Develop, with the other government agencies, a definition of their roles in the fire protection process.

2. Present the proposed municipal fire protection system to the city administration for review.

3. Present the proposed system for adoption as the fire protection element of the jurisdiction's general plan. The standard process for development of a general plan provides the fire department administrator an opportunity to inform the community leaders of the fire protection goals and system and to obtain their support.

Phase III

In considering the fire protection element the governing body of the jurisdiction will have to pay special attention to:

1. Short- and long-range goals,
2. Long-range staffing and capital improvement plans,
3. The code revisions required to provide fire loss management.

Phase IV

The fire loss management system must be reviewed and updated as budget allocations, capital improvement plans, and code revisions occur. Continuing review of results should concentrate on these areas :

1. Did fires remain within estimated limits? Should limits be changed?
2. Did losses prove to be acceptable?
3. Could resources be decreased or should they be increased?

in addition. In recognition that most deaths in residential fires are from smoke inhalation, they recommended that smoke detectors and sprinkler heads be required at the top of the stairwell in all two-story residences.

The Mountain View chief and his staff inventoried the fire department, in terms of both personnel and equipment, and then projected additional needs of manpower and capital investments over a 10-year period. In developing the master plan, the chief and his assistants made a detailed list of objectives, in order of priority, not only for the department as a whole, but for the chief, assistant chiefs, battalion chiefs, and captains. They established a timetable for implementing special events, such as company inspections and arson

seminars. To make sure the fire prevention bureau and firefighters understood their responsibilities in fire inspection, they listed every kind of occupancy in the city and assigned each category to one or the other. Another detailed listing set forth clearly the fire protection responsibilities of other city departments, such as the police, water, engineering, and planning departments.

The kind of study Mountain View has been conducting is not costly. Certainly it is not expensive in light of the cost-effectiveness it promises taxpayers of that city. The data from which its projections are derived are mostly data fire departments ought to be collecting every day as a means of continually monitoring their effectiveness. Yet we recognize that many local and county govern-

ments are financially strapped ; they are hard put to provide adequate services for today, much less to plan for better services tomorrow. They will need help tomorrow to improve fire protection, but they need help today to determine what those improvements should be.

The planning we have called for does more than place fire department activities on a rational footing; it requires fire departments to consider means of reducing fire losses beyond mere fire suppression. It calls for a broader approach, which may require changes in laws and codes as well as increased emphasis on fire prevention and fire safety education by fire departments. This broader approach, which might be termed "fire loss management," is a radical departure for many communities.

Some fire departments will lack the expertise and management ability to devise master plans on their own. If they have been relying solely on the Grading Schedule, they will find that the master plan involves attention to many more factors and calls for custom-tailoring future priorities to meet local conditions. For the first time, they may find it necessary to call in fire protection engineers and management consultants to aid in establishing levels of fire protection and methods to obtain those levels. **The Commission recommends that the proposed United States Fire Administration provide grants to local fire jurisdictions for developing master plans for fire protection. Further, the proposed U.S. Fire Administration should provide technical advice and qualified personnel to local fire jurisdictions to help them develop master plans.**

The Impetus for Change

Every system has advantages and disadvantages. No one is motivated to change a system or pattern of behavior when the advantages seem to lie with the status quo and the disadvantages with the contemplated change. Change toward fire loss management will be attractive only if the rewards of the proposed practices and the penalties of existing practices are seen to outweigh the rewards for existing practices and the penalties associated with change. If the opposite holds true, then there will be little impetus to move in the direction of fire loss management.

One of the jobs of the US. Fire Administration will be to persuade local governments that the rewards lie in a change toward fire loss management, penalties in the status quo. A few of the advantages of the fire loss management approach deserve mention here. It puts planning for the future on a sound basis and makes it easier to defend budget requests each year. It brings the top levels of local government, who don't understand fire department program needs, into active participation in planning the community's total fire protection. It brings from "under the carpet" emergency situations beyond the capabilities of the fire department and makes clear what will be done in such cases. The approach provides fire departments with a management system that can weed out outmoded practices and justify the practices they retain. Lastly, it can restructure firefighters' jobs to make them more productive to the citizenry-and more rewarding to the firefighter.



5

FIRE SERVICE PERSONNEL

Common sense tells us that, once a destructive fire has begun, the effectiveness of the fire department in reducing life and property losses depends, to a large extent, on (1) how soon firefighters arrive at the scene and (2) what they and their equipment do after they have arrived.

Thus, manpower is a key factor in fire suppression. Quick response requires not only that fire stations and fire trucks be placed in enough locations, but that the fire houses be adequately manned. And while it is important that equipment at the fire scene be adequate to the task (a concern we discuss in Chapter 7), it is equally important that there be enough firefighters, adequately trained, to use the equipment effectively.

Manpower is also a key factor in fire prevention. Efforts to inspect buildings for fire safety and to educate the public about fire hazards require the actions of specially trained people,

Common sense tells us, therefore, that changes in manning of fire departments (especially if they have responsibilities for fire prevention as well as suppression) affect the ability of those departments to control life and property losses from fire. Changes in manning, one would expect, also affect the rate at which firefighters sustain injuries. By changes in manning we mean

not only the addition or subtraction of firemen, but changes in departmental entrance requirements, changes in training, changes in physical conditioning, and changes in the way manpower is deployed.

But precisely how do such changes affect fire losses or firefighter injuries? As was true of some of the questions in Chapter 3, good answers do not exist. Almost no data-gathering and almost no systematic studies have been performed to correlate various manpower strategies with effectiveness.

Such questions are not idle ones. In a poll conducted for *Nation's Cities* in February 1972, 33 percent of the responding cities reported that their fire departments were manned at under authorized levels. The International Association of Fire Fighters, among others, is concerned that cuts in manpower, made in the name of economy, may be exposing firefighters to greater risks of injuries. Fire chiefs worry because layoffs of younger men are robbing their departments of future leaders. The fire insurance industry is concerned that manpower cuts may lead to an increase of large-loss fires. Citizens, too, worry about reduced fire protection and the effect of undermanning on their insurance rates.

In the absence of cost-effectiveness studies of various manpower strategies, who can say what the effects of manpower cuts are likely to be? But this is not solely a scientific question; it has a moral dimension as well. Saving lives, reducing property losses, and preventing firefighter injuries are far more important considerations than efficiency in government. It is far better to err on the side of overmanning than to risk the public's safety through manpower cuts. Economy-minded governments should be concerned with getting greater productivity from their fire departments, not with saving dollars to the possible detriment of their citizens' safety.

Pressure Toward Better Utilization

Fire departments cannot continue to base their manpower practices on past experience and hunches. The economic pressures on local governments translate into a need to base manpower policies on a firm foundation of proven cost-effectiveness. There are other pressures in this direction as well :

Public expectations. Fire departments are not the only municipal service under pressure to justify their policies. The fact that other departments of local government are under similar pressure suggests that the departments that come forward with the best analyses are likely to convince local officials and the public that their needs are valid. If fire departments lag behind, they are likely to be treated with indifference. If fire departments come forward with bond issues for new equipment and facilities based on inadequate studies, they are apt to encounter stiff resistance from those public officials and influential citizens who live in a world of cost-benefit analyses and trade-off studies.

Other pressures arise when public expectations exceed what the fire department is delivering. Many citizens are bothered by their perception of the paid firefighter as one who spends most of his duty time in idleness. While in many communities this impression is out of date, the fact that the impression lingers should concern fire department administrators. In some communities, on the other hand, the public has come to expect the fire service to handle any life safety emergency. If the fire department does not live up to this expectation, the public may conclude that fire



department manpower is not worth its costs to taxpayers.

The changing environment. Another pressure toward placing manpower practices on a more rational basis stems from changes that have occurred in our urban society and in fire problems. Take, for example, the high-rise building, a special problem to which more and more fire departments are being introduced. Heights exceed ladder reach. Air and heating ducts, in many cases, rapidly spread fire and smoke, sometimes faster than a heavily populated building can be evacuated. Windows may be sealed, caus-



Using firefighters in fire prevention work increases their productivity and helps to reduce fire losses.

ing heat to build up. These and other special problems require not only an adequate number of firefighters at the scene, but firefighters who are trained to deal with the special hazards and who are effectively managed in the team effort to put out the fire.

Fire departments have been growing larger as the Nation becomes more urbanized. Shopping centers and other commercial complexes are sprouting up in rural areas, putting increased demands on their fire departments. With the growing size of fire departments and the growing complexity of the hazards in the environment, the

desirability of specialization within the departments increases.

Equal opportunity considerations. Moral considerations dictate, and Federal law requires,¹ that entrance-level requirements for fire depart-

¹ The equal employment opportunity provisions of the Civil Rights Act of 1964 (as amended) apply to all fire departments except those that are purely volunteer and without any quasi-governmental attributes, and those departments with fewer than 15 employees. In court decisions, purely volunteer departments have been found exempt from the provisions only if they function without any significant governmental sponsorship or aid and without any privilege to claim government benefits.

ments be related only to the performance requirements of the job. This is to prevent discrimination against minorities in hiring. It is our observation that many fire departments have quite some distance to go to fulfill this need. Too many entrance tests expect skills unrelated to firefighting; some put so much emphasis on administrative skills that they appear to be saying, "In every firefighter there must be a fire chief waiting to be discovered." Too few tests, on the other hand, relate to the skills a firefighter needs. Only recently, in fact, have any attempts been made to correlate entrance examination scores, fire school scores, and on-the-job performance.

What Can Be Done?

What we have said thus far about manpower considerations in the fire services suggests several areas of research that need to be pursued. Specifically, **the Commission recommends that the proposed United States Fire Administration sponsor research in the following areas:**

productivity measure of fire departments.

How do various manning strategies affect the ability of a fire department to put out fires and rescue fire's victims? How can firefighters' responsibilities be extended into new areas, especially into fire prevention efforts or non-fire emergency rescue, without jeopardizing fire suppression and rescue?

job analyses. Different fire departments render different kinds of services, depending on their assigned responsibilities and the kinds of hazards that exist in the environment they serve. What skills are required of firefighters and officers under these varying conditions? How should candidates be screened for these positions?

firefighter injuries. How can injuries be reduced? For example, are firefighters taking unnecessary risks to save abandoned buildings? (In this area there is a need for studies of firemen's protective equipment, which we discuss in Chapter 7.)

fire prevention efforts. What kinds of educational programs effectively reduce burn injuries? What kinds of hazards are most important to eliminate? How can fire department inspections and educational programs be made most effective?

In all these areas of research, a very useful method is to compare the performance of fire departments using different strategies in attacking the problem under study, and then to isolate the factor that makes the difference in performance. This means that fire departments under study must keep adequate records of their performance. Impact must be considered. In evaluating the relative importance of a particular fire hazard, for example, it is not enough to record the number of inspections made (input) and then the frequency with which the unsafe practice occurs (output). It is necessary that the number of fires attributable to-or aggravated by-the unsafe practice be evaluated (impact), (Note that input over impact in dollars is the cost-benefit ratio.)

Since the research needs are urgent and should not await pursuit until a U.S. Fire Administration is established, **the Commission urges the Federal research agencies, such as the National Science Foundation and the National Bureau of Standards, to sponsor research appropriate to their respective missions within the areas of productivity of fire departments, causes of firefighter injuries, effectiveness of fire prevention efforts, and the skills required to perform various fire department functions,**

The emergence of guidelines for fire services development through federally sponsored research will be a long step forward. But to implement the findings to meet local conditions, expert leadership in fire departments is needed.

The linking of "expert" with "leadership" is vital. Most American fire departments are strong in leadership and weak in management expertise. The typical hiring and promotion system-in which everyone from the chief on down started as a rookie fireman-has guaranteed good leaders who understand the needs of the men under them and are respected by their subordinates. But fire departments could profit from competition for certain leadership positions from outside fire departments. They need qualified planners whose expertise lies in fire protection engineering, operations research, and systems studies rather than firefighting. This is especially true in larger departments where, further, specialists in budgeting, personnel, and community relations need not be firefighters. The experience of other kinds of organizations, moreover, shows that thinking can be-

come stale and practices inbred when no outside entry is permitted. **The Commission recommends that the Nation's fire departments recognize advanced and specialized education and hire or promote persons with experience at levels commensurate with their skills.**

Presently, the retirement systems of most fire departments discourage hiring from outside at any level above that of basic firefighters. For example, in many departments, only those who join between the ages of 21 and 30 are eligible for retirement benefits. Seldom are retirement system credits portable; a fireman who transfers to another department must begin building credits anew, as though he were a rookie firefighter. **To** encourage greater opportunity for choice for firefighters and officers, the vesting of retirement rights and transfer of retirement credits to other jurisdictions needs to be made possible. The subject of lateral transfer should be studied in detail through a project sponsored by the proposed U.S. Fire Administration. A major objective should be to determine ways in which personnel can transfer between fire departments and retain all retirement rights.

As important as we consider flexible hiring practices, we do not mean to depreciate the value of training within fire departments. At the outset of this chapter we said that one of the important ways to change fire department manning is to change training programs. Improvements in training can favorably influence a department's effectiveness in saving lives, reducing property losses, and preventing injuries to firefighters.

The quality of training given America's firefighters and officers varies widely. It is not difficult to see why. There are no national training requirements for firemen, and only 15 States have training standards which all firemen must meet. For volunteer firefighters there are no financial incentives and sometimes little opportunity to further their training. For paid departments as well as volunteer ones, training is an expensive undertaking that removes the trainees from useful service for a period of time. Many communities, if called upon to augment their fire department training, simply could not afford to. **The Commission recommends a program of Federal financial assistance to local fire services to upgrade their training.**' To qualify for this assistance, a

fire jurisdiction should be required to present a master plan for fire protection substantiating the need for further training.

As we indicated earlier, entrance requirements for the Nation's fire departments also vary widely, and too few tests meet the Federal requirements that they be related only to the performance requirements of the job applied for. Because of the conservative hiring and promotion practices of fire departments, too many tests emphasize the applicant's potentiality for moving far up in rank. Better training programs, together with greater willingness of departments to hire at all ranks from outside, would diminish the need for this emphasis. A fair and job-related test, which the Joint Council of National Fire Service Organizations is now working on, will, in turn, create pressures for better training and more liberal hiring and promotion practices,

It is our concern for the rights of America's racial minorities which prompts our urging that entrance tests be fair and job-related. But we believe even further steps are necessary to overcome the effects of years of discrimination in many departments. It is not enough for fire departments to establish fair standards in hiring; they must reach out to minority communities and actively seek recruits. **In the administering of Federal funds for training or other assistance to local fire departments, the Commission recommends that eligibility be limited to those departments that have adopted an effective, affirmative action program related to the employment and promotion of members of minority groups.**

Increasing Productivity: Two Possibilities

The nature of the job of most firefighters requires much standby time which is not devoted to reducing fire losses. Most leaders in the fire services agree that the productive time of firefighters ought to be increased. And most agree that whatever additional services firefighters are called

^a In the next chapter, we recommend the establishment of a National Fire Academy, primarily to provide special training for fire department management. It would be appropriate for the U.S. Fire Administration, through the National Fire Academy, not only to channel funds to local and regional training programs, but to develop curricula for local use, train local instructors, and provide special instructors 'to local and regional' fire training centers.

upon to render, the services ought to utilize firefighters' special capabilities. Painting street signs and registering bicycles are useful activities, but they don't meet this criterion.

Activities which meet this criterion, and which ought to receive topmost priority in extending firefighters' productivity, lie in the area of fire prevention. A recurring theme of this report is that a much heavier investment of time and resources in fire prevention is the most expeditious route to reduce life and property losses from fire. While many departments recognize responsibilities in fire prevention, too few are doing all they should or could.

There are many fire prevention activities that fire departments can undertake. They can conduct inspections to enforce local codes, ordinances, and common-sense fire prevention practices. They can supplement the efforts of other code inspectors-for example, by reviewing building plans in cooperation with the building department. They can inspect special items of importance, such as hydrants, sprinkler systems, and standpipes. They can check high-risk areas, such as wooden-structured slums and areas where buildings are under construction. For the sake of pre-fire planning, they can conduct familiarization inspections of structures and areas where their services may be needed someday.

Last but not least, fire departments can conduct educational programs-not only to teach school children and heads of households, but also to teach employees of hospitals, hotels, and other public buildings of their special responsibilities. These programs should be continuing, year-round efforts, not simply projects for fire prevention week.

The payoffs of such efforts lie in reduced demands for fire suppression, and reduced deaths, injuries, and property losses. Which of these efforts have the greatest payoff is, as we have indicated, a question on which appallingly little research has been done. But greater efforts in fire prevention cannot await the arrival of better data. Not for the sake of productivity alone, but for the sake of the public's safety, the time to get on with it is now.

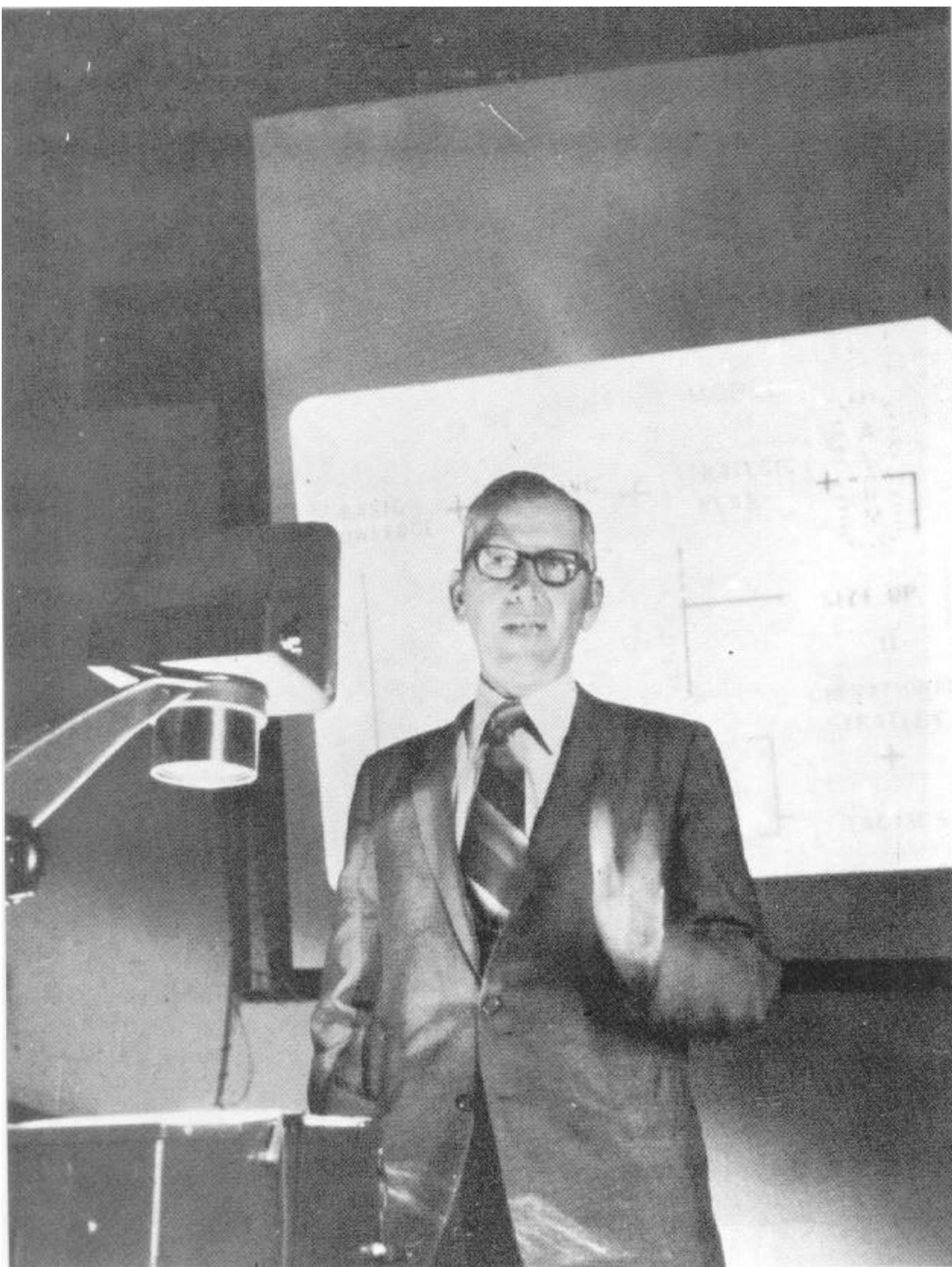
Another kind of activity that meets the criterion of utilizing firefighter's special capabilities is emergency ambulance and paramedical service. From time to time, nearly every fire department is called upon to respond to emergencies having nothing to do with fire. Indeed, in some departments, responding to non-fire emergencies is an official responsibility and a major part of the department's workload. But many departments have moved gradually toward heavier assumption of this responsibility without adequate planning and preparation. As a result, they are still responding to non-fire emergencies with fire trucks-an expensive and inappropriate use of equipment. Or they are requiring firefighters to handle some patients they are not trained to handle. Or they are compiling a poor record of response to non-fire emergencies because they have an inadequate communications and deployment system.

There are sound reasons for fire departments assuming emergency ambulance and paramedical functions. If fire stations are logically located to guarantee quick response to fires, then ambulances placed in fire stations will be logically deployed as well. Secondly, firefighters are, by temperament and training, people-rescuers, and handling all emergency patients is not a major shift of responsibility. Thirdly, a communications system designed to get emergency vehicles to the fire scene is well along the way to sufficiency for handling all emergencies. Lastly, a consideration not to be discounted : The provision of ambulance services will enhance the value of the fire department in the eyes of the community that supports it.

The Commission recommends that fire departments lacking emergency ambulance, paramedical, and rescue services consider providing them, especially if they are located in communities where these services are not adequately provided by other agencies, We recognize that assumption of these responsibilities requires investment in new equipment, in additional training programs, and-most likely-in additional manpower. Also, careful planning is required to ensure that the general rescue responsibility does not compromise the fire department's responsibilities in fire protection-and vice versa.



Paramedical and rescue services have, in many communities, become an important part of firefighters' duties.



6

A NATIONAL FIRE ACADEMY

Fire department managers have difficult tasks thrust upon them. Every second counts in the battle against a fire, and they must make quick but well-informed decisions affecting, at the same time, the outcome of a fire and the safety of the firefighters under their command. They must see to it that their firefighters are adequately trained—not only to fight fires, but to handle frightened fire victims and administer first aid. Since firefighters have other duties, especially in fire prevention education and inspections, their officers must ensure that the duties are carried out effectively. Fire department managers must also deal with the public—making sure that the department meets public expectations, and seeking, in turn, public support of the department. What makes these responsibilities particularly difficult is that, in thousands of smaller departments, they are bound up in a single individual, the fire chief, often a man elected from among the volunteer membership.

Those who bear these responsibilities know that the key to their performance, and the performance of those under them, lies in training. At both State and local levels in this Nation, the quality of training ranges from excellence to total absence. Usually the quality of training is tied to economic circumstances. But poor training programs could

be improved, at little cost, if they followed the example of outstanding programs. At present, however, there is no systematic, interchange of information among educators in the fire services.

One possible remedy has almost unanimous support within the fire suppression and protection fields—namely, a National Fire Academy. What most experts envision is an institution that not only has advanced education programs of its own, but also lends help to State and local training and educational programs. In addition to conducting classes and seminars at its own facility, the Academy would serve as the hub of an educational network. The Academy system would use existing fire training school programs, fire science education programs in community colleges, and fire management and fire protection engineering programs at the college or university level in each State. The Academy would function as the core of the Nation's efforts in fire service education—feeding out model programs, curricula, and information, and at the same time receiving helpful advice from those schools and the fire services.

The list of advocates of a National Fire Academy includes the International Association of Fire Chiefs and the International Association of Fire Fighters. It includes, as well, the National Fire Protection Association, the Committee on

Fire Research of the National Research Council, the Joint Council of National Fire Service Organizations, the National Association of Mutual Insurance Companies, and many more. As other organizations have done, **the Commission recommends the establishment of a National Fire Academy to provide specialized training in areas important to the fire services and to assist State and local jurisdictions in their training programs.**

A National Fire Academy could have a number of salutary effects upon the fire services. For example:

- The Academy would help fire departments to reduce injuries, deaths, and property losses. Individual fire departments have discovered superior techniques for coping with fires, but their successes have not been shared with other departments except through informal channels. Academy courses in command strategy and tactics could be attuned to specific categories of risk, such as congested cities, industrial complexes, and wildlands. Courses in such fields as arson investigation, code enforcement, and fire safety education would address themselves to major ways of reducing fire losses.
- The Academy would increase the attractiveness of fire service careers. The training opportunities offered by the Academy would make positions in the fire services intellectually more stimulating.
- Academy training would equip fire service officers with the technical expertise they need in today's competitive environments. Courses in management techniques would help chiefs of paid departments compete for budgetary dollars with other municipal departments; such courses would also help them recognize antiquated practices that should be abandoned. Special engineering courses would help fire service managers to assess the relative advantages of different pieces of equipment on the market.
- At the same time, the Academy could help fire departments shift priorities toward fire prevention. One major barrier to such a shift has been official doubt about the effectiveness of fire prevention measures. Academy courses could acquaint fire services officers, not only with fire prevention practices that work, but also with

sound record keeping methods that prove that they work.

- Officers educated by the Academy probably would be sought far and wide, with the effect that fire departments would be encouraged to abandon parochial hiring practices.

Volunteer as well as paid fire departments have need of a National Fire Academy. Many volunteer departments lack the resources for training beyond a rudimentary level. Indeed, there are many volunteer firefighters who, having never been exposed to adequate training, don't fully appreciate how it could improve their performance and their safety. Their communities harbor the same lack of appreciation, believing that "adequate" fire protection is wholly a matter of trucks and men to ride them. Because volunteers are part-time firefighters with insufficient time to undertake fire prevention activities, training in that area has often been neglected. With a limited vision of their community role, many volunteer departments-but many paid departments as well-have neglected training in such important fields as arson investigation and fire-safe design of structures.

As we have indicated, the Academy would not supplant State and local training programs but would assist them: by identifying and making available course material and demonstration projects, by accrediting programs, and by lending special instructors to these programs. In general, State and local programs would continue to train firefighters; the Academy's own specialized courses would be for officers and officer candidates.

In addition, the National Fire Academy could assist in the development of effective materials for public education in fire safety. Assistance to community fire prevention efforts could include, in addition to information, financial support and the lending of special personnel. The Academy could also offer architects, engineers, code writers, and code inspectors short courses in the fire aspects of those professions.

One problem that cries out for Academy attention is that of arson. As we pointed out in Chapter 1, the National Fire Protection Association estimates that about 7 percent of the Nation's fires are likely the work of arsonists. Many urban fire chiefs believe the local incidence of

deliberately set fires is far higher. To mount a concerted attack on arson will require the communication of intelligence and expertise from every region and locality of the Nation. **The Commission recommends that the proposed National Fire Academy assume the role of developing, gathering, and disseminating, to State and local arson investigators, information on arson incidents and on advanced methods of arson investigations.** Short courses, newsletters, and bulletins would be appropriate means of communication.

Lastly, through newsletters and other media of continuing education, the Academy could bring to the attention of the Nation's fire service leadership emerging problems and trends of the fire services, pioneering efforts by individual fire departments, and new developments in fire protection technology.

While there is near-unanimity among fire protection organizations on the need for a National Fire Academy, proposals regarding its structure vary widely. **The Commission recommends that the National Fire Academy be organized as a division of the proposed United States Fire Administration, which would assume responsibility for deciding details of the Academy's structure and administration.** We see the Academy as a growing organism, the pattern of its growth being determined by a careful and continuing assessment of the fire services' needs. The U.S. Fire Administration would be in the best position to conduct this assessment.

One thing is certain: Federal support of the National Fire Academy, both in its own programs and those it assists at local levels, is vital. Volunteer firefighters and officers should not be expected to pay for their specialized training and would probably be unable to take advantage of the Academy's offerings in great numbers if they were required to do so. Paid firemen in many communities are in no better position to get local funds to subsidize their special training. **The Commission recommends that the full cost of operating the proposed National Fire Academy and subsidizing the attendance of fire service members be borne by the Federal Government.** Federal assistance for members of paid and volunteer fire departments would cover cost of travel, tuition, teaching materials, and accommodations. Paid fire departments would be obligated to continue to pay the salaries of students. Full Federal financing would not preclude acceptance by the Academy of grants and other forms of support from government and private sources.

Federal support of the National Fire Academy is a worthwhile endeavor. Through the Academy, the management capabilities of the fire services can be improved. Priorities of fire departments can be effectively shifted, through Academy training, in the direction of more fire prevention effort. Man's environment can be made less hazardous through special courses in fire-safe design. And most important, the National Fire Academy can help to reduce life and property losses and injuries from fire.



The National Fire Academy would not supplant local training programs but would provide guidance and assistance.



7

EQUIPPING THE FIRE FIGHTER

Of the fire chiefs and firefighters who responded to our nationwide survey early in 1972, more than seven out of ten said there is a need for greater innovation to improve the equipment and protective clothing they use every day.

And no wonder. A quick glimpse at firefighting practices yields a sampling of where improvements can be made:

- The breathing apparatus designed for 30 minutes' use typically weighs 30 pounds. Often firefighters reach exhaustion long before their 30 minutes are up. The weight of the apparatus, it seems likely, contributes to the exhaustion. In actual use, moreover, a 30-minute apparatus often provides less than 20 minutes' protection because great exertion requires more air.
- Most firefighters' helmets readily conduct heat to the inside of the helmet. Beyond certain temperatures, helmets made of hard plastics lose strength and begin to deform.
- Helmets and breathing apparatus alike tend to get snagged by protruding objects. In many instances, firemen wearing face masks cannot put on their helmets; the two don't fit together.
- "Turnout" coats can be virtual sweat boxes, even when there are air vents under the arms. To the extent that turnout coats hinder body movements or build up body heat, they contribute to the firefighter's exhaustion.
- A fireman manipulating the controls of an aerial ladder must peer upward many stories to see how to guide the ladder into position. If the smoke is too thick to see through, he must have another firefighter, perched precariously at the top of the ladder, giving him instructions as he swings the ladder into position. AS Howard W. Emmons, professor of mechanical engineering at Harvard, pointed out in 1968, "A man in Houston, Tex., can manipulate a space ship photographing the moon, but the fireman must climb up to the top of a 100-foot ladder to find out just where it is."

These and many other deficiencies have been around for years, despite the great power of American ingenuity to innovate to overcome technological problems. Few equipment manufacturers can afford to invest heavily in research and development, especially when the payoff in a fragmented and conservative market is so un-

certain. Marketing is affected by the fact that many fire departments simply cannot afford to buy innovative equipment. Others purchase conservatively because they lack the technical expertise to evaluate innovative equipment. Because firemen typically spend their careers with one department, they become attached to the "tried and true" methods of that department.

Of course the fire services are not alone in facing barriers to innovation. In recent years there has been growing recognition that the innovative process-by which needs get translated into research and development projects, and the results of research and development get translated into new products or processes-throughout American society can be improved. In his Message on Science and Technology in March 1972, the President assigned to the National Science Foundation and the National Bureau of Standards responsibilities for finding ways to spur innovation. In response, the National Science Foundation established an Experimental Research and Development Incentives Program to seek ways of "increasing the efficiency and speed of conversion of research and development to new or improved products, processes, and services." The National Bureau of Standards launched a similar effort, called the Experimental Technology Incentives Program.

The blockages to innovation in the fire services are many, and they offer a rich vein for scientific prospectors. Moreover, the blockages together form a major impediment to "improvements in the quality of life," which the National Science Foundation lists foremost among the kinds of innovations to be spurred along. **The Commission urges the National Science Foundation, in its Experimental Research and Development Incentives Program, and the National Bureau of Standards, in its Experimental Technology Incentives Program, to give high priority to the needs of the fire services.**

Guidelines for Research and Development

The fire services do not need innovation for the sake of innovation, the way car manufacturers need styling changes to assure themselves new customers. The fire services need innovations in equipment to improve their performance. Improved performance, in turn, can mean any of the

four following : saving more lives, reducing deaths and injuries to firefighters, reducing property losses, and protecting the public at lower cost.

Clearly, reducing life loss, reducing firefighter injuries, and reducing property losses are prime considerations. Improvements in these areas can be made simultaneously. A firefighter better protected against injury to himself is, of course, better equipped to suppress fires and rescue people. No technological innovations designed to reduce life and property losses should create new risks to firefighters.

In all research and development efforts, then, effectiveness in lowering firefighter injuries as well as life and property losses should rank ahead of dollar savings as a goal. Current technology, for example, makes feasible automated control of hose pressure at the scene of a fire and could free an additional fireman-the one now operating the controls on the truck manually-for service at the nozzle end of a hose. Yet the job of the man on the pumper is a complicated one. He must see to it that men holding a hose line do not get thrown by surges in pressure caused by unequal demands from different hose lines. He must cut water pressure when crews are endangered by ladder sway and cut pressure when hoses rupture. He must act as a relief man for crews, a reserve for rescue of fire victims, and a protector of the pumper from vandalism. An automated system that left any of these protective functions unprovided would be an unacceptable substitute.

A second requirement of research and development is that they stem from an accurate assess-



With few exceptions (such as this one), firefighters' helmets have changed little in design and materials in 50 years.

ment of fire service needs. Almost any piece of fire apparatus, for example, can be built bigger, better, and more expensive, with a greater capacity to perform its expected functions and impress the citizenry. But in the real world of tight fire department budgets, trade-offs are needed. Thus, the chief emphasis in the development of improved firefighting equipment should be on apparatus designed to meet most potential fire situations, rather than on equipment rarely needed. More research is also needed to help settle questions of diversity versus standardization. Standardization of fire engine components is desirable from the standpoint of bringing down costs. Diversity may be needed to meet the varying needs of different communities. The best solutions may lie in the middle—that is, with standard modules that permit add-on features.

One fire department need that should not be subjected to trade-off or compromise is *safety*. A two-step program of research is needed: to identify features of firefighting equipment that do not adequately protect firemen, then to explore means of providing such protection.

Thirdly, research and development must take whole systems, rather than piecemeal, approaches. The complete firefighter's uniform consists of turnout coat, trousers, boots, breathing apparatus, gloves, and helmet. It may also consist of a walkie-talkie radio strapped to the body 'and a hand-held flashlight. Each of these elements has been designed separately without thought to its relation to other parts of the uniform. One result has already been cited: a breathing apparatus so incompatible with the helmet that the two cannot be worn together, whereas a face mask and helmet could be an integrated unit. Turnout coat, trousers, and boots are separate items that take time to don, whereas they could be replaced by a one-piece, zip-up suit. Walkie-talkies and flashlights are cumbersome appendages, whereas both could be integrated into the helmet. A further example: Only the helmet is designed to protect against impact injuries (and that, very inadequately), whereas many impact injuries occur on the trunk of the body.

Much of the technology exists for better protective gear. Ideally, product development of an integrated system, not unlike the life support system built into the individually tailored 'astronauts'

suits, would afford optimum protection. On the other hand, the hard realities of costs and ready availability of the equipment must be considered in approaching the ideal. The National Aeronautics and Space Administration, in fact, has put its space exploration capabilities to work on the problems of developing better breathing apparatus and better protective clothing for firefighters. As for helmets with built-in communications systems, they have long been in use by fighter pilots. To provide protection from impact injuries, technology might be borrowed from bulletproof vests or even from football players' protective gear.

At the same time, research and development are needed to make incremental improvements in existing kinds of equipment. The search for major departures from existing equipment, based on a systems approach, should not be pursued at the expense of development of improvements in traditional equipment. There are two reasons for this. First, the search for major departures is a long-term investment, and results are not likely to reach the market for several years to come. Secondly, fire departments cannot afford to discard all the equipment they have now, and adoption of major departures will be a slow process, extending over many years. Better versions of current types of equipment will be needed for some time to come.

A single example will suffice. Tests of six types of turnout coats by the Boston Fire Department have shown that, in each case, the material fails the flammability test for drapery fabrics used in places of public assembly. That more firefighters' coats do not catch fire is due largely to the fact that the heat on the fireman's exposed hands and face drives him from flames before his coat is endangered. If hands and face can be adequately protected—and the technology exists to do just that—then there will have to be a corresponding improvement in the flame resistance of turnout coats.

A fifth consideration for research and development: improvements must be acceptable to fire departments. Barriers to acceptance of an innovation are of several kinds. A new piece of equipment may be too expensive in absolute terms: simply beyond a fire department's budget. It may 'be too expensive in relative terms—that is, offer too little improvement in performance for the in-

vestment required. It may require skilled operators which fire departments are unable to provide without further training. There can be psychological barriers as well; if an innovation departs too radically from traditional practice, it will be resisted.

A related consideration is that developed products need to be adapted to users' capabilities. Human factors engineering—that is, the modification of equipment design so that the equipment is comfortable, safe, and easy to use—has been applied with success to military and industrial equipment but never, to our knowledge, to fire trucks and other firefighting equipment.

A purchaser of fire equipment must be able to make comparisons among different pieces of equipment competing for his dollars. This means that names for particular kinds of equipment, descriptions of their functions, and measurements of their capacities should be uniform throughout the fire protection field. While some standardization exists, confusing discrepancies are commonplace. One result of these discrepancies is that data cannot be compared across different fire jurisdictions; for example, a “rescue truck” is an ambulance in some places, a pickup that carries firefighters' rescue equipment in another. The National Fire Protection Association has published many standards for fire equipment and an excellent guide called *Fire Terminology*. But long-established traditions and local custom have not given way totally to NFPA standards. **The Commission recommends that the proposed United States Fire Administration review current practices in terminology, symbols, and equipment descriptions, and seek to introduce standardization where it is lacking.**

Equipment R. & D.: Reducing Fire Losses

Research and development priorities ought to stem from careful assessment of the needs of the fire services. We can only suggest therefore, not define, areas where research would be useful. The following discussion is a mixture of subjects on which little or no research is being done, subjects on which progress is being made, and, indeed, subjects in which demonstration projects have already proved successful.

Notification. The beginning step in a fire department's effort to put out a fire is notifica-





Space Age wonders of automation have not yet supplanted the firefighter perched dangerously atop a 100-foot ladder.

tion of the fire's whereabouts-usually by telephone or alarm. Systems exist which sense smoke, products of combustion, heat, or water flow (in an activated sprinkler system) and notify the fire department automatically. Improvements in the technology of such systems, especially in bringing down their cost, might encourage more widespread use. Systems based on human activation might be developed which (1) meet the criterion of universal accessibility (as private telephones do in many communities) and, at the same time, (2) discourage false alarms (which account for a third of the fire calls in many cities), and (3) provide for the transmittal of qualitative information about the fire. Some cities are already using public telephones which require no coins for emergency calls. These telephones (if adequately maintained against breakdowns and vandalism), together with private telephones, would substitute for fire alarm boxes.

Response. Computerized systems for dispatching firefighters and fire trucks have been installed in a number of cities. Into such systems are being built retrieval mechanisms that transmit to firefighters floor plans and other helpful information about the building on fire.

Suppression. Lights, periscopes, or closed-circuit TV might be mounted atop aerial ladders. Sensors to locate trapped victims and chemical detectors to warn of dangerous concentrations of toxic gases are other possibilities. Infrared sensing devices are available that can locate fires in smoke-filled rooms and fires inside walls, but they need development and demonstration of their usefulness to the fire services.

More research is needed on extinguishing agents, hardware, and techniques, to improve the effectiveness of existing agents and to investigate the chemical and physical mechanisms of new agents. Water, particularly in its droplet or stream state, requires further study; there is a controversy, for example, as to whether keeping buildings closed and applying water fog is a suitable alternative to ventilating the fire and attacking with water streams.

Additives that reduce friction losses in hoses have proved their effectiveness, but are not widely used. Foams and dry chemicals have proved their effectiveness and are being continually improved, but exactly how these agents operate to extinguish

fire is little understood. More important, lack of knowledge in flame chemistry inhibits progress toward radical departures from present extinguishing methods, such as the use of sound waves.

Lastly, development efforts should be directed toward reducing the weight of suppression equipment, especially hoses and couplings.

Equipment R. & D.: Reducing Fire Fighter Injuries

Especially in the realm of fire suppression, technological improvements which reduce firefighter injuries will improve the effectiveness of fire departments in saving lives and reducing property losses. Such improvements are worthy of pursuit in their own right, since the risks we currently ask firefighters to take are unconscionable. In many cases, we must assume, the proper protective equipment is not available to firefighters-or, if available, is not being worn. When firefighters do not wear equipment because it is cumbersome or uncomfortable, that is, to some extent, an indictment of the equipment.

Toxic fumes. The inadequacy of breathing apparatus systems is shown by studies which indicate that face masks used by fire departments leak to some extent. The National Bureau of Standards has proposed a program of research to improve breathing apparatus systems, taking into account the physiological, human factors, and engineering elements important to their design. **The Commission urges rapid implementation of a program to improve breathing apparatus systems and expansion of the program's scope where appropriate.**

Impact injuries. The only standard piece of equipment meant to protect against injuries from falling objects or other blows is the helmet. The most common standard (which many helmets fail to meet) is resistance against 40 foot-pounds of impact. The British standard is three times as high. No attention has been paid to impact protection in turnout coats, despite a Bureau of Labor Statistics study which shows that impact injuries to the trunk occur 26 times as often as trunk burn injuries.

Over-exertion. While the very nature of firefighting invites over-exertion, there are technological improvements that undoubtedly would reduce instances of over-exertion. Protective gear could be

improved from the standpoint of weight and freedom of bodily movement. In addition, lightweight power tools—for example, for prying open doors or cutting through walls—would also reduce the need for physical exertion.

Strains and sprains. Lightweight power tools would likely reduce strains as well. In addition, failure to apply human factors engineering to the design of firefighting equipment has led to strains and sprains, as it has to over-exertion and other kinds of casualties. What is needed, for these and other classes of injuries, is thorough study of the kinds of movements and stresses the body sustains in firefighting.

Heat and burns. Equipment that leaves any part of the body exposed, or which is easily ignited, openly invites burns and heat injuries. Development of protective clothing to reduce these hazards should be accompanied by the development of sensing devices that can warn the firefighter when surrounding temperatures are getting dangerous.

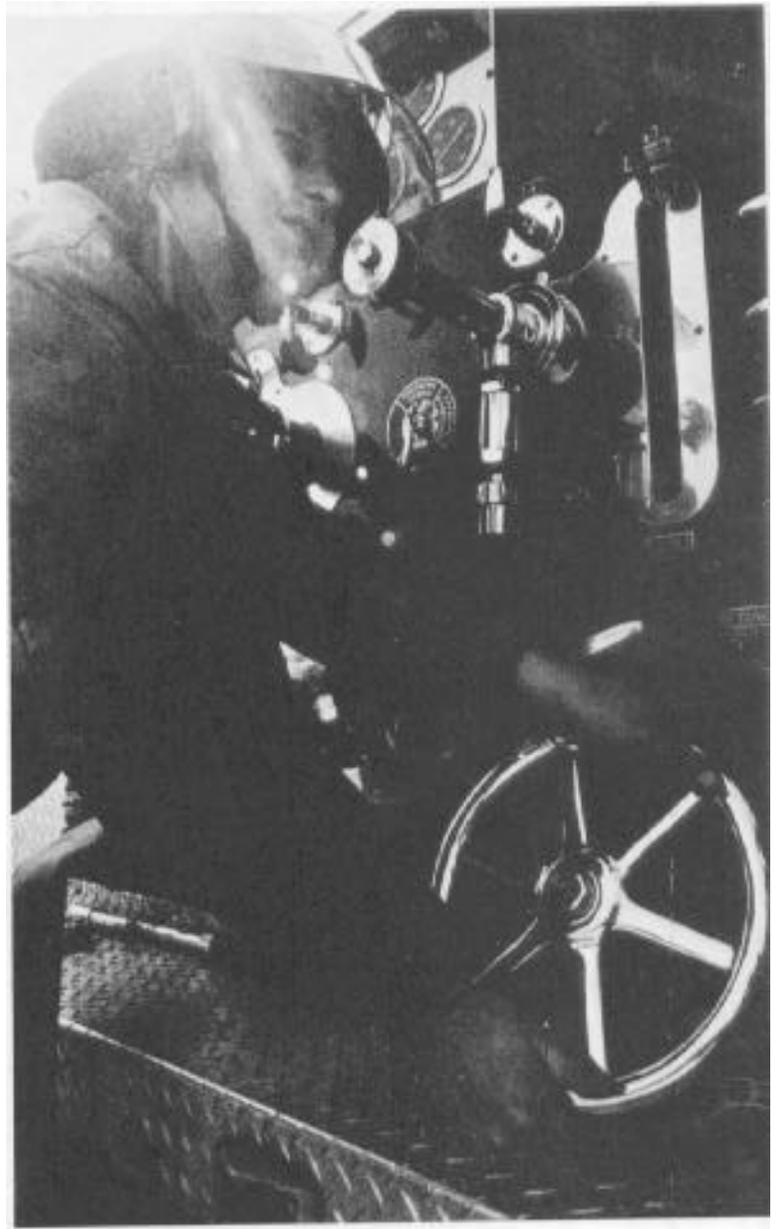
Getting on With the Job

The foregoing discussion is hardly exhaustive. There needs to be undertaken a definitive study of the needs of the fire services. Such a study would have to do more than aggregate what fire departments say they want; it would have to identify needs growing out of demonstrable shortcomings of current equipment.

The Commission recommends that the proposed U.S. Fire Administration undertake a continuing study of equipment needs of the fire services, monitor research and development in progress, encourage needed research and development, disseminate results, and provide grants to fire departments for equipment procurement to stimulate innovation in equipment design. As an interim measure, pending establishment of a U.S. Fire Administration, the Commission urges the **Join Council of National Fire Service Organizations to sponsor a study to identify shortcomings of firefighting equipment and the kinds of research, development, or technology transfer that can overcome the deficiencies.** Funding would be appropriately sought from the National Science Foundation or from

the Department of Commerce under the provisions of the Fire Research and Safety Act of 1968.

Capabilities for research and development to improve the effectiveness of the fire services lie in many places : universities, Federal agencies, non-profit research firms, and the fire equipment industry. Research and development in these places will be useful if they are guided by clearly identified needs of the fire services.



Especially as firefighting equipment grows more complex, it must be designed to be comfortable, safe, and easy to use.